Minutes for the Plan meeting of 1 July 2015

1. FE & OF related :

1.1 Update on results from test range -- pending from 17 Jun & before (HRB/GSS/SSK) : Reorganised into the following issues :

(i) Tests of ver1 550-900 CDF and CSIRO feeds at test range : new results with VVM set-up, after installation of new encoder + notch filter for mobile band, showed : for ver2 550-900 CDF : reasonable E-H match at 610 and then degradation in shape and matching at 700 & 800; partially supported by older measurements from Dec 2013 (with slightly different set-up). Further, results for dipole-2a & dipole-2b with cone v2 show that the degradation of pattern with frequency is worse for v2a than with v2b; radiation pattern measurements have been done with 50 MHz step & using CW signal; comparison with simulation results is awaited. Current restuls and action items are :
(a) first order comparison of C1 dipole 2B vs C2 dipole 2B measurements : C1 D2B shows better E-H match at 610 ; C2 D2B shows good E-H match at 700; and appears to be decent even at 800, though 3 dB width may be changing; agreed to make plots vs freq for 3 dB and 9-11 dB widths, and for taper of E and H at fixed dish angle of 62.5 to check mismatch in taper, for both the feed versions.
First results from the measurements for the plots of 3 dB and taper values vs freq show evidence for change of properties with freq as well as asymmetry of the pattern (as had been seen in the earlier plots also); agreed to try to compare with results from C1 + D2b (make fresh measurements, if needed).
Repeat tests for C2 + D2b sent by HRB which show repeatibility with earlier results; FE team to check C1 + D2b data and complete the comparison -- fresh data needed to be taken for this (earlier records "don't exist"); radiation pattern tests done for C1 + D2B -- comparison plots to be sent soon.
(b) Phase centre of ver1 550-900 CDF and CSIRO feeds needs to be done -- phase centre measurements for C2 + D2b can be tried at the range.
Waiting for comparision report to be done and then follow-up for deciding next course of action.
==> to take up a detailed discussion later on.

(ii) Phase efficiency computation has to be linked to the aperture efficiency computation (NRAO's eff. program, modified for GMRT specific paramters) -- this work is ongoing, alongwith Sougata (was expected to take 4 weeks -- till mid-Sep); code is being ported to matlab (?); some issues about input file with the values to be given -- this also needs to be resolved; also, original NRAO fortran program can be made to run to give some initial cross-checks? code had been ported from the C version that student had written to Matlab but results are not yet matching with expected behaviour and debugging is going one. Now trying to port original fortran version to matlab; one email has been sent by Sougata with some updates on pattern calculations -- need to discuss and understand its relevance.
FORTRAN to MatLab conversion : ~ 50% completed; was to be fully done by end-Jan / early-Feb -- code is still giving problems in terms of the results; now trying with simplified geometries to see if sensible results can be achieved. Meanwhile, agreed to try and see if the original NRAO Fortran code can be compiled and executed.
The NRAO Fortran code now works (after identifying appropriate compiler, making

necessary syntax changes etc); the efficiencies have been combined (Fortran + MATLAB); new results expected by 15-Apr-2015; first results were to be circulated by 23 Apr. NRAO code is running now. Tried for Lband : give E-H pattern at 10 deg interval, plus specificy value at 62.5 deg; plus various efficiencies : mesh leakage and RMS efficiencies (phase eff is taken as unity) + dish geometry (right now coded inside) including a square piece for blockage; output is spill-over and taper eff, cross-polar eff and overall eff (some are with and without blockage) -- to cross check the outputs against blue book values and rationalise against relevant docs and inputs. Can do this for all the other bands for which results are available in the blue book.
20 May : Above action is pending for follow-up between Sougata and GSS; agreed that meanwhile Sougata can look at the plots from blue book (they have enough resolution) and compare with the code.
17 Jun : at 327, the code gives 68.4, 66.6 and 66.4% for 259, 270 and 290; at L-band it is 43.2%, for 259 K.
Current model takes the following inputs : mesh geometry, mesh deviation in rms, feed pattern for E & H with 10 deg resln, taper value at 62.624 deg, gnd temp; blockage is hard-coded inside right now (alongwith quadripod legs etc).
Sougata to produce a note about the usage of the code and the various parameters, and to try varying different parameters to understand the effect on the output; also, check the blockage term inside the code.
==> no progress on these items.

(iii) calculation (based on reference paper) of expected deflection & comparison with measurements to check if there is significant loss of sensitivity : GSS developing refined version of code that is more relevant for GMRT (to compare with 250-500 or 500-1000 feed data) : cross check of results from code wrt curves from Kildal paper was confirmed (0.3 dB drop for 0.5 lambda offset); for GMRT specific case of 250-500, efficiency factor as a function of freq over the band, using the data for the measured feed pattern, was implemented; after correcting one error in the code, better result (9.9 dB vs 11.6 dB expected) was achieved; further, a realistic phase response (instead of 1.0) was included by reading data from a file; results (reported on 19th Mar) showed better match between measured and expected deflections for the 250-500 system : 327 -- 12.8 dB vs 12.4 dB; 400 -- 12.8 dB vs 12.2 dB; 450 -- 12.4 dB vs 11.4 dB; 500 -- 11.2 dB vs 11.0 dB (some re-work needed for lower frequencies?); computed results (based on change in efficiency due to shift of phase centre) show likely drop in sensitivity by about 1.4 dB from 250 to 500 -- this is now to be folded into the net sensitivity / deflection curves made by GP (see agenda item following this one). Present action items :
(a) GSS is working on plans to extend this to 550-900 system -- was waiting to get measured values from test range.
data for cone2 + dipole2b exists; needs to be run through NRAO code to get the efficiency factor -- will happen soone; when data is available for cone1 + dipole2b, same can be done.
20 May : pending for item (ii) to be completed.
==> still pending.

(iv) Comparison of computed results with measurements for 250-500 band : initial results for good antennas at 250-500 (other than C6) with default height of 1280 (and for C6 with reduced height of 1080) showed that computed values are actually better at high freq end for 1080, which is different from the observations which are showing droop at high freq for 1080 (in conflict with first results reported above); computed results, which were for 1180 to 1480 in 4 steps, were extended to 1080 & 980 and 1180 was found to give the best response (note : this is for a particular

value of ph centre based on range measurements); computations were extended to much smaller values (down to 580 mm) and latest results show a peak in the response around 580 o 780 (!), which are in sharp contrast to the experimental results which were carried out in the range 1080 to 1480 mm and showed optimum performance around 1280 mm -- this needs closer scrutiny of the simulation code and experimental results; with new code, it may be possible to recheck the calculations and then can take up for discussion to rationalise.
Code is running; but first being used for the cross-checks described above; will go to new 250-500 etc after that.
20 May : also pending for item (ii) to be completed.
==> still pending.

1.2 Phase centre tests for 250-500 CDF -- from 17 Jun and before (HRB/GSS): to test with 100 to 200 mm height change (around default of 1280 mmm) in 250-500 feed on one antenna to see how much change in sensitivity is seen. Tests done on c6 using feed with shortened support legs of the cone (instead of shortened stool) -- comparison of results for 1180, 1280 (default) and 1380 : 1280 & 1380 show slightly better sensitivity at low freq (250-400) but at higher frequencies they match with 1180 (which is quite flat throughout freq range); agreed to try for 1480 to see if there is a monotonic behaviour; also compare with simulation results of GSS. Consolidated results tend to show that the latest level at 1180 height does show a slightly better response; a final confirmation is needed about the optimum performance from the measurements; confirmed that we can't go below 1080 by further cutting the support legs of the cone; also, current adjustable stool will not work for 325 MHz face due to welded nature of existing stool; agreed with HSK to reproduce one more adjustable stool with modifications learnt from present experience, and try on one CSQ antenna (C6?) by removing the Lband feed, shifting the cone-dipole with new stool to this face and using the existing 250-500 FE box on it; tried on C6 during MTAC period (Oct 2014), but measurements could not be completed as antenna was required for L-band GTAC observations. Current action items :
(i) Agreed to go back to C8 at a later point of time (after 550-900 measurements are completed) -- deferred for now.
(ii) Meanwhile, FE team to go over all the available measurements and produce a consolidated summary -- this is pending for some time now !
==> no progress on any of the above items.

1.3 Comparison of measured & expected sensitivity curves -- from 17 Jun (SSK/GP/HRB): Scheme for (re)calculation of expected values across the broad bands to be finalised (and added to measured curves) : curves with constant QH value and variation of T_lna with freq were incorporated; model for the main BPF was also put in; after that antenna efficiency factor (based on measurements with 4-5 points across the band) was added by interpolating the measured values; return loss of the feed was added to the above and the result now matches much better with the data -- all this was done for 250-500 band; subsequently, the formula was revised to change the constant factor, which resulted in some discrepancy in the mean deflection values, and also some cases where the measued deflection is higher than the theoretical values -- these issues to be understood and resolved; after some cross-checks and refinements (dir coupler loss values, source flux from Baars et al, recalculated constant etc) -- spot value of 13.0 dB at 325 for CasA compares well with 12.7 used in control room; antenna efficiency factor still needs to be determined a bit more carefully -- agreed that both the efficiency terms (which includes default ap eff + phase eff, from measurements on test range) and the RL term whould be kept and the product should be used; some follow-up action items :

(i) cross-check the flux values and get updated numbers with DVL's help :
20 May : DVL has generated a table of 5 MHz apart flux values (covering entire uGMRT range?) for all the main sources, which can now be used by GP in the detailed formula; simple comparison with formula is folded in under item (c) when comparing with control room values; to check if this sub-item can be closed.
4 Jun : GP has done a cross-check at 325 with the existing and new value of flux and finds new value is higher (leading to 14 dB expected deflection!); to check one or two more spot freqs (like 610) and then raise an email to DVL and others on this matter.
17 Jun : DVL & ICH have agreed to look into the matter and resolve the broader issues.
==> no updates this week.

(ii) to get clear confirmation about which all terms are included in the efficiency term that is currently being used in the calculations. Some results may be available from the NRAO code calculations ?
20 May : this should happen soon hopefully; till then the interpolated values are being used in (c) below.
4 Jun : this is still status quo at present.
17 Jun : remains status quo till NRAO code issue is completely resolved.
==> pending for NRAO code work.

(iii) develop the model for Lband : information gathering had been started -- feed pattern (efficiency) at 3 individual freqs is available, and measurements are now available for 5-6 frequencies (?); agreed to work with the 3 pt data and do simple interpolation and see what kind of curve is produced; first order calculation of model had been done -- Sanjit + Gaurav had worked to put the curve for expected deflection alongwith the measurement results to do the comparison, and weekly plots now have this added; current action items :
(a) 1 or 2 antennas with response better than theoretical esp at lower edge of Lband -- need to be checked;
(b) fall-off of theoretical curve at edges needs to be investigated
(c) RL of feed is to be included -- now done.
(d) notch filter alongwith BPF to be added -- this is also done (but still no resolution of slope-error);
20 May : GP had completed (c) and (d) and shown that it falls off correctly on lower side of pass-band after filters and RL included, but extends a bit beyond on high freq side; need a more detailed comparison with BPF to understand this, and mobile notch filter + BPF to resolve the extra bump at ~ 800 MHz);
also, Sanjeet's latest plots still show expected curve to be flat on both sides of the passband... this also needs to be resolved.
4 Jun : some checks done between BPF and mobile notch show why the bump in response at 800 comes -- may need a sharper BPF cut-off if we want to avoid it; for the HF side, looks like it may be an issue of sensitivity values used (3 pt interpolation); agreed to try with constant value, held at the lowest of the 3 points and see if HF response becomes ok; also, control room values are now there on the plot !
17 Jun : looks like there is a genuine HF extension even when all known terms (except varying eff with freq) are included. To try and get inferred eff curve from best model and sample data and later compare with NRAO code output.
==> GP has done the calculation of the required eff curve to explain the data, and the variation is very steep at just around 1450 MHz (as expected) -- to compare with code calculations when they are ready.

(iv) a note summarising the overall scheme to be generated and discussed : updated note from GP was discussed : this is much more detailed now; need to cross-check :

* the variation of Tgnd with frequency (understood that this is due to incremental addition to Tsys due to ground ??);
* add points for existing control room values;
* replot with better y-axis resolution;
* 250-500 and 550-900 look reasonable; Lband has some extra features that need to be understood (see details above);
* could start thinking also about 130-260;
* to vary parameters for 550-900 to understand the 3 dB droop from low to high end
20 May : variation of parameters for 550-900 to understand the observed curves has been done and has provided useful information; replot with better y-axis resolution has been done; comparison with control room values needs to be completed formally; updated version of the note to be circulated and discussed.
4 Jun : not clear about Tgnd with freq; control room pts done; y-axis resln done; Lband discussed above; 130-260 started looking at; can do one more round of checks and improvements to the note and circulate (including DVL and others).
17 Jun : Tgnd in blue book is a func of Tmesh and Tspillover and hence will be a fn of freq; agreed to circulate the present note.
==> note has been circulated, including DVL and ICH (YG to take it for follow-up)

1.4 Total power detector for FE & common boxes -- from 17 Jun & earlier (GP/ANR/SSK): plans for final scheme : 20 dB coupler for CB and 10 dB coupler for FE (at final output) with common 20 dB amplifier (Galli-52 instead of Sirenza); feed-thru vs connectorised arrangement also resolved; after lab tests (including monitoring via MCM channel) in FE and common box, sample units installed in C4 FE box and E2 common box. Some other details are as follows :
For common box : data from 2 units installed on E2 showed basic things working ok: first round of testing showed 11 dB deflection (12.4 dB expected) on Cass-A; later on Crab, getting 5.5 to 6 dB (6.6 dB expected); flat-top on-source waveform was understood to be due to quantisation of step size of detector levels (least count issue); script / SOP created for automated running of tests;
For FE version : 2 units had been assembled and found to give identical performance as per specs; problem of feed-thru vs connector was resolved in favour of feed-thru (as per original chassis design); all testing completed in the lab; first units (on C4) showed problems -- traced to incorrect mapping of channels etc.; new units (batch of 20) that were assembled showed unexpected change in detector o/p due to grounding problem which was corrected (manually) for 10 units and final PCB for mass production was modified for this change; script for automating the observations has been done an released by GP. The issue of RC time constant was taken up, resolved and closed (c. 22 Apr 2015); final report was submitted (c. 22 Apr 2015), with most of the outstanding issues resolved.

The remaining pending action items now being followed are :

(i) To decide upon long-term plan for power monitoring : GP to generate a short note about the proposed scheme for this; some discussions on 11 Mar about exactly what this note should specificy (over and above the SOP). Agreed for GP to produce the note. GP has produced a note for procedure to be followed, which is useful; need to move to a strategy document for running the program on a long-term basis. Shilpa has been identified to monitor weekly (MCM to be turned ON for collecting data & then put OFF);
Need a discussion with SN + SSK + YG to clear this (alongwith item below).
Strategy document yet to be produced; brief 3-way meeting has been held.
20 May : first version of the strategy document discussed : need to add some more details about the strategy : how and why of the test observations being planned,

and then give the procedural part.
4 Jun : no updates on this at present.
17 Jun : strategy document discussed -- looks better now and ver1 can be released by today and given to Shilpa to try out.
==> no fresh updates on this; GP to complete the pending changes and circulate, with copy to Shilpa.

(ii) possibilities for automating data reading, analysis and plotting also discussed -- GP has now implemented automated program for plotting CB, FE power levels (both chans) and 3 temp monitor values (2 in FE and 1 in CB) in one go from a file containing data for X nos of antennas is ready; this has been tested with the above data sets; agreed that it is generic but not tested for anything other than temp and pwr; can be generalised for all channels of all 30 antennas but can be taken up at lower priority; also, does not have a user friendly interface; current actions :
(a) agreed that working version of code + SOP to be fully released asap : SOP has been released; GP working on note about analysis procedure (using matlab) -- note has been made ready : discussed and looks basically ok, except for hard code locations of GP's machine -- to check best way to address this.
17 Jun : linked to decision about who will be analysing the data -- team to discuss and come back.
(b) SSK to take up discussion with SN about GUI development with suitable person from control room : initial discussion with SN has happened, but not clear if optimal person has been identified -- YG to take up the discussion jointly with SSK & SN
3-way meeting has been held and Shilpa has been identified as the person to take care of both GUI development and also ensure regular running of the tests, as per strategy document. YG to check with SN (and also ICH) and close the matter.
4 Jun : YG to check that ICH is aware and ok with the arrangement.
17 Jun : this is resolved and can be closed.
==> GP to describe the requirements for the GUI to Shilpa and follow-up at reasonable intervals about the progress -- to keep it open for this follow-up.

1.5 Installing and testing of temperature monitors in front-end & common boxes -- from 17 Jun (VBB/SSK) : scheme for fitting two temp monitors (one for LNA, one for FE box) for tests on bench, followed by antenna tests and installation: lab test with manual readings had been done (showed 15 deg temp difference between LNA body and FE box (open)); work was ongoing to study online data from 3 antennas : W1 (130-260 FE box), W4 (250-500 FE box) and E2 (common box) was tested ok, and some long duration tests had been carried out; meanwhile, C4 & C10 fitted with dual temp monitors in FE box, and C13 with monitor in both FE & CB -- some tests had been done but data was not sensible due to unresolved issues in the wiring of the existing common box units that prevents desired data to come on expected channels in online monitoring set-up ! Agreed to select a few antennas (maybe W1, C13, E2) for proper monitoring after resolving the issue, and for the rest, keep putting the temp monitors and maintain a log of which ones work in online monitoring; later, correct the wiring whenever a common box is taken for maintenance or upgrade (same argument applies for power monitor also). Combined SOP for temp monitoring and total power monitoring has been prepared and released. Current action items :

(i) Analysis of the data : C13 & E2 both channels temp monitor available at online output (fixed for C13 one ch FE & both chans in CB, and E2 both chans in CB); some test data had been taken; also, some data had been collected for 6-7 antennas; first results for ~ 5-6 antennas (LNA + FE box) + 2 antennas (CB) for 3 hr duration shows some basic behaviour but not clear how well things are working; to try two things : (a) to check if any old data of longer duration (from last 2-3 months)

is available (b) to try a longer run, even for one antenna like W4 which is under maintenance; some of the short data stretches have been looked at; at least one 6 hr data has been taken; report has been updated and submitted to library for uploading; longer stretch of data and analysis of that is still pending.
Tried one run on E2, but signal is flat ! Could have been problem of MCM5 not being in scan mode. Expt being redone on 11th; finally data from one long run is available, and has been analysed; shows decent results for a first attempt : temp of FE and CB following each other; with LNA temp a bit below but tracking (with some delay maybe?);
(a) need more confirmation runs to establish repeatibility -- fresh data have been taken; being analysed;
(b) regular monitoring can be folded into strategy doc for power monitoring.
for (a) : one repeat expt was tried but FE temp monitor stopped after about 1.5 hrs, whereas CB monitor was working ok -- need to repeat the test run.
for (b) : update is needed.
Repeat test yet to be done; now E2 doesn't have the broadband system, so a different antenna has to be tried. item (b) will be taken care of in the strategy doc.
20 May : 12 hrs data taken on C13 : common box not showing any variation -- needs to be checked if it has monitor or not; FE data needs to be checked. For adding to strategy document, can try for one hour once a week + one 8-12 hr slot (sunrise to sunset) once a month : can be on Thursdays.
4 Jun : C13 problem due to CB not having temp monitor; can revert to E2 now.
17 Jun : one data run taken with E2 : either MCM scan mode problem or temp monitor not working; one more round to be tried on short duration to resolve the cause.
==> some data and results are available from the regular monitoring tests : ~2-3 hr durations of 3-4 antennas : basic results look reasonable, but there is enough variability between antennas (and between FE, LNA and CB values) to cause some concerns; agreed to keep getting data, including couple of long runs.

1.6 Spare LNAs for L-band feeds -- from 17 Jun & before (SSK/ANR) : we had 32 feeds; 2 were not working (1 has been dismantled for making drawings of new feed) due to lack of electronics spares -- mostly device failures (including some new ones?); some new LNAs were successfully assembled by Gopi and failed feeds for C3,W1,E2 & E5 were fitted with these and found working ok. Also, one spare feed was assembled and installed on W1 and working fine. It was agreed to have at least 5 LNAs assembled and available as spares -- initial lot of 10 was assembled and used up; finally (c 20 May 2015), status quo situation was that 2 fully assembled spare feeds (i.e. 4 LNAs) ready for use, and no extra LNAs available (from old design).
Current action items :

(i) to update about status of feeds on recently installed units (W1, C1 etc) :
finally, after a lot of follow-up, it was confirmed from PMQC data that W1 appears to be working ok for past few months. 2 other recent units are on C1 + one more antenna (C3?): C1 has units with new LNAs, for both pols made ready from older batch of devices with careful retuning; it was giving ripple and bad bandshape problem -- was found to be due to broken cable (fixed); then it was down due to low deflection in one poln; problem found in phase switch -- repaired and put back on C1 and now working ok. check health status of other antennas with recently installed LNAs : C3 + ?? -- this needs to be got from the records.
Sanjit to collect this information and send -- is that done now?
4 Jun : Sanjit is compiling and will send.
17 Jun : Sanjit to be reminded.
==> no updates on this and maybe the question is somewhat redundant by now?

(ii) alternate LNA designs : to see if design used for 550-900 can be modified for 1-2 GHz use; to also check the design done by Abhay Kulkarni and see if it can be improved for our needs; design files had been obtained and were being checked by GP and ANR : model files converted to match simulator used by us; component models in software had to be downloaded; also ultralam2000 that was used is not available in the market now; agreed to simulate with ultalam2000 first to check ckt works ok; then concentrate only upto 2 GHz and change substrate to RT 5870 (easily available); simulations matching with original results completed; simuation reproduced ok with RT 5870; trying to tune the design to required specs of gain (30 vs 34), Tlna (~28 or better); in terms of NF target is to go from 0.4 to 0.3, and maybe at cost of reduced BW; Feb-Mar 2015 : now getting close to Tlna of 28-30 across the band; overall gain is also very good ~ 38 dB; but 4 db slope across the band needs to be adjusted; move from s2p to non-linear model completed successfully -- did not disturb the results.
Current action items :
(a) work still ongoing to try to flatten 4 dB slope -- this has been attempted in prototype PCB that has been sent for fabrication (the 4 dB slope is due to missing consideration of feedback in simulations)
(b) meanwhile going ahead with layout & ordering of PCB and making couple of units, while continuing to improve the design; first proto PCB had problem with layout due to error in device footprint -- was redone; finally, original design fabricated on RT 5870 with retuning of components gave a working solution -- gain is not high enough (28-30 dB) and Tlna maybe a bit on the higher side (28-30 K); working on increasing the gain (may be difficult as it is a 2 stage amplifier); reduction in Tlna may be easier. The 3rd unit has been assembled (but needs to share chassis with the first 2 prototypes) and will be tuned to try for better noise performance.
20 May : after retuning of 3rd unit, some improvement in gain -- it is now ~ 32 dB across the band (no slope); Tlna had reduced to 31 - 28 - 27 - 31 over 1060 to 1390; also S11 and S22 are below -10 over the entire band. To check if there is any further scope for improvement in Tlna and also to assemble 2 units to check repeatibility.
4 Jun : this is still status quo in terms of retuning; meanwhile, 4 PCBs assembled (2 are retuned to optimal gain); 2 chassis available; 4 more being ordered; to try for improved Tlna, and then decide for putting on antenna for tests.
17 Jun : no progress on this item.
==> no update on this due to attention given to 550-900 LNA.

(iv) possibilities for new LNA with Tantrayukt (Yogesh Karandikar) : item to be taken up for discussion, following the visit of YK in Dec 2014.
To check if YK has got results from his first prototype for 500 to 1500 and then take the matter forward. Discussions are ongoing with Yogesh. Some email updates from Yogesh (Apr 2015) -- getting close to fabricating the first batch of the LNAs; also, NDA needs to be completed, and EoI process needs to be carried out -- this is ongoing.
==> some updates from YK who has his first LNA almost ready and would like to come to GMRT to test it.

1.7 Completion of spare L-band feeds -- from 17 Jun & before (SSK/ANR) : Target to have a total of at least 5 (out of 8) working spare feeds (from mechanical to electronics) : 30 antennas had working Lband feeds, but there were no spares, though we had 2 feeds; one unit was assembled back from the feed that was dismantled for making the drawings -- this was completed and installed on W1 (one feed is now in the regular 'maintenance cycling' of feeds); 32nd unit was there in Pune wshop and was shifted back after assembling by mech group and then fitted with electronics;

it uses newly fabricated push-type (presss-fit) probes; after 2 LNAs were made ready (see above) this feed is now available as the 2nd spare feed. Furthermore, 6 new feeds were made (via outsourcing) in 2 batches of 3 nos; in the first set of 3, 2 nos had wrong size of horn and had to be corrected by the vendor; all 3 needed new covers as old ones were not suitable; second set of 3 feeds from Akvira : OMT + horn + cover; hence, total of 8 spares CAN become available; note that weight of 3 latest feeds is 18 kg more (72 vs 61 kg) than earlier feeds -- now accepted as 'fait accompli' !

Following issues need to be resolved currently :

(i) having sufficient number of spare LNAs : see item above for details.

(ii) other electronics : sub-band filter bank is the main item missing; it was found that the sub-band filter ckts spares don't work as one gnd line (for switch ckt) is missing in the films from RRI (!) -- to try with a wire providing the gnding ckt; alternate is to start using the new design -- this shows good performance for individual filters, but integrated unit is giving poor performance for selection of 1280 -- problem with the switch (new make is not giving same performance as original make) and this is affecting both reuse of old filter PCBs and also the new design; looking for original make (MACOM) and also trying a different switch (Hitite, which means new PCB); new PCB designed with Hitite switch (will need additional patch PCB to convert logic levels; one chassis (for 2 pols) made available for testing; new design still not working for 1280. After isolating the filter from the switch, response was found to be fine; found some issue about the layout on the PCB for the Hitite case and PCB was redone -- received, populated and tested : looks like still not producing proper results? Finally problem tracked to the amount of grounding : added a metal plate below and screws to provide additional ground area -- now both MACOM and Hitite designs are working ! Modified PCB layout being done (for both cases) -- design sent for fabrication around 10th May; expecting PCBs within a week.
4 Jun : both PCBs have come; Hitite is assembled and tested ok; will do the same for MACOM shortly and put out a detailed comparison for discussion.
17 Jun : results circulated by Imran : MACCOM response is better; Hitite is showing some shift in some of the sub-bands; recommendation is to go with MACCOM. Agreed to assemble for both channels and put on one antenna (without 1390 ampl) and compare with existing system.
==> detailed look at the results at 1390 shows that the new filter is better in shape (and insertion loss) but not good enough to dispense with the extra amplifier; when new PCBs come (from Argus), will assemble in both channels (with ampl) and put in one antenna.

1.8 Testing of LBand wideband systems on 30 antennas -- from 17 Jun (SKR/PAR/SSK) : (to maintain a proper log of action taken on individual antennas during these tests and debugging activities); data being taken fairly regularly since June; some history is as follows :
June 2014 data : C08 & W01 CH-2??shows ripples at OF RX output -- gone now (to check possible cause); Sep data showed problem with W4 ch2 -- fixed;
RFI issues : S04 & E02 showed RFI type lines, E06 showed RFI lines in CH1 (June data); line RFI in 1070-80 range (likely to be airport radar), around 1280 (likely to be due to GPS) -- July 2014 data; lines at 1030 & 1090 (3 MHz BW) also seen (Aug 2014 data); also, is there a RFI line at ~ 1200 (3 Sep 2014 data)? -- need to confirm status of all these lines (can be covered under RFI agenda). From Sep 2014 data : lines at 1176.0 & 1176.45, 1191.80 & 1204.70 are likely to GPS (in addition to 1280) and 1090 is airport radar; there appear to be a few unknown ones also (e.g. 1320, 1480 etc)

-- check with RFI team separately by including in that agenda item.

Current action items are as follows :

(i) some antennas with poor deflection overall : to be addressed as and when such cases are found. e.g. Ch2 of C1 -- was confirmed to be a cable problem, but was still showin some slope, whereas test at antenna base shows OK.
8 Apr 2015 update : the slope is OK now; during current MTAC power level difference issue being studied; C14 shows slightly low deflection (by 1 db) in latest data.
20 May new results : C3 shows somewhat lower deflection; overall, most antennas may be showing 1 db or so lower than usual? -- this may not be true as the values match with 4 control room numbers and theory curve had gone up for some reason (compared to Jan 2015 !); agreed to mark the control room values on the plots.
W4 one channel not working -- true for other bands also (?)
4 Jun : control room values are now marked not by 4 pts, but by a curve (!);
C1 both chans are 1 dB less; C11 ch2 is less -- need to be followed up.
17 Jun : no updates.
1 Jul : no new data or updates.

(ii) some antennas with deflection changing over the band (less at high frequencies): checked if pointing offset can explain this -- not found relevant; was shown that it happens for cases where the RF power level (at laser input) is too low -- confirmed with a more careful set of tests (and plots) for few selected antennas (including make good ones look bad by increasing OF attenuation), and demonstrated in deflection test report of 11 Nov 2014; to check if appropriate reasons for low power levels can be identified. S4 had very low power for long time -- was solved with change of RF PIU in OF system (!); currently (11 Mar 2015), C8 ch2 being investigated.
8 Apr 2015 : OF attenuation needed to be changed from (default) -20dB to -11dB for a few antennas (W1 ?);
In latest March 2015 data, this problem is seen for E6 but power level is ok.
20 May : low sensitivity in C3 shows this kind of slope across the band in deflection.
4 Jun : E6 is now added to this list (C3 was not available) -- to check with JP about pointing related for E6; go backwards in the record to check when C3 problem started.
17 Jun : no updates.

(iii) some antennas with poor on/off bandshapes, including large slope e.g. W1 (has been there for several months); C4 and W6 also; such cases need to be checked (call sheeted) and understood.
8 Apr : cable faults found (& rectified) in C4 & W6; Mar2015 data does not show any major problems. To evolve a method to keep regular track of this issue.
W1 still needs to be understood. W4 one channel may be developing some problems.
4 Jun : W4 problem was due to splitter and now fixed; W1 feed has been replaced by spare unit and slope is seen in the LNA of unit brought down -- one LNA has been retuned, second one is being done; C2 also shows this problem -- will do in-situ tests of check the cause and then decide action to be taken.
17 Jun : no updates.

(iv) few antennas with ripple or large slope across the band -- to be followed up as and when seen. C3 and C12 identified as problematic and being looked into.
8 Apr : C3 & C12 problems traced to loose connectors (after tightening they are OK); Mar2015 data does not show any major problems.
4 Jun : no new instances of ripple reported; except may W4 ch1 having a bump near 1070 MHz.
17 Jun : S6 is now showing ripple; maybe cable problem.

(v) there is a good data base from sometime in 2013 onwards -- can we have a well-defined algorithm for comparison of different data sets and getting statistical conclusions? -- to look at developing a tool for this; a basic tool was developed : overplotting of on and off is possible and clear patterns can be picked up. To check for next level of sophistication of the tool.

(vi) RFI and other issues :
20 May updates : C2 and C12 show problem with setting of OF attenuation values and likely to be telemetry problem -- corrected by telemetry team by putting the proper antcomm unit (4 Jun) -- to check if this item can be closed.
RFI study : GPS signals seen very strongly (will need detection algorithm); new RFI lines seen near 1470 (maybe something related to 4G) and near 1540 ; also something around 1320 may be there?
4 Jun : new data does not have significant RFI, with the 1090 radar being the predominant one; Q : why GPS etc vary so much with epoch? need to plan predictive algorithm for these. Also, mobile rejection shows different level of residuals and quite high for some antennas -- need to be investigated a bit more.
17 Jun : S3 appears to be showing some RFI problem in 1390 band.

==> 1 Jul : no new data or updates.

1.9 Characterisation of recommended attenuator settings for different bands -- from 17 Jun and before (SSK/AP) :

(i) values had been given for Lband, 250-500, existing 610; only 130-260 / existing 150 was pending -- this was also completed (appears that 6,6 may be the best value); note to be circulated soon (Sanjeet + Ankur); matter got sidetracked for some time due to problem of OF attenuation settings not working properly for some antennas; was taken up again on 22 Apr, with a discussion on the latest version of the SFA for OF system (including a part which has combined analysis with FE system) -- has lot of useful additions made, including recommended attn values for Lband, 250-500; however, recommended attn values for 130-260 and 150 still need to be worked out and reported; bandshape measurements with 0,0 attn compared with expected values from SFA report (-24 dBm over 130 MHz BW) leads to likely conclusion of 10,10 as the optimal choice -- needs to be confirmed and finalised.
4 Jun : work in progress to confirm the values.
17 Jun : no updates.
==> repeat tests confirm the values above and 10,10 looks like the optimal setting; note to be finalised (side issue : quite a bit of RFI lines and variable on different dates -- RFI team to look into it).

(ii) FE team to test the power levels at OF o/p and cross-check against SFA values : for 250-500, this has been done and results incorporated in the updated SFA report; for Lband the exercise is ongoing (antenna to antenna variation is a major issue); can be done now, as Lband is relatively stable now; was done by Ankur in a report back in July 2014 -- discussed and suggested to add a few refinements of the statements used (for 250-500) and add an explicit entry in the table; further to compare for each sub-band of Lband using realistic cable loss value for each sub-band (this can then be done for 250-500 also, if found significant). Updated version of report to be produced with these modifications; first part (for changes related to 250-500) has been done; waiting for measurements at Lband to be completed; some work has been done by Ankur, some work has been done by Imran to characterise FE, and SFA report also has measurements of cable loss; calculations have been done;

need to cross-check with measurements; waiting for report to be finalised, after some internal feedback. Meanwhie, contents of updated report discussed (see item above) -- to check current status and see if this can be closed with formal release of the report.
Just pending for item (i) to be completed and updated report to be released.
==> this should be possible now.

1.10 Switched filters at different stages of receiver -- from 17 Jun & before (SSK):
2 main categories of switched filters are needed : (a) switched filter banks inside FE boxes (these are mostly covered under agenda items of the respective FE systems) (b) switched filter banks in rx room for additional, selective filtering of the RF signal before it goes to GAB system; (c) monitoring set-up in rx room (at o/p of OF system); these are being designed using the new switches : 2, 4, 8 way switches with different possible configurations;

Current action items are as follows :

(i) for rx room monitoring at OF o/p : note that these circuits are connected to the nonitor ports of the OF system; first design did not give enough isolation at highest freq of operation and hence new design was done; ckt for 2:1 and 4:1 versions was mdae ready & tested -- 25 dB isolation achieved; drops to 17 dB with frequency for 8:1 switch -- now getting improved rejection : better than 25 dB below 1 GHz; goes down to 16 dB above 1 GHz; the leakage between the signals with this switch is still unacceptable; trying another switch (MACOM make) which terminates unused inputs while selecting the desired input (will be used in the final 30:1 monitoring system), and gives 40 dB isolation; new switch + modified design with additional isolation switch and power supply isolation done : achieving 35 dB at Lband and more than 50-55 dB at lower frequencies, with all channels powered; will be tested in monitoring system for 16 antenna set-up. 8 antenna system completed and under test; appears to be working ok; assembly for 16 antenna system is ongoing; components are available for full 64 input (32 antenna) system.

Current action itesm :
(a) to look at test results of 8 antenna system -- especially the isolation results.
(b) to do an additional test with signal injected at Tx i/p ; not done yet.
(c) to completed 16 antenna system (4 units wired and ready) :
(d) to summarise the design in a note.
20 May : isolation numbers (at 3 spot freqs) ~ -40 db to -35 db for adjacent ports and ~ -40 to -70 for other ports. item (b) yet to be completed; 16 antenna version has been completed and tested -- some minor issues related to ripple in one of the 8:1 units; to start the work on design note for this.
4 Jun : 16 antenna system is completed and ready for release; to complete item (b) and see if a report can be generated.
17 Jun : completed unit was showing a dip in 1390 region; required additional grounding in the relevant part of the ckt -- this is done now and just completed; test in item (b) yet to be done.
==> 14 antennas are showing reasonable result; some issues related to driving of digital lines etc. test in item (b) yet to be done.

(ii) for rx room switched filterbank : prototype system was been developed; tests were done and performance found ok; report describing the design and characterising the performance was produced, circulated and discussed (22 Apr 2015) -- was in quite good shape, with results for different filter combinations. Final version was sent to Dongare by Ankur around 20 May 2015. Pending issue is about availability

of space in rx room for housing these units -- agreed to keep this pending (on low priority) till final requirement for this system is clear.
==> nothing to discuss.

1.11 Follow-up on 550-900 MHz band filters -- from 17 Jun & before (ANR/SSK) : Comparison of ICON product with in-house effort and finalisation of plans : technical comparison of individual filter responses showed in-house design to be slightly better; tests with integrated unit using new PCB showed insertion loss increases to 3 dB now and some change in slope on higher side; complete chassis and full integration done and tests repeated to make detailed comparison with ICON results -- showed performance is very similar except for some out of band bumps (at 30 dB level) and slightly slower roll-off ; tried with AC coupling capacitors (no improvement); new board fabricated which, after retuning, gave much better roll-off; meanwhile, some realistic cost estimates for in-house production vs getting it done by ICON were made : concluded that ICON option will be much more expensive. Sample PCBs from Argus and Shogini had been obained -- first test results (without chassis) showed ~ 5 MHz shift in 2 sub-bands but better roll-off; final plots showed same IL but the higher sub-bands having slightly shifted centre and widths which cross the main BPF upper cut-off; design was modified and new PCB was obtained from Shogini and tested ok and one complete system with chassis (for one poln) was made ready; detailed report was produced and released; it was agreed to defer further work till ready for integration in new FE box; meanwhile, cost estimates for mass production made : Rs 32000 for 2 PCBs is the dominant cost; total is about Rs 41,000 per antenna (compared to Rs 90,000 by ICON); hence, agreed to go ahead with building our own design; meanwhile, reduced wt chassis (700 g less) had been made (2 nos) by w'shop and integrated filter unit was made and tested ok. Ready to go for mass production.

Current action items :
(i) to confirm if PCB material and switches need for all 30 antennas is in hand; PCB material is enough for 30 antennas; switches are somewhere in the ordering process -- (20 May) switches have come (quantity more than needed for 30 antennas) This is closed as of 4 Jun 2015.
(ii) to confirm that chassis required for all 30 antennas are in hand? -- 35 nos of chassis in hand -- sufficient for 30 antennas; no further action on this sub-item. This is also closed as of 4 Jun 2015.
(iii) making the units : one prototype made ready; agreed to go for mass production in batches of 20 nos (10 antennas); encountered problem with Shogini for production of PCBs; problem now resolved and first batch of PCBs for 20 units under process and delivered; was waiting for the switches; now waiting for identified manpower to be free for starting the wiring; to check current status.
4 Jun : wiring work has been assigned; will start soon -- to confirm the status, and see if the item can be closed.
17 Jun : wiring work has been initiated; will make 2 units (for 2 antennas in one go); avg rate will be about 1 unit per week. This matter can now be fully closed.
==> going smoothly; one unit alredy installed in C10 FE box; can be closed.

1.12 Finalisation of 550-900 FE box -- from 17 Jun (IK/ANR/SSK) : to produce a block diagram for the 550-900 FE box; then to start seeing which units are ready, which need to be done; which may need to be combined into single units etc; roughly same number of components as 250-500 box, slight difference in the arrangement of notch filters; size of sub-band filter chassis will be different; agreed to start this layout work in paralle with the work on common box layout -- Imran+Ganesh looking at it, with Bhalerao's help.

Current action items :

(i) to confirm if block diagram of updated system is available : existing version to be given to Imran for producing updated version -- check if ready (now pending for a LONG time !!)
4 Jun : first version of blk diagram presented : generally ok; includes separation of FE system into 2 boxes; issue of noise source splitter -- needs to be in the main box and hence 2 cables are needed for sending noise o/p for LNA box; also, the post-amp + 2:1 RF switch (before it) + RF on-off switch (after it) need to be integrated into one PCB -- will take some time.
17 Jun : no specific action items related to blk diag -- can be closed.

(ii) dir coupler not available -- being designed fresh; 2 options done and PCB sent for manufacture (to Mohite, then changed to Argus); first tests without chassis look ok; tests with chassis for 2 designs (with different substrates) : one design is better in terms of insertion loss (~ 004-0.06 vs 0.06 to 0.08) and variation of coupling over the band (3 dB vs 6 dB); selected design to be tested with noise source + LNA + feed load in the lab.
4 Jun : integration could not be done as the first version hood is not big enough; agreed to complete antenna tests with this frist version (without noise coupling) and check later if dimensions of hood can be increased; fall back option is to use the 2nd coupler whose size is smaller. To check current status of this.
17 Jun : favoured option is to increase the height of the hood by about 2-3 inches to accommodate the dir coupler.
==> request for new version yet to be given to w'shop; other chassis required are already in process in w'shop.

(iii) sub-band filter : chassis (only unit) was given to w'shop for mass production needs (!); current status : all the chassis for 30 antennas have come; this is complete and can be treated as closed (20 May).

(iv) noise source (with attenuators) : right now using the unit from 250-500 system; need to check if same noise diode will be used or changed -- likely to be changed; but same ckt and PCB and chassis can be reused; prototype yet to be made.
4 Jun : prototype (with different noise diode) is ready and needs to be tested on the bench with suitable LNAs.
17 Jun : prototype unit LNAs gone with hood to C10; this test will be done with the next set-up.
==> waiting for new unit (with updated hood to be ready) + LNAs.

(v) post-amp + phase switch to be combined on one PCB + chassis that matches with size of Lband post-amp + ph swtich system and RF on-off will be added to it; proto yet to be made (see discussion earlier).
17 Jun : PCB layout is ready and will be sent for fabrication shortly.
==> PCB sent for fabrication (to Techno Ckt).

(vi) plans for split FE box (if dir coupler and QH + LNA has to be close to the feed with short cables) : prototype unit (with proper protection against water etc) is available; can be put on the final feed (once confirmed) and tested during monsoon; to check current status of readiness of this.
4 Jun : planning to put on C10 by 5th June for initial tests.
17 Jun : unit has gone on C10; need a few deflection tests to be done alongwith beam width measurements and then decide which way to proceed.
==> this can be closed.

(vii) main FE box : prototype is now ready and demonstrated -- looks in good shape; testing to start shortly; prototype of DC + LNA combo with feed will be ready in 2 weeks time (by 20 May).
20 May : DC wiring is completed; RF routing work is going on.
4 Jun : this is completed and will be tested on the bench with the hood today and go to C10 tomorrow (5th).
17 Jun : this box is working ok on C10 and the design can be taken to be the final version, except noise injection connection is not made and tested to the hood.
==> just waiting for unit to be assembled with new hood and tested on the bench and then the item can be closed.

1.13 New filters for Lband -- from 17 Jun & before (ANR/SSK) : Sample Lband full-band BPF had been designed -- has no slope with freq and better insertion loss, and maybe a better option than the existing main BPF; similarly, prototype design of new sub-band filters (with better insertion loss) has also been done. Detailed results for the main BPF shows that the BW is slightly less than existing BPF : 500 MHz (965 to 1465 MHz), instead of 590 MHz (890 to 1500 MHz) -- this gives better rejection to mobile band signals, but has implications for final usable BW of L-band system; furthermore, an improved notch filter has been designed for the 850-950 mobile band (-60 dB vs -45 dB at 900 MHz), alongwith a LPF for cutting off the 1800 mobile band has been designed -- 3 dB cut-off freq of 1650 MHz. The matter was presented to the users in Friday meeting on 9th May 2014, and it was agreed to generate a note about this proposal, for clearance in the GSG. This was done and matter was discussed in GSG of 13 Nov 2014 and it was cleared to proceed on the following: new BPF + mobile notch filter to replace existing filters in FE box; LPF to be put in common path at antenna base as a common facility for all bands; to be taken up as a case-by-case replacement job, whenever a unit comes down for some maintenance work. Meanwhile, plans for mass production need to be worked out.

Current action items :

(i) status of mass production :
(a) for the LPF : 10 units of 1650 LPF have been fabricated out of 40 PCBs available; PCBs (stripline) do not need much work for assembly -- can be given for manufacture; new chassis will be needed; PCB order for 70 nos can be sent using existing eps10 board; both pols can be combined in one chassis requiring 35 nos only -- drawing to be finalised for rail-type chassis; to check if existing chassis can be re-used;
(b) for the main BPF : PCB + chassis for new BPF ready for 40 nos (30 antennas + 10 spares) -- this can be closed.
(c) for the new notch filter : 60 nos had been made (PCB + chassis) of which 30 have been used in existing system; waiting to order more -- to check status and see if it can be closed.
(d) to include these items in Ankur's spreadsheet : Lband new filters now included (BPF is completed); sub-band filters TBD; to check current status.
The above appears generally ok, except for sub-band filter in spread-sheet; to check latest status.
17 Jun : spread-sheet has entries for the sub-band filters; to check if any further action needs to be tracked here.
==> updated spreadsheet has been circulated and it contains the new information; plan is to transition to a web-based tool for long-term tracking of progress of various filters.

(ii) status of installation :
(a) agreed to put 10 nos of 1650 LPF in one channel of 10 antennas which have 250-500 broadband system installed; waiting for chassis; meanwhile, 1650 filter was put in one poln of C10 on a trial basis; appears to remove the 1800 mobile signal and does not appear to affect other bands; shows about 0.5 dB insertion loss; agreed to put available 10 nos in ch1 of 10 antennas. Now done for C4 & C10 (?)
3 antennas done (to confirm which ones) -- target to do 10 nos of CSQ.
17 Jun : installed and to be left for some time for user feedback.
==> installed in 7 antennas so far -- list to be given to NSR for updating the webpage; watch and wait for some time.
(b) also agreed to move the 70 MHz HPF to just before the signal enters existing IF system (instead of just after the signal enters the ABR cage) -- to check the plans for mass implementation of this. now done only for 1 antenna (C4) ? Need feedback from ABR team?
Discussion with ABR team did not converge as planned; right now, LPF and HPF put in series and put on top of the rack.
17 Jun : nothing new can be done here and hence this can be closed.

2. RFI related matters :

2.1 Discussion relating to Industrial RFI survey -- from 17 Jun & before (PAR/SSK) : revised docs (from 2009 and 2012 discussions) had been circulated by RFI group and were discussed in 5 June 2013 meeting (is the document too exhaustive?); new survey planned with main aim to generate updated database which will be useful to pinpoint likely hotbeds of RFI in the industrial areas in addition to finding those without NOC; after months of planning and discussion with DIC, was finally conducted during 23-27 June with 4 teams; covered Ambegaon and Junnar talukas ~ 40-50 villages in each; ~ 40-80 working industrial units (large number are closed down or never existed!). Some of the progress is as follows :
A form had been prepared for use in the survey and had been discussed in detail and agreed that it is suitable for use; about 70% of existing data had been entered into this form; agreed that this activity would be superseded with making a database of equipment and NOC record for the existing industries found in the survey; this data entry now completed for all 3 regions : Junnar, Ambegaon and V-K industrial estate; some highlidhts from the database : of the total list, a significant number of industries are closed down, and another significant factor are no longer traceable; about 1/3 of the original are still working (ignoring poultry which is about 1/4, but is considered RFI-friendly). A follow-up meeting with DIC took place on 30th Sep 2014.
Summary is as follows :
a. To maintain proper record of the data of existing and future industries in the same format. The data format and data base was shared with them during the meeting.
b. Complete list of the villages in Zone I to Zone IV is submitted to them, based on which they can decide the issuing of NOC for industries in different regions (and also outside?).
(c) DIC to issue NOC to the old units which are working in the GMRT identified zones, with guidelines from the GMRT
Matters had been stuck for some time due the issue of payment to DIC team for some of the expenses incurred during the survy work. This has been resolved, following the meeting between PAR + JKS and DIC office, on 27 Apr 2015.

Some of the present action items are as follows :

(i) To cross-check the list against the ones which have NOC (for those operating

without NOC, add to our database and inform them about informing us for changes, and DIC to issue NOC post-facto as mentioned in other agenda item) -- this is happening now; current table has a column indicating whether NOC is there or not. DIC has started taking action on parties without NOC (e.g. Govardhan dairy, ~ 20-30 km away). DIC will be sending the standard form to all and it will come to us for clearance; we need to be careful about to whom we say "yes" in retrospective manner, so as to avoid setting up a precedent of giving NOC to somebody with wrong kind of equipment already installed & running ! Possibilities for improvement can be suggested to them. Some work to start on this by NCRA giving a first list of names to DIC for initiating action (to choose first set of parties a bit carefully).
4 Jun : need to check Govardhan in our records; for both the sugar factories (near W6 and S6) -- there is no NOC; other than these, it is only the welding units? to do one round of careful check in the data to verify the facts about which ones don't have NOC. Need a status update.
17 Jun : one more unit identified : old unit of DJ exports; no updates on Govardhan etc.
1 Jul : email update from PAR : NOC for Gowardhan Dairy and D J exports old unit has not been issued. I have checked and confirmed from the data base.

(ii) Related topic : units that have NOC and grow in size to exceed the norms -- what is to be done. One unit just under 2 km away on highway -- should be told "NO" and see if he will shift beyond 2 km. Also to check if our norms can be tightened further for differentiating between less harmful and more harmful industries -- to check the procedure used for establishing the norms.
17 Jun : records show that one unit located at 1.93 km was given clearance (2009) for a serum making plant.

(iii) To follow up with DIC about
(a) issuing of NOC to the old units which are working in the GMRT identified zones, with guidelines from the GMRT -- 4 Jun : to check the facts and then follow-up.
17 Jun : it appears that there are no other such units except the 4 identified above.
(b) Follow-up on single phase welding units : they have requested letter from GMRT to collect information from users around GMRT antennas.
20 May : Agreed for preparing the letter and sending to DIC. RFI team to coordinate with Admin (ABJ + JKS) on this.
4 Jun : follow-up with JKS is pending.
17 Jun : discuss with admin to agree on the procedure to be recommended : maybe can have both in parallel -- letter to DIC, and to gram panchayats to collect the data.
1 Jul : email update from PAR : regarding preparation of norms related to NOC (less harmful and harmful industries) and sending letter to DIC and Grampanchayt offices for collecting data related to the operating industries in their area to be discussed and will be prepared on 6th July 2015 at the NCRA. This week was not possible due to busy schedule of Shri. Solanki.

(iv) during the survey, some units which are likely to be important from RFI point of view have been identified for detailed studies later on -- some work can start in parallel with completion of database, beginning with the bigger units; measurements (using LPDA) for 2 big industrial units in Junnar & Ambegaon area completed; no new ones have been done (about 10 more need to be done); results for the 1st two have been analysed & no strong RFI is seen other than the ambience due to powerlines etc. To check current status of this.
17 Jun : no updates on this.
1 Jul : email update from PAR : regarding measurement of rfi from bigger industries other than two still pending. In the mean while we have visited transformer installations for power line interference measurement.

2.2 Transformer RFI revisited -- from 17 Jun and before (PAR): Team has been doing a check on transformer RFI and the updated results from this will be available soon -- will need to see how this compares with the earlier round of this work.
Comparison of old and new data is in progress. Only 6 locations are common between new and old data (!) -- many new installations are coming up ! No clear conclusions have been drawn from the study; also more data needs to be taken to cover a larger number of transformers -- to wait for an update from RFI team.
20 May : some of the old data has been found (2005-06 & 2006-07 surveys) and there is likely to be some more data from 2008-2012 period -- to fill up the details properly; to try and extract the following : (i) typical time constant for failure / malfunctioning of a xmer and (ii) most common types of RFI problems : fuse links, bad transformer, cut joints...
4 Jun : older data have been found and are being added to a combined data base (old data were upto 2 km and new data is upto 1 km only -- but has more transformers !); one unit near W1 may need urgent attention -- to get the history of this and initiate the action.
17 Jun : still waiting for consolidated report! meanwhile, electrical has initiated action on the urgent case near W1.
==> updated transformer related data will be sent out in next couple of days; work has been initiated by electrical with MSECTL for W1.

2.3 Follow-up on UPS RFI -- from 17 Jun & earlier (SSK/PAR/RVS) : UPS units from Ador were found to be the most suitable : 2 nos of 3 kVA were purchased, tested for RFI & cleared; units were in use in C9 and C10. Updated RFI report was done (with comparative statements quantifying the repeatibility). Further, 2 nos of 4.5 kVA units were also ordered with Ador, with option of 2 single phase o/p with different isolation transformers (3 + 1.5 kVA); units were delivered but failed the RFI tests -- lots of discrete lines seen; finally, modified version of Ador 4.5 kVA was tested and preliminary results were quite good (report for this had been circulated).

It was agreed to go ahead with 3 kVA units from Ador; 10 nos of these were ordered as a starting option (total cost per antenna was estimated to be around 2.x lakhs); first batch of 5 nos had come in Jan 2015; power factor found to be very low (0.2 ?); RFI tests showed 1 unit with 1 dB increase in noise floor level at 150 to 270 MHz; remaining 4 units showed 2-4 dB increase in 140 to 240 MHz; the following changes were noted by RFI team : MCB make has been changed; panel plate is missing -- direct screen printed units are used; connectors size / type have been changed; finally, found that test had failed at first level because of extra switch that had been installed outside -- this was moved inside and RFI levels much better; further, auto transformer added inside the unit to improve the power factor (to ~ 0.5); after all this, RFI tests done, but still not found fully acceptable; some further desirable improvements suggested : (a) cover over MCB switch panel needs to be shielded; (b) input and output power connectors need to be shielded and filtered; (c) to remove the powder coating and provide enough grounding points.

Finally, agreed to take one unit from the lot of 5 and carry out changes at GMRT (alongwith the vendor) to fix the issues; full gasket and filtered pwr connectors may be required; meanwhile, possible source of leakage was identified -- location of heat-sink mount had opening leading to increased RFI (?);

Final conclusions from last round of testing & clearance were: need better contact of heat sink with cabinet -- no powder coating and more screws; need shielding gasket between square tube frame and door panels; cover over MCB siwtch panel needs

to be shielded properly; avoid powder coating; confirmed that shielded cable and connectors are NOT required; modified design achieves 0.5-0.6 power factor (under full load conditions) -- this is ok, and additional improvement will be with bank of capacitors to be added overall; for this final configuration, price increase may be ~ 35,000 + taxes; break-up given by vendorn shows about half of the cost is xmer and remaining is for the new shielding measures.

Current action items :

(i) Getting all 10 units modified : 1 unit fully ready; within one week (end-May), 5 fully ready units will come; remaining 4 within another week of that.
4 Jun : all 10 units have been delivered; today, xmers are being installed; will be testing for RFI in full load condition in the recreation hall tomorrow.
To check current status.
17 Jun : RFI test report of all 9 units is available and all were found to be ok at 80% of full load. This item can be closed.

(ii) To confirm plans for installation of the new units
4 Jun : only one unit is installed in C10; next unit will go to C00 replacing 4.5 kva unit there; after that, populate in antennas that don't have any UPS at all ? may look at antennas which already have 2 sets of line filters (BLDC antennas?) and see if it is better to put UPS in these antennas?
17 Jun : no status update.
==> C10 and C00 installed; 2 more in CSQ (C14 and C4) & remaining 6 in arm antennas;

(iii) To confirm final price increase for the modified units
4 Jun : final value is Rs 21,000 per antenna now; can check if amendment of PO is possible as total increase is only 10% now and is dominated by cost of xmer.
17 Jun : no status update.
==> amendment was agreed upon as the way forward -- to confirm if that has happened.

(iv) To discuss plans for going beyond 10 units :
17 Jun : not discussed.
==> a new party is showing interest in taking up the job; to check original with party if he will hold the prices (or give a discount) for 25 more units; if yes, then go ahead; if no, then order in smaller quantities and also explore alternate party that has expressed interest (one sample unit can be ordered with the new party anyway).

2.4 RFI testing of LED lights for GMRT labs & building -- from 17 Jun and much before (PAR/SSK/RVS) :
Electrical group has indented for 5 W lamps + X Watt tube lights (after samples had been tested for RFI and cleared) -- delivered units had 5 W and 7 W lamps; the 7 W lamps were found to generate RFI (not to be used at GMRT); tubelights (50 nos?) also failed the test; hence, only 5 W bulbs found suitable ! RFI testing of mass installation was also done and found ok; agreed to install in canteen as first location; these were checked for RFI after about 6 months usage and found ok; thence, cleared for mass procurement and installation in different locations; 30 nos of the original 50 nos of 5W LED lamps were installed in corridor & lab areas; indent was raised for additional quantities; these were delivered (how many?), and this new batch was tested for RFI as per earlier procedure and found to be ok; additionally, RFI team tested the units that have failed in the first 6 months or so of use -- these results are covered in the latest report, wich summarised 2 yrs of tests -- no RFI found from partially or completely failed units being powered on; agreed

that report can be given to interested vendors for improving the products; sample batch of Syska make tested and found NOT ok.

Current action items :
(i) to confirm current quantity purchsed and installed : 50 nos purchased (and installed mostly in the corridors); an additional 200 nos have been received last month (Feb 2015); plan is to put them in guest house rooms, hostel rooms, guest house corridor, and labs as per choice of users -- almost all are used up; agreed that 200 nos more can be ordered; checking with party for single batch supply (ok);
4 Jun : indent has been placed but not yet in order phase. To check current status.
==> still in processing phase.
(ii) light from 5W units is not sufficient at some locations : to try to have arrangement for putting 2 units in parallel on same connection (for more Lumens); fixture is being made ready (abandoned) and now looking for off-the-shelf options? to confirm current status.
==> could not find complete off-the-shelf solution; now trying for some hybrid.
4 Jun : electrical team yet to find a product that meets the requirement.
(iii) do we need to worry about failure rate of the units? (~ 10 have failed so far); agreed to wait for the statistics from the present lot of 200 (looks like it may not be a serious issue ?) -- need to wait for new stats to become available.
4 Jun : agreed to work out a scheme of keeping track of the failures -- need an update on this.
==> electrical to maintain the statistics.

3. Operations :

3.1 Mass production of shielded box for MCM cards -- from 17 Jun & before (SN/CPK/HSK): RFI test report of Akvira vs Physimech showed Akvira is better and this was selected. Testing of new MCM card in shielded box, with final configuration was done and report was very positive, and it was agreed to go ahead with the mass production of this shielded box; RFI group to complete 2 more prototype units and then hand over matter to Ops group, which was to discuss with RFI and Mech groups to get all the inputs and finalise the plans for placing the order on Akvira : drawings for 2 types of box : with & without provision for SPI port on chassis + 1 serial port on each box; parts list for RFI shielding materials to be ordered; list of possible vendors etc; Final target is for 60 + 10 (spares) shielded boxes; was order sent for 70 nos, with one prototype to be delivered first, and batch-wise delivery after that; sample box of Rabbit + switch + media converter + Miltech PC combination was tested on 4th Dec 2014 : results match with earlier tests using prototype units.
Two minor points conveyed to vendor : size of one of the opening and assembly of the side plates. Finally, 70 shielded boxes (for Rabbit MCM) were delivered; agreed to keep them in storage and use as needed; for procurement of the RFI material and components, list was prepared and confirmed with RFI group and indent ready (total cost ~ 33 lakhs (including items for shielding of the switch?) with line filter included (?) ; to check current status of indenting and ordering.
enquiry has gone (combined for both items); quotes have come on the higher side : problem with total now exceeding 25 lakhs whereas the original indent did not!
to investigate the reason for the increase in costs (look like 2 items may be the culprit?); to try to split into 2 equal parts, with repeat order, after checking with party about holding the prices.
20 May : recent clarification from the party is that 2 of the connectors (which are needed for bringing in DC power) have costs increase of ~ 7 x (300 $ each for a pair); modification suggested is to use the normal data connector for bringing in power

(15 V, ~ 1 Amp) -- can parallel all available pins; can check with vendor and then put modified purchase order, dropping the 2 connectors.
4 Jun : going ahead with the scheme of getting power from normal data connector -- test set-up needs to be made and run for some time; to confirm with purchase that order has gone.
17 Jun : order has not yet gone -- CPK to check and see what is holding this up.
==> order for connectors

3.2 Mass production of shielded box for switch enclosure at antenna base -- from 17 Jun and before (SN/CPK/HSK) : Detailed RFI tests show that the shielded enclosure appears to be working quite well; RFI team handed over the information and material to Ops Group for initiating mass production; last round of confirmation to finalise the drawings done; Ops group started on the work requisition for this box (as well as the box for the Rabbit card), in cooperation with mechanical group; target is 35 nos of these shielded enclosures; order placed for 35 nos, with one prototype to be delivered first, and batch-wise delivery after that. All 35 boxes delivered (c. Feb-Mar 2015); for ordering the components : list made in conjunction with tha for Rabbit card box (see item 3.1 above); to check current status and plans.

3.3 Planning for proper UPS & space utilisation for new equipment at antenna base -- from 17 Jun & long before (SN/CPK/RVS) : long-term plans for intallation of final UPS system and proper utilisation of the space at antenna base. Follow-up on 14 Aug 2013 discussion on first report : 2nd report was generated and detailed discussion took place on 5 Feb 2014; successive follow-up & final agreement on way forward (alongwith updated report) reached c. May 2014.

Some highlights are as follows :

(a) Regarding electrical loads : power drawn by different sub-systems estimated carefully, alongwith actual sample measurements on a few different antennas, for both existing systems as well as upgrade systems; effect of in-rush current at switch on also considered; total current requirement of 10 A for the ABR systems + servo control electronics found to be sufficient; hence 3 kVA UPS is adequate; agreed that, if needed, peak load requirement (e.g. in-rush current) can be balanced out by synchronised delayed switching on of different units -- this is already implemented to some extent at present. Final load requirements have been carefully checked and tabulated in the updated report.

(b) Regarding electrical wiring : agreed to have separate isolated supplies for (i) servo drive system (without UPS) (ii) servo control electronics (with UPS) and (iii) ABR electronics (with UPS); one common 3 KVA UPS with split o/p (2 KVA + 1 KVA for servo and ABR respectively) each with its own isolation transformer is the ideal solution; the new UPS can have the isolation transformer(s) integrated into it, without increasing its footprint (only height may go up); updated wiring diagram has been produced by RVS in consultation with SKB and others, and is available alongwith the udpated report.

(c) Regarding space utilisation : new UPS can be located in the space between the ABR and servo racks -- this has been done in one antenna with the new UPS and appears to work ok; existing servo FPS units can be left where they are; if isolation transformer can be moved out from the rack, then space in that common rack is enough for all growth plans of FE and OF systems; this leaves some empty space in ABR rack bottom that can be utilised for further growth of telemetry system; all new servo growth to be accommodated in the servo racks (or in-situ replacement of existing units);

extraneous items in the surrounding of the racks (electrical fittings etc) can be relocated, as far as possible, to make it convenient for people visiting for work. Most of these issues have been captured in the updated report. Matter discussed in GSG meeting of 13th Nov 2014. This item can now be taken to the logical conclusion : net outcomes can be summarised and follow-up action to be finalised.

Main list of actionable items :

(i) ordering of 10 nos of UPS : order has been placed; delivery expected end-Jan. 5 units had arrived and tested for RFI -- failed; some modifications were required; additional issue of PF of the UPS -- improved to ~ 0.6 & accepted (will add capacitor band at ABR for further improvement); first unit available for use c 20 Apr 2015); installed in C10, replacing existing UPS, alongwith 3 ph wiring arrangement (6 May); 2nd unit is ready (only xmer is needed) -- will go to C00; remaining 8 units with modification in 10-15 days -- should be with us in one month (early June); extra cost will be absorbed in next batch, which can be for 22 nos and will cross 25 lakhs -- to check with purchase about the procedure for handling this : amendment or include in next order? See earlier discussion (under RFI item) for more details;

(ii) final wiring diagram for servo + ABR is needed : modified wiring diagram was prepared by electrical and shared with servo (4 Aug 2014); meanwhile, discussions with BLDC supplier convereged : now ok to ground the neutral of the main 3 phase transformer; extra EMI filter may be required (RVS confirmed it to be only Rs 10,000 per antenna) + only one set of line-filters will be required. Action items :

(a) RVS had circulated updated wiring diagram (done in consultation with servo) which included inputs from MACON (via servo group) which suggested radiation shield between the BLDC rack and other racks. Finally, updated diagram providing sufficient shielding distance had been prepared and circulated (c Feb 2015) : no objections received; agreed to implement in one or two antennas, with few units of the line filter on trial basis; new input from servo for extra load to be added for PC104 related item -- to check current status.

(b) for the EMI filters : contact with party (Schaffner) was proving difficult to establish (to try other parties also?). finally, EMI filters indented (enquiry gone), waiting for quote from Schaffner.
4 Jun : order as been placed; delivery date is end July (only 4 nos being ordered).
==> 4 units received; one installed in C10; can install second in C00 and talk to servo about which 2 other antennas to install (including one new BLDC antenna); decide after 2-4 weeks to order more units (10 more).

(c) meanwhile, agreed to try the test of sharing the xmer between servo and other loads, via two sets of AC line filters (that already exist) : to choose either C00 or C10 after discussion with servo, for the initial tests.
20 May : heating in servo transformer is found to be significant (even without adding the additional load) and the load in each phase is ~ 6-9 Amp (much less than rating of 15 Amp); likely causes :
old vs new lot of xmer : new lot has different core & heats up more -- to be checked
THD -- can be measured for each phase
PF -- can be measured for each phase
aging -- to check mechanical features by visual inspection etc; calendar age
weather -- can the inside of the concrete shell be kept a bit cooler?
allowed range of temperature for xmer to be checked (80 is for old one; 120 is the value it goes for new one);

to check the above issues, including actual temperatures reached, and come back with numbers and conclusions for follow-up.
17 Jun : work is ongoing and detailed tests will be done in next 2 weeks time.
==> 2 fans added in C10 xmer cover to help circulation; temperature reached with full load on servo xmer is about 78 deg -- to confirm if ok with servo and then replicate the scheme in C00 and then converge towards mass production.

(d) Meanwhile, on a trial basis, with a change-over switch, the extra ABR load can be added and checked for heating etc in C10. (increase in load is expected to be about 30%).
4 Jun : expt done in C10 for 10 mins : full load put on xmer (~ 2 kVA, up from ~ 1 kVA) total current ~ 8 A (up from ~ 4 A); PF changed a bit (improved!); THD increased to upto 90-120% (from 70%); 1 deg temp increase noticed. To discuss with servo and see if the test can be run for a longer duration.
==> tests for longer duration being done (see above); THD increase may be due to the Mosfet property of the xmer. To try and find a series filter unit of appropriate (lower) current capacity.

(iii) making 1 or 2 antennas as model where all the configurations are made as per the recommendations : finally, agreed to use both C10 and C00.
At C10 : 3 kVA UPS was installed, but was feeding power to ABR only; later, servo shift PC104 load to UPS (isolation transformer still in use?); switch boards / extension boards shifted to safe level.
At C00 : 4.5 kVA UPS, with 2 isolation transformers, was installed with ABR rack connected on it; PC104 load was added to it subsequently; relocation of elec boards was pending.

Current action items are : (see also email update from Nayak & Jitendra on 22 April)
(a) agreed to put the FE power supply in the proper location in both antennas -- space was made ready (after removing delay contactor) in C10; agreed to do in C00 also; turns out that relocation of extn board is also needed to relocate the FE pwr supply -- SSK to ensure that this is done for C00 and C10. Need a status check.
(b) ask servo to confirm FPS drive location is in keeping with the agreed diagram : needs to be slightly shifted and servo is ok with it -- check if done at C00 & C10.
(c) RVS to circulate an email about the updates and finalisation of layout in C0 and C10 for replicaton in all antennas. This was done and some feedback from FE and BE teams received, and following items being looked into :
* shifting of sentinel "yellow box" (PSB + BR) -- check if done at both antennas and confirm plans for other antennas.
* alternate arrangement for keeping the phone : to change to hook phones that can be hanged -- check if done at both antennas.
* directive to keep AC flow downwards in default conditions : prepare stickers and put in 2 locations in shell -- check if done or not.
* contactor and timer for delayed start is obstructing FE pwr supply (can be removed once UPS is there?) : right now, agreed to shift; done in C10? -- check and confirm current status.
4 Jun : JPK visited antennas with FE person (Satish Lokhande) and Nandi to look at mechanical arrangements that may be needed to effect some of the changes; some solutions are being worked out, without violating the available space; yellow box shifting done on both antennas; sample phone units with proper buzzer arrangement done in C10, can be done in C00 (IP phones vs normal phones -- to be looked into by Ops group); contactors and timers have been removed in both antennas. Once the ps is put on new rails, the rearrangement would be complete.
17 Jun : mech and Ops have looked at it; estimate of down time to be brought up in

coord meet.
==> adjustments in the rack will be done this week for C10 (may not need antenna to be down).

(iv) to improve the RFI shielding of the antenna cage, starting with the model antennas : check for unshielded cable and pipe entries in model antenna shell, including unused holes and punctures, and initiate appropriate corrective steps.
RVS to make a list of all the punctures in both C00 and C10 and bring for discussion.
Work had started at C10 for this; 22 Apr : pictorial report by RVS : AC plumbing; AC line filters; servo cables (BLDC + FPS) crossing; RF cables entry points; OFC cables crossing; plus a few more; RVS to send an email to all concerned, for identification of cables, entry & exit points and unused holes / punctures. Need a discussion with RFI team about measures to prevent the RFI leakage from the punctures. Current action item :
RVS and SSK/PAR to classify the various kinds of punctures and then RFI team to suggest solutions for each category, including plugging of unused punctures.
20 May : discussed with PAR also to move this forward; to check current status & plans.
==> some work had been done in earlier days (TLV, NVN times) and electrical is beginning to replicate that (similar soln has been used in ISRO cage); meanwhile, RFI team is workign on the formal solution; also procedure for plugging the holes is being evolved.

(v) also agreed to populate C0 & C10 with Rabbit, switch, PC (with shielding) as and when available -- these 2 antennas can be used for next gen M&C work to add to C4,C6,C12 to make a total of 5. Work in progress; JPK to keep track of this aspect.
Agreed to start activity of populating during MTAC for C00 and C10, and next to C8 and C11; and then, if needed, to C4, C6, with aim to have 5 antennas ready.
Action has been initiated for C00 and C10 : one shielded box with Rabbit cards + one switch with shielded box ready; 2nd unit getting ready.
Will need to make some of the other changes to make space for the final arrangement; also 2 sets of units to be made ready. Check current status.
4 Jun : see updates in email from JPK. (to fold in the results from this !!!); ethernet shielded box needs support structure in the rack for installation -- will require in-situ welding etc; Rabbit card shielded box does not need any additional mechanical work for mounting. Issue about physical monitoring of switch working inside the shielded box.
==> Ops group and mech team to look into mounting of ethernet shielding box (without welding, if possible); monitoring of switch inside the box is solved by fibre team;

3.4 New, improved Miltech PC -- from 17 Jun and earlier (CPK/SN/PAR) :
Two units of Miltech PC with two changes (more screws on panels + panel mount pwrline filters instead of chassis mount) were under test : conclusion was that PC ok from all aspects. Pending action items :

(i) agreed to initiate the purchase of 10 nos of the final version above -- indent had been raised for 10 nos (including some spare accessories?); current status of the PO : order sent; expected date of delivery 31st Dec -- trying to expedite, if possible; note from vendor informing about delay due to late arrival of m'boards : end of Jan is new delivery date. "still under test" reply from vendor -- to see if delivery date estimate can be got. SN to follow-up with BRJ on an urgent basis.
22 Apr : update from vendor to purchase : 3 units have failed and heat sink is being redesigned; will take some more time; no response from party for a long time; Nayak to request Sureshkumar to make a visit and check; confirm if there are any updates, and decide future course of action.

4 Jun : some response from vendor got by SSK (15th June date has been given) -- to follow-up with a visit and f2f meet if possible next time.
==> item not supplied yet; vendor is still facing problem with overheating of CPU; SSK to try and visit him next time to get first hand information.

4. Back-ends :

4.1 Documenations at various levels -- from 24 Jun and before (BAK+others) :
To complete basic,internal documentation (at ITR level) and then move to the point wehere formal publications of relevant items can be done.
Current action items are as follows :

(i) Detailed design doc : analog back-end was being done by Hande : 2nd version had been circulated in April. Next level of document going down to chassis level is to be made ready -- chassis level doc will take about 2 months; was deferred till end Oct; and then deferred till end of Dec; 2nd version had ~50% chassis level inputs; to be completed by end-Jan'15; needs some more time as 2nd LO scheme inputs are also being folded in; work in progress; may take another month; check in mid-May.
27 May & 4 Jun : progress is slow, but going on. 10 Jun : still ongoing...
24 Jun : will take ~ 1 month (till end-July) !
==> no significant update.

(ii) ITRs + publications for analog back-end systems to be taken up :
(a) analog back-end : Sandeep and Navnath to look into that; pending. Work pending for some time; team to review and pick up the activity. BAK to follow-up.
SCC and Navnath have had one discussion and will follow-up with BAK; not much progress; may take it up next month, after MTAC; list of items to be done has been prepared; work has been started by Navnath; to check current status; not much progress in last few weeks, but will pick up now (27 May).
4 Jun : not started yet -- to start now. 10 Jun : same status as 4 Jun !
==> no progress reported.

(iii) ITRs + publications for digital back-end systems : ITR was completed by SHR (quite some time ago; after some follow-up, SHR and BAK started work on modifying GWB ITR to convert to a paper; first version has been circulated; needs to be taken up for discussion between YG, BAK & SHR
27 May : not yet reviewed and discussed; but agreed that meanwhile SHR can look at it from the point of view of improving by putting in the latest work on expansion to 16 antenna, dual GPU system.
4 & 10 Jun : will get into this once GWB-III release work is completed.
24 Jun : can start work now on incorporation of new GWB developments.
==> no progress here also.

4.2 : Power supply for GAB : from 17 Jun and before (NDS/BAK) : Two options are possible : linear vs SMPS. Comparison note with all pros & cons was produced : pros and cons are in terms of convenience (and price) vs RFI properties; agreed that present (c. Aug 2014?) set-up of 30 ant GAB (with 5 spare SMPS supplies on order) can run for 6 months or so ; final decision can be taken later on. 4 SMPS units that had come were used to get 4 racks with SMPS and 4 racks with linear / CVT supplies; meanwhile, shielded box was designed for the SMPS by RFI team -- RFI report showed good performance; agreed to go ahead with it for mass production; meanwhile, SMPS installed in 4 rack; 12 new boxes with RFI shielding planned -- 8 are needed in the system, and 4+1 will be spare. Mech group to place the order for

12 nos (after BE and RFI teams check the drawings); drawing had errors (!); needs modification; was stuck for PC problems. To check current status and see if order can be / has been placed. Issue of problem with the drawing has been cleared. One sample being made in-house for clearing the drawing etc.; required fans etc being indented by Raybole -- now on order; 12 boxes for SMPS awaited from workshop to outsource (proto found acceptable); still waiting for the sample unit being made in-house by mechanical; to check current status.
17 Jun : prototype has come and being tested; may need some change in arrangement before mass production.
==> prototype sent back for modification has not come back yet from w'shop; balance SMPS units (plus others to be used for other applications) to be procured.

4.3 Power equalisation schemes for new back-ends -- from 17 Jun and before (SSK/NSR/BAK/SRoy): Need updates on both of the following :

(i) option 1 : using detectors in GAB and local feedback loop -- monitoring set-up was made ready; DKN worked on code (using algorithm taken from NSR); first round of testing showed problems like detector output saturation -- gain adjustment checked and problem fixed; basic power equalisation algorithm was first tested ok with 4 antennas, and then expanded to more antennas; comparative study of this scheme with the GWB-based scheme to see if there are any differences or pros and cons wad done : do GAB power equalise and look at GWB bandshapes; complete the loop by doing GWB power equalise and checking GAB o/p. Test completed both ways, first for 4 antennas and then later for 8 antennas (extended to more?); BE team is ready to release for use by operators -- a basic SOP to be generated and released. Current actions :
(a) to completed the SOP and release the set-up -- check if this can be closed : yes.
(b) to run this alongwith GWB bandshape check to help debug problems in GAB -- can be formalised as a debug tool to be run by PMQC periodically; DKN to make the test procedure for control room use; check current status.
17 Jun : still pending with DKN.

(ii) option 2 : using correlator self outputs and computing gain corrections :
basic scheme is implemented & working; more general implementation of a user controlled ALC mode aims for the following 4 modes of operation
(see MoM of 3 Oct 2013 !) :
(1) on demand -- this is the current released mode.
(2) repeatable at some interval specified by the user -- can it be script based?
Sanjay has completed the core coding; a wrapper is being done by SRoy; to be taken up for discussion.
(3) automatic, should adjust in response to a stimulus in the input power -- needs a discussion.
(4) should provide a reliable power monitoring scheme -- needs discussion.

Issues that came up are as follows :
Accuracy of attenuaton values and repeatibility of settings : 5% (0.25 dB) ok; agreed to add median calculation feature; to check if a feature to predict the expected change in attn for a given change in sky direction can / needs to be added; better option for saving the attenuation values for future use / reference to be defined; logging of results to be looked into; agreed to have a document that summarises all of the above and spells out the main requirements (from user point of view) and possible solution options / techniques; detailed discussion has taken place between SRoy, BAK, SSK and YG on 14Aug2014 -- main conclusions and present action items are as follows :

(a) attenuator values : aim is to check if measurements match with specs (within +/- 0.25 dB); initial test results for 3-4 units (at one epoch) had been reported by BE team (found acceptable); pending items (for BE team) are :
 * to check the constancy of the values across the band;
 * to repeat the tests for vayring i/p power levels with constant o/p power;
 * to repeat the tests on different epochs to verify constancy with time;
 * to work out plan for calibration table for each attenuator (after above results).
Test data were taken and analysed by BE team and results reported; SRoy had done some cross-checks on these; tests have been done with varying i/p range from -37 to -17 dBm also and behaviour of attenuator appears to be all right. SRoy to cross-check the results and confirm if we are ok, and if this aspect can be closed.
SRoy has sent some plots from his analysis of the data and some follow-up is needed to see in what operating regime we are hitting the non-linear range of the GAB system. BAK to look at the results from SRoy and send an email.
22 Apr : "linear range" available depends on absolute input power level; but there is enough for our desired range of operations -- it may vary from one RF band to another and a note will be needed to define the working zone and avoidance zone for each RF band. Agreed that all other aspects can be closed except for the note -- check status of this.

(b) requirements document to be updated to reflect the outcomes of the disussions e.g. better clarity about the 3 modes of operation etc. -- SRoy has produced an updated version : needs to be checked to see if it can be cleared.

(c) self data (from correlator data stream) to be saved in shared memory ring buffer of ~ 30 mins depth for further processing tasks to work on (should also work off a recorded lta file); also median calculation feature to be added; some work was done by NSR to write raw data to file for 10 mins duration; to convert this to shm and also to add a feature for calculating median values every 2 sec or so and saving these to a file for long durations. SRoy to work with NSR to implement these (take help from SSK where needed); some progress from NSR's side on median calculations;
22 Apr : SRoy reported that NSR now has a version that is able to save the median values in a file, as multiple rows -- to convert in to multiple columns version; not yet started work on shared memory version. Any recent updates? Waiting for NSR to be back on 15 May.
17 Jun : NSR has not yet had a chance to do this; should happen in next 2 weeks.

(d) testing of bandpass shape (ampl and phase) for different values of attenuation : 6 out of 7 antennas showed less than 5% percent and 5 degrees change in ampl and phase over 5 dB change in attenuation. SRoy to follow-up to see how much is the intrinsic varn of the GWB corrln level with change in input power level -- SRoy analysed the data provided by DVL and found that behaviour is acceptable for the range of i/p power variation tested which is about factor of 5 (~ 7 dB); plan to extend this to larger range: set power level on galactic plane calibrator to about 80 or so; then go to calibrator away and equalise to 350 -- larger change in attenuation (~ 12 dB) required -- can check if corrln coeff (bandshape) remains ok or not; SRoy would like to now try the test with upto 10 dB variation in attenuator values to see how the bandshape changes; 22 Apr : test has been done, but there appears to be some problem with the data quality -- may have to be repeated again; SRoy to check for free slots for this.
17 Jun : SRoy will be scheduling in the near future.

4.4 GPU corr (GWB-II) : release of 4 node, 8 input, 200/250/400 MHz version -- from 24 Jun & before (SHR/SSK/BAK/DVL/YG) : (NOTE : GWB-I is existing released system !) :

agreed to make 4 T7500 nodes with C2050/C2075 Fermi GPUs + remaining 4 T7500 nodes as host machines (to take care that these are the ones that transient pipeline uses presently so that sharing is possible); this should have ALL basic modes : total intensity and full polar IFR modes; IA + PA BFR modes with process_psr pipeline attached; full GUI support; to come up in trial code section without affecting the presently released mode. Action items :

(i) beam modes in GWB II : new version with separate kernel (outside phase shift kernel) for beam formation has been developed (compute load is 7% increase on 2050 GPU); IA mode tested; PA mode completed and tested; phasing implemented & tested; process_psr pipeline has been completed and released; first version of SOP has been released; pending action items :

(a) last version of GWB-II (ver4) expected end of April, with the following new features : 16k channel support in GUI and SOP; multiple choice for beam integration and # of channels; pulsar beam header ver1 (limited number of parameters); for more than 2K channels in correlator, need modified shell script -- this needs to be understood. Most of these changes have been done; GUI for 'ver4' needs to be done by Nilesh -- should happen after 15 May. Check if action has been initiated.
27 May : SHR and NSR to test upto 8 and 16 K channels to see if o/p side i/o works ok; if yes, then no further changes; if no, then to change the MPI calls as done in GWB-III (and make GUI and SOP compatible with that).
10 Jun : no progress on this (due to concentration on GWB-III !).
17 Jun : ver 4 tested for 8 and 16 k channels; GUI level change has been done; dasmon needs to be modified for more than 2K (upto 16K) -- being done by NSR; beamformer will also need to be tested.
24 Jun : GUI for correlator part completed (except for dasmon); GUI for beamformer will take 2 weeks (till 8 Jul).
==> SSK to talke with NSR to close the loose ends.

(b) header for beam mode data : to be taken up & incorporated alongwith the PA mode; SSK has done first round, and discussion between YG and SSK has happened and next version is underway; to check current status and plans for release.
Work under progress; can circulate the current list to others (back-end team; NSR + other users). -- can shift this to GWB III ?
20 May : header part I has been done for GWB-II and III (need to confirm for II); header part II will be done later, only for GWB-III. To confirm plans and move to GWB-III agenda accordingly.
17 Jun : new version of GWB is under test which has part I header; part II header will come in the next release. part I header will come in GWB-II ver4 and GWB-III ver2.
24 Jun : GWB-II next (and final) version release in 2 weeks (8 Jul 2015); will have flexibility of upto 16K channels.
==> to ensure loose ends closed by 8 Jul and v4 released.

(c) availability of online monitoring tools for beam data : psr_mon was successfully installed, compiled and tested (for 16k channels?) on node 52, node 53, gwbh2 & gwbh3; now installed on the new host machines also; installing pmon needs polycos, psr catalog etc; pmon done in off-line mode on GWB-III, ongoing for real-time mode -- needs to be tested and cleared;
port to GWB-II : real-time mode of psr_mon and pmon for GWB-II are under test now by SSK -- check present status.
SSK to check and place the final working code for pmon in the right place on GWB-III beam host machine.
17 Jun : offline version working on GWB-III (v2) and real-time version to be tried.

==> SSK close to finishing the real-time version for GWB-III.

(d) meanwhile, work for incorporating new code developed by Rajora by adding shared memory interface is ongoing (both of these can go directly to GWB-III) -- work resumed in May 2015, with summer student Balaji; there is significant progress on this now; agreed to move this to GWB-III.
4 Jun : new features related to bandshape plot and profile plot have been added and filtering has been tested; need to start looking at shm related aspect.
==> work in progress.

(ii) spikes in channels that are power of 2 : this problem needs to be discussed, understood and fixed. SHR has done several tests, including using digital noise source; effect is seen in packetised corr also; checked with offline analysis of raw voltage data acquired through Roach board, and with digital noise generated on Roach board -- appears that problem is seen only in data coming through the ADC path only? further, trying single ADC streams or channels (compared to the interleaved data streams that come normally) still shows the spikes in the streams; slower FPGA clk rate also doesn't show any difference -- it appears to be natively present in the ADC data; to check if the power level of these spikes is constant and how much below the mean passband level; varying i/p power level of broadband noise source at ADC allows characterisation of input power level at which spikes show up; looks like occuring at multiples of 128 ch (for 2K spectrum); to check the level as seen in cross of two such signals -- some test results have been sent by Reddy recently; can take up for discussion, including tests with 2 different clk sources...
To correlate against new results coming from histogram testing by Niruj & Kaushal -- some work needed here -- KDB & NMR to check and report back.
27 May : to cross-check with GSB voltage data taken and put through similar analysis of histogram and spectrum;
17 Jun : tested with two different Roach boards with two different clk sources and corrln is still seen, including when sig gens are not locked to same source.
24 Jun : GSB raw voltages to be read and analysed (at GWB-III).
==> to be done.

4.5 GPU corr (GWB-III) : next gen system -- from 17 Jun & before (SHR/SSK/GSJ/BAK) : Design and delivery of 32 input (16 ant dual pol or 32 ant single pol) system; uses 8 Roach boards + 8 compute machines (with final 36 port switch) + 4 host machines, installed in 4 old racks & made ready with wiring + cabling complete (c. Feb 2015?); tested with analog noise source; new code with 2 x 10 Gbe I/O + improved logic for assigning specific threads to each core + set-up with environment variables completed (tested for 200 MHz / 8 bits and 400 MHz / 4 bits, 16 inputs and working ok with no pkt loss); modified ferrules were put on cables & GWB-III (v1) has been released with full online control (c Mar 2015); final connections to GWB-II and III can be chosen by the user on the wall panel; confirmed that GSB, GWB-II, GWB-III can ALL be run simultaneously with full online control; updated SOP has been released; basic user level tests have been carried out (DVL) and by and large system appears to be work ok.

Later GWB-III was expanded to dual-GPU version, as it became clear (c. Mar 2015) that existing code for corr + beamformer is exceeding real-time by 9% for full 400 MHz BW for 16 inputs correlation (will become worse for final, 32 input system); options looked at were : 2 K20s per host, double-GPU card, K20 + K40 per host, 2 K40s per host, 32 host machines (with single GPU); agreed to try out 2 K20 option; first results from dual-GPU code (6 May) were encouraging and have led to GWB-III (v2) : 16 antenna dual pol, 8 node system with 2 K20s on each node : total intensity & full polar correlator + IA and PA beams (16K spec chans and 1.3 msec integration)

for 200 MHz 8 bits and 400 MHz 4 bits; tested to work ok with equal load between the two GPUs; also ready for testing on 2 K40s -- results may be available soon; issue of sharing between K20 and K40 needs to be looked carefully for the value of the slice and also the drivers for both GPUs working simultaneoulsy. Tests have been done using noise source; now ready to try with real antenna signals (done 4 Jun); GUI development under progress.

Current action items: see also email from BAK on 22 April 2015) :

(i) Various kinds of tests of GWB III (v1) :

(a) basic user level tests : DVL had carried out some tests; pending problems have been call sheeted and will be checked again to see if fixed or not (most are related to upstream systems) -- to check status with DVL, and see if this can be closed.
==> this can be closed.

(b) to check if new SOP supports flexible connectivity for user -- this required manual editing of the files (explained in SOP), which is not desirable;
2 possible options discussed for getting flexibility in connection : ascii file update or drop down menu -- to discuss with NSR and decide which is easier to implement.
4 Jun : GWB-III ver2 is being debugged for release and it has this feature (tested).
==> this appears to be working fine

(c) testing the 400 MHz BW mode : basic changes to the code for the 400 MHz, 4-bit mode had been done and basic tests were ok for 16 inputs (delay correction also working ok); some pending tasks are :
* choice of which 4 bits to use needs to be finalised (right now it is set for 4 MSbits) : what algorithm is needed? can it be made a user choice?;
* extendng to full 400 MHz BW : computationally, existing GWB-III (v1) does NOT sustain 400 MHz for all 32 inputs -- safe limit is 300 MHz (including beams ON); agreed that making if work for less number of inputs is not worth the effort -- more useful to concentrate on dual K20 option in GWB-III (v2).
==> except for the issue of choice of 4 bits, all other issues here can be closed.

(d) checking of beam modes : all basic beam modes are working; phasing has also been verified; note that phasing will work only if beam mode is turned on (!) -- change has been made in the new code that will be released soon (v2).
==> is implemented; will be tested by user upon release.

(ii) to discuss and agree the various modes to be provided in different releases of GWB-III, folding in long-term planning (to take up from email exchange of 22 Apr and later) : one round of discussion has happened; to finalise the list of modes and the various releases of GWB-III and then put it formally in the Plan agenda -- this needs to be discussed.
17 Jun : BAK to summarise the specific details of ver 2.
==> for ver2, to make sure that the information is available in SOP or otherwise; for ver3, BAK has discussed with team and will come back with an update shortly.

(iii) choice of integration time for beam data (for v1 & v2) : in the original design 128 was default pre-int (on GPU); later, it was made variable (upper limit 1024, lower limit ?) -- needs to be tested, and constraints in the range of parameter choice needs to be established);
17 Jun : 128 can be reduced in v1; in v2 there will be a table giving combination

of nch and sampling;
==> to confirm the situation for v1 and v2; plans for v3 to be worked out.

(iv) beam data header for GWB-III (v1 & v2) : current status to be confirmed
17 Jun : current plans are as mentioned above under item 4.x
==> v1 has no header; v2 will have part I header and v3 will have final part II version.

(v) psr_mon and pmon tools for beam data monitoring for GWB-III (v1 & v2) : current status to be confirmed
17 Jun : same version should work; to put final working version in a common place.
==> real-time version to be made ready for v2 by SSK (see earlier comment also)

(vi) tests with dual K40 system in GWB-III (v2) ?
17 Jun : one of the 8 is running with dual K40 as default; at some point, bench markingcan be done wrt dual K20.
==> getting the benchmark values is pending.

(vii) tests with K20 + K40 sytem in GWB-III (v2) ?
17 Jun : this is stuck because of driver related issues as pointed out by SHR; can defer till we try cuda 7.0 and then see.
==> no update.

4.6 Next gen improvements (beyond GWB-III v2) : targets for Sep 2015 release -- from 17 Jun and before (BAK/SHR/...) :

(i) final range of channels to be handled : GWB-III (v2) will be up to 16K channels; extension to 32K channels to be looked into (I/O issues will need to be tackled); increasing integration beyond 0.6 can be a solution.
17 Jun : changing integration time may be easier option for now.
==> to be tried at a later date.

(ii) new features to be added in next versions of GWB-III code : correction for net_sign[] flipping (LSB/USB modes of correlator); multi-subarray, 4 beam capability; all off-line utilities with backward compatibility; time + DUT corrections; optimisation of code; feature for folding visibilities with pulsar period; PFB implementation; shift to 2 inputs per Roach board.
Some of these can be delayed for some time, depending on prioritites.
26 Mar : multi-subarray implemented and tested, including online interface; needs some more testing for getcmd mode; DUT corrections coded, but not yet fully tested; both of these work upto 32k channels but some testing may still be needed; see also 22 Apr email of BAK and follow-up discussions); to see if action items can be firmed up for this.
4 Jun : for ver 2 : lower beam integration possible, beam header as above, multi-subarray ok; will have off-line utilities, without backward compatibility; DUT corrections will be in; net sign correction done; 4 inputs per Roach used;
for ver 3 : 4 beam capability, visibility folding; PFB
17 Jun : 4 beam and PFB are part of the plan for ver3; to check about vis folding later on.
==> ver2 items are ok; ver3 items will get finalised shortly.

(iii) long-term items like provision for control of FPGA and other peripherals (like sig generator) for different modes : agreed to identify one PC for control of all the peripherals related to GWB; this m/c can / is interfaced to online via a socket

and GUI can send commands via this -- already done for loading of FPGA files, needs to be extended for other applications; for other things like turning RFI rejection or Walsh modulation on/off, writing to registers in powerPC would work all right; agreed to start working towards implementing scheme in GUI for taking additional parameters that allow different bof files to be loaded; agreed that these flags need not go into ltahdr but can go in the user log as setting parameters (can also be there in gpu.hdr); agreed to go ahead with discussion with NSR for implementing the logic for allowing support of multiple corr modes that use different BOF files; other action items to be taken up later; BAK to talk with NSR / SSK to work out the time frame for having it in place.
17 Jun : needs to be tried out; can be taken up after v2 is released.
==> scheme needs to be tried out at some time by NSR, when a bit free.

(iv) incorporation of DDC : this is important requirement, to be done asap :
Agreed to try on one node of GWB-II or GWB-III and get back to earlier situation and see exactly what are the issues. SHR has circulated an update; first part is that it appears that the current realisation is properly implementing a DDC; only the filter BW needs to be decoupled from the decimating factor and do a careful set of tests; in the long run, better filters with sharper cut-offs may be required (can check with nvidia about availability of std library functions for such applications); second aspect is to check about the nature or format of the o/p to see whether I & Q components are ok for further work or whether we need / can have the real voltage representation of the o/p signal.
new tests still pending; to check about nvidia primitives; to check about I,Q version vs real output possibilities.
26 Mar : independent DDC has been developed by UG and tested and appears to be working ok; to circulate summary of test results to see if more parameter space needs to be explored... test results found OK; note being prepared.
22 Apr : DDC code has been incorporated in 2-antenna GPU correlator and under tests to clear unresolved issues -- see also latest update from UG in May : need follow-up discussion on this.
20 May : email update from UG stating that the mode is basically working -- need a more detailed discussion about the status and plans.
4 Jun : agreed that basic mode is working ok; to check the issue of normalised cross in the stop band region. may not be released in ver2, but should be there in ver3 (Sep release).
17 Jun : bit more testing with noise source; generating proper delay and fringe to be ensured; overlap between data segments for proper FIR operation will be needed; to check total compute requirement.
Need a status update and discussion on the latest situation.
==> final choice of specific code to be used has been made (between work done by UG and earlier code); porting from one node to multi-node system should not be an issue; still need to test delay and fringe with DDC on; also FIR edge effects at blk boundary to be checked.

(v) porting from CUDA 5.0 to CUDA 7.0 : to work out a plan for doing this
==> this needs to be looked at.

(vi) full beam header : plans to be discussed and finalised.
==> also needs a discussion.

(vii) RFI filtering capabilities : for corr and beamformer
==> needs a coordinated discussion...

4.7 Long term improvements (towards final GWB-IV system?) -- from 17 Jun and before (BAK/SHR/...)

(i) further optimisation of the GWB-III code (SHR/SSK) : different optimisations have been suggested and tried and these need to be further refined and ported to the GWB-III code:

(a) optimised XPGU for GMRT (with Vinay of nvidia) : is showing ~20% improvement -- needs to be confirmed and then incorporated; ready to upgrade to CUDA 6.0?; results from R2C vs C2C (with callback) to be finalised and then decide about incorporating. SHR has done the basic porting of XGPU in GMRT code to GWB-III. Summary : xGPU has been ported and shown to work; gets 20% speed-up overall; but works only in full polar mode (!); other modes need change in xGPU code; output shuffling work in real-time for present time,freq combination, but may not work for faster rates and finer channels... agreed to halt xPGU work and concentrate on 2-GPU per host GMRT correlator code. No further action on this for now.

(b) another concern is about data ordering at XGPU o/p vs LTA format requirement -- needs to be quantified in order for changes in (a) to be meaningful; note : Vinay has already written the code that does this on the CPU.
Currently using unoptimised routine which will work for about 4k channels; for larger number, optimised version will be needed. See item (a) above.

(ii) trying new ideas like FP16 etc to be discussed.

(iii) Layout and racks (GSJ/BAK) : layout diagram to be updated and long-term plan for racks to be initiated; 3 different kinds of President racks discussed ("cyber", "cool" + one more?) -- to try and finalise after one more round of discussions including RVS (also, check new vendor Jyoti Tech); as an interim, 2 nos of cyber racks ordered with President. Meanwhile, for GWB-III, 4 nos of half-height racks have been used -- two nos are populated with 4 compute nodes each, third one has 3 host machines + 1 extra machine + clk source etc; fourth one has 8 Roach boards + IFB switch; will need to expand this to 16 Roach boards at some point of time -- may need to add one more half-height rack? One half-height rack is available in hand and can be used when required. For final system, present estimate is 5 full height racks housing 32 Roach boards + 16 compute nodes with 2 GPUs each (+ host machines?). Current action items :

(a) For the 2 President racks : first one has been used for putting GSB related spare nodes etc; second rack being used for trying the arrangement for special cooling (with help from mech group) -- tested with 1 kW load and increasing slowly; loading up to 4 kW tested by comparing the temp difference between input and output air (need to compare with unmodified rack); results so far appear to show that there is about factor of 2 discrepancy in estimated CFM rate and AC plant capacity CFM rate. agreed to include the test with unmodified rack and then circulate the report; with 2 AC vents feeding 5 racks (final number), the estimate is that the available CFM may be marginal -- this needs to be resolved against the CFM discrepancy noted earlier; also to explore additional margin the AC system (joint meeting with RVS and team may be useful);
20 May : intermediate update from report of IMH about discrepancy of factor of 2; measurements with the flow meter show that the amount of air flowing into the corr room is matching with the expectations from the AC system, which means that the utilisation of the cold air by the correlator test rack is only about 50%; method of taking in the cold air from the vent to the rack is being modified to improve

the efficiency.
4 Jun : some inprovements in results with better ducting of cold air and 2 stronger fans to better pull the cold air -- now reaching 75% of capacity; to test at floor locations far away from the available vents.
17 Jun : at 5 feet away from vent, getting more than 100% (!)
(b) to decide on plans for ordering more racks.
==> interim report has been circulated; results appear to indicate that for any typical position of a rack in the room, having fans at the bottom near the input of the cold air (and maybe some ducting for the hot air at the top) should be enough for our requirements; to see if one round with more heat load (2 to 3 x is possible) to see the effect on GSB. To try and see if we can finalise the choice of rack soon and start the procurement.

4.8 Procurement of new hardware & accessories required for final GWB system -- from 17 Jun and before (BAK/GSJ) :

(i) purchase of 4 new host machines for GWB III : to decide configuration of host machines (disk i/o to be kept in mind); also to check if SSD is a viable option for recording of data. Investigaiton shows that SSD vs SATA has pros and cons; it may be possible that one class of server may be there that supports both?
4 nos of T620s have come and integrated into GWB-III: 2 are with 16 TB with and 2 with 4 TB -- compute vs host. No pending action items here?

(ii) purchase of remaining compute/host machines (for GWB IV) : PERC card issue needs to be resolved : agreed that we will buy machine that can support upto 12 disks (which means with PERC card) but will have 2 x 2 TB to start with. More disks can be added as needed, and if at all extra slot is needed, PERC can be removed (will support only 4 disks) and backplane has to be changed with a new one (which has to be bought along with the machines);
To decide quantity to order at present : agreed to proceed with 16 nos with full waiver for DELL proprietary item with DELL as the supplier.
Action started to generate the papers; tender waiver is done; and enquiry has been sent -- last date is 30th for the quotes and then tender will be opened.
6 May : sample T630 received from DELL; suitable (CentOS6.5) and CUDA 5.0 loaded and 2 GPU configuration done; 1 dual port 10Gbe card; 1 infiniband card installed; 3 slots still available -- 2 are x4 and 1 is x8 (PERC card is already on the mboard); can test the spare x8 slot and also the 2 x4 slots with appropriate 10Gbe cards.
Power supply problem : not really, as 2 nos x 1060 GPUs did not work, but 2 nos of K20s worked (will be tested with 2 nos of K40s).
20 May : final stages of configuring the T630 for swapping in place of a working T620 in the GWB-III. Meanwhile, to ask for extension of validity by 1 month (from 25th May).
4 Jun : initial set of tests showing that T630 loses packets; tried with lower BW and still getting packet loss; now trying a more recent OS.
17 Jun : still having problems with packet loss; in touch with DELL for resolving the problem; to try T620 with the updated OS; to try T630 in stand-alone mode; may be an issue of NIC card compatibility?
==> reverse test of upgrading T620 to higher OS has been tried and it works ok; to see if stand-alone T630 test can be tried; to follow-up more closely with DELL.

(iii) procurement of accessories like network cards, disks, cables etc :
20 nos of CX4 based dual 10 Gbe cards purchased and tested; to confirm that this order is enough to meet our long-term requirements; agreed to produce a formal note about the situation for long-term : to relook at the spares requirement without

counting the units already being used in the existing systems (including the PoCo and pkt corr) and buy more if needed; GSJ has produced this list and fresh orders to be done, based on this : 10 Gbe cables and NIC cards (spares); 36-port IB switch; 8 nos of K20s.
c. 4 Jun : 8 nos of K20 have come; IB cables and NIC have arrived; IB switch (36 port) has also come and has been installed in GWB-III. Agreed to put in a repeat order for the 36-port IB switch. Check current status and see if any other accessories need to be ordered.
==> Order has gone for spare switch.

(iv) new purchase of Roach boards etc : need to have enough Roach1 boards and ADC card; need to invest in Roach2 technology to keep abreast of things; new lot of 12 Roach1, 16 ADCs and 4 Roach2 was procured and Roach1 test set-up was made ready and all the Roach1 and ADC cards above were tested ok; current action items are :

(a) for Roach1 + ADC : summary spreasheet about current stock and usage of Roach1 and ADC created and taken up for discussion; agreed for final configuration of 32 working Roach boards + spares -- to check how many new ones have to be ordered (note : Xport will be missing in the new ones); agreed to go with 1 ADC card per Roach board -- to check how many new ADCs needed.
Confirmed that no new ADCs needed for 1 per Roach board; to order balance number of Roach1 boards.
==> processing for procurement for balance Roach1 boards (~20) has started; Digicom has confirmed that they will provide.

(b) for Roach2 : to check standard test procedure on CASPER; to check if we need to buy add-on mezzanine card; to check if Roach2 can be seen on USB port using Ubuntu and if some basic tests can be done with this; mezzanine cards were needed in order to use Roach2 -- these were procured, allowing work to start on Raoch2 testing.
20 May : Aniket has been working on testing basic things like mezzanine card; 10 Gbe design etc; can now try to see if PoCo design can be ported to this system.
==> delay in progress due to sharing of PC with host environment of Roach1 & Roach2.

(c) software environment needs to be upgraded (for working with Roach2) :
Matlab-Simulink upgrade was ordered and installed on one machine (64-bit), including updated license manager (additionl license is for parallel toolbox); Xilinx ISE v14 was ordered, procured and installed; one existing PC was taken for putting new Matlab, Simulink, ISE v14.2; casper tool flow was also installed; LED blinking on Roach1 tested ok; to try PoCo design (may need some changes?) on Roach1 and then go for packetised design and GWB III design; after that, try these designs on Roach2, taking into account the change in architecture.
26 Mar email updates from SCC : CASPER toolflow for ROACH-2 installed; takes a lot of time for compilation of simple ADC Snap design (almost 45 minutes); also PoCo compilation needs rebuilding of design using new casper libraries. Still the toolflow has some freaky issues. ROACH-2 booting environment has been setup and need to test booting of roach2.
Need more RAM on the machine; installed on machine with 32 GB DDR-III and found significant speed-up of compilation -- sharing with Roach-I server machine.
need to identify another server.
==> Agreed to initiate the process of looking for another server; and to try T7500 as an intermediate option.

4.9 Testing leakage, coupling and correlated noise in new back-end chain -- from 17 Jun & before (BAK/YG/++) : detailed tests had been done by Vikram Jaiswal (with

SSK, SHR and YG) and report has been circulated; for GAB systems, some follow-up action for testing the leakage has been initiated; procedure for testing to be done with GWB-II release modes clarified and tried out -- new tests show significantly different results for cross-coupling for GAB+GWB; maybe due to synth LO (old tests) vs sig gen LO (new tests), whereas earlier tests used synth LO; new report had been circulated that showed significantly reduced coupling; agreed to repeat the original, user level tests done by YG & VJ to see if things are different now ; agreed to try the ADC noise input and north pole sky tests and see what results come out;
2nd round of tests done, show leakage of 2-4% (consistent with first round results of 1-3%) -- to check with SCC whether all user level tests (done earlier by YG + Jaiswal) have been covered; some user level tests done with north pole and different leakage found for lower and higher LO settings -- needs to be understood.
From Aug-2014 : <= 4% leakage; FE+GAB+GWB (L-band) ~ 40% leakage.
Need to organise a detailed discussion on this.
==> no fresh updates, except maybe to organise a fresh set of tests with GWB-III.

4.10 Walsh modulation : prototype set-up on Roach board -- from 17 Jun & before (SCC/BAK): plans of BE team for implementing prototype scheme -- basic unit for switching using sq wave signal from GPIO pin tested ok; was put in PoCo correlator and was being tested; walsh waveform delay functionality was added -- can set delay from 1 to 2^32 clk samples (!); with this, variation of correlation with delay was tested using noise source inputs and found ok; Walsh patterns were put on the Roach board (not many slices needed) -- there was some mismatch between CPLD and FPGA waveforms that was resolved and all FPGA waveforms were shown to be ok; dmodulator on FPGA was implemented; list of targets and action items is as follows :

(i) issue of accuracy of oscillator being used needs to be resolved -- to check if this has been done and item can be closed?
==> one round of tests to be done with generator CPLD running with free running osc.

(ii) to comlete the final delay setting algorithm : to provide upto 500 msec of delay (for 128x4 Walsh length) with resolution of 5 nsec (FPGA clk); there were problems related to varying start-up offsets and fractional delay setting, as well as problems related to set up and hold -- these are now reported to have been resolved : this is confirmed to be work ok and can be closed.
==> can be closed.

(iii) what about synchronisation of starting? -- this is taken care of by running the CPLD with a sig gen locked to 10 MHz. Can be closed?
==> this is coupled to item (i).

(iv) to develop and optimise the hunting algorithm :

(v) to demonstrate cancellation of unwanted signals in ADC card and/or GAB; first, need to run a test where pattern from external source can be synchronised to the pattern generated in the FPGA -- this requires being able to hunt and correct for the unknown delay !
==> this is yet to be demonstrated and is likely to be coupled to item (iv)

26 Mar email updates from SCC : the test is going on with pocket correlator to check effect of walsh pattern delay on normalized cross. CH-1 walsh modulated and CH-2 delaying walsh pattern by 50uS and check effect on normalized cross. The testing software is ready and will be tested soon. The design don't take much resources

only 2-3% of fpga. To check if first results from tests are available.
New feature : Walsh pattern generated on fpga can be grabbed on PC and plotted.
tests of correlation change with delay change will come in next few days.

20 May : Actual Walsh patterns show multiple peaks of full correlation amplitude (!);
50% duty cycle Walsh shows only 2 peaks -- this becomes one peak once the sign is
also considered. To redo the 60 Walsh patterns with sign of correlation to check
number of +ve peaks and their exact value.

4 Jun : able to correct the sign problem, but still issue of multiple peaks etc --
needs to be looked into.

17 Jun : hunting algorithm being developed.
==> coarse hunting with 4 ms step is working; and now trying to refine with finer
steps of inverse of basic clock.

5. Other items :

5.1 New python assembly design -- from 17 Jun (HSK/SSK) : FE group wants the
python configuration in E6 to be adopted for all antennas -- FE and mech have
dicussed about plans for modified python assembly that will give additional
protection to cables; mech group had circulate a short note on their view of the
matter, alongwith photos; this was discussed and existing vs E6 system was compared;
Action items :

(i) modified E6 design with hinge-like support was installed on C4 (July 2014);
agreed to watch the set-up on C4 and do periodic inspection for checks of (a) damage
to hose (b) hose clamps (c) water entry etc -- first inspection was done after 2
months (mid-Sep 2014) by mech and fe teams; subsequently, inspection was done (around
mid-Nov?) and a video of the same was circulated; scheme appeared to be working ok;
however HSK felt that this scheme with hinge may not be good in the long run -- this
was discussed in detail; the hinge arrangement on C4 is NOT exactly same as the E6
arrangement (!); the C4 design does not completely solve the problem; agreed that
E6 set-up does solve the problem (!); agreed that it can be replicated if needed.

(ii) IGUS cable wrap -- new technology prototype to be developed and tested on
quadripod : a) hose without wire impregnation b) entire hose assembly
(both could be tried as long-term solutions).
Quotes for both items received : item (a) is Rs 10k for 10m (4 antennas); item (b)
is 60k each -- will try on the quadripod test range; items received; basic assembly
made ready; finally, installed on test range around Oct 2014; tested ok without
cabling (video available); then populated with cables by FE team for further testing;
proto model made fully ready; this set-up uses a slightly different arrangement of
fixed members, along with the IGUS hose; will work as well as the E6 design.

Agreed to : (a) replicate the test arrangement on 2 antennas, one with normal hose
and one with IGUS hose (b) to check how much extra cable can be accommodated in the
existing hose and (c) look for wider diameter assembly (32 to 40 mm or more).

Email update from HSK : (i) hose procurement in progress under cash purchase
(ii) spare assembly with old type hose will be prepared for 2 antennas in time for
installation during Mar-April 2015 MTAC (ii) spare assembly with new IGUS hose will
be also be prepared for 2 antennas for installation during MTAC (iv) extra hose of

38/40 mm is being procured and assembly preparation is in progress -- will be ready by 1st week of April.

26 Mar : 2 sets of hose assembly are ready for use -- two antennas to be selected : maybe W1 + one. HSK says no scope for adding more cables in existing; wider assembly of 38/40 mm is getting ready -- can go to antenna directly (W4) and add optical fibre cable as a test case.

6 May : 2 Finolex-type hose assemblies (with normal dia) made ready for use in 2 antennas as an improved version of E6 assembly. IGUS hose assembly (with normal dia) 2 units are also ready; agreed to put one of each kind using C4 and W1 as test antennas. Wider hose (50 mm) under procurement -- it is a Teflon based product -- will need to be tested for temperature and then made into an improved E6 assembly and tried out.

26 May (email update from HSK): 2 sets of assembly of Finolex pipe made ready were given to FE group for putting cables etc and returned on 21st May; one set of Igus hose assembly also given to FE group to make ready, and returned on 25th May; now preparing to install on C4 and W1 antennas within a week.

17 Jun : Igus type hose assembly installed on C4 -- had some problems (2 iterations), now done on 3rd iteration with another modification; old E6 design with Finolex pipe will be installed on W1 early next week.

==> C4 installed and working, but video yet to be made; W1 to be installed soon (wind problems slowing down the work); to wait for few weeks to assess the performance.

5.2 Problem of access to FE boxes with 500-1000 CDF feed -- from 17 Jun & before (HSK) : Update on new solution being designed by Mech group -- tested in situ and found working ok; agreed to use this for present; for future where bigger and heavier boxes will come into play, mech group will think of an improved solution, including an option for removing one feed and bringing the stool inside the basket; a few options explored by mech group, with target of 1800 mm height for boxes with max weight up to 150 kg (?), quotes received from some parties, processed and order placed; delivery by end of November 2014; inspection done (in Bangalore) in mid/late Nov 2014; some simple improvements suggested to vendor (guard rail, simple clamping arrangement for item); platform delivered at GMRT (early-Dec 2014), tested and found ok, including modifications that had been suggested; trials had been happening on ground; ready to test with actual antenna operations -- waiting for new crane to be operational (why can't it be done with the HLPs ?)
Email update from HSK : waiting for RTO registration of new crane to complete. Confirmed that not a good idea to carry it to remote locations in HLP basket; hence, crane has to go (as item is too heavy to be easily handled by humans) ! Crane is now ready for use; to try the test on one antenna with crane + HLP + platform; to coordinate with FE team.
26 May (email update from HSK) : markings made in the basket and making of hole is in progress; after that, can start using on a need basis.
17 Jun : no upates on this.
==> no progress on this.

5.3 New FE boxes and testing with reflective paint -- from 17 Jun (HSK/SSK) : two kinds of paint received and 1 box will be made ready next week for testing. 6 new boxes are ready as per specifications -- only some engraving work is pending.

email update from HSK : One FE box painted with Luxtrotherm HT 400 (range from 250-400 deg C ?) and handover to FES group for testing. Second grade paint : Luxtrotherm HT 600 (range from 400 to 600 deg C) -- waiting for arrival; 3 types of FE boxes handed over to FE team : (i) plain box with powder coating (ii) box painted with HT400 (iii) box painted with HT 600; waiting for test results.
2 types of paints tried : HT400 & HT600; neither successful; to try new paint options?
Item needs to be discussed jointly with mech and FE to understand why the original selection did not work and what should be done about it.
Agreed to circulate the description of the method used, the results and the conclusions and then take up for discussion and decide what needs to be done; this has now been done by the FE team; need a follow-up discussion.
To cross-check proprerites of HT400 and 600 about reflective nature and what are the other alternatives -- some alternatives had been identified; HSK to report status of follow-up action.
6 May : one product has been identified (summer cool made by excel coatings); sample has been ordered. in addition, modified version of 15m as well as antenna shell cage to be used on 2nd box and 3rd box to be normal box. to try the test this month.
26 May (email update from HSK) : paint material received on 18 May; painted box handed over to FE team on 19 May; first round testing has been done by 25 May and some results are available (to be circulated) -- overall effect may be 3-4 deg improvement...
17 Jun : mech group wants to try with one expt with summercool on top and PU based insulating material (Stopaque) on the inside.
==> mech group to go ahead with the test after procuring the Stopaque material via cash purchase.

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Minutes for the weekly Plan Meeting of 8 July 2015

1. FE & OF related :

1.1 Documentation : follow-up on level 2 (ITR) -- from 24 Jun and earlier (SSK+team):
(i) Check status of new items : work was ongoing for

(a) spares for 1420 feed -- to be taken up after temperature monitor report is completed (which is done mid Mar) -- VBB to talk to SSK to work out the contents.
No progress on this; agreed that to have an upate on this 2 weeks later (27 May)
still pending for discussion between SSK & VBB -- to check if some progress is there.
==> some issue about who is the FE person responsible for this ! (S Ramesh vs VBB); SSK to check and come back (maybe SSK can help S Ramesh to do).

(b) OF & RF monitoring schemes : OF power monitoring (starting from initial version from Gehlot) will be done by Sanjit; RF power monitoring (to be named as "Broadband RF monitor") by Pravin, Sanjit and Ankur. Not yet started -- FE & OF teams to plan the activity and report back -- was deferred to after MTAC (Apr 2015); now waiting for some test results from newly assembled system; meanwhile core of material for OF monitoring is to be taken from old report; for RF monitoring report, work has to start from scratch; preliminary report by Sanjit Rai discussed (27 May); improvements about the layout of the block diagram, terminology used, functional blocks etc needs some refinement; otherwise has good amount of details, including sample result etc; may need a section that emphasises the future growth path and plans a little bit (e.g. long term monitoring 24x7 and transfer to online etc). side issue : plans to add monitoring of temp in OF rack at antenna base and also the RF power...
24 June : suggestions for corrections to OF monitoring scheme have been provided, needs implementation; RF monitoring acitvity is running satisfactorily; documentation is yet to begin [expected by 01-Jul-2015];
==> revised version of OF monitor doc discussed : blk diags are much better now, a few small iprovements are needed; some of the pictures could be moved next to the corresponding blk diagrams and labeled; blk diagram and scheme as how multiple antennas are handled needs to be added; some description of which antennas behave good and which don't and possible causes for poor behaiviour; future plans and scope to be added.
RF monitoring to be started soon.

(c) Test and characterisation set-up for OF system : Sanjit will be looking into this. To be ready in 2 weeks (18-Mar-15) & then report will come; work ongoing (Sanjit + SSK) -- first draft is with SSK for review; some feedback has been given by SSK, to include some new measurements and also drawings of test set-up, change of linearity / dynamic range with level, temp stability of bias point etc.
Work is ongoing; may have updated version by Friday of this week (17 May) -- this has not happened; 27 May : work in progress -- new measurements not yet completed due to some issues; and some of the plots and diagrams are yet to be added.
24 June : Suggestions available on first DRAFT circulated - needs to be implemented (addition of Block Diagram; some tests ...); expected after 08-Jul-2015;
==> work is ongoing, some modifications have been done; one measurement of phase stability is pending.

(ii) Also, can we look at which ITRs may be ready for conversion to NTRs : it was thought that filter design work can be taken up for this, once the ITR is done. For the 250-500 filter, paper has been accepted for publication in IEEE (Sougata & Anil).
Pending action items :
(a) agreed that the 550-900 filter work can be looked at for a paper : Imran is looking at that -- will come back shortly with a proposal for presentation in paper content; Imran urged to look into it; discussion between Imran and SSK has taken place -- Imran has made a rough first draft and is working on refining it.
==> no progress on this item; may need a discussion.

(b) to check what else can be taken up for publication -- defer for now.
==> defered for now.

1.2 OF system NTR -- from 24 Jun & much, much earlier (SSK): can this be initiated now, leading to a journal paper publication? agreed to take the first draft of what was done for the MWSky paper & build on the OF section of it towards a first draft of NTR / paper. PENDING FOR VERY LONG NOW. SSK looking at specific formats and content / scope of the paper; some thinking about what to include and flow and format : to focus on RF over fibre for radio astronomy applications, for GMRT.
First draft expected 1st week of June -- to check status.
10 & 24 June : still no updates.
==> SSK described an outline document showing the plan, layout and some of the features (including some equations and expressions and tables); SSK needs a bit more time to collect more material (including results and measurements) and then will be ready to organise the contents.

1.3 Noise temp & gain vs temperature for new LNAs -- from 24 Jun & before (VBB/SSK):
Results for new 250-500 LNA show ~5 to ~55 deg K varn in Tlna for variation of 0-60 deg K in env chamber, and gain change is ~ 0.2 to 0.3 dB -- confirmed with new test that waits for temp to stabilise after giving 10 deg steps (tests are now done with one monitor in contact with the device and one in the box, alongwith chamber temp monitor); repeatibility has been tested ok with 2nd round of experiment.

Results from testing of 130-260 LNA show about 35 to 40 deg K variation in Tlna over 0-60 deg and 0.6 to 0.8 dB (drop) in gain with increasing temp.

Results for 550-900 LNA are similar : 35 to 40 deg K change in Tlna with 0-60 deg change in temp, and gain change is 0.04 to 0.36 dB -- results obained for two epochs for both cases and found to be repeatable.

Results for Lband LNA also done, with similar amplitude of swing : ~ 35 deg K change in Tlna (at 1300 MHz) with 0-60 deg K change in ambient temp; however, the lowest temp value reaches 5 deg K (!), which is a bit hard to believe.

Current action items :
These constitute a nice set of measurements; now need to understand what may be the cause : what is the expected variation for the device (same is used in both stages of all the 3 LNAs) and what is the expected sensitivity to bias point variations with temp -- these issues need to be looked at in some detail now.

(i) Agreed to verify measured values against the data sheet specs; check for bias pt variation with temperature (empirically) and compare with data sheet; also try Lband amplifier; expt has been tried to measure bias voltage but it is difficult as the probe affects the bias voltage and LNA behaviour changes; to check if any another

method can allow the test to be done; no other option has been found yet.
24 June : required information not available from the data sheets;
==> still no progress in finding reliable methods for in-situ measurement.

(ii) in parallel to check existing schemes (in lit) for temperature compensation of bias pt (assuming that this is the cause of the problem); agreed that this can be taken up -- start with a simple google search; any updates?
10 June : no action taken; agreed for VBB to take a look at this matter.
24 June : temperature compensation schemes found to exist -- would be useful to get a summary of these.
==> VBB has tried new scheme with active (transistor based) bias instead of the passive bias. Basic scheme appears to be working as LNA performance is not affected; variation of bias voltage with ambient temp (inside the chamber) has been measured; now to try to adjust bias pt to get best performance of the LNA (concentrating on Tlna) and then put it in the chamber to see effect of temp variation; to do the same with original design and compare the results.

(iii) to check option for artificial heating of LNA to constant temp (via a TEC); SSK had initiated some enquiries to see if some suitable products may be there.
10 June : no follow-up on this topic.
==> SSK has found some potential products in the market and will see if sample items can be procured.

(iv) The very low T_LNA (~ 5 K) seen at Lband issue being looked into by using 'new calibrated noise source' which just arrived : first look at data with new noise source shows results which are more sensible : absolute values of Tlnas are higher and easier to believe; variation with chamber temperature is a bit less over the range; other general comments : at all RF bands, the Tlnas with old and new noise source are showing an increase of 10 to 20 K ! Further, 2 different measurements of Lband, inside and outside the chamber are NOT giving matching results -- needs to be checked with use of the same LNA. Also to check other outside locations for testing : DIAT, IITB, Sameer etc; SSK has checked with DIAT and Sameer -- can try at Sameer Mumbai : SSK to send the info to YG for writing an introductory letter; tests with same LNA not done yet -- to check with VBB.
10 June : VBB agreed to complete the test and report by next time (2 weeks later).
==> LNA test may not be possible now, as no spare LNA is available (!); YG to send the letter.

1.4 Testing of 130-260 system -- from 24 Jun & before (HRB/GSS/SSK/NK) : Analysis so far, from 2 antenna installation (C10 & W1) shows that deflection and sensitivity at 150 is better than existing 150 feed + receiver; at 235 it may be slightly less than existing system; need firm tests to establish this, including interferometric tests using 3 or more antennas; initially, since wideband FE box was not available, tried to put feed in place of the 235-610 feed in one antenna and use the existing 235 MHz band receiver for doing the test -- this didn't quite work out, and caused fair bit of confusion; finally installed on 150 face on S3 and replaced the 150 FE box with a 235 FE box to carry out the tests; results showed C10 and W1 deflection matching quite well (and only 0.6 dB less than expected at 235); but S3 showed about 1 dB further less deflection -- suspected to be due to the narrow band FE box; agreed to install new braodband 130-260 FE box when ready; 2 more boxes were made -- 3rd unit was installed on S3, and 4th was installed on E2 (25 May 2015).

Current action items :

(i) plans for sensitivity tests and results from these : consolidates summary from total power deflection tests by HRB and NK is as follows (interferometric tests have been difficult, due to various reasons) :
-- C10, W01, S02 (all 3 new feeds + receivers) behaving very similar, which is good;
-- sensitivity at 150 MHz is better than existing systems (and keeps getting better till 170 MHz) : the linear increase is almost 2x and NK to check if it can be explained by changing Tsky with frequency; this was analysed by NK (10 June 2015) and shown that the expected variation of sky background can explain the observed change in sensitivity quite well; may need to add the effect of Tlna into the calculations; this matter can be closed?
-- sensitivity from 200 to 230 is better than (a) existing 150 system (?) and (b) existing 235 system;
-- however, sensitivity from 230 to 250 is worse than existing 235 system (almost 2x worse at the peak at 240 MHz in the existing system); cross-over point is 230-240 region; this needs to be understood and improved.
-- there are prominent oscillations in the sensitivity of new systems in 200 to 240 MHz range : this needs to be understood;

The last 2 bullet items need to be understood and resolved.

(ii) there are RFI lines which ned to be properly identified -- can take up for discussion in RFI section.

(iii) Sougata will start regular monitoring of the antennas with the new systems (from 22 April 2015 onwards) : regular testing appears to have starated -- Sougata showed first sample plots; some antenna measurements (W1) showed more noise; S3 looked relatively clean; C10 was not available; one more round of new data was sent (27 May); from now on, 4 antennas will be available.
10 June : no new data set this week (maybe there next week).
24 June : update expected next week (01-Jul-2015); The plate of the feed on S3 has fallen off !
==> plate has been repaired; cause has to be studied more carefully for long-term solution; may also look into reducing the weight; no new data taken; to wait till Sougata is back from leave.

(iv) Other issues :
(a) possibility of sub-band filters discussed : not clear if it is required, except for RFI related issues (space in FE box will not be a problem) -- agreed to keep pending for now.
(b) to check items for longer term : most of the items required are there; noise source and coupling needs to be integrated;
(c) new PCB for QH + dir coupler with noise injection port has been designed and sent for manufacture to TechnoCkt; PCB had come and chassis was made by w'shop; combined unit with QH + dir coupler + noise splitter (for 2 channels) was assembled and tested -- basic performance looked ok; noise coupling has some slope ~ 5-6 dB across the band; to wait for detailed report to be circulated; unit has gone in box #4 (on E2) -- not so; it is box #5; VBB to produce a brief description / report of the work and then can be discussed about possible improvements and also field tests.
10 June : 10 units have been assembled and data has been taken to test repeatibility; results of this and basic performance to be summarised in a brief note; to plan to install in at least 2 of the 4 antennas for field tests.
24 June : No progress reported;
==> brief report brought up for discussion : shows basic design of QH + noise

injection system with 4 boxes tested; results look pretty good for insertion loss, phase change, and noise coupling -- small variation from unit to unit for the last item, may be because of accuracy of the length of the wireline that is cut; right now integrating alongwith RFCM card in box #s 5 & 6; when ready, will replace existing box on 2 of the 4 antennas.

1.5 Testing of 250-500 FE receiver system -- from 24 Jun & before (ANR/SSK) :
15 antennas have the new feed installed (remaining feeds are kept in storage) and 10 antennas have been fitted with the broadband FE box (with 2 spare units). Note that the new configuration of QH + dir coupler + LNA is working ok in the new FE boxes (e.g. C1) but it needs to be checked individually for each new box that is made ready.
Characterisation and testing of installed systems (using monthly data):
Main tasks are as follows (FE team to maintain a proper log of action taken on individual antennas during these tests and debugging activities) :
* stability of power levels and bandshapes to be checked from weekly plots for the available broadband antennas; bad antennas to be taken up for correction.
* antenna sensitivity to be checked from on-off plots generated from the data; bad antennas to be taken for investigation e.g. E6 was found bad in earlier tests; even after many changes (including change of dipole) the problem was not fixed.
* failure rate of new FE system : about 1 in 2 months over the past 5-6 months(?) -- what are main reasons : oscillations? device failures? loose connections?

Specific action items are as follows:
(i) specific problems : E6 had one dipole showing poor return loss; problem traced to use of metal screw in place of teflon screw (with some insulating tape) -- this was a one-off case; after that, there were strong lines seen and FE box was replaced with spare unit; to check if E6 results are ok now; also to check problem with FE box. latest E6 deflection plots shown 9-11 dB (against expected of 12.7 dB); need few more tests to conclude -- looks ok now; reason not known; any other specific antennas?
10 June : E6 looks ok now; no other antenna with very specific problem.

(ii) to check if new data is available and what results are seen from it : monthly reports available since last several months, which includes interpretation also -- to see if some conclusions / trends can be identified from these.
e.g. C8 shows less deflection at higher freq - confirmed that C8 is modified Kildal and not cone-dipole -- this may be the reason; agreed to replace with regular cone-dipole at the earliest -- check if this has been done.
24 June : C8 has recently got the cone-dipole feed put up (this being the 16th antenna); new 250-500 FE box to be put up tomorrow (25-Jun-2015).
==> new results from 30th June (13 out of 16 ants) show some antennas work very well, but also some problematic issues : C8 is not working properly -- needs to be looked into; some cases (E02) of ripple / RFI in off-source (maybe better to avoid Npole?); W04 both chans show RF band extending beyond the normal cut-off at 500 MHz end (by ~ 8-10 MHz).

(iii) some antennas showing slightly lower sensitivity than the best ones -- need to be followed to understand the cause; e.g C13 seen in Feb 2015 data -- it appears to be ok now in recent tests; C13 still ok; latest plots show only C11 low in both channels -- to check earlier results & decide follow-up action for this; any others? for C11, not clear what is happening; latest data shows significant ripple in ch2 for almost all settings of attn value -- needs to be followed up; also W6 both chans are about 1 dB down; for C11, OF attn problem was found (faulty unit?) and after fixing that, the deflection now appears to be ok. W6 also ok now (reason not clear).

10 June : no clear signal of any antenna being down. S4 and W6 were not available.

(iv) some antennas show ripples and unstable behaviour in on off and deflection plots which need to be characterised and understood; this seems to not be a major problem now; check if any new antennas showing unstable behaviour ?
10 June : W1 ch 2 is the only one which showed some unstable behaviour.

(v) some antennas show RFI (in addition to military aircraft) -- need to watch out for such RFI and catalog and inform; recent report generated with list of lines shows 4 lines within 250-500 MHz : from localized satellites? to take up in RFI dicussion; more recently (29 April) strong RFI seen in most antennas near 400 MHz -- to be confirmed with RFI team.
no fresh updates except that latest data shows RFI near 470 MHz -- Mumbai digital TV, and lines near 484 MHz due to Russian satellite system (details in RFI section)
10 & 24 June : no fresh updates; need to check the status of W6 which has strong, periodic lines seen for last few months !

(vi) W4 problem : several tests and checks have been done (including new cable with modified connector pins); exact issue not clear; finally, main RF cable change was done and deflection tests appeared to be ok, but later results showed one ch dead -- debugging shifted the focus to the OF Tx system, where bad cable in RF PIU was found which fixed the problem (including ripple?); looks like first 10-12 OF units may not have been tuned for full temp range of variation; can be done now with the env chamber. This is being tried in W4 now and result will be clear in about a week. Similar retuning has been done for C14; meanwhile, entire OF system has been replaced by new unit; also 250-500 box has been brought down (replaced with narrow band system), rechecked thoroughly and some units have been swapped and now ready to go back to antenna -- to check current status of this matter.
10 June : finally, a new box was put and old box is being fitted with new LNAs. now deflection is ok, but BPF filter on HF side seems to be extending beyond the normal range -- needs to be checked.

(vii) New results from 27 March show : some difference in the deflection taken wrt cold sky (Npole) & the OffCasA source (from online) with the former giving slightly higher deflection (~ 1 dB) at 375 MHz -- may have some frequency dependence; also, absolute value of deflection appears to have reduced (to ~ 11 dB) from the early days (~ 12 dB) -- agreed to do a systematic study of last 1 yr data with 1-2 month sampling; sample data from C4 & C0 displayed (remaining to be studied before conclusion) -- to check if this has been done; also to cross-check role of pointing offsets, location of Sun etc.; sample plots for ~ 1 yr span for few antennas discussed; looks like Npole gives higher sensitivity than Off-CasA; to put all available data on one plot to check for any systematic variations with time.
10 June : analysis extended from 2013 to 2015 and appears to show that deflection taken with Npole as off source is 1.5 to 2 dB better than off Cas-A location -- trend seen for 3 antennas; can check for couple more; discussion with DVL and ICH showed that the off-CasA source is NOT a cold spot in the sky -- it is a spot with same background as that of CasA ! Hence, the calculations and results have to be interpreted accordingly !
==> ICH and DVL working on this; Ankur to show the data to ICH for comments.

(viii) FE team to maintain a log of the issues found and work done (antenna wise); some discussion took place about possible options (hard copy and soft copy); FE team to think and come back with possible way forward.
24 June : FE team proceeding with hard copy format.

(ix) Academic colleagues from NCRA ready to look at the data for helping with long-term statistics and user-level interpretation : can the raw data be made available for use (past and future)?
==> agreed to provide raw data for one epoch to Tirth for understanding.

1.6 Mass production of 250-500 FE receiver system -- from 24 Jun & before (ANR/SSK) : 15 antennas have the new feed installed (remaining feeds are kept in storage) and 10 antennas have been fitted with the broadband FE box (with 2 spare units). Note that the new configuration of QH + dir coupler + LNA is working ok in the new FE boxes (e.g. C11) but it needs to be checked individually for each new box that is made ready. First version (v1) of FE box was installed on C13; final version (v2) of new FE box was installed on C11 and found working ok except for Walsh problems. Meanwhile, GSG cleared to go ahead with mass production; making of LNAs for 30 antennas (plus use as spares for existing 325 MHz system) were finalised and item was closed (27 May 2015). Current action items towards mass production are :

(i) spurious bandshape / instability of LNA -- was not seen in the lab, except when i/p was loose or not connected -- this could be typical for all units? need to check about this; various tests were done in the lab and spurious lines were seen under some conditions of thermal cycling; there is an issue with central pin of QH (at both i/p and o/p side); at o/p side problem was fixed by ordering special connectors; may need same solution for i/p side (at cable connector i/p); sample machined pins were got from workshop for making a trial version of the cable; tested with FE box in the lab, and then tried on W4 to see if it solves the problem of oscillation seen there -- did not make a difference (!); however, since there is a fundamental mismatch, better to make this as a permanent feature; to check with Amphenol and Radiall if they will make to order for this (temporary solution is to get the changes done in workshop); plan is to have all new boxes with new connectors with sharpeend central pins; however, it is not clear that this is solving the problem of spurious effects in the bandshapes.

E6 oscillation reproduced in the lab with feed connected; tested with impedance stub connected in place of feed; can produce oscillation and stable behaviour by changing the stub length -- impedance going down from 50 and below; another LNA is stable with full variation of stub length; hence control tests can be done now to try and isolate design vs quality issue, both for QH and LNA and the combination.

Current effort ongoing to tune the ckt to improve RL at (small) cost to Tlna; in addition, to check for quality control on the ones that have come down from the antennas; also to monitor continuously at high temp to see if that stimulates the problem; 2 LNA units were modified to get better RL over 250-500 band without loss in Tlna and Gain (27 May 2015) -- but there is still a line seen when put with the stub; to try with stub on n/w analyser; to try the swap between LNA and other QH. 2 LNAs were tuned to give below -10 dB RL upto 600 MHz, without compremise of gain or noise temp (10 June 2015); however, when integrated with QH and tested, the gain response does not remain the same and when the units are connected to Sp An, the response is not good, and some lines are also seen (which is not the case for the originally tuned LNA); it appears that the retuning may have affected some of the components that are important for stability -- to put these back to the original values (or even towards the other direction) and try to change others which improve the RL...

Action items can be summarised as follows :

(a) plans for procuring modified connectors for i/p side
==> yet to check with the manufacturers to see if standard item is available or not.
(b) to confirm if any quality issues have been found in the PCBs that have come down in FE unis from working antennas
==> looks like this has no relevance to the problem and this item can be closed.
(c) current status of retuning of LNAs to improve stability
==> no further progress this time, as ANR busy with 550-900 amplifier.

(ii) status of QH, noise source, coupler etc : QH is available for all 30 antennas; current version of noise source, power splitter, directional coupler etc were tested before putting up in C13; but in-situ tests showed that the power level (deflection) of the noise was not sufficient; traced to faulty functioning (unequal distribution) of power divider module; alternate approach (using resistive components) seems to work ok : equal powers on both channels ~ 4.5 dB for E-Hi cal, no need to reduce coupling from 20 dB. Also, additional issue of 7 dB slope over the band (due to coupler) and 4 dB due to noise source; agreed to a change in the layout of noise module -- to try and reduce the 4 dB slope, increase the noise power slightly, reduce temperature sensitivity etc; more compact PCB with constant current source, shorter track lengths etc) was made and first results showed fairly flat (+/- 1 dB) spectrum over 200-600 MHz.

Current action items are :

(a) First two of the new noise source units are on C11 (box #2) and S02 (box #1); 3rd unit should be up on antenna now. To check status of noise cal tests by DVL for these antennas -- test results have been under circulation and can be taken up for discussion; meanwhile, some changes and corrections have been made, may be useful to do one more round of tests.
10 June : the results need to be looked at carefully and conclusions need to be agreed upon by all concerned and then follow-up action needs to be decided.
24 June : 4 units showing repeatable performance in the lab; from noise cal tests : S02, C11 & C13 gave identical 6 dB gradient across ~ 200 MHz range;
==> except for C13, all the new ones have the improved noise coupling circuitry can check the list of antennas and repeat the measurements.

(b) for new PCB : agreed to check on 2-3 more units for repeatibility & also thermal cycling and then finalise plans for mass production : one more unit has been made but work held up due to shortage of switch needed for control of noise level; meanwhile, thermal cycling tests passed ok. 30 nos of switches were procured, wired & 2 new units were tested (data appeared to repeat well, but final record is not available). To circulate the results for discussion, even while conintuing with the 30 nos.
VBB to circulate the results -- has not happened yet.
10 June : VBB agreed to circulate the results.
==> results for one LNA connected to different noise source units shows good repeatibility; and one noise source + LNA combination over 0 to 60 deg in evn chamber shows constant noise power level (across the band); with this issue can be cleared for mass production; could think of including results in next version of the FE document.

(c) discussion about the 7 dB slope due to coupler : to be deferred for now.

(iii) plans for sub-band filters for 250-500 MHz system -- results from sample units with all 4 sub-bands over plotted showed roll-off is a bit slow on the higher freq

side compared to existing L-band sub-band filters, but insertion loss is better; lab tests with manual settings using patch card + old MCM card done successfully, and sample units assembled in the new FE box put on C13; meanwhile, new, integrated unit that is more compact was developed : one chassis with 4 filters (on 2 PCBs)? plus separate chassis for switch; following are the pending action items :

(a) prototype PCB for this had come and was tested : worked ok, except for small difference in 2 pols; maybe due to unit to unit variations?; one more PCB was given to Argus to make with stricter tolerance (less than 10%) to see if that fixes the problems (Shogini was unable to meet the specs); this new PCB from Argus had problem meeting 4 mil requirement : 3 sub-bands ok; 360-460 band had some issues -- slight shift in the band, and repeatibility of units not assured; hence agreed to design with 4.5 mil spacing for all subbands (may lose 3-4 MHz BW in each subband); design was made and sent to Argus and after receipt of PCB 2 filters for each of 2 pols were made ready and 1 filter was tested; out of 4 units, 3 were sort of same and acceptable, but 1 was quite different; after discussions, another set of all sub-band filters was sent to Argus -- these were also found to be problematic;
3-pronged approach : Argus is ready to try and correct the problem -- should go ahead with one sampe; alternate fabricators : Epiton from Ahmednagar is ready to take the job (Atlantis from H'bad may also take it); 3rd option is to try simulating with 5 mil spacing and see what results are available.
13 May : 5 mil spacing design done (with loss of 3 MHz BW) and sent to Argus; 4.5 mil order going to Epiton; Atlantis is ready to try 4.0 mil -- waiting for quote; not pursuing 4.5 mil with Argus; 5 mil has come from Argus; waiting for chassis; waiting for other PCBs from Epitome and Atlantis.
27 May : 4.0 mil PCB from Atlantis has come and comparison with 4.0 mil of Argus : Atlantis appears to be better for the 2 lower bands and Argus appears to be better for the 2 higher bands ! Agreed to try 2 more samples each (for higher and lower bands resp) with these 2 parties. For 5.0 mil from Argus only one sample has come and shows expected shift -- need to compare when 2nd unit comes; to check current status on this.
10 June : one unit each from Argus and Atlantis is still awaited; may come by next week; can check status after 2 weeks (24 June).
24 June : Argus performance better at higher frequencies & Atlantis at lower frequencies; x4 units tested (from Argus) show very consistent behaviour - frequency reproducibility within ~ 50 kHz;
==> new set of PCBs from Epitome : higher 2 sub-bands tested ok for 2 units, lower 2 sub-bands yet to be tested; also waiting for balance 2 units from Atlantis for low sub-band.

(b) plans for mass production : switch PCB (20 nos) were available, along with sample chassis; agreed to first put on one antenna; if found acceptable, then go for mass production; compact v2 was installed on C11 and worked fine (tests completed); agreed to give order for mass production alongwith final sub-band filter PCBs; for the switch item itself, 100 nos were available (120 needed); confirmed that this switch is not used in other circuits, hence quantity can be finalised; chassis requirement has been worked out and request has been put (for how many?); mass production spreadsheet getting ready (by Temkar); meanwhile, 30 nos chassis to come next week (~ 11-Mar-15); spreadsheet still in internal circulation -- changes being made as per suggestions of ANR; has been checked after internal circulation -- needs a few small improvements before releasing.
10 June : spreadsheet is ready; will be circulated shortly.
24 June : meanwhile, rate of one antenna per month has accelerated to 1 antenna per 3-weeks; (target of x16 antennas + 2 spares);

==> Temkar spreadsheet is not yet released; meanwhile, Ankur spreadsheet is now put online, with modification access control only for the owner; read access for others.
14 antennas with feed + FE + CB and 16 antennas with feed ; one in 3 weeks can be done; may be useful to put spares also on antennas, so that user can have better chance of getting 16 antennas.

(iv) post amp + slow rise ps : Hitite 740 new stock for 30 antennas available; slow rise power supply -- agreed that this would be useful for the post amp in common box, but not really required for FE box; new design was done and PCB was ordered & tested Ok; agreed to give this for mass production to cover common box requirements for 30 antennas; mass production PCBs had come, few cards were populated and tested ok; agreed to mass produce, once the layout for the box is finalised and sample unit is integrated successfully in the prototype box. no specific action item here.

(v) Walsh testing for 250-500 : early tests showed both channels working in C13, but only one channel working in C11 -- box was brought down to check Walsh + problem of spurious bandshape of LNA; current action items :
(a) C11 FE box tested in the lab -- Walsh working ok in both channels -- may be a common box problem or D49 PIU? finally, cable from antenna base to top was found to be faulty -- replaced; agreed to test C11 (alongwith S2 and C13) to verify that everything is working fine; was waiting for C11 antenna to be released; finally, tests were done, and working on 2 antennas (C11 and maybe S2) was confirmed; to confirm for C13 and C00.
C13 problem needs to be solved; remaining issues are related to Walsh PROM;
9 antennas can be used. To plan another round of tests at 250-500 to check status.
10 June : C13 is a wiring problem being looked into this week for fixing.
24 June : C13 problem has been fixed; 250-500 tests show : only S06 with problem, rest x23 antennas show good performance;
==> no new updates.

1.7 Final version of 250-500 FE box -- from 24 Jun and before (ANR/SSK/HSK) : modelling showed that existing size of box is not adequate (inspite of double deckering of chassis); deeper FE boxes are needed -- 15 cm longer box was made (wt of new empty box was 15 kg) after mech group confirmed that this is ok (present depth is 468 mm, can be increased to 700 mm; also, rear member in the cage can be removed to further increase depth); also total weight of populated box will go up by a significant amount. One such bigger box was populated as a prototype and put up on C13 and tested; increased size and weight of prototype new box makes it unwieldy to handle at the focus and is a potential problem; FE group worked on compacting the contents to shrink it back to the old size, with minimum increase in weight : some of the smaller units were integrated into single units; milled chassis were replaced by plate+rail chassis wherever possible; ver2 box with everything fitting inside the original box (now 19 kg, down by 9 kg) completed and tested in the lab; unit #1 installed on C11 and tested fairly one; later, it came down for checking Walsh and some other problems.
Present status is as follows : C13 has original (heavier) new box; 1st unit of final (v2) box (which went originally to C11), is now on S2; 2nd unit of final box is on C11.

Current action items :

(i) installation of new boxes : 3rd unit of final v2 box was expected to go on C00 (Temkar responsible for final testing & release) -- was finally put on C00; however,

oscillations were seen -- brought down and tested in the lab; LNA was changed & box was installed back at C00; deflection test results showed working ok, and appears to be holding fine so far (27 May); check current status of this; also, update about plans for next box, and schedule for reaching 16+ antennas at 250-500.
10 June : COO seems to be working fine; next box went to W4 to replace the old one (which will be refurbished and put on next antenna); rate of 1 per month is quite feasible, except for the problem of sub-band filters; agreed to put up the new boxes as they get ready, without waiting for sub-band filters and retrofit as needed; target is to reach 18 by 15th Sep; question is how many are up now? 13 were confirmed, including C8 (FE team to provide exact status) -- may need to do one in 3 weeks.
24 June : C08 to go up this week.
==> C08 is up but there are some performance issues being looked at right now. Actual present count to be confirmed (see item above).

(ii) choice of reflective paint for the final FE boxes needs to be made : a few different options available (ref : APK, HSK) -- need to identify the best option; methodology of the tests to be done -- empty box to be painted and tested in parallel with control unit (without paint) using in-situ tempearture measuring device; issue of possible clash with powder coating needs to be understood.
3 types of FE boxes handed over by mech groupt to FE team : (a) plain box with powder coating (b) box painted with HT400 (c) box painted with HT 600; initial results from 5 day continuous run, having 4 curves : ambient showed large increase at sunrise (even a spike to 55 deg); for the box temperatures, results were slightly confusing as one box under test and power coating box tracked each other very well and other box under test behaved worse than these 2 (!); also there is extra cooling in the night ! Further tests also appeared to show that this is not working out; FE team prepared a brief report with the data and their conclusions; issues discussed were : current coating thickness 0.7 mm, to try higher value [can that help ?? skin depth much smaller]; are we using the correct type of paint? new options for reflective paint were discussed on 26 Mar 2015 -- mech group did some follow-up; some inputs from web-search and from Dr.Shenoy were used to identify proper paint;
Later (27 May 2015) tests were done with SummerCool make of IR reflective paint; at the peak of the ambient temp, the reduction in temp is about 8 deg from ambient and about 4 deg wrt powder coating; at the minima, all are the same (which is somewhat surprising); some follow-up actions identified :
agreed to try with thermocol layer inside in both the boxes; to also try with the insulating foam used in antenna shell; Kale awaiting 2nd brand of reflective paint.

10 June : some new tests have been done; update by Sanjit shows that the best results are still for the SummerCool coated box (the one using the material used in the antenna shell gives intermediate results); to wait for the 2nd brand of reflective paint (from HSK) and then decide the next course of action; also mech group wants to do one test using thin layer of insulating material on the inside of the box (see relevant agenda item in alternate week)
24 June : new insulating material (for trial) expected from HSK; what about status of 2nd brand of paint?
==> action items pending with HSK; no updates today.

1.8 Status of improved 500-1000 MHz CDF -- from 24 Jun & earlier (HRB/GSS/SSK) : there are 3 different versions of dipole (v1, v2a, v2b) and 2 versions of cone (v1 with 66 deg and v2 with 70 deg) in trial phase; 3 test feeds have been built using these :
ver1 : dipole v1 + cone v1 : RL is OK, deflection is not good & falls with freq

ver2a : dipole v2a + cone v2 (mesh?) : RL is good; deflection is OK & flat with freq
ver2b : dipole 2b + cone v2 (solid?) : RL is VG; deflection is good but not flat.

Simulation results for different combinations of the above were carried out and discussed in detail : it appears that dipole (rather than cavity) is dominant for deciding the RL behaviour (and also H-plane taper?); cone appears important for E-plane taper; best results for RL and good beam pattern match over large freq range appear to be for dipole v2b (triple sleeve) with cone v1 (66 deg).

Current action items are af follows :

(i) Running the simulations :
(a) Simulations with denser mesh case (higher order basis functions): new simulations were done with finer planes rather than with higher order basis functions; this needs to be confirmed; also, 50 MHz shift that is seen needs to be understood; also explore default number of current elements in simulation (from 19 Dec 13 meet); discussion with WiPLD indicates that increase in PolDeg may make a difference; tried with some changes in values of PolDeg related but no change in the results is seen; to contact WIPLD to see if they have a case study that exemplifies these effects and then decide the future course of action. WIPLD had sent a response but it had not been tried as PC was down;

(b) PC problems : licensed version of windows7 was obtained and installed on the lab PC but still had problems : may be some hardware issues (hanging or shut down); finally, after several months, all problems resolved & PC working properly (c. early March 2015)! however, still some problems : display goes blank at times; replaced with another PC, occurence reduced but problem persists; finally (around 10 June 2015), tried on a different PC in the same lab (to explore if problem is due to 'older' version of PC/ hardware)
24 June : Now WiPld working on x2 different Dell PCs; to decide future course of action.
==> need to decide on an action item here.

(ii) there is noticeable difference in simulated and measured RL curves which needs some study also (it appears that agreement was better for 250-500 CDF?); to check if new simulations make any difference or not (the same can be compared for the test range pattern measurement results for the two feeds?) -- this is not being actively followed right now.

(iii) deflection tests for different combinations of dipole & cavities (as mentioned above) for varying distance from focus using a variable height stool to see which design gives optimal performance :

After a lot of effort, a reasonable set of results on Cass-A obtained for the different combinations of feed : 750 MHz Kildal feed turned out to be very similar in response to Cone1-Dipole2); Cone1-Dipole2b as well as Cone2-Dipole2b gave results similar to CSIRO feed plots obtained in ~ 2011; later, it was discovered that using short length cables to minimse the loss made a significant difference to the results.

for cone2 + dipole2b at optimal ht of 1260 mm + matching short length cables (0.6 m instead of 1.4 m) was tested on C10 -- showed measurable improvement ~ 1 dB over most of the band (!); further reduction to 0.3 m cable appeared to produce another ~ 0.5 dB of improvement (!!) over most of the band; agreed to follow-up with LMR low loss cable; tests done with new arrangement of QH + LNA mounted on plate and kept right next to the feed showed another ~ 1 dB increase in sensitivity at 610, but no improvement by 800 (note that this was a different LNA and not the same one

used in the FE box, with the matching connectorisation); further tests with LNA used with CSIRO feed (SMA coupler may be producing some loss), mini-circuit LNA (very bad result); best result is for ~ 0.15 m long cable connecting feed to LNA directly with type-N;

for cone1 + dipole2b, peak was found to be around 1310-20 mm ht; also a new version of the CDF was introduced with a "choke".

Deflection plots for one chan for above 3 combinations were discussed (13 May 2015): cone2+dipole2b gives the best overall deflection curve; cone2+dipole2b + choke gives almost identical curve to cone1+dipole2b (!) and both are worse than c2+d2b.

Agreed to confirm 2nd poln is similar in behaviour & to get beam shape plots done asap; to prepare comparative chart with CSIRO feed results for taking to GSG level. Most of these matters were resolved, tests were done and results were presented in GSG of 8 June 2015 and clearance to go ahead with C2D2b design was obtained; now, need to close the loose ends and move forward.

Around 5 June 2015 : prototype C2D2b feed was replaced with new unit (with better stool arrangement?) and first round of deflection tests with this showed slightly lower deflection compared to earlier (for Cyg-A and also Cas-A); also, first beam shape tests showed slightly larger (~10%) value than expected (e.g. ~ 50' instead of ~ 45' at 610), also the prototype version showed Az values to be ~ 50 larger than expected -- all of these issues need to be understood and resolved.

10 June : in order to move forward after GSG : 2nd prototype put on C10 on 5th June, now has final FE box (hood) with 15 cm semi-rigid cable; fresh data for deflection and beam shape for both channels has been taken over the last few days, and the conclusions need to be checked and understood.

24 June : HRB summarized results from tests conducted over last few days/nights which are very satisfactory (as a 'final' option); (about ~ 1 dB peak-to-peak noise/ oscillation is attributed to test equipment (needs to be confirmed); also spikes in beam size plots attributed to RFI (needs to be confirmed); meanwhile, HRB would like to try with a modified version of cone2 (reduced length of the cavity) to see if it affects the beamwidth.

Comparison of beam shapes for the 3 feed combinations to see which is better : quick results from PMQC data (at 610) give some indication that cone1+dipole2b has slightly broader beam (?) -- need to get full RF test data taken and analysed, for both cases; finally plots of beamwidth vs frequency obtained from Manisha's program were obtained (May 2015) : showed ele and az beamwidths varying with freq, but with some difference in slope, and also absolute values are higher than expected (x2 for Ele and x4 for Az); finally (early June) these issues were sorted out and a series of measurements were done from ~ 6th June 2015 onwards. These showed that C1D2B has a beamwidth that matches closely with the "expected" curve and the same was true for the C2D2B with choke, whereas C2D2B clearly showed about 10% larger beams than "expected". These need to be followed up for checking repeatability and understanding the discrepancies.

24 June : Displayed plots (beam size vs frequency) from measurements on different dates show great variation (some even theoretcally impossible - like too narrow angular size) - for antennas S06, C03 & E05. (It was suggested that the strategy should be to first identify the RFI affected data & discard the same before being

included in the plots);

Action plan suggested (c 24 June) to be followed in the near future :
(a) to resolve the conflict between beam width measurements reported by regular PMQC tests vs those obtained from the beam fitting code vs expected values -- is there an issue of definition (or use of some constants)?
(b) to test "final" feed combination with next gen LNA alongwith final version of hood + FE box
(c) to test the alternate (shortened) cone2 design

(iv) Also, GP to work out the sensitivity curves for the expected parameters for this range : first version has been done, may need some refinement. There is some indication that some of the drop in sensitivity at ~ 750 MHz may be due to slight (10%) increase in Tlna -- this needs to be investigated in some more detail. Refined analysis with 2 different (fixed) values for T_lna show that the range of variation of T_lna over 600 to 750 MHz can explain the change in sensitivity seen in the expected curve. To check about options for retuning this LNA design; meanwhile, can test the commercial off-the-shelf broadband LNA available in the lab (which may have constant T_lna of about 30K) to see if it can be used to test flatness of the response across the band. Meanwhile, ANR to look at the existing LNA design critically to see what are the characteristics and what can be done to improve the Tlna vs freq. Also, can there be a matching problem? Agreed to take the 250-500 LNA PCB and adapt the ckt for 550-900, with the aim to improve the Tlna at high frequencies.

13 May status : expected curves made for varying values of Tlna, Eff and RL and some differences can be seen clearly : low freq (~600 MHz) matches with Tlna constant at 19 deg; high freq (~800 MHz) matches with Tlna of 28 deg -- consistent with known / measured Tlna variation -- to try to retune for ~ 19 deg across the band (or higher at low freqs), starting with simulation (can use the 250-500 PCB and chassis);
RL variation : varies from about -10 to -20 : there is scope for improvement at edges of the band (HRB can go back to simulation at some time to see); also 65% constant efficiency shows some improvement, esp at high freq side -- not sure what this is due to and what can be done to recover this... Need some follow-up.

(v) any new ideas? discussion of 19 Dec 2013 came up with following action items:
(a) design Kildal ring feed at 750 MHz using v2b dipole -- 14 dB RL achieved (over what BW?) -- first results from sample unit (tried on C10), including varying stool height, and the conclusion was that it is not as good as C2D2B (see earlier discussion) -- this can be taken as closed (May 2015).
(b) try simulation of CDF250-500 scaled by factor of 2 (including with different dipole sleeve combinations) -- maybe after (a) is done; status update needed; this is also now not relevant and could be closed (May 2015).
(c) design Dual-ring feed 550-900 MHz (intial BFRs can be made for 650 & 800 MHz) -- waiting for above items to complete; also not relevant now (May 2015)
(d) modified version of cone-dipole based on patent by Shefai + ... (1991) : refers to Kildal paper of 1982; recommends additional choke structure just below the cone but protruding out to lambda/4 : supposed to improve (a) cross-polar (E-H match) by 30 dB; (b) reduce back-lobe and (c) ??? ; agreed to cross-check the date of the paper on which our cone-dipole is based; agreed to build a prototype using cone2 (why not cone1?) matched to lambda at 750 MHz -- this was done and tested on C10 (see results reported above) and was NOT found to give results better than original C2D2b design (turned out to be similar to C1D2b performance); can be taken as closed (c. 10 June 2015).

1.9 Design of new RFCM card (v3) -- from 24 Jun & before (SSK/Imran/Sougata) : RFCM card (v1) was built as part of generating spares for Lband system and fully tested for all control functionalities -- for Lband, as well as for 250-500 FE box (alongwith patch card); it was agreed that since this RFCM card can not do monitoring (without further changes), old RFCM card + patch card will be used for present in the new FE box; will upgrade later to new RFCM card with monitoring capabilities included. Later, 5 monitoring points were added to the existing card, tested ok. Plan was to enhance the design of v1 by explicitly adding the monitoring facilities & full compatibility with new MCM card so that it can be used in all FE systems. A prototype version of the v2 PCB was designed, sent for fabrication, assembled, tested and incorporated into one Lband feed (which is now on W1) -- it still had some unresolved issues about bringing out the TTL lines and to take in the 8 monitor points : appropriate connectors need to be put for this; new PCB (v3) was designed and sent for fabricationl; 12 nos had been fabricated, received, assembled & tested; all cards were found ok, but not yet integrated into a box -- agreed to complete this before going ahead with mass production (~ 120 cards may be required in the long run); v3 card was then tested ok in different conditions : L-band system on W6, 327 FE box that is now on C11, 130-260 box on C10 etc.. PCBs for mass production quantities were done and components required were procured; plan is to assemble and use as needed. Pending issues are as follows :

(i) report : first draft was discussed : generally ok, but needs additions about monitoring points and internal review (c 4 Feb 2015); some significant changes were made and 2nd version was released and discussed (13 May 2015) : details of the work done is very good; need a few changes : motivation for making new RFCM card to be explained better in introduction; more detailed comparison between original and final card to be added in redesign section;
27 May : Imran is working on the modifications; can check after 2 weeks.
10 June : not much progress on this in last 2 weeks; can check again after 2 weeks.
==> no progress reported.

1.10 Next Gen Common Box -- from 24 Jun (ANR/SSK) : Like 250-500 FE box, final version of Common Box needs to be assembled and tested : final power & temp monitor (are in hand), interface to Rabbit card (work in progress), design of new RFCM card (work in progress), new arrangement for power supply distribution; a block diagram of the new box has been prepared and circulated and accepted after some modifications and improvements; it was agreed that old boxex can be re-used (no need for making new boxes), except for the issue whether new MCM card can be inside or needs to be outside the common box (the former option would be preferable); action items to be looked into :

(i) The interface card in common box needs extra PCBs due to wear and tear of existing PCBs. One to one copy of the card to be made as a new PCB, on lower priority. Work is in progresss (Sougata); may be ready to go for fabrication by 1st or 2nd week of April -- not yet ready to go for fabrication (13 May);
27 May : was at low priority earlier, but need to increase priority now. Sougata will get back by next meeting.
10 June : will go for fabrication this week.

(ii) FE team has worked out a plan for integrating the Rabbit card inside, which requires to swap the interface card to the other side of the box; to ease the wiring problem, the centre plate needs to be cut into 2 pieces; some issues about stacking of power detector with broadband amplifier need to be addressed; integrated

power supply card is included in this scheme; media converter added to allow for additional capability of fibre connect from top to bottom (as an alternate to shielded eth cable or serial link on RS485) -- FE team plans to mount it outside; confirmed that RS485 serial link will be supported as default option, and that eth over Cu is not viable; sample unit assembled and looks ok; wiring is ongoing -- to check if ready for testing now.
24 June : FE group's work completed; Telemetry group needs to test Rabbit card etc.
==> FE has tested the box fully using current MCM card; now it needs to be tested with Rabbit card interface, with existing command structure (!) -- need a discussion with telemetry team about this !

(iii) getting sample box ready : to take one old common box, get new plates made, put dummy boxes and work out the wiring scheme : mechanical items were completed for the sample box and all the items were available, including Rabbit card enclosure, slow-rise power supply card etc; wiring was to start after completing the layout -- this needed to be redone as things did not fit into the box in the first attempt; mechanical issue due to space crunch, required swap switch PCB and chassis to be redone. Swap switch PCB + chassis now ready and being tested; after that will be ready for integration in the box; sample unit assembled and looks ok; final wiring is ongoing (13 May)
27 May : VBB, Ganesh and Anand are working on it, but delayed due to 250-500 related matters; can check status after 2 weeks. Should be ready by now ?
24 June : Nothing pending with the FE group (wiring completed);
==> Box ready (see above); longer term plans : have 2 older style CB ready; and 2 of the new, modified ones ready and then start the cycling process on the antennas. For that main items required will be post amp (for remaining 14 antennas only); Rabbit card in shielded enclosure (to be supplied by telemetry); new power supply card; new interface card and power + temp monitors. May be possibe to do one in 3 weeks, as far as wiring is concerned; can use the boxes that come down, except that front plate assembly will need to be changed to accommodate ethernet connection; outer shell of the box can be reused, like in FE box case.

1.11 Calibration scheme with radiator at apex of antenna -- from 24 Jun & before (SSK/PAR/SRoy/DO/YG): Current set of issues being tracked are as follows :

(i) testing of dynamic range of old vs new electronics on specific antennas :
First round of tests were done on C0 and C1 (both old electronics); C4 was the first antenna with new electronics that was tested (in Dec 2013) and compared with C1 (old electronics); informal / short report was produced, which showed that : 1 dB compression pt has improved by 6 to 8 dB (from -6 to -10 dBm to about -1 to 0 dBm); change in phase (and also ampl?) with change in elevation shows cyclic variation -- may be due to position shift? W1 was identified for testing repeatibility on new electronics, in addition to repeating on C4 itself (though it has old common box).

Summary of new results :
Sensitivity and 1 dB compression point results look ok; stability of ampl and phase response need some interpretation; fair amount of new data is available which needs to be studied and the summary understood and then taken up for discussion -- this was done, and conclusions about 1 dB compression point are reasonably clear and ok (need to compare with results from signal flow analysis results); for the ampl and phase varn with antenna position, the results and conclusions are not very clear, but there appears to be some indication of the variations; a more detailed study with a couple of concrete follow-up options may be considered; agreed to complete the 1 dB compression point comparison with SFA; to repeat tests on either C0 or C1

to check validity of old results

Updates from results extracted from the analysis :
1 dB compression point values shown for C4 and C0 (new and old) show 7-9 dB change between old and new electronics; there is a hint for frequency dependence with reducing improvement at higher freqs; agreed to check with 20 MHz steps of CW radiating signal for both these antennas, in the range of 250 to 500 MHz.
Results replotted to show ampl, phase and elevation vs time on same panel -- there is clear anticorrelation of phase with elevation; for ampl, things are not so clear; for phase there may even be some frequency dependence in going from 150/400 to 1250 MHz; to try the test for broadband response alongwith n/w analyser; also give a copy of the data to SRoy to try plotting ampl/phase vs elevation directly.

Current action items :

(a) confirm when new common box was put on C4 (12th July 2013; sr no 119) -- to correlate with results. PAR to confirm results from data before and after this date.
24 June : No updates for a very long time -- to close or not to close?
==> can be closed, as there is not much data before July 2013.

(b) to get comparison plots for C4 with old and new radiator antenna : new data taken with new antenna at 327 Mhz : 6 dB ampl and 40 deg ph for elevation angle cycle -- this appears to be larger than that for the old antenna;
24 June : No confirmation of this forthcoming.
==> ampl loss can be explained due to poor return loss of feed, and extra phase may be added to the signal? item could be noted and closed.

(c) to check the change in 1 dB compression pt against SFA numbers -- this has been done and they compare well; to extend this to test 1 dB compression point at different stages of the chain : from OF i/p to GAB o/p; tests have been done and upto optical receiver output [OF Tx Rx FE CB] 1 dB compression point available; first presentation of results (29th April) :
C4 antenna, 450 610 1170 MHz 3-plots : 1 dB compression point variation with freq - plots shown :
first for 610 MHz :
[FE] saturates at +11 dBm (@input) Blue
[FE+RF amp] serenza +4 dBm (@input) Red
[FE+RF amp+opt Rx] saturates at +0 dBm Pink
next for 250-500 [450 MHz] :
[FE] +4 dBm; [FE+RF amp] -6 dBm ; [FE+RF amp +opt Rx] -11 dBm at 1170 MHz (L-band) :
[FE] +1 dBm; [FE+RF amp] +1 dBm; [FE+RF amp+opt Rx] -2 dBm
Conclusion : while FE system provides for the designed head-room, for some cases, later sub-systems restrict that dynamic range; needs discussion to chart out future course of action.
Some discussion of the results -- reasonable first order match between measured and SFA values; some consistency checks are needed.
==> overall this looks all right, except maybe for repeatibility tests; can modify the agenda item accordingly and close some aspects.

(d) to repeat on another antenna with new electronics and one with old : W1 had been identified, and work for RF cable and antenna mounting related arrangements was completed and tests were to be done -- agreed to defer this for some time.
this is not being pursued; instead can try on C11 and C13; instead of W1, C4 in in progress? to confirm status of this activity.

C4 has one of the new antenna; put one more of new radiator antenna in dish with old electronics, and old radiator in C11 or C13 kind of antenna. Check current status. Repeat for C4 -> C13 antenna (honeybee issue led to delay; maybe can be done by 30-Apr-15; to check current status.
27 May : 1 dB compression point tests now done for C13 also; details, alongwith comparisons, to be sent shortly.
10 Jun : first results from C13 discussed : getting similar power levels as C4, except for 3-5 dB kind of differences (for 325 MHz) and other wavebands also... shown that the Aronia radiator works ok down to 150 MHz.
==> results for C4 and C13 for 3 wave-bands (610, 250-500 and Lband) at 3 stages of Rx chain are available : to compare these to check repeatibility; then identify a 3rd antenna. If this succeeds then the main goal of the 1 dB expt can be taken as met; only when new wave-band is installed (e.g. 550-900, 130-260).

(e) to check meaning of results from other wavebands that have been done. tabulation / report to be made ready in a week -- to check status of this.
==> see above for a summary.

==> long-term prospects : agreed to generate a concept note for long-term usage, with pros and cons listed for detailed discussion later on; Pravin to make the seed version and circulate.

(f) to share the data with SRoy to get the plots done for the variation with antenna position (elevation etc) & then work on interpretation : results from plots of ampl or phase vs elevation angle show clear distinctive shape for the ph vs angle and less clear shape of ampl vs angle; also there is slow secular variation of ampl and phase with time; to try and model ph vs angle with a mathematical form and see what physical phenomenn matches that form; first attempting at fitting with a mathematical fn has been tried; new data now with SRoy; on 1 Apr15, SRoy has sent an update on the analysis done by him on long stretch of data from 8 april 2013 (!); plots made vs az and ele (instead of time) show no strong evidence for systematic variations with ele. This needs to be checked and discussed and understood; no other updates on any other item, as RFI team has not done any work in this area in the recent weeks.
SRoy has sent some fresh plots of ampl vs elevation -- don't quite show the expected behaviour -- need to check carefully, and also get phase vs elevation.
27 May : SRoy has now made some plots of phase vs elevation and they do show a sinusoidal pattern -- this needs some discussion and some follow-up action; agreed to try to separate into 2 categories : one for increasing ele and one for decreasing else.

10 June : meanwhile, new data taken by FE team and discussed briefly : may be 0.5-0.8 dB gain varn and 5-8 deg phase varn with elevation wit the latter more systematic. FE team to give final summary and also circulate data to SRoy -- this is still pending !

==> summary by SRoy : ampl variation is not confirmed to be a smooth or systematic variation that can be fit with a mathematical function; whereas the phase varn does seem to show a clear pattern which can be modeled; SRoy agreed to summarise the conclusions so far, incuding any difference seen with old and new radiator antenna..

(g) new tests with sweeping of RF to check 1 dB compression points with finer resolution over the band -- some tests have been done at 610 band and after corrections, fairly good match for gain curve is seen, but some variation in the

1 dB point with frequency... to try 250-500 with old antenna in steps of 25 MHz at C11 and C13. 1 dB step data in ealier plots above ; 25 MHz step data collection planned; to check current status.

(ii) Understanding change of amplitude with change in antenna elevation :
SRoy has done the basic calculations but needs to cross check against the beam width of the feed to estimate the amount of deflection / shift between feed and transmitter at apex required to produce the measured change in signal level.
Test done by Subhashis by rotating the feed : power falls by a factor of about 4 with about 600 counts from the 0 reference position (-700 to +200 arcmin range) : fitting a gaussian to the voltage pattern (asymmetric) gives a HPBW of about 21 deg (about 15 deg for power pattern); this gives about 2 deg for 0.5 dB change in power.
SRoy to refine the calculations (including other antennas) and also check Raybole's new report on this matter and summarise for a discussion.
drop in power is 4 sec out of 20 sec ==> 15 deg is 3 dB beamwidth (ok with other test of SRoy); ==> about 2 deg for 0.5 dB change; if converted to lateral shift of the feed, it may be close to 1 m -- to check alternative interpretation about rotation about feed axis by the require angle. not clear if the matter has been resolved or not; SRoy has circulated a first draft note; agreed to discuss during the meeting of 13 Aug; meanwhile, SRoy to circulate a drawing to illustrate the geometry. both documents have been circulated, and a discussion is required...
some discussion about the analysis done by Subhashis : whether lateral translation of feed converted into an angular shift is enough? does the transmitter beam pattern make a difference? how much rotational offset of the feed would produce the same change.

(iii) deployment of new broadband antenna : suitable unit (from Aronia) had been identified and ordered : 2 nos with slightly different freq coverage are there -- looks like will work from 100 MHz to few GHz (hence OK for our use); one unit mounted at C4 and tested with broadband noise source covering all GMRT frequencies; found to work ok to first order, but there are some frequencies where there is loss of power -- being studied; also, tested with varying power levels of noise source and data is being aanlysed; first version of report has been circulated; few points raised are : why 1 dB compression pt changes dramatically for some of the frequencies e.g. 327 vs 393; to check consistency of results with earlier for same frequency; then check change in ampl and phase response for other freq; to check the angular pattern of the new antenna and compare with the earlier dipole antenna that was used -- to check what has been done and discuss the new results; to send one data set from old measurements to SRoy for same kind of plot; to cross-check measurements of old and new at the same frequency; some data has been shared with SRoy; preliminary look has been taken and more detailed anaysis is ongoing and results can be discussed two weeks from now.
SRoy wants to check if correct parameter is being used for antenna coordinate; also to make the plots for couple of other data sets to verify the issues.
One unit has been installed in C13 dish, and used for 1 dB compression tests (before, it was used at C4); for future plans, to try and put on one antenna like C10 where most of the wideband feeds are present and obtain response from 120 to top of Lband in 5 MHz steps to see if this radiator is sufficient for all GMRT bands.

10 June : No updates; to check 2 weeks later for updates.

1.12 Walsh switching arrangement in FE -- from 24 Jun & before (SSK/SCC/PAR) :
Some tests have been done on the bench by FE group; first draft of report has been circulated. Current action items are :

(i) to devise a simple test using Lband system + radiation from apex to demonstrate the working of the system (on any antenna) -- agreed to try and couple this with the new test set-up at W1; agreed that CW test can be done to check functioning of modulation scheme when other tests are done at W1; FE team tried 4 antenna test including C13 but could not get a definitive answer; appears that the problem was due to improper test cable used at antenna base; new cable with all cores connected was made and used; further, it was found that Walsh eeprom IC has been removed from all antennas be BE team -- restored in W1, and tests done : this looks like working satisfactorily in first round testing. To go to next step of getting the signal to receiver room and check on oscilloscope (one pol can still be going to the VVM at antenna base); 2nd step will be to talk to BE team and get the end to end test going. Antenna base tests completed (instead of C04, done at W1 - why ?); demodulation at receiver room not done yet -- to check status of these activities.

(ii) further, Walsh switching has been tested on C4 with astroomical source : loss of correlation happens when Walsh is turned ON (need to understand upper and lower bit in Walsh); next step is to match it with the demodulator in the back-end system.

Summary : radiation test from apex done at W1 to show that Walsh switching is happening; astronomical source test done with Walsh on-off at C4; in addition C11 and C13 are Walsh-ready and should be tested in similar mannaer; after that, to take up discussion with back-end team about extending test to demodulation side; C13 tested ok in both pols; C11 : required change in IC of Walsh gen ckt; result shows one poln work and one not working -- to confirm if working or not. Work on verifying that Walsh works is pretty much over; need to work with BE team to do end to end test.

Fresh set of tests to be planned after MTAC, using the following standard procedure : get all antennas including one under test to fringe; then turn on Walsh for just the antenna under test and verify the loss of fringe for this antenna (for both pols); if does not work, then appropriate debug to be done to localise the problem in FE box, cable or Walsh generation circuitry; also item on upper and lower bit need to be understand. To try this for all 250-500 antennas with new v2 FE box. Test report of 7th May shows fairly decent results, except for issues related to C1 and C13; some isues with Walsh EPROMs -- BE team is re-installing original Walsh EPROM in all CSQ antennas.

27 May : C13 needs check of cabling / wiring as Walsh bit is not reacing to top; EPROM installation done for 9 out of 14 antennas -- to check remaining 5 antennas.

1.13 OF links : new and old, from 24 Jun and before (PAR/SSK) : This involves getting the new, broadband links installed on all 30 antennas and working properly, as well as maintaining the fibre joints efficiently. Following are the action items:

(i) installation of new, broadband links :
22 antennas installed : C0, C1, C2, C3, C4, C5, C6, C8, C9, C10, C11, C12, C13, C14, E2, E6, W1, W4, W6, S2, S4, S6.
Further, S3 was completed and released; next was S1, which took a long time for telemetry team to complete their part; next was W5, but units made ready for this were diverted to replace units on W4 to fix the problem there (early May 2015); retuned units were installed on W5 (10 June); next antenna : E3 (26th antenna).
==> E3 is completed, telemetry yet to be done; next is E4.

(ii) maintenance issues of installed broadband links : see action item under 250-500 system... : 2 antennas C14 and W4, old units replaced by new (which are thermal cycled); remaining will be done if problems are seen. To check if there are any updates on this.
==> no new action on this.

(iii) long-term maintenance of OF field joints : Growing evidence for problems with older joints (over last 10-20 years); need some kind of consolidated approach to address the problem. Likely causes : nature and condition of splicing equipment? Nature of cover / protection provided? ... Agreed to get the statistics of the old field joints over time, including a comparison of the losses seen with fresh measurements -- this exercise may take 2-4 weeks; meanwhile, urgent attention is required for the field joint near W1 as it is affecting W4 and W3 significantly. There is a technical problem that the newer kits are not compatible with our existing cable and old kits are not availabel -- 2 options ongoing : trying through Chinese company and also workign with mech group for additional support structure.

Trying to understand the problem : fibre cable used is the same type as original; however, the splice kit for new cables is incompatible with older cables -- this problem is from about 2007 / 2010 onwards?; claim is that joints made before this are ok, as the quality of the material in the older (Australian) ones are better.
except if there is a problem of break or crack in the protective coating or the kit.
basic list shows ~ 40 cuts (80 joints) distributed over the array; agreed to produce the table alongwith the loss values; then one can look at the worst losses and compare with other external factors like location, environmmetn and old vs new kit etc.
30 nos of new kits (15 joints) have come; these look quite good and fairly cheap and should meet all the requirements for different kinds of joints; first trial may happen by MTAC. New kits will be used for the joint near W1 identified earlier.
W1 & W3 being done during current MTAC -- to check current status.
W1 to be done on 6-7 May'15; thereafter, take up W3.
13 May : joint at W1 reworked completely -- connection to W3 was the highest loss; next target is joint near W3 -- to be confirmed after checking new OTDR data.
27 May : OTDR data is taken but not yet fully analysed; to check again after 2 weeks.
10 June : analysis of data is ongoing; meanwhile, problem of high optical loss in W6; now made working by putting a higher power laser at 1310 on forward link.
24 June : Measured signal-to-noise was compared between W05 & W06; latter is better by 10 dB due to new optical transmitter used -- this laser has much lower noise (-155 dBm compared to older one with -125 dBm); to discuss and decide future course of action.
==> relooking at the field joints : may need to do one more near W3, but better not to touch it now; for high power laser at 1310 for telemetry + LO (forward link), W6 soln can be tried on other extreme arm antennas : may have one more in stock; need to find more in the market.

2. RFI related matters :

2.1 RFI from different spectral lines -- from 24 Jun and before (PAR/SSK) : this covers RFI from TV signals (from cable to terrestial systems + boosters), aviation and radar systems, police wireless and such like.

Summary of the various issues is as follows (specific action items are dealt with later, in the next section) :

(a) TV lines : Cable TV leakage does not appear to be a problem; present thinking is

that the lines seen are from terrestial TV transmitters -- mostly in 175 to 229 MHz range. Need a comprehensive list of terrestial TV transmitters in neighbourhood (with large enough range) and their frequencies, and to check which ones are expected to affect us : updated document shows about 17 transmitters around GMRT area -- based on information gathered from DD personnel and web. Not all of these are seen by GMRT antennas (some are very low power ~ 10 to 100 W, including UHF transmitters); the list of ones seen at GMRT is 11 transmitters : 2 of them are at same freq : Junnar & Sangamner; all are analog TV transmitters, except Mumbai DTT (digital transmission at 471.25 to 477.25 MHz). See specific action items below under (ii).

(b) civil aviation related lines -- these may be of 2 kinds : airport radars (e.g. near 1090 MHz?), and transponders on aircraft (and counterparts at airports?) -- these are generally at lower frequencies (TBC). Lines seen near 1030 and 1090 : interrogation at 1030+/- 3.5 from airport and response from aircraft at 1090+/- 5 with width of about 20 MHz. In addition to these lines, 108 to 140 MHz is used by ATC -- again stronger near W-arm antennas. Need a comprehensive list of known / expected lines from civil aviation related activities near GMRT -- the list of lines have been identified in the main document (below). See specific action items listed below under (iii).

(c) any other sources of spectral line RFI : e.g. police wireless etc -- need to be discussed and characterised : work ongoing with omni-directional antenna and disc-cone antenna; police wireless is in 159 to 163 MHz; there are some reports that there is increasing amounts of such activities in GMRT area (earlier it was more eastern side; now also seen in southern side). See specific ation items below under item (iv).

(d) lines from satellites : these include US military satellites (240 MHz region), host of GPS satellites (in L-band), a Russian military satellite system (6 satellites, 24x7, with 12 hr period, single line from each satellite; max of 5 lines are seen : 483.0, 483.5, 484.0, 484.25) etc; plan is to identify as many of these as possibles and then work on algorithms for real-time prediction of when a given observation / pointing will be affected by these (see appropriate action items below and elsewhere)

(e) other, unidentified lines : new RFI was reported in 270-290 range (not quite matched with MUOS frequency) only one incident has been reported so far (?) -- needs to be cross-checked; line seen at 485 MHz (very narrow, almost a CW) -- may be due to radar wind profiler -- needs to be confirmed; see specific action items under item (v) below.

Current action items :

(i) to generate comprehensive report on list of lines seen around GMRT and their RFI influence : updated report with list of lines around GMRT getting ready ; have used log-periodic + disc-cone + actual GMRT data for making final compilation. Highlights of the results : lines are color coded as per different sources of RFI e.g. mobile phone, TV, civil aviation. Good amount of information appears to be captured here -- discussed in fair detail during Dec 2014 : agreed to modify title of report; to clearly mark lines not seen in GMRT region; to think of separate version of table (for external circulation) that has ONLY lines seen at GMRT; to think of prediction algorithm for GPS satellites (similar to military satellites). Updated version circulated in first week of March; some feedback had been given in email reply; additionally, still need to look at ways of marking which lines are seen at GMRT and which are not (including those which are not there all the

time), and also to check the figures and have only the ones that are useful or adding value. Revisions to be done to the report and updated version to be produced. Check status -- report being refined; check current status.
10 June : ready for circulating again for a recheck -- has it been done?

(ii) For TV lines :
(a) check for evidence for Mumbai digital TV transmission near 470 MHz : there is some evidence for terrestial TV at 471.25 and 477.25; needs to be cross-checked and confirmed that it is Mumbai digital TV. Level of lines appears to vary from antenna to antenna -- need to do a careful check of this aspect.
Difficult to check at W6 (maint), W5 (no broadband system), can try in W4 (may be seen in E6 also due to reflections?) -- need follow-up.
W6 471-477 MHz digital TV Tx [plots were displayed]; police wireless (tbd in W5) confirmed to be 'Mumbai digital TV' (from direction ?)
W6 plots at 471-477 MHz are suspected to be Mumbai digital TV -- may need a bit more of confirmation.

(b) noticed that 540 TV line still leaks through for some antennas (also maybe true for the 175 TV line?) -- need to check if this is due to shift of the filters or not enough rejection of the line. To work with operators (via a note) to ask for feedback on occurrence and strength of 540 line in GWB data. Can also work with Ankur's data to check... Are there any updates on this?
(c) can we take the strongest TV line & characterise if it saturates the electronics or not? Maybe only Junnar TV at 189 & 194 MHz satures only W6 (needs to be confirmed). Wider notch filter has been put in W5 and W6 as a precautionary measure... need some way to resolve the matter. W6 antenna results plot shown -- what is the conclusion? W6 data (at lowest elevation; moving from north to south) shows no harmonics of the TV lines and hence may not be saturating -- need to check LNA gain upto 400 MHz to confirm; also all TV lines to be identified in the band against the list circulated in 2014 for known transmitters near GMRT.

(iii) For civil aviation : some follow-up is needed to see if they saturate the W-arm antennas : may be saturating only W6, but needs to be confirmed -- will do as soon as W6 is released from feed cage painting. There may be some evidence for saturation due to 1090 civil aviation line, for short durations only. Need to confirm this matter.

(iv) For police wireless : to discuss with admin if the information about their transmitters (esp the fixed ones) can be obtained -- needs to be followed up.
Raybole and Solanki have planned to visit (alongwith DIC work in Pune) -- this has happened now -- check outcomes and follow-up plans.
JKS + PAR visited police wireless office for discussion; strong police Tx now at Giravli hill -- installed 6 months back (may be causing the saturation); need to send a letter stating GMRT's concern; then their technical people will plan visit to GMRT.
Measurement plots shown 150 MHz (civil avaition line); may need notch filter for 164 MHz police wireless?
Current tests (e.g. data at W6 at lowest elevation) shows saturation at times when the police wireless is the strongest -- need to have the power reduced, as part of the ongoing negotiations with rural police. To get latest update on this.

10 June : Girawali transmitter now running at 18 W (down from 15 W earlier; found 10 W to be too low) -- checked that saturation is avoided for W6 and S6 at low elevations; one set of new measurements made near Giravali by RFI team, yet to be analysed. [some of the facts above appear to be wrong ?]

(v) New lines :
(a) to check all the RFI lines in 250-500 band (at least 4 have been identified);
new cluster of lines seen in GWB output : 332 to 344 Mhz -- need urgent follow-up !
some initial tests have been done looking at specific antennas -- not seen; needs
some follow-up. Check status.
(b) to confirm status of about new RFI in 270-290 range; any updates?
(c) follow-up on Russian satellite sytem : exact range of frequencies (483 to 484
MHz or just 483 to 484.25?), how many lines?, trajectory of the satellites?, not
seen in low elevation scans?
(d) new lines seen in around ~ 340-350 MHz : seen in few antennas, in one pol only;
not yet understood. Any updates?

(vi) omni-directional antenna needs repair and replacement also; processing for
10 nos (including remote location sensing) was ongoing -- order had been placed;
all 10 nos arrived around mid-Jan; one unit opened to verify the components; 2
units assembled and performance tested and found ok; plan to mount 3 antennas at 3
different heights on the wind tower of servo.. change in plans... to discuss the
goals of the exercise and decide -- to be discussed alongwith prioritisation of
all the RFI related jobs.
To try and make it work at one remote antenna site and show that it works.

2.2 Radiation from CAT5 cable -- from 24 Jun & earlier (SSK/PAR): Follow-up on
action from 3 Apr 2013 (!): to install shielded CAT5/CAT6 cable in conference room
as trial and finalise the scheme for all other public places in the building:
first report had been circulated that combines testing of switches and CAT5
cables; conclusion was that use of shielded cable makes significant difference to
the discrete lines as well as to broadband RFI. Agreed to go ahead with controlled
expt in GMRT Conf room to quantify the improvement; tests had been completed, and
report showed not much change in radiation level with and without shielded CAT-5
cable in conference room (!) -- maybe dominated by RFI from other equipment in the
room? Agreed to move ahead by extrapolating from the results of testing of Miltech
+ switch : to try and estimate the cost of material and labour (time) for changing
to shielded cable + connector in all the unshielded rooms of the building; discussion
on 16 Jul 2014 : table of invetory of un-shielded cables currently in use (94 copper
lines); total length ~ 1200 metres; procurement of shielded cable was initiated; data
was submitted by RFI team, and an updated document had been circulated; about 900 m
cable (3 rolls) + crimping tool need to be ordered (enough connectors are available);
total investment is about Rs 1.7 lakhs : agreed to go ahead with this; item was under
negotiation about details of the pricing (Rs vs $ quotes due to difference in value);
meanwhile, work had started using existing spare CAT5 cables (old stock) to replace
older cables in various labs, as per their requirements; conference room & canteen
annexe has also been done; meanwhile, folder for main order was followed up and it
appears that there is no choice but to go with the Rupee quote and hence total outlay
will be ~ 5 lakhs.

Current action items :
(i) Status of completion of the work in different labs and rooms : conf room,
canteen annexe, EPABX room and all engineer's rooms, user's room are done; rest
are waiting for main order to supply. delivery has happened now (29 Apr 15); can
initiate the work with consultation of digital team...

(ii) To check status of final order and availability of cables, connectors, crimping
tools etc; finally, order is gone; to confirm expected date of delivery; finally,

after a lot of delay, items received on 28 Apr 2015. To check if anything more is on order or needed; otherwise close this item. This can be closed.

(iii) Need to work out a scheme for proper long-term maintenance with OF and computer group : at the level of PAR to MU it has been discussed -- SSK to send an email to formalise the arrangement; cables, connectors, tools given to Mangesh; a concluding discussion may be required with computer group. YG to bring up with BAK -- need to try and close the matter. Item discussed in meeting of 13 May : not clear what is the best way to close it...

2.3 Effect of military satellite RFI in 243 band -- from 24 Jun & before (PAR/SSK/SN) : follow-up action on testing for saturation effects, decision about appropriate location of switchable filter, possibility about control room (ops group) being able to come up with algorithm for prediction (for users); results for tests done by pointing to the satellite (and tracking for some time) show increase in total broadband power of about 12-15 dB on the strongest satellites (others are weaker) -- this leads to harmonic at ~ 500 MHz also visible; there is good evidence that the FE is saturating as harmonics level does not change with changing OF attenuation; current action items are as follows :

(i) filter related action items : to try a test where filter is inserted in the path (for 2 antennas) -- done for E2 & C6 and check effect on other bands (610 and Lband); need to decide if we want this filter in a switchable mode (at FE box or Rx room) or permanently in the path or not at all ! does the answer depend on the strength of the signal? not clear... trial results on one channel of C6 was to be circulated for getting feedback... ssome results were displayed by Ankur. filters are still there in C6 & E2 -- can be checked.

(ii) to test saturation effects and limiting angular distance from satellites : we need to quantify at what angular distance do the signatures of non-linearity (harmonics) show up; agreed to try for a plot that shows power in the RFI band as a function of angle from the satellite; and also to quantify when the alarm turns on; to do the finer experiment to find the angle range that avoids saturation and to plot power in fundamental and harmonic as a function of angle from satellite.

Some action items are as follows :
(a) 2 kinds of tests done : keep Az fixed and move in Ele and vice-versa : yields +/- 2.5 deg as the width over which saturation is seen -- tested for 2 satellites which show saturation. To confirm status of this and see if final conclusion can be drawn. Waiting for couple more measurements.

(b) It appears that 2 out of the 6 satellites have 2 deg limit for saturation. Can we put this as the default limit for all the satellites? Ops group to generate statistics of the duration of encounters in the current set-up. This needs to be followed-up, including checking the log that Santaji has created.

(c) Need accurate positions of the satellites -- to be tried using GMRT antennas itself?

All these data have been taken; waiting to be analysed -- this should give more accurate positions of the satellites. Check status of this work.
Az-El data taken Az=26deg El=59deg
2 datasets give 2 different AzEl for satellite (!); need more measurement to confirm which is 'better' coordinate [for giving alarm]-- methodology and results to be

discussed in further detail.
One curve seen with az constt and ele changing and appears there is an elevation offset of 2 deg or so; need better understanding of the experiment.

(iii) Ops group to investigate and come up with alarm algorithm to use in control room, after getting the relevant data from PAR. Present aim to cover 3 scenarios :

(a) real-time alarm in the control room -- SNK has implemented this, but may need some retuning (some refinement of coordinates is needed)

(b) for a given source at a given time, for a given frequency, predict the effect, including a facility for running through an obs file -- this is TBD;

(c) post-facto : given log of an observation (lta and servo files?) analyse how much data affected by satellite RFI -- this is also TBD.

email from SNK gives some details about implementation and testing for (a); Giving refined coords is still pending; (b) and (c) are still pending.

SN to look into the matters with SNK. SN updated that SNK has completed the implementation for all the 3 options (a, (b) & (c) -- waiting for more accurate coordinates to get improved results; can we get a demo ?

There was a joint discussion with PAR, SNK and SN; satellite data /information given by PAR to SN;

10 June : new expt has been done to track satellites and refined positions have been obtained; will be testing shortly to confirm this; GPS satellite data has been given to Santaji on a trial basis. To check current status of this.

2.4 Mobile phone RFI -- from 24 Jun & earlier (SSK/PAR) :
Progress on identifying the operators at and around E06, and in Nagar, Junnar directions : letter had been sent to BSNL, some follow-up action was on -- they had agreed to change to 1800 at 3 locations (Ale, Gulanchwadi & Pargaon Mangarul) : one location (Pargaon Mangarul) tower has been swithced over to 1800 by BSNL; Alephata tower -- 2 sectors changed to 1800 (what about the rest?); for Gulanchwadi tower -- work is pending (as per latest update from BSNL officials); RFI team to verify these changes by visit to the sites & by checking the GMRT data (compare old vs new data), and summarise their finding -- some new tests are done and looks like there is improvement; Gulanchwadi needs reminder to BSNL. Appears that BSNL has no spare hardware to move from 900 MHz to 1800 MHz; eventually will move when additional units become available -- no commitment about time frame; check if there is any change in status; latest update : looks like end of September for any work by BSNL? check with BSNL reveals, no change in situation; if no change till end Oct, to decide whether to escalate to higher level or not.
update on 10dec14 : BSNL has finally done at Gulanchwadi -- this is now verified that power in 950 has come down and 1800 has gone up in that direction. Letter needs to be sent (to confirm if it is to be a letter or request or appreciation)
-- YG and PAR to discuss and resolve the matter. Also, to discuss the way forward with the next step on this topic.

3. Operations :

3.1 Interfacing of FE with new M&C system -- from 24 Jun & earlier (SN/NS/CPK) : Naresh + Charu & Sougata + Rodrigues were working on this; will have full set-up of FE + Common box, but will start with M&C of common box using Rabbit card : initial h'ware connectivity may not be too much work as 32 lines have to be mapped to 16 lines on interface card; low level software for bit pattern setting may be enough to demonstrate basic connectivity; after that, packaging will be the issue to be sorted out. Action items:

(i) basic set-up was made working, and tested (by Rodrigues + others); difficulty of communicating via Rabbit to FE appears was resolved with demo of some commands by Rodrigues et al : initially 2-3 basic control commands, later all the commands (except Walsh) were tested and cleared; brief report from Rodrigues summarises the work done; logic + softawre for monitoring commands (6-7 FE + CB monitors) need to be implemented; Charu and Sougata are identified to work together on the monitoring functionality with guidance from Raj where needed. Check current status of this.
27 May : waiting for Charu to finish report of FPS testing with Rabbit; meanwhile, to see if one assembled Rabbit + shielded box can be given to FE team to complete the wiring (to check status of box #2 with PAR and Sanjit) -- can go ahead with couple of boxes without shielded connector.

10 June : FPS testing report is finished and work will start now.
3 stages of the work : FE Rabbit to FE system (local at FE lab); from tel lab to Rabbit + FE system in FE lab (serial and ethernet options) -- need to verify that the monitoring is working all right.

24 June : Walsh commands also incorporated now;

==> present status : computer to dummy Rabbit card to FE Rabbit card all on eth link; monitoring now being tested for CB and then will do FE; then can try serial link from dummy Rabbit to FE Rabbit; finally, to look at option of current online path via antcomm to FE Rabbit to interface code.

(ii) to look ahead at the plans for the packaging of Rabbit inside common box and integrated tests with serial link, and then later moving to trials with eth link
13 May : since we are getting close to having the common box ready, a plan needs to be worked out; agreed to come back with a joint plan (Ops + FE) in 2 weeks time.
27 May : to run the test from telemetry lab and FE lab to simulate antenna base to focus and run 100 m serial link and also ethernet link; need to order some serial link cable used in the antenna.

3.2 Development of M&C software -- from 24 Jun & before (JPK/RU/SN/NGK/SJ) :

(i) taking up EPICs based PoC version for putting additional functionality : basic loading (and unloading) of the EPICS has been done successfully on the machine; now need to connect Rabbit card and test existing PoC software and then go to the new adition to be done; Joardar and Yogesh had made a fresh installation of the software (under Debian linux) and demo software was working fine; first test with Rabbit card (with v2 subsystem) to OF system was done successfully; agreed to develop the software first for OF attenuators; a SOP to make running of things easier was prepared by JPK; a new module was being made for fibre optic link (old one was for GAB); first attempt was to take the given code and modifying / editing it to do both monitor and control -- to produce a short report describing this phase of work; development of new module to implement the same functionality -- working for monitoring and trying for control (to discuss with JPK and come back);

script for installation of EPICS + peripherals was getting ready.
Latest status : for monitor side : able to get data and display; working on command flow for control side; some extra information may be required. Check current status and future plans. See if this can be closed or needs to continue.

(ii) plans for tasks for next phase of work for new M&C software : architecture definition and UI definition tasks had been completed; next phase of work for implementation of design for 3 antenna system has been started; 3 phases of work identified : core, business logic, web application; ~ 6 months per phase; first phase was started, kick-off meeting has happened and work is ongoing; the issue of which Linux OS should be used : CentOS or enterprise, instead of Fedora (for rapid changes) has been discussed with TCS and final choic is to go with Fedora20. Since this is a SKA prototype, issues of alignment with the TelMgt design are being taken up; also, impact of SKA decision to go with TANGO as the platform are being evaluated; much of this to converge by end of April, even as work on design of eninges etc is continuing. Joint meetings have happened between GMRT software team and SKA TelMgt team and consensus plan is being worked out -- admin procedure needs to be initiated. Meanwhile, other work has already started and is on-going relating to the engines -- to check status of this.
27 May : writing of test cases is going on; some issues found and resolved; not much discussion in the last couple of weeks, maybe; to update current status of the work.

(iii) M&C software in-house : this is a mix of Online V2 and other developments that are useful for all M&C platforms (need to separate out these issues at some level): tests done with switch + rabbit card at antenna base and used for commands and monitoring of the OF system -- this path is cleared. Testing with GWB corr at first level by interfacing to existing dassrv structure and environment also done; webpage based display done; some routines in astropy added; some additional code added for diagnostics purposes; Santaji has built web based monitoring for temp/wind/3-phase power etc -- tested ok; need to separate out online V2 items from overall web-based tools for enabling absentee observing.
During MTAC of Oct 2014, 3 antennas (C1, C4 & C6), 2-sub-systems tested, using 2 rabbit cards; servo system tested in servo lab and in C1 antenna (all commands tried out); draft report circulated;
Communication to FPS being tested; NOVAS library interface done in C, Perl, Python and PHP -- can be utilised by any of the new software developments.
During MTAC of April 2015, 16 antennas tested with eth link from central building and one Rabbit card controlling OF and sentinel with commands sending with python and GUI interface. Set-up to be kept switched off during regular GTAC time.
No fresh updates; report writing is going on; meanwhile, work started on shared memory design for sharing of the information.

24 June : work in progress for communication from Online to rabbit cards (antenna base & FE box) via serial port [via ethernet already completed]; OnlineV2 draft report with NGK, to be finalized by 30-Jun-2015.

3.3 Long-term plans for evolution of M&C systems -- from 24 Jun and before (JPK/RU/CPK/SN) : MoM of Sep 2014 meeting identified following urgent / immediate action items :

(i) Verification of compatibility of switching equipment at antenna base and CEB to be compatible with HRS requirements -- CPK and Nayak to ensure the same; to check if this has been done and item can be closed? Still waiting for confirmation.
SN to check with CPK and come back. THIS IS A SIMPLE MATTER, PENDING FOR A LONG TIME!

Note circulated by CPK; 2 changes proposed :
(i) TCS's document for hardware req. says 10 years operation : needs to be changed to 3-5 years (to be able to get vendors);
(ii) power for server class machine stated : < 500 W; this will be hard to get; ~ 600 W may be preferable.
To check feedback from TCS and take up for discussion; just waiting for formal confirmation from TCS and make a formal note and then item can be closed.

(ii) To discuss and finalise optimised packet format for Command/Data response with the Rabbit card -- RU + JPK with YG.
Agreed to wait till March 2015 for a detailed check of what the existing framework offers and what is required for next gen system and decide if any changes needed.
Outcome of current discussion : online V2 already has a packet structure; during TCS prototype development, one version of protocol was defined and used; JPK to cross-check if that will be sufficient to meet the present needs; also, telemetry team is agreed that whatever changes are needed to modify on Rbabit side to meet this requirement, will be done by the team.
Latest status (15 Apr 2015) : JPK is reasonably confident that version developed during TCS proto development is fine; online V2 has 2 kinds : one for servo and one for the rest. Team is internally agreed that whatever changes are needed for the final TCS version, then can handle internally. may need to track the development of the packet structure for next gen SKA proto system? Agreed to have a note generated after finalisation of pkt structure for new system; check current status.

(iii) To discuss and agree upon a unique set of Rabbit commands per sub-system -- Nayak to coordinate with team; RU to put out the list of currently implemented commands (with parameters) and matter can be taken forward from there for checking sutiability for different requirements; 'list of currently implemented commands' circulated; agreed to bring out the list of commands needed for the next gen system and compare with list sent by RU and quantify the extra amount of work to be put in by the team. May need special focus on high level commands for FE system?
Pending for JPK to produce the list of commands -- that has happened now, and can be looked at and taken up for discussion next time. To take up for discussion.
27 May : many of the commands are same; there are some cases on commands not (yet) covered in one system; agreed to keep two branches of the Rabbit code meant for the two M&C systems and make sure that bug fixes are common to both. Item can be closed now?

(iv) Hardware at antenna base : JPK to circulate a background note for antenna base computer system and then item can be taken up for a larger discussion -- not done yet. Pending for note from JPK -- reminded to bring this out soon; check status -- still pending.

4. Back-ends :

4.1 Documenation at various levels -- from 24 Jun and before (BAK + team) :
To complete basic, internal documentation (at ITR level) and then move to the point where formal publications of relevant items can be done.
Current action items are as follows (many are pending for long durations now !):

(i) Detailed design doc : analog back-end was being done by Hande : 2nd version had been circulated in April. Next level of document going down to chassis level is to be made ready -- chassis level doc will take about 2 months; was deferred

till end Oct 2014; and then deferred till end of Dec 2014; 2nd version had ~50% chassis level inputs; to be completed by end-Jan'15; needs some more time as 2nd LO scheme inputs are alos being folded in; work in progress; may take another month -- can check in mid-May. This is now pending for quite some time !
27 May & 4 June : progress is slow, but going on. What is the current status?
10 June : ongoing... 24 June : will take ~ 1 month (end-July);

(ii) ITRs + publications for analog back-end systems to be taken up : Sandeep and Navnath to look into that; pending for a fairly long time; SCC to look into this and come back on this by 11 Mar -- SCC and Navnath have had one discussion and will follow-up after MTAC. 29 Apr : list of items to be done has been prepared now; work has been started by Navnath. To check current status.
27 May : not much progress in last 2 weeks; to pick-up now. Current status?
4 & 10 June : not started yet; to start now. 24 June : no progress reported.

(iii) ITRs + publications for digital backend : ITR was completed by SHR; after some follow-up, SHR and BAK started work on modifying GWB ITR to convert to a paper; first version has been circulated; needs to be taken up for discussion between YG, BAK and SHR.
27 May : not yet reviewed and discussed, but meanwhile SHR can look at it from the point of view of improving by putting in the latest work on expansion to 16 antenna, dual GPU system.
4 & 10 June : will get into this once GWB-III release work is completed
1 July : no progress reported.

4.2 Analog back-end : LO setting related issues -- from 24 Jun & before (BAK) : There are at least 2 differen issues that remain to be resolved :

(i) problem with LO setting using FSW resulting in reduction of correlation in GWB (compared to LO from sig gen) : understanding is that 10 MHz refreence is at the edge of the locking range; shifted to 105 MHz based reference -- this appears to solve the correlation problem; however, this appears to show phase jumps whenever it is reinitailised; trial and error tests showdd that using 50 MHz reference avoids this problem for GWB.
Latest tests (1 April) show that with 10 MHz reference, the correlation coefficients are fine; would like to test bit more before confirming and releasing. However, mixed results during further tests in MTAC (with 10 MHz) : for longer baselines there is drop in cross-correlation;
105 MHz phase jumps; unclear & confusing; but with 50 MHz ref. both issues absent;
Current conclusion (27 May 2015) is that 50 MHz reference works ok for giving proper corrln on all baselines, as well as no phase jump on reinitialisation -- would like to switch to this in the long run, for both GAB and existing system at antenna base; higher priority is to fix the problem at antenna base (BE team to come back with a proposal) and then tackle for GAB (as there is not much of an issue of reinitialisation for GWB, and 105 can be used for some more time).
10 June : right now planning for the set-up to be built for antenna base...
24 June : Solution found using 50 MHz reference; issue now is to identify method for generation of the 50 MHz;

4.3 Analog back-end : completion of 30 antenna system -- from 24 Jun & before (BAK): 16 antenna system completed (from cabling from OF to cabling to corr wall panel); 24 antenna system also released (mid-April 2014); and now 30 antenna system has also been completed (July 2014). Pending action item :

(i) long-term plans for power supply and ethernet switches to be discussed : for power supply, discussion is as before; ethernet switch : there may be a complication about accommodation 24 port switch in terms of space and layout; 8-port switch was tested for RFI (with and without shielded CAT5 cable -- old 2013 report + new Jul 2014 report) and it is clear that there is some RFI even after shielded CAT5 cable is used. Possibilities for shielding box for 8-port switch discussed; BE team to check about space for putting a shielded box around the 8 port switch; Hande and Raybole have discussed the matter and it is agreed to try and design a shielded box that allows the switch to occupy a 1U slot in the backside of the GAB racks. Raybole is working on design of shielded box and is ready to order material for this; first sample box was ready; controlled tests show very good RFI rejection (report is awaited) -- can check after report comes and finalise on mass production. (true for both ps and eth units) --- shielded box finalized; 12 nos ordered in work shop. Components required have been ordered; first box will be tested and then order for rest will be cleared; There was a problem about modification of the drawing -- has been resolved; now to check where and how the mass production will be done. Waiting for first proto unit from w'shop to come; to check status and time scales.
27 May : work under progress in w'shop. 10 June : work still ongoing...
24 June : enclosures (boxes) for the ethernet switch have arrived from Workshop; also one sample box for power supply which is found acceptable -- RFI shielding mesh needs to be added - given back to Workshop;

(ii) status of work for having i/p side RF filters : plans with FE group for sharing mass production units; agreed that it is ok with FE group to share the designs, provided BE team is ok with the performance specs; ok to include BE requirements in order of PCBs and components (cost sharing to be worked out accordingly); however, BE group to take care of mass assembly separately, as it will be done with in-house manpower by FE group for their filters. BE group has completed design of 8:1 switch to be used for this. Meanwhile, 4 BPF filter chassis (from FE group) + 2 nos of 8:1 sw chassis + one straight through path -- found difficlut to fit it one PIU; agreed to go ahead with single chassis plan for the main 5 BPFs + one switch; second switch and other sub-band filters to be put outside, within the PIU. Prototype unit was completed by BE team; agreed to get the PCBs from FE group (supply the board to them) and then check the integrated filter performance against the single filter. In ther interim, prototype unit using existing PCBs with chassis was assembled in the PIU and tested in-situ.
Final configuration will have direct path + one 100 MHz LPF path + main band filters for each band, with one 8:1 switch; FE team will buy the substrate board and give to FE for getting the PCBs and will buy their own components to populate the PCBs they will receive.
13 May : PCBs for low frequency band ready; chassis for Lband ready (!); waiting for LF chassis; Lband and 550-900 PCBs will come from FE group. Mech boxes awaited; check current status.
27 May : no change in status; following up with w'shop.
10 June : 25 chassis have been received for 250-500; not yet ready for assembling a prototype unit.
24 June : (x25) Chassis for all Low-Frequency & High-Frequency usage now available; PCBs available only for the Low-Frequency usage, which are being populated; to be completed by 09-Jul-2015;

(iii) appropriate attenuator settings for Lband & 250-500 done; 610 band was being finalised -- updated table had been circulated; few iterations were done and a more accurate updated table for 16 antenna system has been circulated; also, agreed that BE group will do monthly monitoring and report the status (for all the 3 bands)

-- regular monitoring was to be started in May 2014, but took some time to get organised; montly reports will come regularly from June onwards. To discuss how to handle interpretation of the results and iterations to change the attenuator settings for future, as there are evolving changes happening in the FE systems. One round of measurements has been made and set-up is reasonably stable (may need a PC to be arranged?); will take some more time till regular monthly monitoring data can be meaningfully discussed. PC has been arranged; need to start the regular monitoring now; set-up is sort of in place; first round of checkign will happen during the MTAC. first round of readings has been taken and some summary will be sent shortly. Results not yet circulated internally; BAK to check with team.
Tests are now done regularly; need a way to share the summary of the results for taking appropriate follow-up action.
Raw data is being uploaded on plan website; Atul Ganla looking into some intelligent interpretation and summarising of the results.
Started work on making plots showing the variation with epoch for any antenna; will resume after MTAC is over. Should be having first results by now?
27 May : still pending. 10 June : work is ongoing...
24 June : Analogue Back End check /test (for 'attenuation' values leading to power equalization) happens regularly every Monday; one band at a time - so every 4 weeks a full set is available; new student working on analysis - to be completed in 3-4 weeks (end-July'15).

4.4 GPU corr (GWB-II) : release of 4 node, 8 input, 200/250/400 MHz version -- from 15 Apr & before (SHR/SSK/BAK/DVL/YG) : (NOTE : GWB-I is existing released system !) : agreed to make 4 T7500 nodes with C2050/C2075 Fermi GPUs + remaining 4 T7500 nodes as host machines (to take care that these are the ones that transient pipeline uses presently so that sharing is possible); this should have ALL basic modes : total intensity and full polar IFR modes; IA + PA BFR modes with process_psr pipeline attached; full GUI support; to come up in trial code section without affecting the presently released mode. Action items :

(i) beam modes in GWB II : new version with separate kernel (outside phase shift kernel) for beam formation has been developed (compute load is 7% increase on 2050 GPU); IA mode tested; PA mode completed and tested; phasing implemented & tested; process_psr pipeline has been completed and released; first version of SOP has been released; pending action items :

(a) last version of GWB-II (ver4) expected end of April, with the following new features : 16k channel support in GUI and SOP; multiple choice for beam integration and # of channels; pulsar beam header ver1 (limited number of parameters); for more than 2K channels in correlator, need modified shell script -- this needs to be understood. Most of these changes have been done & tested; GUI for 'ver4' needs to be done by Nilesh (who is on long leave) -- will happen after 16 May. To check current status and see if this can be closed.
27 May : SHR and NSR to test upto 8 and 16 K channels to see if o/p side i/o works ok; if yes, then no further changes; if no, then to change the MPI calls as done in GWB-III (and make GUI and SOP compatible with that).
10 June : ver 4 tested for 8 and 16 k channels; GUI level change has been done; dasmon needs to be modified for more than 2K (upto 16K) -- being done by NSR; beamformer will also need to be tested.
24 June : GUI for correlator part completed (except for 'dasmon'); GUI for beam-former will take 2 weeks (08-Jul-2015);
1 July : SSK to talk with NSR to close the loose ends.

(b) header for beam mode data : to be taken up & incorporated alongwith the PA mode; SSK has done first round (part I), and discussion between YG and SSK has happened and next version (part II) is underway;
20 May : header part I has been done for GWB-II and III (need to confirm for GWB II). header part II will be done later, only for GWB-III
27 May : new version of GWB is under test which has part I header; part II will come in the next release.
Check status for GWB II and close, and move remaining items to GWB-III agenda.
10 June : new version of GWB is under test which has part I header; part II header will come in the next release; part I header will come in GWB-II ver4 & GWB-III ver2.
24 June : GWB-II next (and final) version release in 2 weeks (08-Jul-2015); will have flexibility of upto 16K channels;
1 July : to ensure that loose ends are closed by 8 Jul and v4 released.

(c) availability of online monitoring tools for beam data : psr_mon was successfully installed, compiled and tested (for 16k channels?) on node 52, node 53, gwbh2 & gwbh3; now installed on the new host machines also; installing pmon needs polycos, psr catalog etc -- confirm if completed and released on the new host machines?
pmon done in off-line mode on GWB-III, will convert to real-time and also port to GWB-II; currently working on real-time mode of psr_mon and pmon for GWB-II. these are under test by SSK; pmon for GWB-III needs to be tested and cleared -- SSK to check and place the final working pmon code in the right place on GWB-III beam host machine (27 May).
17 June : offline version working on GWB-III (v2) and real-time version to be tried.
1 July : SSK close to finishing the real-time version for GWB-III.

(d) meanwhile, work for incorporating new code developed by Rajora by adding shared memory interface is ongoing (both of these can go directly to GWB-III?) -- to check status of this; 13 May : work now resumed with summer student Balaji looking at it. New features related to bandshape plot and profile plot have been added and filtering part has been tested; need to start looking at shm part; agreed to move this to GWB-III agenda.
4 Jun : new features related to bandshape plot and profile plot have been added and filtering has been tested; need to start looking at shm related aspect; also, see agenda under RFI filtering.
1 July : work in progress.

(ii) spikes in channels that are power of 2 : this problem needs to be discussed, understood and fixed. SHR has done several tests, including using digital noise source; effect is seen in packetised corr also; checked with offline analysis of raw voltage data acquired through Roach board, and with digital noise generated on Roach board -- appears that problem is seen only in data coming through the ADC path only? further, trying single ADC streams or channels (compared to the interleaved data streams that come normally) still shows the spikes in the streams; slower FPGA clk rate also doesn't show any difference -- it appears to be natively present in the ADC data; to check if the power level of these spikes is constant and how much below the mean passband level; varying i/p power level of broadband noise source at ADC allows characterisation of input power level at which spikes show up; looks like occuring at multiples of 128 ch (for 2K spectrum); to check the level as seen in cross of two such signals -- some test results have been sent by Reddy recently; can take up for discussion, including tests with 2 different clk sources...
To correlate against new results coming from histogram testing by Niruj & Kaushal -- some further work is needed here; KDB and NMR to check and report back; can move this also under GWB-III ?

27 May : to cross-check with GSB voltage data taken and put through similar analysis of histogram and spectrum.
10 June : tested with two different Roach boards with two different clk sources and corrln is still seen, including when sig gens are not locked to same source.
24 June : GSB raw voltages to be read & analysed [at GWB-III];

4.5 RFI filtering -- from 24 Jun & before (KDB/BAK/YG) : aim is to develop and implement RFI detection and mitigation algorithms at different stages of the back-end : both in time domain and in frequency domain, and for interferometric and beam modes. The overall plan is as follows :
(a) For impulsive, time domain RFI : First version of real-time RFI filtering block was added to packetizer of GWB-I (in one input out of two) with different options like replace by median or by constant or by digital noise source sample or clip to a threshold via s'ware registers) -- basic tests were done and found ok; trials with real antenna signal split into 2 copies and checking both self and cross outputs proved somewhat harder; further, design (with some optimisation of FPGA resources) was ported to GWB-II; agreed for time domain tests using either corr self powers or 2 IA beam signals; some tests with varying sigma were tried on antenna signals (results?); data taken with pulsed noise source input also; new results circulated and discussed; agreed that the basic scheme appears to be working ok; to try 3 versions of the scheme, with different options for the statistics; agreed to support 3 modes : continuous update; update on request; external update; this has been demonstrated in tests on GWB-II; need 3 separate versions of design (with optimisations) -- agreed we will carry forward the full design and then, when final baseline is established, the reduced modes can be made available. Meanwhile, design compilation for 4, 6, 8 bit inputs completed; utilisation (for one analog channel) : 41%, 19% and 17% (for total design) for 4 K window; tests were done to see if there is some biasing by digitally splitting the antenna signal -- confirmed ok, i.e. mean level changes for lower thld happens for replacement with zero or replacement with noise but not for clipping; next part is testing with two different methods of generating thld statistics : shown that a priori stats works better for rejecting RFI infected data. Agreed to carry forward, for now, only 8 bit design -- other options can be brought up whenever needed.
Further, the design was optimised to fit on Roach board in the GWB-III design -- first for 2 filters out of 4 channels on each Roach board at 800 MHz (with compensated delay in the 2 other channels) -- this was implemented and shown to be working; dynamic window size control was also implemented -- shown to work upto 8k size for 800 MHz, 8 bits (will be adapted for 4 bits, as needed).

(b) For spectral domain, narrow band RFI : implementation of MAD filter across time (MFAT) and MAD filter across channels (MFAC) done on MATLAB and tests with simulated and real data carried out; basic tests show that, for spectral RFI that is steady with time MFAC works better than MFAT, except that there are issues when the RFI is near the edge of the pass band (or in the stop band region) -- proper normalisation of the bandshape may be needed to improve the performance?

(c) For beamformer output (for impulsive, time-domain RFI) : code developed by Shiv Rajora as part of the wpmon work (see also item XX(yy) above) for finding impulsive RFI in the data, tracking it for individual channels based on the DM and masking appropriate data while creating the dedispersed time series has been tested and needs to be refined and finalised;

(d) For beamformer output (for narrow band, spectral line RFI) : work needs to be initiated, which should borrow from the routine for (b) above.

Some action items are as follows :

(i) pulsed noise generator (PNG) ckt with additive noise source shown to be working -- can now be used for demonstrating RFI cancellation on visibility data. Some new tests were done : basically working ok; but would like to go down more realistic duty cycle; also, there appears to be some saturation like problem which is not clear; team can discuss and decide the growth path of a new PNG.
New results circulated; report of PNG inter-channel coupling - located where the couplign occurs; to follow-up on current status and discuss future plans.
BE team to discuss locally, and resolve the matter. To check if there are any updates.
10 June : some disussion has taken place and may have update in next few days.
24 June : Coupling reduced drastically after changing the coupling from resistive to inductive;

(ii) to work out proper scheme for testing -- KDB has circulated a proposed scheme, which is now been refined and accepted; to discuss and check if results are available. Some tests have been done and results discussed : scheme appears to be working fine; need better quantification of the results.
(noise + RFI) & only noise : filtered vs unfilterd comparison -> filtered (noise + RFI) gives higher cross-correlation; to check latest results and conclusions -- mostly done, and conclusions are reasonable; can move to real-life tests now -- check if any updated are available on this.
10 June : antenna tests not yet showing a conclusive result (correlator + beamformer results)

(iii) book-keeping : trying to work out the packing scheme, with the understanding that jumbo packet size is taking up. Need to discuss long-term plans for this.
1-bit flag implementation has been started; need a discussion for agreeing on the option for double rate sampling and how to structure the packets. Need to move this discussion forward.
Summary of discussion avaiable as a note [passing RFI flag bits thru the chain] how to use it is not decided yet; some follow-up discussions have happened; to check latest status.
10 June : recalled that test needs to be done with 4K packet size to see that corr works ok.
24 June : Today 4K design is under test;

(iv) spectral line filtering needs to be taken up for discussion -- first results have been circulate for projected back-end systems; a concept note has been generated for this; some feedback has been sent by YG; need a follow-up discussion on this matter. To examine if the best place to test spectral line filtering may be beamformer output.

(v) filtering of beamformer output needs to be taken up : time domain impulse RFI filtering has been demonstrated in the work done by Shiv Rajora and is being followed up by Balaji (summer 2015); spectral line filtering needs to be introduced for this data.
10 June : to have a discussion between Balaji, Kaushal and YG.
24 June : Discussion has taken place; Balaji continuing tests

4.6 Power and cooling requirements for projected back-end systems -- from 24 Jun and earlier (GSJ/BAK/RVS/YG) : This includes plans for monitoring the temperature

on the GSB and GWB nodes so that health of the systems can be kept track of as various changes to the heat load and air flow are made in the corr room for putting in the full GWB system. Specific action items are :

(i) scheme for monitoring of processor temperatures for GSB : for the main compute nodes : new package for temp monitoring requires slightly different version of kernel than what is used on the main GSB nodes; new kernel was installed on a few nodes and following 2 issues came up : new kernel on 2 compute nodes may have been causing the buffer loss problem (new kernel was rolled back to the old one); and for the current kernel on gsbm2, the high time resolution mode did not work (gsbm2 kernel was rolled back to the previous version that was there); for the first matter, follow-up was done with a controlled test -- node18 and 19 test was repeated and some degradation of performance confirmed; agreed to put new kernel on ALL the GSB nodes and test again : 3-4 hours' data collected with all nodes with new kernel; analysis showed a few occasions of buffer loss; comparison with normal GSB kernel showed that it doesn't show buffer loss; agreed to try new kernel once more; also to check for possible causes of buffer loss with new kernel; tests done with 16 and 32 MHz, 256 channels -- tending to show statistical difference in buffer loss; confirmed that there is a difference between in the 16 and 32 MHz modes; discussion between SSK and GSJ to try once more with kernel change only one node and examine the log file carefully and report back.
GSB data old & new kernels taken; 17-43 nodes completely new kernel gives heavy buffer loss; (old kernel have very small buffer loss ; old does not support temp monitoring).
More tests have been done and it appears that GSB is rather sensitive to the exact choice of kernel. Agreed that this item can be closed at this point.
No further action items here.

(ii) to add temp monitoring package on all GWB nodes : to check if this is feasible and has been done or not -- agreed that this can be done easily and that we should implement on all the GWB-II and GWB-III nodes. To make a list of machines which have it and then put it on all the machines; to reuse the earlier code for logging the data, plotting it, and also to add an option to generate a warning if the value exceeds some threshold; to think about a real-time version of the warning algorithm. ready to run on GWB -- agreed to go ahead and test; to think about long-term monitoring tool that shows the temp of all the GWB nodes.
To ensure that code starts every time GWB nodes are rebooted; to work a bit more about plan for bringing the results to a common place for visualisation. Discussed a few possible options ranging from MPI to sockets to cross mounted disk systems -- to decide on concrete action plan.
installed "lmsensor" on all the GWB-III machines and working ok; right now using cross-mounted disks on 3 GWB-III machines; browser based tool for monitoring the data is working ok; cycle for 7 days for preserving the data. To see how this can be evolved.
Right now running on 1 compute m/cs and 1 host m/c of GWB-III (waiting to install on other m/cs); refining the scheme for cross-mounting of disks; auto-restart and halt scripts; cgi script for plotting on monitor can be made more intelligent.
H1 & cor5 cor5 packages installed; auto-restart completed; cross-mounting of disks : to use old scheme.
Installed on 2 more and ongoing; for cross-mounting : not using autofs, but using old scheme of cross-mounting via /etc/fstab; auto-restart is done (every 30 secs). Current status of the scheme shown (live !) appears to be working very well; can think of seeing if any additional performance parameters e.g. CPU load, IO load can be monitored. To write a technical note on the work done -- make take some time.

CPU load is already there; for I/O load, need to do some work.
27 May : looking at tools for network monitoring (e.g. Cacti) to see if it is suitable; if not, then would go back to a simple perl script. To start looking at writing a technical note (including the GSB experience).
10 June : Cacti software tested on a trial m/c; will move to gwbh1....
24 June : Cacti software tests completed for 'gwbh1' & 'gwbh2' nodes; other nodes yet to be done [other nodes need internal connections ...]

4.7 Next-gen time & frequency standards -- from 15 Apr & before (NDS/BAK) :
(i) brief update from BE team from visit to NPL was provided in last discussion; waiting for detailed report to be circulated draft (maser report already circulated)
complete report has been circulated today -- need to schedule a discussion.
not much progress; need to follow-up and discuss within the group also, to work out a possible "plan".
First discussion has happened between NDS, BAK and YG -- need a follow-up !!

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Minutes for the Plan meeting of 29 July 2015

1. FE & OF related :

1.1 Update on results from test range -- pending from 15 Jul & before (HRB/SSK) :

(i) Tests of ver1 550-900 CDF and CSIRO feeds at test range : new results with VVM set-up, after installation of new encoder + notch filter for mobile band, showed : for ver2 550-900 CDF : reasonable E-H match at 610 and then degradation in shape and matching at 700 & 800; partially supported by older measurements from Dec 2013 (with slightly different set-up). Further, results for dipole-2a & dipole-2b with cone v2 show that the degradation of pattern with frequency is worse for v2a than with v2b; radiation pattern measurements have been done with 50 MHz step & using CW signal; comparison with simulation results is awaited. Current restuls and action items are :
(a) first order comparison of C1 dipole 2B vs C2 dipole 2B measurements : C1 D2B shows better E-H match at 610 ; C2 D2B shows good E-H match at 700; and appears to be decent even at 800, though 3 dB width may be changing; agreed to make plots vs freq for 3 dB and 9-11 dB widths, and for taper of E and H at fixed dish angle of 62.5 to check mismatch in taper, for both the feed versions.
First results from the measurements for the plots of 3 dB and taper values vs freq show evidence for change of properties with freq as well as asymmetry of the pattern (as had been seen in the earlier plots also); agreed to try to compare with results from C1 + D2b (make fresh measurements, if needed).
Repeat tests for C2 + D2b sent by HRB which show repeatibility with earlier results; FE team to check C1 + D2b data and complete the comparison -- fresh data needed to be taken for this (earlier records "don't exist"); radiation pattern tests done for C1 + D2B -- comparison plots to be sent soon.
(b) Phase centre of ver1 550-900 CDF and CSIRO feeds needs to be done -- phase centre measurements for C2 + D2b can be tried at the range.
Waiting for comparision report to be done and then follow-up for deciding next course of action.

1.2 Phase centre tests for 250-500 CDF -- from 15 Jul and before (HRB/GSS): to test with 100 to 200 mm height change (around default of 1280 mmm) in 250-500 feed on one antenna to see how much change in sensitivity is seen. Tests done on c6 using feed with shortened support legs of the cone (instead of shortened stool) -- comparison of results for 1180, 1280 (default) and 1380 : 1280 & 1380 show slightly better sensitivity at low freq (250-400) but at higher frequencies they match with 1180 (which is quite flat throughout freq range); agreed to try for 1480 to see if there is a monotonic behaviour; also compare with simulation results of GSS. Consolidated results tend to show that the latest level at 1180 height does show a slightly better response; a final confirmation is needed about the optimum performance from the measurements; confirmed that we can't go below 1080 by further cutting the support legs of the cone; also, current adjustable stool will not work for 325 MHz face due to welded nature of existing stool; agreed with HSK to reproduce one more adjustable stool with modifications learnt from present experience, and try on one CSQ antenna (C6?) by removing the Lband feed, shifting the cone-dipole with new stool to this face and using the existing 250-500 FE box on it; tried on C6 during MTAC period (Oct 2014), but measurements could not be completed as antenna was required for

L-band GTAC observations. Current action items :

(i) Agreed to go back to C8 at a later point of time (after 550-900 measurements are completed) -- deferred for now.
(ii) Meanwhile, FE team to go over all the available measurements and produce a consolidated summary -- this is pending for some time now !
1 Jul : no progress on either of the above items.
15 Jul : HRB is in the process of generating the note to coordination (to identify which antenna & when adjustable stool for L-band or 610 ?)

==> item not discussed.

1.3 Theoretical calculations based on NRAO code -- from 15 Jul & before (SC/GP/HRB) :

(i) Phase efficiency computation has to be linked to the aperture efficiency computation (NRAO's eff. program, modified for GMRT specific paramters) -- work is ongoing, alongwith Sougata (was expected to take 4 weeks -- till mid-Sep2014); code was being ported to matlab (?); also, original NRAO fortran program can be made to run to give some initial cross-checks? code had been ported from the C version that student had written to Matlab but results were not matching with expected behaviour; then tried to port original fortran version to matlab (was to be fully done by end-Jan / early-Feb 2015), but had problems in getting sensible results; agreed to try and see if original NRAO Fortran code can be compiled & executed -- this was done ! (after identifying appropriate compiler, making necessary syntax changes etc) and first results were to be circulated by 23 Apr 2015, with first trial for Lband : inputs are E-H pattern at 10 deg interval, plus specificy value at 62.5 deg, plus various efficiencies -- mesh leakage and RMS efficiencies (phase eff is taken as unity), plus dish geometry (right now coded inside) including a square piece for blockage; output is spill-over and taper eff, cross-polar eff and overall eff (some are with and without blockage); to cross check the outputs against blue book values and rationalise against relevant docs and inputs; later, can extend this for all the other bands for which results are available in the blue book;
Current model takes the following inputs : mesh geometry, mesh deviation in rms, feed pattern for E & H with 10 deg resln, taper value at 62.624 deg, gnd temp; blockage is hard-coded inside right now (alongwith quadripod legs etc).

Some results were shared (c 17 Jun 2015) :
at 327, the code gives 68.4, 66.6 and 66.4% for 259, 270 and 290 ; at L-band it is 43.2%, for 259 K.

Sougata to produce a note about the usage of the code and the various parameters, and to try varying different parameters to understand the effect on the output; also, check the blockage term inside the code.
1 Jul : no progress on these items.
==> note by Sougata taken up in some detail : detailed discussion on the various factors going into the efficiency and temperature terms; agreed that these need to be described in more detail and brought out in a clear note, including drawings where needed (can work jointly with GP); good agrement found for Lband (earlier) and 235, 325, 610 feeds with blue book values; agreed to go ahead with 250-500 system.

(ii) calculation (based on reference paper) of expected deflection & comparison with measurements to check if there is significant loss of sensitivity : GSS developing refined version of code that is more relevant for GMRT (to compare with 250-500 or 500-1000 feed data) : cross check of results from code wrt curves from Kildal

paper was confirmed (0.3 dB drop for 0.5 lambda offset); for GMRT specific case of 250-500, efficiency factor as a function of freq over the band, using the data for the measured feed pattern, was implemented; after correcting one error in the code, better result (9.9 dB vs 11.6 dB expected) was achieved; further, a realistic phase response (instead of 1.0) was included by reading data from a file; results (reported on 19th Mar) showed better match between measured and expected deflections for the 250-500 system : 327 -- 12.8 dB vs 12.4 dB; 400 -- 12.8 dB vs 12.2 dB; 450 -- 12.4 dB vs 11.4 dB; 500 -- 11.2 dB vs 11.0 dB (some re-work needed for lower frequencies?); computed results (based on change in efficiency due to shift of phase centre) show likely drop in sensitivity by about 1.4 dB from 250 to 500 -- this is now to be folded into the net sensitivity / deflection curves made by GP (see agenda item following this one). Present action items :
(a) plans to extend this to 550-900 system -- was waiting to get measured values from test range; data for cone2 + dipole2b exists; needs to be run through NRAO code to get the efficiency factor -- will happen soon; when data is available for cone1 + dipole2b, same can be done.
20 May & 1 Jul : pending for item (ii) to be completed.

(iii) Comparison of computed results with measurements for 250-500 band : initial results for good antennas at 250-500 (other than C6) with default height of 1280 (and for C6 with reduced height of 1080) showed that computed values are actually better at high freq end for 1080, which is different from the observations which are showing droop at high freq for 1080 (in conflict with first results reported above); computed results, which were for 1180 to 1480 in 4 steps, were extended to 1080 & 980 and 1180 was found to give the best response (note : this is for a particular value of ph centre based on range measurements); computations were extended to much smaller values (down to 580 mm) and latest results show a peak in the response around 580 o 780 (!), which are in sharp contrast to the experimental results which were carried out in the range 1080 to 1480 mm and showed optimum performance around 1280 mm -- this needs closer scrutiny of the simulation code and experimental results; with new code, it may be possible to recheck the calculations and then can take up for discussion to rationalise; code is running; but first being used for the cross-checks described above; will go to new 250-500 etc after that.
20 May & 1 Jul : also pending for item (ii) to be completed.

1.4 Comparison of measured & expected sensitivity curves -- from 15 Jul (GP/SC/HRB): Scheme for (re)calculation of expected values across the broad bands to be finalised (and added to measured curves) : curves with constant QH value and variation of T_lna with freq were incorporated; model for the main BPF was also put in; after that antenna efficiency factor (based on measurements with 4-5 points across the band) was added by interpolating the measured values; return loss of the feed was added to the above and the result now matches much better with the data -- all this was done for 250-500 band; subsequently, the formula was revised to change the constant factor, which resulted in some discrepancy in the mean deflection values, and also some cases where the measued deflection is higher than the theoretical values -- these issues to be understood and resolved; after some cross-checks and refinements (dir coupler loss values, source flux from Baars et al, recalculated constant etc) -- spot value of 13.0 dB at 325 for CasA compares well with 12.7 used in control room; antenna efficiency factor still needs to be determined a bit more carefully -- agreed that both the efficiency terms (which includes default ap eff + phase eff, from measurements on test range) and the RL term whould be kept and the product should be used; some follow-up action items :

(i) cross-check the flux values and get updated numbers with DVL's help :

Around 20 May 2015, DVL had generated a table of 5 MHz apart flux values (covering entire uGMRT range?) for all the main sources, which can now be used by GP in the detailed formula; simple comparison with formula is folded in when comparing with control room values; GP had done a cross-check at 325 with the existing and new value of flux and finds new value is higher (leading to 14 dB expected deflection!); to check one or two more spot freqs (like 610); DVL & ICH have agreed to look into the matter and resolve the broader issues (17 Jun 2015);
1 Jul : no updates on this matter.

(ii) to get clear confirmation about which all terms are included in the efficiency factor currently being used in the calculations. Some results may be available from the NRAO code calculations?; till then the interpolated values are being used.
4 & 17 Jun : remains status quo till NRAO code issue is completely resolved.

(iii) develop the model for Lband : information gathering had been started -- feed pattern (efficiency) at 3 individual freqs available, and measurements available for 5-6 frequencies (?); agreed to work with the 3 pt data, do simple interpolation and see what kind of curve is produced; first order calculation of model had been done -- Sanjit + Gaurav had put the curve for expected deflection alongwith the measurement results to do the comparison, and this was added to the weekly plots; current action items :
(a) 1 or 2 antennas with response better than theoretical esp at lower edge of Lband -- need to be checked;
(b) fall-off of theoretical curve at edges needs to be investigated;
(c) RL of feed is to be included -- now done;
(d) notch filter alongwith BPF to be added -- this is also done (but still no resolution of slope-error);
20 May : GP had completed (c) and (d) and shown that it falls off correctly on lower side of pass-band after filters and RL included, but extends a bit beyond on high freq side; need a more detailed comparison with BPF to understand this, and mobile notch filter + BPF to resolve the extra bump at ~ 800 MHz);
also, Sanjeet's latest plots still show expected curve to be flat on both sides of the passband... this also needs to be resolved.
4 Jun : some checks done with BPF & mobile notch data show why there is a bump in response at 800 MHz -- may need sharper BPF cut-off to avoid it; for the HF side, looks like it may be an issue of sensitivity values used (3 pt interpolation); agreed to try with constant value, held at the lowest of the 3 points and see if HF response becomes ok; also, control room values are now there on the plot !
17 Jun : looks like there is a genuine HF extension even when all known terms (except varying eff with freq) are included; to try and get inferred eff curve from best model and sample data and later compare with NRAO code output.
1 Jul : GP has done the calculation of the required eff curve to explain the data, and the variation is very steep at just around 1450 MHz (as expected) -- to compare with code calculations when they are ready.

(iv) a note summarising the overall scheme to be generated and discussed : updated note from GP was discussed : this is much more detailed now; need to cross-check :
(a) the variation of Tgnd with frequency -- understood that this is due to the fact that Tgnd in blue book is a func of Tmesh and Tspillover and hence will be a func of frequency; item can be closed?
(b) add points for existing control room values -- this is done; can be closed?
(c) replot with better y-axis resolution -- this is done & can be closed.
(d) 250-500 and 550-900 look reasonable; Lband has some extra features that need to be understood (see details above);

(e) could start looking at 130-260;
(f) to vary parameters for 550-900 to understand the 3 dB droop from low to high -- this has been done and has provided useful information (looks like Tlna may be issue)
1 Jul : updated note has been circulated, including DVL & ICH (YG to follow-up)

==> some aspects of these items discussed alongwith Sougata's presentation under item 1.3 above.

1.5 Total power detector for FE & common boxes -- from 15 Jul & earlier (GP/ANR/SSK): plans for final scheme : 20 dB coupler for CB and 10 dB coupler for FE (at final output) with common 20 dB amplifier (Galli-52 instead of Sirenza); feed-thru vs connectorised arrangement also resolved; after lab tests (including monitoring via MCM channel) in FE and common box, sample units installed in C4 FE box and E2 common box. Some other details are as follows :
For common box : data from 2 units installed on E2 showed basic things working ok: first round of testing showed 11 dB deflection (12.4 dB expected) on Cass-A; later on Crab, getting 5.5 to 6 dB (6.6 dB expected); flat-top on-source waveform was understood to be due to quantisation of step size of detector levels (least count issue); script / SOP created for automated running of tests;
For FE version : 2 units had been assembled and found to give identical performance as per specs; problem of feed-thru vs connector was resolved in favour of feed-thru (as per original chassis design); all testing completed in the lab; first units (on C4) showed problems -- traced to incorrect mapping of channels etc.; new units (batch of 20) that were assembled showed unexpected change in detector o/p due to grounding problem which was corrected (manually) for 10 units and final PCB for mass production was modified for this change; script for automating the observations has been done an released by GP. The issue of RC time constant was taken up, resolved and closed (c. 22 Apr 2015); final report was submitted (c. 22 Apr 2015), with most of the outstanding issues resolved.

The remaining pending action items now being followed are :

(i) To decide upon long-term plan for power monitoring : GP to generate a short note about the proposed scheme for this; some discussions on 11 Mar 15 about exactly what this note should specificy (over and above the SOP); GP produced a note for the procedure to be followed -- need to move to a strategy document for running the program on a long-term basis; meanwhile, Shilpa was identified as the person to implement the monitoring strategy (maybe weekly tests; MCM to be turned ON for collecting data & then put OFF); first version of strategy document was discussed (20 May 15) -- need to add some more details about the strategy : how and why of the test observations being planned, and then give the procedural part; updated version discussed (17 Jun 15) -- looks better and can be released to Shilpa as ver1 for trying out;
15 Jul : GP has completed the pending changes ansd circulated (today - 15-Jul-15); plots yet to be circulated;
==> This has been done and this aspect of strategy doc can be closed. Regular observations by Shilpa is also going fine.

(ii) possibilities for automating data reading, analysis and plotting also discussed -- GP has now implemented automated program for plotting CB, FE power levels (both chans) and 3 temp monitor values (2 in FE and 1 in CB) in one go from a file containing data for X nos of antennas is ready; this has been tested with the above data sets; agreed that it is generic but not tested for anything other than temp and pwr; can be generalised for all channels of all 30 antennas but can be taken up at

lower priority; also, does not have a user friendly interface; current actions :

(a) agreed that working version of code + SOP to be fully released asap : SOP has been released; GP working on note about analysis procedure (using matlab) -- note has been made ready : discussed and looks basically ok, except for hard code locations of GP's machine -- to check best way to address this.
17 Jun : linked to decision about who will be analysing the data -- team to discuss and come back.
15 Jul : sample GUI using matlab has been done for showing what the real GUI should do.
==> SOP has been released to control room.

(b) development of user level GUI : SSK took up the matter with SN to identify suitable person from control room, and Shilpa was identified as the person to take care of both GUI development and also ensure regular running of the tests, as per strategy document; matter was discussed and cleared with ICH also (4 Jun 15);
1 Jul : GP to describe the requirements for the GUI to Shilpa and follow-up at reasonable intervals about the progress -- to keep it open for this follow-up.
15 Jul : GP has given inputs to Shilpa; to decide what follow-up is required.
==> work is in progress for a UI for visualising the data / results -- this can go ahead; after that a UI for creating the obs file required for different test runs can be developed.

1.6 Installing and testing of temperature monitors in front-end & common boxes -- from 15 Jul (VBB/SSK) : scheme for fitting two temp monitors (one for LNA, one for FE box) for tests on bench, followed by antenna tests and installation: lab test with manual readings had been done (showed 15 deg temp difference between LNA body and FE box (open)); work was ongoing to study online data from 3 antennas : W1 (130-260 FE box), W4 (250-500 FE box) and E2 (common box) was tested ok, and some long duration tests had been carried out; meanwhile, C4 & C10 fitted with dual temp monitors in FE box, and C13 with monitor in both FE & CB -- some tests had been done but data was not sensible due to unresolved issues in the wiring of the existing common box units that prevents desired data to come on expected channels in online monitoring set-up ! Agreed to select a few antennas (maybe W1, C13, E2) for proper monitoring after resolving the issue, and for the rest, keep putting the temp monitors and maintain a log of which ones work in online monitoring; later, correct the wiring whenever a common box is taken for maintenance or upgrade (same argument applies for power monitor also). Combined SOP for temp monitoring and total power monitoring was been prepared and released. Current action items :

(i) Analysis of the data : C13 & E2 both channels temp monitor available at online output (fixed for C13 one ch FE & both chans in CB, and E2 both chans in CB); some test data had been taken; also, some data had been collected for 6-7 antennas; first results for ~ 5-6 antennas (LNA + FE box) + 2 antennas (CB) for 3 hr duration shows some basic behaviour but not clear how well things are working; to try two things : (a) to check if any old data of longer duration (from last 2-3 months) is available (b) to try a longer run, even for one antenna like W4 which is under maintenance; some of the short data stretches have been looked at; at least one 6 hr data has been taken; report has been updated and submitted to library for uploading; longer stretch of data and analysis of that is still pending.
Finally data from one long run (on E02) was obtained -- showed decent results for a first attempt : temp of FE and CB following each other; with LNA temp a bit below but tracking (with some delay maybe?);

Current action items :

(a) need more confirmation runs to establish repeatibility -- fresh data taken, but some problems with FE monitor stopping after 1.5 hrs; broadband system was removed from E02, and tests shifted to C13, but had problems with CB temp monitor not available (20 May 15); back to E02 (17 Jun 15), but still having some problems; finally, some useful data from the regular monitoring tests -- 2-3 hrs on 3-4 ants : basic results look reasonable, but there is enough variability between antennas (and between FE, LNA and CB values) to cause some concerns; agreed to keep getting data, including couple of long runs.
15 Jul : One set of data taken for long stretch (on W4) & analysed; results need to be circulated.
(b) regular monitoring can be folded into strategy doc for power monitoring : this was done, with the aim of one hour once a week + one 8-12 hr slot.
==> one long run data has been acquired; couple of comments for improvement : to see if an ambient temp measurement can be included, and to cross-check with another run to check LNA vs box temperature behaviour.

(ii) Other related issues : plans to add monitoring of temp in OF rack at antenna base and also the RF power...
==> can be kept pending for some time.

1.7 Spare LNAs for L-band feeds -- from 15 Jul & before (SSK/ANR) : we had 32 feeds; 2 were not working (1 has been dismantled for making drawings of new feed) due to lack of electronics spares -- mostly device failures (including some new ones?); some new LNAs were successfully assembled by Gopi and failed feeds for C3,W1,E2 & E5 were fitted with these and found working ok. Also, one spare feed was assembled and installed on W1 and working fine. It was agreed to have at least 5 LNAs assembled and available as spares -- initial lot of 10 was assembled and used up; finally (c 20 May 2015), status quo situation was that 2 fully assembled spare feeds (i.e. 4 LNAs) ready for use, and no extra LNAs available (from old design).
Current action items :

(i) to update about status of feeds on recently installed units (W1, C1 etc) : finally, after a lot of follow-up, it was confirmed from PMQC data that W1 appears to be working ok for past few months. 2 other recent units are on C1 + one more antenna (C3?): C1 has units with new LNAs, for both pols made ready from older batch of devices with careful retuning; it was giving ripple and bad bandshape problem -- was found to be due to broken cable (fixed); then it was down due to low deflection in one poln; problem found in phase switch -- repaired and put back on C1 and now working ok. check health status of other antennas with recently installed LNAs : C3 + ?? -- this needs to be got from the records.
Sanjit to collect this information and send -- is that done now?
4 Jun : Sanjit is compiling and will send.
17 Jun : Sanjit to be reminded.
1 Jul : no updates on this and maybe the question is somewhat redundant by now?

(ii) alternate LNA designs : to see if design used for 550-900 can be modified for 1-2 GHz use; to also check the design done by Abhay Kulkarni and see if it can be improved for our needs; design files had been obtained and were being checked by GP and ANR : model files converted to match simulator used by us; component models in software had to be downloaded; also ultralam2000 that was used is not available in the market now; agreed to simulate with ultalam2000 first to check ckt works ok; then concentrate only upto 2 GHz and change substrate to RT 5870 (easily available); simulations matching with original results completed; simuation reproduced ok with RT 5870; trying to tune the design to required specs of gain (30 vs 34), Tlna (~28

or better); in terms of NF target is to go from 0.4 to 0.3, and maybe at cost of reduced BW; Feb-Mar 2015 : now getting close to Tlna of 28-30 across the band; overall gain is also very good ~ 38 dB; but 4 db slope across the band needs to be adjusted; move from s2p to non-linear model completed successfully -- did not disturb the results.
Current action items :
(a) work still ongoing to try to flatten 4 dB slope -- this has been attempted in prototype PCB that has been sent for fabrication (the 4 dB slope is due to missing consideration of feedback in simulations)
(b) meanwhile going ahead with layout & ordering of PCB and making couple of units, while continuing to improve the design; first proto PCB had problem with layout due to error in device footprint -- was redone; finally, original design fabricated on RT 5870 with retuning of components gave a working solution -- gain is not high enough (28-30 dB) and Tlna maybe a bit on the higher side (28-30 K); working on increasing the gain (may be difficult as it is a 2 stage amplifier); reduction in Tlna may be easier. The 3rd unit has been assembled (but needs to share chassis with the first 2 prototypes) and will be tuned to try for better noise performance.
20 May : after retuning of 3rd unit, some improvement in gain -- it is now ~ 32 dB across the band (no slope); Tlna had reduced to 31 - 28 - 27 - 31 over 1060 to 1390; also S11 and S22 are below -10 over the entire band. To check if there is any further scope for improvement in Tlna and also to assemble 2 units to check repeatibility.
4 Jun : this is still status quo in terms of retuning; meanwhile, 4 PCBs assembled (2 are retuned to optimal gain); 2 chassis available; 4 more being ordered; to try for improved Tlna, and then decide for putting on antenna for tests.
17 Jun & 1 Jul : no progress on this item, due to attention given to 550-900 LNA.
==> chassis and PCB are in hand; work on optimising for Tlna to start now.

(iv) possibilities for new LNA with Tantrayukt (Yogesh Karandikar) : item to be taken up for discussion, following the visit of YK in Dec 2014.
To check if YK has got results from his first prototype for 500 to 1500 and then take the matter forward. Discussions are ongoing with Yogesh. Some email updates from Yogesh (Apr 2015) -- getting close to fabricating the first batch of the LNAs; also, NDA needs to be completed, and EoI process needs to be carried out -- this is ongoing.
1 Jul : some updates from YK who has his first LNA almost ready and would like to come to GMRT to test it.
15 Jul : YK's visit planned on 27-Jul-15 (need to strategize "MoU" & modus operandi);
==> to have a discussion tomorrow.

1.8 Completion of spare L-band feeds -- from 15 Jul & before (SSK/ANR) : Target to have a total of at least 5 (out of 8) working spare feeds (from mechanical to electronics) : 30 antennas had working Lband feeds, but there were no spares, though we had 2 feeds; one unit was assembled back from the feed that was dismantled for making the drawings -- this was completed and installed on W1 (one feed is now in the regular 'maintenance cycling' of feeds); 32nd unit was there in Pune wshop and was shifted back after assembling by mech group and then fitted with electronics; it uses newly fabricated push-type (presss-fit) probes; after 2 LNAs were made ready (see above) this feed is now available as the 2nd spare feed. Furthermore, 6 new feeds were made (via outsourcing) in 2 batches of 3 nos; in the first set of 3, 2 nos had wrong size of horn and had to be corrected by the vendor; all 3 needed new covers as old ones were not suitable; second set of 3 feeds from Akvira : OMT + horn + cover; hence, total of 8 spares CAN become available; note that weight of 3 latest feeds is 18 kg more (72 vs 61 kg) than earlier feeds -- now accepted as

'fait accompli' !

Following issues need to be resolved currently :

(i) having sufficient number of spare LNAs : see item above for details.
==> one spare feed only available right now;
matter of requirement for 15m feed also discussed : can take the electronics from the existing OH feed and put in a spare feed and give to 15m dish; may need to change filter bank also.

(ii) other electronics : sub-band filter bank is the main item missing; it was found that the sub-band filter ckts spares don't work as one gnd line (for switch ckt) is missing in the films from RRI (!) -- to try with a wire providing the gnding ckt; alternate is to start using the new design -- this shows good performance for individual filters, but integrated unit is giving poor performance for selection of 1280 -- problem with the switch (new make is not giving same performance as original make) and this is affecting both reuse of old filter PCBs and also the new design; looking for original make (MACOM) and also trying a different switch (Hitite, which means new PCB); new PCB designed with Hitite switch (will need additional patch PCB to convert logic levels; one chassis (for 2 pols) made available for testing; new design still not working for 1280. After isolating the filter from the switch, response was found to be fine; found some issue about the layout on the PCB for the Hitite case and PCB was redone -- received, populated and tested : looks like still not producing proper results? Finally problem tracked to the amount of grounding : added a metal plate below and screws to provide additional ground area -- now both MACOM and Hitite designs are working ! Modified PCB layout being done (for both cases) -- design sent for fabrication around 10th May; expecting PCBs within a week.
4 Jun : both PCBs have come; Hitite is assembled and tested ok; will do the same for MACOM shortly and put out a detailed comparison for discussion.
17 Jun : results circulated by Imran : MACCOM response is better; Hitite is showing some shift in some of the sub-bands; recommendation is to go with MACCOM. Agreed to assemble for both channels and put on one antenna (without 1390 ampl) and compare with existing system.
1 Jul : detailed look at the results at 1390 shows that the new filter is better in shape (and insertion loss) but not good enough to dispense with the extra amplifier; when new PCBs come (from Argus), will assemble in both channels (with ampl) and put in one antenna.
==> work in progress.

1.9 Testing of LBand wideband systems on 30 antennas -- from 15 Jul (SKR/PAR/SSK) : (to maintain a proper log of action taken on individual antennas during these tests and debugging activities); data being taken fairly regularly since June; some history is as follows :
June 2014 data : C08 & W01 CH-2??shows ripples at OF RX output -- gone now (to check possible cause); Sep data showed problem with W4 ch2 -- fixed;
RFI issues : S04 & E02 showed RFI type lines, E06 showed RFI lines in CH1 (June data); line RFI in 1070-80 range (likely to be airport radar), around 1280 (likely to be due to GPS) -- July 2014 data; lines at 1030 & 1090 (3 MHz BW) also seen (Aug 2014 data); also, is there a RFI line at ~ 1200 (3 Sep 2014 data)? -- need to confirm status of all these lines (can be covered under RFI agenda). From Sep 2014 data : lines at 1176.0 & 1176.45, 1191.80 & 1204.70 are likely to GPS (in addition to 1280) and 1090 is airport radar; there appear to be a few unknown ones also (e.g. 1320, 1480 etc) -- check with RFI team separately by including in that agenda item.

Current action items are as follows :

(i) some antennas with poor deflection overall : to be addressed as and when such cases are found. e.g. Ch2 of C1 -- was confirmed to be a cable problem, but was still showin some slope, whereas test at antenna base shows OK.
8 Apr 2015 update : the slope is OK now; during current MTAC power level difference issue being studied; C14 shows slightly low deflection (by 1 db) in latest data.
20 May new results : C3 shows somewhat lower deflection; overall, most antennas may be showing 1 db or so lower than usual? -- this may not be true as the values match with 4 control room numbers and theory curve had gone up for some reason (compared to Jan 2015 !); agreed to mark the control room values on the plots.
W4 one channel not working -- true for other bands also (?)
4 Jun : control room values are now marked not by 4 pts, but by a curve (!);
C1 both chans are 1 dB less; C11 ch2 is less -- need to be followed up.
17 Jun & 1 Jul : no new data or updates.

(ii) some antennas with deflection changing over the band (less at high frequencies): checked if pointing offset can explain this -- not found relevant; was shown that it happens for cases where the RF power level (at laser input) is too low -- confirmed with a more careful set of tests (and plots) for few selected antennas (including make good ones look bad by increasing OF attenuation), and demonstrated in deflection test report of 11 Nov 2014; to check if appropriate reasons for low power levels can be identified. S4 had very low power for long time -- was solved with change of RF PIU in OF system (!); currently (11 Mar 2015), C8 ch2 being investigated.
8 Apr 2015 : OF attenuation needed to be changed from (default) -20dB to -11dB for a few antennas (W1 ?);
In latest March 2015 data, this problem is seen for E6 but power level is ok.
20 May : low sensitivity in C3 shows this kind of slope across the band in deflection.
4 Jun : E6 is now added to this list (C3 was not available) -- to check with JP about pointing related for E6; go backwards in the record to check when C3 problem started.
17 Jun : no updates.

(iii) some antennas with poor on/off bandshapes, including large slope e.g. W1 (has been there for several months); C4 and W6 also; such cases need to be checked (call sheeted) and understood.
8 Apr : cable faults found (& rectified) in C4 & W6; Mar2015 data does not show any major problems. To evolve a method to keep regular track of this issue.
W1 still needs to be understood. W4 one channel may be developing some problems.
4 Jun : W4 problem was due to splitter and now fixed; W1 feed has been replaced by spare unit and slope is seen in the LNA of unit brought down -- one LNA has been retuned, second one is being done; C2 also shows this problem -- will do in-situ tests of check the cause and then decide action to be taken.
17 Jun : no updates.
15 Jul : Now both C4 & W6 are ok (as of 14-Jul-2015) -- how and why?
==> these were feed replacement + other problems fixed.

(iv) few antennas with ripple or large slope across the band -- to be followed up as and when seen. C3 and C12 identified as problematic and being looked into.
8 Apr : C3 & C12 problems traced to loose connectors (after tightening they are OK); Mar2015 data does not show any major problems.
4 Jun : no new instances of ripple reported; except may W4 ch1 having a bump near 1070 MHz.
17 Jun : S6 is now showing ripple; maybe cable problem.
15 Jul : no ripple in S6 now (as of 14-Jul-2015) -- how and why ?

==> may have gone away due to tightening of connections.

(v) there is a good data base from sometime in 2013 onwards -- can we have a well-defined algorithm for comparison of different data sets and getting statistical conclusions? -- to look at developing a tool for this; a basic tool was developed : overplotting of on and off is possible and clear patterns can be picked up. To check for next level of sophistication of the tool.

(vi) RFI and other issues :
20 May updates : C2 and C12 show problem with setting of OF attenuation values and likely to be telemetry problem -- corrected by telemetry team by putting the proper antcomm unit (4 Jun) -- to check if this item can be closed.
RFI study : GPS signals seen very strongly (will need detection algorithm); new RFI lines seen near 1470 (maybe something related to 4G) and near 1540 ; also something around 1320 may be there?
4 Jun : new data does not have significant RFI, with the 1090 radar being the predominant one; Q : why GPS etc vary so much with epoch? need to plan predictive algorithm for these. Also, mobile rejection shows different level of residuals and quite high for some antennas -- need to be investigated a bit more.
17 Jun : S3 appears to be showing some RFI problem in 1390 band.
1 Jul : no new data or updates.
15 Jul : 1090 Radar RFI still present (as of 14-Jul-2015);

==> latest data from 22 Jully, shows a few (2-3) antennas with low deflection e.g. C1, W4 (feed replaced); C1 needs to be investigated. Some antennas (C11) showing some extra RFI; also, one line seen at 1137.5 -- suspected to be distance measuring instrument on aircraft. Full set of known lines is given at the end of the document. Antennas checked for strength of mobile signal received : C9, C10, C14, E2, S1, S3, S4 and W5 show higher than -20 dBm in single carrier power level.

1.10 Characterisation of recommended attenuator settings for different bands -- from 15 Jul and before (SSK/AP) :

(i) values had been given for Lband, 250-500, existing 610; only 130-260 / existing 150 was pending -- this was also completed (appears that 6,6 may be the best value); note to be circulated soon (Sanjeet + Ankur); matter got sidetracked for some time due to problem of OF attenuation settings not working properly for some antennas; was taken up again on 22 Apr, with a discussion on the latest version of the SFA for OF system (including a part which has combined analysis with FE system) -- has lot of useful additions made, including recommended attn values for Lband, 250-500; however, recommended attn values for 130-260 and 150 still need to be worked out and reported; bandshape measurements with 0,0 attn compared with expected values from SFA report (-24 dBm over 130 MHz BW) leads to likely conclusion of 10,10 as the optimal choice -- needs to be confirmed and finalised.
1 Jul : repeat tests confirm the values above and 10,10 looks like the optimal setting; note to be finalised (side issue : quite a bit of RFI lines and variable on different dates -- RFI team to look into it).
==> note has been finalised and submitted.

(ii) FE team to test the power levels at OF o/p and cross-check against SFA values : for 250-500, this has been done and results incorporated in the updated SFA report; for Lband the exercise is ongoing (antenna to antenna variation is a major issue); can be done now, as Lband is relatively stable now; was done by Ankur in a report back in July 2014 -- discussed and suggested to add a few refinements of the

statements used (for 250-500) and add an explicit entry in the table; further to compare for each sub-band of Lband using realistic cable loss value for each sub-band (this can then be done for 250-500 also, if found significant). Updated version of report to be produced with these modifications; first part (for changes related to 250-500) has been done; waiting for measurements at Lband to be completed; some work has been done by Ankur, some work has been done by Imran to characterise FE, and SFA report also has measurements of cable loss; calculations have been done; need to cross-check with measurements; waiting for report to be finalised, after some internal feedback. Meanwhie, contents of updated report discussed (see item above) -- to check current status and see if this can be closed with formal release of the report.
Just pending for item (i) to be completed and updated report to be released.
15 Jul : 150 MHz also included & report circulated; to check current status & plans.
==> report submitted and matter can be closed.

1.11 Switched filters at different stages of receiver -- from 15 Jul & before (SSK):
2 main categories of switched filters are needed : (a) switched filter banks inside FE boxes (these are mostly covered under agenda items of the respective FE systems) (b) switched filter banks in rx room for additional, selective filtering of the RF signal before it goes to GAB system; (c) monitoring set-up in rx room (at o/p of OF system); these are being designed using the new switches : 2, 4, 8 way switches with different possible configurations;

Current action items are as follows :

(i) for rx room monitoring at OF o/p : note that these circuits are connected to the nonitor ports of the OF system; first design did not give enough isolation at highest freq of operation and hence new design was done; ckt for 2:1 and 4:1 versions was mdae ready & tested -- 25 dB isolation achieved; drops to 17 dB with frequency for 8:1 switch -- now getting improved rejection : better than 25 dB below 1 GHz; goes down to 16 dB above 1 GHz; the leakage between the signals with this switch is still unacceptable; trying another switch (MACOM make) which terminates unused inputs while selecting the desired input (will be used in the final 30:1 monitoring system), and gives 40 dB isolation; new switch + modified design with additional isolation switch and power supply isolation done : achieving 35 dB at Lband and more than 50-55 dB at lower frequencies, with all channels powered; will be tested in monitoring system for 16 antenna set-up. 8 antenna system completed and under test; appears to be working ok; assembly for 16 antenna system is ongoing; components are available for full 64 input (32 antenna) system.

Current action itesm :
(a) to look at test results of 8 antenna system -- especially the isolation results :
Around 20 May 15 : isolatio numbers (at 3 spot freqs) ~ -40 db to -35 db for adjacent ports and ~ -40 to -70 for other ports; lab tests on integrated system (15 Jul 15) show 35-55 dB; to check if it holds for 16 antenna system.

(b) to do an additional test with signal injected at Tx i/p at antenna also :
done finally (15 Jul 15) and demonstrated to give 35-55 dB isolation.

(c) to completed 16 antenna system (4 units wired and ready) : initial system made ready (20 May 15), showed ripple in one of the 8:1 units; later (17 Jun 15), there was problem of dip in 1390 region that required additional grounding in relevant part of the ckt; by 1 Jul 15, had good results for 14 antennas, but still some issues related to driving of digital lines...

15 Jul : above problem persists; need to increase fan-out capacity by improved design;
==> work in progress; to wait and see.

(d) to summarise the design in a note -- work yet to start?

(ii) for rx room switched filterbank : prototype system was been developed; tests were done and performance found ok; report describing the design and characterising the performance was produced, circulated and discussed (22 Apr 2015) -- was in quite good shape, with results for different filter combinations. Final version was sent to Dongare by Ankur around 20 May 2015. Pending issue is about availability of space in rx room for housing these units -- agreed to keep this pending (on low priority) till final requirement for this system is clear.

1.12 Finalisation of 550-900 FE box -- from 15 Jul (IK/ANR/SSK) : to produce a block diagram for the 550-900 FE box; then to start seeing which units are ready, which need to be done; which may need to be combined into single units etc; roughly same number of components as 250-500 box, slight difference in the arrangement of notch filters; size of sub-band filter chassis will be different; agreed to start this layout work in paralle with the work on common box layout -- Imran+Ganesh looking at it, with Bhalerao's help.
Current action items :

(i) to confirm if block diagram of updated system is available : existing version to be given to Imran for producing updated version -- check if ready (now pending for a LONG time !!)
4 Jun : first version of blk diagram presented : generally ok; includes separation of FE system into 2 boxes; issue of noise source splitter -- needs to be in the main box and hence 2 cables are needed for sending noise o/p for LNA box; also, the post-amp + 2:1 RF switch (before it) + RF on-off switch (after it) need to be integrated into one PCB -- will take some time.
17 Jun : no specific action items related to blk diag -- can be closed.

(ii) dir coupler not available -- being designed fresh; 2 options done and PCB sent for manufacture (to Mohite, then changed to Argus); first tests without chassis look ok; tests with chassis for 2 designs (with different substrates) : one design is better in terms of insertion loss (~ 004-0.06 vs 0.06 to 0.08) and variation of coupling over the band (3 dB vs 6 dB); selected design to be tested with noise source + LNA + feed load in the lab.
4 Jun : integration could not be done as the first version hood is not big enough; agreed to complete antenna tests with this frist version (without noise coupling) and check later if dimensions of hood can be increased; fall back option is to use the 2nd coupler whose size is smaller. To check current status of this.
17 Jun : favoured option is to increase the height of the hood by about 2-3 inches to accommodate the dir coupler.
1 Jul : request for new version yet to be given to w'shop; other chassis required are already in process in w'shop.
15 Jul : height of the 'hood' (QH, direction coupler) : remains to be designed;
==> waiting for one pair of chassis (with type N connectors) and modified hood from wshop; also 2nd FE box has to be made ready (2 are being made ready).

(iii) sub-band filter : chassis (only unit) was given to w'shop for mass production needs (!); current status : all the chassis for 30 antennas have come; this is complete and can be treated as closed (20 May).

(iv) noise source (with attenuators) : right now using the unit from 250-500 system; need to check if same noise diode will be used or changed -- likely to be changed; but same ckt and PCB and chassis can be reused; prototype yet to be made.
4 Jun : prototype (with different noise diode) is ready and needs to be tested on the bench with suitable LNAs.
17 Jun : prototype unit LNAs gone with hood to C10; this test will be done with the next set-up.
1 Jul : waiting for new unit (with updated hood to be ready) + LNAs.
15 Jul : noise source under mass production;
==> this appears to be going smoothly, and can be closed.

(v) post-amp + phase switch to be combined on one PCB + chassis that matches with size of Lband post-amp + ph swtich system and RF on-off will be added to it; proto yet to be made (see discussion earlier).
17 Jun : PCB layout is ready and will be sent for fabrication shortly.
1 Jul : PCB sent for fabrication (to Techno Ckt).
==> some PCB has come but not both sides that are required; this will hold up integration of box #2; agreed to go without RF on-off, using the Lband unit (same as done for C10 box).

(vi) plans for split FE box (if dir coupler and QH + LNA has to be close to the feed with short cables) : prototype unit (with proper protection against water etc) is available; can be put on the final feed (once confirmed) and tested during monsoon; to check current status of readiness of this.
4 Jun : planning to put on C10 by 5th June for initial tests.
17 Jun : unit has gone on C10; need a few deflection tests to be done alongwith beam width measurements and then decide which way to proceed.
1 Jul 2015 : this can be closed.

(vii) main FE box : prototype is now ready and demonstrated -- looks in good shape; testing to start shortly; prototype of DC + LNA combo with feed will be ready in 2 weeks time (by 20 May).
20 May : DC wiring is completed; RF routing work is going on.
4 Jun : this is completed and will be tested on the bench with the hood today and go to C10 tomorrow (5th).
17 Jun : this box is working ok on C10 and the design can be taken to be the final version, except noise injection connection is not made and tested to the hood.
1 Jul : just waiting for unit to be assembled with new hood and tested on the bench and then the item can be closed.
==> one completed and sent to C10; 2nd and 3rd getting ready (see above).

1.13 New filters for Lband -- from 15 Jul & before (ANR/SSK) : Sample Lband full-band BPF had been designed -- has no slope with freq and better insertion loss, and maybe a better option than the existing main BPF; similarly, prototype design of new sub-band filters (with better insertion loss) has also been done. Detailed results for the main BPF shows that the BW is slightly less than existing BPF : 500 MHz (965 to 1465 MHz), instead of 590 MHz (890 to 1500 MHz) -- this gives better rejection to mobile band signals, but has implications for final usable BW of L-band system; furthermore, an improved notch filter has been designed for the 850-950 mobile band (-60 dB vs -45 dB at 900 MHz), alongwith a LPF for cutting off the 1800 mobile band has been designed -- 3 dB cut-off freq of 1650 MHz. The matter was presented to the users in Friday meeting on 9th May 2014, and it was agreed to generate a note about this proposal, for clearance in the GSG. This was done and matter was discussed in GSG of 13 Nov 2014 and it was cleared to proceed on the

following: new BPF + mobile notch filter to replace existing filters in FE box; LPF to be put in common path at antenna base as a common facility for all bands; to be taken up as a case-by-case replacement job, whenever a unit comes down for some maintenance work. Meanwhile, plans for mass production need to be worked out.

Current action items :

(i) status of mass production :
(a) for the LPF : 10 units of 1650 LPF have been fabricated out of 40 PCBs available; PCBs (stripline) do not need much work for assembly -- can be given for manufacture; new chassis will be needed; PCB order for 70 nos can be sent using existing eps10 board; both pols can be combined in one chassis requiring 35 nos only -- drawing to be finalised for rail-type chassis; to check if existing chassis can be re-used;
15 Jul : PCBs to be ordered; of the x30 PCBs in hand, x8 used for Channel-1 of x8 antennas;
==> 10 are completed; can go ahead and do more antennas and both channels.
(b) for the main BPF : PCB + chassis for new BPF ready for 40 nos (30 antennas + 10 spares) -- this can be closed.
(c) for the new notch filter : 60 nos had been made (PCB + chassis) of which 30 have been used in existing system; waiting to order more -- to check status and see if it can be closed.
==> all 60 ordered and received and matter can be closed.
(d) to include these items in Ankur's spreadsheet : Lband new filters now included (BPF is completed); sub-band filters TBD; to check current status.
The above appears generally ok, except for sub-band filter in spread-sheet; to check latest status.
17 Jun : spread-sheet has entries for the sub-band filters; to check if any further action needs to be tracked here.
1 Jul : updated spreadsheet has been circulated and it contains the new information; plan is to transition to a web-based tool for long-term tracking of progress of various filters.
15 Jul : the spreadsheet is now available for online viewing;
==> this appears to be ok and can be closed.

(ii) status of installation :
(a) agreed to put 10 nos of 1650 LPF in one channel of 10 antennas which have 250-500 broadband system installed; waiting for chassis; meanwhile, 1650 filter was put in one poln of C10 on a trial basis; appears to remove the 1800 mobile signal and does not appear to affect other bands; shows about 0.5 dB insertion loss; agreed to put available 10 nos in ch1 of 10 antennas. Now done for C4 & C10 (?)
3 antennas done (to confirm which ones) -- target to do 10 nos of CSQ.
17 Jun : installed and to be left for some time for user feedback.
1 Jul : installed in 7 antennas so far -- list to be given to NSR for updating the webpage; watch and wait for some time.
15 Jul : 1650 LPF : now x8 have been put on antennas;

(b) also agreed to move the 70 MHz HPF to just before the signal enters existing IF system (instead of just after the signal enters the ABR cage) -- to check the plans for mass implementation of this. now done only for 1 antenna (C4) ? Need feedback from ABR team?
Discussion with ABR team did not converge as planned; right now, LPF and HPF put in series and put on top of the rack.
17 Jun : nothing new can be done here and hence this can be closed.

2. RFI related matters :

2.1 Discussion relating to Industrial RFI survey -- from 15 Jul & before (PAR/SSK) : revised docs (from 2009 and 2012 discussions) had been circulated by RFI group and were discussed in 5 June 2013 meeting (is the document too exhaustive?); new survey planned with main aim to generate updated database which will be useful to pinpoint likely hotbeds of RFI in the industrial areas in addition to finding those without NOC; after months of planning and discussion with DIC, was finally conducted during 23-27 June with 4 teams; covered Ambegaon and Junnar talukas ~ 40-50 villages in each; ~ 40-80 working industrial units (large number are closed down or never existed!). Some of the progress is as follows :
A form had been prepared for use in the survey and had been discussed in detail and agreed that it is suitable for use; about 70% of existing data had been entered into this form; agreed that this activity would be superseded with making a database of equipment and NOC record for the existing industries found in the survey; this data entry now completed for all 3 regions : Junnar, Ambegaon and V-K industrial estate; some highlidhts from the database : of the total list, a significant number of industries are closed down, and another significant factor are no longer traceable; about 1/3 of the original are still working (ignoring poultry which is about 1/4, but is considered RFI-friendly). A follow-up meeting with DIC took place on 30th Sep 2014. Summary is as follows :
a. To maintain proper record of the data of existing and future industries in the same format. The data format and data base was shared with them during the meeting.
b. Complete list of the villages in Zone I to Zone IV is submitted to them, based on which they can decide the issuing of NOC for industries in different regions (and also outside?).
(c) DIC to issue NOC to the old units which are working in the GMRT identified zones, with guidelines from the GMRT
Matters had been stuck for some time due the issue of payment to DIC team for some of the expenses incurred during the survy work. This has been resolved, following the meeting between PAR + JKS and DIC office, on 27 Apr 2015.

Some of the present action items are as follows :

(i) To cross-check the list against the ones which have NOC (for those operating without NOC, add to our database and inform them about informing us for changes, and DIC to issue NOC post-facto as mentioned in other agenda item) -- this is happening now; current table has a column indicating whether NOC is there or not. DIC has started taking action on parties without NOC (e.g. Govardhan dairy, ~ 20-30 km away). DIC will be sending the standard form to all and it will come to us for clearance; we need to be careful about to whom we say "yes" in retrospective manner, so as to avoid setting up a precedent of giving NOC to somebody with wrong kind of equipment already installed & running ! Possibilities for improvement can be suggested to them. Some work to start on this by NCRA giving a first list of names to DIC for initiating action (to choose first set of parties a bit carefully).
4 Jun : need to check Govardhan in our records; for both the sugar factories (near W6 and S6) -- there is no NOC; other than these, it is only the welding units? to do one round of careful check in the data to verify the facts about which ones don't have NOC. Need a status update.
17 Jun : one more unit identified : old unit of DJ exports; no updates on Govardhan etc.
1 Jul : email update from PAR : NOC for Gowardhan Dairy and D J exports old unit has not been issued. I have checked and confirmed from the data base.

15 Jul : In search of 'no industrial zone' decision; to request JS(ER) for help ?
==> see below for some updates.

(ii) Related topic : units that have NOC and grow in size to exceed the norms -- what is to be done. One unit just under 2 km away on highway -- should be told "NO" and see if he will shift beyond 2 km. Also to check if our norms can be tightened further for differentiating between less harmful and more harmful industries -- to check the procedure used for establishing the norms.
17 Jun : records show that one unit located at 1.93 km was given clearance (2009) for a serum making plant.
==> item discussed in detail about possible options for moving beyond moving 2 km : to shift sub-station + genset to 100 m beyond 2 km limit and put underground cable from there to supply point, and test by GMRT team before final NOC.
Letter to be sent to DIC with this feedback.

(iii) To follow up with DIC about
(a) issuing of NOC to the old units which are working in the GMRT identified zones, with guidelines from the GMRT -- 4 Jun : to check the facts and then follow-up.
17 Jun : it appears that there are no other such units except the 4 identified above.
(b) Follow-up on single phase welding units : they have requested letter from GMRT to collect information from users around GMRT antennas.
20 May : Agreed for preparing the letter and sending to DIC. RFI team to coordinate with Admin (ABJ + JKS) on this.
4 Jun : follow-up with JKS is pending.
17 Jun : discuss with admin to agree on the procedure to be recommended : maybe can have both in parallel -- letter to DIC, and to gram panchayats to collect the data.
1 Jul : email update from PAR : regarding preparation of norms related to NOC (less harmful and harmful industries) and sending letter to DIC and Grampanchayat offices for collecting data related to the operating industries in their area to be discussed and will be prepared on 6th July 2015 at the NCRA. This week was not possible due to busy schedule of Shri. Solanki.
15 Jul : two letters have been prepared with Solanki; one letter has been delivered to DIC office, requesting authorisation of survey.

(iv) during the survey, some units which are likely to be important from RFI point of view have been identified for detailed studies later on -- some work can start in parallel with completion of database, beginning with the bigger units; measurements (using LPDA) for 2 big industrial units in Junnar & Ambegaon area completed; no new ones have been done (about 10 more need to be done); results for the 1st two have been analysed & no strong RFI is seen other than the ambience due to powerlines etc. To check current status of this.
17 Jun : no updates on this.
1 Jul : email update from PAR : regarding measurement of rfi from bigger industries other than two still pending. In the mean while we have visited transformer installations for power line interference measurement.
==> no action on this.

(v) New issue (15 Jul) : "India Overseas" fresh problem with 'old' party - difficulty in measuring RFI from close range of Compressor (min. 500-m) 'best effort' basis measurement planned; suggested : underground cable to shift transformer & DG set [~ 2 km];
==> this is same as DJ exports !!

==> meeting with DIC last week (with JKS) : docs about 30 km zone handed over (formal

doc from Mantrayala to be obtained by JKS later); data about villages within 30 km zone also handed over; discussion about collecting information from Gram panchayata about other, smaller unauthorised industries (e.g. welding units) -- discussion with new person who will visit GMRT in the near future. YG to rewrite the agenda item in a more compact format.

2.2 Transformer RFI revisited -- from 15 Jul and before (PAR): Team has been doing a check on transformer RFI and the updated results from this will be available soon -- will need to see how this compares with the earlier round of this work. Comparison of old and new data is in progress. Only 6 locations are common between new and old data (!) -- many new installations are coming up ! No clear conclusions have been drawn from the study; also more data needs to be taken to cover a larger number of transformers -- to wait for an update from RFI team.
20 May : some of the old data has been found (2005-06 & 2006-07 surveys) and there is likely to be some more data from 2008-2012 period -- to fill up the details properly; to try and extract the following : (i) typical time constant for failure / malfunctioning of a xmer and (ii) most common types of RFI problems : fuse links, bad transformer, cut joints...
4 Jun : older data have been found and are being added to a combined data base (old data were upto 2 km and new data is upto 1 km only -- but has more transformers !); one unit near W1 may need urgent attention -- to get the history of this and initiate the action.
17 Jun : still waiting for consolidated report! meanwhile, electrical has initiated action on the urgent case near W1.
1 Jul : updated transformer related data will be sent out in next couple of days; work has been initiated by electrical with MSECTL for W1.
15 Jul : Older data needs to be added to already tabulated [2006/7; 2007/8; 2015]; current table shows 37 out of 58 transformers show problem in 'fuse link'; to decide follow-up action.
==> all data is now combined into one spreadsheet; there is still significant non-overlap between old and new coverage -- agreed to cover some more of the ones done earlier; also start looking at the worst problems in the new data.

2.3 Follow-up on UPS RFI -- from 15 Jul & earlier (SSK/PAR/RVS) : UPS units from Ador were found to be the most suitable : 2 nos of 3 kVA were purchased, tested for RFI & cleared; units were in use in C9 and C10. Updated RFI report was done (with comparative statements quantifying the repeatibility). Further, 2 nos of 4.5 kVA units were also ordered with Ador, with option of 2 single phase o/p with different isolation transformers (3 + 1.5 kVA); units were delivered but failed the RFI tests -- lots of discrete lines seen; finally, modified version of Ador 4.5 kVA was tested and preliminary results were quite good (report for this had been circulated).

It was agreed to go ahead with 3 kVA units from Ador; 10 nos of these were ordered as a starting option (total cost per antenna was estimated to be around 2.x lakhs); first batch of 5 nos had come in Jan 2015; power factor found to be very low (0.2 ?); RFI tests showed 1 unit with 1 dB increase in noise floor level at 150 to 270 MHz; remaining 4 units showed 2-4 dB increase in 140 to 240 MHz; the following changes were noted by RFI team : MCB make has been changed; panel plate is missing -- direct screen printed units are used; connectors size / type have been changed; finally, found that test had failed at first level because of extra switch that had been installed outside -- this was moved inside and RFI levels much better; further, auto transformer added inside the unit to improve the power factor (to ~ 0.5); after all this, RFI tests done, but still not found fully acceptable; some further desirable improvements suggested : (a) cover over MCB switch panel needs to be shielded;

(b) input and output power connectors need to be shielded and filtered;
(c) to remove the powder coating and provide enough grounding points.

Finally, agreed to take one unit from the lot of 5 and carry out changes at GMRT (alongwith the vendor) to fix the issues; full gasket and filtered pwr connectors may be required; meanwhile, possible source of leakage was identified -- location of heat-sink mount had opening leading to increased RFI (?);

Final conclusions from last round of testing & clearance were: need better contact of heat sink with cabinet -- no powder coating and more screws; need shielding gasket between square tube frame and door panels; cover over MCB siwtch panel needs to be shielded properly; avoid powder coating; confirmed that shielded cable and connectors are NOT required; modified design achieves 0.5-0.6 power factor (under full load conditions) -- this is ok, and additional improvement will be with bank of capacitors to be added overall; for this final configuration, price increase may be ~ 35,000 + taxes; break-up given by vendorn shows about half of the cost is xmer and remaining is for the new shielding measures.

Current action items :

(i) Getting all 10 units modified : 1 unit fully ready; within one week (end-May), 5 fully ready units will come; remaining 4 within another week of that.
4 Jun : all 10 units have been delivered; today, xmers are being installed; will be testing for RFI in full load condition in the recreation hall tomorrow.
To check current status.
17 Jun : RFI test report of all 9 units is available and all were found to be ok at 80% of full load. This item can be closed.

(ii) To confirm plans for installation of the new units
4 Jun : only one unit is installed in C10; next unit will go to C00 replacing 4.5 kva unit there; after that, populate in antennas that don't have any UPS at all ? may look at antennas which already have 2 sets of line filters (BLDC antennas?) and see if it is better to put UPS in these antennas?
1 Jul : C10 & C00 installed; 2 more in CSQ (C14 & C4) & remaining 6 in arm antennas;

(iii) To confirm final price increase for the modified units
4 Jun : final value is Rs 21,000 per antenna now; can check if amendment of PO is possible as total increase is only 10% now and is dominated by cost of xmer.
1 Jul : amendment was agreed upon as the way forward -- to confirm if done.

(iv) To discuss plans for going beyond 10 units :
1 Jul : a new party is showing interest in taking up the job; to check original with party if he will hold the prices (or give a discount) for 25 more units; if yes, then go ahead; if no, then order in smaller quantities and also explore alternate party that has expressed interest (one sample unit can be ordered with the new party anyway).

==> RFI team has finished all the works in this agenda item; can be moved to Ops?
Agreed to go with 10 more with Ador and 1 unit to new party (Aircon) and then decide for the last 10 units. Installation of existing 10 nos : C00, C10, S3 and S1 done; C13 has old UPS; new EMI filter in 4 ants; in 3 ants cooling of xmer with fan has been tested and found to give 20 deg improvement -- this design can be finalised; servo wants to test the performane with the EMI filter and then give final clearance -- to check if this can be expedited; meanwhile can start the paperwork for more

filters.

2.4 RFI testing of LED lights for GMRT labs & building -- from 15 Jul and much before (PAR/SSK/RVS) :
Electrical group has indented for 5 W lamps + X Watt tube lights (after samples had been tested for RFI and cleared) -- delivered units had 5 W and 7 W lamps; the 7 W lamps were found to generate RFI (not to be used at GMRT); tubelights (50 nos?) also failed the test; hence, only 5 W bulbs found suitable ! RFI testing of mass installation was also done and found ok; agreed to install in canteen as first location; these were checked for RFI after about 6 months usage and found ok; thence, cleared for mass procurement and installation in different locations; 30 nos of the original 50 nos of 5W LED lamps were installed in corridor & lab areas; indent was raised for additional quantities; these were delivered (how many?), and this new batch was tested for RFI as per earlier procedure and found to be ok; additionally, RFI team tested the units that have failed in the first 6 months or so of use -- these results are covered in the latest report, wich summarised 2 yrs of tests -- no RFI found from partially or completely failed units being powered on; agreed that report can be given to interested vendors for improving the products; sample batch of Syska make tested and found NOT ok.

Current action items :
(i) to confirm current quantity purchsed and installed : 50 nos purchased (and installed mostly in the corridors); an additional 200 nos have been received last month (Feb 2015); plan is to put them in guest house rooms, hostel rooms, guest house corridor, and labs as per choice of users -- almost all are used up; agreed that 200 nos more can be ordered; checking with party for single batch supply (ok);
4 Jun : indent has been placed but not yet in order phase.
1 Jul : still in processing phase (!).
(ii) light from 5W units is not sufficient at some locations : to try to have arrangement for putting 2 units in parallel on same connection (for more Lumens); fixture is being made ready (abandoned) and now looking for off-the-shelf options? to confirm current status.
4 Jun : electrical team yet to find a product that meets the requirement.
1 Jul : could not find complete off-the-shelf solution; now trying for some hybrid.
==> work is in progress and two sample units have been made.

(iii) do we need to worry about failure rate of the units? (~ 10 have failed so far); agreed to wait for the statistics from the present lot of 200 (looks like it may not be a serious issue ?) -- need to wait for new stats to become available.
4 Jun : agreed to work out a scheme of keeping track of the failures -- need an update on this.
1 Jul : electrical to maintain the statistics.
==> no new action right now.

3. Operations :

3.1 Mass production of shielded box for MCM cards -- from 15 Jul & before (SN/CPK/HSK): RFI test report of Akvira vs Physimech showed Akvira is better and this was selected. Testing of new MCM card in shielded box, with final configuration was done and report was very positive, and it was agreed to go ahead with the mass production of this shielded box; RFI group to complete 2 more prototype units and then hand over matter to Ops group, which was to discuss with RFI and Mech groups to get all the inputs and finalise the plans for placing the order on Akvira : drawings

for 2 types of box : with & without provision for SPI port on chassis + 1 serial port on each box; parts list for RFI shielding materials to be ordered; list of possible vendors etc; Final target is for 60 + 10 (spares) shielded boxes; was order sent for 70 nos, with one prototype to be delivered first, and batch-wise delivery after that; sample box of Rabbit + switch + media converter + Miltech PC combination was tested on 4th Dec 2014 : results match with earlier tests using prototype units.
Two minor points conveyed to vendor : size of one of the opening and assembly of the side plates. Finally, 70 shielded boxes (for Rabbit MCM) were delivered; agreed to keep them in storage and use as needed; for procurement of the RFI material and components, list was prepared and confirmed with RFI group and indent ready (total cost ~ 33 lakhs (including items for shielding of the switch?) with line filter included (?) ; to check current status of indenting and ordering.
enquiry has gone (combined for both items); quotes have come on the higher side : problem with total now exceeding 25 lakhs whereas the original indent did not!
to investigate the reason for the increase in costs (look like 2 items may be the culprit?); to try to split into 2 equal parts, with repeat order, after checking with party about holding the prices.
20 May : recent clarification from the party is that 2 of the connectors (which are needed for bringing in DC power) have costs increase of ~ 7 x (300 $ each for a pair); modification suggested is to use the normal data connector for bringing in power (15 V, ~ 1 Amp) -- can parallel all available pins; can check with vendor and then put modified purchase order, dropping the 2 connectors.
4 Jun : going ahead with the scheme of getting power from normal data connector -- test set-up needs to be made and run for some time; to confirm with purchase that order has gone.
17 Jun : order has not yet gone -- CPK to check and see what is holding this up.
1 Jul : order for connectors appears to have gone.
15 Jul : Order has gone; to confirm expected date of delivery.
==> one month more for delivery.

3.2 Mass production of shielded box for switch enclosure at antenna base -- from 15 Jul and before (SN/CPK/HSK) : Detailed RFI tests show that the shielded enclosure appears to be working quite well; RFI team handed over the information and material to Ops Group for initiating mass production; last round of confirmation to finalise the drawings done; Ops group started on the work requisition for this box (as well as the box for the Rabbit card), in cooperation with mechanical group; target is 35 nos of these shielded enclosures; order placed for 35 nos, with one prototype to be delivered first, and batch-wise delivery after that. All 35 boxes delivered (c. Feb-Mar 2015); for ordering the components : list made in conjunction with tha for Rabbit card box (see item 3.1 above); to check current status and plans.
15 Jul : CAT5 cables Delivery expected in 2 months;
==> CAT5 order is for these switches.

3.3 Planning for proper UPS & space utilisation for new equipment at antenna base -- from 15 Jul & long before (SN/CPK/RVS) : long-term plans for intallation of final UPS system and proper utilisation of the space at antenna base. Follow-up on 14 Aug 2013 discussion on first report : 2nd report was generated and detailed discussion took place on 5 Feb 2014; successive follow-up & final agreement on way forward (alongwith updated report) reached c. May 2014.

Some highlights are as follows :

(a) Regarding electrical loads : power drawn by different sub-systems estimated carefully, alongwith actual sample measurements on a few different antennas, for

both existing systems as well as upgrade systems; effect of in-rush current at switch on also considered; total current requirement of 10 A for the ABR systems + servo control electronics found to be sufficient; hence 3 kVA UPS is adequate; agreed that, if needed, peak load requirement (e.g. in-rush current) can be balanced out by synchronised delayed switching on of different units -- this is already implemented to some extent at present. Final load requirements have been carefully checked and tabulated in the updated report.

(b) Regarding electrical wiring : agreed to have separate isolated supplies for (i) servo drive system (without UPS) (ii) servo control electronics (with UPS) and (iii) ABR electronics (with UPS); one common 3 KVA UPS with split o/p (2 KVA + 1 KVA for servo and ABR respectively) each with its own isolation transformer is the ideal solution; the new UPS can have the isolation transformer(s) integrated into it, without increasing its footprint (only height may go up); updated wiring diagram has been produced by RVS in consultation with SKB and others, and is available alongwith the udpated report.

(c) Regarding space utilisation : new UPS can be located in the space between the ABR and servo racks -- this has been done in one antenna with the new UPS and appears to work ok; existing servo FPS units can be left where they are; if isolation transformer can be moved out from the rack, then space in that common rack is enough for all growth plans of FE and OF systems; this leaves some empty space in ABR rack bottom that can be utilised for further growth of telemetry system; all new servo growth to be accommodated in the servo racks (or in-situ replacement of existing units); extraneous items in the surrounding of the racks (electrical fittings etc) can be relocated, as far as possible, to make it convenient for people visiting for work. Most of these issues have been captured in the updated report. Matter discussed in GSG meeting of 13th Nov 2014. This item can now be taken to the logical conclusion : net outcomes can be summarised and follow-up action to be finalised.

Main list of actionable items :

(i) ordering of 10 nos of UPS : order has been placed; delivery expected end-Jan. 5 units had arrived and tested for RFI -- failed; some modifications were required; additional issue of PF of the UPS -- improved to ~ 0.6 & accepted (will add capacitor band at ABR for further improvement); first unit available for use c 20 Apr 2015); installed in C10, replacing existing UPS, alongwith 3 ph wiring arrangement (6 May); 2nd unit is ready (only xmer is needed) -- will go to C00; remaining 8 units with modification in 10-15 days -- should be with us in one month (early June); extra cost will be absorbed in next batch, which can be for 22 nos and will cross 25 lakhs -- to check with purchase about the procedure for handling this : amendment or include in next order? See earlier discussion (under RFI item) for more details; ==> see discussion above.

(ii) final wiring diagram for servo + ABR is needed : modified wiring diagram was prepared by electrical and shared with servo (4 Aug 2014); meanwhile, discussions with BLDC supplier convereged : now ok to ground the neutral of the main 3 phase transformer; extra EMI filter may be required (RVS confirmed it to be only Rs 10,000 per antenna) + only one set of line-filters will be required. Action items :

(a) RVS had circulated updated wiring diagram (done in consultation with servo) which included inputs from MACON (via servo group) which suggested radiation shield between the BLDC rack and other racks. Finally, updated diagram providing sufficient shielding distance had been prepared and circulated (c Feb 2015) : no objections

received; agreed to implement in one or two antennas, with few units of the line filter on trial basis; new input from servo for extra load to be added for PC104 related item -- to check current status.
==> see above

(b) for the EMI filters : contact with party (Schaffner) was proving difficult to establish (to try other parties also?). finally, EMI filters indented (enquiry gone), waiting for quote from Schaffner.
4 Jun : order as been placed; delivery date is end July (only 4 nos being ordered).
1 Jul : 4 units received; one installed in C10; can install second in C00 and talk to servo about which 2 other antennas to install (including one new BLDC antenna); decide after 2-4 weeks to order more units (10 more).
==> see above

(c) meanwhile, agreed to try the test of sharing the xmer between servo and other loads, via two sets of AC line filters (that already exist) : to choose either C00 or C10 after discussion with servo, for the initial tests.
20 May : heating in servo transformer is found to be significant (even without adding the additional load) and the load in each phase is ~ 6-9 Amp (much less than rating of 15 Amp); likely causes :
old vs new lot of xmer : new lot has different core & heats up more -- to be checked
THD -- can be measured for each phase
PF -- can be measured for each phase
aging -- to check mechanical features by visual inspection etc; calendar age
weather -- can the inside of the concrete shell be kept a bit cooler?
allowed range of temperature for xmer to be checked (80 is for old one; 120 is the value it goes for new one);
to check the above issues, including actual temperatures reached, and come back with numbers and conclusions for follow-up.
17 Jun : work is ongoing and detailed tests will be done in next 2 weeks time.
1 Jul : 2 fans added in C10 xmer cover to help circulation; temperature reached with full load on servo xmer is about 78 deg -- to confirm if ok with servo and then replicate the scheme in C00 and then converge towards mass production.
==> see above.

(d) Meanwhile, on a trial basis, with a change-over switch, the extra ABR load can be added and checked for heating etc in C10. (increase in load is expected to be about 30%).
4 Jun : expt done in C10 for 10 mins : full load put on xmer (~ 2 kVA, up from ~ 1 kVA) total current ~ 8 A (up from ~ 4 A); PF changed a bit (improved!); THD increased to upto 90-120% (from 70%); 1 deg temp increase noticed. To discuss with servo and see if the test can be run for a longer duration.
1 Jul : tests for longer duration being done (see above); THD increase may be due to the Mosfet property of the UPS. To try and find a series filter unit of appropriate (lower) current capacity.
==> series filter of higher rating is available; need to find one with lower rating;

(iii) making 1 or 2 antennas as model where all the configurations are made as per the recommendations : finally, agreed to use both C10 and C00.
At C10 : 3 kVA UPS was installed, but was feeding power to ABR only; later, servo shift PC104 load to UPS (isolation transformer still in use?); switch boards / extension boards shifted to safe level.
At C00 : 4.5 kVA UPS, with 2 isolation transformers, was installed with ABR rack connected on it; PC104 load was added to it subsequently; relocation of elec boards

was pending.

Current action items are : (see also email update from Nayak & Jitendra on 22 April)
(a) agreed to put the FE power supply in the proper location in both antennas -- space was made ready (after removing delay contactor) in C10; agreed to do in C00 also; turns out that relocation of extn board is also needed to relocate the FE pwr supply -- SSK to ensure that this is done for C00 and C10. Need a status check.
(b) ask servo to confirm FPS drive location is in keeping with the agreed diagram : needs to be slightly shifted and servo is ok with it -- check if done at C00 & C10.
(c) RVS to circulate an email about the updates and finalisation of layout in C0 and C10 for replicaton in all antennas. This was done and some feedback from FE and BE teams received, and following items being looked into :
* shifting of sentinel "yellow box" (PSB + BR) -- check if done at both antennas and confirm plans for other antennas.
* alternate arrangement for keeping the phone : to change to hook phones that can be hanged -- check if done at both antennas.
* directive to keep AC flow downwards in default conditions : prepare stickers and put in 2 locations in shell -- check if done or not.
* contactor and timer for delayed start is obstructing FE pwr supply (can be removed once UPS is there?) : right now, agreed to shift; done in C10? -- check and confirm current status.
4 Jun : JPK visited antennas with FE person (Satish Lokhande) and Nandi to look at mechanical arrangements that may be needed to effect some of the changes; some solutions are being worked out, without violating the available space; yellow box shifting done on both antennas; sample phone units with proper buzzer arrangement done in C10, can be done in C00 (IP phones vs normal phones -- to be looked into by Ops group); contactors and timers have been removed in both antennas. Once the ps is put on new rails, the rearrangement would be complete.
17 Jun : mech and Ops have looked at it; estimate of down time to be brought up in coord meet.
1 Jul : adjustments in the rack will be done this week for C10 (may not need antenna to be down).
==> in C10, the EMI filter position needs to be shifted. FE power supply can be put in C10 -- FE team to try out the change with FE supply.

(iv) to improve the RFI shielding of the antenna cage, starting with the model antennas : check for unshielded cable and pipe entries in model antenna shell, including unused holes and punctures, and initiate appropriate corrective steps.
RVS to make a list of all the punctures in both C00 and C10 and bring for discussion.
Work had started at C10 for this; 22 Apr : pictorial report by RVS : AC plumbing; AC line filters; servo cables (BLDC + FPS) crossing; RF cables entry points; OFC cables crossing; plus a few more; RVS to send an email to all concerned, for identification of cables, entry & exit points and unused holes / punctures. Need a discussion with RFI team about measures to prevent the RFI leakage from the punctures. Current action item :
RVS and SSK/PAR to classify the various kinds of punctures and then RFI team to suggest solutions for each category, including plugging of unused punctures.
20 May : discussed with PAR also to move this forward; to check current status & plans.
1 Jul : some work had been done in earlier days (TLV, NVN times) and electrical is beginning to replicate that (similar soln has been used in ISRO cage); meanwhile, RFI team is workign on the formal solution; also procedure for plugging the holes is being evolved.
==> Pravin has made the list of punctures and status and provisions : punctures of AC power -- may not need to worry about it; .... Pravin to circulate the results.

(v) also agreed to populate C0 & C10 with Rabbit, switch, PC (with shielding) as and when available -- these 2 antennas can be used for next gen M&C work to add to C4,C6,C12 to make a total of 5. Work in progress; JPK to keep track of this aspect. Agreed to start activity of populating during MTAC for C00 and C10, and next to C8 and C11; and then, if needed, to C4, C6, with aim to have 5 antennas ready. Action has been initiated for C00 and C10 : one shielded box with Rabbit cards + one switch with shielded box ready; 2nd unit getting ready.
Will need to make some of the other changes to make space for the final arrangement; also 2 sets of units to be made ready. Check current status.
4 Jun : see updates in email from JPK. (to fold in the results from this !!!); ethernet shielded box needs support structure in the rack for installation -- will require in-situ welding etc; Rabbit card shielded box does not need any additional mechanical work for mounting. Issue about physical monitoring of switch working inside the shielded box.
1 Jul : Ops group and mech team to look into mounting of ethernet shielding box (without welding, if possible); monitoring of switch inside the box is solved by fibre team;

3.4 New, improved Miltech PC -- from 15 Jul and earlier (CPK/SN/PAR) :
Two units of Miltech PC with two changes (more screws on panels + panel mount pwrline filters instead of chassis mount) were under test : conclusion was that PC ok from all aspects. Pending action items :

(i) agreed to initiate the purchase of 10 nos of the final version above -- indent had been raised for 10 nos (including some spare accessories?); current status of the PO : order sent; expected date of delivery 31st Dec -- trying to expedite, if possible; note from vendor informing about delay due to late arrival of m'boards : end of Jan is new delivery date. "still under test" reply from vendor -- to see if delivery date estimate can be got. SN to follow-up with BRJ on an urgent basis.
22 Apr : update from vendor to purchase : 3 units have failed and heat sink is being redesigned; will take some more time; no response from party for a long time; Nayak to request Sureshkumar to make a visit and check; confirm if there are any updates, and decide future course of action.
4 Jun : some response from vendor got by SSK (15th June date has been given) -- to follow-up with a visit and f2f meet if possible next time.
1 Jul : item not supplied yet; vendor is still facing problem with overheating of CPU; SSK to try and visit him next time to get first hand information.
15 Jul : visit has taken place; x10 machines are under test; expected soon;
==> no fresh updates from the party; SSK to check again...

Other updates : New Rabbit MCM protocol is being developed; new Front-End to M&C over serial link being worked on;
==> can take up next week.

4. Back-ends :

4.1 Documenations at various levels -- from 22 Jul and before (BAK+others) :
To complete basic,internal documentation (at ITR level) and then move to the point wehere formal publications of relevant items can be done.
Current action items are as follows :

(i) Detailed design doc : analog back-end was being done by Hande : 2nd version

had been circulated in April. Next level of document going down to chassis level is to be made ready -- chassis level doc will take about 2 months; was deferred till end Oct; and then deferred till end of Dec; 2nd version had ~50% chassis level inputs; to be completed by end-Jan'15; needs some more time as 2nd LO scheme inputs are also being folded in; work in progress; may take another month; check in mid-May.
27 May & 4 Jun : progress is slow, but going on. 10 Jun : still ongoing...
24 Jun : will take ~ 1 month (till end-July) !
1, 15, 22 Jul : no significant update.
==> no progress.

(ii) ITRs + publications for analog back-end systems to be taken up :
(a) analog back-end : Sandeep and Navnath to look into that; pending. Work pending for some time; team to review and pick up the activity. BAK to follow-up.
SCC and Navnath have had one discussion and will follow-up with BAK; not much progress; may take it up next month, after MTAC; list of items to be done has been prepared; work has been started by Navnath; to check current status; not much progress in last few weeks, but will pick up now (27 May).
4 Jun : not started yet -- to start now. 10 Jun : same status as 4 Jun !
1, 15, 22 Jul : no progress reported.
==> no progress.

(iii) ITRs + publications for digital back-end systems : ITR was completed by SHR (quite some time ago; after some follow-up, SHR and BAK started work on modifying GWB ITR to convert to a paper; first version has been circulated; needs to be taken up for discussion between YG, BAK & SHR
27 May : not yet reviewed and discussed; but agreed that meanwhile SHR can look at it from the point of view of improving by putting in the latest work on expansion to 16 antenna, dual GPU system.
4 & 10 Jun : will get into this once GWB-III release work is completed.
24 Jun : can start work now on incorporation of new GWB developments.
1, 15, 22 Jul : no progress here also.
==> no progress.

4.2 : Power supply for GAB : from 15 Jul and before (NDS/BAK) : Two options are possible : linear vs SMPS. Comparison note with all pros & cons was produced : pros and cons are in terms of convenience (and price) vs RFI properties; agreed that present (c. Aug 2014?) set-up of 30 ant GAB (with 5 spare SMPS supplies on order) can run for 6 months or so ; final decision can be taken later on. 4 SMPS units that had come were used to get 4 racks with SMPS and 4 racks with linear / CVT supplies; meanwhile, shielded box was designed for the SMPS by RFI team -- RFI report showed good performance; agreed to go ahead with it for mass production; meanwhile, SMPS installed in 4 rack; 12 new boxes with RFI shielding planned -- 8 are needed in the system, and 4+1 will be spare. Mech group to place the order for 12 nos (after BE and RFI teams check the drawings); drawing had errors (!); needs modification; was stuck for PC problems. To check current status and see if order can be / has been placed. Issue of problem with the drawing has been cleared.
One sample being made in-house for clearing the drawing etc.; required fans etc being indented by Raybole -- now on order; 12 boxes for SMPS awaited from workshop to outsource (proto found acceptable); still waiting for the sample unit being made in-house by mechanical; to check current status.
17 Jun : prototype has come and being tested; may need some change in arrangement before mass production.
1 Jul : prototype sent back for modification has not come back yet from w'shop; balance SMPS units (plus others to be used for other applications) to be procured.

15 Jul : prototype sent back for modification has now come back; 10-12 boxes have come; all except SMPS available; full set available or x5 boxes, except SMPS which is under order;
==> first unit getting wired which will be tested by RFI team before final acceptance and mass production.

4.3 Power equalisation schemes for new back-ends -- from 15 Jul and before (SSK/NSR/BAK/SRoy): Need updates on both of the following :

(i) option 1 : using detectors in GAB and local feedback loop -- monitoring set-up was made ready; DKN worked on code (using algorithm taken from NSR); first round of testing showed problems like detector output saturation -- gain adjustment checked and problem fixed; basic power equalisation algorithm was first tested ok with 4 antennas, and then expanded to more antennas; comparative study of this scheme with the GWB-based scheme to see if there are any differences or pros and cons wad done : do GAB power equalise and look at GWB bandshapes; complete the loop by doing GWB power equalise and checking GAB o/p. Test completed both ways, first for 4 antennas and then later for 8 antennas (extended to more?); BE team is ready to release for use by operators -- a basic SOP to be generated and released. Current actions :
(a) to completed the SOP and release the set-up -- check if this can be closed : yes.
(b) to run this alongwith GWB bandshape check to help debug problems in GAB -- can be formalised as a debug tool to be run by PMQC periodically; DKN to make the test procedure for control room use; check current status.
17 Jun : still pending with DKN.
==> BAK to check and get back.

(ii) option 2 : using correlator self outputs and computing gain corrections :
basic scheme is implemented & working; more general implementation of a user controlled ALC mode aims for the following 4 modes of operation
(see MoM of 3 Oct 2013 !) :
(1) on demand -- this is the current released mode.
(2) repeatable at some interval specified by the user -- can it be script based?
Sanjay has completed the core coding; a wrapper is being done by SRoy; to be taken up for discussion.
(3) automatic, should adjust in response to a stimulus in the input power -- needs a discussion.
(4) should provide a reliable power monitoring scheme -- needs discussion.

Issues that came up are as follows :
Accuracy of attenuaton values and repeatibility of settings : 5% (0.25 dB) ok; agreed to add median calculation feature; to check if a feature to predict the expected change in attn for a given change in sky direction can / needs to be added; better option for saving the attenuation values for future use / reference to be defined; logging of results to be looked into; agreed to have a document that summarises all of the above and spells out the main requirements (from user point of view) and possible solution options / techniques; detailed discussion has taken place between SRoy, BAK, SSK and YG on 14Aug2014 -- main conclusions and present action items are as follows :

(a) attenuator values : aim is to check if measurements match with specs (within +/- 0.25 dB); initial test results for 3-4 units (at one epoch) had been reported by BE team (found acceptable); pending items (for BE team) are :
* to check the constancy of the values across the band;
* to repeat the tests for vayring i/p power levels with constant o/p power;

 * to repeat the tests on different epochs to verify constancy with time;
 * to work out plan for calibration table for each attenuator (after above results).
Test data were taken and analysed by BE team and results reported; SRoy had done some cross-checks on these; tests have been done with varying i/p range from -37 to -17 dBm also and behaviour of attenuator appears to be all right. SRoy to cross-check the results and confirm if we are ok, and if this aspect can be closed.
SRoy has sent some plots from his analysis of the data and some follow-up is needed to see in what operating regime we are hitting the non-linear range of the GAB system.
BAK to look at the results from SRoy and send an email.
22 Apr : "linear range" available depends on absolute input power level; but there is enough for our desired range of operations -- it may vary from one RF band to another and a note will be needed to define the working zone and avoidance zone for each RF band. Agreed that all other aspects can be closed except for the note -- check status of this.

(b) requirements document to be updated to reflect the outcomes of the disussions e.g. better clarity about the 3 modes of operation etc. -- SRoy has produced an updated version : needs to be checked to see if it can be cleared.

(c) self data (from correlator data stream) to be saved in shared memory ring buffer of ~ 30 mins depth for further processing tasks to work on (should also work off a recorded lta file); also median calculation feature to be added; some work was done by NSR to write raw data to file for 10 mins duration; to convert this to shm and also to add a feature for calculating median values every 2 sec or so and saving these to a file for long durations. SRoy to work with NSR to implement these (take help from SSK where needed); some progress from NSR's side on median calculations;
22 Apr : SRoy reported that NSR now has a version that is able to save the median values in a file, as multiple rows -- to convert in to multiple columns version; not yet started work on shared memory version. Any recent updates? Waiting for NSR to be back on 15 May.
17 Jun : NSR has not yet had a chance to do this; should happen in next 2 weeks.
==> this change has been done now; but facing some issue about extra time taken for writing with format change -- SRoy has suggested a solution; then SRoy to take up follow-up action on this.

(d) testing of bandpass shape (ampl and phase) for different values of attenuation : 6 out of 7 antennas showed less than 5% percent and 5 degrees change in ampl and phase over 5 dB change in attenuation. SRoy to follow-up to see how much is the intrinsic varn of the GWB corrln level with change in input power level -- SRoy analysed the data provided by DVL and found that behaviour is acceptable for the range of i/p power variation tested which is about factor of 5 (~ 7 dB); plan to extend this to larger range: set power level on galactic plane calibrator to about 80 or so; then go to calibrator away and equalise to 350 -- larger change in attenuation (~ 12 dB) required -- can check if corrln coeff (bandshape) remains ok or not; SRoy would like to now try the test with upto 10 dB variation in attenuator values to see how the bandshape changes; 22 Apr : test has been done, but there appears to be some problem with the data quality -- may have to be repeated again; SRoy to check for free slots for this.
17 Jun : SRoy will be scheduling in the near future.
==> needs a black slot (SMTS) request for the slot; 3-4 hrs; can also get white slot.

4.4 GPU corr (GWB-II) : release of 4 node, 8 input, 200/250/400 MHz version -- from 15 Jul & before (SHR/SSK/BAK/DVL/YG) :
agreed to make 4 T7500 nodes with C2050/C2075 Fermi GPUs + remaining 4 T7500 nodes

as host machines (to take care that these are the ones that transient pipeline uses presently so that sharing is possible); this should have ALL basic modes : total intensity and full polar IFR modes; IA + PA BFR modes with process_psr pipeline attached; full GUI support; to come up in trial code section without affecting the presently released mode. Action items :

(i) beam modes in GWB II : new version with separate kernel (outside phase shift kernel) for beam formation has been developed (compute load is 7% increase on 2050 GPU); IA mode tested; PA mode completed and tested; phasing implemented & tested; process_psr pipeline has been completed and released; first version of SOP has been released; pending action items :

(a) last version of GWB-II (ver4) expected end of April, with the following new features : 16k channel support in GUI and SOP; multiple choice for beam integration and # of channels; pulsar beam header ver1 (limited number of parameters); for more than 2K channels in correlator, need modified shell script -- this needs to be understood. Most of these changes have been done; GUI for 'ver4' needs to be done by Nilesh -- should happen after 15 May. Check if action has been initiated.
27 May : SHR and NSR to test upto 8 and 16 K channels to see if o/p side i/o works ok; if yes, then no further changes; if no, then to change the MPI calls as done in GWB-III (and make GUI and SOP compatible with that).
10 Jun : no progress on this (due to concentration on GWB-III !).
17 Jun : ver 4 tested for 8 and 16 k channels; GUI level change has been done; dasmon needs to be modified for more than 2K (upto 16K) -- being done by NSR; beamformer will also need to be tested.
24 Jun : GUI for correlator part completed (except for dasmon); GUI for beamformer will take 2 weeks (till 8 Jul).
1 Jul : SSK to talke with NSR to close the loose ends.
15 Jul : work on changes to 'dasmon' has began;

(b) header for beam mode data : to be taken up & incorporated alongwith the PA mode; SSK has done first round, and discussion between YG and SSK has happened and next version is underway; to check current status and plans for release.
Work under progress; can circulate the current list to others (back-end team; NSR + other users). -- can shift this to GWB III ?
20 May : header part I has been done for GWB-II and III (need to confirm for II); header part II will be done later, only for GWB-III. To confirm plans and move to GWB-III agenda accordingly.
17 Jun : new version of GWB is under test which has part I header; part II header will come in the next release. part I header will come in GWB-II ver4 and GWB-III ver2.
24 Jun : GWB-II next (and final) version release in 2 weeks (8 Jul 2015); will have flexibility of upto 16K channels.
1 Jul : to ensure loose ends closed by 8 Jul and v4 released.
==> work in underway for v4 release of GWB-II.

(c) availability of online monitoring tools for beam data : psr_mon was successfully installed, compiled and tested (for 16k channels?) on node 52, node 53, gwbh2 & gwbh3; now installed on the new host machines also; installing pmon needs polycos, psr catalog etc; pmon done in off-line mode on GWB-III, ongoing for real-time mode -- needs to be tested and cleared;
port to GWB-II : real-time mode of psr_mon and pmon for GWB-II are under test now by SSK -- check present status.
SSK to check and place the final working code for pmon in the right place on GWB-III beam host machine.

17 Jun : offline version working on GWB-III (v2) and real-time version to be tried.
1 Jul : SSK close to finishing the real-time version for GWB-III.
14 Jul : online had problem with psr_mon -- now corrected but needs testing (~ 1 week)
==> no clear updates from SSK.

(d) meanwhile, work for incorporating new code developed by Rajora by adding shared memory interface is ongoing (both of these can go directly to GWB-III) -- work resumed in May 2015, with summer student Balaji; there is significant progress on this now; agreed to move this to GWB-III.
4 Jun : new features related to bandshape plot and profile plot have been added and filtering has been tested; need to start looking at shm related aspect.
1 Jul : work in progress.
==> updated code is workng; tested and showing good resuls for off-line analysis (for GSB & GWB); basic tests in real-time mode carried out and shown to be working with shm of GSB.

(ii) spikes in channels that are power of 2 : this problem needs to be discussed, understood and fixed. SHR has done several tests, including using digital noise source; effect is seen in packetised corr also; checked with offline analysis of raw voltage data acquired through Roach board, and with digital noise generated on Roach board -- appears that problem is seen only in data coming through the ADC path only? further, trying single ADC streams or channels (compared to the interleaved data streams that come normally) still shows the spikes in the streams; slower FPGA clk rate also doesn't show any difference -- it appears to be natively present in the ADC data; to check if the power level of these spikes is constant and how much below the mean passband level; varying i/p power level of broadband noise source at ADC allows characterisation of input power level at which spikes show up; looks like occuring at multiples of 128 ch (for 2K spectrum); to check the level as seen in cross of two such signals -- some test results have been sent by Reddy recently; can take up for discussion, including tests with 2 different clk sources...
To correlate against new results coming from histogram testing by Niruj & Kaushal -- some work needed here -- KDB & NMR to check and report back.
27 May : to cross-check with GSB voltage data taken and put through similar analysis of histogram and spectrum;
17 Jun : tested with two different Roach boards with two different clk sources and corrln is still seen, including when sig gens are not locked to same source.
24 Jun : GSB raw voltages to be read and analysed (at GWB-III).
14 Jul : work has started, can expect some results by next week;
22 Jul : test data has been taken; update expected shortly.
==> tests done with GSB raw voltage data also show some spurious lines -- needs some thinking and investigation about possible causes and issues...

4.5 GPU corr (GWB-III) : next gen system -- from 15 Jul & before (SHR/SSK/GSJ/BAK) : Design and delivery of 32 input (16 ant dual pol or 32 ant single pol) system; uses 8 Roach boards + 8 compute machines (with final 36 port switch) + 4 host machines, installed in 4 old racks & made ready with wiring + cabling complete (c. Feb 2015?); tested with analog noise source; new code with 2 x 10 Gbe I/O + improved logic for assigning specific threads to each core + set-up with environment variables completed (tested for 200 MHz / 8 bits and 400 MHz / 4 bits, 16 inputs and working ok with no pkt loss); modified ferrules were put on cables & GWB-III (v1) has been released with full online control (c Mar 2015); final connections to GWB-II and III can be chosen by the user on the wall panel; confirmed that GSB, GWB-II, GWB-III can ALL be run simultaneously with full online control; updated SOP has been released; basic user level tests have been carried out (DVL) and by and large system appears to be work ok.

Later GWB-III was expanded to dual-GPU version, as it became clear (c. Mar 2015) that existing code for corr + beamformer is exceeding real-time by 9% for full 400 MHz BW for 16 inputs correlation (will become worse for final, 32 input system); options looked at were : 2 K20s per host, double-GPU card, K20 + K40 per host, 2 K40s per host, 32 host machines (with single GPU); agreed to try out 2 K20 option; first results from dual-GPU code (6 May) were encouraging and have led to GWB-III (v2) : 16 antenna dual pol, 8 node system with 2 K20s on each node : total intensity & full polar correlator + IA and PA beams (16K spec chans and 1.3 msec integration) for 200 MHz 8 bits and 400 MHz 4 bits; tested to work ok with equal load between the two GPUs; also ready for testing on 2 K40s -- results may be available soon; issue of sharing between K20 and K40 needs to be looked carefully for the value of the slice and also the drivers for both GPUs working simultaneoulsy. Tests have been done using noise source; now ready to try with real antenna signals (done 4 Jun); GUI development under progress.

Current action items: see also email from BAK on 22 April 2015) :

(i) Various kinds of tests of GWB III (v1) :

(a) basic user level tests : DVL had carried out some tests; pending problems have been call sheeted and will be checked again to see if fixed or not (most are related to upstream systems) -- to check status with DVL, and see if this can be closed.
1 Jul : this can be closed.

(b) to check if new SOP supports flexible connectivity for user -- this required manual editing of the files (explained in SOP), which is not desirable;
2 possible options discussed for getting flexibility in connection : ascii file update or drop down menu -- to discuss with NSR and decide which is easier to implement.
4 Jun : GWB-III ver2 is being debugged for release and it has this feature (tested).
1 Jul : this appears to be working fine
15 Jul : SOP needs modifications (new GUI changes need to be included);
==> completion of SOP (by Nilesh) and multi-subarray testing (Sanjay) are remaining to be done.

(c) testing the 400 MHz BW mode : basic changes to the code for the 400 MHz, 4-bit mode had been done and basic tests were ok for 16 inputs (delay correction also working ok); some pending tasks are :
* choice of which 4 bits to use needs to be finalised (right now it is set for 4 MSbits) : what algorithm is needed? can it be made a user choice?;
* extendng to full 400 MHz BW : computationally, existing GWB-III (v1) does NOT sustain 400 MHz for all 32 inputs -- safe limit is 300 MHz (including beams ON); agreed that making if work for less number of inputs is not worth the effort -- more useful to concentrate on dual K20 option in GWB-III (v2).
1 Jul : except for the issue of choice of 4 bits, all other issues here can be closed.
==> need to test 400 MHz mode with GWB-III v2 and then close this item, carrying forward only the issue of flexibility of choice of 4 bits.

(d) checking of beam modes : all basic beam modes are working; phasing has also been verified; note that phasing will work only if beam mode is turned on (!) -- change has been made in the new code that will be released soon (v2).
1 Jul : this is implemented; will be tested by user upon release.
==> not yet tested, but can be done once v2 is available to user.

(ii) to discuss and agree the various modes to be provided in different releases of GWB-III, folding in long-term planning (to take up from email exchange of 22 Apr and later) : one round of discussion has happened; to finalise the list of modes and the various releases of GWB-III and then put it formally in the Plan agenda -- this needs to be discussed.
17 Jun : BAK to summarise the specific details of ver 2.
1 Jul : for ver2, to make sure that the information is available in SOP or otherwise; for ver3, BAK has discussed with team and will come back with an update shortly.
15 Jul : to be completed in 1 week (22-Jul-2015);
==> updated version has been circulated by BAK; need to see about porting it to the format of a table of modes, as in GSB.

(iii) choice of integration time for beam data (for v1 & v2) : in the original design 128 was default pre-int (on GPU); later, it was made variable (upper limit 1024, lower limit ?) -- needs to be tested, and constraints in the range of parameter choice needs to be established);
17 Jun : 128 can be reduced in v1; in v2 there will be a table giving combination of nch and sampling;
1 Jul : to confirm the situation for v1 and v2; plans for v3 to be worked out.
==> table of possible combinations for v2 has been circulated; lower and upper limits for sampling interval are calculated based on disk writing speed and gulp size; the former needs to be changed to be limited by GPU memory or I/O speed. Also a table about memory usage is available.

(iv) beam data header for GWB-III (v1 & v2) : current status to be confirmed
17 Jun : current plans are as mentioned above under item 4.x
1 Jul : v1 has no header; v2 will have part I header and v3 will have final part II version.
==> no updates on this.

(v) psr_mon and pmon tools for beam data monitoring for GWB-III (v1 & v2) : current status to be confirmed
17 Jun : same version should work; to put final working version in a common place.
1 Jul : real-time version to be made ready for v2 by SSK (see earlier comment also)
15 Jul : work completed; needs testing;
==> ready for release, as per email update by SSK.

(vi) tests with dual K40 system in GWB-III (v2) ?
17 Jun : one of the 8 is running with dual K40 as default; at some point, bench markingcan be done wrt dual K20.
1 Jul : getting the benchmark values is pending.
==> pending.

(vii) tests with K20 + K40 sytem in GWB-III (v2) ?
17 Jun : this is stuck because of driver related issues as pointed out by SHR; can defer till we try cuda 7.0 and then see.
1 Jul : no update.
==> no updates.

4.6 Next gen improvements (beyond GWB-III v2) : targets for Sep 2015 release -- from 1 Jul and before (BAK/SHR/...) :

(i) final range of channels to be handled : GWB-III (v2) will be up to 16K channels;

extension to 32K channels to be looked into (I/O issues will need to be tackled); increasing integration beyond 0.6 can be a solution.
17 Jun : changing integration time may be easier option for now -- to be tried at a later date (maybe after 15 Sep).
==> not discussed.

(ii) new features to be added in next versions of GWB-III code : correction for net_sign[] flipping (LSB/USB modes of correlator); multi-subarray, 4 beam capability; all off-line utilities with backward compatibility; time + DUT corrections; optimisation of code; feature for folding visibilities with pulsar period; PFB implementation; shift to 2 inputs per Roach board.
Some of these can be delayed for some time, depending on prioritites.
26 Mar : multi-subarray implemented and tested, including online interface; needs some more testing for getcmd mode; DUT corrections coded, but not yet fully tested; both of these work upto 32k channels but some testing may still be needed; see also 22 Apr email of BAK and follow-up discussions); to see if action items can be firmed up for this.
4 Jun : for ver 2 : lower beam integration possible, beam header as above, multi-subarray ok; will have off-line utilities, without backward compatibility; DUT corrections will be in; net sign correction done; 4 inputs per Roach used;
for ver 3 : 4 beam capability, visibility folding; PFB
17 Jun : 4 beam and PFB are part of the plan for ver3; to check about vis folding later on.
1 Jul : ver2 items are ok; ver3 items needs to be finalised shortly.
15 Jul : multi-subarray design complete and testing in progress -- appears to be working, but GUI needs improvements (delay & fringe computations etc).
==> email update from SSK : multi-subarray mode ready for release -- SOP to be updated by NSR.

(iii) long-term items like provision for control of FPGA and other peripherals (like sig generator) for different modes : agreed to identify one PC for control of all the peripherals related to GWB; this m/c can / is interfaced to online via a socket and GUI can send commands via this -- already done for loading of FPGA files, needs to be extended for other applications; for other things like turning RFI rejection or Walsh modulation on/off, writing to registers in powerPC would work all right; agreed to start working towards implementing scheme in GUI for taking additional parameters that allow different bof files to be loaded; agreed that these flags need not go into ltahdr but can go in the user log as setting parameters (can also be there in gpu.hdr); agreed to go ahead with discussion with NSR for implementing the logic for allowing support of multiple corr modes that use different BOF files; other action items to be taken up later; BAK to talk with NSR / SSK to work out the time frame for having it in place.
17 Jun : needs to be tried out; can be taken up after v2 is released.
1 Jul : scheme needs to be tried out at some time by NSR, when a bit free.
==> no updates.

(iv) incorporation of DDC : this is important requirement, to be done asap : Agreed to try on one node of GWB-II or GWB-III and get back to earlier situation and see exactly what are the issues. SHR has circulated an update; first part is that it appears that the current realisation is properly implementing a DDC; only the filter BW needs to be decoupled from the decimating factor and do a careful set of tests; in the long run, better filters with sharper cut-offs may be required (can check with nvidia about availability of std library functions for such applications); second aspect is to check about the nature or format of the o/p to

see whether I & Q components are ok for further work or whether we need / can have the real voltage representation of the o/p signal.
new tests still pending; to check about nvidia primitives; to check about I,Q version vs real output possibilities.
26 Mar : independent DDC has been developed by UG and tested and appears to be working ok; to circulate summary of test results to see if more parameter space needs to be explored... test results found OK; note being prepared.
22 Apr : DDC code has been incorporated in 2-antenna GPU correlator and under tests to clear unresolved issues -- see also latest update from UG in May : need follow-up discussion on this.
20 May : email update from UG stating that the mode is basically working -- need a more detailed discussion about the status and plans.
4 Jun : agreed that basic mode is working ok; to check the issue of normalised cross in the stop band region. may not be released in ver2, but should be there in ver3 (Sep release).
17 Jun : bit more testing with noise source; generating proper delay and fringe to be ensured; overlap between data segments for proper FIR operation will be needed; to check total compute requirement.
Need a status update and discussion on the latest situation.
1 Jul : final choice of specific code to be used has been made (between work done by UG and earlier code); porting from one node to multi-node system should not be an issue; still need to test delay and fringe with DDC on; also FIR edge effects at blk boundary to be checked.
15 Jul : Basic DDC completed; Problem : 90% time usgae (with DDC itself ~ 60%); needs optimization;
==> no new updates.

(v) porting from CUDA 5.0 to CUDA 7.0 : to work out a plan for doing this
1 Jul : this needs to be looked at.
==> no updates.

(vi) full beam header : plans to be discussed and finalised.
1 Jul : also needs a discussion.
==> no updates.

(vii) RFI filtering capabilities : for corr and beamformer
1 Jul : needs a coordinated discussion...
==> no discussion.

4.7 Long term improvements (towards final GWB-IV system?) -- from 15 Jul and before (BAK/SHR/...)

(i) further optimisation of the GWB-III code (SHR/SSK) : different optimisations have been suggested and tried and these need to be further refined and ported to the GWB-III code:

(a) optimised XPGU for GMRT (with Vinay of nvidia) : is showing ~20% improvement -- needs to be confirmed and then incorporated; ready to upgrade to CUDA 6.0?; results from R2C vs C2C (with callback) to be finalised and then decide about incorporating.
SHR has done the basic porting of XGPU in GMRT code to GWB-III. Summary : xGPU has been ported and shown to work; gets 20% speed-up overall; but works only in full polar mode (!); other modes need change in xGPU code; output shuffling work in real-time for present time,freq combination, but may not work for faster rates and finer channels... agreed to halt xPGU work and concentrate on 2-GPU per host GMRT

correlator code. No further action on this for now.

(b) another concern is about data ordering at XGPU o/p vs LTA format requirement -- needs to be quantified in order for changes in (a) to be meaningful; note : Vinay has already written the code that does this on the CPU.
Currently using unoptimised routine which will work for about 4k channels; for larger number, optimised version will be needed. See item (a) above.

==> no discussion and no action on this for now.

(ii) trying new ideas like FP16 etc to be discussed.
==> to be taken up after v2 is released.

(iii) Layout and racks (GSJ/BAK) : layout diagram to be updated and long-term plan for racks to be initiated; 3 different kinds of President racks discussed ("cyber", "cool" + one more?) -- to try and finalise after one more round of discussions including RVS (also, check new vendor Jyoti Tech); as an interim, 2 nos of cyber racks ordered with President. Meanwhile, for GWB-III, 4 nos of half-height racks have been used -- two nos are populated with 4 compute nodes each, third one has 3 host machines + 1 extra machine + clk source etc; fourth one has 8 Roach boards + IFB switch; will need to expand this to 16 Roach boards at some point of time -- may need to add one more half-height rack? One half-height rack is available in hand and can be used when required. For final system, present estimate is 5 full height racks housing 32 Roach boards + 16 compute nodes with 2 GPUs each (+ host machines?). Current action items :

(a) For the 2 President racks : first one has been used for putting GSB related spare nodes etc; second rack being used for trying the arrangement for special cooling (with help from mech group) -- tested with 1 kW load and increasing slowly; loading up to 4 kW tested by comparing the temp difference between input and output air (need to compare with unmodified rack); results so far appear to show that there is about factor of 2 discrepancy in estimated CFM rate and AC plant capacity CFM rate. agreed to include the test with unmodified rack and then circulate the report; with 2 AC vents feeding 5 racks (final number), the estimate is that the available CFM may be marginal -- this needs to be resolved against the CFM discrepancy noted earlier; also to explore additional margin the AC system (joint meeting with RVS and team may be useful);
20 May : intermediate update from report of IMH about discrepancy of factor of 2; measurements with the flow meter show that the amount of air flowing into the corr room is matching with the expectations from the AC system, which means that the utilisation of the cold air by the correlator test rack is only about 50%; method of taking in the cold air from the vent to the rack is being modified to improve the efficiency.
4 Jun : some inprovements in results with better ducting of cold air and 2 stronger fans to better pull the cold air -- now reaching 75% of capacity; to test at floor locations far away from the available vents.
17 Jun : at 5 feet away from vent, getting more than 100% (!)
(b) to decide on plans for ordering more racks.
1 Jul : interim report has been circulated; results appear to indicate that for any typical position of a rack in the room, having fans at the bottom near the input of the cold air (and maybe some ducting for the hot air at the top) should be enough for our requirements; to see if one round with more heat load (2 to 3 x is possible) to see the effect on GSB. To try and see if we can finalise the choice of rack soon and start the procurement.

15 Jul : electrical load simulation using 12 kW heater on a rack -- report circulated; report on choice of rack to be circulated in 1 week (22 Jul 15).
==> short discussion : updated report on rack layout etc is ready; can go ahead with ordering of relevant racks from President (slightly deeper than standard rack but is still readily available product) -- to be confirmed and action initiated.

4.8 Procurement of new hardware & accessories required for final GWB system -- from 15 Jul and before (BAK/GSJ) :

(i) purchase of 4 new host machines for GWB III : to decide configuration of host machines (disk i/o to be kept in mind); also to check if SSD is a viable option for recording of data. Investigaiton shows that SSD vs SATA has pros and cons; it may be possible that one class of server may be there that supports both?
4 nos of T620s have come and integrated into GWB-III: 2 are with 16 TB with and 2 with 4 TB -- compute vs host. No pending action items here?
==> confirm disk storage capacity on the host machins and close the matter.

(ii) purchase of remaining compute/host machines (for GWB IV) : PERC card issue needs to be resolved : agreed that we will buy machine that can support upto 12 disks (which means with PERC card) but will have 2 x 2 TB to start with. More disks can be added as needed, and if at all extra slot is needed, PERC can be removed (will support only 4 disks) and backplane has to be changed with a new one (which has to be bought along with the machines);
To decide quantity to order at present : agreed to proceed with 16 nos with full waiver for DELL proprietary item with DELL as the supplier.
Action started to generate the papers; tender waiver is done; and enquiry has been sent -- last date is 30th for the quotes and then tender will be opened.
6 May : sample T630 received from DELL; suitable (CentOS6.5) and CUDA 5.0 loaded and 2 GPU configuration done; 1 dual port 10Gbe card; 1 infiniband card installed; 3 slots still available -- 2 are x4 and 1 is x8 (PERC card is already on the mboard); can test the spare x8 slot and also the 2 x4 slots with appropriate 10Gbe cards.
Power supply problem : not really, as 2 nos x 1060 GPUs did not work, but 2 nos of K20s worked (will be tested with 2 nos of K40s).
20 May : final stages of configuring the T630 for swapping in place of a working T620 in the GWB-III. Meanwhile, to ask for extension of validity by 1 month (from 25th May).
4 Jun : initial set of tests showing that T630 loses packets; tried with lower BW and still getting packet loss; now trying a more recent OS.
17 Jun : still having problems with packet loss; in touch with DELL for resolving the problem; to try T620 with the updated OS; to try T630 in stand-alone mode; may be an issue of NIC card compatibility?
1 Jul : reverse test of upgrading T620 to higher OS has been tried and it works ok; to see if stand-alone T630 test can be tried; to follow-up more closely with DELL.
15 Jul : 'T630 test' continues [packet loss]; no loss observed with x2 10Tb NIC cards (in 1 hour); longer test planned.
==> latest test results summarised by SHR show that there is one working combination using 2 NIC cards that works; to get back to DELL with the test report for follow-up action; to see if we can go ahead with the order, with 4 of the T630s becoming compute m/cs and the rest becoming host m/cs; to check status of the existing folder and decide course of action.

(iii) procurement of accessories like network cards, disks, cables etc :
20 nos of CX4 based dual 10 Gbe cards purchased and tested; to confirm that this order is enough to meet our long-term requirements; agreed to produce a formal

note about the situation for long-term : to relook at the spares requirement without counting the units already being used in the existing systems (including the PoCo and pkt corr) and buy more if needed; GSJ has produced this list and fresh orders to be done, based on this : 10 Gbe cables and NIC cards (spares); 36-port IB switch; 8 nos of K20s.
c. 4 Jun : 8 nos of K20 have come; IB cables and NIC have arrived; IB switch (36 port) has also come and has been installed in GWB-III. Agreed to put in a repeat order for the 36-port IB switch. Check current status and see if any other accessories need to be ordered.
1 Jul : Order has gone for spare switch.
15 Jul : IB switch is expected soon;
==> not discussed.

(iv) new purchase of Roach boards etc : need to have enough Roach1 boards and ADC card; need to invest in Roach2 technology to keep abreast of things; new lot of 12 Roach1, 16 ADCs and 4 Roach2 was procured and Roach1 test set-up was made ready and all the Roach1 and ADC cards above were tested ok; current action items are :

(a) for Roach1 + ADC : summary spreasheet about current stock and usage of Roach1 and ADC created and taken up for discussion; agreed for final configuration of 32 working Roach boards + spares -- to check how many new ones have to be ordered (note : Xport will be missing in the new ones); agreed to go with 1 ADC card per Roach board -- to check how many new ADCs needed.
Confirmed that no new ADCs needed for 1 per Roach board; to order balance number of Roach1 boards.
1 Jul : processing for procurement for balance Roach1 boards (~20) has started; Digicom has confirmed that they will provide.
==> not discussed.

(b) for Roach2 : to check standard test procedure on CASPER; to check if we need to buy add-on mezzanine card; to check if Roach2 can be seen on USB port using Ubuntu and if some basic tests can be done with this; mezzanine cards were needed in order to use Roach2 -- these were procured, allowing work to start on Raoch2 testing.
20 May : Aniket has been working on testing basic things like mezzanine card; 10 Gbe design etc; can now try to see if PoCo design can be ported to this system.
1 Jul : delay in progress due to sharing of PC with host environment of Roach1 & Roach2.
15 Jul : x1 more server needed (to speed up);
==> not discussed.

(c) software environment needs to be upgraded (for working with Roach2) :
Matlab-Simulink upgrade was ordered and installed on one machine (64-bit), including updated license manager (additionl license is for parallel toolbox); Xilinx ISE v14 was ordered, procured and installed; one existing PC was taken for putting new Matlab, Simulink, ISE v14.2; casper tool flow was also installed; LED blinking on Roach1 tested ok; to try PoCo design (may need some changes?) on Roach1 and then go for packetised design and GWB III design; after that, try these designs on Roach2, taking into account the change in architecture.
26 Mar email updates from SCC : CASPER toolflow for ROACH-2 installed; takes a lot of time for compilation of simple ADC Snap design (almost 45 minutes); also PoCo compilation needs rebuilding of design using new casper libraries. Still the toolflow has some freaky issues. ROACH-2 booting environment has been setup and need to test booting of roach2.
Need more RAM on the machine; installed on machine with 32 GB DDR-III and found significant speed-up of compilation -- sharing with Roach-I server machine.

need to identify another server.
1 Jul : agreed to initiate the process of looking for another server; and to try T7500 as an intermediate option.
==> not discussed.

4.9 Testing leakage, coupling and correlated noise in new back-end chain -- from 15 Jul & before (BAK/YG/++) : detailed tests had been done by Vikram Jaiswal (with SSK, SHR and YG) and report has been circulated; for GAB systems, some follow-up action for testing the leakage has been initiated; procedure for testing to be done with GWB-II release modes clarified and tried out -- new tests show significantly different results for cross-coupling for GAB+GWB; maybe due to synth LO (old tests) vs sig gen LO (new tests), whereas earlier tests used synth LO; new report had been circulated that showed significantly reduced coupling; agreed to repeat the original, user level tests done by YG & VJ to see if things are different now ; agreed to try the ADC noise input and north pole sky tests and see what results come out;
2nd round of tests done, show leakage of 2-4% (consistent with first round results of 1-3%) -- to check with SCC whether all user level tests (done earlier by YG + Jaiswal) have been covered; some user level tests done with north pole and different leakage found for lower and higher LO settings -- needs to be understood.
From Aug-2014 : <= 4% leakage; FE+GAB+GWB (L-band) ~ 40% leakage.
Need to organise a detailed discussion on this.
1 Jul : no fresh updates, except maybe to organise a fresh set of tests with GWB-III.
==> not discussed.

4.10 Walsh modulation : prototype set-up on Roach board -- from 15 Jul & before (SCC/BAK): plans of BE team for implementing prototype scheme -- basic unit for switching using sq wave signal from GPIO pin tested ok; was put in PoCo correlator and was being tested; walsh waveform delay functionality was added -- can set delay from 1 to 2^32 clk samples (!); with this, variation of correlation with delay was tested using noise source inputs and found ok; Walsh patterns were put on the Roach board (not many slices needed) -- there was some mismatch between CPLD and FPGA waveforms that was resolved and all FPGA waveforms were shown to be ok; dmodulator on FPGA was implemented; list of targets and action items is as follows :

(i) issue of accuracy of oscillator being used needs to be resolved -- to check if this has been done and item can be closed?
1 Jul : one round of tests to be done with generator CPLD with free running osc.

(ii) to comlete the final delay setting algorithm : to provide upto 500 msec of delay (for 128x4 Walsh length) with resolution of 5 nsec (FPGA clk); there were problems related to varying start-up offsets and fractional delay setting, as well as problems related to set up and hold -- these are now reported to have been resolved : this is confirmed to be work ok and can be closed.
1 Jul : can be closed.

(iii) what about synchronisation of starting? -- this is taken care of by running the CPLD with a sig gen locked to 10 MHz. Can be closed?
1 Jul : this is coupled to item (i).

(iv) to develop and optimise the hunting algorithm :
15 Jul : a version of the hunting algorithm developed - tests in lab done; tests in progress with C1 antenna; it takes 20 minutes to lock; further optimization leads to ~ 10 minutes lock time (is this acceptable); to discuss plans for future.

(v) to demonstrate cancellation of unwanted signals in ADC card and/or GAB;
first, need to run a test where pattern from external source can be synchronised to
the pattern generated in the FPGA -- this requires being able to hunt and correct
for the unknown delay !
1 Jul : this is yet to be demonstrated and is likely to be coupled to item (iv)

26 Mar email updates from SCC : the test is going on with pocket correlator to check
effect of walsh pattern delay on normalized cross. CH-1 walsh modulated and CH-2
delaying walsh pattern by 50uS and check effect on normalized cross. The testing
software is ready and will be tested soon. The design don't take much resources
only 2-3% of fpga. To check if first results from tests are available.
New feature : Walsh pattern generated on fpga can be grabbed on PC and plotted.
tests of correlation change with delay change will come in next few days.

20 May : Actual Walsh patterns show multiple peaks of full correlation amplitude (!);
50% duty cycle Walsh shows only 2 peaks -- this becomes one peak once the sign is
also considered. To redo the 60 Walsh patterns with sign of correlation to check
number of +ve peaks and their exact value.

4 Jun : able to correct the sign problem, but still issue of multiple peaks etc --
needs to be looked into.

17 Jun : hunting algorithm being developed.
1 Jul : coarse hunting with 4 ms step is working; and now trying to refine with
finer steps of inverse of basic clock.
15 Jul : 'finer steps' work completed;
==> first tests have been done with astronomical signal and modulation at FE with
demodulation at BE (alongwith hunting algorithm) -- locsk in about 10 mins; gives
back proper correlation; but appears to drift rather quickly -- need to check the
cause for this.

5. Other items :

5.1 New python assembly design -- from 15 Jul (HSK/SSK) : FE group wants the
python configuration in E6 to be adopted for all antennas -- FE and mech have
dicussed about plans for modified python assembly that will give additional
protection to cables; mech group had circulate a short note on their view of the
matter, alongwith photos; this was discussed and existing vs E6 system was compared;
Action items :

(i) modified E6 design with hinge-like support was installed on C4 (July 2014);
agreed to watch the set-up on C4 and do periodic inspection for checks of (a) damage
to hose (b) hose clamps (c) water entry etc -- first inspection was done after 2
months (mid-Sep 2014) by mech and fe teams; subsequently, inspection was done (around
mid-Nov?) and a video of the same was circulated; scheme appeared to be working ok;
however HSK felt that this scheme with hinge may not be good in the long run -- this
was discussed in detail; the hinge arrangement on C4 is NOT exactly same as the E6
arrangement (!); the C4 design does not completely solve the problem; agreed that
E6 set-up does solve the problem (!); agreed that it can be replicated if needed.

(ii) IGUS cable wrap -- new technology prototype to be developed and tested on
quadripod : a) hose without wire impregnation b) entire hose assembly
(both could be tried as long-term solutions).

Quotes for both items received : item (a) is Rs 10k for 10m (4 antennas); item (b) is 60k each -- will try on the quadripod test range; items received; basic assembly made ready; finally, installed on test range around Oct 2014; tested ok without cabling (video available); then populated with cables by FE team for further testing; proto model made fully ready; this set-up uses a slightly different arrangement of fixed members, along with the IGUS hose; will work as well as the E6 design.

Agreed to : (a) replicate the test arrangement on 2 antennas, one with normal hose and one with IGUS hose (b) to check how much extra cable can be accommodated in the existing hose and (c) look for wider diameter assembly (32 to 40 mm or more).

Email update from HSK : (i) hose procurement in progress under cash purchase (ii) spare assembly with old type hose will be prepared for 2 antennas in time for installation during Mar-April 2015 MTAC (ii) spare assembly with new IGUS hose will be also be prepared for 2 antennas for installation during MTAC (iv) extra hose of 38/40 mm is being procured and assembly preparation is in progress -- will be ready by 1st week of April.

26 Mar : 2 sets of hose assembly are ready for use -- two antennas to be selected : maybe W1 + one. HSK says no scope for adding more cables in existing; wider assembly of 38/40 mm is getting ready -- can go to antenna directly (W4) and add optical fibre cable as a test case.

6 May : 2 Finolex-type hose assemblies (with normal dia) made ready for use in 2 antennas as an improved version of E6 assembly. IGUS hose assembly (with normal dia) 2 units are also ready; agreed to put one of each kind using C4 and W1 as test antennas. Wider hose (50 mm) under procurement -- it is a Teflon based product -- will need to be tested for temperature and then made into an improved E6 assembly and tried out.

26 May (email update from HSK): 2 sets of assembly of Finolex pipe made ready were given to FE group for putting cables etc and returned on 21st May; one set of Igus hose assembly also given to FE group to make ready, and returned on 25th May; now preparing to install on C4 and W1 antennas within a week.

17 Jun : Igus type hose assembly installed on C4 -- had some problems (2 iterations), now done on 3rd iteration with another modification; old E6 design with Finolex pipe will be installed on W1 early next week.

1 Jul : C4 installed and working, but video yet to be made; W1 to be installed soon (wind problems slowing down the work); to wait for few weeks to assess the performance.

==> not discussed.

5.2 Problem of access to FE boxes with 500-1000 CDF feed -- from 15 Jul & before (HSK) : Update on new solution being designed by Mech group -- tested in situ and found working ok; agreed to use this for present; for future where bigger and heavier boxes will come into play, mech group will think of an improved solution, including an option for removing one feed and bringing the stool inside the basket; a few options explored by mech group, with target of 1800 mm height for boxes with max weight up to 150 kg (?), quotes received from some parties, processed and order placed; delivery by end of November 2014; inspection done (in Bangalore) in mid/late Nov 2014; some simple improvements suggested to vendor (guard rail, simple

clamping arrangement for item); platform delivered at GMRT (early-Dec 2014), tested and found ok, including modifications that had been suggested; trials had been happening on ground; ready to test with actual antenna operations -- waiting for new crane to be operational (why can't it be done with the HLPs ?)
Email update from HSK : waiting for RTO registration of new crane to complete. Confirmed that not a good idea to carry it to remote locations in HLP basket; hence, crane has to go (as item is too heavy to be easily handled by humans) !
Crane is now ready for use; to try the test on one antenna with crane + HLP + platform; to coordinate with FE team.
26 May (email update from HSK) : markings made in the basket and making of hole is in progress; after that, can start using on a need basis.
17 Jun & 1 Jul : no upates on this; no progress.
==> not discussed.

5.3 New FE boxes and testing with reflective paint -- from 15 Jul (HSK/SSK) : two kinds of paint received and 1 box will be made ready next week for testing. 6 new boxes are ready as per specifications -- only some engraving work is pending.
email update from HSK : One FE box painted with Luxtrotherm HT 400 (range from 250-400 deg C ?) and handover to FES group for testing. Second grade paint : Luxtrotherm HT 600 (range from 400 to 600 deg C) -- waiting for arrival; 3 types of FE boxes handed over to FE team : (i) plain box with powder coating (ii) box painted with HT400 (iii) box painted with HT 600; waiting for test results.
2 types of paints tried : HT400 & HT600; neither successful; to try new paint options?
Item needs to be discussed jointly with mech and FE to understand why the original selection did not work and what should be done about it.
Agreed to circulate the description of the method used, the results and the conclusions and then take up for discussion and decide what needs to be done; this has now been done by the FE team; need a follow-up discussion.
To cross-check proprerites of HT400 and 600 about reflective nature and what are the other alternatives -- some alternatives had been identified; HSK to report status of follow-up action.
6 May : one product has been identified (summer cool made by excel coatings); sample has been ordered. in addition, modified version of 15m as well as antenna shell cage to be used on 2nd box and 3rd box to be normal box. to try the test this month.
26 May (email update from HSK) : paint material received on 18 May; painted box handed over to FE team on 19 May; first round testing has been done by 25 May and some results are available (to be circulated) -- overall effect may be 3-4 deg improvement...
17 Jun : mech group wants to try with one expt with summercool on top and PU based insulating material (Stopaque) on the inside.
1 Jul : mech group to go ahead with the test after procuring the Stopaque material via cash purchase.
==> not discussed.

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MoM for the weekly Plan meeting of 12 Aug 2015

1. FE & OF related :

1.1 Update on results from test range -- pending from 29 Jul & before (HRB/SSK) :

(i) Tests of ver1 550-900 CDF and CSIRO feeds at test range : new results with VVM set-up, after installation of new encoder + notch filter for mobile band, showed : for ver2 550-900 CDF : reasonable E-H match at 610 and then degradation in shape and matching at 700 & 800; partially supported by older measurements from Dec 2013 (with slightly different set-up). Further, results for dipole-2a & dipole-2b with cone v2 show that the degradation of pattern with frequency is worse for v2a than with v2b; radiation pattern measurements have been done with 50 MHz step & using CW signal; comparison with simulation results is awaited. Current restuls and action items are :
(a) first order comparison of C1 dipole 2B vs C2 dipole 2B measurements : C1 D2B shows better E-H match at 610 ; C2 D2B shows good E-H match at 700; and appears to be decent even at 800, though 3 dB width may be changing; agreed to make plots vs freq for 3 dB and 9-11 dB widths, and for taper of E and H at fixed dish angle of 62.5 to check mismatch in taper, for both the feed versions.
First results from the measurements for the plots of 3 dB and taper values vs freq show evidence for change of properties with freq as well as asymmetry of the pattern (as had been seen in the earlier plots also); agreed to try to compare with results from C1 + D2b (make fresh measurements, if needed).
Repeat tests for C2 + D2b sent by HRB which show repeatibility with earlier results; FE team to check C1 + D2b data and complete the comparison -- fresh data needed to be taken for this (earlier records "don't exist"); radiation pattern tests done for C1 + D2B -- comparison plots to be sent soon.
(b) Phase centre of ver1 550-900 CDF and CSIRO feeds needs to be done -- phase centre measurements for C2 + D2b can be tried at the range.
Waiting for comparision report to be done and then follow-up for deciding next course of action.
==> HRB has reviewed the situation with the existing set-up which is in functional shape; only, they would like to energise the set-up with the transmitter at the further distance (on other bldg) for which optical fibre transmission with temperature is suspected to be a cause of errors, in addition to possible reflections from gnd and nearby objects; will try with sig gen at transmitter (2 persons required) and compare results with one test case.

1.2 Phase centre tests for 250-500 CDF -- from 29 Jul and before (HRB/GSS): to test with 100 to 200 mm height change (around default of 1280 mmm) in 250-500 feed on one antenna to see how much change in sensitivity is seen. Tests done on c6 using feed with shortened support legs of the cone (instead of shortened stool) -- comparison of results for 1180, 1280 (default) and 1380 : 1280 & 1380 show slightly better sensitivity at low freq (250-400) but at higher frequencies they match with 1180 (which is quite flat throughout freq range); agreed to try for 1480 to see if there is a monotonic behaviour; also compare with simulation results of GSS. Consolidated results tend to show that the latest level at 1180 height does show a slightly better response; a final confirmation is needed about the optimum performance from the measurements; confirmed that we can't go below 1080 by further cutting the support

legs of the cone; also, current adjustable stool will not work for 325 MHz face due to welded nature of existing stool; agreed with HSK to reproduce one more adjustable stool with modifications learnt from present experience, and try on one CSQ antenna (C6?) by removing the Lband feed, shifting the cone-dipole with new stool to this face and using the existing 250-500 FE box on it; tried on C6 during MTAC period (Oct 2014), but measurements could not be completed as antenna was required for L-band GTAC observations. Current action items :

(i) Agreed to go back to C8 at a later point of time (after 550-900 measurements are completed) -- deferred for now.
(ii) Meanwhile, FE team to go over all the available measurements and produce a consolidated summary -- this is pending for some time now !
15 Jul : HRB is in the process of generating the note to coordination (to identify which antenna & when adjustable stool for L-band or 610 ?)
==> action items : to produce the summary of existing results for 250-500 and prepare for these tests once adjustable stool is fully functional.

1.3 Theoretical calculations based on NRAO code -- from 29 Jul & before (SC/GP/HRB) :

(i) Phase efficiency computation has to be linked to the aperture efficiency computation (NRAO's eff. program, modified for GMRT specific paramters) : work is ongoing, alongwith Sougata (was expected to take 4 weeks -- till mid-Sep2014); code was being ported to matlab; also, original NRAO fortran program can be made to run to give some initial cross-checks? code had been ported from the C version that student had written to Matlab but results were not matching with expected behaviour; then tried to port original fortran version to matlab (was to be fully done by end-Jan / early-Feb 2015), but had problems in getting sensible results; agreed to try and see if original NRAO Fortran code can be compiled & executed -- this was done ! (after identifying appropriate compiler, making necessary syntax changes etc) and first results were to be circulated by 23 Apr 2015, with first trial for Lband : inputs are E-H pattern at 10 deg interval, plus specific value at 62.5 deg, plus various efficiencies -- mesh leakage and RMS efficiencies (phase eff is taken as unity), plus dish geometry (right now coded inside) including a square piece for blockage; output is spill-over and taper eff, cross-polar eff and overall eff (some are with and without blockage); plan was to cross check outputs against blue book values and rationalise against relevant docs and inputs; later, to extend this for all the other bands for which results are available in the blue book; current model takes the following inputs : mesh geometry, mesh deviation in rms, feed pattern for E & H with 10 deg resln, taper value at 62.624 deg, gnd temp; blockage is hard-coded inside right now (alongwith quadripod legs etc).

Some results were shared (c 17 Jun 2015) :
at 327, the code gives 68.4, 66.6 & 66.4% for 259, 270 & 290 MHz;
at L-band it is 43.2%, for 259 K.

Sougata to produce a note about the usage of the code and the various input and output parameters, and to try varying different parameters to understand the effect on the output; also, check the blockage term inside the code.
29 Jul : note by Sougata taken up in some detail : discussion on the various factors going into the efficiency and temperature terms; agreed that these need to be described in more detail and brought out in a clear note, including drawings where needed (can work jointly with GP); good agrement found for Lband (earlier) and 235, 325, 610 feeds with blue book values; agreed to go ahead with 250-500 system.
==> updated note by Sougata taken up for discussion : clearer definitions of some

of the terms; effective gnd temp : black body + green house effect !; comparison of Tsys and Eff with blue book show decent match (can highlight the differences in the contributing terms; extension to 250-500 done : need better comparison of the difference at 327 MHz; non monotonic behaviour with frequuncy of some of the terms; Sougata and GP to combine their efforts and plan to present a talk of 1 hr at GMRT and then at NCRA.

(ii) calculation (based on reference paper) of expected deflection & comparison with measurements to check if there is significant loss of sensitivity : GSS developing refined version of code that is more relevant for GMRT (to compare with 250-500 or 500-1000 feed data) : cross check of results from code wrt curves from Kildal paper was confirmed (0.3 dB drop for 0.5 lambda offset); for GMRT specific case of 250-500, efficiency factor as a function of freq over the band, using the data for the measured feed pattern, was implemented; after correcting one error in the code, better result (9.9 dB vs 11.6 dB expected) was achieved; further, a realistic phase response (instead of 1.0) was included by reading data from a file; results (reported on 19th Mar) showed better match between measured and expected deflections for the 250-500 system : 327 -- 12.8 dB vs 12.4 dB; 400 -- 12.8 dB vs 12.2 dB; 450 -- 12.4 dB vs 11.4 dB; 500 -- 11.2 dB vs 11.0 dB (some re-work needed for lower frequencies?); computed results (based on change in efficiency due to shift of phase centre) show likely drop in sensitivity by about 1.4 dB from 250 to 500 -- this is now to be folded into the net sensitivity / deflection curves made by GP (see agenda item following this one). Present action items :
(a) plans to extend this to 550-900 system -- was waiting to get measured values from test range; data for cone2 + dipole2b exists; needs to be run through NRAO code to get the efficiency factor -- will happen soon; when data is available for cone1 + dipole2b, same can be done.
20 May & 1 Jul : pending for item (ii) to be completed.
==> this can now be updated based on the earlier results reported above;

(iii) Comparison of computed results with measurements for 250-500 band : initial results for good antennas at 250-500 (other than C6) with default height of 1280 (and for C6 with reduced height of 1080) showed that computed values are actually better at high freq end for 1080, which is different from the observations which are showing droop at high freq for 1080 (in conflict with first results reported above); computed results, which were for 1180 to 1480 in 4 steps, were extended to 1080 & 980 and 1180 was found to give the best response (note : this is for a particular value of ph centre based on range measurements); computations were extended to much smaller values (down to 580 mm) and latest results show a peak in the response around 580 o 780 (!), which are in sharp contrast to the experimental results which were carried out in the range 1080 to 1480 mm and showed optimum performance around 1280 mm -- this needs closer scrutiny of the simulation code and experimental results; with new code, it may be possible to recheck the calculations and then can take up for discussion to rationalise; code is running; but first being used for the cross-checks described above; will go to new 250-500 etc after that.
20 May & 1 Jul : also pending for item (ii) to be completed.

1.4 Comparison of measured & expected sensitivity curves -- from 29 Jul (GP/SC/HRB): Scheme for (re)calculation of expected values across the broad bands to be finalised (and added to measured curves) : curves with constant QH value and variation of T_lna with freq were incorporated; model for the main BPF was also put in; after that antenna efficiency factor (based on measurements with 4-5 points across the band) was added by interpolating the measured values; return loss of the feed was added to the above and the result now matches much better with the data -- all

this was done for 250-500 band; subsequently, the formula was revised to change the constant factor, which resulted in some discrepancy in the mean deflection values, and also some cases where the measued deflection is higher than the theoretical values -- these issues to be understood and resolved; after some cross-checks and refinements (dir coupler loss values, source flux from Baars et al, recalculated constant etc) -- spot value of 13.0 dB at 325 for CasA compares well with 12.7 used in control room; antenna efficiency factor still needs to be determined a bit more carefully -- agreed that both the efficiency terms (which includes default ap eff + phase eff, from measurements on test range) and the RL term whould be kept and the product should be used; some follow-up action items :

(i) cross-check the flux values and get updated numbers with DVL's help :
Around 20 May 2015, DVL had generated a table of 5 MHz apart flux values (covering entire uGMRT range?) for all the main sources, which can now be used by GP in the detailed formula; simple comparison with formula is folded in when comparing with control room values; GP had done a cross-check at 325 with the existing and new value of flux and finds new value is higher (leading to 14 dB expected deflection!); to check one or two more spot freqs (like 610); DVL & ICH have agreed to look into the matter and resolve the broader issues (17 Jun 2015);
15 and 29 Jul : no updates on this matter.
==> from ICH and DVL : finding comparable sky backgnd -- 5 deg away may not be enough for all bands; hence some refinement is needed -- work is ongoing.
Agreed that ICH & DVL to provide the flux and sky temp values (for cold sky and actual background) and FE team to provide all the efficency factors.

(ii) to get clear confirmation about which all terms are included in the efficiency factor currently being used in the calculations. Some results may be available from the NRAO code calculations?; till then the interpolated values are being used.
4 & 17 Jul : remains status quo till NRAO code issue is completely resolved.

(iii) develop the model for Lband : information gathering had been started -- feed pattern (efficiency) at 3 individual freqs available, and measurements available for 5-6 frequencies (?); agreed to work with the 3 pt data, do simple interpolation and see what kind of curve is produced; first order calculation of model had been done, including RL of feed, notch filter alongwith BPF etc -- Sanjit + Gaurav had put the curve for expected deflection alongwith the measurement results to do the comparison, and this was added to the weekly plots; results showed shape mismatch at high freq side of the band (good match with data at low freq end), and an extra bump at 800 MHz; the bump was explained due to combination of BPF and mobile notch filter -- may need sharper BPF cut-off to avoid it; for the high freq mismatch, the best guess at present (Jul 2015) is that the sensitivity curve being used is not realistic enough (though feed RL is included) and inverse calculation of the drop in sensitivity required shows a very steep drop just after 1450 -- this needs to be understood. current action items :
(a) 1 or 2 antennas with response better than theoretical esp at lower edge of Lband -- need to be checked;
(b) shape mismatch at high freq end needs to be resolved (why RL drop + BPF is not enough to kill the response?)
==> not yet resolved; may need detailed feed pattern at 1400 and above for this... to look at Raghu's thesis.

(iv) a note summarising the overall scheme to be generated and discussed : updated note from GP was discussed : this is much more detailed now; need to cross-check :
(a) the variation of Tgnd with frequency -- understood that this is due to the fact

that Tgnd in blue book is a func of Tmesh and Tspillover and hence will be a func of frequency; item can be closed?
(b) add points for existing control room values -- this is done and is closed.
(c) replot with better y-axis resolution -- this is done & can be closed.
(d) 250-500 and 550-900 look reasonable; Lband has some extra features that need to be understood (see details above);
(e) could start looking at 130-260;
(f) to vary parameters for 550-900 to understand the 3 dB droop from low to high -- this has been done and has provided useful information (looks like Tlna may be issue)
1 Jul : updated note has been circulated, including DVL & ICH (YG to follow-up)
==> Sougata and GP to do this jointly and confer with DVL and ICH as mentioned above.

1.5 Total power detector for FE & common boxes -- from 29 Jul & earlier (GP/ANR/SSK): plans for final scheme : 20 dB coupler for CB and 10 dB coupler for FE (at final output) with common 20 dB amplifier (Galli-52 instead of Sirenza); feed-thru vs connectorised arrangement also resolved; after lab tests (including monitoring via MCM channel) in FE and common box, sample units installed in C4 FE box and E2 common box. Some other details are as follows :
For common box : data from 2 units installed on E2 showed basic things working ok: first round of testing showed 11 dB deflection (12.4 dB expected) on Cass-A; later on Crab, getting 5.5 to 6 dB (6.6 dB expected); flat-top on-source waveform was understood to be due to quantisation of step size of detector levels (least count issue); script / SOP created for automated running of tests;
For FE version : 2 units had been assembled and found to give identical performance as per specs; problem of feed-thru vs connector was resolved in favour of feed-thru (as per original chassis design); all testing completed in the lab; first units (on C4) showed problems -- traced to incorrect mapping of channels etc.; new units (batch of 20) that were assembled showed unexpected change in detector o/p due to grounding problem which was corrected (manually) for 10 units and final PCB for mass production was modified for this change; script for automating the observations has been done an released by GP. The issue of RC time constant was taken up, resolved and closed (c. 22 Apr 2015); final report was submitted (c. 22 Apr 2015), with most of the outstanding issues resolved.

The remaining pending action items now being followed are :

(i) To decide upon long-term plan for power monitoring : GP to generate a short note about the proposed scheme for this; some discussions on 11 Mar 15 about exactly what this note should specificy (over and above the SOP); GP produced a note for the procedure to be followed -- need to move to a strategy document for running the program on a long-term basis; meanwhile, Shilpa was identified as the person to implement the monitoring strategy (maybe weekly tests; MCM to be turned ON for collecting data & then put OFF); first version of strategy document was discussed (20 May 15) -- need to add some more details about the strategy : how and why of the test observations being planned, and then give the procedural part; updated version discussed (17 Jun 15) -- looks better and can be released to Shilpa as ver1 for trying out;
29 Jul : This has been done and this aspect of strategy doc can be closed. Regular observations by Shilpa is also going fine -- to follow the progress of that.
==> regular tests are happening.

(ii) possibilities for automating data reading, analysis and plotting also discussed -- GP has now implemented automated program for plotting CB, FE power levels (both chans) and 3 temp monitor values (2 in FE and 1 in CB) in one go from a file

containing data for X nos of antennas is ready; this has been tested with the above data sets; agreed that it is generic but not tested for anything other than temp and pwr; can be generalised for all channels of all 30 antennas but can be taken up at lower priority; also, does not have a user friendly interface; current actions :

(a) agreed that working version of code + SOP to be fully released asap : SOP has been released; GP had prepared a note about analysis procedure (using matlab) -- it was discussed and found basically ok, except for hard coded locations of GP's machine -- this is linked to decision about who will be doing the analysis : FE team to check best way to address this and come back with suggestion.
==> agreed with the team to make the code accessible on one of the common machines in FE lab. GP to work out the procedure and small SOP for this.

(b) development of user level GUI : SSK took up the matter with SN and Shilpa was identified as the person to take care of both GUI development and also ensure regular running of the tests, as per strategy document; matter was discussed and cleared with ICH also (4 Jun 15); GP had discussed with Shilpa about requireemnts (15 Jul 15) and work is in progress for a UI for visualising the data / results -- this can go ahead; after that a UI for creating the obs file required for different test runs can be developed.
==> work is progressing, GP to check and report updates.

1.6 Installing and testing of temperature monitors in front-end & common boxes -- from 29 Jul (VBB/SSK) : scheme for fitting two temp monitors (one for LNA, one for FE box) for tests on bench, followed by antenna tests and installation: lab test with manual readings had been done (showed 15 deg temp difference between LNA body and FE box (open)); work was ongoing to study online data from 3 antennas : W1 (130-260 FE box), W4 (250-500 FE box) and E2 (common box) was tested ok, and some long duration tests had been carried out; meanwhile, C4 & C10 fitted with dual temp monitors in FE box, and C13 with monitor in both FE & CB -- some tests had been done but data was not sensible due to unresolved issues in the wiring of the existing common box units that prevents desired data to come on expected channels in online monitoring set-up ! Agreed to select a few antennas (maybe W1, C13, E2) for proper monitoring after resolving the issue, and for the rest, keep putting the temp monitors and maintain a log of which ones work in online monitoring; later, correct the wiring whenever a common box is taken for maintenance or upgrade (same argument applies for power monitor also). Combined SOP for temp monitoring and total power monitoring was been prepared and released. Current action items :

(i) Analysis of the data : C13 & E2 both channels temp monitor available at online output (fixed for C13 one ch FE & both chans in CB, and E2 both chans in CB); some test data had been taken; also, some data had been collected for 6-7 antennas; first results for ~ 5-6 antennas (LNA + FE box) + 2 antennas (CB) for 3 hr duration shows some basic behaviour but not clear how well things are working; to try two things : (a) to check if any old data of longer duration (from last 2-3 months) is available (b) to try a longer run, even for one antenna like W4 which is under maintenance; some of the short data stretches have been looked at; at least one 6 hr data has been taken; report has been updated and submitted to library for uploading; longer stretch of data and analysis of that is still pending.
Finally data from one long run (on E02) was obtained -- showed decent results for a first attempt : temp of FE and CB following each other; with LNA temp a bit below but tracking (with some delay maybe?);

Current action items :

(a) need more confirmation runs to establish repeatibility -- fresh data taken, but some problems with FE monitor stopping after 1.5 hrs; broadband system was removed from E02, and tests shifted to C13, but had problems with CB temp monitor not available (20 May 15); back to E02 (17 Jun 15), but still having some problems; finally, some useful data from the regular monitoring tests -- 2-3 hrs on 3-4 ants : basic results look reasonable, but there is enough variability between antennas (and between FE, LNA and CB values) to cause some concerns; agreed to keep getting data, including couple of long runs.
15 Jul : One set of data taken for long stretch (on W4) & analysed; results need to be circulated.
(b) regular monitoring can be folded into strategy doc for power monitoring : this was done, with the aim of one hour once a week + one 8-12 hr slot.
29 Jul : one long run data has been acquired; couple of comments for improvement : see if an ambient temp measurement can be included, and cross-check with another run to check LNA vs box temperature behaviour.
==> new long-run not yet available; ambient temp monitoring : Sanjit to help make a standard set-up.

(ii) Other related issues : plans to add monitoring of temp in OF rack at antenna base and also the RF power...
29 Jul : can be kept pending for some time.
==> can keep pending.

1.7 Spare LNAs for L-band feeds -- from 29 Jul & before (SSK/ANR) : we had 32 feeds; 2 were not working (1 has been dismantled for making drawings of new feed) due to lack of electronics spares -- mostly device failures (including some new ones?); some new LNAs were successfully assembled by Gopi and failed feeds for C3,W1,E2 & E5 were fitted with these and found working ok. Also, one spare feed was assembled and installed on W1 and working fine. It was agreed to have at least 5 LNAs assembled and available as spares -- initial lot of 10 was assembled and used up; finally (c 20 May 2015), status quo situation was that 2 fully assembled spare feeds (i.e. 4 LNAs) ready for use, and no extra LNAs available (from old design).
Current action items :

(i) alternate LNA designs : to see if design used for 550-900 can be modified for 1-2 GHz use; to also check the design done by Abhay Kulkarni and see if it can be improved for our needs; design files had been obtained and were being checked by GP and ANR : model files converted to match simulator used by us; component models in software had to be downloaded; also ultralam2000 that was used is not available in the market now; agreed to simulate with ultalam2000 first to check ckt works ok; then concentrate only upto 2 GHz and change substrate to RT 5870 (easily available); simulations matching with original results completed; simuation reproduced ok with RT 5870; trying to tune the design to required specs of gain (30 vs 34), Tlna (~28 or better); in terms of NF target is to go from 0.4 to 0.3, and maybe at cost of reduced BW; Feb-Mar 2015 : now getting close to Tlna of 28-30 across the band; overall gain is also very good ~ 38 dB; but 4 db slope across the band needs to be adjusted (due to some missing feedback in the ckt design?); move from s2p to non-linear model completed successfully -- did not disturb the results; May 2015 : couple of prototype units completed to get a working solution : gain is 28-30 dB (not high enough), Tlna is 28-30 K (bit on the higher side) -- increase in gain may be difficult as it is a 2-stage design (?); 3rd unit was made and after some retuning, achieved some improvement in gain (~ 32 dB now across the band with no slope), and Tlna is 31-28-27-31 over 1060 to 1390, and S11 & S22 are below -10 over the entire band; few more PCBs were assembled (and extra chassis were obtained);

current action items :

(a) to try for improved Tlna
(b) decide for trying out on antenna
==> for (a) some improvement in Tlna reported : 23 to 25 K mostly and 31 to 33 dB repeatibility tested on 3 units; further tuning possible (but need AWR to start working again -- both PC and dongle solutions progressing); to select one CSQ antenna (not short baseline) and put up spare feed with these 2 LNAs and do careful measurement of deflection before and after.

(ii) possibilities for new LNA with Tantrayukt (Yogesh Karandikar) : item was taken up for discussion, following the visit of YK in Dec 2014 : to check if YK has got results from his first prototype for 500 to 1500 and then take the matter forward; some email updates from Yogesh (Apr 2015) -- getting close to fabricating the first batch of the LNAs; also, NDA needs to be completed, and EoI process may need to be carried out -- these are being looked into; 15 Jul : YK has first version of LNA ready for testing and would like to do that at GMRT; visit happened 27-29 July and follow-up action items are :
(a) to fnalise the modus operandi for usage of our lab facilities : can we work out the equivalent consultation time and offer that as a package deal.
(b) to complete the NDA asap
(c) discuss items where we would like his consultancy
==> FE team to work on item (a) and YG on (b) and take up for discussion 2 weeks later.

1.8 Completion of spare L-band feeds -- from 29 Jul & before (SSK/ANR) : Target to have a total of at least 5 (out of 8) working spare feeds (from mechanical to electronics) : 30 antennas had working Lband feeds, but there were no spares, though we had 2 feeds; one unit was assembled back from the feed that was dismantled for making the drawings -- this was completed and installed on W1 (one feed is now in the regular 'maintenance cycling' of feeds); 32nd unit was there in Pune wshop and was shifted back after assembling by mech group and then fitted with electronics; it uses newly fabricated push-type (presss-fit) probes; after 2 LNAs were made ready (see above) this feed is now available as the 2nd spare feed. Furthermore, 6 new feeds were made (via outsourcing) in 2 batches of 3 nos; in the first set of 3, 2 nos had wrong size of horn and had to be corrected by the vendor; all 3 needed new covers as old ones were not suitable; second set of 3 feeds from Akvira : OMT + horn + cover; hence, total of 8 spares CAN become available; note that weight of 3 latest feeds is 18 kg more (72 vs 61 kg) than earlier feeds -- now accepted as 'fait accompli' !

Following issues need to be resolved currently :

(i) having sufficient number of spares : only one spare feed available right now; matter of requirement for 15m feed also discussed : can take the electronics from the existing OH feed and put in a spare feed and give to 15m dish; may need to change filter bank also -- to be taken up when required by JNC (may be in Sep 2015).
==> one working feed still there; 2nd feed will get new LNAs (as above) and will be going up for tests.
==> shortage of post-ampl + phase switch (due to mixer going obsolete) -- substitute device has been identified but it may not work for Lband (due to slope) -- this will work for 550-900; to find few spares in the market (or from our old stock).

(ii) other electronics : sub-band filter bank is the main item missing; it was found that the sub-band filter ckts spares don't work as one gnd line (for switch ckt) is

missing in the films from RRI (!) -- to try with a wire providing the gnding ckt;
alternate is to start using the new design -- this shows good performance for
individual filters, but integrated unit is giving poor performance for selection
of 1280 -- problem with the switch (new make is not giving same performance as
original make) and this is affecting both reuse of old filter PCBs and also the new
design; looking for original make (MACOM) and also trying a different switch (Hitite,
which means new PCB); new PCB designed with Hitite switch (will need additional patch
PCB to convert logic levels; one chassis (for 2 pols) made available for testing;
new design still not working for 1280. After isolating the filter from the switch,
response was found to be fine; found some issue about the layout on the PCB for the
Hitite case and PCB was redone -- received, populated and tested : looks like still
not producing proper results? Finally problem tracked to the amount of grounding :
added a metal plate below and screws to provide additional ground area -- now both
MACOM and Hitite designs are working ! Modified PCB layout being done (for both
cases) -- design sent for fabrication around 10th May; both PCBs assembled & tested
(15 Jun 15) : results showed MACCOM response is better; Hitite is showing some shift
in some of the sub-bands; recommendation is to go with MACCOM;
current action items are :
(a) to check and confirm whether 10 dB extra amplifier for 1390 is needed or not :
detailed look at results show new filter is better in shape (and insertion loss)
but still not good enough to dispense with the extra amplifier at 1390 (1 Jul 15)
-- to check if this item can be concluded and closed.
(b) to assemble sample units for both channels and put on one antenna and compare
with existing system : when new PCBs come (from Argus), will assemble in both
channels (with ampl) and put in one antenna.
29 Jul : work in progress.
==> filter is assembled; need to add the 10 dB amplifier and test; may be ready
for putting on antenna by next week; can check after 2 weeks.

1.9 Testing of LBand wideband systems on 30 antennas -- from 29 Jul (SKR/PAR/SSK) :
(to maintain a proper log of action taken on individual antennas during these
tests and debugging activities); data being taken fairly regularly since June 2014;
issues being looked at and their histories are as follows (some of these are dynamic
and keep changing as problems occur and are fixed and new ones pop up) :

(a) antennas with poor deflection overall : C1 in early 2015 (cable problem); C14
slightly low (1 dB) (Apr 2015); C3 slightly low & W4 one chan not working (May 2015);
C1 both chans 1 dB & C11 ch2 (Jun 2015); see action items below.

(b) antennas with deflecton changing over the band (less at high frequencies) :
checked if pointing offset can explain this -- not found relevant; was shown that it
happens for cases where the RF power level (at laser input) is too low -- confirmed
with a more careful set of tests (and plots) for few selected antennas (including
make good ones look bad by increasing OF attenuation), and demonstrated in deflection
test report of 11 Nov 2014; to check if appropriate reasons for low power levels can
be identified.
Mar 2015 : S4 had low power for long time -- was solved with change of RF PIU in
OF system (!); C8 ch2 being investigate; problem seen for E6 but power level is ok;
Apr 2015 : OF attenuation needed to be changed from (default) -20dB to -11dB for
a few antennas (eg W1 ?);
May 2015 : low sensitivity in C3 shows this kind of slope across the band in deflection.
Jun 2015 : E6 is now added to this list (C3 was not available) -- to check with JP
about pointing related for E6; go backwards in the record to check when C3 problem
started;

see specific action items below.

(c) antennas with improper off/on bandshapes : low power level or excessive slope
e.g. W1 (was there for several months); C4 and W6 also;
Apr 2015 : cable faults found (& rectified) in C4 & W6; Mar2015 data does not show
Jun 2015 : W4 showed problem in 1 chan : was due to splitter and now fixed; W1 feed has been replaced by spare unit and slope is seen in the LNA of unit brought down -- one LNA has been retuned, second one is being done; C2 also shows this problem -- will do in-situ tests to check the cause;
see specific action items below.

(d) antennas with ripple in the band (this is mostly due to cable problems or loose connectors) :
Apr 2015 : C3 & C12 showed problem -- traced to loose connectors (after tightening they are OK); and Mar2015 data does not show any major problems.
Jun 2015 : S6 showd ripple; maybe cable problem? gone in Jul 2015 : may have gone away due to tightening of connections?
see specific action items below.

(e) antennas with significant RFI in the band :
some possible lines are (full set of known lines now given at end of test report):
airport radar : 1030 and 1090 (3 MHz BW)
GPS signals : 1176.0 & 1176.45, 1191.80 & 1204.70 + some at 1280 (will need predictive algorithm)
mobile signals : rejection is not equally good in all antennas -- needs to be checked.
unknown ones : 1137.5 (distance measuring equipment in aircraft?); 1320, 1470-1480 (maybe related to 4G), something near 1540.
see specific action items below.

Current action items :

(i) there is a good data base from sometime in 2013 onwards -- can we have a well-defined algorithm for comparison of different data sets and getting statistical conclusions? -- to look at developing a tool for this; a basic tool was developed : overplotting of on and off is possible and clear patterns can be picked up. To check for next level of sophistication of the tool. Tirth has started looking into things; expect some feedback from him by end Aug.
==> new pie-chart records showing different types of failures over last 3 yr period; need to cross-check the numbers it is showing...

(ii) learnings from the latest data :
dat from 22 July, shows a few (2-3) antennas with low deflection e.g. C1, W4 (feed replaced); C1 needs to be investigated. Some antennas (C11) showing some extra RFI; also, one line seen at 1137.5 -- suspected to be distance measuring instrument on aircraft. Antennas checked for strength of mobile signal received : C9, C10, C14, E2, S1, S3, S4 and W5 show higher than -20 dBm in single carrier power level.
==> new data taken today (12 Aug) -- not yet fully analysed, but results discussed in brief: quite a few antennas are down; quite a few showing poor deflection, and sloping with freq : C03, E03, E06; agreed to follow-up at least one or two of these (C3 and E6) to track when the problem started and to check OF vs FE and then decide follow-up action.
C1 very low, C2 no deflection -- these are being looked at.
1180 1230 MHz lines seen predominantly in these tests (to checkf if both are GPS).

1.10 Characterisation of recommended attenuator settings for different bands -- from 29 Jul and before (SSK/AP) :

(i) values had been given for Lband, 250-500, existing 610; only 130-260 / existing 150 was pending -- this was also completed (appears that 6,6 may be the best value); note to be circulated soon (Sanjeet + Ankur); matter got sidetracked for some time due to problem of OF attenuation settings not working properly for some antennas; was taken up again on 22 Apr, with a discussion on the latest version of the SFA for OF system (including a part which has combined analysis with FE system) -- has lot of useful additions made, including recommended attn values for Lband, 250-500; however, recommended attn values for 130-260 and 150 still need to be worked out and reported; bandshape measurements with 0,0 attn compared with expected values from SFA report (-24 dBm over 130 MHz BW) leads to likely conclusion of 10,10 as the optimal choice -- needs to be confirmed and finalised.
1 Jul : repeat tests confirm the values above and 10,10 looks like the optimal setting; note to be finalised (side issue : quite a bit of RFI lines and variable on different dates -- RFI team to look into it).
29 Jul : note has been finalised and submitted; to check if item can be closed.

(ii) FE team to test the power levels at OF o/p and cross-check against SFA values : for 250-500, this has been done and results incorporated in the updated SFA report; for Lband the exercise is ongoing (antenna to antenna variation is a major issue); can be done now, as Lband is relatively stable now; was done by Ankur in a report back in July 2014 -- discussed and suggested to add a few refinements of the statements used (for 250-500) and add an explicit entry in the table; further to compare for each sub-band of Lband using realistic cable loss value for each sub-band (this can then be done for 250-500 also, if found significant). Updated version of report to be produced with these modifications; first part (for changes related to 250-500) has been done; waiting for measurements at Lband to be completed; some work has been done by Ankur, some work has been done by Imran to characterise FE, and SFA report also has measurements of cable loss; calculations have been done; need to cross-check with measurements; waiting for report to be finalised, after some internal feedback. Meanwhie, contents of updated report discussed (see item above) -- to check current status and see if this can be closed with formal release of the report.
Just pending for item (i) to be completed and updated report to be released.
15 Jul : 150 MHz also included & report circulated; to check current status & plans.
29 Jul : report has been submitted and matter can be closed.

1.11 Switched filters at different stages of receiver -- from 29 Jul & before (SSK): 2 main categories of switched filters are needed : (a) switched filter banks inside FE boxes (these are mostly covered under agenda items of the respective FE systems) (b) switched filter banks in rx room for additional, selective filtering of the RF signal before it goes to GAB system; (c) monitoring set-up in rx room (at o/p of OF system); these are being designed using the new switches : 2, 4, 8 way switches with different possible configurations;

Current action items are as follows :

(i) for rx room monitoring at OF o/p : note that these circuits are connected to the nonitor ports of the OF system; first design did not give enough isolation at highest freq of operation and hence new design was done; ckt for 2:1 and 4:1 versions was mdae ready & tested -- 25 dB isolation achieved; drops to 17 dB with frequency for 8:1 switch -- now getting improved rejection : better than 25 dB below 1 GHz;

goes down to 16 dB above 1 GHz; the leakage between the signals with this switch is still unacceptable; trying another switch (MACOM make) which terminates unused inputs while selecting the desired input (will be used in the final 30:1 monitoring system), and gives 40 dB isolation; new switch + modified design with additional isolation switch and power supply isolation done : achieving 35 dB at Lband and more than 50-55 dB at lower frequencies, with all channels powered; will be tested in monitoring system for 16 antenna set-up. 8 antenna system completed and under test; appears to be working ok; assembly for 16 antenna system is ongoing; components are available for full 64 input (32 antenna) system.

Current action itesm :
(a) to look at test results of 8 antenna system -- especially the isolation results :
Around 20 May 15 : isolatio numbers (at 3 spot freqs) ~ -40 db to -35 db for adjacent ports and ~ -40 to -70 for other ports; lab tests on integrated system (15 Jul 15) show 35-55 dB; to check if it holds for 16 antenna system.

(b) to do an additional test with signal injected at Tx i/p at antenna also :
done finally (15 Jul 15) and demonstrated to give 35-55 dB isolation.

(c) to completed 16 antenna system (4 units wired and ready) : initial system made ready (20 May 15), showed ripple in one of the 8:1 units; later (17 Jun 15), there was problem of dip in 1390 region that required additional grounding in relevant part of the ckt; by 1 Jul 15, had good results for 14 antennas, but still some issues related to driving of digital lines...
15 Jul : above problem persists; need to increase fan-out capacity by improved design;
29 Jul : work in progress; to wait and see.
==> fan out problem solved; 16 antenna system completed; now adding 8 more.

(d) to summarise the design in a note -- work yet to start?
==> to aim for a basic report by next meeting.

(ii) for rx room switched filterbank : prototype system was been developed; tests were done and performance found ok; report describing the design and characterising the performance was produced, circulated and discussed (22 Apr 2015) -- was in quite good shape, with results for different filter combinations. Final version was sent to Dongare by Ankur around 20 May 2015. Pending issue is about availability of space in rx room for housing these units -- agreed to keep this pending (on low priority) till final requirement for this system is clear.

1.12 Finalisation of 550-900 FE box -- from 29 Jul (IK/ANR/SSK) : to produce a block diagram for the 550-900 FE box; then to start seeing which units are ready, which need to be done; which may need to be combined into single units etc; roughly same number of components as 250-500 box, slight difference in the arrangement of notch filters; size of sub-band filter chassis will be different; agreed to start this layout work in paralle with the work on common box layout -- Imran+Ganesh looking at it, with Bhalerao's help.
Current action items :

(i) to confirm if block diagram of updated system is available : existing version to be given to Imran for producing updated version -- check if ready (now pending for a LONG time !!)
4 Jun : first version of blk diagram presented : generally ok; includes separation of FE system into 2 boxes; issue of noise source splitter -- needs to be in the main box and hence 2 cables are needed for sending noise o/p for LNA box; also, the

post-amp + 2:1 RF switch (before it) + RF on-off switch (after it) need to be integrated into one PCB -- will take some time.
17 Jun : no specific action items related to blk diag -- can be closed.

(ii) dir coupler not available -- being designed fresh; 2 options done and PCB sent for manufacture (to Mohite, then changed to Argus); first tests without chassis look ok; tests with chassis for 2 designs (with different substrates) : one design is better in terms of insertion loss (~ 004-0.06 vs 0.06 to 0.08) and variation of coupling over the band (3 dB vs 6 dB); selected design to be tested with noise source + LNA + feed load in the lab.
4 Jun : integration could not be done as the first version hood is not big enough; agreed to complete antenna tests with this frist version (without noise coupling) and check later if dimensions of hood can be increased; fall back option is to use the 2nd coupler whose size is smaller. To check current status of this.
17 Jun : favoured option is to increase the height of the hood by about 2-3 inches to accommodate the dir coupler.
1 Jul : request for new version yet to be given to w'shop; other chassis required are already in process in w'shop.
15 Jul : height of the 'hood' (QH, direction coupler) : remains to be designed;
29 Jul : waiting for one pair of chassis (with type N connectors) and modified hood from wshop; also 2nd FE box has to be made ready (2 are being made ready).
==> chassis with type N connectors has been assembled alongwith new hood; FE box in DC wiring stage; will get done this week and should go to antenna (E02) by earlier next week.

(iii) sub-band filter : chassis (only unit) was given to w'shop for mass production needs (!); current status : all the chassis for 30 antennas have come; this is complete and can be treated as closed (20 May).

(iv) noise source (with attenuators) : right now using the unit from 250-500 system; need to check if same noise diode will be used or changed -- likely to be changed; but same ckt and PCB and chassis can be reused; prototype yet to be made.
4 Jun : prototype (with different noise diode) is ready and needs to be tested on the bench with suitable LNAs.
17 Jun : prototype unit LNAs gone with hood to C10; this test will be done with the next set-up.
1 Jul : waiting for new unit (with updated hood to be ready) + LNAs.
15 Jul : noise source under mass production;
29 Jul : this appears to be going smoothly, and can be closed.

(v) post-amp + phase switch to be combined on one PCB + chassis that matches with size of Lband post-amp + ph swtich system and RF on-off will be added to it; proto yet to be made (see discussion earlier).
17 Jun : PCB layout is ready and will be sent for fabrication shortly.
1 Jul : PCB sent for fabrication (to Techno Ckt).
29 Jul : some PCB has come but not both sides that are required; this will hold up integration of box #2; agreed to go without RF on-off, using the Lband unit (same as done for C10 box).
==> Lband unit is with the new device (see above) which needs to be tested (by Sougata) and then integrated into the current box being assembled; still waiting for mirror image side of the PCB.

(vi) plans for split FE box (if dir coupler and QH + LNA has to be close to the feed with short cables) : prototype unit (with proper protection against water etc) is

available; can be put on the final feed (once confirmed) and tested during monsoon; to check current status of readiness of this.
4 Jun : planning to put on C10 by 5th June for initial tests.
17 Jun : unit has gone on C10; need a few deflection tests to be done alongwith beam width measurements and then decide which way to proceed.
1 Jul 2015 : this can be taken to be closed.

(vii) main FE box : prototype is now ready and demonstrated -- looks in good shape; testing to start shortly; prototype of DC + LNA combo with feed will be ready in 2 weeks time (by 20 May).
20 May : DC wiring is completed; RF routing work is going on.
4 Jun : this is completed and will be tested on the bench with the hood today and go to C10 tomorrow (5th).
17 Jun : this box is working ok on C10 and the design can be taken to be the final version, except noise injection connection is not made and tested to the hood.
1 Jul : just waiting for unit to be assembled with new hood and tested on the bench and then the item can be closed.
29 Jul : one completed and sent to C10; 2nd and 3rd getting ready (see above).
==> 2nd one is getting ready, in DC wiring stage; 3rd one will be taken up after that.

1.13 New filters for Lband -- from 29 Jul & before (ANR/SSK) : Sample Lband full-band BPF had been designed -- has no slope with freq and better insertion loss, and maybe a better option than the existing main BPF; similarly, prototype design of new sub-band filters (with better insertion loss) has also been done. Detailed results for the main BPF shows that the BW is slightly less than existing BPF : 500 MHz (965 to 1465 MHz), instead of 590 MHz (890 to 1500 MHz) -- this gives better rejection to mobile band signals, but has implications for final usable BW of L-band system; furthermore, an improved notch filter has been designed for the 850-950 mobile band (-60 dB vs -45 dB at 900 MHz), alongwith a LPF for cutting off the 1800 mobile band has been designed -- 3 dB cut-off freq of 1650 MHz. The matter was presented to the users in Friday meeting on 9th May 2014, and it was agreed to generate a note about this proposal, for clearance in the GSG. This was done and matter was discussed in GSG of 13 Nov 2014 and it was cleared to proceed on the following: new BPF + mobile notch filter to replace existing filters in FE box; LPF to be put in common path at antenna base as a common facility for all bands; to be taken up as a case-by-case replacement job, whenever a unit comes down for some maintenance work. Meanwhile, plans for mass production need to be worked out.

Current action items :

(i) status of mass production :
(a) for the LPF : 10 units of 1650 LPF have been fabricated out of 40 PCBs available; PCBs (stripline) do not need much work for assembly -- can be given for manufacture; new chassis will be needed; PCB order for 70 nos can be sent using existing eps10 board; both pols can be combined in one chassis requiring 35 nos only -- drawing to be finalised for rail-type chassis; to check if existing chassis can be re-used;
15 Jul : PCBs to be ordered; of the x30 PCBs in hand, x8 used for Channel-1 of x8 antennas;
29 Jul : 10 are completed; can go ahead and do more antennas and both channels.
(b) for the main BPF : PCB + chassis for new BPF ready for 40 nos (30 antennas + 10 spares) -- this can be closed.
(c) for the new notch filter : 60 nos had been made (PCB + chassis) of which 30 have been used in existing system; waiting to order more -- to check status and see if it

can be closed.
29 Jul : all 60 ordered and received and matter can be closed.
(d) to include these items in Ankur's spreadsheet : Lband new filters now included (BPF is completed); sub-band filters TBD; to check current status.
The above appears generally ok, except for sub-band filter in spread-sheet; to check latest status.
17 Jun : spread-sheet has entries for the sub-band filters; to check if any further action needs to be tracked here.
1 Jul : updated spreadsheet has been circulated and it contains the new information; plan is to transition to a web-based tool for long-term tracking of progress of various filters.
15 Jul : the spreadsheet is now available for online viewing;
29 Jul : this appears to be ok and can be closed.

(ii) status of installation :
(a) agreed to put 10 nos of 1650 LPF in one channel of 10 antennas which have 250-500 broadband system installed; waiting for chassis; meanwhile, 1650 filter was put in one poln of C10 on a trial basis; appears to remove the 1800 mobile signal and does not appear to affect other bands; shows about 0.5 dB insertion loss; agreed to put available 10 nos in ch1 of 10 antennas. Now done for C4 & C10 (?)
3 antennas done (to confirm which ones) -- target to do 10 nos of CSQ.
17 Jun : installed and to be left for some time for user feedback.
1 Jul : installed in 7 antennas so far -- list to be given to NSR for updating the webpage; watch and wait for some time.
15 Jul : 1650 LPF : now x8 have been put on antennas;

(b) also agreed to move the 70 MHz HPF to just before the signal enters existing IF system (instead of just after the signal enters the ABR cage) -- to check the plans for mass implementation of this. now done only for 1 antenna (C4) ? Need feedback from ABR team?
Discussion with ABR team did not converge as planned; right now, LPF and HPF put in series and put on top of the rack.
17 Jun : nothing new can be done here and hence this can be closed.

2. RFI related matters :

2.1 Discussion relating to Industrial RFI survey -- from 29 Jul & before (PAR/SSK) : revised docs (from 2009 and 2012 discussions) had been circulated by RFI group and were discussed in 5 June 2013 meeting (is the document too exhaustive?); new survey planned with main aim to generate updated database which will be useful to pinpoint likely hotbeds of RFI in the industrial areas in addition to finding those without NOC; after months of planning and discussion with DIC, was finally conducted during 23-27 June with 4 teams; covered Ambegaon and Junnar talukas ~ 40-50 villages in each; ~ 40-80 working industrial units (large number are closed down or never existed!). Some of the progress is as follows :
A form had been prepared for use in the survey and had been discussed in detail and agreed that it is suitable for use; about 70% of existing data had been entered into this form; agreed that this activity would be superseded with making a database of equipment and NOC record for the existing industries found in the survey; this data entry now completed for all 3 regions : Junnar, Ambegaon and V-K industrial estate; some highlidhts from the database : of the total list, a significant number of industries are closed down, and another significant factor are no longer traceable; about 1/3 of the original are still working (ignoring poultry which is about 1/4, but

is considered RFI-friendly). A follow-up meeting with DIC took place on 30th Sep 2014. Summary is as follows :
a. To maintain proper record of the data of existing and future industries in the same format. The data format and data base was shared with them during the meeting.
b. Complete list of the villages in Zone I to Zone IV is submitted to them, based on which they can decide the issuing of NOC for industries in different regions (and also outside?).
(c) DIC to issue NOC to the old units which are working in the GMRT identified zones, with guidelines from the GMRT

Matters had been stuck for some time due the issue of payment to DIC team for some of the expenses incurred during the survy work. This has been resolved, following the meeting between PAR + JKS and DIC office, on 27 Apr 2015.

Also, we don't have formal declaration of "no industrial zone" decision -- need to find a way to formalise this.

Some of the present action items are as follows :

(i) To cross-check the list against the ones which have NOC, to identify those which don't have NOC and initiate appropriate follow-up action :
(a) identify those operating without NOC clearly in our database -- Govardhan, sugar factories near W6 and S6, old unit of DJ exporst, any more? is the final count available now?
(b) to approach DIC to work out a procedure for issuing NOCs to such old units : DIC will be sending the standard form to them, and it will come to us for clearance; we need to be careful about to whom we say "yes" in retrospective manner, so as to avoid setting up a precedent of giving NOC to somebody with wrong kind of equipment already installed & running ! Possibilities for improvement can be suggested to them. Some work to start on this by NCRA giving a first list of names to DIC for initiating action.
29 Jul : meeting with DIC last week (with JKS) : docs about 30 km zone handed over (formal doc from Mantrayala to be obtained by JKS later); data about villages within 30 km zone also handed over;
==> email update from PAR : The NOC related to old units Govardhan, Sugar Factory and Overseas Exports Ltd (Near D J Export Ltd.) were discussed with DIC officials. The same will be discussed once again during visit of Mr. Dekate to the GMRT. The date is not finalized yet.

(ii) Related topic : units that have NOC and grow in size to exceed the norms -- what is to be done. One unit just under 2 km away on highway -- should be told "NO" and see if he will shift beyond 2 km. Also to check if our norms can be tightened further for differentiating between less harmful and more harmful industries -- to check the procedure used for establishing the norms.
17 Jun : records show that one unit located at 1.93 km was given clearance (2009) for a serum making plant.
29 Jul : item discussed in detail about possible options for moving beyond 2 km : to shift sub-station + genset to 100 m beyond 2 km limit and put underground cable from there to supply point, and test by GMRT team before final NOC.
Letter to be sent to DIC with this feedback.
==> email update from PAR : The corresponding draft letter was sent to the director with all possible suggestion to move beyond 2kms distance.

(iii) To follow up with DIC about single phase welding units : they have requested

letter from GMRT to collect information from users around GMRT antennas; after discussion with NCRA admin (ABJ + JKS), agreed to follow 2-pronged approach : send letter to DIC authorising the survey, and also approach gram panchayats to collect the data; letter delivered to DIC (mid-July); to check if action initiated with gram panchayats.
29 Jul : discussion about collecting information from gram panchayats about other, smaller unauthorised industries (e.g. welding units) -- discussion with new person who will visit GMRT in the near future.
==> email update from PAR : We are waiting for the visit of Shri. Dekate (DIC) to the GMRT, during which it will be discussed.

(iv) during the survey, some units which are likely to be important from RFI point of view have been identified for detailed studies later on -- some work can start in parallel with completion of database, beginning with the bigger units; measurements (using LPDA) for 2 big industrial units in Junnar & Ambegaon area completed; no new ones have been done (about 10 more need to be done); results for the 1st two have been analysed & no strong RFI is seen other than the ambience due to powerlines etc. To check current status of this.
1 Jul : email update from PAR : regarding measurement of rfi from bigger industries other than two still pending. In the mean while we have visited transformer installations for power line interference measurement.
email update from PAR : presently we are visiting transformer installation site on the west arm. After completion of the work we will start industry related RFI measurement.

(v) To try and formalise the declaration of 'no industrial zone' around the GMRT : to request JS(ER) for help ? Can be brought up in the NMB?

2.2 Transformer RFI revisited -- from 29 Jul and before (PAR): Team has been doing a check on transformer RFI and the updated results from this will be available soon -- will need to see how this compares with the earlier round of this work.
Comparison of old and new data is in progress. Only 6 locations are common between new and old data (!) -- many new installations are coming up ! No clear conclusions have been drawn from the study; also more data needs to be taken to cover a larger number of transformers -- to wait for an update from RFI team.
20 May : some of the old data has been found (2005-06 & 2006-07 surveys) and there is likely to be some more data from 2008-2012 period -- to fill up the details properly; to try and extract the following : (i) typical time constant for failure / malfunctioning of a xmer and (ii) most common types of RFI problems : fuse links, bad transformer, cut joints...
4 Jun : older data have been found and are being added to a combined data base (old data were upto 2 km and new data is upto 1 km only -- but has more transformers !); one unit near W1 may need urgent attention -- to get the history of this and initiate the action.
17 Jun : still waiting for consolidated report! meanwhile, electrical has initiated action on the urgent case near W1.
1 Jul : updated transformer related data will be sent out in next couple of days; work has been initiated by electrical with MSECTL for W1.
15 Jul : Older data needs to be added to already tabulated [2006/7; 2007/8; 2015]; current table shows 37 out of 58 transformers show problem in 'fuse link'; to decide follow-up action.
29 Jul : all data is now combined into one spreadsheet; there is still significant non-overlap between old and new coverage -- agreed to cover some more of the ones done earlier; also start looking at the worst problems in the new data.

==> electrical team is first checking and fixing our transformers and then will go for external ones; some difficulty in getting cooperation from MSECTL for ext locations (even W1 problem is not fixed).
additional email update from PAR : On the west arm 65 transformer location are completed for west arm near W04,W05, W06 antenna; and 20 transformer installation near S01 and S02 antenna site. The analysis of the data has not been done due to antenna work in the GCC duty. It will be done in the next week.

2.3 RFI from air conditioning systems -- from 5 Aug (PAR) :
RFI from new Air Conditioning system (VRV) at NCRA building has been measured [at 3-m distance from x1 & x3 compressor/(s)]; need to compare with RFI from single AC units e.g. in antenna shell, in GMRT main bldg etc.
Need a joint discussion with electrical to move the issue forward.
==> agreed to examine what can be done with the canteen annexe AC units for isolating the digital control circuitry and then conducting controlled tests;

2.4 RFI testing of LED lights for GMRT labs & building -- from 29 Jul and much before (PAR/SSK/RVS) :
Electrical group has indented for 5 W lamps + X Watt tube lights (after samples had been tested for RFI and cleared) -- delivered units had 5 W and 7 W lamps; the 7 W lamps were found to generate RFI (not to be used at GMRT); tubelights (50 nos?) also failed the test; hence, only 5 W bulbs found suitable ! RFI testing of mass installation was also done and found ok; agreed to install in canteen as first location; these were checked for RFI after about 6 months usage and found ok; thence, cleared for mass procurement and installation in different locations; 30 nos of the original 50 nos of 5W LED lamps were installed in corridor & lab areas; indent was raised for additional quantities; these were delivered (how many?), and this new batch was tested for RFI as per earlier procedure and found to be ok; additionally, RFI team tested the units that have failed in the first 6 months or so of use -- these results are covered in the latest report, wich summarised 2 yrs of tests -- no RFI found from partially or completely failed units being powered on; agreed that report can be given to interested vendors for improving the products; sample batch of Syska make tested and found NOT ok.

Current action items :
(i) to confirm current quantity purchsed and installed : 50 nos purchased (and installed mostly in the corridors); an additional 200 nos have been received last month (Feb 2015); plan is to put them in guest house rooms, hostel rooms, guest house corridor, and labs as per choice of users -- almost all are used up; agreed that 200 nos more can be ordered; checking with party for single batch supply (ok);
4 Jun : indent has been placed but not yet in order phase.
1 Jul : still in processing phase (!).
==> order placed; delivery expected in next week or so.
(ii) light from 5W units is not sufficient at some locations : to try to have arrangement for putting 2 units in parallel on same connection (for more Lumens); fixture is being made ready (abandoned) and now looking for off-the-shelf options? to confirm current status.
4 Jun : electrical team yet to find a product that meets the requirement.
1 Jul : could not find complete off-the-shelf solution; now trying for some hybrid.
29 Jul : work is in progress and two sample units have been made.
==> still trying to get the final reflector into the design; sample unit to be installed in canteen annexe.

(iii) do we need to worry about failure rate of the units? (~ 10 have failed so far);

agreed to wait for the statistics from the present lot of 200 (looks like it may not be a serious issue ?) -- need to wait for new stats to become available.
4 Jun : agreed to work out a scheme of keeping track of the failures -- need an update on this.
1 Jul : electrical to maintain the statistics.
29 Jul : no new action right now.

3. Operations :

3.1 Mass production of shielded box for MCM cards -- from 29 Jul & before (SN/CPK/HSK): RFI test report of Akvira vs Physimech showed Akvira is better and this was selected. Testing of new MCM card in shielded box, with final configuration was done and report was very positive, and it was agreed to go ahead with the mass production of this shielded box; RFI group to complete 2 more prototype units and then hand over matter to Ops group, which was to discuss with RFI and Mech groups to get all the inputs and finalise the plans for placing the order on Akvira : drawings for 2 types of box : with & without provision for SPI port on chassis + 1 serial port on each box; parts list for RFI shielding materials to be ordered; list of possible vendors etc; Final target is for 60 + 10 (spares) shielded boxes; was order sent for 70 nos, with one prototype to be delivered first, and batch-wise delivery after that; sample box of Rabbit + switch + media converter + Miltech PC combination was tested on 4th Dec 2014 : results match with earlier tests using prototype units.
Two minor points conveyed to vendor : size of one of the opening and assembly of the side plates. Finally, 70 shielded boxes (for Rabbit MCM) were delivered; agreed to keep them in storage and use as needed; for procurement of the RFI material and components, list was prepared and confirmed with RFI group and indent ready (total cost ~ 33 lakhs (including items for shielding of the switch?) with line filter included (?) ; to check current status of indenting and ordering.
enquiry has gone (combined for both items); quotes have come on the higher side : problem with total now exceeding 25 lakhs whereas the original indent did not!
to investigate the reason for the increase in costs (look like 2 items may be the culprit?); to try to split into 2 equal parts, with repeat order, after checking with party about holding the prices.
20 May : recent clarification from the party is that 2 of the connectors (which are needed for bringing in DC power) have costs increase of ~ 7 x (300 $ each for a pair); modification suggested is to use the normal data connector for bringing in power (15 V, ~ 1 Amp) -- can parallel all available pins; can check with vendor and then put modified purchase order, dropping the 2 connectors.
4 Jun : going ahead with the scheme of getting power from normal data connector -- test set-up needs to be made and run for some time; to confirm with purchase that order has gone.
17 Jun : order has not yet gone -- CPK to check and see what is holding this up.
1 Jul : order for connectors appears to have gone.
15 Jul : Order has gone; to confirm expected date of delivery.
29 Jul : one month more for delivery.
==>

3.2 Mass production of shielded box for switch enclosure at antenna base -- from 29 Jul and before (SN/CPK/HSK) : Detailed RFI tests show that the shielded enclosure appears to be working quite well; RFI team handed over the information and material to Ops Group for initiating mass production; last round of confirmation to finalise the drawings done; Ops group started on the work requisition for this box (as well as the box for the Rabbit card), in cooperation with mechanical group; target is

35 nos of these shielded enclosures; order placed for 35 nos, with one prototype to be delivered first, and batch-wise delivery after that. All 35 boxes delivered (c. Feb-Mar 2015); for ordering the components : list made in conjunction with tha for Rabbit card box (see item 3.1 above);
15 Jul : CAT5 cables (for these switches) delivery expected in 2 months;

3.3 Planning for proper UPS & space utilisation for new equipment at antenna base -- from 29 Jul & long before (SN/CPK/RVS) : long-term plans for intallation of final UPS system and proper utilisation of the space at antenna base. Follow-up on 14 Aug 2013 discussion on first report : 2nd report was generated and detailed discussion took place on 5 Feb 2014; successive follow-up & final agreement on way forward (alongwith updated report) reached c. May 2014.

Some highlights are as follows :

(a) Regarding electrical loads : power drawn by different sub-systems estimated carefully, alongwith actual sample measurements on a few different antennas, for both existing systems as well as upgrade systems; effect of in-rush current at switch on also considered; total current requirement of 10 A for the ABR systems + servo control electronics found to be sufficient; hence 3 kVA UPS is adequate; agreed that, if needed, peak load requirement (e.g. in-rush current) can be balanced out by synchronised delayed switching on of different units -- this is already implemented to some extent at present. Final load requirements have been carefully checked and tabulated in the updated report.

(b) Regarding electrical wiring : agreed to have separate isolated supplies for (i) servo drive system (without UPS) (ii) servo control electronics (with UPS) and (iii) ABR electronics (with UPS); one common 3 KVA UPS with split o/p (2 KVA + 1 KVA for servo and ABR respectively) each with its own isolation transformer is the ideal solution; the new UPS can have the isolation transformer(s) integrated into it, without increasing its footprint (only height may go up); updated wiring diagram has been produced by RVS in consultation with SKB and others, and is available alongwith the udpated report.

(c) Regarding space utilisation : new UPS can be located in the space between the ABR and servo racks -- this has been done in one antenna with the new UPS and appears to work ok; existing servo FPS units can be left where they are; if isolation transformer can be moved out from the rack, then space in that common rack is enough for all growth plans of FE and OF systems; this leaves some empty space in ABR rack bottom that can be utilised for further growth of telemetry system; all new servo growth to be accommodated in the servo racks (or in-situ replacement of existing units); extraneous items in the surrounding of the racks (electrical fittings etc) can be relocated, as far as possible, to make it convenient for people visiting for work. Most of these issues have been captured in the updated report. Matter discussed in GSG meeting of 13th Nov 2014. This item can now be taken to the logical conclusion : net outcomes can be summarised and follow-up action to be finalised.

Main list of actionable items are as follows :

(i) ordering of 10 nos of UPS : order has been placed; delivery expected end-Jan. 5 units had arrived and tested for RFI -- failed; some modifications were required; additional issue of PF of the UPS -- improved to ~ 0.6 & accepted (will add capacitor band at ABR for further improvement); first unit available for use c 20 Apr 2015); installed in C10, replacing existing UPS, alongwith 3 ph wiring arrangement (6 May);

2nd unit is ready (only xmer is needed) -- will go to C00; remaining 8 units with modification in 10-15 days -- should be with us in one month (early June); extra cost will be absorbed in next batch, which can be for 22 nos and will cross 25 lakhs -- to check with purchase about the procedure for handling this : amendment or include in next order?
29 Jul consolidated :
(a) RFI test report on all 9 units is available and all are found to be ok at 80% of full load -- this aspect is now closed;
(b) units installed in C00 & C10 and 2 more in progress in CSQ (C4 and C14); remaining 6 to go in arm antennas -- S1 & S3 completed; C13 has old UPS;
(c) for clearing the payment for these 10 units : agreed upon to amend the existing order to include the extra amount (finally came to Rs 21K per unit, dominated by cost of transformer);
(d) for going beyond 10 units : a new party is showing interest in taking up the job; to check original with party if he will hold the prices (or give a discount) for additional units; finally agreed to go with 10 more with Ador and 1 unit to new party (Aircon) and then decide upon the last 10 units.
==> payment not yet completed (in progress); 11 new units (10 + 1) processing started.

(ii) final wiring diagram for servo + ABR is needed : modified wiring diagram was prepared by electrical and shared with servo (4 Aug 2014); meanwhile, discussions with BLDC supplier convereged : now ok to ground the neutral of the main 3 phase transformer; extra EMI filter may be required (RVS confirmed it to be only Rs 10,000 per antenna) + only one set of line-filters will be required. Action items :

(a) RVS had circulated updated wiring diagram (done in consultation with servo) which included inputs from MACON (via servo group) which suggested radiation shield between the BLDC rack and other racks. Finally, updated diagram providing sufficient shielding distance had been prepared and circulated (c Feb 2015) : no objections received; agreed to implement in one or two antennas, with few units of the line filter on trial basis; new input from servo for extra load to be added for PC104 related item -- to check current status.
29 Jul : no immediate action items here?
==> servo control rack + PC104 added in C10 : this is not as per agreement -- TBC and discussed with servo.

(b) for the EMI filters : contact with party (Schaffner) was proving difficult to establish (to try other parties also?). finally, EMI filters indented (enquiry gone), waiting for quote from Schaffner.
4 Jun : order as been placed; delivery date is end July (only 4 nos being ordered).
1 Jul : 4 units received; one installed in C10; can install second in C00 and talk to servo about which 2 other antennas to install (including one new BLDC antenna); decide after 2-4 weeks to order more units (10 more).
29 Jul : EMI filter installed in 4 antennas; servo wants to test the performane with the EMI filter and then give final clearance -- to check if this can be expedited; meanwhile can start the paperwork for more filters.
==> RVS to check with servo (via email) and meanwhile processing for 10 nos.

(c) meanwhile, agreed to try the test of sharing the xmer between servo and other loads, via two sets of AC line filters (that already exist) : to choose either C00 or C10 after discussion with servo, for the initial tests.
20 May : heating in servo transformer is found to be significant (even without adding the additional load) and the load in each phase is ~ 6-9 Amp (much less than rating

of 15 Amp); likely causes :
old vs new lot of xmer : new lot has different core & heats up more -- to be checked
THD -- can be measured for each phase
PF -- can be measured for each phase
aging -- to check mechanical features by visual inspection etc; calendar age
weather -- can the inside of the concrete shell be kept a bit cooler?
allowed range of temperature for xmer to be checked (80 is for old one; 120 is the value it goes for new one);
to check the above issues, including actual temperatures reached, and come back with numbers and conclusions for follow-up.
17 Jun : work is ongoing and detailed tests will be done in next 2 weeks time.
1 Jul : 2 fans added in C10 xmer cover to help circulation; temperature reached with full load on servo xmer is about 78 deg -- to confirm if ok with servo and then replicate the scheme in C00 and then converge towards mass production.
29 Jul : in 3 antennas cooling of transformer with fans tested and found to give 20 deg improvement -- this design can be finalised;
==> this aspect can be closed.

(d) Meanwhile, on a trial basis, with a change-over switch, the extra ABR load can be added and checked for heating etc in C10. (increase in load is expected to be about 30%).
4 Jun : expt done in C10 for 10 mins : full load put on xmer (~ 2 kVA, up from ~ 1 kVA) total current ~ 8 A (up from ~ 4 A); PF changed a bit (improved!); THD increased to upto 90-120% (from 70%); 1 deg temp increase noticed. To discuss with servo and see if the test can be run for a longer duration.
1 Jul : tests for longer duration being done (see above); THD increase may be due to the Mosfet property of the UPS. To try and find a series filter unit of appropriate (lower) current capacity.
29 Jul : series filter of higher rating available; need to find one with lower rating;
==> identified one possible supplier.

(iii) making 1 or 2 antennas as model where all the configurations are made as per the recommendations : finally, agreed to use both C10 and C00.
At C10 : 3 kVA UPS was installed, but was feeding power to ABR only; later, servo shift PC104 load to UPS (isolation transformer still in use?); switch boards / extension boards shifted to safe level.
At C00 : 4.5 kVA UPS, with 2 isolation transformers, was installed with ABR rack connected on it; PC104 load was added to it subsequently; relocation of elec boards was pending. Following items being followed up :
(see also email update from Nayak & Jitendra on 22 April)

(a) agreed to put the FE power supply in the proper location in both antennas -- space was made ready (after removing delay contactor) in C10; agreed to do in C00 also; turns out that relocation of extn board is also needed to relocate the FE pwr supply -- SSK to ensure that this is done for C00 and C10. Need a status check.
(b) ask servo to confirm FPS drive location is in keeping with the agreed diagram : needs to be slightly shifted and servo is ok with it -- check if done at C00 & C10.
(c) RVS to circulate an email about the updates and finalisation of layout in C0 and C10 for replicaton in all antennas. This was done and some feedback from FE and BE teams received, and following items being looked into :
* shifting of sentinel "yellow box" (PSB + BR) -- check if done at both antennas and confirm plans for other antennas.
* alternate arrangement for keeping the phone : to change to hook phones that can be hanged -- check if done at both antennas.

* directive to keep AC flow downwards in default conditions : prepare stickers and put in 2 locations in shell -- check if done or not.
* contactor and timer for delayed start is obstructing FE pwr supply (can be removed once UPS is there?) : right now, agreed to shift; done in C10? -- check and confirm current status.
4 Jun : JPK visited antennas with FE person (Satish Lokhande) and Nandi to look at mechanical arrangements that may be needed to effect some of the changes; some solutions are being worked out, without violating the available space; yellow box shifting done on both antennas; sample phone units with proper buzzer arrangement done in C10, can be done in C00 (IP phones vs normal phones -- to be looked into by Ops group); contactors and timers have been removed in both antennas. Once the ps is put on new rails, the rearrangement would be complete.
17 Jun : mech and Ops have looked at it; estimate of down time to be brought up in coord meet.
1 Jul : adjustments in the rack will be done this week for C10 (may not need antenna to be down).
2 Jul : in C10, the EMI filter position needs to be shifted. FE power supply can be put in C10 -- FE team to try out the change with FE supply.
==> in C10, location for FE power supply was tested, with some additions; agreed to put on a permanent basis; and same change can be initiated for C00.

(iv) to improve the RFI shielding of the antenna cage, starting with the model antennas : check for unshielded cable and pipe entries in model antenna shell, including unused holes and punctures, and initiate appropriate corrective steps.
RVS to make a list of all the punctures in both C00 and C10 and bring for discussion.
Work had started at C10 for this; 22 Apr : pictorial report by RVS : AC plumbing; AC line filters; servo cables (BLDC + FPS) crossing; RF cables entry points; OFC cables crossing; plus a few more; RVS to send an email to all concerned, for identification of cables, entry & exit points and unused holes / punctures. Need a discussion with RFI team about measures to prevent the RFI leakage from the punctures. Current action item :
RVS and SSK/PAR to classify the various kinds of punctures and then RFI team to suggest solutions for each category, including plugging of unused punctures.
20 May : discussed with PAR also to move this forward; to check current status & plans.
1 Jul : some work had been done in earlier days (TLV, NVN times) and electrical is beginning to replicate that (similar soln has been used in ISRO cage); meanwhile, RFI team is workign on the formal solution; also procedure for plugging the holes is being evolved.
29 Jul : Pravin has made the list of punctures and status and provisions : punctures of AC power -- may not need to worry about it; .... Pravin to circulate the results.

(v) also agreed to populate C0 & C10 with Rabbit, switch, PC (with shielding) as and when available -- these 2 antennas can be used for next gen M&C work to add to C4,C6,C12 to make a total of 5. Work in progress; JPK to keep track of this aspect.
Agreed to start activity of populating during MTAC for C00 and C10, and next to C8 and C11; and then, if needed, to C4, C6, with aim to have 5 antennas ready.
Action has been initiated for C00 and C10 : one shielded box with Rabbit cards + one switch with shielded box ready; 2nd unit getting ready.
Will need to make some of the other changes to make space for the final arrangement; also 2 sets of units to be made ready. Check current status.
4 Jun : see updates in email from JPK. (to fold in the results from this !!!); ethernet shielded box needs support structure in the rack for installation -- will require in-situ welding etc; Rabbit card shielded box does not need any additional mechanical work for mounting. Issue about physical monitoring of switch working

inside the shielded box.
1 Jul : Ops group and mech team to look into mounting of ethernet shielding box (without welding, if possible); monitoring of switch inside the box is solved by fibre team;
==> switch + Rabbit card in shielded assembly installed in final location in C10.

3.4 New, improved Miltech PC -- from 29 Jul and earlier (CPK/SN/PAR) :
Two units of Miltech PC with two changes (more screws on panels + panel mount pwrline filters instead of chassis mount) were under test : conclusion was that PC ok from all aspects. Pending action items :

(i) agreed to initiate the purchase of 10 nos of the final version above -- indent had been raised for 10 nos (including some spare accessories?); current status of the PO : order sent; expected date of delivery 31st Dec -- trying to expedite, if possible; note from vendor informing about delay due to late arrival of m'boards : end of Jan is new delivery date. "still under test" reply from vendor -- to see if delivery date estimate can be got. SN to follow-up with BRJ on an urgent basis.
22 Apr : update from vendor to purchase : 3 units have failed and heat sink is being redesigned; will take some more time; no response from party for a long time; Nayak to request Sureshkumar to make a visit and check; confirm if there are any updates, and decide future course of action.
4 Jun : some response from vendor got by SSK (15th June date has been given) -- to follow-up with a visit and f2f meet if possible next time.
1 Jul : item not supplied yet; vendor is still facing problem with overheating of CPU; SSK to try and visit him next time to get first hand information.
15 Jul : visit has taken place; x10 machines are under test; expected soon;
29 Jul : no fresh updates from the party; SSK to check again...
==> no updates at present.

4. Back-ends :

4.1 Documenations at various levels -- from 5 Aug and before (BAK+others) :
To complete basic,internal documentation (at ITR level) and then move to the point wehere formal publications of relevant items can be done.
Current action items are as follows :

(i) Detailed design doc : analog back-end was being done by Hande : 2nd version had been circulated in April. Next level of document going down to chassis level is to be made ready -- chassis level doc will take about 2 months; was deferred till end Oct; and then deferred till end of Dec; 2nd version had ~50% chassis level inputs; to be completed by end-Jan'15; needs some more time as 2nd LO scheme inputs are also being folded in; work in progress; may take another month; check in mid-May.
27 May & 4 Jun : progress is slow, but going on. 10 Jun : still ongoing...
24 Jun : will take ~ 1 month (till end-July) !
1, 15, 22, 29 Jul : no significant update.
5 Aug : Hande is still busy with some other activities; hence delayed some more.
==> no progress on this.

(ii) ITRs + publications for analog back-end systems to be taken up :
(a) analog back-end : Sandeep and Navnath to look into that; pending. Work pending for some time; team to review and pick up the activity. BAK to follow-up.
SCC and Navnath have had one discussion and will follow-up with BAK; not much progress; may take it up next month, after MTAC; list of items to be done has been

prepared; work has been started by Navnath; to check current status; not much progress in last few weeks, but will pick up now (27 May).
4 Jun : not started yet -- to start now. 10 Jun : same status as 4 Jun !
1, 15, 22, 29 Jul : no progress reported.
5 Aug : Navnath and Sweta to work on this now and have a version by end of Aug.
==> work in ongoing.

(iii) ITRs + publications for digital back-end systems : ITR was completed by SHR (quite some time ago; after some follow-up, SHR and BAK started work on modifying GWB ITR to convert to a paper; first version has been circulated; needs to be taken up for discussion between YG, BAK & SHR
27 May : not yet reviewed and discussed; but agreed that meanwhile SHR can look at it from the point of view of improving by putting in the latest work on expansion to 16 antenna, dual GPU system.
4 & 10 Jun : will get into this once GWB-III release work is completed.
24 Jun : can start work now on incorporation of new GWB developments.
1, 15, 22, 29 Jul : no progress here also.
5 Aug : to try and take this up now, as GWB-III release is almost done.
==> not started yet.

4.2 : Power supply for GAB : from 29 Jul and before (NDS/BAK) : Two options are possible : linear vs SMPS. Comparison note with all pros & cons was produced : pros and cons are in terms of convenience (and price) vs RFI properties; agreed that present (c. Aug 2014?) set-up of 30 ant GAB (with 5 spare SMPS supplies on order) can run for 6 months or so ; final decision can be taken later on. 4 SMPS units that had come were used to get 4 racks with SMPS and 4 racks with linear / CVT supplies; meanwhile, shielded box was designed for the SMPS by RFI team -- RFI report showed good performance; agreed to go ahead with it for mass production; meanwhile, SMPS installed in 4 rack; 12 new boxes with RFI shielding planned -- 8 are needed in the system, and 4+1 will be spare. Mech group to place the order for 12 nos (after BE and RFI teams check the drawings); drawing had errors (!); needs modification; was stuck for PC problems. To check current status and see if order can be / has been placed. Issue of problem with the drawing has been cleared.
One sample being made in-house for clearing the drawing etc.; required fans etc being indented by Raybole -- now on order; 12 boxes for SMPS awaited from workshop to outsource (proto found acceptable); still waiting for the sample unit being made in-house by mechanical; to check current status.
17 Jun : prototype has come and being tested; may need some change in arrangement before mass production.
1 Jul : prototype sent back for modification has not come back yet from w'shop; balance SMPS units (plus others to be used for other applications) to be procured.
15 Jul : prototype sent back for modification has now come back; 10-12 boxes have come; all except SMPS available; full set available or x5 boxes, except SMPS which is under order;
29 Jul : first unit getting wired which will be tested by RFI team before final acceptance and mass production.
==> unit wired and ready for testing

Extra item : enabling independent LO for 2 pols : check email from NDS & include !!

4.3 Power equalisation schemes for new back-ends -- from 29 Jul and before (SSK/NSR/BAK/SRoy): Need updates on both of the following :

(i) option 1 : using detectors in GAB and local feedback loop -- monitoring set-up

was made ready; DKN worked on code (using algorithm taken from NSR); first round of testing showed problems like detector output saturation -- gain adjustment checked and problem fixed; basic power equalisation algorithm was first tested ok with 4 antennas, and then expanded to more antennas; comparative study of this scheme with the GWB-based scheme to see if there are any differences or pros and cons wad done : do GAB power equalise and look at GWB bandshapes; complete the loop by doing GWB power equalise and checking GAB o/p. Test completed both ways, first for 4 antennas and then later for 8 antennas (extended to more?); BE team is ready to release for use by operators -- a basic SOP to be generated and released. Current actions :
(a) to completed the SOP and release the set-up -- check if this can be closed : yes.
(b) to run this alongwith GWB bandshape check to help debug problems in GAB -- can be formalised as a debug tool to be run by PMQC periodically; DKN to make the test procedure for control room use; check current status.
17 Jun : still pending with DKN.
29 Jul : BAK to check and get back.
==> BE team to decide about usefulness of PMQC procedure and proceed accordingly.

(ii) option 2 : using correlator self outputs and computing gain corrections :
basic scheme is implemented & working; more general implementation of a user controlled ALC mode aims for the following 4 modes of operation
(see MoM of 3 Oct 2013 !) :
(1) on demand -- this is the current released mode.
(2) repeatable at some interval specified by the user -- can it be script based?
Sanjay has completed the core coding; a wrapper is being done by SRoy; to be taken up for discussion.
(3) automatic, should adjust in response to a stimulus in the input power -- needs a discussion.
(4) should provide a reliable power monitoring scheme -- needs discussion.

Issues that came up are as follows :
Accuracy of attenuaton values and repeatibility of settings : 5% (0.25 dB) ok; agreed to add median calculation feature; to check if a feature to predict the expected change in attn for a given change in sky direction can / needs to be added; better option for saving the attenuation values for future use / reference to be defined; logging of results to be looked into; agreed to have a document that summarises all of the above and spells out the main requirements (from user point of view) and possible solution options / techniques; detailed discussion has taken place between SRoy, BAK, SSK and YG on 14Aug2014 -- main conclusions and present action items are as follows :

(a) attenuator values : aim is to check if measurements match with specs (within +/- 0.25 dB); initial test results for 3-4 units (at one epoch) had been reported by BE team (found acceptable); pending items (for BE team) are :
* to check the constancy of the values across the band;
* to repeat the tests for vayring i/p power levels with constant o/p power;
* to repeat the tests on different epochs to verify constancy with time;
* to work out plan for calibration table for each attenuator (after above results).
Test data were taken and analysed by BE team and results reported; SRoy had done some cross-checks on these; tests have been done with varying i/p range from -37 to -17 dBm also and behaviour of attenuator appears to be all right. SRoy to cross-check the results and confirm if we are ok, and if this aspect can be closed.
SRoy has sent some plots from his analysis of the data and some follow-up is needed to see in what operating regime we are hitting the non-linear range of the GAB system.
BAK to look at the results from SRoy and send an email.

22 Apr : "linear range" available depends on absolute input power level; but there is enough for our desired range of operations -- it may vary from one RF band to another and a note will be needed to define the working zone and avoidance zone for each RF band. Agreed that all other aspects can be closed except for the note -- check status of this.
29 Jul : to check the status of the note...
==> need a note describing tests done and outcomes -- to be put on record for future.

(b) requirements document to be updated to reflect the outcomes of the disussions e.g. better clarity about the 3 modes of operation etc. -- SRoy has produced an updated version : needs to be checked to see if it can be cleared.

(c) self data (from correlator data stream) to be saved in shared memory ring buffer of ~ 30 mins depth for further processing tasks to work on (should also work off a recorded lta file); also median calculation feature to be added; some work was done by NSR to write raw data to file for 10 mins duration; to convert this to shm and also to add a feature for calculating median values every 2 sec or so and saving these to a file for long durations. SRoy to work with NSR to implement these (take help from SSK where needed); some progress from NSR's side on median calculations;
22 Apr : SRoy reported that NSR now has a version that is able to save the median values in a file, as multiple rows -- to convert in to multiple columns version; not yet started work on shared memory version. Any recent updates? Waiting for NSR to be back on 15 May.
17 Jun : NSR has not yet had a chance to do this; should happen in next 2 weeks.
29 Jul : this change has been done now; but facing some issue about extra time taken for writing with format change -- SRoy has suggested a solution; then SRoy to take up follow-up action on this.

(d) testing of bandpass shape (ampl and phase) for different values of attenuation : 6 out of 7 antennas showed less than 5% percent and 5 degrees change in ampl and phase over 5 dB change in attenuation. SRoy to follow-up to see how much is the intrinsic varn of the GWB corrln level with change in input power level -- SRoy analysed the data provided by DVL and found that behaviour is acceptable for the range of i/p power variation tested which is about factor of 5 (~ 7 dB); plan to extend this to larger range: set power level on galactic plane calibrator to about 80 or so; then go to calibrator away and equalise to 350 -- larger change in attenuation (~ 12 dB) required -- can check if corrln coeff (bandshape) remains ok or not; SRoy would like to now try the test with upto 10 dB variation in attenuator values to see how the bandshape changes; 22 Apr : test has been done, but there appears to be some problem with the data quality -- may have to be repeated again; SRoy to check for free slots for this.
17 Jun : SRoy will be scheduling in the near future.
29 Jul : needs a black slot (SMTS) request for the slot; 3-4 hrs; can also get white slot.

4.4 GPU corr (GWB-II) : release of 4 node, 8 input, 200/250/400 MHz version -- from 29 Jul & before (SHR/SSK/BAK/DVL/YG) :
agreed to make 4 T7500 nodes with C2050/C2075 Fermi GPUs + remaining 4 T7500 nodes as host machines (to take care that these are the ones that transient pipeline uses presently so that sharing is possible); this should have ALL basic modes : total intensity and full polar IFR modes; IA + PA BFR modes with process_psr pipeline attached; full GUI support; to come up in trial code section without affecting the presently released mode. Action items :

(i) beam modes in GWB II : new version with separate kernel (outside phase shift kernel) for beam formation has been developed (compute load is 7% increase on 2050 GPU); IA mode tested; PA mode completed and tested; phasing implemented & tested; process_psr pipeline has been completed and released; first version of SOP has been released; pending action items :

(a) last version of GWB-II (ver4) expected end of April, with the following new features : 16k channel support in GUI and SOP; multiple choice for beam integration and # of channels; pulsar beam header ver1 (limited number of parameters); for more than 2K channels in correlator, need modified shell script -- this needs to be understood. Most of these changes have been done; GUI for 'ver4' needs to be done by Nilesh -- should happen after 15 May. Check if action has been initiated.
27 May : SHR and NSR to test upto 8 and 16 K channels to see if o/p side i/o works ok; if yes, then no further changes; if no, then to change the MPI calls as done in GWB-III (and make GUI and SOP compatible with that).
10 Jun : no progress on this (due to concentration on GWB-III !).
17 Jun : ver 4 tested for 8 and 16 k channels; GUI level change has been done; dasmon needs to be modified for more than 2K (upto 16K) -- being done by NSR; beamformer will also need to be tested.
24 Jun : GUI for correlator part completed (except for dasmon); GUI for beamformer will take 2 weeks (till 8 Jul).
1 Jul : SSK to talke with NSR to close the loose ends.
15 Jul : work on changes to 'dasmon' has began;

(b) header for beam mode data : to be taken up & incorporated alongwith the PA mode; SSK has done first round, and discussion between YG and SSK has happened and next version is underway; to check current status and plans for release.
Work under progress; can circulate the current list to others (back-end team; NSR + other users). -- can shift this to GWB III ?
20 May : header part I has been done for GWB-II and III (need to confirm for II); header part II will be done later, only for GWB-III. To confirm plans and move to GWB-III agenda accordingly.
17 Jun : new version of GWB is under test which has part I header; part II header will come in the next release. part I header will come in GWB-II ver4 and GWB-III ver2.
24 Jun : GWB-II next (and final) version release in 2 weeks (8 Jul 2015); will have flexibility of upto 16K channels.
1 Jul : to ensure loose ends closed by 8 Jul and v4 released.
29 Jul : work in underway for v4 release of GWB-II.

(c) availability of online monitoring tools for beam data : psr_mon was successfully installed, compiled and tested (for 16k channels?) on node 52, node 53, gwbh2 & gwbh3; now installed on the new host machines also; installing pmon needs polycos, psr catalog etc; pmon done in off-line mode on GWB-III, ongoing for real-time mode -- needs to be tested and cleared;
port to GWB-II : real-time mode of psr_mon and pmon for GWB-II are under test now by SSK -- check present status.
SSK to check and place the final working code for pmon in the right place on GWB-III beam host machine.
17 Jun : offline version working on GWB-III (v2) and real-time version to be tried.
1 Jul : SSK close to finishing the real-time version for GWB-III.
14 Jul : online had problem with psr_mon -- now corrected but needs testing (~ 1 week)
22 & 29 Jul : not clear if tests completed and system ready for release or not;

5 Aug : GWB-II ver4 (final version) has now been released ! To chek if all of the above issues can be closed now.

(d) meanwhile, work for incorporating new code developed by Rajora by adding shared memory interface is ongoing (both of these can go directly to GWB-III) -- work resumed in May 2015, with summer student Balaji; there is significant progress on this now; agreed to move this to GWB-III.
4 Jun : new features related to bandshape plot and profile plot have been added and filtering has been tested; need to start looking at shm related aspect.
1 Jul : work in progress.
29 Jul : updated code is workng; tested and showing good resuls for off-line analysis (for GSB & GWB); basic tests in real-time mode carried out and shown to be working with shm of GSB.
5 Aug : tests ongoing and being used by KDB & others; can be moved under RFI section?

(ii) spikes in channels that are power of 2 : this problem needs to be discussed, understood and fixed. SHR has done several tests, including using digital noise source; effect is seen in packetised corr also; checked with offline analysis of raw voltage data acquired through Roach board, and with digital noise generated on Roach board -- appears that problem is seen only in data coming through the ADC path only? further, trying single ADC streams or channels (compared to the interleaved data streams that come normally) still shows the spikes in the streams; slower FPGA clk rate also doesn't show any difference -- it appears to be natively present in the ADC data; to check if the power level of these spikes is constant and how much below the mean passband level; varying i/p power level of broadband noise source at ADC allows characterisation of input power level at which spikes show up; looks like occuring at multiples of 128 ch (for 2K spectrum); to check the level as seen in cross of two such signals -- some test results have been sent by Reddy recently; can take up for discussion, including tests with 2 different clk sources...
To correlate against new results coming from histogram testing by Niruj & Kaushal -- some work needed here -- KDB & NMR to check and report back.
27 May : to cross-check with GSB voltage data taken and put through similar analysis of histogram and spectrum;
17 Jun : tested with two different Roach boards with two different clk sources and corrln is still seen, including when sig gens are not locked to same source.
24 Jun : GSB raw voltages to be read and analysed (at GWB-III).
14 Jul : work has started, can expect some results by next week;
22 Jul : test data has been taken; update expected shortly.
29 Jul : tests done with GSB raw voltage data also show some spurious lines -- needs some thinking and investigation about possible causes and issues...

4.5 GPU corr (GWB-III) : next gen system -- from 29 Jul & before (SHR/SSK/GSJ/BAK) : Design and delivery of 32 input (16 ant dual pol or 32 ant single pol) system; uses 8 Roach boards + 8 compute machines (with final 36 port switch) + 4 host machines, installed in 4 old racks & made ready with wiring + cabling complete (c. Feb 2015?); tested with analog noise source; new code with 2 x 10 Gbe I/O + improved logic for assigning specific threads to each core + set-up with environment variables completed (tested for 200 MHz / 8 bits and 400 MHz / 4 bits, 16 inputs and working ok with no pkt loss); modified ferrules were put on cables & GWB-III (v1) has been released with full online control (c Mar 2015); final connections to GWB-II and III can be chosen by the user on the wall panel; confirmed that GSB, GWB-II, GWB-III can ALL be run simultaneously with full online control; updated SOP has been released; basic user level tests have been carried out (DVL) and by and large system appears to be work ok.

Later GWB-III was expanded to dual-GPU version, as it became clear (c. Mar 2015) that existing code for corr + beamformer is exceeding real-time by 9% for full 400 MHz BW for 16 inputs correlation (will become worse for final, 32 input system); options looked at were : 2 K20s per host, double-GPU card, K20 + K40 per host, 2 K40s per host, 32 host machines (with single GPU); agreed to try out 2 K20 option; first results from dual-GPU code (6 May) were encouraging and have led to GWB-III (v2) : 16 antenna dual pol, 8 node system with 2 K20s on each node : total intensity & full polar correlator + IA and PA beams (16K spec chans and 1.3 msec integration) for 200 MHz 8 bits and 400 MHz 4 bits; tested to work ok with equal load between the two GPUs; also ready for testing on 2 K40s -- results may be available soon; issue of sharing between K20 and K40 needs to be looked carefully for the value of the slice and also the drivers for both GPUs working simultaneoulsy. Tests have been done using noise source; now ready to try with real antenna signals (done 4 Jun); GUI development under progress.

Current action items: see also email from BAK on 22 April 2015) :

(i) Various kinds of tests of GWB III (v1) :

(a) basic user level tests : DVL had carried out some tests; pending problems have been call sheeted and will be checked again to see if fixed or not (most are related to upstream systems) -- to check status with DVL, and see if this can be closed.
1 Jul : this can be closed.

(b) to check if new SOP supports flexible connectivity for user -- this required manual editing of the files (explained in SOP), which is not desirable;
2 possible options discussed for getting flexibility in connection : ascii file update or drop down menu -- to discuss with NSR and decide which is easier to implement.
4 Jun : GWB-III ver2 is being debugged for release and it has this feature (tested).
1 Jul : this appears to be working fine
15 Jul : SOP needs modifications (new GUI changes need to be included);
29 Jul : completion of SOP (by Nilesh) and multi-subarray testing (Sanjay) are remaining to be done; to discuss layout of the SOP.
==> to check if SOP should be branched for developer's manual and user's manual.

(c) testing the 400 MHz BW mode : basic changes to the code for the 400 MHz, 4-bit mode had been done and basic tests were ok for 16 inputs (delay correction also working ok); some pending tasks are :
* choice of which 4 bits to use needs to be finalised (right now it is set for 4 MSbits) : what algorithm is needed? can it be made a user choice?;
* extendng to full 400 MHz BW : computationally, existing GWB-III (v1) does NOT sustain 400 MHz for all 32 inputs -- safe limit is 300 MHz (including beams ON); agreed that making if work for less number of inputs is not worth the effort -- more useful to concentrate on dual K20 option in GWB-III (v2).
1 Jul : except for the issue of choice of 4 bits, all other issues here can be closed.
29 Jul : need to test 400 MHz mode with GWB-III v2 and then close this item, carrying forward only the issue of flexibility of choice of 4 bits.
==> tests in next couple of weeks with new SOP should decide this.

(d) checking of beam modes : all basic beam modes are working; phasing has also been verified; note that phasing will work only if beam mode is turned on (!) -- change has been made in the new code that will be released soon (v2).
1 Jul : this is implemented; will be tested by user upon release.

29 Jul : not yet tested, but can be done once v2 is available to user.
==> to be tested soon.

(ii) to discuss and agree the various modes to be provided in different releases of GWB-III, folding in long-term planning (to take up from email exchange of 22 Apr and later) : one round of discussion has happened; to finalise the list of modes and the various releases of GWB-III and then put it formally in the Plan agenda -- this needs to be discussed.
17 Jun : BAK to summarise the specific details of ver 2.
1 Jul : for ver2, to make sure that the information is available in SOP or otherwise; for ver3, BAK has discussed with team and will come back with an update shortly.
15 Jul : to be completed in 1 week (22-Jul-2015);
29 Jul : updated version has been circulated by BAK; need to see about porting it to the format of a table of modes, as in GSB.
==> to put in the table format for final release and cross-check for any refinements.

(iii) choice of integration time for beam data (for v1 & v2) : in the original design 128 was default pre-int (on GPU); later, it was made variable (upper limit 1024, lower limit ?) -- needs to be tested, and constraints in the range of parameter choice needs to be established);
17 Jun : 128 can be reduced in v1; in v2 there will be a table giving combination of nch and sampling;
1 Jul : to confirm the situation for v1 and v2; plans for v3 to be worked out.
29 Jul : table of possible combinations for v2 has been circulated; lower and upper limits for sampling interval are calculated based on disk writing speed and gulp size; the former needs to be changed to be limited by GPU memory or I/O speed. Also a table about memory usage is available.
==>

(iv) beam data header for GWB-III (v1 & v2) : current status to be confirmed
17 Jun : current plans are as mentioned above under item 4.x
1 Jul : v1 has no header; v2 will have part I header and v3 will have final part II version.
29 Jul : no updates on this.
==>

(v) psr_mon and pmon tools for beam data monitoring for GWB-III (v1 & v2) : current status to be confirmed
17 Jun : same version should work; to put final working version in a common place.
1 Jul : real-time version to be made ready for v2 by SSK (see earlier comment also)
15 Jul : work completed; needs testing;
29 Jul : ready for release, as per email update by SSK.
==> see email update from SSK.

(vi) tests with dual K40 system in GWB-III (v2) ?
17 Jun : one of the 8 is running with dual K40 as default; at some point, bench markingcan be done wrt dual K20.
1 Jul : getting the benchmark values is pending.
29 Jul : was pending release of GWB-III ver2; can be taken up now?
==> basic tests done :
for 400 MHz full polar with 2 PA beams, 16k channels, 2.6 s : 80%/73% vs 64%/58%
for 200 MHz full polar with 2 PA beams, 16k channels, 2.6 s : 50%/42% vs 37%/31%
future requirements : 32 antennas MAC, PFB, DDC, folding of visibility data to be accounted for;

(vii) tests with K20 + K40 sytem in GWB-III (v2) ?
17 Jun : this is stuck because of driver related issues as pointed out by SHR; can defer till we try cuda 7.0 and then see.
1 Jul : no update.
29 Jul : no updates.
==> dual K20 + K40 may not be that significant, given the above results.

4.6 Next gen improvements (beyond GWB-III v2) : targets for Sep 2015 release -- from 29 Jul and before (BAK/SHR/...) :

(i) final range of channels to be handled : GWB-III (v2) will be up to 16K channels; extension to 32K channels to be looked into (I/O issues will need to be tackled); increasing integration beyond 0.6 can be a solution.
17 Jun : changing integration time may be easier option for now -- to be tried at a later date (maybe after 15 Sep).
29 Jul : not discussed.
==> to be deferred for now.

(ii) new features to be added in next versions of GWB-III code : correction for net_sign[] flipping (LSB/USB modes of correlator); multi-subarray, 4 beam capability; all off-line utilities with backward compatibility; time + DUT corrections; optimisation of code; feature for folding visibilities with pulsar period; PFB implementation; shift to 2 inputs per Roach board.
Some of these can be delayed for some time, depending on prioritites.
26 Mar : multi-subarray implemented and tested, including online interface; needs some more testing for getcmd mode; DUT corrections coded, but not yet fully tested; both of these work upto 32k channels but some testing may still be needed; see also 22 Apr email of BAK and follow-up discussions); to see if action items can be firmed up for this.
4 Jun : for ver 2 : lower beam integration possible, beam header as above, multi-subarray ok; will have off-line utilities, without backward compatibility; DUT corrections will be in; net sign correction done; 4 inputs per Roach used;
for ver 3 : 4 beam capability, visibility folding; PFB
17 Jun : 4 beam and PFB are part of the plan for ver3; to check about vis folding later on.
1 Jul : ver2 items are ok; ver3 items needs to be finalised shortly.
15 Jul : multi-subarray design complete and testing in progress -- appears to be working, but GUI needs improvements (delay & fringe computations etc).
29 Jul : email update from SSK : multi-subarray mode ready for release -- SOP to be updated by NSR.
==> deferred for now.

(iii) long-term items like provision for control of FPGA and other peripherals (like sig generator) for different modes : agreed to identify one PC for control of all the peripherals related to GWB; this m/c can / is interfaced to online via a socket and GUI can send commands via this -- already done for loading of FPGA files, needs to be extended for other applications; for other things like turning RFI rejection or Walsh modulation on/off, writing to registers in powerPC would work all right; agreed to start working towards implementing scheme in GUI for taking additional parameters that allow different bof files to be loaded; agreed that these flags need not go into ltahdr but can go in the user log as setting parameters (can also be there in gpu.hdr); agreed to go ahead with discussion with NSR for implementing the logic for allowing support of multiple corr modes that use different BOF files;

other action items to be taken up later; BAK to talk with NSR / SSK to work out the time frame for having it in place.
17 Jun : needs to be tried out; can be taken up after v2 is released.
1 Jul : scheme needs to be tried out at some time by NSR, when a bit free.
29 Jul : no updates.
==> deferred for now.

(iv) incorporation of DDC : this is important requirement, to be done asap :
Agreed to try on one node of GWB-II or GWB-III and get back to earlier situation and see exactly what are the issues. SHR has circulated an update; first part is that it appears that the current realisation is properly implementing a DDC; only the filter BW needs to be decoupled from the decimating factor and do a careful set of tests; in the long run, better filters with sharper cut-offs may be required (can check with nvidia about availability of std library functions for such applications); second aspect is to check about the nature or format of the o/p to see whether I & Q components are ok for further work or whether we need / can have the real voltage representation of the o/p signal.
new tests still pending; to check about nvidia primitives; to check about I,Q version vs real output possibilities.
26 Mar : independent DDC has been developed by UG and tested and appears to be working ok; to circulate summary of test results to see if more parameter space needs to be explored... test results found OK; note being prepared.
22 Apr : DDC code has been incorporated in 2-antenna GPU correlator and under tests to clear unresolved issues -- see also latest update from UG in May : need follow-up discussion on this.
20 May : email update from UG stating that the mode is basically working -- need a more detailed discussion about the status and plans.
4 Jun : agreed that basic mode is working ok; to check the issue of normalised cross in the stop band region. may not be released in ver2, but should be there in ver3 (Sep release).
17 Jun : bit more testing with noise source; generating proper delay and fringe to be ensured; overlap between data segments for proper FIR operation will be needed; to check total compute requirement.
Need a status update and discussion on the latest situation.
1 Jul : final choice of specific code to be used has been made (between work done by UG and earlier code); porting from one node to multi-node system should not be an issue; still need to test delay and fringe with DDC on; also FIR edge effects at blk boundary to be checked.
15 Jul : Basic DDC completed; Problem : 90% time usgae (with DDC itself ~ 60%); needs optimization;
29 Jul : no new updates.
==> may needto look at the FIR filter and optimize.

(v) porting from CUDA 5.0 to CUDA 7.0 : to work out a plan for doing this
1 Jul : this needs to be looked at.
29 Jul : no updates.
==> defer for now.

(vi) full beam header : plans to be discussed and finalised.
1 Jul : also needs a discussion.
29 Jul : no updates.

(vii) RFI filtering capabilities : for corr and beamformer
1 Jul : needs a coordinated discussion...

29 Jul : no discussion.

4.7 Long term improvements (towards final GWB-IV system?) -- from 29 Jul and before (BAK/SHR/...)

(i) further optimisation of the GWB-III code (SHR/SSK) : different optimisations have been suggested and tried and these need to be further refined and ported to the GWB-III code:

(a) optimised XPGU for GMRT (with Vinay of nvidia) : is showing ~20% improvement -- needs to be confirmed and then incorporated; ready to upgrade to CUDA 6.0?; results from R2C vs C2C (with callback) to be finalised and then decide about incorporating. SHR has done the basic porting of XGPU in GMRT code to GWB-III. Summary : xGPU has been ported and shown to work; gets 20% speed-up overall; but works only in full polar mode (!); other modes need change in xGPU code; output shuffling work in real-time for present time,freq combination, but may not work for faster rates and finer channels... agreed to halt xPGU work and concentrate on 2-GPU per host GMRT correlator code. No further action on this for now.

(b) another concern is about data ordering at XGPU o/p vs LTA format requirement -- needs to be quantified in order for changes in (a) to be meaningful; note : Vinay has already written the code that does this on the CPU.
Currently using unoptimised routine which will work for about 4k channels; for larger number, optimised version will be needed. See item (a) above.
29 Jul : no discussion and no action on this for now.

(ii) trying new ideas like FP16 etc to be discussed.
29 Jul : to be taken up after v2 is released.
==> defer for now.

(iii) Layout and racks (GSJ/BAK) : layout diagram to be updated and long-term plan for racks to be initiated; 3 different kinds of President racks discussed ("cyber", "cool" + one more?) -- to try and finalise after one more round of discussions including RVS (also, check new vendor Jyoti Tech); as an interim, 2 nos of cyber racks ordered with President. Meanwhile, for GWB-III, 4 nos of half-height racks have been used -- two nos are populated with 4 compute nodes each, third one has 3 host machines + 1 extra machine + clk source etc; fourth one has 8 Roach boards + IFB switch; will need to expand this to 16 Roach boards at some point of time -- may need to add one more half-height rack? One half-height rack is available in hand and can be used when required. For final system, present estimate is 5 full height racks housing 32 Roach boards + 16 compute nodes with 2 GPUs each (+ host machines?). Current action items :

(a) For the 2 President racks : first one has been used for putting GSB related spare nodes etc; second rack being used for trying the arrangement for special cooling (with help from mech group) -- tested with 1 kW load and increasing slowly; loading up to 4 kW tested by comparing the temp difference between input and output air (need to compare with unmodified rack); results so far appear to show that there is about factor of 2 discrepancy in estimated CFM rate and AC plant capacity CFM rate. agreed to include the test with unmodified rack and then circulate the report; with 2 AC vents feeding 5 racks (final number), the estimate is that the available CFM may be marginal -- this needs to be resolved against the CFM discrepancy noted earlier; also to explore additional margin the AC system (joint meeting with RVS and team may be useful);

20 May : intermediate update from report of IMH about discrepancy of factor of 2; measurements with the flow meter show that the amount of air flowing into the corr room is matching with the expectations from the AC system, which means that the utilisation of the cold air by the correlator test rack is only about 50%; method of taking in the cold air from the vent to the rack is being modified to improve the efficiency.
4 Jun : some inprovements in results with better ducting of cold air and 2 stronger fans to better pull the cold air -- now reaching 75% of capacity; to test at floor locations far away from the available vents.
17 Jun : at 5 feet away from vent, getting more than 100% (!)
(b) to decide on plans for ordering more racks.
1 Jul : interim report has been circulated; results appear to indicate that for any typical position of a rack in the room, having fans at the bottom near the input of the cold air (and maybe some ducting for the hot air at the top) should be enough for our requirements; to see if one round with more heat load (2 to 3 x is possible) to see the effect on GSB. To try and see if we can finalise the choice of rack soon and start the procurement.
15 Jul : electrical load simulation using 12 kW heater on a rack -- report circulated; report on choice of rack to be circulated in 1 week (22 Jul 15).
29 Jul : short discussion : updated report on rack layout etc is ready; can go ahead with ordering of relevant racks from President (slightly deeper than standard rack but is still readily available product) -- to be confirmed and action initiated.
==> ongoing; do discuss with RVS and HSK about layout of racks in corr room. Item can be shifted to other, alternate week...

4.8 Procurement of new hardware & accessories required for final GWB system -- from 29 Jul and before (BAK/GSJ) :

(i) purchase of 4 new host machines for GWB III : to decide configuration of host machines (disk i/o to be kept in mind); also to check if SSD is a viable option for recording of data. Investigaiton shows that SSD vs SATA has pros and cons; it may be possible that one class of server may be there that supports both?
4 nos of T620s have come and integrated into GWB-III: 2 are with 16 TB with and 2 with 4 TB -- compute vs host. No pending action items here?
29 Jul : confirm disk storage capacity on the host machins and close the matter.

(ii) purchase of remaining compute/host machines (for GWB IV) : PERC card issue needs to be resolved : agreed that we will buy machine that can support upto 12 disks (which means with PERC card) but will have 2 x 2 TB to start with. More disks can be added as needed, and if at all extra slot is needed, PERC can be removed (will support only 4 disks) and backplane has to be changed with a new one (which has to be bought along with the machines);
To decide quantity to order at present : agreed to proceed with 16 nos with full waiver for DELL proprietary item with DELL as the supplier.
Action started to generate the papers; tender waiver is done; and enquiry has been sent -- last date is 30th for the quotes and then tender will be opened.
6 May : sample T630 received from DELL; suitable (CentOS6.5) and CUDA 5.0 loaded and 2 GPU configuration done; 1 dual port 10Gbe card; 1 infiniband card installed; 3 slots still available -- 2 are x4 and 1 is x8 (PERC card is already on the mboard); can test the spare x8 slot and also the 2 x4 slots with appropriate 10Gbe cards.
Power supply problem : not really, as 2 nos x 1060 GPUs did not work, but 2 nos of K20s worked (will be tested with 2 nos of K40s).
20 May : final stages of configuring the T630 for swapping in place of a working T620 in the GWB-III. Meanwhile, to ask for extension of validity by 1 month (from

25th May).
4 Jun : initial set of tests showing that T630 loses packets; tried with lower BW and still getting packet loss; now trying a more recent OS.
17 Jun : still having problems with packet loss; in touch with DELL for resolving the problem; to try T620 with the updated OS; to try T630 in stand-alone mode; may be an issue of NIC card compatibility?
1 Jul : reverse test of upgrading T620 to higher OS has been tried and it works ok; to see if stand-alone T630 test can be tried; to follow-up more closely with DELL.
15 Jul : 'T630 test' continues [packet loss]; no loss observed with x2 10Tb NIC cards (in 1 hour); longer test planned.
29 Jul : latest test results summarised by SHR show that there is one working combination using 2 NIC cards that works; to get back to DELL with the test report for follow-up action; to see if we can go ahead with the order, with 4 of the T630s becoming compute m/cs and the rest becoming host m/cs; to check status of the existing folder and decide course of action.

(iii) procurement of accessories like network cards, disks, cables etc :
20 nos of CX4 based dual 10 Gbe cards purchased and tested; to confirm that this order is enough to meet our long-term requirements; agreed to produce a formal note about the situation for long-term : to relook at the spares requirement without counting the units already being used in the existing systems (including the PoCo and pkt corr) and buy more if needed; GSJ has produced this list and fresh orders to be done, based on this : 10 Gbe cables and NIC cards (spares); 36-port IB switch; 8 nos of K20s.
c. 4 Jun : 8 nos of K20 have come; IB cables and NIC have arrived; IB switch (36 port) has also come and has been installed in GWB-III. Agreed to put in a repeat order for the 36-port IB switch. Check current status and see if any other accessories need to be ordered.
1 Jul : Order has gone for spare switch.
15 Jul : IB switch is expected soon;
29 Jul : not discussed.

(iv) new purchase of Roach boards etc : need to have enough Roach1 boards and ADC card; need to invest in Roach2 technology to keep abreast of things; new lot of 12 Roach1, 16 ADCs and 4 Roach2 was procured and Roach1 test set-up was made ready and all the Roach1 and ADC cards above were tested ok; current action items are :

(a) for Roach1 + ADC : summary spreasheet about current stock and usage of Roach1 and ADC created and taken up for discussion; agreed for final configuration of 32 working Roach boards + spares -- to check how many new ones have to be ordered (note : Xport will be missing in the new ones); agreed to go with 1 ADC card per Roach board -- to check how many new ADCs needed.
Confirmed that no new ADCs needed for 1 per Roach board; to order balance number of Roach1 boards.
1 Jul : processing for procurement for balance Roach1 boards (~20) has started; Digicom has confirmed that they will provide.
29 Jul : not discussed.

(b) for Roach2 : to check standard test procedure on CASPER; to check if we need to buy add-on mezzanine card; to check if Roach2 can be seen on USB port using Ubuntu and if some basic tests can be done with this; mezzanine cards were needed in order to use Roach2 -- these were procured, allowing work to start on Raoch2 testing.
20 May : Aniket has been working on testing basic things like mezzanine card; 10 Gbe design etc; can now try to see if PoCo design can be ported to this system.

1 Jul : delay in progress due to sharing of PC with host environment of Roach1 & Roach2.
15 Jul : x1 more server needed (to speed up);
29 Jul : not discussed.

(c) software environment needs to be upgraded (for working with Roach2) :
Matlab-Simulink upgrade was ordered and installed on one machine (64-bit), including updated license manager (additionl license is for parallel toolbox); Xilinx ISE v14 was ordered, procured and installed; one existing PC was taken for putting new Matlab, Simulink, ISE v14.2; casper tool flow was also installed; LED blinking on Roach1 tested ok; to try PoCo design (may need some changes?) on Roach1 and then go for packetised design and GWB III design; after that, try these designs on Roach2, taking into account the change in architecture.
26 Mar email updates from SCC : CASPER toolflow for ROACH-2 installed; takes a lot of time for compilation of simple ADC Snap design (almost 45 minutes); also PoCo compilation needs rebuilding of design using new casper libraries. Still the toolflow has some freaky issues. ROACH-2 booting environment has been setup and need to test booting of roach2.
Need more RAM on the machine; installed on machine with 32 GB DDR-III and found significant speed-up of compilation -- sharing with Roach-I server machine.
need to identify another server.
1 Jul : agreed to initiate the process of looking for another server; and to try T7500 as an intermediate option.
29 Jul : not discussed.

4.9 Testing leakage, coupling and correlated noise in new back-end chain -- from 29 Jul & before (BAK/YG/++) : detailed tests had been done by Vikram Jaiswal (with SSK, SHR and YG) and report has been circulated; for GAB systems, some follow-up action for testing the leakage has been initiated; procedure for testing to be done with GWB-II release modes clarified and tried out -- new tests show significantly different results for cross-coupling for GAB+GWB; maybe due to synth LO (old tests) vs sig gen LO (new tests), whereas earlier tests used synth LO; new report had been circulated that showed significantly reduced coupling; agreed to repeat the original, user level tests done by YG & VJ to see if things are different now ; agreed to try the ADC noise input and north pole sky tests and see what results come out;
2nd round of tests done, show leakage of 2-4% (consistent with first round results of 1-3%) -- to check with SCC whether all user level tests (done earlier by YG + Jaiswal) have been covered; some user level tests done with north pole and different leakage found for lower and higher LO settings -- needs to be understood.
From Aug-2014 : <= 4% leakage; FE+GAB+GWB (L-band) ~ 40% leakage.
Need to organise a detailed discussion on this.
1 Jul : no fresh updates, except maybe to organise a fresh set of tests with GWB-III.
29 Jul : not discussed.

4.10 Walsh modulation : prototype set-up on Roach board -- from 29 Jul & before (SCC/BAK): plans of BE team for implementing prototype scheme -- basic unit for switching using sq wave signal from GPIO pin tested ok; was put in PoCo correlator and was being tested; walsh waveform delay functionality was added -- can set delay from 1 to 2^32 clk samples (!); with this, variation of correlation with delay was tested using noise source inputs and found ok; Walsh patterns were put on the Roach board (not many slices needed) -- there was some mismatch between CPLD and FPGA waveforms that was resolved and all FPGA waveforms were shown to be ok; dmodulator on FPGA was implemented; list of targets and action items is as follows :

(i) issue of accuracy of oscillator being used needs to be resolved -- to check

if this has been done and item can be closed?
1 Jul : one round of tests to be done with generator CPLD with free running osc.

(ii) to comlete the final delay setting algorithm : to provide upto 500 msec of delay (for 128x4 Walsh length) with resolution of 5 nsec (FPGA clk); there were problems related to varying start-up offsets and fractional delay setting, as well as problems related to set up and hold -- these are now reported to have been resolved : this is confirmed to be work ok and can be closed.
1 Jul : can be closed.

(iii) what about synchronisation of starting? -- this is taken care of by running the CPLD with a sig gen locked to 10 MHz. Can be closed?
1 Jul : this is coupled to item (i).

(iv) to develop and optimise the hunting algorithm :
15 Jul : a version of the hunting algorithm developed - tests in lab done; tests in progress with C1 antenna; it takes 20 minutes to lock; further optimization leads to ~ 10 minutes lock time (is this acceptable); to discuss plans for future.

(v) to demonstrate cancellation of unwanted signals in ADC card and/or GAB; first, need to run a test where pattern from external source can be synchronised to the pattern generated in the FPGA -- this requires being able to hunt and correct for the unknown delay !
1 Jul : this is yet to be demonstrated and is likely to be coupled to item (iv)

26 Mar email updates from SCC : the test is going on with pocket correlator to check effect of walsh pattern delay on normalized cross. CH-1 walsh modulated and CH-2 delaying walsh pattern by 50uS and check effect on normalized cross. The testing software is ready and will be tested soon. The design don't take much resources only 2-3% of fpga. To check if first results from tests are available.
New feature : Walsh pattern generated on fpga can be grabbed on PC and plotted. tests of correlation change with delay change will come in next few days.

20 May : Actual Walsh patterns show multiple peaks of full correlation amplitude (!); 50% duty cycle Walsh shows only 2 peaks -- this becomes one peak once the sign is also considered. To redo the 60 Walsh patterns with sign of correlation to check number of +ve peaks and their exact value.

4 Jun : able to correct the sign problem, but still issue of multiple peaks etc -- needs to be looked into.

17 Jun : hunting algorithm being developed.
1 Jul : coarse hunting with 4 ms step is working; and now trying to refine with finer steps of inverse of basic clock.
15 Jul : 'finer steps' work completed;
29 Jul : first tests have been done with astronomical signal and modulation at FE with demodulation at BE (alongwith hunting algorithm) -- locsk in about 10 mins; gives back proper correlation; but appears to drift rather quickly -- need to check the cause for this.

5. Other items :

5.1 New python assembly design -- from 29 Jul (HSK/SSK) : FE group wants the

python configuration in E6 to be adopted for all antennas -- FE and mech have dicussed about plans for modified python assembly that will give additional protection to cables; mech group had circulate a short note on their view of the matter, alongwith photos; this was discussed and existing vs E6 system was compared; Action items :

(i) modified E6 design with hinge-like support was installed on C4 (July 2014); agreed to watch the set-up on C4 and do periodic inspection for checks of (a) damage to hose (b) hose clamps (c) water entry etc -- first inspection was done after 2 months (mid-Sep 2014) by mech and fe teams; subsequently, inspection was done (around mid-Nov?) and a video of the same was circulated; scheme appeared to be working ok; however HSK felt that this scheme with hinge may not be good in the long run -- this was discussed in detail; the hinge arrangement on C4 is NOT exactly same as the E6 arrangement (!); the C4 design does not completely solve the problem; agreed that E6 set-up does solve the problem (!); agreed that it can be replicated if needed.

(ii) IGUS cable wrap -- new technology prototype to be developed and tested on quadripod : a) hose without wire impregnation b) entire hose assembly (both could be tried as long-term solutions).
Quotes for both items received : item (a) is Rs 10k for 10m (4 antennas); item (b) is 60k each -- will try on the quadripod test range; items received; basic assembly made ready; finally, installed on test range around Oct 2014; tested ok without cabling (video available); then populated with cables by FE team for further testing; proto model made fully ready; this set-up uses a slightly different arrangement of fixed members, along with the IGUS hose; will work as well as the E6 design.

Agreed to : (a) replicate the test arrangement on 2 antennas, one with normal hose and one with IGUS hose (b) to check how much extra cable can be accommodated in the existing hose and (c) look for wider diameter assembly (32 to 40 mm or more).

Email update from HSK : (i) hose procurement in progress under cash purchase (ii) spare assembly with old type hose will be prepared for 2 antennas in time for installation during Mar-April 2015 MTAC (ii) spare assembly with new IGUS hose will be also be prepared for 2 antennas for installation during MTAC (iv) extra hose of 38/40 mm is being procured and assembly preparation is in progress -- will be ready by 1st week of April.

26 Mar : 2 sets of hose assembly are ready for use -- two antennas to be selected : maybe W1 + one. HSK says no scope for adding more cables in existing; wider assembly of 38/40 mm is getting ready -- can go to antenna directly (W4) and add optical fibre cable as a test case.

6 May : 2 Finolex-type hose assemblies (with normal dia) made ready for use in 2 antennas as an improved version of E6 assembly. IGUS hose assembly (with normal dia) 2 units are also ready; agreed to put one of each kind using C4 and W1 as test antennas. Wider hose (50 mm) under procurement -- it is a Teflon based product -- will need to be tested for temperature and then made into an improved E6 assembly and tried out.

26 May (email update from HSK): 2 sets of assembly of Finolex pipe made ready were given to FE group for putting cables etc and returned on 21st May; one set of Igus hose assembly also given to FE group to make ready, and returned on 25th May; now preparing to install on C4 and W1 antennas within a week.

17 Jun : Igus type hose assembly installed on C4 -- had some problems (2 iterations), now done on 3rd iteration with another modification; old E6 design with Finolex pipe will be installed on W1 early next week.

1 Jul : C4 installed and working, but video yet to be made; W1 to be installed soon (wind problems slowing down the work); to wait for few weeks to assess the performance.

==> 29 Jul : C4 running for over one month and W1 for 3 weeks; can wait for one more month; meanwhile some accelerated testing is required -- can be done on maint day via control room.

5.2 Problem of access to FE boxes with 500-1000 CDF feed -- from 29 Jul & before (HSK) : Update on new solution being designed by Mech group -- tested in situ and found working ok; agreed to use this for present; for future where bigger and heavier boxes will come into play, mech group will think of an improved solution, including an option for removing one feed and bringing the stool inside the basket; a few options explored by mech group, with target of 1800 mm height for boxes with max weight up to 150 kg (?), quotes received from some parties, processed and order placed; delivery by end of November 2014; inspection done (in Bangalore) in mid/late Nov 2014; some simple improvements suggested to vendor (guard rail, simple clamping arrangement for item); platform delivered at GMRT (early-Dec 2014), tested and found ok, including modifications that had been suggested; trials had been happening on ground; ready to test with actual antenna operations -- waiting for new crane to be operational (why can't it be done with the HLPs ?)
Email update from HSK : waiting for RTO registration of new crane to complete. Confirmed that not a good idea to carry it to remote locations in HLP basket; hence, crane has to go (as item is too heavy to be easily handled by humans) ! Crane is now ready for use; to try the test on one antenna with crane + HLP + platform; to coordinate with FE team.
26 May (email update from HSK) : markings made in the basket and making of hole is in progress; after that, can start using on a need basis.
17 Jun & 1 Jul : no upates on this; no progress.
==> used in W6; to try for a few more times and then see how it is going.

5.3 New FE boxes and testing with reflective paint -- from 29 Jul (HSK/SSK) : two kinds of paint received and 1 box will be made ready next week for testing. 6 new boxes are ready as per specifications -- only some engraving work is pending.
email update from HSK : One FE box painted with Luxtrotherm HT 400 (range from 250-400 deg C ?) and handover to FES group for testing. Second grade paint : Luxtrotherm HT 600 (range from 400 to 600 deg C) -- waiting for arrival; 3 types of FE boxes handed over to FE team : (i) plain box with powder coating (ii) box painted with HT400 (iii) box painted with HT 600; waiting for test results.
2 types of paints tried : HT400 & HT600; neither successful; to try new paint options? Item needs to be discussed jointly with mech and FE to understand why the original selection did not work and what should be done about it.
Agreed to circulate the description of the method used, the results and the conclusions and then take up for discussion and decide what needs to be done; this has now been done by the FE team; need a follow-up discussion.
To cross-check proprerites of HT400 and 600 about reflective nature and what are the other alternatives -- some alternatives had been identified; HSK to report status of follow-up action.
6 May : one product has been identified (summer cool made by excel coatings); sample has been ordered. in addition, modified version of 15m as well as antenna shell

cage to be used on 2nd box and 3rd box to be normal box. to try the test this month.
26 May (email update from HSK) : paint material received on 18 May; painted box handed over to FE team on 19 May; first round testing has been done by 25 May and some results are available (to be circulated) -- overall effect may be 3-4 deg improvement...
17 Jun : mech group wants to try with one expt with summercool on top and PU based insulating material (Stopaque) on the inside.
1 Jul : mech group to go ahead with the test after procuring the Stopaque material via cash purchase.
==> instead of Stopaque make, Unishield has been procured and test will be done soon in coordination with FE, depending on ambient conditions.

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Minutes for the weekly Plan Meeting of 19 August 2015

1. FE & OF related :

1.1 Documentation : follow-up on level 2 (ITR) -- from 5 Aug and earlier (SSK+team):
(i) Check status of new items : work was ongoing for

(a) spares for 1420 feed -- to be taken up after temperature monitor report is completed (which is done mid Mar) -- VBB to talk to SSK to work out the contents.
No progress on this; agreed that to have an upate on this 2 weeks later (27 May)
still pending for discussion between SSK & VBB.
8 Jul : issue about who is the FE person responsible for this ! (S Ramesh vs VBB); SSK to check and come back (maybe SSK can help S Ramesh to do this?).
5 Aug : SSK will work with Ramesh to start with earlier report and update to reflect the new changes made while making the new Lband spares.

(b) OF & RF monitoring schemes : OF power monitoring (starting from initial version from Gehlot) -- to be done by Sanjit; RF power monitoring (to be named as "Broadband RF monitor"), from scratch -- by Pravin, Sanjit and Ankur; was deferred to after MTAC (Apr 2015); then waiting for some test results from newly assembled system; preliminary report on OF monitoring by Sanjit Rai discussed on 27 May 15 : has good amount of material, including sample results etc, but needs improvements about the layout of the block diagram, terminology used, functional blocks etc and a section that emphasises the future growth path and plans a little bit (e.g. long term monitoring 24x7 and transfer to online etc).
8 Jul : revised version of OF monitor doc discussed : blk diags are much better now, a few small iprovements are needed; some of the pictures could be moved next to the corresponding blk diagrams and labeled; blk diagram and scheme as to how multiple antennas are handled needs to be added; some description of which antennas behave good and which don't and possible causes for poor behaviour; future plans and scope to be added. Work on RF monitoring report to be started soon.
5 Aug : RF monitoring : work yet to start (PAR to be encouraged to start soon); OF monitoring : most of the suggested improvements have been done; only a bit more detail is needed about antennas showing good or poor behaviour, alongwith possible reasons and future plans for tackling this issue.
==> Report circulated today (19Aug15)
==> OF or RF ?

(c) Test & characterisation set-up for OF system : Sanjit will be looking into this. Set-up to be ready in 2 weeks (18-Mar-15) & then report will come; work ongoing (Sanjit + SSK) -- first draft is with SSK for review; some feedback has been given by SSK, to include some new measurements and also drawings of test set-up, change of linearity / dynamic range with level, temp stability of bias point etc. Updated draft discussed (24 Jun 15) - needs to be implemented (addition of Block Diagram; some tests ...).
8 Jul : work is ongoing, some modifications have been done; one measurement of phase stability is pending.
22 Jul : Phase stability measurement carried out (x1 set); data collected for amplitude & bias stability of optical transmitter also; report to be completed.
5 Aug : phase stability measurement for 8 km of exposed fibre behind the lab shows

significant phase varn with temp; now need to compare with similar or longer length of buried fibre to antenna, for comparison. AFter that, report can be finalised.

(ii) Also, can we look at which ITRs may be ready for conversion to NTRs : it was thought that filter design work can be taken up for this, once the ITR is done. For the 250-500 filter, paper has been accepted for publication in IEEE (Sougata & Anil).
Pending action items :
(a) agreed that the 550-900 filter work can be looked at for a paper : Imran is looking at that -- will come back shortly with a proposal for presentation in paper content; Imran urged to look into it; discussion between Imran and SSK has taken place -- Imran has made a rough first draft and is working on refining it.
8 Jul : no progress on this item; may need a discussion.
5 Aug : Work has started on preparing the draft and will be circulating first version internally in about a week.

(b) to check what else can be taken up for publication -- defer for now.

1.2 OF system NTR -- from 5 Aug & much, much earlier (SSK): can this be initiated now, leading to a journal paper publication? agreed to take the first draft of what was done for the MWSky paper & build on the OF section of it towards a first draft of NTR / paper. PENDING FOR VERY LONG NOW. SSK looking at specific formats and content / scope of the paper; some thinking about what to include and flow and format : to focus on RF over fibre for radio astronomy applications, for GMRT. First draft expected 1st week of June -- to check status.
8 Jul : SSK described an outline document showing the plan, layout and some of the features (including some equations and expressions and tables); SSK needs a bit more time to collect more material (including results and measurements) and then will be ready to organise the contents.
5 Aug : SSK will circulate a first draft of contents by this week.

1.3 Noise temp & gain vs temperature for new LNAs -- from 5 Aug & before (VBB/SSK): Results for new 250-500 LNA show ~5 to ~55 deg K varn in Tlna for variation of 0-60 deg K in env chamber, and gain change is ~ 0.2 to 0.3 dB -- confirmed with new test that waits for temp to stabilise after giving 10 deg steps (tests are now done with one monitor in contact with the device and one in the box, alongwith chamber temp monitor); repeatibility has been tested ok with 2nd round of experiment.

Results from testing of 130-260 LNA show about 35 to 40 deg K variation in Tlna over 0-60 deg and 0.6 to 0.8 dB (drop) in gain with increasing temp.

Results for 550-900 LNA are similar : 35 to 40 deg K change in Tlna with 0-60 deg change in temp, and gain change is 0.04 to 0.36 dB -- results obained for two epochs for both cases and found to be repeatable.

Results for Lband LNA also done, with similar amplitude of swing : ~ 35 deg K change in Tlna (at 1300 MHz) with 0-60 deg K change in ambient temp; however, the lowest temp value reaches 5 deg K (!), which is a bit hard to believe.

Current action items :
These constitute a nice set of measurements; now need to understand what may be the cause : what is the expected variation for the device (same is used in both stages of all the 3 LNAs) and what is the expected sensitivity to bias point variations with temp -- these issues need to be looked at in some detail now.

(i) Agreed to verify measured values against the data sheet specs; check for bias pt variation with temperature (empirically) and compare with data sheet; also try Lband amplifier; expt has been tried to measure bias voltage but it is difficult as the probe affects the bias voltage and LNA behaviour changes; to check if any another method can allow the test to be done; no other option has been found yet.
24 June : required information not available from the data sheets;
8 Jul : still no progress in finding reliable methods for in-situ measurement.
5 Aug : no new updates.
==> [after changing bias as per datasheets] in 1 hour at different temps -
==> no change in noise temp [5/15/30/45 C]; report will come shortly

(ii) in parallel to check existing schemes (in lit) for temperature compensation of bias pt (assuming that this is the cause of the problem); agreed that this can be taken up -- start with a simple google search; any updates?
10 June : no action taken; agreed for VBB to take a look at this matter.
8 Jul : VBB has tried new scheme with active (transistor based) bias instead of the passive bias. Basic scheme appears to be working as LNA performance is not affected; variation of bias voltage with ambient temp (inside the chamber) has been measured; now to try to adjust bias pt to get best performance of the LNA (concentrating on Tlna) and then put it in the chamber to see effect of temp variation; to do the same with original design and compare the results.
22 Jul : replacing chip-resistor (100 ppm/deg C -> 25 ppm/deg C)
5 Aug : work on testing the active bias ckt with temp in chamber is ongoing; better stability chip resistors -- list of required values and possible part nos (and vendors) identified and to be circulated to see if items can be found more easily at TIFR Mumbai or to be ordered by GMRT team.

(iii) to check option for artificial heating of LNA to constant temp (via a TEC); SSK had initiated some enquiries to see if some suitable products may be there.
10 June : no follow-up on this topic.
8 Jul : SSK has found some potential products in the market and will see if sample items can be procured.
22 Jul : 13 W heating element with thermostat identified; programmable over -10 to 60 deg C; to work on a scheme using this device.
5 Aug : indent has been raised; but this device will not fit inside the LNA chassis (only in the main box); to continue to look for products that are suitable to put inside the LNA chassis.
==> cash purchased item is small [being checked if it will fit & may take
==> heavy current; 6 Amp ? New power supply]

(iv) The very low T_LNA (~ 5 K) seen at Lband issue being looked into by using 'new calibrated noise source' which just arrived : first look at data with new noise source shows results which are more sensible : absolute values of Tlnas are higher and easier to believe; variation with chamber temperature is a bit less over the range; other general comments : at all RF bands, the Tlnas with old and new noise source are showing an increase of 10 to 20 K ! Further, 2 different measurements of Lband, inside and outside the chamber are NOT giving matching results -- needs to be checked with use of the same LNA. Also to check other outside locations for testing : DIAT, IITB, Sameer etc; SSK has checked with DIAT and Sameer -- can try at Sameer Mumbai : SSK to send the info to YG for writing an introductory letter; tests with same LNA not done yet -- to check with VBB.
10 June : VBB agreed to complete the test and report by next time (2 weeks later).
8 Jul : LNA test may not be possible now, as no spare LNA is available (!); YG to send the letter.

1.4 Testing of 130-260 system -- from 5 Aug & before (HRB/GSS/SSK/NK) :
Analysis so far, from 2 antenna installation (C10 & W1) shows that deflection and sensitivity at 150 is better than existing 150 feed + receiver; at 235 it may be slightly less than existing system; need firm tests to establish this, including interferometric tests using 3 or more antennas; initially, since wideband FE box was not available, tried to put feed in place of the 235-610 feed in one antenna and use the existing 235 MHz band receiver for doing the test -- this didn't quite work out, and caused fair bit of confusion; finally installed on 150 face on S3 and replaced the 150 FE box with a 235 FE box to carry out the tests; results showed C10 and W1 deflection matching quite well (and only 0.6 dB less than expected at 235); but S3 showed about 1 dB further less deflection -- suspected to be due to the narrow band FE box; agreed to install new braodband 130-260 FE box when ready; 2 more boxes were made -- 3rd unit was installed on S3, and 4th was installed on E2 (25 May 2015).

Current action items :

(i) plans for sensitivity tests and results from these : consolidates summary from total power deflection tests by HRB and NK is as follows (interferometric tests have been difficult, due to various reasons) :
-- C10, W01, S02 (all 3 new feeds + receivers) behaving very similar, which is good;
-- sensitivity at 150 MHz is better than existing systems (and keeps getting better till 170 MHz) : the linear increase is almost 2x and NK to check if it can be explained by changing Tsky with frequency; this was analysed by NK (10 June 2015) and shown that the expected variation of sky background can explain the observed change in sensitivity quite well; may need to add the effect of Tlna into the calculations; this matter can be closed?
-- sensitivity from 200 to 230 is better than (a) existing 150 system (?) and (b) existing 235 system;
-- however, sensitivity from 230 to 250 is worse than existing 235 system (almost 2x worse at the peak at 240 MHz in the existing system); cross-over point is 230-240 region; this needs to be understood and improved.
-- there are prominent oscillations in the sensitivity of new systems in 200 to 240 MHz range : this needs to be understood;

The last 2 bullet items need to be understood and resolved.
==> not understood yet

==> deflection tests of 12Aug15 displayed C10, S3 & W1 (E2 not avaulable BLDC)
==> 150 & 235 compariosn with 'old' system : deflections (~ 1.5 dB less at 235)
==> 150 OK or higher than 'old'; C10 & S3; W1 there is some problem (no deflection)
==> 240-260 spikes [satellite RFI] (C10) whcih has extended band pass
==> 'off' source not same for Ch1 * Ch2 ? all anatennas

(ii) there are RFI lines which ned to be properly identified -- can take up for discussion in RFI section.
22 Jul : cable TV lines or system saturation ?? being studied;

(iii) Regular monitoring of the antennas with the new systems by Sougata (from 22 April 2015 onwards) : regular testing appears to have starated -- Sougata showed first sample plots; some antenna measurements (W1) showed more noise; S3 looked relatively clean; C10 was not available; one more round of new data was sent (27 May); from now on, 4 antennas will be available.
24 June : update expected next week (01-Jul-2015); The plate of the feed on S3

has fallen off !
8 Jul : plate has been repaired; cause has to be studied more carefully for long-term solution; may also look into reducing the weight; no new data taken;
22 Jul : Results from 14-Jul-2015 data on Cas-A (~ 9:45 AM); lot of RFI seen; 140 - 155 looks like a clean, strong band; report to be circulated by Sougata.
5 Aug : old data (14 Jul tests) discussed again : S3 has funny increase in power around 140 MHz during off-source, leading to poor deflection; E2 also shows slightly poorer quality of deflection plot. New set of data may come this week and can cross-check the above effects.

(iv) Other issues :
(a) possibility of sub-band filters discussed : not clear if it is required, except for RFI related issues (space in FE box will not be a problem) -- agreed to keep pending for now.
(b) to check items for longer term : most of the items required are there; noise source and coupling needs to be integrated;
==> integrated & put on C10
(c) QH + dir coupler : new PCB for QH + dir coupler with noise injection port was designed and manufactured (TechnoCkt); combined unit with QH + dir coupler + noise splitter (for 2 channels) was assembled and tested -- basic performance looked ok; noise coupling has slope ~ 5-6 dB across the band; unit was put in box #4 (on E2?); 10 units were assembled and data was taken to test repeatibility; results of this (and basic design + performance) to be summarised in a brief note; to plan to install in at least 2 of the 4 antennas for field tests.
8 Jul : brief report brought up for discussion : shows basic design of QH + noise injection system with 4 boxes tested; results look pretty good for insertion loss, phase change, and noise coupling -- small variation from unit to unit for the last item, may be because of accuracy of the length of the wireline that is cut; right now integrating alongwith RFCM card in box #s 5 & 6; when ready, will replace existing box on 2 of the 4 antennas.
5 Aug : one modified box is ready to replace existing box on C10; 2nd unit will be made on this C10 box. Report to be updated and released.
==> installed on C10; awaiting feedback on the performance.

1.5 Testing of 250-500 FE receiver system -- from 5 Aug & before (ANR/SSK) :
15 antennas have the new feed installed (remaining feeds are kept in storage) and 10 antennas have been fitted with the broadband FE box (with 2 spare units). This quantity is now (June 2015) going up again as 16 + 2 antenna target for 15 Sep 2015 is to be met.
Note that the new configuration of QH + dir coupler + LNA is working ok in the new FE boxes (e.g. C1) but it needs to be checked individually for each new box that is made ready.

Characterisation and testing of installed systems (using monthly data): Main tasks and issues that occur (in a somewhat dynamic fashion), alongwith their historical record, are as follows (FE team to maintain a proper log of action taken on individual antennas during these tests and debugging activities) :

(a) antennas with improper off/on bandshapes : low power leve or excessive slope, also variation of level with epoch (for standard settings);

(b) antennas with poor deflection overall :
In the early days (May 2015) E6 was found band and after many changes (including change of dipole as it had poor return loss) the problem was traced to use of metal

screw in place of teflon (this was a one-off case?); after that, there were strong lines seen and FE box was replaced with spare; E6 ok now (10 Jun 15); similarly, C13 showed problems in Feb 2015 data -- it appears to be ok now in recent tests (Jun 2015); plots showed C11 low in both channels -- later data showed significant ripple in ch2 for almost all settings of attn value -- finally traed to faulty OF attn unit; C11 deflection ok after that (Jun 2015); W6 both chans showed about 1 dB down; new FE box put there and appears to be ok (old box went to E4 !);

(c) antennas wth deflection changing over the band (usually, less at higher freqs):
C8 showed drop in deflection with freq -- this is a modified Kildal feed (not cone dipole) -- to be replaced at the earliest.
W4 showing RF band extending 8-10 MHz beyond the normal cut-off at 500 MHz

(d) antennas which show ripple in the band (either in ON or OFF or in deflection), or signs of oscillations and instabilities : ripples are usually due to cable problems or loose connections, and oscillations / instabilities are more due to problems with LNA (though bad cables & connections can also produce some effects);
E2 was showing problems around 8 Jul 2015 (but ok on 22 Jul).
W1 ch2 showing problems around 10 Jun 2015.

(e) antennas with significant RFI in the band : need to keep a track of this, esp new lines and also antenna specific RFI; recent report generated with list of lines shows 4 lines within 250-500 MHz : from satellites? more recently (29 Apr 15) strong RFI seen in most antennas near 400 MHz; latest data (May 2015) shows RFI near 470 MHz (Mumbai digital TV), and lines near 484 MHz (Russian satellite system);

(f) failure rate of new FE electronics : about 1 in 2 months over last 5-6 months (May 2015)? main reasons : oscillations? device failures? loose connections?

Specific action items are as follows:

(i) specific antenna problems being followed up :
(a) check if C8 modified Kildal feed replaced with cone-dipole.
24 June : C8 has recently got the cone-dipole feed put up (this being the 16th antenna); new 250-500 FE box to be put up tomorrow (25 Jun); it was not working properly (8 Jul); became ok after tightening of python (22 Jul) -- need status upate.
(b) check deflection of S4 and E4 (has FE box taken from W4)
(c) check status of E2 for ripples
(d) check status of S2 for ripples
==> C8 is fine now;
==> all Ae fringing & deflection as expected
==> C6 & W4 has CH1 CH2 difference
==> S6 needs check at FE output
==> C11 only OFF source has ripples ;

(ii) W4 problem : several tests and checks have been done (including new cable with modified connector pins); exact issue not clear; finally, main RF cable change was done and deflection tests appeared to be ok, but later results showed one ch dead -- debugging shifted the focus to the OF Tx system, where bad cable in RF PIU was found which fixed the problem (including ripple?); looks like first 10-12 OF units may not have been tuned for full temp range of variation; can be done now with the env chamber. This is being tried in W4 now and result will be clear in about a week. Similar retuning has been done for C14; meanwhile, entire OF system has been replaced by new

unit; also 250-500 box has been brought down (replaced with narrow band system), rechecked thoroughly and some units have been swapped and now ready to go back to antenna -- to check current status of this matter.
10 June : finally, a new box was put and old box is being fitted with new LNAs; now deflection is ok, but BPF filter on HF side seems to be extending beyond the normal range -- needs to be checked.
==> see above.

(iii) learnings from the latest test data :
last discussion was around 8 Jul for results from 30th June tests : results for 13 out of 16 antennas available; some antennas working very well, but also some problematic ones; to check if new data set is available.
==> see above.

(iv) Appropriate off-source location : new results 27 Mar 15) show some difference in the deflection taken wrt cold sky (Npole) & the OffCasA source (from online) with the former giving slightly higher deflection (~ 1 dB) at 375 MHz -- may have some frequency dependence; also, absolute value of deflection appears to have reduced (to ~ 11 dB) from the early days (~ 12 dB) -- agreed to do a systematic study of last 1 yr data with 1-2 month sampling; sample data from C4 & C0 displayed (remaining to be studied before conclusion) -- to check if done; also to cross-check role of pointing offsets, location of Sun etc.; sample plots for ~ 1 yr span for few antennas discussed; looks like Npole gives higher sensitivity than Off-CasA; to put all available data on one plot to check for any systematic variations with time.
10 June : analysis extended from 2013 to 2015 and appears to show that deflection taken with Npole as off source is 1.5 to 2 dB better than off Cas-A location -- trend seen for 3 antennas; can check for couple more; discussion with DVL and ICH showed that the off-CasA source is NOT a cold spot in the sky -- it is a spot with same background as that of CasA ! Hence, the calculations and results have to be interpreted accordingly !
8 Jul : ICH and DVL working on this; Ankur to show the data to ICH for comments.
5 Aug : discussion on this is under progress; need some clarity about the Tsky backgnd values.

(v) FE team to maintain a log of the issues found and work done (antenna wise); some discussion took place about possible options (hard copy and soft copy); FE team to think and come back with possible way forward.
24 June : FE team proceeding with hard copy format.

(vi) Academic colleagues from NCRA ready to look at the data for helping with long-term statistics and user-level interpretation : can the raw data be made available for use (past and future)?
8 Jul : agreed to provide raw data for one epoch to Tirth for understanding.
22 Jul : data given recently to Tirth, who is looking into it.

1.6 Mass production of 250-500 FE receiver system -- from 5 Aug & before (ANR/SSK) :
15 antennas have the new feed installed (remaining feeds are kept in storage) and 10 antennas have been fitted with the broadband FE box (with 2 spare units). Note that the new configuration of QH + dir coupler + LNA is working ok in the new FE boxes (e.g. C11) but it needs to be checked individually for each new box that is made ready. First version (v1) of FE box was installed on C13; final version (v2) of new FE box was installed on C11 and found working ok except for Walsh problems. Meanwhile, GSG cleared to go ahead with mass production; making of LNAs for 30 antennas (plus use as spares for existing 325 MHz system) were finalised and item

was closed (27 May 2015). Current action items towards mass production are :

(i) number of antennas completed : 16 are done now; details of combinations of old and new electronics to be made available (Nilesh table will have); 2 more antennas to be done to take target to 18 (3 in each arm + 9 in CSQ, avoid 3 short baseline antennas); have 2 old 325 FE boxes as spares (note : possible issue of wideband feed with narrow band FE box).

(ii) spurious bandshape / instability of LNA -- was not seen in the lab, except when i/p was loose or not connected -- this could be typical for all units? need to check about this; various tests were done in the lab and spurious lines were seen under some conditions of thermal cycling; there is an issue with central pin of QH (at both i/p and o/p side); at o/p side problem was fixed by ordering special connectors; may need same solution for i/p side (at cable connector i/p); sample machined pins were got from workshop for making a trial version of the cable; tested with FE box in the lab, and then tried on W4 to see if it solves the problem of oscillation seen there -- did not make a difference (!); however, since there is a fundamental mismatch, better to make this as a permanent feature; to check with Amphenol and Radiall if they will make to order for this (temporary solution is to get the changes done in workshop); plan is to have all new boxes with new connectors with sharpeend central pins; however, it is not clear that this is solving the problem of spurious effects in the bandshapes.

E6 oscillation reproduced in the lab with feed connected; tested with impedance stub connected in place of feed; can produce oscillation and stable behaviour by changing the stub length -- impedance going down from 50 and below; another LNA is stable with full variation of stub length; hence control tests can be done now to try and isolate design vs quality issue, both for QH and LNA and the combination.

Current effort ongoing to tune the ckt to improve RL at (small) cost to Tlna; in addition, to check for quality control on the ones that have come down from the antennas; also to monitor continuously at high temp to see if that stimulates the problem; 2 LNA units were modified to get better RL over 250-500 band without loss in Tlna and Gain (27 May 2015) -- but there is still a line seen when put with the stub; to try with stub on n/w analyser; to try the swap between LNA and other QH.
2 LNAs were tuned to give below -10 dB RL upto 600 MHz, without compremise of gain or noise temp (10 June 2015); however, when integrated with QH and tested, the gain response does not remain the same and when the units are connected to Sp An, the response is not good, and some lines are also seen (which is not the case for the originally tuned LNA); it appears that the retuning may have affected some of the components that are important for stability -- to put these back to the original values (or even towards the other direction) and try to change others which improve the RL...

Action items can be summarised as follows :

(a) plans for procuring modified connectors for i/p side :
yet to check with the manufacturers to see if standard item is available or not.
22 Jul : 'Radiall' connectors solve this (enough stock); feed to FE (input of FE : cable connector type-N male); visit to Amphenol : not happened yet [MOQ : bulk order needed ??; to explore custom made solution also.
5 Aug : agreed to go forward with a visit to Amphenol factory at Chennai / office at B'lore for finalising the plans for custom made connector for matching input cable to QH.

(b) to confirm if any quality issues have been found in the PCBs that have come down in FE unis from working antennas :
looks like this has no relevance to the problem and this item can be closed.
5 Aug : closed.

(c) current status of retuning of LNAs to improve stability :
no further progress this time, as ANR busy with 550-900 amplifier.
22 Jul : conclusion appears to be in the direction of using the original design (as any of the modifications tried have not shown improvement) -- will need combined tuning 2 LNAs with QH).
5 Aug : agreed and closed.

(iii) status of QH, noise source, coupler etc : QH is available for all 30 antennas; current version of noise source, power splitter, directional coupler etc were tested before putting up in C13; but in-situ tests showed that the power level (deflection) of the noise was not sufficient; traced to faulty functioning (unequal distribution) of power divider module; alternate approach (using resistive components) seems to work ok : equal powers on both channels ~ 4.5 dB for E-Hi cal, no need to reduce coupling from 20 dB. Also, additional issue of 7 dB slope over the band (due to coupler) and 4 dB due to noise source; agreed to a change in the layout of noise module -- to try and reduce the 4 dB slope, increase the noise power slightly, reduce temperature sensitivity etc; more compact PCB with constant current source, shorter track lengths etc) was made and first results showed fairly flat (+/- 1 dB) spectrum over 200-600 MHz.

Current action items are :

(a) First two of the new noise source units are on C11 (box #2) and S02 (box #1); 3rd unit should be up on antenna now. To check status of noise cal tests by DVL for these antennas -- test results have been under circulation and can be taken up for discussion; meanwhile, some changes and corrections have been made, may be useful to do one more round of tests.
10 June : the results need to be looked at carefully and conclusions need to be agreed upon by all concerned and then follow-up action needs to be decided.
24 June : 4 units showing repeatable performance in the lab; from noise cal tests : S02, C11 & C13 gave identical 6 dB gradient across ~ 200 MHz range;
8 Jul : except for C13, all the new ones have the improved noise coupling circuitry can check the list of antennas and repeat the measurements.
==> except for C13 all have new improved noise coupling circuitry;

(b) for new PCB : agreed to check on 2-3 more units for repeatibility & also thermal cycling and then finalise plans for mass production : one more unit has been made but work held up due to shortage of switch needed for control of noise level; meanwhile, thermal cycling tests passed ok. 30 nos of switches were procured, wired & 2 new units were tested (data appeared to repeat well, but final record is not available).
To circulate the results for discussion, even while conintuing with the 30 nos.
VBB to circulate the results -- has not happened yet.
10 June : VBB agreed to circulate the results.
8 Jul : results for one LNA connected to different noise source units shows good repeatibility; and one noise source + LNA combination over 0 to 60 deg in evn chamber shows constant noise power level (across the band); with this issue can be cleared for mass production; could think of including results in next version of the FE document.

5 Aug : mass production of PCB and chassis completed; only noise module to be soldered when needed.
==> this item can be closed ?

(c) discussion about the 7 dB slope due to coupler : to be deferred for now.

(iii) plans for sub-band filters for 250-500 MHz system -- results from sample units with all 4 sub-bands over plotted showed roll-off is a bit slow on the higher freq side compared to existing L-band sub-band filters, but insertion loss is better; lab tests with manual settings using patch card + old MCM card done successfully, and sample units assembled in the new FE box put on C13; meanwhile, new, integrated unit that is more compact was developed : one chassis with 4 filters (on 2 PCBs)? plus separate chassis for switch; following are the pending action items :

(a) prototype PCB for this had come and was tested : worked ok, except for small difference in 2 pols; maybe due to unit to unit variations?; one more PCB was given to Argus to make with stricter tolerance (less than 10%) to see if that fixes the problems (Shogini was unable to meet the specs); this new PCB from Argus had problem meeting 4 mil requirement : 3 sub-bands ok; 360-460 band had some issues -- slight shift in the band, and repeatibility of units not assured; hence agreed to design with 4.5 mil spacing for all subbands (may lose 3-4 MHz BW in each subband); design was made and sent to Argus and after receipt of PCB 2 filters for each of 2 pols were made ready and 1 filter was tested; out of 4 units, 3 were sort of same and acceptable, but 1 was quite different; after discussions, another set of all sub-band filters was sent to Argus -- these were also found to be problematic;
3-pronged approach : Argus is ready to try and correct the problem -- should go ahead with one sampe; alternate fabricators : Epiton from Ahmednagar is ready to take the job (Atlantis from H'bad may also take it); 3rd option is to try simulating with 5 mil spacing and see what results are available.
13 May : 5 mil spacing design done (with loss of 3 MHz BW) and sent to Argus; 4.5 mil order going to Epiton; Atlantis is ready to try 4.0 mil -- waiting for quote; not pursuing 4.5 mil with Argus; 5 mil has come from Argus; waiting for chassis; waiting for other PCBs from Epitome and Atlantis.
27 May : 4.0 mil PCB from Atlantis has come and comparison with 4.0 mil of Argus : Atlantis appears to be better for the 2 lower bands and Argus appears to be better for the 2 higher bands ! Agreed to try 2 more samples each (for higher and lower bands resp) with these 2 parties. For 5.0 mil from Argus only one sample has come and shows expected shift -- need to compare when 2nd unit comes; to check current status on this.
10 June : one unit each from Argus and Atlantis is still awaited; may come by next week; can check status after 2 weeks (24 June).
24 June : Argus performance better at higher frequencies & Atlantis at lower frequencies; x4 units tested (from Argus) show very consistent behaviour - frequency reproducibility within ~ 50 kHz;
8 Jul: new set of PCBs from Epitome : higher 2 sub-bands tested ok for 2 units, lower 2 sub-bands yet to be tested; also waiting for balance 2 units from Atlantis for low sub-band.
22 Jul : Sougata's report on 250-500 sub-band filter fabrication : all 3 vendors' results reported (Epitome, Atlantis & Argus) : BEST is Argus ! (x4 units for each of the 4 sub-bands show excellent consistency; x4 PCBs from same batch/run); Epitome not explored fully (ony x1 unit tested); to have a follow-up discussion and take a decision.
5 Aug : final outcome is 4 mil track PCBs for all sub-bands to be done with Argus; out of the 7 antennas which already have sub-band filters, 2 maybe with 4.5 mil,

others are with 4 mil final design; PCBs for 6 more antennas have been ordered -- will come in a week or so.
==> items have reached Pune.

(b) plans for mass production : switch PCB (20 nos) were available, along with sample chassis; agreed to first put on one antenna; if found acceptable, then go for mass production; compact v2 was installed on C11 and worked fine (tests completed); agreed to give order for mass production alongwith final sub-band filter PCBs; for the switch item itself, 100 nos were available (120 needed); confirmed that this switch is not used in other circuits, hence quantity can be finalised; chassis requirement has been worked out and request has been put (for how many?); mass production spreadsheet getting ready (by Temkar); meanwhile, 30 nos chassis to come next week (~ 11-Mar-15); spreadsheet still in internal circulation -- changes being made as per suggestions of ANR; has been checked after internal circulation -- needs a few small improvements before releasing.
10 June : spreadsheet is ready; will be circulated shortly.
8 Jul : Temkar spreadsheet is not yet released; meanwhile, Ankur spreadsheet is now online, with modification access control only for the owner; read access for others.
14 antennas with feed + FE + CB and 16 antennas with feed ; one in 3 weeks can be done; may be useful to put spares also on antennas, so that user can have better chance of getting 16 antennas.
5 Aug : Temkar spreadsheet content is finalised; will be making it online soon; other items above resolved at other places (to rewrite the agenda).

(iv) post amp + slow rise ps : Hitite 740 new stock for 30 antennas available; slow rise power supply -- agreed that this would be useful for the post amp in common box, but not really required for FE box; new design was done and PCB was ordered & tested Ok; agreed to give this for mass production to cover common box requirements for 30 antennas; mass production PCBs had come, few cards were populated and tested ok; agreed to mass produce, once the layout for the box is finalised and sample unit is integrated successfully in the prototype box. no specific action item here.

(v) Walsh testing for 250-500 : early tests showed both channels working in C13, but only one channel working in C11 -- box was brought down to check Walsh + problem of spurious bandshape of LNA; current action items :
(a) C11 FE box tested in the lab -- Walsh working ok in both channels -- may be a common box problem or D49 PIU? finally, cable from antenna base to top was found to be faulty -- replaced; agreed to test C11 (alongwith S2 and C13) to verify that everything is working fine; was waiting for C11 antenna to be released; finally, tests were done, and working on 2 antennas (C11 and maybe S2) was confirmed; to confirm for C13 and C00.
C13 problem needs to be solved; remaining issues are related to Walsh PROM; 9 antennas can be used. To plan another round of tests at 250-500 to check status.
10 June : C13 is a wiring problem being looked into this week for fixing.
24 June : C13 problem has been fixed; 250-500 tests show : only S06 with problem, rest x23 antennas show good performance;
5 Aug : 25 antennas tested at 250-500; remaining 5 can't be tested as Walsh is not generated at antenna base due to different IF circuitry in D49 PIU. Same 25 antennas working at Lband also.

1.7 Final version of 250-500 FE box -- from 5 Aug and before (ANR/SSK/HSK) : modelling showed that existing size of box is not adequate (inspite of double deckering of chassis); deeper FE boxes are needed -- 15 cm longer box was made (wt of new empty box was 15 kg) after mech group confirmed that this is ok (present depth

is 468 mm, can be increased to 700 mm; also, rear member in the cage can be removed to further increase depth); also total weight of populated box will go up by a significant amount. One such bigger box was populated as a prototype and put up on C13 and tested; increased size and weight of prototype new box makes it unwieldy to handle at the focus and is a potential problem; FE group worked on compacting the contents to shrink it back to the old size, with minimum increase in weight : some of the smaller units were integrated into single units; milled chassis were replaced by plate+rail chassis wherever possible; ver2 box with everything fitting inside the original box (now 19 kg, down by 9 kg) completed and tested in the lab; unit #1 installed on C11 and tested fairly one; later, it came down for checking Walsh and some other problems.
Present status is as follows : C13 has original (heavier) new box; 1st unit of final (v2) box (which went originally to C11), is now on S2; 2nd unit of final box is on C11.

Current action items :

(i) installation of new boxes : 3rd unit of final v2 box was expected to go on C00 (Temkar responsible for final testing & release) -- was finally put on C00; however, oscillations were seen -- brought down and tested in the lab; LNA was changed & box was installed back at C00; deflection test results showed working ok, and appears to be holding fine so far (27 May); check current status of this; also, update about plans for next box, and schedule for reaching 16+ antennas at 250-500.
10 June : COO seems to be working fine; next box went to W4 to replace the old one (which will be refurbished and put on next antenna); rate of 1 per month is quite feasible, except for the problem of sub-band filters; agreed to put up the new boxes as they get ready, without waiting for sub-band filters and retrofit as needed; target is to reach 18 by 15th Sep; question is how many are up now? 13 were confirmed, including C8 (FE team to provide exact status) -- may need to do one in 3 weeks.
24 June : C08 to go up this week.
8 Jul : C08 is up but there are some performance issues being looked at right now. Actual present count to be confirmed (see item above).
22 Jul : now problem at C8 not seen; to confirm present status.

(ii) choice of reflective paint for the final FE boxes needs to be made : a few different options available (ref : APK, HSK) -- need to identify the best option; methodology of the tests to be done -- empty box to be painted and tested in parallel with control unit (without paint) using in-situ tempearture measuring device; issue of possible clash with powder coating needs to be understood.
3 types of FE boxes handed over by mech groupt to FE team : (a) plain box with powder coating (b) box painted with HT400 (c) box painted with HT 600; initial results from 5 day continuous run, having 4 curves : ambient showed large increase at sunrise (even a spike to 55 deg); for the box temperatures, results were slightly confusing as one box under test and power coating box tracked each other very well and other box under test behaved worse than these 2 (!); also there is extra cooling in the night ! Further tests also appeared to show that this is not working out; FE team prepared a brief report with the data and their conclusions; issues discussed were : current coating thickness 0.7 mm, to try higher value [can that help ?? skin depth much smaller]; are we using the correct type of paint? new options for reflective paint were discussed on 26 Mar 2015 -- mech group did some follow-up; some inputs from web-search and from Dr.Shenoy were used to identify proper paint;
Later (27 May 2015) tests were done with SummerCool make of IR reflective paint; at the peak of the ambient temp, the reduction in temp is about 8 deg from ambient and

about 4 deg wrt powder coating; at the minima, all are the same (which is somewhat surprising); some follow-up actions identified :
agreed to try with thermocol layer inside in both the boxes; to also try with the insulating foam used in antenna shell; Kale awaiting 2nd brand of reflective paint.

10 June : some new tests have been done; update by Sanjit shows that the best results are still for the SummerCool coated box (the one using the material used in the antenna shell gives intermediate results); to wait for the 2nd brand of reflective paint (from HSK) and then decide the next course of action; also mech group wants to do one test using thin layer of insulating material on the inside of the box (see relevant agenda item in alternate week)
24 June : new insulating material (for trial) expected from HSK; what about status of 2nd brand of paint?
8 Jul : action items pending with HSK; no updates today.

1.8 Status of improved 500-1000 MHz CDF -- from 5 Aug & earlier (HRB/GSS/SSK) : there are 3 different versions of dipole (v1, v2a, v2b) and 2 versions of cone (v1 with 66 deg and v2 with 70 deg) in trial phase; 3 test feeds have been built using these :
ver1 : dipole v1 + cone v1 : RL is OK, deflection is not good & falls with freq
ver2a : dipole v2a + cone v2 (mesh?) : RL is good; deflection is OK & flat with freq
ver2b : dipole 2b + cone v2 (solid?) : RL is VG; deflection is good but not flat.

Simulation results for different combinations of the above were carried out and discussed in detail : it appears that dipole (rather than cavity) is dominant for deciding the RL behaviour (and also H-plane taper?); cone appears important for E-plane taper; best results for RL and good beam pattern match over large freq range appear to be for dipole v2b (triple sleeve) with cone v1 (66 deg).

Current action items are af follows :

(i) Running the simulations :
(a) Simulations with denser mesh case (higher order basis functions): new simulations were done with finer planes rather than with higher order basis functions; this needs to be confirmed; also, 50 MHz shift that is seen needs to be understood; also explore default number of current elements in simulation (from 19 Dec 13 meet); discussion with WiPLD indicates that increase in PolDeg may make a difference; tried with some changes in values of PolDeg related but no change in the results is seen; to contact WIPLD to see if they have a case study that exemplifies these effects and then decide the future course of action. WIPLD had sent a response but it had not been tried as PC was down;

(b) PC problems : licensed version of windows7 was obtained and installed on the lab PC but still had problems : may be some hardware issues (hanging or shut down); finally, after several months, all problems resolved & PC working properly (c. early March 2015)! however, still some problems : display goes blank at times; replaced with another PC, occurence reduced but problem persists; finally (around 10 June 2015), tried on a different PC in the same lab (to explore if problem is due to 'older' version of PC/ hardware)
24 June : Now WiPld working on x2 different Dell PCs; to decide future course of action.
8 Jul : need to decide on an action item here.
22 Jul : to look into PC procurement for this.
5 Aug : some solution is being worked out by YG for the PCs.
==> new HP (i7) PC being made ready for use.

(ii) there is noticeable difference in simulated and measured RL curves which needs some study also (it appears that agreement was better for 250-500 CDF?); to check if new simulations make any difference or not (the same can be compared for the test range pattern measurement results for the two feeds?) -- this is not being actively followed right now.

(iii) deflection tests for different combinations of dipole & cavities (as mentioned above) for varying distance from focus using a variable height stool to see which design gives optimal performance :

After a lot of effort, a reasonable set of results on Cass-A obtained for the different combinations of feed : 750 MHz Kildal feed turned out to be very similar in response to Cone1-Dipole2); Cone1-Dipole2b as well as Cone2-Dipole2b gave results similar to CSIRO feed plots obtained in ~ 2011; later, it was discovered that using short length cables to minimse the loss made a significant difference to the results.

for cone2 + dipole2b at optimal ht of 1260 mm + matching short length cables (0.6 m instead of 1.4 m) was tested on C10 -- showed measurable improvement ~ 1 dB over most of the band (!); further reduction to 0.3 m cable appeared to produce another ~ 0.5 dB of improvement (!!) over most of the band; agreed to follow-up with LMR low loss cable; tests done with new arrangement of QH + LNA mounted on plate and kept right next to the feed showed another ~ 1 dB increase in sensitivity at 610, but no improvement by 800 (note that this was a different LNA and not the same one used in the FE box, with the matching connectorisation); further tests with LNA used with CSIRO feed (SMA coupler may be producing some loss), mini-circuit LNA (very bad result); best result is for ~ 0.15 m long cable connecting feed to LNA directly with type-N;

for cone1 + dipole2b, peak was found to be around 1310-20 mm ht; also a new version of the CDF was introduced with a "choke".

Deflection plots for one chan for above 3 combinations were discussed (13 May 2015): cone2+dipole2b gives the best overall deflection curve; cone2+dipole2b + choke gives almost identical curve to cone1+dipole2b (!) and both are worse than c2+d2b.

Agreed to confirm 2nd poln is similar in behaviour & to get beam shape plots done asap; to prepare comparative chart with CSIRO feed results for taking to GSG level. Most of these matters were resolved, tests were done and results were presented in GSG of 8 June 2015 and clearance to go ahead with C2D2b design was obtained; now, need to close the loose ends and move forward.

Around 5 June 2015 : prototype C2D2b feed was replaced with new unit (with better stool arrangement?) and first round of deflection tests with this showed slightly lower deflection compared to earlier (for Cyg-A and also Cas-A); also, first beam shape tests showed slightly larger (~10%) value than expected (e.g. ~ 50' instead of ~ 45' at 610), also the prototype version showed Az values to be ~ 50 larger than expected -- all of these issues need to be understood and resolved.

10 June : in order to move forward after GSG : 2nd prototype put on C10 on 5th June, now has final FE box (hood) with 15 cm semi-rigid cable; fresh data for deflection and beam shape for both channels has been taken over the last few days, and the conclusions need to be checked and understood.

24 June : HRB summarized results from tests conducted over last few days/nights

which are very satisfactory (as a 'final' option); (about ~ 1 dB peak-to-peak noise/ oscillation is attributed to test equipment (needs to be confirmed); also spikes in beam size plots attributed to RFI (needs to be confirmed); meanwhile, HRB would like to try with a modified version of cone2 (reduced length of the cavity) to see if it affects the beamwidth.

Comparison of beam shapes for the 3 feed combinations to see which is better : quick results from PMQC data (at 610) give some indication that cone1+dipole2b has slightly broader beam (?) -- need to get full RF test data taken and analysed, for both cases; finally plots of beamwidth vs frequency obtained from Manisha's program were obtained (May 2015) : showed ele and az beamwidths varying with freq, but with some difference in slope, and also absolute values are higher than expected (x2 for Ele and x4 for Az); finally (early June) these issues were sorted out and a series of measurements were done from ~ 6th June 2015 onwards. These showed that C1D2B has a beamwidth that matches closely with the "expected" curve and the same was true for the C2D2B with choke, whereas C2D2B clearly showed about 10% larger beams than "expected". These need to be followed up for checking repeatability and understanding the discrepancies.

24 June : Displayed plots (beam size vs frequency) from measurements on different dates show great variation (some even theoretcally impossible - like too narrow angular size) - for antennas S06, C03 & E05. (It was suggested that the strategy should be to first identify the RFI affected data & discard the same before being included in the plots);

Action plan suggested (c 24 June) to be followed in the near future :
(a) to resolve the conflict between beam width measurements reported by regular PMQC tests vs those obtained from the beam fitting code vs expected values -- is there an issue of definition (or use of some constants)?
(b) to test "final" feed combination with next gen LNA alongwith final version of hood + FE box
(c) to test the alternate (shortened) cone2 design
==> with hood configuration to go to C2 Ae ; update Manisha+HRB next week

(iv) Also, GP to work out the sensitivity curves for the expected parameters for this range : first version has been done, may need some refinement. There is some indication that some of the drop in sensitivity at ~ 750 MHz may be due to slight (10%) increase in Tlna -- this needs to be investigated in some more detail. Refined analysis with 2 different (fixed) values for T_lna show that the range of variation of T_lna over 600 to 750 MHz can explain the change in sensitivity seen in the expected curve. To check about options for retuning this LNA design; meanwhile, can test the commercial off-the-shelf broadband LNA available in the lab (which may have constant T_lna of about 30K) to see if it can be used to test flatness of the response across the band. Meanwhile, ANR to look at the existing LNA design critically to see what are the characteristics and what can be done to improve the Tlna vs freq. Also, can there be a matching problem? Agreed to take the 250-500 LNA PCB and adapt the ckt for 550-900, with the aim to improve the Tlna at high frequencies.

13 May status : expected curves made for varying values of Tlna, Eff and RL and some differences can be seen clearly : low freq (~600 MHz) matches with Tlna constant at 19 deg; high freq (~800 MHz) matches with Tlna of 28 deg -- consistent with known / measured Tlna variation -- to try to retune for ~ 19 deg across the band (or higher at low freqs), starting with simulation (can use the 250-500 PCB and chassis);

RL variation : varies from about -10 to -20 : there is scope for improvement at edges of the band (HRB can go back to simulation at some time to see); also 65% constant efficiency shows some improvement, esp at high freq side -- not sure what this is due to and what can be done to recover this... Need some follow-up.
==> redesigned LNA 25K T_lna; (no 7 dB slope); Eff calculation remains to be done.

(v) any new ideas? discussion of 19 Dec 2013 came up with following action items:
(a) design Kildal ring feed at 750 MHz using v2b dipole -- 14 dB RL achieved (over what BW?) -- first results from sample unit (tried on C10), including varying stool height, and the conclusion was that it is not as good as C2D2B (see earlier discussion) -- this can be taken as closed (May 2015).
(b) try simulation of CDF250-500 scaled by factor of 2 (including with different dipole sleeve combinations) -- maybe after (a) is done; status update needed; this is also now not relevant and could be closed (May 2015).
(c) design Dual-ring feed 550-900 MHz (intial BFRs can be made for 650 & 800 MHz) -- waiting for above items to complete; also not relevant now (May 2015)
(d) modified version of cone-dipole based on patent by Shefai + ... (1991) : refers to Kildal paper of 1982; recommends additional choke structure just below the cone but protruding out to lambda/4 : supposed to improve (a) cross-polar (E-H match) by 30 dB; (b) reduce back-lobe and (c) ???; agreed to cross-check the date of the paper on which our cone-dipole is based; agreed to build a prototype using cone2 (why not cone1?) matched to lambda at 750 MHz -- this was done and tested on C10 (see results reported above) and was NOT found to give results better than original C2D2b design (turned out to be similar to C1D2b performance); can be taken as closed (c. 10 June 2015).

22 Jul update : reduced cone-length feed version put on C2 antenna; results displayed by HRB - no improvement in angular size vs freq; existing feed will be restored in C2;

5 Aug summary : feed removed from C2 and original 610 coax feed restored; modified hood being made ready at w'shop; will come by end of this week; all the electronics for it is ready; and FE box is also ready; can go up by middle of next week, provided fixed ht stool can be made ready; likely antenna is C2; some work from mechanical side is needed. Plan would be to have this up on the antenna for about one month; and then take a call for final mass production.
Discussion with mechanical : new hood + feed will come to GMRT by Sunday / Monday ; stool in MS can be made at GMRT and ready alongwith hood + feed; long-term plan for production of feed+hood and stool (in SS) to be done.
==> stool is ready [with hood it will be installed on C2] next week

1.9 Design of new RFCM card (v3) -- from 5 Aug & before (SSK/Imran/Sougata) :
RFCM card (v1) was built as part of generating spares for Lband system and fully tested for all control functionalities -- for Lband, as well as for 250-500 FE box (alongwith patch card); it was agreed that since this RFCM card can not do monitoring (without further changes), old RFCM card + patch card will be used for present in the new FE box; will upgrade later to new RFCM card with monitoring capabilities included. Later, 5 monitoring points were added to the existing card, tested ok.
Plan was to enhance the design of v1 by explicitly adding the monitoring facilities & full compatibility with new MCM card so that it can be used in all FE systems.
A prototype version of the v2 PCB was designed, sent for fabrication, assembled, tested and incorporated into one Lband feed (which is now on W1) -- it still had some unresolved issues about bringing out the TTL lines and to take in the 8 monitor points : appropriate connectors need to be put for this; new PCB (v3) was designed and sent for fabricationl; 12 nos had been fabricated, received, assembled & tested;

all cards were found ok, but not yet integrated into a box -- agreed to complete this before going ahead with mass production (~ 120 cards may be required in the long run); v3 card was then tested ok in different conditions : L-band system on W6, 327 FE box that is now on C11, 130-260 box on C10 etc.. PCBs for mass production quantities were done and components required were procured; plan is to assemble and use as needed. Pending issues are as follows :

(i) report : first draft was discussed : generally ok, but needs additions about monitoring points and internal review (c 4 Feb 2015); some significant changes were made and 2nd version was released and discussed (13 May 2015) : details of the work done is very good; need a few changes : motivation for making new RFCM card to be explained better in introduction; more detailed comparison between original and final card to be added in redesign section;
27 May : Imran is working on the modifications; can check after 2 weeks.
10 June : not much progress on this in last 2 weeks; can check again after 2 weeks.
8 Jul : no progress reported.
5 Aug : updated report has been submitted; item can be closed?

1.10 Next Gen Common Box -- from 5 Aug (ANR/SSK) : Like 250-500 FE box, final version of Common Box needs to be assembled and tested : final power & temp monitor (are in hand), interface to Rabbit card (work in progress), design of new RFCM card (work in progress), new arrangement for power supply distribution; a block diagram of the new box has been prepared and circulated and accepted after some modifications and improvements; it was agreed that old boxex can be re-used (no need for making new boxes), except for the issue whether new MCM card can be inside or needs to be outside the common box (the former option would be preferable); action items to be looked into :

(i) The interface card in common box needs extra PCBs due to wear and tear of existing PCBs. One to one copy of the card to be made as a new PCB, on lower priority. Work is in progresss (Sougata); may be ready to go for fabrication by 1st or 2nd week of April -- not yet ready to go for fabrication (13 May);
27 May : was at low priority earlier, but need to increase priority now. Sougata will get back by next meeting.
10 June : will go for fabrication this week.
22 Jul : PCB has come, populated & under test;
5 Aug : testing not yet completed.
==> still waiting for tests to be completed.

(ii) FE team has worked out a plan for integrating the Rabbit card inside, which requires to swap the interface card to the other side of the box; to ease the wiring problem, the centre plate needs to be cut into 2 pieces; some issues about stacking of power detector with broadband amplifier need to be addressed; integrated power supply card is included in this scheme; media converter added to allow for additional capability of fibre connect from top to bottom (as an alternate to shielded eth cable or serial link on RS485) -- FE team plans to mount it outside; confirmed that RS485 serial link will be supported as default option, and that eth over Cu is not viable; sample unit assembled and looks ok; wiring is ongoing -- to check if ready for testing now.
24 June : FE group's work completed; Telemetry group needs to test Rabbit card etc.
8 Jul : FE has tested the box fully using current MCM card; now it needs to be tested with Rabbit card interface, with existing command structure (!) -- need a discussion with telemetry team about this !
==> tested with MCM5; now waiting for Rabbit card based testing (see below).

(iii) getting sample box ready : to take one old common box, get new plates made, put dummy boxes and work out the wiring scheme : mechanical items were completed for the sample box and all the items were available, including Rabbit card enclosure, slow-rise power supply card etc; wiring was to start after completing the layout -- this needed to be redone as things did not fit into the box in the first attempt; mechanical issue due to space crunch, required swap switch PCB and chassis to be redone. Swap switch PCB + chassis now ready and being tested; after that will be ready for integration in the box; sample unit assembled and looks ok; final wiring is ongoing (13 May)
27 May : VBB, Ganesh and Anand are working on it, but delayed due to 250-500 related matters; can check status after 2 weeks. Should be ready by now ?
24 June : Nothing pending with the FE group (wiring completed);
8 Jul : Box ready (see above); longer term plans : have 2 older style CB ready; and 2 of the new, modified ones ready and then start the cycling process on the antennas. For that main items required will be post amp (for remaining 14 antennas only); Rabbit card in shielded enclosure (to be supplied by telemetry); new power supply card; new interface card and power + temp monitors. May be possibe to do one in 3 weeks, as far as wiring is concerned; can use the boxes that come down, except that front plate assembly will need to be changed to accommodate ethernet connection; outer shell of the box can be reused, like in FE box case.
5 Aug : 2 new boxes are ready with all electronics and wiring; one (maybe both) are tested using existing MCM card; Rabbit card with box has been mechanically integrated; now awaiting testing via serial connection using (a) online V2 (b) existind command set. Ops group is going for option (b) and have already implemented 10 out of 23 commands and then monitor part has to be done, and being done with 100 m long serial cable. When completed, will put the Rabbit card inside common box and test with each FE box, and then a final combined RFI test before moving to antenna.
==> see comments recorded under Ops agenda (check and rationalise)

1.11 Calibration scheme with radiator at apex of antenna -- from 5 Aug & before (SSK/PAR/SRoy/DO/YG): Current set of issues being tracked are as follows :

(i) testing of dynamic range of old vs new electronics on specific antennas :
First round of tests were done on C0 and C1 (both old electronics); C4 was the first antenna with new electronics that was tested (in Dec 2013) and compared with C1 (old electronics); informal / short report was produced, which showed that : 1 dB compression pt has improved by 6 to 8 dB (from -6 to -10 dBm to about -1 to 0 dBm); change in phase (and also ampl?) with change in elevation shows cyclic variation -- may be due to position shift? W1 was identified for testing repeatibility on new electronics, in addition to repeating on C4 itself (though it has old common box).

Summary of new results :
Sensitivity and 1 dB compression point results look ok; stability of ampl and phase response need some interpretation; fair amount of new data is available which needs to be studied and the summary understood and then taken up for discussion -- this was done, and conclusions about 1 dB compression point are reasonably clear and ok (need to compare with results from signal flow analysis results); for the ampl and phase varn with antenna position, the results and conclusions are not very clear, but there appears to be some indication of the variations; a more detailed study with a couple of concrete follow-up options may be considered; agreed to complete the 1 dB compression point comparison with SFA; to repeat tests on either C0 or C1 to check validity of old results

Updates from results extracted from the analysis :
1 dB compression point values shown for C4 and C0 (new and old) show 7-9 dB change between old and new electronics; there is a hint for frequency dependence with reducing improvement at higher freqs; agreed to check with 20 MHz steps of CW radiating signal for both these antennas, in the range of 250 to 500 MHz.
Results replotted to show ampl, phase and elevation vs time on same panel -- there is clear anticorrelation of phase with elevation; for ampl, things are not so clear; for phase there may even be some frequency dependence in going from 150/400 to 1250 MHz; to try the test for broadband response alongwith n/w analyser; also give a copy of the data to SRoy to try plotting ampl/phase vs elevation directly.

Current action items :

(a) confirm when new common box was put on C4 (12th July 2013; sr no 119) -- to correlate with results. PAR to confirm results from data before and after this date.
24 June : No updates for a very long time -- to close or not to close?
8 Jul : can be closed, as there is not much data before July 2013.

(b) to get comparison plots for C4 with old and new radiator antenna : new data taken with new antenna at 327 Mhz : 6 dB ampl and 40 deg ph for elevation angle cycle -- this appears to be larger than that for the old antenna;
24 June : No confirmation of this forthcoming.
8 Jul : ampl loss can be explained due to poor return loss of feed, and extra phase may be added to the signal? item could be noted and closed.

(c) to check the change in 1 dB compression pt against SFA numbers -- this has been done and they compare well; to extend this to test 1 dB compression point at different stages of the chain : from OF i/p to GAB o/p; tests have been done and upto optical receiver output [OF Tx Rx FE CB] 1 dB compression point available;
first presentation of results (29th April) :
C4 antenna, 450 610 1170 MHz 3-plots : 1 dB compression point variation with freq - plots shown :
first for 610 MHz :
[FE] saturates at +11 dBm (@input) Blue
[FE+RF amp] serenza +4 dBm (@input) Red
[FE+RF amp+opt Rx] saturates at +0 dBm Pink
next for 250-500 [450 MHz] :
[FE] +4 dBm; [FE+RF amp] -6 dBm ; [FE+RF amp +opt Rx] -11 dBm at 1170 MHz (L-band) :
[FE] +1 dBm; [FE+RF amp] +1 dBm; [FE+RF amp+opt Rx] -2 dBm
Conclusion : while FE system provides for the designed head-room, for some cases, later sub-systems restrict that dynamic range; needs discussion to chart out future course of action.
Some discussion of the results -- reasonable first order match between measured and SFA values; some consistency checks are needed.
8 Jul : overall this looks all right, except maybe for repeatibility tests; can modify the agenda item accordingly and close some aspects.

(d) to repeat on another antenna with new electronics and one with old : W1 had been identified, and work for RF cable and antenna mounting related arrangements was completed and tests were to be done -- agreed to defer this for some time.
this is not being pursued; instead can try on C11 and C13; instead of W1, C4 in in progress? to confirm status of this activity.
C4 has one of the new antenna; put one more of new radiator antenna in dish with old electronics, and old radiator in C11 or C13 kind of antenna. Check current status.

Repeat for C4 -> C13 antenna (honeybee issue led to delay; maybe can be done by 30-Apr-15; to check current status.
27 May : 1 dB compression point tests now done for C13 also; details, alongwith comparisons, to be sent shortly.
10 Jun : first results from C13 discussed : getting similar power levels as C4, except for 3-5 dB kind of differences (for 325 MHz) and other wavebands also... shown that the Aronia radiator works ok down to 150 MHz.
8 Jul : results for C4 and C13 for 3 wave-bands (610, 250-500 and Lband) at 3 stages of Rx chain are available : to compare these to check repeatibility; then identify a 3rd antenna. If this succeeds then the main goal of the 1 dB expt can be taken as met; only when new wave-band is installed (e.g. 550-900, 130-260).

(e) to check meaning of results from other wavebands that have been done. tabulation / report to be made ready in a week -- to check status of this.
8 Jul : see above for a summary.

8 Jul : long-term prospects : agreed to generate a concept note for long-term usage, with pros and cons listed for detailed discussion later on; Pravin to make the seed version and circulate.

(f) to share the data with SRoy to get the plots done for the variation with antenna position (elevation etc) & then work on interpretation : results from plots of ampl or phase vs elevation angle show clear distinctive shape for the ph vs angle and less clear shape of ampl vs angle; also there is slow secular variation of ampl and phase with time; to try and model ph vs angle with a mathematical form and see what physical phenomenn matches that form; first attempting at fitting with a mathematical fn has been tried; new data now with SRoy; on 1 Apr15, SRoy has sent an update on the analysis done by him on long stretch of data from 8 april 2013 (!); plots made vs az and ele (instead of time) show no strong evidence for systematic variations with ele. This needs to be checked and discussed and understood; no other updates on any other item, as RFI team has not done any work in this area in the recent weeks.
SRoy has sent some fresh plots of ampl vs elevation -- don't quite show the expected behaviour -- need to check carefully, and also get phase vs elevation.
27 May : SRoy has now made some plots of phase vs elevation and they do show a sinusoidal pattern -- this needs some discussion and some follow-up action; agreed to try to separate into 2 categories : one for increasing ele and one for decreasing else.

10 June : meanwhile, new data taken by FE team and discussed briefly : may be 0.5-0.8 dB gain varn and 5-8 deg phase varn with elevation wit the latter more systematic. FE team to give final summary and also circulate data to SRoy -- this is still pending !

8 Jul : summary by SRoy : ampl variation is not confirmed to be smooth or systematic variation that can be fit with a mathematical function; whereas the phase varn does seem to show a clear pattern which can be modeled; SRoy agreed to summarise the conclusions so far, incuding any difference seen with old and new radiator antenna..

==> SRoy had circulated summary of his analysis and conclusions and YG had sent a set of comments; some of the discussions : ph vs el model done for older transmitter, but can also be shown for Aronia transmitter; sign change of phase variation appears to be there between old unit and Aronia, but also between two different epochs of old unit; ampl variations not so clear...

FE team plans to fit Aronia transmitter on C10 by next week and repeat a set of tests for the broad band antennas.

Question about nature of noise source testing of receiver system : to check about the possibilities and come back for a discussion about noise calibration.

(g) new tests with sweeping of RF to check 1 dB compression points with finer resolution over the band -- some tests have been done at 610 band and after corrections, fairly good match for gain curve is seen, but some variation in the 1 dB point with frequency... to try 250-500 with old antenna in steps of 25 MHz at C11 and C13. 1 dB step data in ealier plots above ; 25 MHz step data collection planned; to check current status.
22 Jul : to be done at C10;

(ii) Understanding change of amplitude with change in antenna elevation :
SRoy has done the basic calculations but needs to cross check against the beam width of the feed to estimate the amount of deflection / shift between feed and transmitter at apex required to produce the measured change in signal level.
Test done by Subhashis by rotating the feed : power falls by a factor of about 4 with about 600 counts from the 0 reference position (-700 to +200 arcmin range) : fitting a gaussian to the voltage pattern (asymmetric) gives a HPBW of about 21 deg (about 15 deg for power pattern); this gives about 2 deg for 0.5 dB change in power.
SRoy to refine the calculations (including other antennas) and also check Raybole's new report on this matter and summarise for a discussion.
drop in power is 4 sec out of 20 sec ==> 15 deg is 3 dB beamwidth (ok with other test of SRoy); ==> about 2 deg for 0.5 dB change; if converted to lateral shift of the feed, it may be close to 1 m -- to check alternative interpretation about rotation about feed axis by the require angle. not clear if the matter has been resolved or not; SRoy has circulated a first draft note; agreed to discuss during the meeting of 13 Aug; meanwhile, SRoy to circulate a drawing to illustrate the geometry. both documents have been circulated, and a discussion is required... some discussion about the analysis done by Subhashis : whether lateral translation of feed converted into an angular shift is enough? does the transmitter beam pattern make a difference? how much rotational offset of the feed would produce the same change.

(iii) deployment of new broadband antenna : suitable unit (from Aronia) had been identified and ordered : 2 nos with slightly different freq coverage are there -- looks like will work from 100 MHz to few GHz (hence OK for our use); one unit mounted at C4 and tested with broadband noise source covering all GMRT frequencies; found to work ok to first order, but there are some frequencies where there is loss of power -- being studied; also, tested with varying power levels of noise source and data is being aanlysed; first version of report has been circulated; few points raised are : why 1 dB compression pt changes dramatically for some of the frequencies e.g. 327 vs 393; to check consistency of results with earlier for same frequency; then check change in ampl and phase response for other freq; to check the angular pattern of the new antenna and compare with the earlier dipole antenna that was used -- to check what has been done and discuss the new results; to send one data set from old measurements to SRoy for same kind of plot; to cross-check measurements of old and new at the same frequency; some data has been shared with SRoy; preliminary look has been taken and more detailed anaysis is ongoing and results can be discussed two weeks from now.
SRoy wants to check if correct parameter is being used for antenna coordinate;

also to make the plots for couple of other data sets to verify the issues.
One unit has been installed in C13 dish, and used for 1 dB compression tests (before, it was used at C4); for future plans, to try and put on one antenna like C10 where most of the wideband feeds are present and obtain response from 120 to top of Lband in 5 MHz steps to see if this radiator is sufficient for all GMRT bands.

10 June : No updates; to check 2 weeks later for updates.

1.12 Walsh switching arrangement in FE -- from 5 Aug & before (SSK/SCC/PAR) : Some tests have been done on the bench by FE group; first draft of report has been circulated. Current action items are :

(i) to devise a simple test using Lband system + radiation from apex to demonstrate the working of the system (on any antenna) -- agreed to try and couple this with the new test set-up at W1; agreed that CW test can be done to check functioning of modulation scheme when other tests are done at W1; FE team tried 4 antenna test including C13 but could not get a definitive answer; appears that the problem was due to improper test cable used at antenna base; new cable with all cores connected was made and used; further, it was found that Walsh eeprom IC has been removed from all antennas be BE team -- restored in W1, and tests done : this looks like working satisfactorily in first round testing. To go to next step of getting the signal to receiver room and check on oscilloscope (one pol can still be going to the VVM at antenna base); 2nd step will be to talk to BE team and get the end to end test going. Antenna base tests completed (instead of C04, done at W1 - why ?); demodulation at receiver room not done yet -- to check status of these activities.

(ii) further, Walsh switching has been tested on C4 with astroomical source : loss of correlation happens when Walsh is turned ON (need to understand upper and lower bit in Walsh); next step is to match it with the demodulator in the back-end system.

Summary : radiation test from apex done at W1 to show that Walsh switching is happening; astronomical source test done with Walsh on-off at C4; in addition C11 and C13 are Walsh-ready and should be tested in similar mannaer; after that, to take up discussion with back-end team about extending test to demodulation side; C13 tested ok in both pols; C11 : required change in IC of Walsh gen ckt; result shows one poln work and one not working -- to confirm if working or not. Work on verifying that Walsh works is pretty much over; need to work with BE team to do end to end test.

Fresh set of tests to be planned after MTAC, using the following standard procedure : get all antennas including one under test to fringe; then turn on Walsh for just the antenna under test and verify the loss of fringe for this antenna (for both pols); if does not work, then appropriate debug to be done to localise the problem in FE box, cable or Walsh generation circuitry; also item on upper and lower bit need to be understand. To try this for all 250-500 antennas with new v2 FE box. Test report of 7th May shows fairly decent results, except for issues related to C1 and C13; some isues with Walsh EPROMs -- BE team is re-installing original Walsh EPROM in all CSQ antennas.

27 May : C13 needs check of cabling / wiring as Walsh bit is not reacing to top; EPROM installation done for 9 out of 14 antennas -- to check remaining 5 antennas.

1.13 OF links : new and old, from 5 Aug and before (PAR/SSK) : This involves getting the new, broadband links installed on all 30 antennas and working properly,

as well as maintaining the fibre joints efficiently. Following are the action items:

(i) installation of new, broadband links :
22 antennas installed : C0, C1, C2, C3, C4, C5, C6, C8, C9, C10, C11, C12, C13, C14, E2, E6, W1, W4, W6, S2, S4, S6.
Further, S3 was completed and released; next was S1, which took a long time for telemetry team to complete their part; next was W5, but units made ready for this were diverted to replace units on W4 to fix the problem there (early May 2015); retuned units were installed on W5 (10 June); next antenna : E3 (26th antenna).
8 Jul : E3 is completed, telemetry yet to be done; next is E4.
22 Jul : E4 completed (telemetry also); E5 taken up now; W2, W3 & E5 remains;
5 Aug : work under progress; will meet 15 Sep target.
==> work ongoing for last 2 antennas, W2 & W3, will complete by 15 Sep.

(ii) maintenance issues of installed broadband links : see action item under 250-500 system... : 2 antennas C14 and W4, old units replaced by new (which are thermal cycled); remaining will be done if problems are seen. To check if there are any updates on this.
8 Jul : no new action on this.

(iii) long-term maintenance of OF field joints : Growing evidence for problems with older joints (over last 10-20 years); need some kind of consolidated approach to address the problem. Likely causes : nature and condition of splicing equipment? Nature of cover / protection provided? ... Agreed to get the statistics of the old field joints over time, including a comparison of the losses seen with fresh measurements -- this exercise may take 2-4 weeks; meanwhile, urgent attention is required for the field joint near W1 as it is affecting W4 and W3 significantly. There is a technical problem that the newer kits are not compatible with our existing cable and old kits are not availabel -- 2 options ongoing : trying through Chinese company and also workign with mech group for additional support structure.

Trying to understand the problem : fibre cable used is the same type as original; however, the splice kit for new cables is incompatible with older cables -- this problem is from about 2007 / 2010 onwards?; claim is that joints made before this are ok, as the quality of the material in the older (Australian) ones are better.
except if there is a problem of break or crack in the protective coating or the kit.
basic list shows ~ 40 cuts (80 joints) distributed over the array; agreed to produce the table alongwith the loss values; then one can look at the worst losses and compare with other external factors like location, environmmetn and old vs new kit etc.
30 nos of new kits (15 joints) have come; these look quite good and fairly cheap and should meet all the requirements for different kinds of joints; first trial may happen by MTAC. New kits will be used for the joint near W1 identified earlier.
W1 & W3 being done during current MTAC -- to check current status.
W1 to be done on 6-7 May'15; thereafter, take up W3.
13 May : joint at W1 reworked completely -- connection to W3 was the highest loss; next target is joint near W3 -- to be confirmed after checking new OTDR data.
27 May : OTDR data is taken but not yet fully analysed; to check again after 2 weeks.
10 June : analysis of data is ongoing; meanwhile, problem of high optical loss in W6; now made working by putting a higher power laser at 1310 on forward link.
24 June : Measured signal-to-noise was compared between W05 & W06; latter is better by 10 dB due to new optical transmitter used -- this laser has much lower noise (-155 dBm compared to older one with -125 dBm); to discuss and decide future course of action.
8 Jul : relooking at the field joints : may need to do one more near W3, but better not to touch it now; for high power laser at 1310 for telemetry + LO (forward link),

W6 soln can be tried on other extreme arm antennas : may have one more in stock; need to find more in the market.
5 Aug : indent has been placed for laser; no action on results from OTDR analysis right now.
==> both are still pending final outcome being circulated.

2. RFI related matters :

2.0 New item : discussion on 3 aspects :
(i) verification of in-house RFI measuring scheme with controlled expt with different res BW and with continuum and line RFI sources.
(ii) absolute calibration of RFI power that will reach antenna.
(iii) testing of RFI produced by GMRT bldg vs environment, using GMRT antennas : controlled test to be scheduled.

2.1 RFI from different spectral lines -- from 5 Aug and before (PAR/SSK) : this covers RFI from TV signals (from cable to terrestial systems + boosters), aviation and radar systems, police wireless and such like.

Summary of the various issues is as follows (specific action items are dealt with later, in the next section) :

(a) TV lines : Cable TV leakage does not appear to be a problem; present thinking is that the lines seen are from terrestial TV transmitters -- mostly in 175 to 229 MHz range. Need a comprehensive list of terrestial TV transmitters in neighbourhood (with large enough range) and their frequencies, and to check which ones are expected to affect us : updated document shows about 17 transmitters around GMRT area -- based on information gathered from DD personnel and web. Not all of these are seen by GMRT antennas (some are very low power ~ 10 to 100 W, including UHF transmitters); the list of ones seen at GMRT is 11 transmitters : 2 of them are at same freq : Junnar & Sangamner; all are analog TV transmitters, except Mumbai DTT (digital transmission at 471.25 to 477.25 MHz). See specific action items below under (ii).

(b) civil aviation related lines -- these may be of 2 kinds : airport radars (e.g. near 1090 MHz?), and transponders on aircraft (and counterparts at airports?) -- these are generally at lower frequencies (TBC). Lines seen near 1030 and 1090 : interrogation at 1030+/- 3.5 from airport and response from aircraft at 1090+/- 5 with width of about 20 MHz. In addition to these lines, 108 to 140 MHz is used by ATC -- again stronger near W-arm antennas. Need a comprehensive list of known / expected lines from civil aviation related activities near GMRT -- the list of lines have been identified in the main document (below). See specific action items listed below under (iii).

(c) any other sources of spectral line RFI : e.g. police wireless etc -- need to be discussed and characterised : work ongoing with omni-directional antenna and disc-cone antenna; police wireless is in 159 to 163 MHz; there are some reports that there is increasing amounts of such activities in GMRT area (earlier it was more eastern side; now also seen in southern side). See specific ation items below under item (iv).

(d) lines from satellites : these include US military satellites (240 MHz region), host of GPS satellites (in L-band), a Russian military satellite system (6 satellites, 24x7, with 12 hr period, single line from each satellite; max of 5 lines are seen :

483.0, 483.5, 484.0, 484.25) etc; plan is to identify as many of these as possibles and then work on algorithms for real-time prediction of when a given observation / pointing will be affected by these (see appropriate action items below and elsewhere)

(e) other, unidentified lines : new RFI was reported in 270-290 range (not quite matched with MUOS frequency) only one incident has been reported so far (?) -- needs to be cross-checked; line seen at 485 MHz (very narrow, almost a CW) -- may be due to radar wind profiler -- needs to be confirmed; see specific action items under item (v) below.

Current action items :

(i) to generate comprehensive report on list of lines seen around GMRT and their RFI influence : updated report with list of lines around GMRT getting ready ; have used log-periodic + disc-cone + actual GMRT data for making final compilation. Highlights of the results : lines are color coded as per different sources of RFI e.g. mobile phone, TV, civil aviation. Good amount of information appears to be captured here -- discussed in fair detail during Dec 2014 : agreed to modify title of report; to clearly mark lines not seen in GMRT region; to think of separate version of table (for external circulation) that has ONLY lines seen at GMRT; to think of prediction algorithm for GPS satellites (similar to military satellites). Updated version circulated in first week of March; some feedback had been given in email reply; additionally, still need to look at ways of marking which lines are seen at GMRT and which are not (including those which are not there all the time), and also to check the figures and have only the ones that are useful or adding value. Revisions to be done to the report and updated version to be produced. Check status -- report being refined; check current status.
10 June : ready for circulating again for a recheck -- has it been done?
22 Jul : report circulated (c. 24-Jun-2015); discussed briefly : need 4 columns for GMRT feeds; currently 3)
5 Aug : work ongoing to modify for 4 main bands of GMRT + a few other improvements and will be circulated soon.
==> updated table with channel widths and spacing wherever determined; also separated by GMRT bands now; also more information about various GPS systems in terms of frequencies and BW; to check the latest version that has been mailed and get back to PAR.

(ii) For TV lines :
(a) check for evidence for Mumbai digital TV transmission near 470 MHz : there is some evidence for terrestial TV at 471.25 and 477.25; needs to be cross-checked and confirmed that it is Mumbai digital TV. Level of lines appears to vary from antenna to antenna -- need to do a careful check of this aspect.
Difficult to check at W6 (maint), W5 (no broadband system), can try in W4 (may be seen in E6 also due to reflections?) -- need follow-up.
W6 471-477 MHz digital TV Tx [plots were displayed]; police wireless (tbd in W5) confirmed to be 'Mumbai digital TV' (from direction ?)
W6 plots at 471-477 MHz are suspected to be Mumbai digital TV -- may need a bit more of confirmation.
5 Aug : above is confirmed; to decide future course of action
(b) there is some evidence that the lines in top half of 130-260 band may be due to cable TV n/w? Need a discussion.
==> this appears fairly obvious that these are terrestial TV transmitters -- should be possible to identify each of these from the info that RFI team has (Sougata to look into this).

(b) noticed that 540 TV line still leaks through for some antennas (also maybe true for the 175 TV line?) -- need to check if this is due to shift of the filters or not enough rejection of the line. To work with operators (via a note) to ask for feedback on occurrence and strength of 540 line in GWB data. Can also work with Ankur's data to check... Are there any updates on this?
(c) can we take the strongest TV line & characterise if it saturates the electronics or not? Maybe only Junnar TV at 189 & 194 MHz satures only W6 (needs to be confirmed). Wider notch filter has been put in W5 and W6 as a precautionary measure... need some way to resolve the matter. W6 antenna results plot shown -- what is the conclusion? W6 data (at lowest elevation; moving from north to south) shows no harmonics of the TV lines and hence may not be saturating -- need to check LNA gain upto 400 MHz to confirm; also all TV lines to be identified in the band against the list circulated in 2014 for known transmitters near GMRT.

(iii) For civil aviation : some follow-up is needed to see if they saturate the W-arm antennas : may be saturating only W6, but needs to be confirmed -- will do as soon as W6 is released from feed cage painting. There may be some evidence for saturation due to 1090 civil aviation line, for short durations only. Need to confirm this matter.
5 Aug : this may be the case but needs firm confirmation.
==> this is confirmed; may need to check W5 also; may need to explore special filter for this for some antennas?

(iv) For police wireless : to discuss with admin if the information about their transmitters (esp the fixed ones) can be obtained -- needs to be followed up. Raybole and Solanki have planned to visit (alongwith DIC work in Pune) -- this has happened now -- check outcomes and follow-up plans.
JKS + PAR visited police wireless office for discussion; strong police Tx now at Giravli hill -- installed 6 months back (may be causing the saturation); need to send a letter stating GMRT's concern; then their technical people will plan visit to GMRT. Measurement plots shown 150 MHz (civil avaition line); may need notch filter for 164 MHz police wireless?
Current tests (e.g. data at W6 at lowest elevation) shows saturation at times when the police wireless is the strongest -- need to have the power reduced, as part of the ongoing negotiations with rural police. To get latest update on this.

10 June : Girawali transmitter now running at 15 W (down from 18 W earlier; found 10 W to be too low) -- checked that saturation is avoided for W6 and S6 at low elevations; one set of new measurements made near Giravali by RFI team, yet to be analysed.
5 Aug : waiting for complete analysis of data and final comments from RFI team.
==> waiting for short note from RFI team summarising the matter.

(v) New lines :
(a) to check all the RFI lines in 250-500 band (at least 4 have been identified); new cluster of lines seen in GWB output : 332 to 344 Mhz -- need urgent follow-up ! some initial tests have been done looking at specific antennas -- not seen; needs some follow-up. Check status.
(b) to confirm status of about new RFI in 270-290 range; any updates?
(c) follow-up on Russian satellite sytem : exact range of frequencies (483 to 484 MHz or just 483 to 484.25?), how many lines?, trajectory of the satellites?, not seen in low elevation scans?
(d) new lines seen in around ~ 340-350 MHz : seen in few antennas, in one pol only;

not yet understood. Any updates?
5 Aug : no clear origin for 270-290 and maybe 340-350 ?
==> no updates on these two (plus there may be some more from Lband tests by YG)

(vi) omni-directional antenna needs repair and replacement also; processing for 10 nos (including remote location sensing) was ongoing -- order had been placed; all 10 nos arrived around mid-Jan; one unit opened to verify the components; 2 units assembled and performance tested and found ok; plan to mount 3 antennas at 3 different heights on the wind tower of servo.. change in plans... to discuss the goals of the exercise and decide -- to be discussed alongwith prioritisation of all the RFI related jobs.
To try and make it work at one remote antenna site and show that it works.
5 Aug : some measurements done and will be takne up for discussion.

2.2 Radiation from CAT5 cable -- from 5 Aug & earlier (SSK/PAR): Follow-up on action from 3 Apr 2013 (!): to install shielded CAT5/CAT6 cable in conference room as trial and finalise the scheme for all other public places in the building: first report had been circulated that combines testing of switches and CAT5 cables; conclusion was that use of shielded cable makes significant difference to the discrete lines as well as to broadband RFI. Agreed to go ahead with controlled expt in GMRT Conf room to quantify the improvement; tests had been completed, and report showed not much change in radiation level with and without shielded CAT-5 cable in conference room (!) -- maybe dominated by RFI from other equipment in the room? Agreed to move ahead by extrapolating from the results of testing of Miltech + switch : to try and estimate the cost of material and labour (time) for changing to shielded cable + connector in all the unshielded rooms of the building; discussion on 16 Jul 2014 : table of invetory of un-shielded cables currently in use (94 copper lines); total length ~ 1200 metres; procurement of shielded cable was initiated; data was submitted by RFI team, and an updated document had been circulated; about 900 m cable (3 rolls) + crimping tool need to be ordered (enough connectors are available); total investment is about Rs 1.7 lakhs : agreed to go ahead with this; item was under negotiation about details of the pricing (Rs vs $ quotes due to difference in value); meanwhile, work had started using existing spare CAT5 cables (old stock) to replace older cables in various labs, as per their requirements; conference room & canteen annexe has also been done; meanwhile, folder for main order was followed up and it appears that there is no choice but to go with the Rupee quote and hence total outlay will be ~ 5 lakhs.

Current action items :
(i) Status of completion of the work in different labs and rooms : conf room, canteen annexe, EPABX room and all engineer's rooms, user's room are done; rest are waiting for main order to supply. delivery has happened now (29 Apr 15); can initiate the work with consultation of digital team...

(ii) To check status of final order and availability of cables, connectors, crimping tools etc; finally, order is gone; to confirm expected date of delivery; finally, after a lot of delay, items received on 28 Apr 2015. To check if anything more is on order or needed; otherwise close this item. This can be closed.

(iii) Need to work out a scheme for proper long-term maintenance with OF and computer group : at the level of PAR to MU it has been discussed -- SSK to send an email to formalise the arrangement; cables, connectors, tools given to Mangesh; a concluding discussion may be required with computer group. YG to bring up with BAK -- need to try and close the matter. Item discussed in meeting of 13 May : not clear what is

the best way to close it...

2.3 Effect of military satellite RFI in 243 band -- from 5 Aug & before (PAR/SSK/SN) : follow-up action on testing for saturation effects, decision about appropriate location of switchable filter, possibility about control room (ops group) being able to come up with algorithm for prediction (for users); the military satellites in the 230-240 MHz band were taken up as the test case; results for tests done by pointing to the satellite (and tracking for some time) showed increase in total broadband power of about 12-15 dB on the strongest satellites (others are weaker, with harmonic at ~ 500 MHz also visible; there was good evidence that the FE is saturating as harmonics level does not change with changing OF attenuation;

Current action items are as follows :

(i) filter related action : as a test case, filter was inserted in the path for 2 antennas (E2 & C6) to check rejection (and also effect on other bands like 610 and Lband); results were to be circulated for discussion (some results were shown by Ankur?); need to decide if we want this filter in a switchable mode (at FE box or Rx room) or permanently in the path or not at all ! does the answer depend on the strength of the signal? not clear...; meanwhile (22 Jul 15) filters in C6 & E2 (btoh ch 1) have been removed now;
To decide future course of action here.
==> can defer further discussion on role of filter till warning system's efficacy is fully tested out.

(ii) to test saturation effects and limiting angular distance from satellites : we need to quantify at what angular distance do the signatures of non-linearity (harmonics) show up, and what should be the activation limit for the alaram; various tests were done to test this -- Az fixed and move in El and vice-versa : this yielded +/- 2.5 deg as the width over which saturation is seen (tested for 2 satellites); more tests were done covering larger number of satellites and some confusing results were obtained; there was a suspicion about the accurate coords for the satellites; agreed that it may be possible to get accurate coords from the GMRT tests.

22 Jul : Report was displayed & discussed : GMRT measured coordinates (from +- 2.5 deg Az-El scans) match well with that listed in web pages (literature);
5 Aug : agreed that the work now shows useful & good results; can be summarised in a note; coordinates of these satellites can be finalised and used by the alarm system.
==> summary : in real-time, it appears to work well; only total # of satellites being tracked needs to be confirmed.

(iii) alarm algorithm to use in control room : Ops group (SNK) to implement after getting the relevant data from PAR. Present aim is to cover 3 scenarios :

(a) real-time alarm in the control room -- SNK has implemented this, but may need some retuning (some refinement of coordinates is needed)
(b) for a given source at a given time, for a given frequency, predict the effect, including a facility for running through an obs file -- this is TBD;
(c) post-facto : given log of an observation (lta and servo files?) analyse how much data affected by satellite RFI -- this is also TBD.

10 Jun : SN updated that SNK has completed the implementation for all the 3 options above; waiting for more accurate coordinates to get improved results;

22 Jul : new expt has been done to track satellites and refined positions have
been obtained; these are now being used by SNK;
5 Aug : SN to confirm with SNK if a demo can be arranged for parts (b) & (c) above,
using the refined coordinates.
==> SNK confirms that version for cmd file is almost working and that for LTA file
needs to be done; agreed to complete and release as a package for all users.

(iv) next part of this is to see if it can be applied to other satellites :
first in choice is for the GPS satellites, which is more complicated because the
satellites are moving -- this is being looked into right now, and coords have been
given to SNK; next target would be the Russian military satellites (will need to
get the coordinates).
==> PAR has found a software that gives the positions of all GPS satellites of
all known constellations and can be used in conjunction with SNK -- this needs to
be tested.

2.4 Mobile phone RFI -- from 5 Aug & earlier (SSK/PAR) :
Progress on identifying the operators at and around E06, and in Nagar, Junnar
directions : letter had been sent to BSNL, some follow-up action was on -- they had
agreed to change to 1800 at 3 locations (Ale, Gulanchwadi & Pargaon Mangarul) : one
location (Pargaon Mangarul) tower has been swithced over to 1800 by BSNL; Alephata
tower -- 2 sectors changed to 1800 (what about the rest?); for Gulanchwadi tower --
work is pending (as per latest update from BSNL officials); RFI team to verify these
changes by visit to the sites & by checking the GMRT data (compare old vs new data),
and summarise their finding -- some new tests are done and looks like there is
improvement; Gulanchwadi needs reminder to BSNL. Appears that BSNL has no spare
hardware to move from 900 MHz to 1800 MHz; eventually will move when additional
units become available -- no commitment about time frame; check if there is any
change in status; latest update : looks like end of September for any work by BSNL?
check with BSNL reveals, no change in situation; if no change till end Oct, to
decide whether to escalate to higher level or not.
update on 10dec14 : BSNL has finally done at Gulanchwadi -- this is now verified
that power in 950 has come down and 1800 has gone up in that direction. Letter
needs to be sent (to confirm if it is to be a letter or request or appreciation)
-- YG and PAR to discuss and resolve the matter. Also, to discuss the way forward
with the next step on this topic.
==> draft of letter discussed; looks ok and YG can finalise by tomorrow.

3. Operations :

3.1 Interfacing of FE with new M&C system -- from 5 Aug & earlier (SN/NS/CPK) :
Naresh + Charu & Sougata + Rodrigues were working on this; will have full set-up of
FE + Common box, but will start with M&C of common box using Rabbit card : initial
h'ware connectivity may not be too much work as 32 lines have to be mapped to 16
lines on interface card; low level software for bit pattern setting may be enough to
demonstrate basic connectivity; after that, packaging will be the issue to be sorted
out. Action items:

(i) basic set-up was made working, and tested (by Rodrigues + others); difficulty
of communicating via Rabbit to FE appears was resolved with demo of some commands
by Rodrigues et al : initially 2-3 basic control commands, later all the commands
(except Walsh) were tested and cleared; brief report from Rodrigues summarises the
work done; logic + softawre for monitoring commands (6-7 FE + CB monitors) need to

be implemented; Charu and Sougata are identified to work together on the monitoring functionality with guidance from Raj where needed. Check current status of this.

27 May : waiting for Charu to finish report of FPS testing with Rabbit; meanwhile, to see if one assembled Rabbit + shielded box can be given to FE team to complete the wiring (to check status of box #2 with PAR and Sanjit) -- can go ahead with couple of boxes without shielded connector.
10 June : FPS testing report is finished and work will start now.
3 stages of the work : FE Rabbit to FE system (local at FE lab); from tel lab to Rabbit + FE system in FE lab (serial and ethernet options) -- need to verify that the monitoring is working all right.
24 June : Walsh commands also incorporated now;
8 Jul : present status : computer to dummy Rabbit card to FE Rabbit card all on eth link; monitoring now being tested for CB and then will do FE; then can try serial link from dummy Rabbit to FE Rabbit; finally, to look at option of current online path via antcomm to FE Rabbit to interface code.

(ii) to look ahead at the plans for the packaging of Rabbit inside common box and integrated tests with serial link, and then later moving to trials with eth link
13 May : since we are getting close to having the common box ready, a plan needs to be worked out; agreed to come back with a joint plan (Ops + FE) in 2 weeks time.
27 May : to run the test from telemetry lab and FE lab to simulate antenna base to focus and run 100 m serial link and also ethernet link; need to order some serial link cable used in the antenna.
5 Aug : see discussion earlier.

==> almost all commands are implemented on Rabbit and tested in Tel lab and will be ready for testing with FE + CB arranement in FE lab by next week or so (will be testing with full length cable).

3.2 Development of M&C software -- from 5 Aug & before (JPK/RU/SN/NGK/SJ) :

(i) taking up EPICs based PoC version for putting additional functionality :
basic loading (and unloading) of the EPICS has been done successfully on the machine; now need to connect Rabbit card and test existing PoC software and then go to the new adition to be done; Joardar and Yogesh had made a fresh installation of the software (under Debian linux) and demo software was working fine; first test with Rabbit card (with v2 subsystem) to OF system was done successfully; agreed to develop the software first for OF attenuators; a SOP to make running of things easier was prepared by JPK; a new module was being made for fibre optic link (old one was for GAB); first attempt was to take the given code and modifying / editing it to do both monitor and control -- to produce a short report describing this phase of work; development of new module to implement the same functionality -- working for monitoring and trying for control (to discuss with JPK and come back); script for installation of EPICS + peripherals was getting ready.
Latest status : for monitor side : able to get data and display; working on command flow for control side; some extra information may be required. Check current status and future plans. See if this can be closed or needs to continue.

(ii) plans for tasks for next phase of work for new M&C software : architecture definition and UI definition tasks had been completed; next phase of work for implementation of design for 3 antenna system has been started; 3 phases of work identified : core, business logic, web application; ~ 6 months per phase; first phase was started, kick-off meeting has happened and work is ongoing; the issue

of which Linux OS should be used : CentOS or enterprise, instead of Fedora (for rapid changes) has been discussed with TCS and final choic is to go with Fedora20. Since this is a SKA prototype, issues of alignment with the TelMgt design are being taken up; also, impact of SKA decision to go with TANGO as the platform are being evaluated; much of this to converge by end of April, even as work on design of eninges etc is continuing. Joint meetings have happened between GMRT software team and SKA TelMgt team and consensus plan is being worked out -- admin procedure needs to be initiated. Meanwhile, other work has already started and is on-going relating to the engines -- to check status of this.
27 May : writing of test cases is going on; some issues found and resolved; not much discussion in the last couple of weeks, maybe; to update current status of the work.
22 Jul : 38 functional test cases reviewed for Phase-I & documentation completed; TANGO prototype design & feasibility have been completed;
5 Aug : first demo of some of the prototypes expected shortly; single antenna system expected by mid-Sep. YG to check for more formal feedback on joint activity of TelMgt team and GMRT TCS team; also a discussion session with Vikas tbd on 6th Aug.
==> TANGO exploration demo in 1st week of Sep. OF + sentinel Rabbit card sent to TCS. TANGO based arch doc developed by JPK and sent to TCS -- will discuss later this week and will become part of the report.

(iii) M&C software in-house : this is a mix of Online V2 and other developments that are useful for all M&C platforms (need to separate out these issues at some level): tests done with switch + rabbit card at antenna base and used for commands and monitoring of the OF system -- this path is cleared. Testing with GWB corr at first level by interfacing to existing dassrv structure and environment also done; webpage based display done; some routines in astropy added; some additional code added for diagnostics purposes; Santaji has built web based monitoring for temp/wind/3-phase power etc -- tested ok; need to separate out online V2 items from overall web-based tools for enabling absentee observing.
During MTAC of Oct 2014, 3 antennas (C1, C4 & C6), 2-sub-systems tested, using 2 rabbit cards; servo system tested in servo lab and in C1 antenna (all commands tried out); draft report circulated;
Communication to FPS being tested; NOVAS library interface done in C, Perl, Python and PHP -- can be utilised by any of the new software developments.
During MTAC of April 2015, 16 antennas tested with eth link from central building and one Rabbit card controlling OF and sentinel with commands sending with python and GUI interface. Set-up to be kept switched off during regular GTAC time.
No fresh updates; report writing is going on; meanwhile, work started on shared memory design for sharing of the information.

24 June : work in progress for communication from Online to rabbit cards (antenna base & FE box) via serial port [via ethernet already completed]; OnlineV2 draft report with NGK, to be finalized by 30-Jun-2015.
22 Jul : Draft report in circulation within the group;
5 Aug : Report has been finalised and may have been submitted to library.
==> confirmed; this part can be closed.

3.3 Long-term plans for evolution of M&C systems -- from 5 Aug and before (JPK/RU/CPK/SN) : MoM of Sep 2014 meeting identified following urgent / immediate action items :

(i) Verification of compatibility of switching equipment at antenna base and CEB to be compatible with HRS requirements -- CPK and Nayak to ensure the same; to check if this has been done and item can be closed? Still waiting for confirmation.

SN to check with CPK and come back. THIS IS A SIMPLE MATTER, PENDING FOR A LONG TIME!
Note circulated by CPK; 2 changes proposed :
(i) TCS's document for hardware req. says 10 years operation : needs to be changed to 3-5 years (to be able to get vendors);
(ii) power for server class machine stated : < 500 W; this will be hard to get; ~ 600 W may be preferable.
To check feedback from TCS and take up for discussion; just waiting for formal confirmation from TCS and make a formal note and then item can be closed.
22 Jul : formal note made & item closed now!

(ii) To discuss and finalise optimised packet format for Command/Data response with the Rabbit card -- RU + JPK with YG.
Agreed to wait till March 2015 for a detailed check of what the existing framework offers and what is required for next gen system and decide if any changes needed.
Outcome of current discussion : online V2 already has a packet structure; during TCS prototype development, one version of protocol was defined and used; JPK to cross-check if that will be sufficient to meet the present needs; also, telemetry team is agreed that whatever changes are needed to modify on Rbabit side to meet this requirement, will be done by the team.
Latest status (15 Apr 2015) : JPK is reasonably confident that version developed during TCS proto development is fine; online V2 has 2 kinds : one for servo and one for the rest. Team is internally agreed that whatever changes are needed for the final TCS version, then can handle internally. may need to track the development of the packet structure for next gen SKA proto system? Agreed to have a note generated after finalisation of pkt structure for new system; check current status.
22 Jul : Packet format for Phase-I work has been completed; can be closed now ? Yes.

(iii) To discuss and agree upon a unique set of Rabbit commands per sub-system -- Nayak to coordinate with team; RU to put out the list of currently implemented commands (with parameters) and matter can be taken forward from there for checking sutiability for different requirements; 'list of currently implemented commands' circulated; agreed to bring out the list of commands needed for the next gen system and compare with list sent by RU and quantify the extra amount of work to be put in by the team. May need special focus on high level commands for FE system?
Pending for JPK to produce the list of commands -- that has happened now, and can be looked at and taken up for discussion next time. To take up for discussion.
27 May : many of the commands are same; there are some cases on commands not (yet) covered in one system; agreed to keep two branches of the Rabbit code meant for the two M&C systems and make sure that bug fixes are common to both. Item can be closed now? Yes.

(iv) Hardware at antenna base : JPK to circulate a background note for antenna base computer system and then item can be taken up for a larger discussion -- not done yet. Pending for note from JPK -- reminded to bring this out soon; check status -- still pending.
22 Jul : technical note is in progress;
5 Aug : to see if update is available.
==> slight modification in role and scope of doc to cover antenna based h'ware; will be done now onwards.

4. Back-ends :

4.1 Documenation at various levels -- from 12 Aug and before (BAK + team) :

To complete basic, internal documentation (at ITR level) and then move to the point where formal publications of relevant items can be done.
Current action items are as follows (many are pending for long durations now !):

(i) Detailed design doc : analog back-end was being done by Hande : 2nd version had been circulated in April. Next level of document going down to chassis level is to be made ready -- chassis level doc will take about 2 months; was deferred till end Oct 2014; and then deferred till end of Dec 2014; 2nd version had ~50% chassis level inputs; to be completed by end-Jan'15; needs some more time as 2nd LO scheme inputs are alos being folded in; work in progress; may take another month -- can check in mid-May. This is now pending for quite some time !
27 May & 4 June : progress is slow, but going on. What is the current status?
10 June : ongoing... 24 June : will take ~ 1 month (end-July);
till 29 Jul : no progress !
5 & 12 Aug : Hande still busy with some other activities; hence delayed further.
==> no updates.

(ii) ITRs + publications for analog back-end systems to be taken up : Sandeep and Navnath to look into that; pending for a fairly long time; SCC to look into this and come back on this by 11 Mar -- SCC and Navnath have had one discussion and will follow-up after MTAC. 29 Apr : list of items to be done has been prepared now; work has been started by Navnath. To check current status.
27 May : not much progress in last 2 weeks; to pick-up now. Current status?
4 & 10 June : not started yet; to start now.
till 29 Jul : no progress reported !
5 Aug : Navnath and Sweta to work on this now and have a version by end of Aug.
12 Aug : work ongoing.
==> work on track.

(iii) ITRs + publications for digital backend : ITR was completed by SHR; after some follow-up, SHR and BAK started work on modifying GWB ITR to convert to a paper; first version has been circulated; needs to be taken up for discussion between YG, BAK and SHR.
27 May : not yet reviewed and discussed, but meanwhile SHR can look at it from the point of view of improving by putting in the latest work on expansion to 16 antenna, dual GPU system.
4 & 10 June : will get into this once GWB-III release work is completed
1 to 29 July : no progress reported !
5 Aug : to try and take this up now, as GWB-III release is almost done.
12 Aug : not started yet.
==> no updates.

4.2 Analog back-end : LO setting related issues -- from 5 Aug & before (BAK) : Problem with LO setting using FSW resulting in reduction of correlation in GWB (compared to LO from sig gen) : understanding is that 10 MHz reference is at the edge of the locking range; shifted to 105 MHz based reference -- this appears to solve the correlation problem; however, this appears to show phase jumps whenever it is reinitailised; trial and error tests showdd that using 50 MHz reference avoids this problem for GWB.
Latest tests (1 April) show that with 10 MHz reference, the correlation coefficients are fine; would like to test bit more before confirming and releasing. However, mixed results during further tests in Apr 2015 MTAC (with 10 MHz) : for longer baselines there is drop in cross-correlation; 105 MHz phase jumps -- unclear & confusing; but with 50 MHz ref. both issues absent;

Current conclusion (27 May 2015) is that 50 MHz reference works ok for giving proper corrln on all baselines, as well as no phase jump on reinitialisation -- would like to switch to this in the long run, for both GAB and existing system at antenna base; higher priority is to fix the problem at antenna base (BE team to come back with a proposal) and then tackle for GAB (as the issue of reinitialisation is not important for GWB, and 105 can be used for some more time).
10 June : right now planning for the set-up to be built for antenna base...
22 Jul : confusing result : phase jump seen at 50 MHz reference ? [last 2-3 weeks full day monitoring] -- to check status of this.
5 Aug : not clear about 50 MHz -- will need more testing; to use 105 MHz for now.
==> some data has been taken and being analysed.

4.3 Analog back-end : completion of 30 antenna system -- from 5 Aug & before (BAK): 16 antenna system completed (from cabling from OF to cabling to corr wall panel); 24 antenna system also released (mid-April 2014); and now 30 antenna system has also been completed (July 2014). Pending action item :

(i) long-term plans for power supply and ethernet switches to be discussed : for power supply, discussion is as before; ethernet switch : there may be a complication about accommodation 24 port switch in terms of space and layout; 8-port switch was tested for RFI (with and without shielded CAT5 cable -- old 2013 report + new Jul 2014 report) and it is clear that there is some RFI even after shielded CAT5 cable is used. Possibilities for shielding box for 8-port switch discussed; BE team to check about space for putting a shielded box around the 8 port switch; Hande and Raybole have discussed the matter and it is agreed to try and design a shielded box that allows the switch to occupy a 1U slot in the backside of the GAB racks. Raybole is working on design of shielded box and is ready to order material for this; first sample box was ready; controlled tests show very good RFI rejection (report is awaited) -- can check after report comes and finalise on mass production. (true for both ps and eth units) --- shielded box finalized; 12 nos ordered in work shop. Components required have been ordered; first box will be tested and then order for rest will be cleared; There was a problem about modification of the drawing -- has been resolved; now to check where and how the mass production will be done. Waiting for first proto unit from w'shop to come; to check status and time scales.
27 May : work under progress in w'shop. 10 June : work still ongoing...
24 June : enclosures (boxes) for the ethernet switch have arrived from Workshop; also one sample box for power supply which is found acceptable -- RFI shielding mesh needs to be added - given back to Workshop;
22 Jul : boxes came from W/S; one box being populated - next RFI test planned; if successful, go for x11 more power supplies;
5 Aug : one unit fully ready and will go for RFI testing shortly; vendor related issue for order of the remaining SMPS (15 nos) -- may have 8 week delay.
==> RFI testing completed; ready to install in rx room.

(ii) status of work for having i/p side RF filters : plans with FE group for sharing mass production units; agreed that it is ok with FE group to share the designs, provided BE team is ok with the performance specs; ok to include BE requirements in order of PCBs and components (cost sharing to be worked out accordingly); however, BE group to take care of mass assembly separately, as it will be done with in-house manpower by FE group for their filters. BE group has completed design of 8:1 switch to be used for this. Meanwhile, 4 BPF filter chassis (from FE group) + 2 nos of 8:1 sw chassis + one straight through path -- found difficlut to fit it one PIU; agreed to go ahead with single chassis plan for the main 5 BPFs + one switch; second switch and other sub-band filters to be put outside, within the PIU. Prototype unit

was completed by BE team; agreed to get the PCBs from FE group (supply the board to them) and then check the integrated filter performance against the single filter.
In ther interim, prototype unit using existing PCBs with chassis was assembled in the PIU and tested in-situ.
Final configuration will have direct path + one 100 MHz LPF path + main band filters for each band, with one 8:1 switch; FE team will buy the substrate board and give to FE for getting the PCBs and will buy their own components to populate the PCBs they will receive.
13 May : PCBs for low frequency band ready; chassis for Lband ready (!);
waiting for LF chassis; Lband and 550-900 PCBs will come from FE group. Mech boxes awaited; check current status.
27 May : no change in status; following up with w'shop.
10 June : 25 chassis have been received for 250-500; not yet ready for assembling a prototype unit.
24 June : (x25) Chassis for all Low-Frequency & High-Frequency usage now available; PCBs available only for the Low-Frequency usage, which are being populated; to be completed by 09-Jul-2015;
22 Jul : filter reflection higher than expected; BE group now exploring 'new' filter design; to take up for discussion and resolve.
5 Aug : BE team may be able to make these workable with tuning and change of values of components; YG to chek with FE team about the implications of this. Also, only 250-500 and 130-260 have come; other 2 are still awaited from FE team.
==> needs to be taken up with FE and BE teams.

(iii) appropriate attenuator settings for Lband & 250-500 done; 610 band was being finalised -- updated table had been circulated; few iterations were done and a more accurate updated table for 16 antenna system has been circulated; also, agreed that BE group will do monthly monitoring and report the status (for all the 3 bands) -- regular monitoring was to be started in May 2014, but took some time to get organised; montly reports will come regularly from June onwards. To discuss how to handle interpretation of the results and iterations to change the attenuator settings for future, as there are evolving changes happening in the FE systems. One round of measurements has been made and set-up is reasonably stable (may need a PC to be arranged?); will take some more time till regular monthly monitoring data can be meaningfully discussed. PC has been arranged; need to start the regular monitoring now; set-up is sort of in place; first round of checkign will happen during the MTAC.
first round of readings has been taken and some summary will be sent shortly.
Results not yet circulated internally; BAK to check with team.
Tests are now done regularly; need a way to share the summary of the results for taking appropriate follow-up action.
Raw data is being uploaded on plan website; Atul Ganla looking into some intelligent interpretation and summarising of the results.
Started work on making plots showing the variation with epoch for any antenna; will resume after MTAC is over. Should be having first results by now?
27 May : still pending. 10 June : work is ongoing...
24 June : Analogue Back End check /test (for 'attenuation' values leading to power equalization) happens regularly every Monday; one band at a time - so every 4 weeks a full set is available; new student working on analysis - to be completed in 3-4 weeks (end-July'15).
5 Aug : analysis work is still going on.
==> Atul is working on the analysis; can check next time for status update.

4.4 GPU corr (GWB-II) : release of 4 node, 8 input, 200/250/400 MHz version -- from 12 Aug & before (SHR/SSK/BAK/DVL/YG) :

agreed to make 4 T7500 nodes with C2050/C2075 Fermi GPUs + remaining 4 T7500 nodes as host machines (to take care that these are the ones that transient pipeline uses presently so that sharing is possible); this should have ALL basic modes : total intensity and full polar IFR modes; IA + PA BFR modes with process_psr pipeline attached; full GUI support; to come up in trial code section without affecting the presently released mode. Action items :

(i) beam modes in GWB II : new version with separate kernel (outside phase shift kernel) for beam formation has been developed (compute load is 7% increase on 2050 GPU); IA mode tested; PA mode completed and tested; phasing implemented & tested; process_psr pipeline has been completed and released; first version of SOP has been released; pending action items :

(a) last version of GWB-II (ver4) expected end of April, with the following new features : 16k channel support in GUI and SOP; multiple choice for beam integration and # of channels; pulsar beam header ver1 (limited number of parameters); for more than 2K channels in correlator, need modified shell script -- this needs to be understood. Most of these changes have been done & tested; GUI for 'ver4' needs to be done by Nilesh (who is on long leave) -- will happen after 16 May. To check current status and see if this can be closed.
27 May : SHR and NSR to test upto 8 and 16 K channels to see if o/p side i/o works ok; if yes, then no further changes; if no, then to change the MPI calls as done in GWB-III (and make GUI and SOP compatible with that).
10 June : ver 4 tested for 8 and 16 k channels; GUI level change has been done; dasmon needs to be modified for more than 2K (upto 16K) -- being done by NSR; beamformer will also need to be tested.
24 June : GUI for correlator part completed (except for 'dasmon'); GUI for beam-former will take 2 weeks (08-Jul-2015);
1 July : SSK to talk with NSR to close the loose ends.
15 Jul : work on changes to dasmon has begun.

(b) header for beam mode data : to be taken up & incorporated alongwith the PA mode; SSK has done first round (part I), and discussion between YG and SSK has happened and next version (part II) is underway;
20 May : header part I has been done for GWB-II and III (need to confirm for GWB II). header part II will be done later, only for GWB-III
27 May : new version of GWB is under test which has part I header; part II will come in the next release.
Check status for GWB II and close, and move remaining items to GWB-III agenda.
10 June : new version of GWB is under test which has part I header; part II header will come in the next release; part I header will come in GWB-II ver4 & GWB-III ver2.
24 June : GWB-II next (and final) version release in 2 weeks (08-Jul-2015); will have flexibility of upto 16K channels;
1 Jul : to ensure that loose ends are closed by 8 Jul and v4 released.
29 Jul : work is underway to completed and release v4 of GWB-II.

(c) availability of online monitoring tools for beam data : psr_mon was successfully installed, compiled and tested (for 16k channels?) on node 52, node 53, gwbh2 & gwbh3; now installed on the new host machines also; installing pmon needs polycos, psr catalog etc -- confirm if completed and released on the new host machines?
pmon done in off-line mode on GWB-III, will convert to real-time and also port to GWB-II; currently working on real-time mode of psr_mon and pmon for GWB-II. these are under test by SSK; pmon for GWB-III needs to be tested and cleared -- SSK to check and place the final working pmon code in the right place on GWB-III beam

host machine (27 May).
17 June : offline version working on GWB-III (v2) and real-time version to be tried.
1 July : SSK close to finishing the real-time version for GWB-III.
14 Jul : online had problem with psr_mon -- now corrected but needs testing (~ 1 week)
22 & 29 Jul : not clear if tests completed and system ready for release or not.

5 Aug : GWB-II ver 4 (final version) is now released ! To check if any open issues remain; if not, close this agenda item.

(ii) spikes in channels that are power of 2 : this problem needs to be discussed, understood and fixed. SHR has done several tests, including using digital noise source; effect is seen in packetised corr also; checked with offline analysis of raw voltage data acquired through Roach board, and with digital noise generated on Roach board -- appears that problem is seen only in data coming through the ADC path only? further, trying single ADC streams or channels (compared to the interleaved data streams that come normally) still shows the spikes in the streams; slower FPGA clk rate also doesn't show any difference -- it appears to be natively present in the ADC data; to check if the power level of these spikes is constant and how much below the mean passband level; varying i/p power level of broadband noise source at ADC allows characterisation of input power level at which spikes show up; looks like occuring at multiples of 128 ch (for 2K spectrum); to check the level as seen in cross of two such signals -- some test results have been sent by Reddy recently; can take up for discussion, including tests with 2 different clk sources...
To correlate against new results coming from histogram testing by Niruj & Kaushal -- some further work is needed here; KDB and NMR to check and report back; can move this also under GWB-III ?
27 May : to cross-check with GSB voltage data taken and put through similar analysis of histogram and spectrum.
10 June : tested with two different Roach boards with two different clk sources and corrln is still seen, including when sig gens are not locked to same source.
24 June : GSB raw voltages to be read & analysed [at GWB-III];
14 Jul : work has started, can expect some results by next week.
29 Jul : tests done with GSB raw voltage data also show some spurious lines -- needs some thinking and investigaton about possible causes and issues.

4.5 RFI filtering -- from 5 Aug & before (KDB/BAK/YG) : aim is to develop and implement RFI detection and mitigation algorithms at different stages of the back-end : both in time domain and in frequency domain, and for interferometric and beam modes. The overall plan is as follows :

(a) For impulsive, time domain RFI : First version of real-time RFI filtering block was added to packetizer of GWB-I (in one input out of two) with different options like replace by median or by constant or by digital noise source sample or clip to a threshold via s'ware registers) -- basic tests were done and found ok; trials with real antenna signal split into 2 copies and checking both self and cross outputs proved somewhat harder; further, design (with some optimisation of FPGA resources) was ported to GWB-II; agreed for time domain tests using either corr self powers or 2 IA beam signals; some tests with varying sigma were tried on antenna signals (results?); data taken with pulsed noise source input also; new results circulated and discussed; agreed that the basic scheme appears to be working ok; to try 3 versions of the scheme, with different options for the statistics; agreed to support 3 modes : continuous update; update on request; external update; this has been demonstrated in tests on GWB-II; need 3 separate versions of design (with optimisations) -- agreed we will carry forward the full design and then, when final

baseline is established, the reduced modes can be made available. Meanwhile, design compilation for 4, 6, 8 bit inputs completed; utilisation (for one analog channel) : 41%, 19% and 17% (for total design) for 4 K window; tests were done to see if there is some biasing by digitally splitting the antenna signal -- confirmed ok, i.e. mean level changes for lower thld happens for replacement with zero or replacement with noise but not for clipping; next part is testing with two different methods of generating thld statistics : shown that a priori stats works better for rejecting RFI infected data. Agreed to carry forward, for now, only 8 bit design -- other options can be brought up whenever needed.
Further, the design was optimised to fit on Roach board in the GWB-III design -- first for 2 filters out of 4 channels on each Roach board at 800 MHz (with compensated delay in the 2 other channels) -- this was implemented and shown to be working; dynamic window size control was also implemented -- shown to work upto 8k size for 800 MHz, 8 bits (will be adapted for 4 bits, as needed).

(b) For spectral domain, narrow band RFI : implementation of MAD filter across time (MFAT) and MAD filter across channels (MFAC) done on MATLAB and tests with simulated and real data carried out; basic tests show that, for spectral RFI that is steady with time MFAC works better than MFAT, except that there are issues when the RFI is near the edge of the pass band (or in the stop band region) -- proper normalisation of the bandshape may be needed to improve the performance?

(c) For beamformer output (for impulsive, time-domain RFI) : code developed by Shiv Rajora as part of the wpmon work (see also item XX(yy) above) for finding impulsive RFI in the data, tracking it for individual channels based on the DM and masking appropriate data while creating the dedispersed time series has been tested and needs to be refined and finalised;

(d) For beamformer output (for narrow band, spectral line RFI) : work needs to be initiated, which should borrow from / inform the routine for (b) above. This has now (Jul 2015) acieved at first level by the work done by Balaji Venkat following up on Shive Rajora's work, and basic features of MAD-based spectral line filtering have been incorporated; effects of normalisation have been investigated (and shown to make a difference);

Some action items are as follows :

(i) pulsed noise generator (PNG) ckt with additive noise source shown to be working -- can now be used for demonstrating RFI cancellation on visibility data. Some new tests were done : basically working ok; but would like to go down more realistic duty cycle; also, there appears to be some saturation like problem which is not clear; team can discuss and decide the growth path of a new PNG.
New results circulated; report of PNG inter-channel coupling - located where the couplign occurs; to follow-up on current status and discuss future plans.
BE team to discuss locally, and resolve the matter. To check if there are any updates.
10 June : some disussion has taken place and may have update in next few days.
24 June : Coupling reduced drastically after changing the coupling from resistive to inductive;
5 Aug : this is ok now and can be closed.

(ii) to work out proper scheme for testing -- KDB has circulated a proposed scheme, which is now been refined and accepted; to discuss and check if results are available. Some tests have been done and results discussed : scheme appears to be working fine;

need better quantification of the results.
(noise + RFI) & only noise : filtered vs unfilterd comparison -> filtered (noise + RFI) gives higher cross-correlation; to check latest results and conclusions -- mostly done, and conclusions are reasonable; can move to real-life tests now -- check if any updated are available on this.
10 June : antenna tests not yet showing a conclusive result (correlator + beamformer results)
22 Jul : regular tests are being carried out for comparison between GWB-II & III (a SOP for running these has been created); results look fairly 'good'; to take up for discussion.
5 Aug : scheme is working ok with a well defined SOP using only GWB-II. This can be closed, and attention can be tested to regular testing and results from the same.
==> need to run the tests continuously for getting some statistics and conclusions; to work out a scheme for tracking and finding regions of bad RFI in the beam data (which the filter has caught and mitigated) and go to interferometry data for that region to cross-check.

(x) : updates on time domain filtering algorithm : median of MAD was tried and it appeared to show improvement for long bursts; to check if this recursive method can be an option; to compare it with the case where statistics is supplied exernally.

(iii) book-keeping : trying to work out the packing scheme, with the understanding that jumbo packet size is taking up. Need to discuss long-term plans for this.
1-bit flag implementation has been started; need a discussion for agreeing on the option for double rate sampling and how to structure the packets. Need to move this discussion forward.
Summary of discussion avaiable as a note [passing RFI flag bits thru the chain] how to use it is not decided yet; some follow-up discussions have happened; to check latest status.
10 June : recalled that test needs to be done with 4K packet size to see that corr works ok.
24 June : Today 4K design is under test;
5 Aug : to test GWB-III and report back.
==> GULP based test has been done; now looking at what changes needed in PSRDADA section for 4K packets.

(iv) spectral line filtering needs to be taken up for discussion -- first results have been circulate for projected back-end systems; a concept note has been generated for this; some feedback has been sent by YG; need a follow-up discussion on this matter. To examine if the best place to test spectral line filtering may be beamformer output.
5 Aug : agreed to build up the test and experince on wpmon and then move to main correlator (see below).
==> FPGA based implementation on 4 bit real, imaginary output of FFT has also been demonstrated.

(v) filtering of beamformer output : time domain impulse RFI filtering has been demonstrated in the work done by Shiv Rajora and is being followed up by Balaji (summer 2015); spectral line filtering has also been introduced for this data.
29 Jul : updated code is working; tested and showing good results for off-line analysis (for GSB & GWB); basic tests of real-time mode have been carried out for GSB shm and shown to be working ok.
5 Aug : tests ongoing and being used by KDB and others; plans for further real-time testing on GSB to be worked out; plans for porting to GWB to be worked out.

==> some discussion about this with various options discussed.

4.6 Power and cooling requirements for projected back-end systems -- from 5 Aug and earlier (GSJ/BAK/RVS/YG) : This includes plans for monitoring the temperature on the GSB and GWB nodes so that health of the systems can be kept track of as various changes to the heat load and air flow are made in the corr room for putting in the full GWB system. Specific action items are :

(i) scheme for monitoring of processor temperatures for GSB : for the main compute nodes : new package for temp monitoring requires slightly different version of kernel than what is used on the main GSB nodes; new kernel was installed on a few nodes and following 2 issues came up : new kernel on 2 compute nodes may have been causing the buffer loss problem (new kernel was rolled back to the old one); and for the current kernel on gsbm2, the high time resolution mode did not work (gsbm2 kernel was rolled back to the previous version that was there); for the first matter, follow-up was done with a controlled test -- node18 and 19 test was repeated and some degradation of performance confirmed; agreed to put new kernel on ALL the GSB nodes and test again : 3-4 hours' data collected with all nodes with new kernel; analysis showed a few occasions of buffer loss; comparison with normal GSB kernel showed that it doesn't show buffer loss; agreed to try new kernel once more; also to check for possible causes of buffer loss with new kernel; tests done with 16 and 32 MHz, 256 channels -- tending to show statistical difference in buffer loss; confirmed that there is a difference between in the 16 and 32 MHz modes; discussion between SSK and GSJ to try once more with kernel change only one node and examine the log file carefully and report back.
GSB data old & new kernels taken; 17-43 nodes completely new kernel gives heavy buffer loss; (old kernel have very small buffer loss ; old does not support temp monitoring).
More tests have been done and it appears that GSB is rather sensitive to the exact choice of kernel. Agreed that this item can be closed at this point.
No further action items here.

(ii) to add temp monitoring package on all GWB nodes : to check if this is feasible and has been done or not -- agreed that this can be done easily and that we should implement on all the GWB-II and GWB-III nodes. To make a list of machines which have it and then put it on all the machines; to reuse the earlier code for logging the data, plotting it, and also to add an option to generate a warning if the value exceeds some threshold; to think about a real-time version of the warning algorithm. ready to run on GWB -- agreed to go ahead and test; to think about long-term monitoring tool that shows the temp of all the GWB nodes.
To ensure that code starts every time GWB nodes are rebooted; to work a bit more about plan for bringing the results to a common place for visualisation. Discussed a few possible options ranging from MPI to sockets to cross mounted disk systems -- to decide on concrete action plan.
installed "lmsensor" on all the GWB-III machines and working ok; right now using cross-mounted disks on 3 GWB-III machines; browser based tool for monitoring the data is working ok; cycle for 7 days for preserving the data. To see how this can be evolved.
Right now running on 1 compute m/cs and 1 host m/c of GWB-III (waiting to install on other m/cs); refining the scheme for cross-mounting of disks; auto-restart and halt scripts; cgi script for plotting on monitor can be made more intelligent.
H1 & cor5 cor5 packages installed; auto-restart completed; cross-mounting of disks : to use old scheme.
Installed on 2 more and ongoing; for cross-mounting : not using autofs, but using

old scheme of cross-mounting via /etc/fstab; auto-restart is done (every 30 secs).
Current status of the scheme shown (live !) appears to be working very well;
can think of seeing if any additional performance parameters e.g. CPU load, IO load
can be monitored. To write a technical note on the work done -- make take some time.
CPU load is already there; for I/O load, need to do some work.
27 May : looking at tools for network monitoring (e.g. Cacti) to see if it is suitable;
if not, then would go back to a simple perl script. To start looking at writing a
technical note (including the GSB experience).
10 June : Cacti software tested on a trial m/c; will move to gwbh1....
24 June : Cacti software tests completed for 'gwbh1' & 'gwbh2' nodes; other
nodes yet to be done [other nodes need internal connections ...]
5 Aug : most of the parameters avaiable in Cacti except data on Inf -- may need an
additional piece of software (qualplot);
==>

4.7 Layout of final system in corrator room (racks, cooling etc) -- from 5 Aug
and before (IMH/GSJ/BAK) : Layout diagram to be updated and long-term plan for
racks to be initiated; 3 different kinds of President racks discussed ("cyber",
"cool" + one more?) -- to try and finalise after one more round of discussions
including RVS (also, check new vendor Jyoti Tech); as an interim, 2 nos of cyber
racks ordered with President. Meanwhile, for GWB-III, 4 nos of half-height racks
have been used -- two nos are populated with 4 compute nodes each, third one has
3 host machines + 1 extra machine + clk source etc; fourth one has 8 Roach boards
+ IFB switch; will need to expand this to 16 Roach boards at some point of time
-- may need to add one more half-height rack? One half-height rack is available in
hand and can be used when required. For final system, present estimate is 5 full
height racks housing 32 Roach boards + 16 compute nodes with 2 GPUs each (+ host
machines?). Current action items :

(i) For the 2 President racks : first one has been used for putting GSB related spare
nodes etc; second rack being used for trying the arrangement for special cooling
(with help from mech group) -- tested with 1 kW load and increasing slowly; loading
up to 4 kW tested by comparing the temp difference between input and output air (need
to compare with unmodified rack); results so far appear to show that there is about
factor of 2 discrepancy in estimated CFM rate and AC plant capacity CFM rate.
agreed to include the test with unmodified rack and then circulate the report;
with 2 AC vents feeding 5 racks (final number), the estimate is that the available
CFM may be marginal -- this needs to be resolved against the CFM discrepancy noted
earlier; also to explore additional margin the AC system (joint meeting with RVS
and team may be useful);
20 May : intermediate update from report of IMH about discrepancy of factor of 2;
measurements with the flow meter show that the amount of air flowing into the corr
room is matching with the expectations from the AC system, which means that the
utilisation of the cold air by the correlator test rack is only about 50%; method
of taking in the cold air from the vent to the rack is being modified to improve
the efficiency.
4 Jun : some inprovements in results with better ducting of cold air and 2 stronger
fans to better pull the cold air -- now reaching 75% of capacity; to test at floor
locations far away from the available vents.
17 Jun : at 5 feet away from vent, getting more than 100% (!)
(b) to decide on plans for ordering more racks.
1 Jul : interim report has been circulated; results appear to indicate that for any
typical position of a rack in the room, having fans at the bottom near the input
of the cold air (and maybe some ducting for the hot air at the top) should be

enough for our requirements; to see if one round with more heat load (2 to 3 x
is possible) to see the effect on GSB. To try and see if we can finalise the
choice of rack soon and start the procurement.
15 Jul : electrical load simulation using 12 kW heater on a rack -- report circulated;
report on choice of rack to be circulated in 1 week (22 Jul 15).
29 Jul : short discussion : updated report on rack layout etc is ready; can go ahead
with ordering of relevant racks from President (slightly deeper than standard rack
but is still readily available product) -- to be confirmed and action initiated.
5 & 12 Aug : ongoing; do discuss with RVS and HSK about layout of racks in corr room.
Agreed to move forward with the order for 6 nos of racks.
==> items to be discussd with mechanical have been identified and this will happen
in the next few days; indent for desired depth rack is ready; will be testing 12 kW
heat load next week.

4.8 Next-gen time & frequency standards -- from 5 Aug & before (NDS/BAK) :
(i) brief update from BE team from visit to NPL was provided in last discussion;
waiting for detailed report to be circulated draft (maser report already circulated)
complete report has been circulated today -- need to schedule a discussion.
not much progress; need to follow-up and discuss within the group also, to work out
a possible "plan".
First discussion has happened between NDS, BAK and YG -- need a follow-up !!
5 Aug : to try and schedule a meeting tomorrow with Swami to move forward with the
plans for civil etc for the active option...
==> one round of discussions has happened and possible location has been identified;

Walsh update : as per last email of SCC....

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Minutes for the weekly Plan meeting of 26 Aug 2015

1. FE & OF related :

1.1 Update on results from test range -- pending from 12 Aug & before (HRB/SSK) :

(i) Tests of ver1 550-900 CDF and CSIRO feeds at test range : new results with VVM set-up, after installation of new encoder + notch filter for mobile band, showed : for ver2 550-900 CDF : reasonable E-H match at 610 and then degradation in shape and matching at 700 & 800; partially supported by older measurements from Dec 2013 (with slightly different set-up). Further, results for dipole-2a & dipole-2b with cone v2 show that the degradation of pattern with frequency is worse for v2a than with v2b; radiation pattern measurements have been done with 50 MHz step & using CW signal; comparison with simulation results is awaited. Current restuls and action items are :
(a) first order comparison of C1 dipole 2B vs C2 dipole 2B measurements : C1 D2B shows better E-H match at 610 ; C2 D2B shows good E-H match at 700; and appears to be decent even at 800, though 3 dB width may be changing; agreed to make plots vs freq for 3 dB and 9-11 dB widths, and for taper of E and H at fixed dish angle of 62.5 to check mismatch in taper, for both the feed versions.
First results from the measurements for the plots of 3 dB and taper values vs freq show evidence for change of properties with freq as well as asymmetry of the pattern (as had been seen in the earlier plots also); agreed to try to compare with results from C1 + D2b (make fresh measurements, if needed).
Repeat tests for C2 + D2b sent by HRB which show repeatibility with earlier results; FE team to check C1 + D2b data and complete the comparison -- fresh data needed to be taken for this (earlier records "don't exist"); radiation pattern tests done for C1 + D2B -- comparison plots to be sent soon.
(b) Phase centre of ver1 550-900 CDF and CSIRO feeds needs to be done -- phase centre measurements for C2 + D2b can be tried at the range.
Waiting for comparision report to be done and then follow-up for deciding next course of action.
12 Aug : HRB has reviewed the situation with the existing set-up which is found to be in functional shape; however, they would like to energise the set-up with the transmitter at the further distance (on other bldg), as they suspect that the set-up with sig gen at the main bldg with OF transmission to tx site can have varitions with temperature to be a cause of errors, in addition to possible reflections from gnd and nearby objects; will try with sig gen at transmitter (2 persons required) and compare results with one test case.
==> no updates.

1.2 Phase centre tests for 250-500 CDF -- from 12 Aug and before (HRB/GSS): to test with 100 to 200 mm height change (around default of 1280 mmm) in 250-500 feed on one antenna to see how much change in sensitivity is seen. Tests done on c6 using feed with shortened support legs of the cone (instead of shortened stool) -- comparison of results for 1180, 1280 (default) and 1380 : 1280 & 1380 show slightly better sensitivity at low freq (250-400) but at higher frequencies they match with 1180 (which is quite flat throughout freq range); agreed to try for 1480 to see if there is a monotonic behaviour; also compare with simulation results of GSS. Consolidated results tend to show that the latest level at 1180 height does show a slightly better

response; a final confirmation is needed about the optimum performance from the measurements; confirmed that we can't go below 1080 by further cutting the support legs of the cone; also, current adjustable stool will not work for 325 MHz face due to welded nature of existing stool; agreed with HSK to reproduce one more adjustable stool with modifications learnt from present experience, and try on one CSQ antenna (C6?) by removing the Lband feed, shifting the cone-dipole with new stool to this face and using the existing 250-500 FE box on it; tried on C6 during MTAC period (Oct 2014), but measurements could not be completed as antenna was required for L-band GTAC observations. Current action items :

(i) Agreed to go back to C8 at a later point of time (after 550-900 measurements are completed) -- deferred for now.
(ii) Meanwhile, FE team to go over all the available measurements and produce a consolidated summary -- this is pending for some time now !
15 Jul : HRB is in the process of generating the note to coordination (to identify which antenna & when adjustable stool for L-band or 610 ?)
12 Aug : action items : to produce the summary of existing results for 250-500 and prepare for these tests once adjustable stool is fully functional.
==> email circulated by HRB today with plots of measured deflection for 3 stool heights (1180, 1280 and 1380 mm) -- can take up for detailed discussion next week.

1.3 Comparison of observed performance vs theoretical calculations for feed + dish performance and system sensitivity -- from 12 Aug & before (SC/GP/HRB) : The aim here is to be able to compare performance of (a) feeds (b) feeds + dish (c) overall antenna sensitivity with the theoretical calculation and expectations. There were 2 parts of this work : first was initiated by feeds group in the FE team (G Shankar etal) to use the NRAO code to work out aspects related to (a) & (b) above; the second was initiated by Gaurav to work out the expected deflections for different uGMRT bands (taking into account all the factors affecting the performance); these two attempts (bottoms up and top down) have now met mid-way and it is time to combine the efforts and come up with a final, optimised way of looking at things :

(i) Phase efficiency computation has to be linked to the aperture efficiency computation (NRAO's eff. program, modified for GMRT specific paramters) : work is ongoing, alongwith Sougata (was expected to take 4 weeks -- till mid-Sep2014); code was being ported to matlab; also, original NRAO fortran program can be made to run to give some initial cross-checks? code had been ported from the C version that student had written to Matlab but results were not matching with expected behaviour; then tried to port original fortran version to matlab (was to be fully done by end-Jan / early-Feb 2015), but had problems in getting sensible results; agreed to try and see if original NRAO Fortran code can be compiled & executed -- this was done ! (after identifying appropriate compiler, making necessary syntax changes etc) and first results were to be circulated by 23 Apr 2015, with first trial for Lband : inputs are E-H pattern at 10 deg interval, plus specific value at 62.5 deg, plus various efficiencies -- mesh leakage and RMS efficiencies (phase eff is taken as unity), plus dish geometry (right now coded inside) including a square piece for blockage; output is spill-over and taper eff, cross-polar eff and overall eff (some are with and without blockage); plan was to cross check outputs against blue book values and rationalise against relevant docs and inputs; later, to extend this for all the other bands for which results are available in the blue book; current model takes the following inputs : mesh geometry, mesh deviation in rms, feed pattern for E & H with 10 deg resln, taper value at 62.624 deg, gnd temp; blockage is hard-coded inside right now (alongwith quadripod legs etc).

Some results were shared (c 17 Jun 2015) :
at 327, the code gives 68.4, 66.6 & 66.4% for 259, 270 & 290 MHz;
at L-band it is 43.2%, for 259 K.

Sougata produced a note about the usage of the code and the various input & output parameters, and tried varying different parameters to understand the effect on the output; discussion on first version of this led to the following : various factors going into the efficiency and temperature terms getting identified; agreed that these need to be described in more detail and brought out in a clear note, including drawings where needed (can work jointly with GP); good agreement found for Lband (shown earlier) and 235, 325, 610 feeds with blue book values; agreed to go ahead with 250-500 system.
12 Aug : updated note by Sougata taken up for discussion : clearer definitions of some of the terms now possible; effective gnd temp : black body + green house effect!; comparison of Tsys and Eff with blue book show decent match (can highlight the differences in the contributing terms; extension to 250-500 done : need better comparison of the difference at 327 MHz; non monotonic behaviour with frequuncy of some of the terms; Sougata and GP to combine their efforts and plan to present a talk of 1 hr at GMRT and then at NCRA.
==> new updates from Sougata : using feed patterns from Raghu's thesis, efficiency calculations for 3 freqs of Lband have been done and compared with values in blue book -- decent match (5% or better) -- to check with GSS about cases where it goes to 4-5%; also to try with flared feed pattern to see the trade-off between taper, spill-over and mesh eff. However, at 4 other frequencies (corresponding to the sub-band centres) the patterns given by Raghu produce a slightly different set of efficiencies (looks like these are slightly wider than the 1000, 1200 & 1400 patterns); this needs to be investigated and checked with GSS. Further, expected deflection has been calculated for the 4 subbands and compared with blue book and control room values (the first 2 are higher than control room values).

(ii) calculation (based on reference paper) of expected deflection & comparison with measurements to check the sensitivity being achieved :
(a) GSS had developed refined version of code that is more relevant for GMRT (to compare with 250-500 or 500-1000 feed data) : cross check of results from code wrt curves from Kildal paper was confirmed (0.3 dB drop for 0.5 lambda offset); for GMRT specific case of 250-500, efficiency factor as a function of freq over the band, using the data for the measured feed pattern, was implemented; after correcting one error in the code, better result (9.9 dB vs 11.6 dB expected) was achieved; further, a realistic phase response (instead of 1.0) was included by reading data from a file; results (reported on 19th Mar) showed better match between measured and expected deflections for the 250-500 system : 327 -- 12.8 dB vs 12.4 dB; 400 -- 12.8 dB vs 12.2 dB; 450 -- 12.4 dB vs 11.4 dB; 500 -- 11.2 dB vs 11.0 dB (some re-work needed for lower frequencies?); computed results (based on change in efficiency due to shift of phase centre) show likely drop in sensitivity by about 1.4 dB from 250 to 500; this is now to be folded into the net sensitivity / deflection curves made by GP (see below);
(b) plans to extend this to 550-900 system -- was waiting to get measured values from test range; data for cone2 + dipole2b exists; needs to be run through NRAO code to get the efficiency factor -- will happen soon; when data is available for cone1 + dipole2b, same can be done.
20 May & 1 Jul : pending for item (ii) to be completed.
12 Aug : this can now be updated based on the earlier results reported above;

(iii) Comparison of computed results with measurements for 250-500 band : initial

results for good antennas at 250-500 (other than C6) with default height of 1280 (and for C6 with reduced height of 1080) showed that computed values are actually better at high freq end for 1080, which is different from the observations which are showing droop at high freq for 1080 (in conflict with first results reported above); computed results, which were for 1180 to 1480 in 4 steps, were extended to 1080 & 980 and 1180 was found to give the best response (note : this is for a particular value of ph centre based on range measurements); computations were extended to much smaller values (down to 580 mm) and latest results show a peak in the response around 580 o 780 (!), which are in sharp contrast to the experimental results which were carried out in the range 1080 to 1480 mm and showed optimum performance around 1280 mm -- this needs closer scrutiny of the simulation code and experimental results; with new code, it may be possible to recheck the calculations and then can take up for discussion to rationalise; code is running; but first being used for the cross-checks described above; will go to new 250-500 etc after that.
20 May & 1 Jul : also pending for item (ii) to be completed.

(iv) Comparison of measured & expected sensitivity curves :
Scheme for (re)calculation of expected values across the broad bands to be finalised (and added to measured curves) : curves with constant QH value and variation of T_lna with freq were incorporated; model for the main BPF was also put in; after that antenna efficiency factor (based on measurements with 4-5 points across the band) was added by interpolating the measured values; return loss of the feed was added to the above and the result now matches much better with the data -- all this was done for 250-500 band; subsequently, the formula was revised to change the constant factor, which resulted in some discrepancy in the mean deflection values, and also some cases where the measued deflection is higher than the theoretical values -- these issues to be understood and resolved; after some cross-checks and refinements (dir coupler loss values, source flux from Baars et al, recalculated constant etc) -- spot value of 13.0 dB at 325 for CasA compares well with 12.7 used in control room; antenna efficiency factor still needs to be determined a bit more carefully -- agreed that both the efficiency terms (which includes default ap eff + phase eff, from measurements on test range) and the RL term whould be kept and the product should be used;

(v) cross-check the flux values and get updated numbers with DVL's help :
Around 20 May 2015, DVL had generated a table of 5 MHz apart flux values (covering entire uGMRT range?) for all the main sources, which can now be used by GP in the detailed formula; simple comparison with formula is folded in when comparing with control room values; GP had done a cross-check at 325 with the existing and new value of flux and finds new value is higher (leading to 14 dB expected deflection!); to check one or two more spot freqs (like 610); DVL & ICH have agreed to look into the matter and resolve the broader issues (17 Jun 2015);
15 and 29 Jul : no updates on this matter.
12 Aug : from ICH and DVL : finding comparable sky backgnd -- 5 deg away may not be enough for all bands; hence some refinement is needed -- work is ongoing.
Agreed that ICH & DVL to provide the flux and sky temp values (for cold sky and actual background) and FE team to provide all the efficency factors.

(vi) to get clear confirmation about which all terms are included in the efficiency factor currently being used in the calculations. Some results may be available from the NRAO code calculations?; till then the interpolated values are being used.
4 & 17 Jul : remains status quo till NRAO code issue is completely resolved.

(vii) develop the model for Lband : information gathering had been started -- feed

pattern (efficiency) at 3 individual freqs available, and measurements available for 5-6 frequencies (?); agreed to work with the 3 pt data, do simple interpolation and see what kind of curve is produced; first order calculation of model had been done, including RL of feed, notch filter alongwith BPF etc -- Sanjit + Gaurav had put the curve for expected deflection alongwith the measurement results to do the comparison, and this was added to the weekly plots; results showed shape mismatch at high freq side of the band (good match with data at low freq end), and an extra bump at 800 MHz; the bump was explained due to combination of BPF and mobile notch filter -- may need sharper BPF cut-off to avoid it; for the high freq mismatch, the best guess at present (Jul 2015) is that the sensitivity curve being used is not realistic enough (though feed RL is included) and inverse calculation of the drop in sensitivity required shows a very steep drop just after 1450 -- this needs to be understood. current action items :
(a) 1 or 2 antennas with response better than theoretical esp at lower edge of Lband -- need to be checked;
(b) shape mismatch at high freq end needs to be resolved (why RL drop + BPF is not enough to kill the response?)
12 Aug : not yet resolved; may need detailed feed pattern at 1400 and above for this... to look at Raghu's thesis.

(viii) a note summarising the overall scheme to be generated and discussed : updated note from GP was discussed : this is much more detailed now; need to cross-check :
(a) the variation of Tgnd with frequency -- understood that this is due to the fact that Tgnd in blue book is a func of Tmesh and Tspillover and hence will be a func of frequency; item can be closed?
(b) add points for existing control room values -- this is done and is closed.
(c) replot with better y-axis resolution -- this is done & can be closed.
(d) 250-500 and 550-900 look reasonable; Lband has some extra features that need to be understood (see details above);
(e) could start looking at 130-260;
(f) to vary parameters for 550-900 to understand the 3 dB droop from low to high -- this has been done and has provided useful information (looks like Tlna may be issue)
1 Jul : updated note has been circulated, including DVL & ICH (YG to follow-up)
12 Jul : Sougata + GP to do this jointly & confer with DVL + ICH as mentioned above.

1.4 Total power detector for FE & common boxes -- from 12 Aug & earlier (GP/ANR/SSK): plans for final scheme : 20 dB coupler for CB and 10 dB coupler for FE (at final output) with common 20 dB amplifier (Galli-52 instead of Sirenza); feed-thru vs connectorised arrangement also resolved; after lab tests (including monitoring via MCM channel) in FE and common box, sample units installed in C4 FE box and E2 common box. Some other details are as follows :
For common box : data from 2 units installed on E2 showed basic things working ok: first round of testing showed 11 dB deflection (12.4 dB expected) on Cass-A; later on Crab, getting 5.5 to 6 dB (6.6 dB expected); flat-top on-source waveform was understood to be due to quantisation of step size of detector levels (least count issue); script / SOP created for automated running of tests;
For FE version : 2 units had been assembled and found to give identical performance as per specs; problem of feed-thru vs connector was resolved in favour of feed-thru (as per original chassis design); all testing completed in the lab; first units (on C4) showed problems -- traced to incorrect mapping of channels etc.; new units (batch of 20) that were assembled showed unexpected change in detector o/p due to grounding problem which was corrected (manually) for 10 units and final PCB for mass production was modified for this change; script for automating the observations has been done an released by GP. The issue of RC time constant was taken up,

resolved and closed (c. 22 Apr 2015); final report was submitted (c. 22 Apr 2015), with most of the outstanding issues resolved.

The remaining pending action items now being followed are :

(i) To decide upon long-term plan for power monitoring : GP to generate a short note about the proposed scheme for this; some discussions on 11 Mar 15 about exactly what this note should specificy (over and above the SOP); GP produced a note for the procedure to be followed -- need to move to a strategy document for running the program on a long-term basis; meanwhile, Shilpa was identified as the person to implement the monitoring strategy (maybe weekly tests; MCM to be turned ON for collecting data & then put OFF); first version of strategy document was discussed (20 May 15) -- need to add some more details about the strategy : how and why of the test observations being planned, and then give the procedural part; updated version discussed (17 Jun 15) -- looks better and can be released to Shilpa as ver1 for trying out;
29 Jul : This has been done and this aspect of strategy doc can be closed. Regular observations by Shilpa is also going fine -- to follow the progress of that.
12 Aug : regular tests are happening.
==> weekly data is being taken and being analysed by GP -- results to be circulated.

(ii) possibilities for automating data reading, analysis and plotting also discussed -- GP has now implemented automated program for plotting CB, FE power levels (both chans) and 3 temp monitor values (2 in FE and 1 in CB) in one go from a file containing data for X nos of antennas is ready; this has been tested with the above data sets; agreed that it is generic but not tested for anything other than temp and pwr; can be generalised for all channels of all 30 antennas but can be taken up at lower priority; also, does not have a user friendly interface; current actions :

(a) agreed that working version of code + SOP to be fully released asap : SOP has been released; GP had prepared a note about analysis procedure (using matlab) -- it was discussed and found basically ok, except for hard coded locations of GP's machine -- this is linked to decision about who will be doing the analysis : FE team to check best way to address this and come back with suggestion.
12 Aug : agreed with the team to make the code accessible on one of the common machines in FE lab. GP to work out the procedure and small SOP for this.
==> work TBD.

(b) development of user level GUI : SSK took up the matter with SN and Shilpa was identified as the person to take care of both GUI development and also ensure regular running of the tests, as per strategy document; matter was discussed and cleared with ICH also (4 Jun 15); GP had discussed with Shilpa about requireemnts (15 Jul 15) and work is in progress for a UI for visualising the data / results -- this can go ahead; after that a UI for creating the obs file required for different test runs can be developed.
12 Aug : work is progressing, GP to check and report updates.
==> UI for the analysis / visualisation is going on (some consultation with SNK leading to a more generalised version for 30 antennas).

1.5 Installing and testing of temperature monitors in front-end & common boxes -- from 12 Aug (VBB/SSK) : scheme for fitting two temp monitors (one for LNA, one for FE box) for tests on bench, followed by antenna tests and installation: lab test with manual readings had been done (showed 15 deg temp difference between LNA body and FE box (open)); work was ongoing to study online data from 3 antennas : W1 (130-260 FE

box), W4 (250-500 FE box) and E2 (common box) was tested ok, and some long duration tests had been carried out; meanwhile, C4 & C10 fitted with dual temp monitors in FE box, and C13 with monitor in both FE & CB -- some tests had been done but data was not sensible due to unresolved issues in the wiring of the existing common box units that prevents desired data to come on expected channels in online monitoring set-up ! Agreed to select a few antennas (maybe W1, C13, E2) for proper monitoring after resolving the issue, and for the rest, keep putting the temp monitors and maintain a log of which ones work in online monitoring; later, correct the wiring whenever a common box is taken for maintenance or upgrade (same argument applies for power monitor also). Combined SOP for temp monitoring and total power monitoring was been prepared and released. Current action items :

(i) Analysis of the data : C13 & E2 both channels temp monitor available at online output (fixed for C13 one ch FE & both chans in CB, and E2 both chans in CB); some test data had been taken; also, some data had been collected for 6-7 antennas; first results for ~ 5-6 antennas (LNA + FE box) + 2 antennas (CB) for 3 hr duration shows some basic behaviour but not clear how well things are working; to try two things : (a) to check if any old data of longer duration (from last 2-3 months) is available (b) to try a longer run, even for one antenna like W4 which is under maintenance; some of the short data stretches have been looked at; at least one 6 hr data has been taken; report has been updated and submitted to library for uploading; longer stretch of data and analysis of that is still pending.
Finally data from one long run (on E02) was obtained -- showed decent results for a first attempt : temp of FE and CB following each other; with LNA temp a bit below but tracking (with some delay maybe?);

Current action items :
(a) need more confirmation runs to establish repeatibility -- fresh data taken, but some problems with FE monitor stopping after 1.5 hrs; broadband system was removed from E02, and tests shifted to C13, but had problems with CB temp monitor not available (20 May 15); back to E02 (17 Jun 15), but still having some problems; finally, some useful data from the regular monitoring tests -- 2-3 hrs on 3-4 ants : basic results look reasonable, but there is enough variability between antennas (and between FE, LNA and CB values) to cause some concerns; agreed to keep getting data, including couple of long runs.
15 Jul : One set of data taken for long stretch (on W4) & analysed; results need to be circulated.
(b) regular monitoring can be folded into strategy doc for power monitoring : this was done, with the aim of one hour once a week + one 8-12 hr slot.
29 Jul : one long run data has been acquired; couple of comments for improvement : see if an ambient temp measurement can be included, and cross-check with another run to check LNA vs box temperature behaviour.
12 Aug : new long-run not yet available; for ambient temp monitoring : Sanjit to help make a standard set-up.
==> still waiting for a long run of data and also waiting for interfacing with Sanjit to add ambient temp monitoring capability.

(ii) Other related issues : plans to add monitoring of temp in OF rack at antenna base and also the RF power...
29 Jul : can be kept pending for some time.
12 Aug : can keep pending.
==> will start after completing 30 ant OF system.

1.6 Spare LNAs for L-band feeds -- from 12 Aug & before (SSK/ANR) : we had 32 feeds;

2 were not working (1 has been dismantled for making drawings of new feed) due to lack of electronics spares -- mostly device failures (including some new ones?); some new LNAs were successfully assembled by Gopi and failed feeds for C3,W1,E2 & E5 were fitted with these and found working ok. Also, one spare feed was assembled and installed on W1 and working fine. It was agreed to have at least 5 LNAs assembled and available as spares -- initial lot of 10 was assembled and used up; finally (c 20 May 2015), status quo situation was that 2 fully assembled spare feeds (i.e. 4 LNAs) ready for use, and no extra LNAs available (from old design).
Current action items :

(i) alternate LNA designs : to see if design used for 550-900 can be modified for 1-2 GHz use; to also check the design done by Abhay Kulkarni and see if it can be improved for our needs; design files had been obtained and were being checked by GP and ANR : model files converted to match simulator used by us; component models in software had to be downloaded; also ultralam2000 that was used is not available in the market now; agreed to simulate with ultalam2000 first to check ckt works ok; then concentrate only upto 2 GHz and change substrate to RT 5870 (easily available); simulations matching with original results completed; simuation reproduced ok with RT 5870; trying to tune the design to required specs of gain (30 vs 34), Tlna (~28 or better); in terms of NF target is to go from 0.4 to 0.3, and maybe at cost of reduced BW; Feb-Mar 2015 : now getting close to Tlna of 28-30 across the band; overall gain is also very good ~ 38 dB; but 4 db slope across the band needs to be adjusted (due to some missing feedback in the ckt design?); move from s2p to non-linear model completed successfully -- did not disturb the results; May 2015 : couple of prototype units completed to get a working solution : gain is 28-30 dB (not high enough), Tlna is 28-30 K (bit on the higher side) -- increase in gain may be difficult as it is a 2-stage design (?); 3rd unit was made and after some retuning, achieved some improvement in gain (~ 32 dB now across the band with no slope), and Tlna is 31-28-27-31 over 1060 to 1390, and S11 & S22 are below -10 over the entire band; few more PCBs were assembled (and extra chassis were obtained); current action items :

(a) to try for improved Tlna
(b) decide for trying out on antenna
12 Aug : some improvement in Tlna reported : 23 to 25 K mostly and 31 to 33 dB repeatibility tested on 3 units; further tuning possible (but need AWR to start working again -- both PC and dongle solutions progressing); to select one CSQ antenna (not short baseline) and put up spare feed with these 2 LNAs and do careful measurement of deflection before and after.
==> AWR problems are resolved (dongle has come and put on server and AWR is now working); unit will go up on C02 today (without noise cal injection) and can be left on test for a few weeks.

(ii) possibilities for new LNA with Tantrayukt (Yogesh Karandikar) : item was taken up for discussion, following the visit of YK in Dec 2014 : to check if YK has got results from his first prototype for 500 to 1500 and then take the matter forward; some email updates from Yogesh (Apr 2015) -- getting close to fabricating the first batch of the LNAs; also, NDA needs to be completed, and EoI process may need to be carried out -- these are being looked into; 15 Jul : YK has first version of LNA ready for testing and would like to do that at GMRT; visit happened 27-29 July and follow-up action items are :
(a) to fnalise the modus operandi for usage of our lab facilities : can we work out the equivalent consultation time and offer that as a package deal.
(b) to complete the NDA asap

(c) discuss items where we would like his consultancy
12 Aug : FE team to work on item (a) and YG on (b) and take up for discussion
2 weeks later.
==> FE team to work out cost for rental of measurement instruments.

1.7 Completion of spare L-band feeds -- from 12 Aug & before (SSK/ANR) : Target to have a total of at least 5 (out of 8) working spare feeds (from mechanical to electronics) : 30 antennas had working Lband feeds, but there were no spares, though we had 2 feeds; one unit was assembled back from the feed that was dismantled for making the drawings -- this was completed and installed on W1 (one feed is now in the regular 'maintenance cycling' of feeds); 32nd unit was there in Pune wshop and was shifted back after assembling by mech group and then fitted with electronics; it uses newly fabricated push-type (presss-fit) probes; after 2 LNAs were made ready (see above) this feed is now available as the 2nd spare feed. Furthermore, 6 new feeds were made (via outsourcing) in 2 batches of 3 nos; in the first set of 3, 2 nos had wrong size of horn and had to be corrected by the vendor; all 3 needed new covers as old ones were not suitable; second set of 3 feeds from Akvira : OMT + horn + cover; hence, total of 8 spares CAN become available; note that weight of 3 latest feeds is 18 kg more (72 vs 61 kg) than earlier feeds -- now accepted as 'fait accompli' !

Following issues need to be resolved currently :

(i) having sufficient number of spares : only one spare feed available right now; matter of requirement for 15m feed also discussed : can take the electronics from the existing OH feed and put in a spare feed and give to 15m dish; may need to change filter bank also -- to be taken up when required by JNC (may be in Sep 2015).
12 Aug : one working feed still there; 2nd feed will get new LNAs (as above) and will be going up for tests; for shortage of post-ampl + phase switch (due to mixer going obsolete) -- substitute device has been identified but it may not work for Lband (due to slope) -- this will work for 550-900; to find few spares in the market (or from our old stock).
==> only one working spare now (not counting the one going to go to C2 today); one coming down from C2 will need some servicing (less deflection in one band). VBB looking for spares in old stock and GP has indented for 10 nos at $100 each; for replacing the OH feed on 15m dish : take one of the 3 extra spare feeds and retrofit the electronics from the OH feed into it -- but will need to replace main BPF, sub-band filters and maybe LNAs (if retuning does not work) -- this activity will start after 15th Sep and can be done on lower priority.

(ii) other electronics : sub-band filter bank is the main item missing; it was found that the sub-band filter ckts spares don't work as one gnd line (for switch ckt) is missing in the films from RRI (!) -- to try with a wire providing the gnding ckt; alternate is to start using the new design -- this shows good performance for individual filters, but integrated unit is giving poor performance for selection of 1280 -- problem with the switch (new make is not giving same performance as original make) and this is affecting both reuse of old filter PCBs and also the new design; looking for original make (MACOM) and also trying a different switch (Hitite, which means new PCB); new PCB designed with Hitite switch (will need additional patch PCB to convert logic levels; one chassis (for 2 pols) made available for testing; new design still not working for 1280. After isolating the filter from the switch, response was found to be fine; found some issue about the layout on the PCB for the Hitite case and PCB was redone -- received, populated and tested : looks like still not producing proper results? Finally problem tracked to the amount of grounding :

added a metal plate below and screws to provide additional ground area -- now both MACOM and Hitite designs are working ! Modified PCB layout being done (for both cases) -- design sent for fabrication around 10th May; both PCBs assembled & tested (15 Jun 15) : results showed MACCOM response is better; Hitite is showing some shift in some of the sub-bands; recommendation is to go with MACCOM;
current action items are :
(a) to check and confirm whether 10 dB extra amplifier for 1390 is needed or not : detailed look at results show new filter is better in shape (and insertion loss) but still not good enough to dispense with the extra amplifier at 1390 (1 Jul 15) -- to check if this item can be concluded and closed.
(b) to assemble sample units for both channels and put on one antenna and compare with existing system : when new PCBs come (from Argus), will assemble in both channels (with ampl) and put in one antenna.
29 Jul : work in progress.
12 Aug : filter is assembled; need to add the 10 dB amplifier and test; may be ready for putting on antenna by next week; can check after 2 weeks.
==> 2 PCBs (for 2 poln) from Argus show difference in response : shift of 15-20 MHz in 2 sub-band and one sub-band not working; remaining 3 PCBs to be tested to check; may need to explore another vendor.

1.8 Testing of LBand wideband systems on 30 antennas -- from 12 Aug (SKR/PAR/SSK) : (to maintain a proper log of action taken on individual antennas during these tests and debugging activities); data being taken fairly regularly since June 2014; issues being looked at and their histories are as follows (some of these are dynamic and keep changing as problems occur and are fixed and new ones pop up) :

(a) antennas with poor deflection overall : C1 in early 2015 (cable problem); C14 slightly low (1 dB) (Apr 2015); C3 slightly low & W4 one chan not working (May 2015); C1 both chans 1 dB & C11 ch2 (Jun 2015); see action items below.

(b) antennas with deflecton changing over the band (less at high frequencies) : checked if pointing offset can explain this -- not found relevant; was shown that it happens for cases where the RF power level (at laser input) is too low -- confirmed with a more careful set of tests (and plots) for few selected antennas (including make good ones look bad by increasing OF attenuation), and demonstrated in deflection test report of 11 Nov 2014; to check if appropriate reasons for low power levels can be identified.
Mar 2015 : S4 had low power for long time -- was solved with change of RF PIU in OF system (!); C8 ch2 being investigate; problem seen for E6 but power level is ok;
Apr 2015 : OF attenuation needed to be changed from (default) -20dB to -11dB for a few antennas (eg W1 ?);
May 2015 : low sensitivity in C3 shows this kind of slope across the band in deflection.
Jun 2015 : E6 is now added to this list (C3 was not available) -- to check with JP about pointing related for E6; go backwards in the record to check when C3 problem started;
see specific action items below.

(c) antennas with improper off/on bandshapes : low power level or excessive slope e.g. W1 (was there for several months); C4 and W6 also;
Apr 2015 : cable faults found (& rectified) in C4 & W6; Mar2015 data does not show
Jun 2015 : W4 showed problem in 1 chan : was due to splitter and now fixed; W1 feed has been replaced by spare unit and slope is seen in the LNA of unit brought down -- one LNA has been retuned, second one is being done; C2 also shows this problem -- will do in-situ tests to check the cause;

see specific action items below.

(d) antennas with ripple in the band (this is mostly due to cable problems or loose connectors) :
Apr 2015 : C3 & C12 showed problem -- traced to loose connectors (after tightening they are OK); and Mar2015 data does not show any major problems.
Jun 2015 : S6 showd ripple; maybe cable problem? gone in Jul 2015 : may have gone away due to tightening of connections?
see specific action items below.

(e) antennas with significant RFI in the band :
some possible lines are (full set of known lines now given at end of test report):
airport radar : 1030 and 1090 (3 MHz BW)
GPS signals : 1176.0 & 1176.45, 1191.80 & 1204.70 + some at 1280 (will need predictive algorithm)
mobile signals : rejection is not equally good in all antennas -- needs to be checked.
unknown ones : 1137.5 (distance measuring equipment in aircraft?); 1320, 1470-1480 (maybe related to 4G), something near 1540.
see specific action items below.

Current action items :

(i) there is a good data base from sometime in 2013 onwards -- can we have a well-defined algorithm for comparison of different data sets and getting statistical conclusions? -- to look at developing a tool for this; a basic tool was developed : overplotting of on and off is possible and clear patterns can be picked up. To check for next level of sophistication of the tool. Tirth has started looking into things; expect some feedback from him by end Aug.
12 Aug : new pie-chart records showing different types of failures over last 3 yr period; need to cross-check the numbers it is showing...

(ii) learnings from the latest data :
data from 22 July, shows a few (2-3) antennas with low deflection e.g. C1, W4 (feed replaced); C1 needs to be investigated. Some antennas (C11) showing some extra RFI; also, one line seen at 1137.5 -- suspected to be distance measuring instrument on aircraft. Antennas checked for strength of mobile signal received : C9, C10, C14, E2, S1, S3, S4 and W5 show higher than -20 dBm in single carrier power level.
12 Aug : new data taken today -- not yet fully analysed, but results discussed in brief: quite a few antennas are down; quite a few showing poor deflection, and sloping with freq : C03, E03, E06; agreed to follow-up at least one or two of these (C3 and E6) to track when the problem started and to check OF vs FE and then decide follow-up action.
C1 very low, C2 no deflection -- these are being looked at.
1180 1230 MHz lines seen predominantly in these tests (to checkf if both are GPS).
==> waiting for detailed updates from Sanjit on 12 Aug data + follow-up on known issues.

1.9 Switched filters at different stages of receiver -- from 12 Aug & before (SSK):
2 main categories of switched filters are needed : (a) switched filter banks inside FE boxes (these are mostly covered under agenda items of the respective FE systems) (b) switched filter banks in rx room for additional, selective filtering of the RF signal before it goes to GAB system; (c) monitoring set-up in rx room (at o/p of OF system); these are being designed using the new switches : 2, 4, 8 way switches with different possible configurations;

Current action items are as follows :

(i) for rx room monitoring at OF o/p : note that these circuits are connected to the nonitor ports of the OF system; first design did not give enough isolation at highest freq of operation and hence new design was done; ckt for 2:1 and 4:1 versions was mdae ready & tested -- 25 dB isolation achieved; drops to 17 dB with frequency for 8:1 switch -- now getting improved rejection : better than 25 dB below 1 GHz; goes down to 16 dB above 1 GHz; the leakage between the signals with this switch is still unacceptable; trying another switch (MACOM make) which terminates unused inputs while selecting the desired input (will be used in the final 30:1 monitoring system), and gives 40 dB isolation; new switch + modified design with additional isolation switch and power supply isolation done : achieving 35 dB at Lband and more than 50-55 dB at lower frequencies, with all channels powered; will be tested in monitoring system for 16 antenna set-up. 8 antenna system completed and under test; appears to be working ok; assembly for 16 antenna system is ongoing; components are available for full 64 input (32 antenna) system.

Current action itesm :
(a) to look at test results of 8 antenna system -- especially the isolation results :
Around 20 May 15 : isolatio numbers (at 3 spot freqs) ~ -40 db to -35 db for adjacent ports and ~ -40 to -70 for other ports; lab tests on integrated system (15 Jul 15) show 35-55 dB; to check if it holds for 16 antenna system.
==> no formal circulation of results yet.

(b) to do an additional test with signal injected at Tx i/p at antenna also :
done finally (15 Jul 15) and demonstrated to give 35-55 dB isolation.
==> no formal circulation of results yet.

(c) to completed 16 antenna system (4 units wired and ready) : initial system made ready (20 May 15), showed ripple in one of the 8:1 units; later (17 Jun 15), there was problem of dip in 1390 region that required additional grounding in relevant part of the ckt; by 1 Jul 15, had good results for 14 antennas, but still some issues related to driving of digital lines...
15 Jul : above problem persists; need to increase fan-out capacity by improved design;
29 Jul : work in progress; to wait and see.
12 Aug : fan out problem solved; 16 antenna system completed; now adding 8 more.
==> about further expansion beyond 16 antennas : see below.

(d) to summarise the design in a note -- work yet to start?
12 Aug : to aim for a basic report by next meeting.
==> this is NOW become the highest priority and there has been NO circulation of ANY results so far; agreed to stop work on expanding beyond 16 antennas till these results have been circulated in a brief report and looked at.

(ii) for rx room switched filterbank : prototype system was been developed; tests were done and performance found ok; report describing the design and characterising the performance was produced, circulated and discussed (22 Apr 2015) -- was in quite good shape, with results for different filter combinations. Final version was sent to Dongare by Ankur around 20 May 2015. Pending issue is about availability of space in rx room for housing these units -- agreed to keep this pending (on low priority) till final requirement for this system is clear.

1.10 Finalisation of 550-900 FE box -- from 12 Aug (IK/ANR/SSK) : to produce a block

diagram for the 550-900 FE box; then to start seeing which units are ready, which need to be done; which may need to be combined into single units etc; roughly same number of components as 250-500 box, slight difference in the arrangement of notch filters; size of sub-band filter chassis will be different; agreed to start this layout work in paralle with the work on common box layout -- Imran+Ganesh looking at it, with Bhalerao's help. A basic block diagram was produced by Imran and discussed (Jun to Jul 2015), and some of the aspects were clarified.
Current action items :

(i) dir coupler not available -- being designed fresh; 2 options done and PCB sent for manufacture (to Mohite, then changed to Argus) -- Apr-May 2015; first tests without chassis look ok; tests with chassis for 2 designs (with different substrates) tried (May 2015): one design is better in terms of insertion loss (~ 004-0.06 vs 0.06 to 0.08) and variation of coupling over the band (3 dB vs 6 dB); selected design was to be tested with noise source + LNA + feed load in the lab; integration could not be completed as the 1st version of the "hood" not big enough (4 Jun 2015); agreed to complete antenna tests without this noise coupling (fall back option is to use the 2nd coupler whose size is smaller); took a lot of time for new, bigger hood to be made and delivered; finally, chassis with type N connectors assembled inside the new hood...
12 Aug : chassis with type N connectors has been assembled alongwith new hood; FE box in DC wiring stage; will get done this week and should go to antenna (E02) by earlier next week.
==> unit is ready to go to E02 (was down due to UPS wiring problem) -- will happen this week.

(ii) post-amp + phase switch to be combined on one PCB + chassis that matches with size of Lband post-amp + ph swtich system and RF on-off will be added to it; proto yet to be made (see discussion earlier).
17 Jun : PCB layout is ready and will be sent for fabrication shortly.
1 Jul : PCB sent for fabrication (to Techno Ckt).
29 Jul : some PCB has come but not both sides that are required; this will hold up integration of box #2; agreed to go without RF on-off, using the Lband unit (same as done for C10 box).
12 Aug : Lband unit is with the new device (see above) which needs to be tested (by Sougata) and then integrated into the current box being assembled; still waiting for mirror image side of the PCB.
==> missing PCB has come and tested ok; will be integrated into next box #3 (2nd unit with final hood design) which will come in 2-3 weeks.

(iii) main FE box : prototype is now ready and demonstrated -- looks in good shape; testing to start shortly; prototype of DC + LNA combo with feed will be ready in 2 weeks time (by 20 May).
20 May : DC wiring is completed; RF routing work is going on.
4 Jun : this is completed and will be tested on the bench with the hood today and go to C10 tomorrow (5th).
17 Jun : this box is working ok on C10 and the design can be taken to be the final version, except noise injection connection is not made and tested to the hood.
1 Jul : just waiting for unit to be assembled with new hood and tested on the bench and then the item can be closed.
29 Jul : one completed and sent to C10; 2nd and 3rd getting ready (see above).
12 Aug : 2nd unit is in DC wiring stage; 3rd one will be taken up after that.
==> 2nd unit completed and will go on E2 this week; 3rd one will come up in 2-3 weeks time with the hood (see above).

1.11 New filters for Lband -- from 12 Aug & before (ANR/SSK) : Sample Lband full-band BPF had been designed -- has no slope with freq and better insertion loss, and maybe a better option than the existing main BPF; similarly, prototype design of new sub-band filters (with better insertion loss) has also been done. Detailed results for the main BPF shows that the BW is slightly less than existing BPF : 500 MHz (965 to 1465 MHz), instead of 590 MHz (890 to 1500 MHz) -- this gives better rejection to mobile band signals, but has implications for final usable BW of L-band system; furthermore, an improved notch filter has been designed for the 850-950 mobile band (-60 dB vs -45 dB at 900 MHz), alongwith a LPF for cutting off the 1800 mobile band has been designed -- 3 dB cut-off freq of 1650 MHz. The matter was presented to the users in Friday meeting on 9th May 2014, and it was agreed to generate a note about this proposal, for clearance in the GSG. This was done and matter was discussed in GSG of 13 Nov 2014 and it was cleared to proceed on the following: new BPF + mobile notch filter to replace existing filters in FE box; LPF to be put in common path at antenna base as a common facility for all bands; to be taken up as a case-by-case replacement job, whenever a unit comes down for some maintenance work. Meanwhile, plans for mass production need to be worked out.

Current action items :

(i) status of mass production :
(a) for the LPF (Jul 2015) : 10 units of 1650 LPF had been fabricated out of 40 PCBs available; it was agreed to order PCBs (stripline) for 70 nos using existing eps10 board; both pols to be combined in one rail-type chassis (35 nos needed);
29 Jul : 10 are completed; can go ahead and do more antennas and both channels.
==> mass production to continue beyond 10 nos, if chassis is available.
(b) for the main BPF : PCB + chassis for new BPF ready for 40 nos (30 antennas + 10 spares) -- this can be closed.
(c) for the new notch filter : 60 nos had been made (PCB + chassis) of which 30 have been used in existing system; all 60 ordered and received (29 Jul 2015); sub-item can be closed.
(d) to include these items in Ankur's spreadsheet : Lband new filters now included (BPF is completed); sub-band filter information also added (17 Jun 2015); updated spreadsheet was circulated and it contains the new information (1 Jul 2015); plan is to transition to a web-based tool for long-term tracking of progress;
15 Jul : the spreadsheet is now available for online viewing;
29 Jul : this appears to be ok and can be closed
==> can close all others except item (a) above.

(ii) status of installation :
(a) agreed to put 10 nos of 1650 LPF in one channel of 10 antennas which have 250-500 broadband system installed; initially, 1650 filter was put in one poln of C10 on a trial basis -- appears to remove the 1800 mobile signal and does not appear to affect other bands; shows about 0.5 dB insertion loss; agreed to put available 10 nos in ch1 of 10 antennas in central square.
15 Jul : installed in 8 antennas so far -- list to be given to NSR for updating the webpage; watch and wait for some time.
==> installed in one channel each in 10 antennas (to be confirmed by Ankur); also to check with NSR if the update shows on his page.

(b) also agreed to move the 70 MHz HPF to just before the signal enters existing IF system (instead of just after the signal enters the ABR cage); tried for one antenna (C4 ?); discussion with ABR team did not converge as planned; right now, LPF and HPF

put in series and put on top of the rack. To confirm the final status (for all 30 antennas) and close the matter.
==> confirmed that HPF is restored in all antennas to earlier configuration and 1650 LPF is being added in series (cascade) with it.

2. RFI related matters :

2.1 Some of the broader issues related to RFI -- from 19 Aug (PAR/SSK) :
(i) verification of in-house RFI measuring scheme with controlled expt with different res BW and with continuum and line RFI sources.
(ii) absolute calibration of RFI power that will reach antenna.
(iii) testing of RFI produced by GMRT bldg vs environment, using GMRT antennas : controlled test to be scheduled.
To have a follow-up discussion on these topics.
==> PAR not present; agreed to have a detailed discussion next week.

2.2 Discussion relating to Industrial RFI survey -- from 12 Aug & before (PAR/SSK) : revised docs (from 2009 and 2012 discussions) had been circulated by RFI group and were discussed in 5 June 2013 meeting (is the document too exhaustive?); new survey planned with main aim to generate updated database which will be useful to pinpoint likely hotbeds of RFI in the industrial areas in addition to finding those without NOC; after months of planning and discussion with DIC, was finally conducted during 23-27 June with 4 teams; covered Ambegaon and Junnar talukas ~ 40-50 villages in each; ~ 40-80 working industrial units (large number are closed down or never existed!). Some of the progress is as follows :
A form had been prepared for use in the survey and had been discussed in detail and agreed that it is suitable for use; about 70% of existing data had been entered into this form; agreed that this activity would be superseded with making a database of equipment and NOC record for the existing industries found in the survey; this data entry now completed for all 3 regions : Junnar, Ambegaon and V-K industrial estate; some highlidhts from the database : of the total list, a significant number of industries are closed down, and another significant factor are no longer traceable; about 1/3 of the original are still working (ignoring poultry which is about 1/4, but is considered RFI-friendly). A follow-up meeting with DIC took place on 30th Sep 2014.
Summary is as follows :
a. To maintain proper record of the data of existing and future industries in the same format. The data format and data base was shared with them during the meeting.
b. Complete list of the villages in Zone I to Zone IV is submitted to them, based on which they can decide the issuing of NOC for industries in different regions (and also outside?).
(c) DIC to issue NOC to the old units which are working in the GMRT identified zones, with guidelines from the GMRT

Matters had been stuck for some time due the issue of payment to DIC team for some of the expenses incurred during the survy work. This has been resolved, following the meeting between PAR + JKS and DIC office, on 27 Apr 2015.

Also, we don't have formal declaration of "no industrial zone" decision -- need to find a way to formalise this.

Some of the present action items are as follows :

(i) To cross-check the list against the ones which have NOC, to identify those which

don't have NOC and initiate appropriate follow-up action :
(a) identify those operating without NOC clearly in our database -- Govardhan, sugar factories near W6 and S6, old unit of DJ exporst, any more? is the final count available now?
(b) to approach DIC to work out a procedure for issuing NOCs to such old units : DIC will be sending the standard form to them, and it will come to us for clearance; we need to be careful about to whom we say "yes" in retrospective manner, so as to avoid setting up a precedent of giving NOC to somebody with wrong kind of equipment already installed & running ! Possibilities for improvement can be suggested to them. Some work to start on this by NCRA giving a first list of names to DIC for initiating action.
29 Jul : meeting with DIC last week (with JKS) : docs about 30 km zone handed over (formal doc from Mantrayala to be obtained by JKS later); data about villages within 30 km zone also handed over;
12 Aug : email update from PAR : NOC related to old units Govardhan, Sugar Factory and Overseas Exports Ltd (Near D J Export Ltd.) were discussed with DIC officials. The same will be discussed once again during visit of Mr. Dekate to the GMRT. The date is not finalized yet.

(ii) Related topic : units that have NOC and grow in size to exceed the norms -- what is to be done. One unit just under 2 km away on highway -- should be told "NO" and see if he will shift beyond 2 km. Also to check if our norms can be tightened further for differentiating between less harmful and more harmful industries -- to check the procedure used for establishing the norms.
17 Jun : records show that one unit located at 1.93 km was given clearance (2009) for a serum making plant.
29 Jul : item discussed in detail about possible options for moving beyond 2 km : to shift sub-station + genset to 100 m beyond 2 km limit and put underground cable from there to supply point, and test by GMRT team before final NOC.
Letter to be sent to DIC with this feedback.
12 Aug : email update from PAR : The corresponding draft letter was sent to the director with all possible suggestion to move beyond 2kms distance.

(iii) To follow up with DIC about single phase welding units : they have requested letter from GMRT to collect information from users around GMRT antennas; after discussion with NCRA admin (ABJ + JKS), agreed to follow 2-pronged approach : send letter to DIC authorising the survey, and also approach gram panchayats to collect the data; letter delivered to DIC (mid-July); to check if action initiated with gram panchayats.
29 Jul : discussion about collecting information from gram panchayats about other, smaller unauthorised industries (e.g. welding units) -- discussion with new person who will visit GMRT in the near future.
12 Aug : email update from PAR : We are waiting for the visit of Shri. Dekate (DIC) to the GMRT, during which it will be discussed.

(iv) during the survey, some units which are likely to be important from RFI point of view have been identified for detailed studies later on -- some work can start in parallel with completion of database, beginning with the bigger units; measurements (using LPDA) for 2 big industrial units in Junnar & Ambegaon area completed; no new ones have been done (about 10 more need to be done); results for the 1st two have been analysed & no strong RFI is seen other than the ambience due to powerlines etc. To check current status of this.
1 Jul : email update from PAR : regarding measurement of rfi from bigger industries other than two still pending. In the mean while we have visited transformer

installations for power line interference measurement.
email update from PAR : presently we are visiting transformer installation site on the west arm. After completion of the work we will start industry related RFI measurement.

(v) To try and formalise the declaration of 'no industrial zone' around the GMRT : to request JS(ER) for help ? Can be brought up in the NMB?

==> no updates as PAR not present.

2.3 Transformer RFI revisited -- from 12 Aug and before (PAR): Team has been doing a check on transformer RFI and the updated results from this will be available soon -- will need to see how this compares with the earlier round of this work.
Comparison of old and new data is in progress. Only 6 locations are common between new and old data (!) -- many new installations are coming up ! No clear conclusions have been drawn from the study; also more data needs to be taken to cover a larger number of transformers -- to wait for an update from RFI team.
20 May : some of the old data has been found (2005-06 & 2006-07 surveys) and there is likely to be some more data from 2008-2012 period -- to fill up the details properly; to try and extract the following : (i) typical time constant for failure / malfunctioning of a xmer and (ii) most common types of RFI problems : fuse links, bad transformer, cut joints...
4 Jun : older data have been found and are being added to a combined data base (old data were upto 2 km and new data is upto 1 km only -- but has more transformers !); one unit near W1 may need urgent attention -- to get the history of this and initiate the action.
17 Jun : still waiting for consolidated report! meanwhile, electrical has initiated action on the urgent case near W1.
1 Jul : updated transformer related data will be sent out in next couple of days; work has been initiated by electrical with MSECTL for W1.
15 Jul : Older data needs to be added to already tabulated [2006/7; 2007/8; 2015]; current table shows 37 out of 58 transformers show problem in 'fuse link'; to decide follow-up action.
29 Jul : all data is now combined into one spreadsheet; there is still significant non-overlap between old and new coverage -- agreed to cover some more of the ones done earlier; also start looking at the worst problems in the new data.
12 Aug : electrical team is first checking and fixing our transformers and then will go for external ones; some difficulty in getting cooperation from MSECTL for ext locations (even W1 problem is not fixed).
additional email update from PAR : On the west arm 65 transformer location are completed for west arm near W04,W05, W06 antenna; and 20 transformer installation near S01 and S02 antenna site. The analysis of the data has not been done due to antenna work in the GCC duty. It will be done in the next week.
==> some progress in discussions with MSECTL; work on DPs near W1 may happen this week or next (Fri, Sat & Sun are their preferred dates).

2.4 RFI from air conditioning systems -- from 12 Aug (PAR) :
RFI from new Air Conditioning system (VRV) at NCRA building has been measured [at 3-m distance from x1 & x3 compressor/(s)]; need to compare with RFI from single AC units e.g. in antenna shell, in GMRT main bldg etc.
Need a joint discussion with electrical to move the issue forward.
12 Aug : agreed to examine what can be done with the canteen annexe AC units for isolating the digital control circuitry and then conducting controlled tests;
==> will start work on one of the ACs in the canteen annexe; RFI team will do

one measurement (in next day or two) before the changes are made.

2.5 RFI testing of LED lights for GMRT labs & building -- from 12 Aug and much before (PAR/SSK/RVS) :
Electrical group has indented for 5 W lamps + X Watt tube lights (after samples had been tested for RFI and cleared) -- delivered units had 5 W and 7 W lamps; the 7 W lamps were found to generate RFI (not to be used at GMRT); tubelights (50 nos?) also failed the test; hence, only 5 W bulbs found suitable ! RFI testing of mass installation was also done and found ok; agreed to install in canteen as first location; these were checked for RFI after about 6 months usage and found ok; thence, cleared for mass procurement and installation in different locations; 30 nos of the original 50 nos of 5W LED lamps were installed in corridor & lab areas; indent was raised for additional quantities; these were delivered (how many?), and this new batch was tested for RFI as per earlier procedure and found to be ok; additionally, RFI team tested the units that have failed in the first 6 months or so of use -- these results are covered in the latest report, wich summarised 2 yrs of tests -- no RFI found from partially or completely failed units being powered on; agreed that report can be given to interested vendors for improving the products; sample batch of Syska make tested and found NOT ok.

Current action items :
(i) to confirm current quantity purchsed and installed : 50 nos purchased (and installed mostly in the corridors); an additional 200 nos have been received last month (Feb 2015); plan is to put them in guest house rooms, hostel rooms, guest house corridor, and labs as per choice of users -- almost all are used up; agreed that 200 nos more can be ordered; checking with party for single batch supply (ok);
4 Jun : indent has been placed but not yet in order phase.
12 Aug : order placed; delivery expected in next week or so.
==> shipment has arrived; request sent to RFI group for random sample checks.
(ii) light from 5W units is not sufficient at some locations : to try to have arrangement for putting 2 units in parallel on same connection (for more Lumens); fixture is being made ready (abandoned) and now looking for off-the-shelf options? to confirm current status.
1 Jul : could not find complete off-the-shelf solution; now trying for some hybrid.
29 Jul : work is in progress and two sample units have been made.
12 Aug : still trying to get the final reflector into the design; sample unit to be installed in canteen annexe.
==> sample unit has been installed in canteen annexe with 3 lamps and it appears to be all right. Few more such units can be made for such rooms (and some of the offices); to try for a variant with slightly less reflectivity for lab use.

(iii) do we need to worry about failure rate of the units? (~ 10 have failed so far); agreed to wait for the statistics from the present lot of 200 (looks like it may not be a serious issue ?) -- need to wait for new stats to become available.
4 Jun : agreed to work out a scheme of keeping track of the failures -- need an update on this.
1 Jul : electrical to maintain the statistics.
29 Jul : no new action right now.
==> no new action here as electrical is keeping track.

3. Operations :

3.1 Mass production of shielded box for MCM cards -- from 12 Aug & before

(SN/CPK/HSK): RFI test report of Akvira vs Physimech showed Akvira is better and this was selected. Testing of new MCM card in shielded box, with final configuration was done and report was very positive, and it was agreed to go ahead with the mass production of this shielded box; RFI group to complete 2 more prototype units and then hand over matter to Ops group, which was to discuss with RFI and Mech groups to get all the inputs and finalise the plans for placing the order on Akvira : drawings for 2 types of box : with & without provision for SPI port on chassis + 1 serial port on each box; parts list for RFI shielding materials to be ordered; list of possible vendors etc; Final target is for 60 + 10 (spares) shielded boxes; was order sent for 70 nos, with one prototype to be delivered first, and batch-wise delivery after that; sample box of Rabbit + switch + media converter + Miltech PC combination was tested on 4th Dec 2014 : results match with earlier tests using prototype units.
Two minor points conveyed to vendor : size of one of the opening and assembly of the side plates. Finally, 70 shielded boxes (for Rabbit MCM) were delivered; agreed to keep them in storage and use as needed; for procurement of the RFI material and components, list was prepared and confirmed with RFI group and indent ready (total cost ~ 33 lakhs (including items for shielding of the switch?) with line filter included (?) ; to check current status of indenting and ordering.
enquiry has gone (combined for both items); quotes have come on the higher side : problem with total now exceeding 25 lakhs whereas the original indent did not!
to investigate the reason for the increase in costs (look like 2 items may be the culprit?); to try to split into 2 equal parts, with repeat order, after checking with party about holding the prices.
20 May : recent clarification from the party is that 2 of the connectors (which are needed for bringing in DC power) have costs increase of ~ 7 x (300 $ each for a pair); modification suggested is to use the normal data connector for bringing in power (15 V, ~ 1 Amp) -- can parallel all available pins; can check with vendor and then put modified purchase order, dropping the 2 connectors.
4 Jun : going ahead with the scheme of getting power from normal data connector -- test set-up needs to be made and run for some time; to confirm with purchase that order has gone.
17 Jun : order has not yet gone -- CPK to check and see what is holding this up.
1 Jul : order for connectors appears to have gone.
15 Jul : Order has gone; to confirm expected date of delivery.
29 Jul : one month more for delivery.
==> no change in status.

3.2 Mass production of shielded box for switch enclosure at antenna base -- from 12 Aug and before (SN/CPK/HSK) : Detailed RFI tests show that the shielded enclosure appears to be working quite well; RFI team handed over the information and material to Ops Group for initiating mass production; last round of confirmation to finalise the drawings done; Ops group started on the work requisition for this box (as well as the box for the Rabbit card), in cooperation with mechanical group; target is 35 nos of these shielded enclosures; order placed for 35 nos, with one prototype to be delivered first, and batch-wise delivery after that. All 35 boxes delivered (c. Feb-Mar 2015); for ordering the components : list made in conjunction with tha for Rabbit card box (see item 3.1 above);
15 Jul : CAT5 cables (for these switches) ordered; delivery expected in 2 months;
==> no change in status.

3.3 Planning for proper UPS & space utilisation for new equipment at antenna base -- from 12 Aug & long before (SN/CPK/RVS) : long-term plans for intallation of final UPS system and proper utilisation of the space at antenna base. Follow-up on 14 Aug 2013 discussion on first report : 2nd report was generated and detailed discussion took

place on 5 Feb 2014; successive follow-up & final agreement on way forward (alongwith updated report) reached c. May 2014.

Some highlights are as follows :

(a) Regarding electrical loads : power drawn by different sub-systems estimated carefully, alongwith actual sample measurements on a few different antennas, for both existing systems as well as upgrade systems; effect of in-rush current at switch on also considered; total current requirement of 10 A for the ABR systems + servo control electronics found to be sufficient; hence 3 kVA UPS is adequate; agreed that, if needed, peak load requirement (e.g. in-rush current) can be balanced out by synchronised delayed switching on of different units -- this is already implemented to some extent at present. Final load requirements have been carefully checked and tabulated in the updated report.

(b) Regarding electrical wiring : agreed to have separate isolated supplies for (i) servo drive system (without UPS) (ii) servo control electronics (with UPS) and (iii) ABR electronics (with UPS); one common 3 KVA UPS with split o/p (2 KVA + 1 KVA for servo and ABR respectively) each with its own isolation transformer is the ideal solution; the new UPS can have the isolation transformer(s) integrated into it, without increasing its footprint (only height may go up); updated wiring diagram has been produced by RVS in consultation with SKB and others, and is available alongwith the udpated report.

(c) Regarding space utilisation : new UPS can be located in the space between the ABR and servo racks -- this has been done in one antenna with the new UPS and appears to work ok; existing servo FPS units can be left where they are; if isolation transformer can be moved out from the rack, then space in that common rack is enough for all growth plans of FE and OF systems; this leaves some empty space in ABR rack bottom that can be utilised for further growth of telemetry system; all new servo growth to be accommodated in the servo racks (or in-situ replacement of existing units); extraneous items in the surrounding of the racks (electrical fittings etc) can be relocated, as far as possible, to make it convenient for people visiting for work. Most of these issues have been captured in the updated report. Matter discussed in GSG meeting of 13th Nov 2014. This item can now be taken to the logical conclusion : net outcomes can be summarised and follow-up action to be finalised.

Main list of actionable items are as follows :

(i) ordering of 10 nos of UPS : order has been placed; delivery expected end-Jan. 5 units had arrived and tested for RFI -- failed; some modifications were required; additional issue of PF of the UPS -- improved to ~ 0.6 & accepted (will add capacitor band at ABR for further improvement); first unit available for use c 20 Apr 2015); installed in C10, replacing existing UPS, alongwith 3 ph wiring arrangement (6 May); 2nd unit is ready (only xmer is needed) -- will go to C00; remaining 8 units with modification in 10-15 days -- should be with us in one month (early June); extra cost will be absorbed in next batch, which can be for 22 nos and will cross 25 lakhs -- to check with purchase about the procedure for handling this : amendment or include in next order?
29 Jul consolidated :
(a) RFI test report on all 9 units is available and all are found to be ok at 80% of full load -- this aspect is now closed;
(b) units installed in C00 & C10 and 2 more in progress in CSQ (C4 and C14); remaining 6 to go in arm antennas -- S1 & S3 completed; C13 has old UPS;

(c) for clearing the payment for these 10 units : agreed upon to amend the existing order to include the extra amount (finally came to Rs 21K per unit, dominated by cost of transformer);
(d) for going beyond 10 units : a new party is showing interest in taking up the job; to check original with party if he will hold the prices (or give a discount) for additional units; finally agreed to go with 10 more with Ador and 1 unit to new party (Aircon) and then decide upon the last 10 units.
12 Aug : payment not yet completed (in progress); 11 new units (10 + 1) processing started.
==> bills received and will be getting cleared; indents to be raised for the 10 + 1 new units.

(ii) final wiring diagram for servo + ABR is needed : modified wiring diagram was prepared by electrical and shared with servo (4 Aug 2014); meanwhile, discussions with BLDC supplier convereged : now ok to ground the neutral of the main 3 phase transformer; extra EMI filter may be required (RVS confirmed it to be only Rs 10,000 per antenna) + only one set of line-filters will be required. Action items :

(a) RVS had circulated updated wiring diagram (done in consultation with servo) which included inputs from MACON (via servo group) which suggested radiation shield between the BLDC rack and other racks. Finally, updated diagram providing sufficient shielding distance had been prepared and circulated (c Feb 2015) : no objections received; agreed to implement in one or two antennas, with few units of the line filter on trial basis; new input from servo for extra load to be added for PC104 related item -- to check current status.
29 Jul : no immediate action items here?
12 Aug : servo control rack + PC104 added in C10 : this is not as per agreement -- TBC and discussed with servo.
==> item under discussion (including in SMEC meeting) -- yet to be resolved.

(b) for the EMI filters : contact with party (Schaffner) was proving difficult to establish (to try other parties also?). finally, EMI filters indented (enquiry gone), waiting for quote from Schaffner.
4 Jun : order as been placed; delivery date is end July (only 4 nos being ordered).
1 Jul : 4 units received; one installed in C10; can install second in C00 and talk to servo about which 2 other antennas to install (including one new BLDC antenna); decide after 2-4 weeks to order more units (10 more).
29 Jul : EMI filter installed in 4 antennas; servo wants to test the performane with the EMI filter and then give final clearance -- to check if this can be expedited; meanwhile can start the paperwork for more filters.
12 Aug : RVS to check with servo (via email) and meanwhile processing for 10 nos.
==> indent has been raised and enquiry is under process.

(c) meanwhile, agreed to try the test of sharing the xmer between servo and other loads, via two sets of AC line filters (that already exist) : to choose either C00 or C10 after discussion with servo, for the initial tests.
20 May : heating in servo transformer is found to be significant (even without adding the additional load) and the load in each phase is ~ 6-9 Amp (much less than rating of 15 Amp); likely causes :
old vs new lot of xmer : new lot has different core & heats up more -- to be checked
THD -- can be measured for each phase
PF -- can be measured for each phase
aging -- to check mechanical features by visual inspection etc; calendar age
weather -- can the inside of the concrete shell be kept a bit cooler?

allowed range of temperature for xmer to be checked (80 is for old one; 120 is the value it goes for new one);
to check the above issues, including actual temperatures reached, and come back with numbers and conclusions for follow-up.
17 Jun : work is ongoing and detailed tests will be done in next 2 weeks time.
1 Jul : 2 fans added in C10 xmer cover to help circulation; temperature reached with full load on servo xmer is about 78 deg -- to confirm if ok with servo and then replicate the scheme in C00 and then converge towards mass production.
29 Jul : in 3 antennas cooling of transformer with fans tested and found to give 20 deg improvement -- this design can be finalised;
12 Aug : this aspect can be closed.

(d) Meanwhile, on a trial basis, with a change-over switch, the extra ABR load can be added and checked for heating etc in C10. (increase in load is expected to be about 30%).
4 Jun : expt done in C10 for 10 mins : full load put on xmer (~ 2 kVA, up from ~ 1 kVA) total current ~ 8 A (up from ~ 4 A); PF changed a bit (improved!); THD increased to upto 90-120% (from 70%); 1 deg temp increase noticed. To discuss with servo and see if the test can be run for a longer duration.
1 Jul : tests for longer duration being done (see above); THD increase may be due to the Mosfet property of the UPS. To try and find a series filter unit of appropriate (lower) current capacity.
29 Jul : series filter of higher rating available; need to find one with lower rating;
12 Aug : identified one possible supplier.
==> need updates from RVS.

(iii) making 1 or 2 antennas as model where all the configurations are made as per the recommendations : finally, agreed to use both C10 and C00.
At C10 : 3 kVA UPS was installed, but was feeding power to ABR only; later, servo shift PC104 load to UPS (isolation transformer still in use?); switch boards / extension boards shifted to safe level.
At C00 : 4.5 kVA UPS, with 2 isolation transformers, was installed with ABR rack connected on it; PC104 load was added to it subsequently; relocation of elec boards was pending. Following items being followed up :
(see also email update from Nayak & Jitendra on 22 April)

(a) agreed to put the FE power supply in the proper location in both antennas -- space was made ready (after removing delay contactor) in C10; agreed to do in C00 also; turns out that relocation of extn board is also needed to relocate the FE pwr supply -- SSK to ensure that this is done for C00 and C10. Need a status check.
(b) ask servo to confirm FPS drive location is in keeping with the agreed diagram : needs to be slightly shifted and servo is ok with it -- check if done at C00 & C10.
(c) RVS to circulate an email about the updates and finalisation of layout in C0 and C10 for replicaton in all antennas. This was done and some feedback from FE and BE teams received, and following items being looked into :
* shifting of sentinel "yellow box" (PSB + BR) -- check if done at both antennas and confirm plans for other antennas.
* alternate arrangement for keeping the phone : to change to hook phones that can be hanged -- check if done at both antennas.
* directive to keep AC flow downwards in default conditions : prepare stickers and put in 2 locations in shell -- check if done or not.
* contactor and timer for delayed start is obstructing FE pwr supply (can be removed once UPS is there?) : right now, agreed to shift; done in C10? -- check and confirm current status.

4 Jun : JPK visited antennas with FE person (Satish Lokhande) and Nandi to look at mechanical arrangements that may be needed to effect some of the changes; some solutions are being worked out, without violating the available space; yellow box shifting done on both antennas; sample phone units with proper buzzer arrangement done in C10, can be done in C00 (IP phones vs normal phones -- to be looked into by Ops group); contactors and timers have been removed in both antennas. Once the ps is put on new rails, the rearrangement would be complete.
17 Jun : mech and Ops have looked at it; estimate of down time to be brought up in coord meet.
1 Jul : adjustments in the rack will be done this week for C10 (may not need antenna to be down).
2 Jul : in C10, the EMI filter position needs to be shifted. FE power supply can be put in C10 -- FE team to try out the change with FE supply.
12 Aug : in C10, location for FE power supply was tested, with some additions; agreed to put on a permanent basis; and same change can be initiated for C00.
==> FE supplly in C10 is a dummy load (can be left there); will check if load in C00 can be live one or not. With this C10 can be taken to be in final shape; now to bring C00 to the same level.

(iv) to improve the RFI shielding of the antenna cage, starting with the model antennas : check for unshielded cable and pipe entries in model antenna shell, including unused holes and punctures, and initiate appropriate corrective steps.
RVS to make a list of all the punctures in both C00 and C10 and bring for discussion.
Work had started at C10 for this; 22 Apr : pictorial report by RVS : AC plumbing; AC line filters; servo cables (BLDC + FPS) crossing; RF cables entry points; OFC cables crossing; plus a few more; RVS to send an email to all concerned, for identification of cables, entry & exit points and unused holes / punctures. Need a discussion with RFI team about measures to prevent the RFI leakage from the punctures. Current action item :
RVS and SSK/PAR to classify the various kinds of punctures and then RFI team to suggest solutions for each category, including plugging of unused punctures.
20 May : discussed with PAR also to move this forward; to check current status & plans.
1 Jul : some work had been done in earlier days (TLV, NVN times) and electrical is beginning to replicate that (similar soln has been used in ISRO cage); meanwhile, RFI team is workign on the formal solution; also procedure for plugging the holes is being evolved.
29 Jul : Pravin has made the list of punctures and status and provisions : punctures of AC power -- may not need to worry about it; .... Pravin to circulate the results; also, to circulate documnents on standard practice for such shieldings...
==> PAR has circulated a document with standard practices and now RFI team needs to apply these to come up with recommended solutions for the various punctures.

(v) also agreed to populate C0 & C10 with Rabbit, switch, PC (with shielding) as and when available -- these 2 antennas can be used for next gen M&C work to add to C4,C6,C12 to make a total of 5. Work in progress; JPK to keep track of this aspect.
Agreed to start activity of populating during MTAC for C00 and C10, and next to C8 and C11; and then, if needed, to C4, C6, with aim to have 5 antennas ready.
Action has been initiated for C00 and C10 : one shielded box with Rabbit cards + one switch with shielded box ready; 2nd unit getting ready.
Will need to make some of the other changes to make space for the final arrangement; also 2 sets of units to be made ready. Check current status.
4 Jun : see updates in email from JPK. (to fold in the results from this !!!); ethernet shielded box needs support structure in the rack for installation -- will require in-situ welding etc; Rabbit card shielded box does not need any additional

mechanical work for mounting. Issue about physical monitoring of switch working inside the shielded box.
1 Jul : Ops group and mech team to look into mounting of ethernet shielding box (without welding, if possible); monitoring of switch inside the box is solved by fibre team;
12 Aug : switch + Rabbit card in shielded assembly installed in final location in C10.

==> Can plan an inspection to C10 this week.

3.4 New, improved Miltech PC -- from 12 Aug and earlier (CPK/SN/PAR) :
Two units of Miltech PC with two changes (more screws on panels + panel mount pwrline filters instead of chassis mount) were under test : conclusion was that PC ok from all aspects. Pending action items :

(i) agreed to initiate the purchase of 10 nos of the final version above -- indent had been raised for 10 nos (including some spare accessories?); current status of the PO : order sent; expected date of delivery 31st Dec -- trying to expedite, if possible; note from vendor informing about delay due to late arrival of m'boards : end of Jan is new delivery date. "still under test" reply from vendor -- to see if delivery date estimate can be got. SN to follow-up with BRJ on an urgent basis.
22 Apr : update from vendor to purchase : 3 units have failed and heat sink is being redesigned; will take some more time; no response from party for a long time; Nayak to request Sureshkumar to make a visit and check; confirm if there are any updates, and decide future course of action.
4 Jun : some response from vendor got by SSK (15th June date has been given) -- to follow-up with a visit and f2f meet if possible next time.
1 Jul : item not supplied yet; vendor is still facing problem with overheating of CPU; SSK to try and visit him next time to get first hand information.
15 Jul : visit has taken place; x10 machines are under test; expected soon;
29 Jul : no fresh updates from the party; SSK to check again...
12 Aug : no updates at present.
==> some communication from Miltech to SSK that delivery will happen in one week; CPK to talk to purchase to send a letter threatenign cancellation.

4. Back-ends :

4.1 Documenations at various levels -- from 19 Aug and before (BAK+others) :
To complete basic,internal documentation (at ITR level) and then move to the point wehere formal publications of relevant items can be done.
Current action items are as follows (many are pending for long durations now !) :

(i) Detailed design doc : analog back-end was being done by Hande : 2nd version had been circulated in April. Next level of document going down to chassis level is to be made ready -- chassis level doc will take about 2 months; was deferred till end Oct; and then deferred till end of Dec; 2nd version had ~50% chassis level inputs; to be completed by end-Jan'15; needs some more time as 2nd LO scheme inputs are also being folded in; work in progress; may take another month; check in mid-May.
27 May & 4 Jun : progress is slow, but going on. 10 Jun : still ongoing...
24 Jun : will take ~ 1 month (till end-July) !
1, 15, 22, 29 Jul : no significant update.
5, 12, 19 Aug : Hande is still busy with some other activities; hence delayed further.
==> one version expected by Hande by end of this week; LO for 2nd channel will get added later on.

(ii) ITRs + publications for analog back-end systems to be taken up :
(a) analog back-end : Sandeep and Navnath to look into that; pending. Work pending for some time; team to review and pick up the activity. BAK to follow-up.
SCC and Navnath have had one discussion and will follow-up with BAK; not much progress; may take it up next month, after MTAC; list of items to be done has been prepared; work has been started by Navnath; to check current status; not much progress in last few weeks, but will pick up now (27 May).
4 Jun : not started yet -- to start now. 10 Jun : same status as 4 Jun !
1, 15, 22, 29 Jul : no progress reported.
5 Aug : Navnath and Sweta to work on this now and have a version by end of Aug.
12 & 19 Aug : work is ongoing, and is on track.
==> work on track.

(iii) ITRs + publications for digital back-end systems : ITR was completed by SHR (quite some time ago; after some follow-up, SHR and BAK started work on modifying GWB ITR to convert to a paper; first version has been circulated; needs to be taken up for discussion between YG, BAK & SHR
27 May : not yet reviewed and discussed; but agreed that meanwhile SHR can look at it from the point of view of improving by putting in the latest work on expansion to 16 antenna, dual GPU system.
4 & 10 Jun : will get into this once GWB-III release work is completed.
24 Jun : can start work now on incorporation of new GWB developments.
1, 15, 22, 29 Jul : no progress here also.
5 Aug : to try and take this up now, as GWB-III release is almost done.
12 & 19 Aug : not started yet.
==> need a discussion with SHR.

4.2 : Power supply for GAB : from 12 Aug and before (NDS/BAK) : Two options are possible : linear vs SMPS. Comparison note with all pros & cons (convenience + price vs RFI properties) was produced; agreed that present (c. Aug 2014?) set-up of 30 ant GAB (with 5 spare SMPS supplies on order) can run for 6 months or so ; final decision can be taken later on. 4 SMPS units that had come were used to get 4 racks with SMPS and 4 racks with linear / CVT supplies; meanwhile, shielded box was designed for the SMPS by RFI team -- RFI report showed good performance; agreed to go ahead with it for mass production; meanwhile, SMPS installed in 4 racks; 12 new boxes with RFI shielding planned -- 8 are needed in the system, and 4+1 will be spare; mech group was to place the order for 12 nos (after BE & RFI teams check the drawings); drawing had errors (!); needed modifications; was stuck due to PC problems; finally cleared by early Jun 2015, and one sample was to be made in-house to clear everything; required fans etc ordered by PAR (Jun 2015); 12 boxes for SMPS awaited from workshop (to be outsource); prototype unit tested around 17 Jun 2015 -- required some modifictions;
15 Jul : 10-12 boxes have come; all except SMPS available; full set available or x5 boxes, except SMPS which is under order;
29 Jul : first unit getting wired which will be tested by RFI team before final acceptance and mass production.
12 Aug : unit wired and ready for testing
==> unit wired and tested for RFI (found acceptable, informally, formal report awaited); will be installing in situ today; will start work on the others with the aim to replace all 8 with shielded SMPS. Need additional SMPS supplies (15 nos are on order).

4.3 Enabling independent LO for 2 polarisations -- from 12 Aug (NDS/BAK) : to get

current summary of this effort and plan action items.
==> work on providing separate synth for each polarisation (by adding the PIU) is on-going. All CSQ antennas + 3 in E arm completed (5 racks); 3 more racks to go. Release testing is done from control room commands.

4.4 Power equalisation schemes for new back-ends -- from 12 Aug and before (SSK/NSR/BAK/SRoy): Need updates on both of the following :

(i) option 1 : using detectors in GAB and local feedback loop -- monitoring set-up was made ready; DKN worked on code (using algorithm taken from NSR); first round of testing showed problems like detector output saturation -- gain adjustment checked and problem fixed; basic power equalisation algorithm was first tested ok with 4 antennas, and then expanded to more antennas; comparative study of this scheme with the GWB-based scheme to see if there are any differences or pros and cons wad done : do GAB power equalise and look at GWB bandshapes; complete the loop by doing GWB power equalise and checking GAB o/p. Test completed both ways, first for 4 antennas and then later for 8 antennas (extended to more?); BE team is ready to release for use by operators -- a basic SOP to be generated and released. Current actions :
(a) to completed the SOP and release the set-up -- check if this can be closed : yes.
(b) to run this alongwith GWB bandshape check to help debug problems in GAB -- can be formalised as a debug tool to be run by PMQC periodically; DKN to make the test procedure for control room use; check current status.
17 Jun : still pending with DKN.
29 Jul : BAK to check and get back.
12 Aug : BE team to decide about usefulness of PMQC procedure & proceed accordingly.

(ii) option 2 : using correlator self outputs and computing gain corrections : basic scheme is implemented & working; more general implementation of a user controlled ALC mode aims for the following 4 modes of operation (see MoM of 3 Oct 2013 !) :
(1) on demand -- this is the current released mode.
(2) repeatable at some interval specified by the user -- can it be script based? Sanjay has completed the core coding; a wrapper is being done by SRoy; to be taken up for discussion.
(3) automatic, should adjust in response to a stimulus in the input power -- needs a discussion.
(4) should provide a reliable power monitoring scheme -- needs discussion.

Issues that came up are as follows :
Accuracy of attenuaton values and repeatibility of settings : 5% (0.25 dB) ok; agreed to add median calculation feature; to check if a feature to predict the expected change in attn for a given change in sky direction can / needs to be added; better option for saving the attenuation values for future use / reference to be defined; logging of results to be looked into; agreed to have a document that summarises all of the above and spells out the main requirements (from user point of view) and possible solution options / techniques; detailed discussion has taken place between SRoy, BAK, SSK and YG on 14Aug2014 -- main conclusions and present action items are as follows :

(a) attenuator values : aim is to check if measurements match with specs (within +/- 0.25 dB); initial test results for 3-4 units (at one epoch) had been reported by BE team (found acceptable); pending items (for BE team) are :
* to check the constancy of the values across the band;
* to repeat the tests for vayring i/p power levels with constant o/p power;

 * to repeat the tests on different epochs to verify constancy with time;
 * to work out plan for calibration table for each attenuator (after above results).
Test data were taken and analysed by BE team and results reported; SRoy had done some cross-checks on these; tests have been done with varying i/p range from -37 to -17 dBm also and behaviour of attenuator appears to be all right. SRoy to cross-check the results and confirm if we are ok, and if this aspect can be closed.
SRoy has sent some plots from his analysis of the data and some follow-up is needed to see in what operating regime we are hitting the non-linear range of the GAB system. BAK to look at the results from SRoy and send an email.
22 Apr : "linear range" available depends on absolute input power level; but there is enough for our desired range of operations -- it may vary from one RF band to another and a note will be needed to define the working zone and avoidance zone for each RF band. Agreed that all other aspects can be closed except for the note -- check status of this.
29 Jul : to check the status of the note...
12 Aug : need a note describing tests done and outcomes -- to be put on record for future.
==> work on note is still pending.

(b) requirements document to be updated to reflect the outcomes of the disussions e.g. better clarity about the 3 modes of operation etc. -- SRoy has produced an updated version : needs to be checked to see if it can be cleared.

(c) self data (from correlator data stream) to be saved in shared memory ring buffer of ~ 30 mins depth for further processing tasks to work on (should also work off a recorded lta file); also median calculation feature to be added; some work was done by NSR to write raw data to file for 10 mins duration; to convert this to shm and also to add a feature for calculating median values every 2 sec or so and saving these to a file for long durations. SRoy to work with NSR to implement these (take help from SSK where needed); some progress from NSR's side on median calculations;
22 Apr : SRoy reported that NSR now has a version that is able to save the median values in a file, as multiple rows -- to convert in to multiple columns version; not yet started work on shared memory version. Any recent updates? Waiting for NSR to be back on 15 May.
17 Jun : NSR has not yet had a chance to do this; should happen in next 2 weeks.
29 Jul : this change has been done now; but facing some issue about extra time taken for writing with format change -- SRoy has suggested a solution; then SRoy to take up follow-up action on this.
==> no updates from SRoy.

(d) testing of bandpass shape (ampl and phase) for different values of attenuation : 6 out of 7 antennas showed less than 5% percent and 5 degrees change in ampl and phase over 5 dB change in attenuation. SRoy to follow-up to see how much is the intrinsic varn of the GWB corrln level with change in input power level -- SRoy analysed the data provided by DVL and found that behaviour is acceptable for the range of i/p power variation tested which is about factor of 5 (~ 7 dB); plan to extend this to larger range: set power level on galactic plane calibrator to about 80 or so; then go to calibrator away and equalise to 350 -- larger change in attenuation (~ 12 dB) required -- can check if corrln coeff (bandshape) remains ok or not; SRoy would like to now try the test with upto 10 dB variation in attenuator values to see how the bandshape changes; 22 Apr : test has been done, but there appears to be some problem with the data quality -- may have to be repeated again; SRoy to check for free slots for this.
17 Jun : SRoy will be scheduling in the near future.

29 Jul : needs a black slot (SMTS) request for the slot; 3-4 hrs; can also get white slot.
==> no updates from SRoy.

4.5 GPU corr (GWB-III) : next gen system -- from 12 Aug & before (SHR/SSK/GSJ/BAK) : Design and delivery of 32 input (16 ant dual pol or 32 ant single pol) system; uses 8 Roach boards + 8 compute machines (with final 36 port switch) + 4 host machines, installed in 4 old racks & made ready with wiring + cabling complete (c. Feb 2015?); tested with analog noise source; new code with 2 x 10 Gbe I/O + improved logic for assigning specific threads to each core + set-up with environment variables completed (tested for 200 MHz / 8 bits and 400 MHz / 4 bits, 16 inputs and working ok with no pkt loss); modified ferrules were put on cables & GWB-III (v1) has been released with full online control (c Mar 2015); final connections to GWB-II and III can be chosen by the user on the wall panel; confirmed that GSB, GWB-II, GWB-III can ALL be run simultaneously with full online control; updated SOP has been released; basic user level tests have been carried out (DVL) and by and large system appears to be work ok.

Later GWB-III was expanded to dual-GPU version, as it became clear (c. Mar 2015) that existing code for corr + beamformer is exceeding real-time by 9% for full 400 MHz BW for 16 inputs correlation (will become worse for final, 32 input system); options looked at were : 2 K20s per host, double-GPU card, K20 + K40 per host, 2 K40s per host, 32 host machines (with single GPU); agreed to try out 2 K20 option; first results from dual-GPU code (6 May) were encouraging and have led to GWB-III (v2) : 16 antenna dual pol, 8 node system with 2 K20s on each node : total intensity & full polar correlator + IA and PA beams (16K spec chans and 1.3 msec integration) for 200 MHz 8 bits and 400 MHz 4 bits; tested to work ok with equal load between the two GPUs; also ready for testing on 2 K40s -- results may be available soon; issue of sharing between K20 and K40 needs to be looked carefully for the value of the slice and also the drivers for both GPUs working simultaneoulsy. Tests have been done using noise source; now ready to try with real antenna signals (done 4 Jun); GUI development under progress.

Current action items :

(i) Various kinds of tests of GWB III (v1 & v2) :

(a) basic user level tests : DVL had carried out some tests; pending problems have been call sheeted and will be checked again to see if fixed or not (most are related to upstream systems) -- most of these basic issues were closed; however, more recently (c 20 Aug 2015), DVL pointed out some subtle issues seen in the data when analysed in detail inside AIPS : offsets between RR & LL; dropouts in visibilities for some durations etc. SSK to follow-up, cross-check and report back on these.
==> some discussion has happened on this, and SSK has given a reply; may still be worth looking at GWB3.1 data to identify the nature of the problem.

(b) to check if new SOP supports flexible connectivity for user -- this required manual editing of the files (explained in SOP), which is not desirable;
2 possible options discussed for getting flexi
29 Jul : completion of SOP (by Nilesh) and multi-subarray testing (Sanjay) are remaining to be done; to discuss layout of the SOP.
12 Aug : to check if SOP should be branched for developer's manual and user's manual.
==> need a confirmation about sub-array testing; SOP has been refined; but some further refinement may be needed; to clarify the size of shm for beamformer data chain and check its implication on integration time.

(c) testing the 400 MHz BW mode : basic changes to the code for the 400 MHz, 4-bit mode had been done and basic tests were ok for 16 inputs (delay correction also working ok); some pending tasks are :
* choice of which 4 bits to use needs to be finalised (right now it is set for 4 MSbits) : what algorithm is needed? can it be made a user choice?;
* extendng to full 400 MHz BW : computationally, GWB-III (v1) does NOT sustain this for all 32 inputs -- safe limit is 300 MHz (including beams ON); full 400 MHz for 32 inputs implemented in v2 and released; needs to be tested by user.
12 Aug : tests to be done in next couple of weeks with new SOP should decide this.
==> no user level tests done so far.

(d) checking of beam modes : all basic beam modes are working; phasing has also been verified; note that phasing will work only if beam mode is turned on (!) -- this was fixed in the v2 code.
12 Aug : user level tests of phasing ran into problems -- due to change of net sign convention in the LTA files (!) -- temporary fix was put in : to be discussed and resolved; further tests of beam mode showed problems of "double pulses" from all pulsars -- this was tracked down to some issue in the way data was being distributed to the 2 GPUs -- now fixed and released for tests (to understand implications of this on interferometry data).
==> the above issue is resolved and some other comments on beam mode are as above.

(ii) to discuss and agree the various modes to be provided in different releases of GWB-III, folding in long-term planning (to take up from email exchange of 22 Apr and later) : one round of discussion happened; updated version has circulated by BAK (29 Jul 2015); need to see about porting it to the format of a table of modes, as in GSB; to cross-check for any refinements.
==> options to be provided in GWB3.2 are as spelt out in the latest SOP -- can be cross-checked.

(iii) choice of integration time for beam data (for v1 & v2) : in the original design 128 was default pre-int (on GPU); later (in v2), it was made variable (upper limit 1024, lower limit ?) -- needs to be tested, and constraints in the range of parameter choice needs to be established);
29 Jul : table of possible combinations for v2 has been circulated; lower and upper limits for sampling interval are calculated based on disk writing speed and gulp size; the former needs to be changed to be limited by GPU memory or I/O speed. Also a table about memory usage is available.
12 Aug : brief discussion to work on the above and update the table.
==> see comments above.

(iv) beam data header for GWB-III (v1 & v2) : current status to be confirmed
1 Jul : v1 has no header; v2 will have part I header and v3 will have final part II version.
12 Aug : v2 has binary header; would be useful to have an ascii header and to have the code for reading binary header; to be discussed and finalised.
==> need a follow-up discussion with Sanjay.

(v) psr_mon and pmon tools for beam data monitoring for GWB-III (v1 & v2) : current status to be confirmed :
1 Jul : real-time version to be made ready for v2 by SSK (see earlier comment also)
29 Jul : ready for release, as per email update by SSK.
12 Aug : to check present status.

==> no updates from Sanjay -- need a follow-up with him.

(vi) tests with dual K40 system in GWB-III (v2) :
17 Jun : one of the 8 is running with dual K40 as default; at some point, bench marking can be done wrt dual K20.
12 Aug : basic tests done, results are as follows :
for 400 MHz full polar with 2 PA beams, 16k channels, 2.6 s : 80%+73% vs 64%+58%
for 200 MHz full polar with 2 PA beams, 16k channels, 2.6 s : 50%+42% vs 37%+31%
future requirements : 32 antennas MAC, PFB, DDC, folding of visibility data to be accounted for; to analyse the situation and come up with an action plan, including some of the "next gen" prospects (cuda 7.0, 16-bit versions, other optimisations?)
==> to get break-up between FFT and MAC and then do the scaling for 64 inputs and other issues.

(vii) tests with K20 + K40 sytem in GWB-III (v2)
17 Jun : this is stuck because of driver related issues as pointed out by SHR; can defer till we try cuda 7.0 and then see.
1 - 29 Jul : no updates.
12 Aug : dual K20 + K40 may not be that significant, given the above results. This sub-item can be closed.

4.6 Next gen improvements : GWB-III v3 (32 inputs) and GWB-IV (64 inputs) -- from 12 Aug and before (BAK/SHR/...) :

(i) final range of channels to be handled : GWB-III (v2) will be up to 16K channels; extension to 32K channels to be looked into (I/O issues will need to be tackled); increasing integration beyond 0.6 can be a solution.
17 Jun : changing integration time may be easier option for now -- to be tried at a later date (maybe after 15 Sep).
12 Aug : to be deferred for now.

(ii) new features to be added in next versions of GWB code :
(a) correction for net_sign[] flipping (LSB/USB modes) -- need discussion;
(b) multi-subarray -- some progress achieved (see below);
(c) 4 beam capability;
(d) time + DUT corrections -- some progress reported (see below);
(e) all off-line utilities with backward compatibility;
(f) feature for folding visibilities with pulsar period;
(g) PFB implementation;
(h) shift to 2 inputs per Roach board.
(i) various optimisation options for the code.
Some of these can be delayed for some time, depending on prioritites.
26 Mar : multi-subarray implemented and tested, including online interface; needs some more testing for getcmd mode; DUT corrections coded, but not yet fully tested; both of these work upto 32k channels but some testing may still be needed; see also 22 Apr email of BAK and follow-up discussions); to see if action items can be firmed up for this.
4 Jun : for ver 2 : lower beam integration possible, beam header as above, multi-subarray ok; will have off-line utilities, without backward compatibility; DUT corrections will be in; net sign correction done; 4 inputs per Roach used;
for ver 3 : 4 beam capability, visibility folding; PFB
17 Jun : 4 beam and PFB are part of the plan for ver3; to check about vis folding later on.
1 Jul : ver2 items are ok; ver3 items needs to be finalised shortly.

15 Jul : multi-subarray design complete and testing in progress -- appears to be working, but GUI needs improvements (delay & fringe computations etc).
29 Jul : email update from SSK : multi-subarray mode ready for release -- SOP to be updated by NSR.
==> need a discussion with SSK and NSR for items (a), (b), (d); other items can be taken up later on.

(iii) long-term items like provision for control of FPGA and other peripherals (like sig generator) for different modes : agreed to identify one PC for control of all the peripherals related to GWB; this m/c can / is interfaced to online via a socket and GUI can send commands via this -- already done for loading of FPGA files, needs to be extended for other applications; for other things like turning RFI rejection or Walsh modulation on/off, writing to registers in powerPC would work all right; agreed to start working towards implementing scheme in GUI for taking additional parameters that allow different bof files to be loaded; agreed that these flags need not go into ltahdr but can go in the user log as setting parameters (can also be there in gpu.hdr); agreed to go ahead with discussion with NSR for implementing the logic for allowing support of multiple corr modes that use different BOF files; other action items to be taken up later; BAK to talk with NSR / SSK to work out the time frame for having it in place.
17 Jun : needs to be tried out; can be taken up after v2 is released.
1 Jul : scheme needs to be tried out at some time by NSR, when a bit free.
12 Aug : deferred for now.
==> no action for now.

(iv) incorporation of DDC : this is important requirement, to be done asap : Agreed to try on one node of GWB-II or GWB-III and get back to earlier situation and see exactly what are the issues. SHR has circulated an update; first part is that it appears that the current realisation is properly implementing a DDC; only the filter BW needs to be decoupled from the decimating factor and do a careful set of tests; in the long run, better filters with sharper cut-offs may be required (can check with nvidia about availability of std library functions for such applications); second aspect is to check about the nature or format of the o/p to see whether I & Q components are ok for further work or whether we need / can have the real voltage representation of the o/p signal.
new tests still pending; to check about nvidia primitives; to check about I,Q version vs real output possibilities.
26 Mar : independent DDC has been developed by UG and tested and appears to be working ok; to circulate summary of test results to see if more parameter space needs to be explored... test results found OK; note being prepared.
22 Apr : DDC code has been incorporated in 2-antenna GPU correlator and under tests to clear unresolved issues -- see also latest update from UG in May : need follow-up discussion on this.
20 May : email update from UG stating that the mode is basically working -- need a more detailed discussion about the status and plans.
4 Jun : agreed that basic mode is working ok; to check the issue of normalised cross in the stop band region. may not be released in ver2, but should be there in ver3 (Sep release).
17 Jun : bit more testing with noise source; generating proper delay and fringe to be ensured; overlap between data segments for proper FIR operation will be needed; to check total compute requirement.
Need a status update and discussion on the latest situation.
1 Jul : final choice of specific code to be used has been made (between work done by UG and earlier code); porting from one node to multi-node system should not be an

issue; still need to test delay and fringe with DDC on; also FIR edge effects at blk boundary to be checked.
15 Jul : Basic DDC completed; Problem : 90% time usgae (with DDC itself ~ 60%); needs optimization;
12 Aug : may needto look at the FIR filter and optimize.
==> to work out the DDC load for a realistic 32 input 200 MHz correlator and see how much spare time is available; also quantify the effect of reducing the number of taps from 51 down to about 16.

(v) porting from CUDA 5.0 to CUDA 7.0 : to work out a plan for doing this
1 Jul : this needs to be looked at.
29 Jul : no updates.

(vi) full beam header : plans to be discussed and finalised.
1 Jul : also needs a discussion.
29 Jul : no updates.

(vii) RFI filtering capabilities : for corr and beamformer
1 Jul : needs a coordinated discussion...
29 Jul : no discussion. [see separate discussion]

(viii) spikes in channels that are power of 2 : this problem needs to be discussed, understood and fixed. SHR has done several tests, including using digital noise source; effect is seen in packetised corr also; checked with offline analysis of raw voltage data acquired through Roach board, and with digital noise generated on Roach board -- appears that problem is seen only in data coming through the ADC path only? further, trying single ADC streams or channels (compared to the interleaved data streams that come normally) still shows the spikes in the streams; slower FPGA clk rate also doesn't show any difference -- it appears to be natively present in the ADC data; to check if the power level of these spikes is constant and how much below the mean passband level; varying i/p power level of broadband noise source at ADC allows characterisation of input power level at which spikes show up; looks like occuring at multiples of 128 ch (for 2K spectrum); to check the level as seen in cross of two such signals -- some test results have been sent by Reddy recently; can take up for discussion, including tests with 2 different clk sources...
To correlate against new results coming from histogram testing by Niruj & Kaushal -- some work needed here -- KDB & NMR to check and report back.
27 May : to cross-check with GSB voltage data taken and put through similar analysis of histogram and spectrum;
17 Jun : tested with two different Roach boards with two different clk sources and corrln is still seen, including when sig gens are not locked to same source.
24 Jun : GSB raw voltages to be read and analysed (at GWB-III).
14 Jul : work has started, can expect some results by next week;
22 Jul : test data has been taken; update expected shortly.
29 Jul : tests done with GSB raw voltage data also show some spurious lines -- needs some thinking and investigation about possible causes and issues...

(ix) further optimisation of the GWB-III code (SHR/SSK) : different optimisations have been suggested and tried and these need to be further refined and ported to the GWB-III code:

(a) optimised XPGU for GMRT (with Vinay of nvidia) : is showing ~20% improvement -- needs to be confirmed and then incorporated; ready to upgrade to CUDA 6.0?; results from R2C vs C2C (with callback) to be finalised and then decide about incorporating.

SHR has done the basic porting of XGPU in GMRT code to GWB-III. Summary : xGPU has been ported and shown to work; gets 20% speed-up overall; but works only in full polar mode (!); other modes need change in xGPU code; output shuffling work in real-time for present time,freq combination, but may not work for faster rates and finer channels... agreed to halt xPGU work and concentrate on 2-GPU per host GMRT correlator code. No further action on this for now.

(b) another concern is about data ordering at XGPU o/p vs LTA format requirement -- needs to be quantified in order for changes in (a) to be meaningful; note : Vinay has already written the code that does this on the CPU.
Currently using unoptimised routine which will work for about 4k channels; for larger number, optimised version will be needed. See item (a) above.
29 Jul : no discussion and no action on this for now.

(x) trying new ideas like FP16 etc to be discussed.
29 Jul : to be taken up after v2 is released.
12 Aug : defer for now.

4.7 Layout of racks and long-term logistics plans -- from 12 Aug and before (BAK/GSJ/IMH...) : layout diagram to be updated and long-term plan for racks to be initiated; 3 different kinds of President racks discussed ("cyber", "cool" + one more?) -- to try and finalise after one more round of discussions including RVS (also, check new vendor Jyoti Tech); as an interim, 2 nos of cyber racks ordered with President. Meanwhile, for GWB-III, 4 nos of half-height racks have been used -- two nos are populated with 4 compute nodes each, third one has 3 host machines + 1 extra machine + clk source etc; fourth one has 8 Roach boards + IFB switch; will need to expand this to 16 Roach boards at some point of time -- may need to add one more half-height rack? One half-height rack is available in hand and can be used when required. For final system, present estimate is 5 full height racks housing 32 Roach boards + 16 compute nodes with 2 GPUs each (+ host machines?). Current action items :

(i) For the 2 President racks : first one has been used for putting GSB related spare nodes etc; second rack being used for trying the arrangement for special cooling (with help from mech group) -- tested with 1 kW load and increasing slowly; loading up to 4 kW tested by comparing the temp difference between input and output air (need to compare with unmodified rack); results so far appear to show that there is about factor of 2 discrepancy in estimated CFM rate and AC plant capacity CFM rate. agreed to include the test with unmodified rack and then circulate the report; with 2 AC vents feeding 5 racks (final number), the estimate is that the available CFM may be marginal -- this needs to be resolved against the CFM discrepancy noted earlier; also to explore additional margin the AC system (joint meeting with RVS and team may be useful);
20 May : intermediate update from report of IMH about discrepancy of factor of 2; measurements with the flow meter show that the amount of air flowing into the corr room is matching with the expectations from the AC system, which means that the utilisation of the cold air by the correlator test rack is only about 50%; method of taking in the cold air from the vent to the rack is being modified to improve the efficiency.
4 Jun : some inprovements in results with better ducting of cold air and 2 stronger fans to better pull the cold air -- now reaching 75% of capacity; to test at floor locations far away from the available vents.
17 Jun : at 5 feet away from vent, getting more than 100% (!)
(b) to decide on plans for ordering more racks.

1 Jul : interim report has been circulated; results appear to indicate that for any typical position of a rack in the room, having fans at the bottom near the input of the cold air (and maybe some ducting for the hot air at the top) should be enough for our requirements; to see if one round with more heat load (2 to 3 x is possible) to see the effect on GSB. To try and see if we can finalise the choice of rack soon and start the procurement.
15 Jul : electrical load simulation using 12 kW heater on a rack -- report circulated; report on choice of rack to be circulated in 1 week (22 Jul 15).
29 Jul : short discussion : updated report on rack layout etc is ready; can go ahead with ordering of relevant racks from President (slightly deeper than standard rack but is still readily available product) -- to be confirmed and action initiated.
12 Aug : ongoing; do discuss with RVS and HSK about layout of racks in corr room. Item can be shifted to other, alternate week...
==> to finalise the models and then ask for budgetary quotes.
[Note : item shifted to alternate week's agenda and can be removed from here]

4.8 Procurement of new hardware & accessories required for final GWB system -- from 12 Aug and before (BAK/GSJ) :

(i) purchase of 4 new host machines for GWB III : to decide configuration of host machines (disk i/o to be kept in mind); also to check if SSD is a viable option for recording of data. Investigaiton shows that SSD vs SATA has pros and cons; it may be possible that one class of server may be there that supports both?
4 nos of T620s have come and integrated into GWB-III: 2 are with 16 TB with and 2 with 4 TB -- compute vs host. No pending action items here?
29 Jul : confirm disk storage capacity on the host machins and close the matter.

(ii) purchase of remaining compute/host machines (for GWB IV) : PERC card issue needs to be resolved : agreed that we will buy machine that can support upto 12 disks (which means with PERC card) but will have 2 x 2 TB to start with. More disks can be added as needed, and if at all extra slot is needed, PERC can be removed (will support only 4 disks) and backplane has to be changed with a new one (which has to be bought along with the machines);
To decide quantity to order at present : agreed to proceed with 16 nos with full waiver for DELL proprietary item with DELL as the supplier.
Action started to generate the papers; tender waiver is done; and enquiry has been sent -- last date is 30th for the quotes and then tender will be opened.
6 May : sample T630 received from DELL; suitable (CentOS6.5) and CUDA 5.0 loaded and 2 GPU configuration done; 1 dual port 10Gbe card; 1 infiniband card installed; 3 slots still available -- 2 are x4 and 1 is x8 (PERC card is already on the mboard); can test the spare x8 slot and also the 2 x4 slots with appropriate 10Gbe cards.
Power supply problem : not really, as 2 nos x 1060 GPUs did not work, but 2 nos of K20s worked (will be tested with 2 nos of K40s).
20 May : final stages of configuring the T630 for swapping in place of a working T620 in the GWB-III. Meanwhile, to ask for extension of validity by 1 month (from 25th May).
4 Jun : initial set of tests showing that T630 loses packets; tried with lower BW and still getting packet loss; now trying a more recent OS.
17 Jun : still having problems with packet loss; in touch with DELL for resolving the problem; to try T620 with the updated OS; to try T630 in stand-alone mode; may be an issue of NIC card compatibility?
1 Jul : reverse test of upgrading T620 to higher OS has been tried and it works ok; to see if stand-alone T630 test can be tried; to follow-up more closely with DELL.
15 Jul : 'T630 test' continues [packet loss]; no loss observed with x2 10Tb NIC

cards (in 1 hour); longer test planned.
29 Jul : latest test results summarised by SHR show that there is one working combination using 2 NIC cards that works; to get back to DELL with the test report for follow-up action; to see if we can go ahead with the order, with 4 of the T630s becoming compute m/cs and the rest becoming host m/cs; to check status of the existing folder and decide course of action.

(iii) procurement of accessories like network cards, disks, cables etc :
20 nos of CX4 based dual 10 Gbe cards purchased and tested; to confirm that this order is enough to meet our long-term requirements; agreed to produce a formal note about the situation for long-term : to relook at the spares requirement without counting the units already being used in the existing systems (including the PoCo and pkt corr) and buy more if needed; GSJ has produced this list and fresh orders to be done, based on this : 10 Gbe cables and NIC cards (spares); 36-port IB switch; 8 nos of K20s.
c. 4 Jun : 8 nos of K20 have come; IB cables and NIC have arrived; IB switch (36 port) has also come and has been installed in GWB-III. Agreed to put in a repeat order for the 36-port IB switch. Check current status and see if any other accessories need to be ordered.
1 Jul : Order has gone for spare switch.
15 Jul : IB switch is expected soon;
29 Jul : not discussed.

(iv) new purchase of Roach boards etc : need to have enough Roach1 boards and ADC card; need to invest in Roach2 technology to keep abreast of things; new lot of 12 Roach1, 16 ADCs and 4 Roach2 was procured and Roach1 test set-up was made ready and all the Roach1 and ADC cards above were tested ok; current action items are :

(a) for Roach1 + ADC : summary spreasheet about current stock and usage of Roach1 and ADC created and taken up for discussion; agreed for final configuration of 32 working Roach boards + spares -- to check how many new ones have to be ordered (note : Xport will be missing in the new ones); agreed to go with 1 ADC card per Roach board -- to check how many new ADCs needed.
Confirmed that no new ADCs needed for 1 per Roach board; to order balance number of Roach1 boards.
1 Jul : processing for procurement for balance Roach1 boards (~20) has started; Digicom has confirmed that they will provide.
29 Jul : not discussed.

(b) for Roach2 : to check standard test procedure on CASPER; to check if we need to buy add-on mezzanine card; to check if Roach2 can be seen on USB port using Ubuntu and if some basic tests can be done with this; mezzanine cards were needed in order to use Roach2 -- these were procured, allowing work to start on Raoch2 testing.
20 May : Aniket has been working on testing basic things like mezzanine card; 10 Gbe design etc; can now try to see if PoCo design can be ported to this system.
1 Jul : delay in progress due to sharing of PC with host environment of Roach1 & Roach2.
15 Jul : x1 more server needed (to speed up);
29 Jul : not discussed.

(c) software environment needs to be upgraded (for working with Roach2) :
Matlab-Simulink upgrade was ordered and installed on one machine (64-bit), including updated license manager (additionl license is for parallel toolbox); Xilinx ISE v14 was ordered, procured and installed; one existing PC was taken for putting new Matlab, Simulink, ISE v14.2; casper tool flow was also installed; LED blinking on

Roach1 tested ok; to try PoCo design (may need some changes?) on Roach1 and then go for packetised design and GWB III design; after that, try these designs on Roach2, taking into account the change in architecture.
26 Mar email updates from SCC : CASPER toolflow for ROACH-2 installed; takes a lot of time for compilation of simple ADC Snap design (almost 45 minutes); also PoCo compilation needs rebuilding of design using new casper libraries. Still the toolflow has some freaky issues. ROACH-2 booting environment has been setup and need to test booting of roach2.
Need more RAM on the machine; installed on machine with 32 GB DDR-III and found significant speed-up of compilation -- sharing with Roach-I server machine.
need to identify another server.
1 Jul : agreed to initiate the process of looking for another server; and to try T7500 as an intermediate option.
29 Jul : not discussed.
[Note : this item moved to agenda of alternte week from 9 Sep onwards, and can be removed from here]

4.9 Testing leakage, coupling and correlated noise in new back-end chain -- from 29 Jul & before (BAK/YG/++) : detailed tests had been done by Vikram Jaiswal (with SSK, SHR and YG) and report has been circulated; for GAB systems, some follow-up action for testing the leakage has been initiated; procedure for testing to be done with GWB-II release modes clarified and tried out -- new tests show significantly different results for cross-coupling for GAB+GWB; maybe due to synth LO (old tests) vs sig gen LO (new tests), whereas earlier tests used synth LO; new report had been circulated that showed significantly reduced coupling; agreed to repeat the original, user level tests done by YG & VJ to see if things are different now ; agreed to try the ADC noise input and north pole sky tests and see what results come out;
2nd round of tests done, show leakage of 2-4% (consistent with first round results of 1-3%) -- to check with SCC whether all user level tests (done earlier by YG + Jaiswal) have been covered; some user level tests done with north pole and different leakage found for lower and higher LO settings -- needs to be understood.
From Aug-2014 : <= 4% leakage; FE+GAB+GWB (L-band) ~ 40% leakage.
Need to organise a detailed discussion on this.
1 Jul : no fresh updates, except maybe to organise a fresh set of tests with GWB-III.
29 Jul : not discussed.

4.10 Walsh modulation : prototype set-up on Roach board -- from 12 Aug & before (SCC/BAK): plans of BE team for implementing prototype scheme -- basic unit for switching using sq wave signal from GPIO pin tested ok; was put in PoCo correlator and was being tested; walsh waveform delay functionality was added -- can set delay from 1 to 2^32 clk samples (!); with this, variation of correlation with delay was tested using noise source inputs and found ok; Walsh patterns were put on the Roach board (not many slices needed) -- there was some mismatch between CPLD and FPGA waveforms that was resolved and all FPGA waveforms were shown to be ok; dmodulator on FPGA was implemented; list of targets and action items is as follows :

(i) issue of accuracy of oscillator being used needs to be resolved -- to check if this has been done and item can be closed?
1 Jul : one round of tests to be done with generator CPLD with free running osc.

(ii) to comlete the final delay setting algorithm : to provide upto 500 msec of delay (for 128x4 Walsh length) with resolution of 5 nsec (FPGA clk); there were problems related to varying start-up offsets and fractional delay setting, as well as problems related to set up and hold -- these are now reported to have been

resolved : this is confirmed to be work ok and can be closed.
1 Jul : can be closed.

(iii) what about synchronisation of starting? -- this is taken care of by running the CPLD with a sig gen locked to 10 MHz. Can be closed?
1 Jul : this is coupled to item (i).

(iv) to develop and optimise the hunting algorithm :
15 Jul : a version of the hunting algorithm developed - tests in lab done; tests in progress with C1 antenna; it takes 20 minutes to lock; further optimization leads to ~ 10 minutes lock time (is this acceptable); to discuss plans for future.

(v) to demonstrate cancellation of unwanted signals in ADC card and/or GAB; first, need to run a test where pattern from external source can be synchronised to the pattern generated in the FPGA -- this requires being able to hunt and correct for the unknown delay !
1 Jul : this is yet to be demonstrated and is likely to be coupled to item (iv)

26 Mar email updates from SCC : the test is going on with pocket correlator to check effect of walsh pattern delay on normalized cross. CH-1 walsh modulated and CH-2 delaying walsh pattern by 50uS and check effect on normalized cross. The testing software is ready and will be tested soon. The design don't take much resources only 2-3% of fpga. To check if first results from tests are available.
New feature : Walsh pattern generated on fpga can be grabbed on PC and plotted. tests of correlation change with delay change will come in next few days.

20 May : Actual Walsh patterns show multiple peaks of full correlation amplitude (!); 50% duty cycle Walsh shows only 2 peaks -- this becomes one peak once the sign is also considered. To redo the 60 Walsh patterns with sign of correlation to check number of +ve peaks and their exact value.

4 Jun : able to correct the sign problem, but still issue of multiple peaks etc -- needs to be looked into.

17 Jun : hunting algorithm being developed.
1 Jul : coarse hunting with 4 ms step is working; and now trying to refine with finer steps of inverse of basic clock.
15 Jul : 'finer steps' work completed;
29 Jul : first tests have been done with astronomical signal and modulation at FE with demodulation at BE (alongwith hunting algorithm) -- locks in about 10 mins; gives back proper correlation; but appears to drift rather quickly -- need to check the cause for this.
==> the cause of the drift is now established to be samll frequency offset between the modulator and demodulator clocks; may need to shift to 1 MHz clock signal at antenna that is locked to a reference -- will need a change in the PCB; appears that the scheme of using the noise gen and modulating only in one polarisation to calibrate the delay may work out (will also require a change in the control ckt to enable Walsh only for one polarisation); some issue of standing wave in normalised cross as a function of channel number for actual modulator + demodulator?

5. Other items :

5.1 New python assembly design -- from 12 Aug (HSK/SSK) : FE group wants the

python configuration in E6 to be adopted for all antennas -- FE and mech have dicussed about plans for modified python assembly that will give additional protection to cables; mech group had circulate a short note on their view of the matter, alongwith photos; this was discussed and existing vs E6 system was compared; Action items :

(i) modified E6 design with hinge-like support was installed on C4 (July 2014); agreed to watch the set-up on C4 and do periodic inspection for checks of (a) damage to hose (b) hose clamps (c) water entry etc -- first inspection was done after 2 months (mid-Sep 2014) by mech and fe teams; subsequently, inspection was done (around mid-Nov?) and a video of the same was circulated; scheme appeared to be working ok; however HSK felt that this scheme with hinge may not be good in the long run -- this was discussed in detail; the hinge arrangement on C4 is NOT exactly same as the E6 arrangement (!); the C4 design does not completely solve the problem; agreed that E6 set-up does solve the problem (!); agreed that it can be replicated if needed.

(ii) IGUS cable wrap -- new technology prototype to be developed and tested on quadripod : a) hose without wire impregnation b) entire hose assembly (both could be tried as long-term solutions).
Quotes for both items received : item (a) is Rs 10k for 10m (4 antennas); item (b) is 60k each -- will try on the quadripod test range; items received; basic assembly made ready; finally, installed on test range around Oct 2014; tested ok without cabling (video available); then populated with cables by FE team for further testing; proto model made fully ready; this set-up uses a slightly different arrangement of fixed members, along with the IGUS hose; will work as well as the E6 design.

Agreed to : (a) replicate the test arrangement on 2 antennas, one with normal hose and one with IGUS hose (b) to check how much extra cable can be accommodated in the existing hose and (c) look for wider diameter assembly (32 to 40 mm or more).

Email update from HSK : (i) hose procurement in progress under cash purchase (ii) spare assembly with old type hose will be prepared for 2 antennas in time for installation during Mar-April 2015 MTAC (ii) spare assembly with new IGUS hose will be also be prepared for 2 antennas for installation during MTAC (iv) extra hose of 38/40 mm is being procured and assembly preparation is in progress -- will be ready by 1st week of April.

26 Mar : 2 sets of hose assembly are ready for use -- two antennas to be selected : maybe W1 + one. HSK says no scope for adding more cables in existing; wider assembly of 38/40 mm is getting ready -- can go to antenna directly (W4) and add optical fibre cable as a test case.

6 May : 2 Finolex-type hose assemblies (with normal dia) made ready for use in 2 antennas as an improved version of E6 assembly. IGUS hose assembly (with normal dia) 2 units are also ready; agreed to put one of each kind using C4 and W1 as test antennas. Wider hose (50 mm) under procurement -- it is a Teflon based product -- will need to be tested for temperature and then made into an improved E6 assembly and tried out.

26 May (email update from HSK): 2 sets of assembly of Finolex pipe made ready were given to FE group for putting cables etc and returned on 21st May; one set of Igus hose assembly also given to FE group to make ready, and returned on 25th May; now preparing to install on C4 and W1 antennas within a week.

17 Jun : Igus type hose assembly installed on C4 -- had some problems (2 iterations), now done on 3rd iteration with another modification; old E6 design with Finolex pipe will be installed on W1 early next week.

1 Jul : C4 installed and working, but video yet to be made; W1 to be installed soon (wind problems slowing down the work); to wait for few weeks to assess the performance.

29 Jul : C4 running for over one month and W1 for 3 weeks; can wait for one more month; meanwhile some accelerated testing is required -- can be done on maint day via control room.

26 Aug : no updates.

5.2 Problem of access to FE boxes with 500-1000 CDF feed -- from 12 Aug & before (HSK) : Update on new solution being designed by Mech group -- tested in situ and found working ok; agreed to use this for present; for future where bigger and heavier boxes will come into play, mech group will think of an improved solution, including an option for removing one feed and bringing the stool inside the basket; a few options explored by mech group, with target of 1800 mm height for boxes with max weight up to 150 kg (?), quotes received from some parties, processed and order placed; delivery by end of November 2014; inspection done (in Bangalore) in mid/late Nov 2014; some simple improvements suggested to vendor (guard rail, simple clamping arrangement for item); platform delivered at GMRT (early-Dec 2014), tested and found ok, including modifications that had been suggested; trials had been happening on ground; ready to test with actual antenna operations -- waiting for new crane to be operational (why can't it be done with the HLPs ?)
Email update from HSK : waiting for RTO registration of new crane to complete. Confirmed that not a good idea to carry it to remote locations in HLP basket; hence, crane has to go (as item is too heavy to be easily handled by humans) ! Crane is now ready for use; to try the test on one antenna with crane + HLP + platform; to coordinate with FE team.
26 May (email update from HSK) : markings made in the basket and making of hole is in progress; after that, can start using on a need basis.
17 Jun & 1 Jul : no upates on this; no progress.
12 Aug : used in W6; to try for a few more times and then see how it is going.
26 Aug : no updates.

5.3 New FE boxes and testing with reflective paint -- from 12 Aug (HSK/SSK) : two kinds of paint received and 1 box will be made ready next week for testing. 6 new boxes are ready as per specifications -- only some engraving work is pending.
email update from HSK : One FE box painted with Luxtrotherm HT 400 (range from 250-400 deg C ?) and handover to FES group for testing. Second grade paint : Luxtrotherm HT 600 (range from 400 to 600 deg C) -- waiting for arrival; 3 types of FE boxes handed over to FE team : (i) plain box with powder coating (ii) box painted with HT400 (iii) box painted with HT 600; waiting for test results.
2 types of paints tried : HT400 & HT600; neither successful; to try new paint options? Item needs to be discussed jointly with mech and FE to understand why the original selection did not work and what should be done about it.
Agreed to circulate the description of the method used, the results and the conclusions and then take up for discussion and decide what needs to be done; this has now been done by the FE team; need a follow-up discussion.
To cross-check proprerites of HT400 and 600 about reflective nature and what are the other alternatives -- some alternatives had been identified; HSK to report

status of follow-up action.
6 May : one product has been identified (summer cool made by excel coatings); sample has been ordered. in addition, modified version of 15m as well as antenna shell cage to be used on 2nd box and 3rd box to be normal box. to try the test this month.
26 May (email update from HSK) : paint material received on 18 May; painted box handed over to FE team on 19 May; first round testing has been done by 25 May and some results are available (to be circulated) -- overall effect may be 3-4 deg improvement...
17 Jun : mech group wants to try with one expt with summercool on top and PU based insulating material (Stopaque) on the inside.
1 Jul : mech group to go ahead with the test after procuring the Stopaque material via cash purchase.
12 Aug : instead of Stopaque make, Unishield has been procured and test will be done soon in coordination with FE, depending on ambient conditions.
26 Aug : no updates.

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Minutes for the weekly Plan Meeting of 5 August 2015

1. FE & OF related :

1.1 Documentation : follow-up on level 2 (ITR) -- from 22 Jul and earlier (SSK+team):
(i) Check status of new items : work was ongoing for

(a) spares for 1420 feed -- to be taken up after temperature monitor report is completed (which is done mid Mar) -- VBB to talk to SSK to work out the contents. No progress on this; agreed that to have an upate on this 2 weeks later (27 May) still pending for discussion between SSK & VBB.
8 Jul : issue about who is the FE person responsible for this ! (S Ramesh vs VBB); SSK to check and come back (maybe SSK can help S Ramesh to do this?).
==> SSK will work with Ramesh to start with earlier report and update to reflect the new changes made while making the new Lband spares.

(b) OF & RF monitoring schemes : OF power monitoring (starting from initial version from Gehlot) -- to be done by Sanjit; RF power monitoring (to be named as "Broadband RF monitor"), from scratch -- by Pravin, Sanjit and Ankur; was deferred to after MTAC (Apr 2015); then waiting for some test results from newly assembled system; preliminary report on OF monitoring by Sanjit Rai discussed on 27 May 15 : has good amount of material, including sample results etc, but needs improvements about the layout of the block diagram, terminology used, functional blocks etc and a section that emphasises the future growth path and plans a little bit (e.g. long term monitoring 24x7 and transfer to online etc).
8 Jul : revised version of OF monitor doc discussed : blk diags are much better now, a few small iprovements are needed; some of the pictures could be moved next to the corresponding blk diagrams and labeled; blk diagram and scheme as to how multiple antennas are handled needs to be added; some description of which antennas behave good and which don't and possible causes for poor behaviour; future plans and scope to be added. Work on RF monitoring report to be started soon.
==> RF monitoring : work yet to start (PAR to be encouraged to start soon); OF monitoring : most of the suggested improvements have been done; only a bit more detail is needed about antennas showing good or poor behaviour, alongwith possible reasons and future plans for tackling this issue.

(c) Test and characterisation set-up for OF system : Sanjit will be looking into this. Set-up to be ready in 2 weeks (18-Mar-15) & then report will come; work ongoing (Sanjit + SSK) -- first draft is with SSK for review; some feedback has been given by SSK, to include some new measurements and also drawings of test set-up, change of linearity / dynamic range with level, temp stability of bias point etc. Updated draft discussed (24 Jun 15) - needs to be implemented (addition of Block Diagram; some tests ...).
8 Jul : work is ongoing, some modifications have been done; one measurement of phase stability is pending.
22 Jul : Phase stability measurement carried out (x1 set); data collected for amplitude & bias stability of optical transmitter also; report to be completed.
==> phase stability measurement for 8 km of exposed fibre behind the lab shows significant phase varn with temp; now need to compare with similar or longer length of buried fibre to antenna, for comparison. AFter that, report can be finalised.

(ii) Also, can we look at which ITRs may be ready for conversion to NTRs : it was thought that filter design work can be taken up for this, once the ITR is done. For the 250-500 filter, paper has been accepted for publication in IEEE (Sougata & Anil).
Pending action items :
(a) agreed that the 550-900 filter work can be looked at for a paper : Imran is looking at that -- will come back shortly with a proposal for presentation in paper content; Imran urged to look into it; discussion between Imran and SSK has taken place -- Imran has made a rough first draft and is working on refining it.
8 Jul : no progress on this item; may need a discussion.
==> Work has started on preparing the draft and will be circulating first version internally in about a week.

(b) to check what else can be taken up for publication -- defer for now.

1.2 OF system NTR -- from 22 Jul & much, much earlier (SSK): can this be initiated now, leading to a journal paper publication? agreed to take the first draft of what was done for the MWSky paper & build on the OF section of it towards a first draft of NTR / paper. PENDING FOR VERY LONG NOW. SSK looking at specific formats and content / scope of the paper; some thinking about what to include and flow and format : to focus on RF over fibre for radio astronomy applications, for GMRT.
First draft expected 1st week of June -- to check status.
8 Jul : SSK described an outline document showing the plan, layout and some of the features (including some equations and expressions and tables); SSK needs a bit more time to collect more material (including results and measurements) and then will be ready to organise the contents.
==> SSK will circulate a first draft of contents by this week.

1.3 Noise temp & gain vs temperature for new LNAs -- from 22 Jul & before (VBB/SSK):
Results for new 250-500 LNA show ~5 to ~55 deg K varn in Tlna for variation of 0-60 deg K in env chamber, and gain change is ~ 0.2 to 0.3 dB -- confirmed with new test that waits for temp to stabilise after giving 10 deg steps (tests are now done with one monitor in contact with the device and one in the box, alongwith chamber temp monitor); repeatibility has been tested ok with 2nd round of experiment.

Results from testing of 130-260 LNA show about 35 to 40 deg K variation in Tlna over 0-60 deg and 0.6 to 0.8 dB (drop) in gain with increasing temp.

Results for 550-900 LNA are similar : 35 to 40 deg K change in Tlna with 0-60 deg change in temp, and gain change is 0.04 to 0.36 dB -- results obained for two epochs for both cases and found to be repeatable.

Results for Lband LNA also done, with similar amplitude of swing : ~ 35 deg K change in Tlna (at 1300 MHz) with 0-60 deg K change in ambient temp; however, the lowest temp value reaches 5 deg K (!), which is a bit hard to believe.

Current action items :
These constitute a nice set of measurements; now need to understand what may be the cause : what is the expected variation for the device (same is used in both stages of all the 3 LNAs) and what is the expected sensitivity to bias point variations with temp -- these issues need to be looked at in some detail now.

(i) Agreed to verify measured values against the data sheet specs; check for bias pt variation with temperature (empirically) and compare with data sheet; also try Lband

amplifier; expt has been tried to measure bias voltage but it is difficult as the probe affects the bias voltage and LNA behaviour changes; to check if any another method can allow the test to be done; no other option has been found yet.
24 June : required information not available from the data sheets;
8 Jul : still no progress in finding reliable methods for in-situ measurement.
==> no updates.

(ii) in parallel to check existing schemes (in lit) for temperature compensation of bias pt (assuming that this is the cause of the problem); agreed that this can be taken up -- start with a simple google search; any updates?
10 June : no action taken; agreed for VBB to take a look at this matter.
8 Jul : VBB has tried new scheme with active (transistor based) bias instead of the passive bias. Basic scheme appears to be working as LNA performance is not affected; variation of bias voltage with ambient temp (inside the chamber) has been measured; now to try to adjust bias pt to get best performance of the LNA (concentrating on Tlna) and then put it in the chamber to see effect of temp variation; to do the same with original design and compare the results.
22 Jul : replacing chip-resistor (100 ppm/deg C -> 25 ppm/deg C)
==> work on testing the active bias ckt with temp in chamber is ongoing; better stability chip resistors -- list of required values and possible part nos (and vendors) identified and to be circulated to see if items can be found more easily at TIFR Mumbai or to be ordered by GMRT team.

(iii) to check option for artificial heating of LNA to constant temp (via a TEC); SSK had initiated some enquiries to see if some suitable products may be there.
10 June : no follow-up on this topic.
8 Jul : SSK has found some potential products in the market and will see if sample items can be procured.
22 Jul : 13 W heating element with thermostat identified; programmable over -10 to 60 deg C; to work on a scheme using this device.
==> indent has been raised; but this device will not fit inside the LNA chassis (only in the main box); to continue to look for products that are suitable to put inside the LNA chassis.

(iv) The very low T_LNA (~ 5 K) seen at Lband issue being looked into by using 'new calibrated noise source' which just arrived : first look at data with new noise source shows results which are more sensible : absolute values of Tlnas are higher and easier to believe; variation with chamber temperature is a bit less over the range; other general comments : at all RF bands, the Tlnas with old and new noise source are showing an increase of 10 to 20 K ! Further, 2 different measurements of Lband, inside and outside the chamber are NOT giving matching results -- needs to be checked with use of the same LNA. Also to check other outside locations for testing : DIAT, IITB, Sameer etc; SSK has checked with DIAT and Sameer -- can try at Sameer Mumbai : SSK to send the info to YG for writing an introductory letter; tests with same LNA not done yet -- to check with VBB.
10 June : VBB agreed to complete the test and report by next time (2 weeks later).
8 Jul : LNA test may not be possible now, as no spare LNA is available (!); YG to send the letter.
==> letter to be sent to Sameer.

1.4 Testing of 130-260 system -- from 22 Jul & before (HRB/GSS/SSK/NK) : Analysis so far, from 2 antenna installation (C10 & W1) shows that deflection and sensitivity at 150 is better than existing 150 feed + receiver; at 235 it may be slightly less than existing system; need firm tests to establish this, including

interferometric tests using 3 or more antennas; initially, since wideband FE box was not available, tried to put feed in place of the 235-610 feed in one antenna and use the existing 235 MHz band receiver for doing the test -- this didn't quite work out, and caused fair bit of confusion; finally installed on 150 face on S3 and replaced the 150 FE box with a 235 FE box to carry out the tests; results showed C10 and W1 deflection matching quite well (and only 0.6 dB less than expected at 235); but S3 showed about 1 dB further less deflection -- suspected to be due to the narrow band FE box; agreed to install new braodband 130-260 FE box when ready; 2 more boxes were made -- 3rd unit was installed on S3, and 4th was installed on E2 (25 May 2015).

Current action items :

(i) plans for sensitivity tests and results from these : consolidates summary from total power deflection tests by HRB and NK is as follows (interferometric tests have been difficult, due to various reasons) :
-- C10, W01, S02 (all 3 new feeds + receivers) behaving very similar, which is good;
-- sensitivity at 150 MHz is better than existing systems (and keeps getting better till 170 MHz) : the linear increase is almost 2x and NK to check if it can be explained by changing Tsky with frequency; this was analysed by NK (10 June 2015) and shown that the expected variation of sky background can explain the observed change in sensitivity quite well; may need to add the effect of Tlna into the calculations; this matter can be closed?
-- sensitivity from 200 to 230 is better than (a) existing 150 system (?) and (b) existing 235 system;
-- however, sensitivity from 230 to 250 is worse than existing 235 system (almost 2x worse at the peak at 240 MHz in the existing system); cross-over point is 230-240 region; this needs to be understood and improved.
-- there are prominent oscillations in the sensitivity of new systems in 200 to 240 MHz range : this needs to be understood;

The last 2 bullet items need to be understood and resolved.

(ii) there are RFI lines which ned to be properly identified -- can take up for discussion in RFI section.
22 Jul : cable TV lines or system saturation ?? being studied;

(iii) Sougata will start regular monitoring of the antennas with the new systems (from 22 April 2015 onwards) : regular testing appears to have starated -- Sougata showed first sample plots; some antenna measurements (W1) showed more noise; S3 looked relatively clean; C10 was not available; one more round of new data was sent (27 May); from now on, 4 antennas will be available.
10 June : no new data set this week (maybe there next week).
24 June : update expected next week (01-Jul-2015); The plate of the feed on S3 has fallen off !
8 Jul : plate has been repaired; cause has to be studied more carefully for long-term solution; may also look into reducing the weight; no new data taken; to wait till Sougata is back from leave.
22 Jul : Results displayed 14-Jul-2015 data - ~ 9:38 - 9:50 AM (Cas-A); lot of RFI in 130-260 MHz; 140 - 155 looks like a clean, strong band; report to be circulated by Sougata.
==> old data (14 Jul tests) discussed again : S3 has funny increase in power around 140 MHz during off-source, leading to poor deflection; E2 also shows slightly poorer quality of deflection plot. New set of data may come this week and can cross-check the above effects.

(iv) Other issues :
(a) possibility of sub-band filters discussed : not clear if it is required, except for RFI related issues (space in FE box will not be a problem) -- agreed to keep pending for now.
(b) to check items for longer term : most of the items required are there; noise source and coupling needs to be integrated;
(c) new PCB for QH + dir coupler with noise injection port has been designed and sent for manufacture to TechnoCkt; PCB had come and chassis was made by w'shop; combined unit with QH + dir coupler + noise splitter (for 2 channels) was assembled and tested -- basic performance looked ok; noise coupling has some slope ~ 5-6 dB across the band; to wait for detailed report to be circulated; unit has gone in box #4 (on E2) -- not so; it is box #5; VBB to produce a brief description / report of the work and then can be discussed about possible improvements and also field tests.
10 June : 10 units have been assembled and data has been taken to test repeatibility; results of this and basic performance to be summarised in a brief note; to plan to install in at least 2 of the 4 antennas for field tests.
8 Jul : brief report brought up for discussion : shows basic design of QH + noise injection system with 4 boxes tested; results look pretty good for insertion loss, phase change, and noise coupling -- small variation from unit to unit for the last item, may be because of accuracy of the length of the wireline that is cut; right now integrating alongwith RFCM card in box #s 5 & 6; when ready, will replace existing box on 2 of the 4 antennas.
22 Jul : 'replace existing box on 2 of the 4 antennas' : NOT done yet
==> one modified box is ready to replace existing box on C10; 2nd unit will be made on this C10 box. Report to be updated and released.

1.5 Testing of 250-500 FE receiver system -- from 22 Jul & before (ANR/SSK) :
15 antennas have the new feed installed (remaining feeds are kept in storage) and 10 antennas have been fitted with the broadband FE box (with 2 spare units). Note that the new configuration of QH + dir coupler + LNA is working ok in the new FE boxes (e.g. C1) but it needs to be checked individually for each new box that is made ready.
Characterisation and testing of installed systems (using monthly data):
Main tasks are as follows (FE team to maintain a proper log of action taken on individual antennas during these tests and debugging activities) :
* stability of power levels and bandshapes to be checked from weekly plots for the available broadband antennas; bad antennas to be taken up for correction.
* antenna sensitivity to be checked from on-off plots generated from the data; bad antennas to be taken for investigation e.g. E6 was found bad in earlier tests; even after many changes (including change of dipole) the problem was not fixed.
* failure rate of new FE system : about 1 in 2 months over the past 5-6 months(?) -- what are main reasons : oscillations? device failures? loose connections?

Specific action items are as follows:
(i) specific problems : E6 had one dipole showing poor return loss; problem traced to use of metal screw in place of teflon screw (with some insulating tape) -- this was a one-off case; after that, there were strong lines seen and FE box was replaced with spare unit; to check if E6 results are ok now; also to check problem with FE box. latest E6 deflection plots shown 9-11 dB (against expected of 12.7 dB); need few more tests to conclude -- looks ok now; reason not known; any other specific antennas?
10 June : E6 looks ok now; no other antenna with very specific problem.

(ii) to check if new data is available and what results are seen from it : monthly reports available since last several months, which includes interpretation also -- to see if some conclusions / trends can be identified from these.
e.g. C8 shows less deflection at higher freq - confirmed that C8 is modified Kildal and not cone-dipole -- this may be the reason; agreed to replace with regular cone-dipole at the earliest -- check if this has been done.
24 June : C8 has recently got the cone-dipole feed put up (this being the 16th antenna); new 250-500 FE box to be put up tomorrow (25-Jun-2015).
8 Jul : new results from 30th June (13 out of 16 ants) show some antennas work very well, but also some problematic issues : C8 is not working properly -- needs to be looked into; some cases (E02) of ripple / RFI in off-source (maybe better to avoid Npole?); W04 both chans show RF band extending beyond the normal cut-off at 500 MHz end (by ~ 8-10 MHz).
22 Jul : now C8 is fine (after tightening python !); plots shown E02 also fine now; S2 under investigation;
==> new data to be taken soon (today's attempt spoilt by RFI) -- will check on C8 and E2; no updates on S2.

(iii) some antennas showing slightly lower sensitivity than the best ones -- need to be followed to understand the cause; e.g C13 seen in Feb 2015 data -- it appears to be ok now in recent tests; C13 still ok; latest plots show only C11 low in both channels -- to check earlier results & decide follow-up action for this; any others?
for C11, not clear what is happening; latest data shows significant ripple in ch2 for almost all settings of attn value -- needs to be followed up; also W6 both chans are about 1 dB down; for C11, OF attn problem was found (faulty unit?) and after fixing that, the deflection now appears to be ok. W6 also ok now (reason not clear).
10 June : no clear signal of any antenna being down. S4 and W6 were not available.
==> W6 now has new box (and appears to be working ok) and its box has gone to E4.

(iv) some antennas show ripples and unstable behaviour in on off and deflection plots which need to be characterised and understood; this seems to not be a major problem now; check if any new antennas showing unstable behaviour ?
10 June : W1 ch 2 is the only one which showed some unstable behaviour.

(v) some antennas show RFI (in addition to military aircraft) -- need to watch out for such RFI and catalog and inform; recent report generated with list of lines shows 4 lines within 250-500 MHz : from localized satellites? to take up in RFI dicussion; more recently (29 April) strong RFI seen in most antennas near 400 MHz -- to be confirmed with RFI team.
no fresh updates except that latest data shows RFI near 470 MHz -- Mumbai digital TV, and lines near 484 MHz due to Russian satellite system (details in RFI section)
10 & 24 June : no fresh updates; need to check the status of W6 which has strong, periodic lines seen for last few months !
22 Jul : on 30-Jun-15, W6 was fine -- TBC with user tests & reports.

(vi) W4 problem : several tests and checks have been done (including new cable with modified connector pins); exact issue not clear; finally, main RF cable change was done and deflection tests appeared to be ok, but later results showed one ch dead -- debugging shifted the focus to the OF Tx system, where bad cable in RF PIU was found which fixed the problem (including ripple?); looks like first 10-12 OF units may not have been tuned for full temp range of variation; can be done now with the env chamber. This is being tried in W4 now and result will be clear in about a week. Similar retuning has been done for C14; meanwhile, entire OF system has been replaced by new unit; also 250-500 box has been brought down (replaced with narrow band system),

rechecked thoroughly and some units have been swapped and now ready to go back to antenna -- to check current status of this matter.
10 June : finally, a new box was put and old box is being fitted with new LNAs; now deflection is ok, but BPF filter on HF side seems to be extending beyond the normal range -- needs to be checked.

(vii) Appropriate off-source location : new results 27 Mar 15) show some difference in the deflection taken wrt cold sky (Npole) & the OffCasA source (from online) with the former giving slightly higher deflection (~ 1 dB) at 375 MHz -- may have some frequency dependence; also, absolute value of deflection appears to have reduced (to ~ 11 dB) from the early days (~ 12 dB) -- agreed to do a systematic study of last 1 yr data with 1-2 month sampling; sample data from C4 & C0 displayed (remaining to be studied before conclusion) -- to check if done; also to cross-check role of pointing offsets, location of Sun etc.; sample plots for ~ 1 yr span for few antennas discussed; looks like Npole gives higher sensitivity than Off-CasA; to put all available data on one plot to check for any systematic variations with time.
10 June : analysis extended from 2013 to 2015 and appears to show that deflection taken with Npole as off source is 1.5 to 2 dB better than off Cas-A location -- trend seen for 3 antennas; can check for couple more; discussion with DVL and ICH showed that the off-CasA source is NOT a cold spot in the sky -- it is a spot with same background as that of CasA ! Hence, the calculations and results have to be interpreted accordingly !
8 Jul : ICH and DVL working on this; Ankur to show the data to ICH for comments.
==> discussion on this is under progress; need some clarity about the Tsky backgnd values.

(viii) FE team to maintain a log of the issues found and work done (antenna wise); some discussion took place about possible options (hard copy and soft copy); FE team to think and come back with possible way forward.
24 June : FE team proceeding with hard copy format.

(ix) Academic colleagues from NCRA ready to look at the data for helping with long-term statistics and user-level interpretation : can the raw data be made available for use (past and future)?
8 Jul : agreed to provide raw data for one epoch to Tirth for understanding.
22 Jul : data given recently to Tirth, who is looking into it.

1.6 Mass production of 250-500 FE receiver system -- from 22 Jul & before (ANR/SSK) : 15 antennas have the new feed installed (remaining feeds are kept in storage) and 10 antennas have been fitted with the broadband FE box (with 2 spare units). Note that the new configuration of QH + dir coupler + LNA is working ok in the new FE boxes (e.g. C11) but it needs to be checked individually for each new box that is made ready. First version (v1) of FE box was installed on C13; final version (v2) of new FE box was installed on C11 and found working ok except for Walsh problems. Meanwhile, GSG cleared to go ahead with mass production; making of LNAs for 30 antennas (plus use as spares for existing 325 MHz system) were finalised and item was closed (27 May 2015). Current action items towards mass production are :

(o) number of antennas completed : 16 are done now; details of combinations of old and new electronics to be made available (Nilesh table will have); 2 more antennas to be done to take target to 18 (3 in each arm + 9 in CSQ, avoid 3 short baseline antennas); have 2 old 325 FE boxes as spares (note : possible issue of wideband feed with narrow band FE box).

(i) spurious bandshape / instability of LNA -- was not seen in the lab, except when i/p was loose or not connected -- this could be typical for all units? need to check about this; various tests were done in the lab and spurious lines were seen under some conditions of thermal cycling; there is an issue with central pin of QH (at both i/p and o/p side); at o/p side problem was fixed by ordering special connectors; may need same solution for i/p side (at cable connector i/p); sample machined pins were got from workshop for making a trial version of the cable; tested with FE box in the lab, and then tried on W4 to see if it solves the problem of oscillation seen there -- did not make a difference (!); however, since there is a fundamental mismatch, better to make this as a permanent feature; to check with Amphenol and Radiall if they will make to order for this (temporary solution is to get the changes done in workshop); plan is to have all new boxes with new connectors with sharpeend central pins; however, it is not clear that this is solving the problem of spurious effects in the bandshapes.

E6 oscillation reproduced in the lab with feed connected; tested with impedance stub connected in place of feed; can produce oscillation and stable behaviour by changing the stub length -- impedance going down from 50 and below; another LNA is stable with full variation of stub length; hence control tests can be done now to try and isolate design vs quality issue, both for QH and LNA and the combination.

Current effort ongoing to tune the ckt to improve RL at (small) cost to Tlna; in addition, to check for quality control on the ones that have come down from the antennas; also to monitor continuously at high temp to see if that stimulates the problem; 2 LNA units were modified to get better RL over 250-500 band without loss in Tlna and Gain (27 May 2015) -- but there is still a line seen when put with the stub; to try with stub on n/w analyser; to try the swap between LNA and other QH. 2 LNAs were tuned to give below -10 dB RL upto 600 MHz, without compremise of gain or noise temp (10 June 2015); however, when integrated with QH and tested, the gain response does not remain the same and when the units are connected to Sp An, the response is not good, and some lines are also seen (which is not the case for the originally tuned LNA); it appears that the retuning may have affected some of the components that are important for stability -- to put these back to the original values (or even towards the other direction) and try to change others which improve the RL...

Action items can be summarised as follows :

(a) plans for procuring modified connectors for i/p side :
yet to check with the manufacturers to see if standard item is available or not.
22 Jul : 'Radiall' connectors solve this (enough stock); feed to FE (input of FE : cable connector type-N male); visit to Amphenol : not happened yet [MOQ : bulk order needed ??; to explore custom made solution also.
==> agreed to go forward with a visit to Amphenol factory at Chennai / office at B'lore for finalising the plans for custom made connector for matching input cable to QH.

(b) to confirm if any quality issues have been found in the PCBs that have come down in FE unis from working antennas :
looks like this has no relevance to the problem and this item can be closed.
==> closed.

(c) current status of retuning of LNAs to improve stability :
no further progress this time, as ANR busy with 550-900 amplifier.

22 Jul : conclusion appears to be in the direction of using the original design (as any of the modifications tried have not shown improvement) -- will need combined tuning 2 LNAs with QH).
==> agreed and closed.

(ii) status of QH, noise source, coupler etc : QH is available for all 30 antennas; current version of noise source, power splitter, directional coupler etc were tested before putting up in C13; but in-situ tests showed that the power level (deflection) of the noise was not sufficient; traced to faulty functioning (unequal distribution) of power divider module; alternate approach (using resistive components) seems to work ok : equal powers on both channels ~ 4.5 dB for E-Hi cal, no need to reduce coupling from 20 dB. Also, additional issue of 7 dB slope over the band (due to coupler) and 4 dB due to noise source; agreed to a change in the layout of noise module -- to try and reduce the 4 dB slope, increase the noise power slightly, reduce temperature sensitivity etc; more compact PCB with constant current source, shorter track lengths etc) was made and first results showed fairly flat (+/- 1 dB) spectrum over 200-600 MHz.

Current action items are :

(a) First two of the new noise source units are on C11 (box #2) and S02 (box #1); 3rd unit should be up on antenna now. To check status of noise cal tests by DVL for these antennas -- test results have been under circulation and can be taken up for discussion; meanwhile, some changes and corrections have been made, may be useful to do one more round of tests.
10 June : the results need to be looked at carefully and conclusions need to be agreed upon by all concerned and then follow-up action needs to be decided.
24 June : 4 units showing repeatable performance in the lab; from noise cal tests : S02, C11 & C13 gave identical 6 dB gradient across ~ 200 MHz range;
8 Jul : except for C13, all the new ones have the improved noise coupling circuitry can check the list of antennas and repeat the measurements.

(b) for new PCB : agreed to check on 2-3 more units for repeatibility & also thermal cycling and then finalise plans for mass production : one more unit has been made but work held up due to shortage of switch needed for control of noise level; meanwhile, thermal cycling tests passed ok. 30 nos of switches were procured, wired & 2 new units were tested (data appeared to repeat well, but final record is not available). To circulate the results for discussion, even while conintuing with the 30 nos.
VBB to circulate the results -- has not happened yet.
10 June : VBB agreed to circulate the results.
8 Jul : results for one LNA connected to different noise source units shows good repeatibility; and one noise source + LNA combination over 0 to 60 deg in evn chamber shows constant noise power level (across the band); with this issue can be cleared for mass production; could think of including results in next version of the FE document.
==> mass production of PCB and chassis completed; only noise module to be soldered when needed.

(c) discussion about the 7 dB slope due to coupler : to be deferred for now.

(iii) plans for sub-band filters for 250-500 MHz system -- results from sample units with all 4 sub-bands over plotted showed roll-off is a bit slow on the higher freq side compared to existing L-band sub-band filters, but insertion loss is better; lab tests with manual settings using patch card + old MCM card done successfully, and

sample units assembled in the new FE box put on C13; meanwhile, new, integrated unit that is more compact was developed : one chassis with 4 filters (on 2 PCBs)? plus separate chassis for switch; following are the pending action items :

(a) prototype PCB for this had come and was tested : worked ok, except for small difference in 2 pols; maybe due to unit to unit variations?; one more PCB was given to Argus to make with stricter tolerance (less than 10%) to see if that fixes the problems (Shogini was unable to meet the specs); this new PCB from Argus had problem meeting 4 mil requirement : 3 sub-bands ok; 360-460 band had some issues -- slight shift in the band, and repeatibility of units not assured; hence agreed to design with 4.5 mil spacing for all subbands (may lose 3-4 MHz BW in each subband); design was made and sent to Argus and after receipt of PCB 2 filters for each of 2 pols were made ready and 1 filter was tested; out of 4 units, 3 were sort of same and acceptable, but 1 was quite different; after discussions, another set of all sub-band filters was sent to Argus -- these were also found to be problematic;
3-pronged approach : Argus is ready to try and correct the problem -- should go ahead with one sampe; alternate fabricators : Epiton from Ahmednagar is ready to take the job (Atlantis from H'bad may also take it); 3rd option is to try simulating with 5 mil spacing and see what results are available.
13 May : 5 mil spacing design done (with loss of 3 MHz BW) and sent to Argus; 4.5 mil order going to Epiton; Atlantis is ready to try 4.0 mil -- waiting for quote; not pursuing 4.5 mil with Argus; 5 mil has come from Argus; waiting for chassis; waiting for other PCBs from Epitome and Atlantis.
27 May : 4.0 mil PCB from Atlantis has come and comparison with 4.0 mil of Argus : Atlantis appears to be better for the 2 lower bands and Argus appears to be better for the 2 higher bands ! Agreed to try 2 more samples each (for higher and lower bands resp) with these 2 parties. For 5.0 mil from Argus only one sample has come and shows expected shift -- need to compare when 2nd unit comes; to check current status on this.
10 June : one unit each from Argus and Atlantis is still awaited; may come by next week; can check status after 2 weeks (24 June).
24 June : Argus performance better at higher frequencies & Atlantis at lower frequencies; x4 units tested (from Argus) show very consistent behaviour - frequency reproducibility within ~ 50 kHz;
8 Jul: new set of PCBs from Epitome : higher 2 sub-bands tested ok for 2 units, lower 2 sub-bands yet to be tested; also waiting for balance 2 units from Atlantis for low sub-band.
22 Jul : Sougata's report on 250-500 sub-band filter fabrication : all 3 vendors' results reported (Epitome, Atlantis & Argus) : BEST is Argus ! (x4 units for each of the 4 sub-bands show excellent consistency; x4 PCBs from same batch/run); Epitome not explored fully (ony x1 unit tested); to have a follow-up discussion and take a decision.
==> final outcome is 4 mil track PCBs for all sub-bands to be done with Argus; out of the 7 antennas which already have sub-band filters, 2 maybe with 4.5 mil, others are with 4 mil final design; PCBs for 6 more antennas have been ordered -- will come in a week or so.

(b) plans for mass production : switch PCB (20 nos) were available, along with sample chassis; agreed to first put on one antenna; if found acceptable, then go for mass production; compact v2 was installed on C11 and worked fine (tests completed); agreed to give order for mass production alongwith final sub-band filter PCBs; for the switch item itself, 100 nos were available (120 needed); confirmed that this switch is not used in other circuits, hence quantity can be finalised; chassis requirement has been worked out and request has been put (for how many?); mass

production spreadsheet getting ready (by Temkar); meanwhile, 30 nos chassis to come next week (~ 11-Mar-15); spreadsheet still in internal circulation -- changes being made as per suggestions of ANR; has been checked after internal circulation -- needs a few small improvements before releasing.
10 June : spreadsheet is ready; will be circulated shortly.
8 Jul : Temkar spreadsheet is not yet released; meanwhile, Ankur spreadsheet is now online, with modification access control only for the owner; read access for others.
14 antennas with feed + FE + CB and 16 antennas with feed ; one in 3 weeks can be done; may be useful to put spares also on antennas, so that user can have better chance of getting 16 antennas.
==> Temkar spreadsheet content is finalised; will be making it online soon; other items above resolved at other places (to rewrite the agenda).

(iv) post amp + slow rise ps : Hitite 740 new stock for 30 antennas available; slow rise power supply -- agreed that this would be useful for the post amp in common box, but not really required for FE box; new design was done and PCB was ordered & tested Ok; agreed to give this for mass production to cover common box requirements for 30 antennas; mass production PCBs had come, few cards were populated and tested ok; agreed to mass produce, once the layout for the box is finalised and sample unit is integrated successfully in the prototype box. no specific action item here.

(v) Walsh testing for 250-500 : early tests showed both channels working in C13, but only one channel working in C11 -- box was brought down to check Walsh + problem of spurious bandshape of LNA; current action items :
(a) C11 FE box tested in the lab -- Walsh working ok in both channels -- may be a common box problem or D49 PIU? finally, cable from antenna base to top was found to be faulty -- replaced; agreed to test C11 (alongwith S2 and C13) to verify that everything is working fine; was waiting for C11 antenna to be released; finally, tests were done, and working on 2 antennas (C11 and maybe S2) was confirmed; to confirm for C13 and C00.
C13 problem needs to be solved; remaining issues are related to Walsh PROM;
9 antennas can be used. To plan another round of tests at 250-500 to check status.
10 June : C13 is a wiring problem being looked into this week for fixing.
24 June : C13 problem has been fixed; 250-500 tests show : only S06 with problem, rest x23 antennas show good performance;
==> 25 antennas tested at 250-500; remaining 5 can't be tested as Walsh is not generated at antenna base due to different IF circuitry in D49 PIU. Same 25 antennas working at Lband also.

1.7 Final version of 250-500 FE box -- from 22 Jul and before (ANR/SSK/HSK) : modelling showed that existing size of box is not adequate (inspite of double deckering of chassis); deeper FE boxes are needed -- 15 cm longer box was made (wt of new empty box was 15 kg) after mech group confirmed that this is ok (present depth is 468 mm, can be increased to 700 mm; also, rear member in the cage can be removed to further increase depth); also total weight of populated box will go up by a significant amount. One such bigger box was populated as a prototype and put up on C13 and tested; increased size and weight of prototype new box makes it unwieldy to handle at the focus and is a potential problem; FE group worked on compacting the contents to shrink it back to the old size, with minimum increase in weight : some of the smaller units were integrated into single units; milled chassis were replaced by plate+rail chassis wherever possible; ver2 box with everything fitting inside the original box (now 19 kg, down by 9 kg) completed and tested in the lab; unit #1 installed on C11 and tested fairly one; later, it came down for checking Walsh and some other problems.

Present status is as follows : C13 has original (heavier) new box; 1st unit of final (v2) box (which went originally to C11), is now on S2; 2nd unit of final box is on C11.

Current action items :

(i) installation of new boxes : 3rd unit of final v2 box was expected to go on C00 (Temkar responsible for final testing & release) -- was finally put on C00; however, oscillations were seen -- brought down and tested in the lab; LNA was changed & box was installed back at C00; deflection test results showed working ok, and appears to be holding fine so far (27 May); check current status of this; also, update about plans for next box, and schedule for reaching 16+ antennas at 250-500.
10 June : COO seems to be working fine; next box went to W4 to replace the old one (which will be refurbished and put on next antenna); rate of 1 per month is quite feasible, except for the problem of sub-band filters; agreed to put up the new boxes as they get ready, without waiting for sub-band filters and retrofit as needed; target is to reach 18 by 15th Sep; question is how many are up now? 13 were confirmed, including C8 (FE team to provide exact status) -- may need to do one in 3 weeks.
24 June : C08 to go up this week.
8 Jul : C08 is up but there are some performance issues being looked at right now. Actual present count to be confirmed (see item above).
22 Jul : now problem at C8 not seen; to confirm present status.

(ii) choice of reflective paint for the final FE boxes needs to be made : a few different options available (ref : APK, HSK) -- need to identify the best option; methodology of the tests to be done -- empty box to be painted and tested in parallel with control unit (without paint) using in-situ tempearture measuring device; issue of possible clash with powder coating needs to be understood.
3 types of FE boxes handed over by mech groupt to FE team : (a) plain box with powder coating (b) box painted with HT400 (c) box painted with HT 600; initial results from 5 day continuous run, having 4 curves : ambient showed large increase at sunrise (even a spike to 55 deg); for the box temperatures, results were slightly confusing as one box under test and power coating box tracked each other very well and other box under test behaved worse than these 2 (!); also there is extra cooling in the night ! Further tests also appeared to show that this is not working out; FE team prepared a brief report with the data and their conclusions; issues discussed were : current coating thickness 0.7 mm, to try higher value [can that help ?? skin depth much smaller]; are we using the correct type of paint?
new options for reflective paint were discussed on 26 Mar 2015 -- mech group did some follow-up; some inputs from web-search and from Dr.Shenoy were used to identify proper paint;
Later (27 May 2015) tests were done with SummerCool make of IR reflective paint; at the peak of the ambient temp, the reduction in temp is about 8 deg from ambient and about 4 deg wrt powder coating; at the minima, all are the same (which is somewhat surprising); some follow-up actions identified :
agreed to try with thermocol layer inside in both the boxes; to also try with the insulating foam used in antenna shell; Kale awaiting 2nd brand of reflective paint.

10 June : some new tests have been done; update by Sanjit shows that the best results are still for the SummerCool coated box (the one using the material used in the antenna shell gives intermediate results); to wait for the 2nd brand of reflective paint (from HSK) and then decide the next course of action; also mech group wants to do one test using thin layer of insulating material on the inside of the box (see relevant agenda item in alternate week)

24 June : new insulating material (for trial) expected from HSK; what about status of 2nd brand of paint?
8 Jul : action items pending with HSK; no updates today.

1.8 Status of improved 500-1000 MHz CDF -- from 22 Jul & earlier (HRB/GSS/SSK) : there are 3 different versions of dipole (v1, v2a, v2b) and 2 versions of cone (v1 with 66 deg and v2 with 70 deg) in trial phase; 3 test feeds have been built using these :
ver1 : dipole v1 + cone v1 : RL is OK, deflection is not good & falls with freq
ver2a : dipole v2a + cone v2 (mesh?) : RL is good; deflection is OK & flat with freq
ver2b : dipole 2b + cone v2 (solid?) : RL is VG; deflection is good but not flat.

Simulation results for different combinations of the above were carried out and discussed in detail : it appears that dipole (rather than cavity) is dominant for deciding the RL behaviour (and also H-plane taper?); cone appears important for E-plane taper; best results for RL and good beam pattern match over large freq range appear to be for dipole v2b (triple sleeve) with cone v1 (66 deg).

Current action items are af follows :

(i) Running the simulations :
(a) Simulations with denser mesh case (higher order basis functions): new simulations were done with finer planes rather than with higher order basis functions; this needs to be confirmed; also, 50 MHz shift that is seen needs to be understood; also explore default number of current elements in simulation (from 19 Dec 13 meet); discussion with WiPLD indicates that increase in PolDeg may make a difference; tried with some changes in values of PolDeg related but no change in the results is seen; to contact WIPLD to see if they have a case study that exemplifies these effects and then decide the future course of action. WIPLD had sent a response but it had not been tried as PC was down;

(b) PC problems : licensed version of windows7 was obtained and installed on the lab PC but still had problems : may be some hardware issues (hanging or shut down); finally, after several months, all problems resolved & PC working properly (c. early March 2015)! however, still some problems : display goes blank at times; replaced with another PC, occurence reduced but problem persists; finally (around 10 June 2015), tried on a different PC in the same lab (to explore if problem is due to 'older' version of PC/ hardware)
24 June : Now WiPld working on x2 different Dell PCs; to decide future course of action.
8 Jul : need to decide on an action item here.
22 Jul : to look into PC procurement for this.
==> some solution is being worked out by YG for the PCs.

(ii) there is noticeable difference in simulated and measured RL curves which needs some study also (it appears that agreement was better for 250-500 CDF?); to check if new simulations make any difference or not (the same can be compared for the test range pattern measurement results for the two feeds?) -- this is not being actively followed right now.

(iii) deflection tests for different combinations of dipole & cavities (as mentioned above) for varying distance from focus using a variable height stool to see which design gives optimal performance :

After a lot of effort, a reasonable set of results on Cass-A obtained for the different combinations of feed : 750 MHz Kildal feed turned out to be very similar

in response to Cone1-Dipole2); Cone1-Dipole2b as well as Cone2-Dipole2b gave results similar to CSIRO feed plots obtained in ~ 2011; later, it was discovered that using short length cables to minimse the loss made a significant difference to the results.

for cone2 + dipole2b at optimal ht of 1260 mm + matching short length cables (0.6 m instead of 1.4 m) was tested on C10 -- showed measurable improvement ~ 1 dB over most of the band (!); further reduction to 0.3 m cable appeared to produce another ~ 0.5 dB of improvement (!!) over most of the band; agreed to follow-up with LMR low loss cable; tests done with new arrangement of QH + LNA mounted on plate and kept right next to the feed showed another ~ 1 dB increase in sensitivity at 610, but no improvement by 800 (note that this was a different LNA and not the same one used in the FE box, with the matching connectorisation); further tests with LNA used with CSIRO feed (SMA coupler may be producing some loss), mini-circuit LNA (very bad result); best result is for ~ 0.15 m long cable connecting feed to LNA directly with type-N;

for cone1 + dipole2b, peak was found to be around 1310-20 mm ht; also a new version of the CDF was introduced with a "choke".

Deflection plots for one chan for above 3 combinations were discussed (13 May 2015): cone2+dipole2b gives the best overall deflection curve; cone2+dipole2b + choke gives almost identical curve to cone1+dipole2b (!) and both are worse than c2+d2b.

Agreed to confirm 2nd poln is similar in behaviour & to get beam shape plots done asap; to prepare comparative chart with CSIRO feed results for taking to GSG level. Most of these matters were resolved, tests were done and results were presented in GSG of 8 June 2015 and clearance to go ahead with C2D2b design was obtained; now, need to close the loose ends and move forward.

Around 5 June 2015 : prototype C2D2b feed was replaced with new unit (with better stool arrangement?) and first round of deflection tests with this showed slightly lower deflection compared to earlier (for Cyg-A and also Cas-A); also, first beam shape tests showed slightly larger (~10%) value than expected (e.g. ~ 50' instead of ~ 45' at 610), also the prototype version showed Az values to be ~ 50 larger than expected -- all of these issues need to be understood and resolved.

10 June : in order to move forward after GSG : 2nd prototype put on C10 on 5th June, now has final FE box (hood) with 15 cm semi-rigid cable; fresh data for deflection and beam shape for both channels has been taken over the last few days, and the conclusions need to be checked and understood.

24 June : HRB summarized results from tests conducted over last few days/nights which are very satisfactory (as a 'final' option); (about ~ 1 dB peak-to-peak noise/ oscillation is attributed to test equipment (needs to be confirmed); also spikes in beam size plots attributed to RFI (needs to be confirmed); meanwhile, HRB would like to try with a modified version of cone2 (reduced length of the cavity) to see if it affects the beamwidth.

Comparison of beam shapes for the 3 feed combinations to see which is better : quick results from PMQC data (at 610) give some indication that cone1+dipole2b has slightly broader beam (?) -- need to get full RF test data taken and analysed, for both cases; finally plots of beamwidth vs frequency obtained from Manisha's program were obtained (May 2015) : showed ele and az beamwidths varying with freq, but with some difference in slope, and also absolute values are higher than expected

(x2 for Ele and x4 for Az); finally (early June) these issues were sorted out and a series of measurements were done from ~ 6th June 2015 onwards. These showed that C1D2B has a beamwidth that matches closely with the "expected" curve and the same was true for the C2D2B with choke, whereas C2D2B clearly showed about 10% larger beams than "expected". These need to be followed up for checking repeatability and understanding the discrepancies.

24 June : Displayed plots (beam size vs frequency) from measurements on different dates show great variation (some even theoretcally impossible - like too narrow angular size) - for antennas S06, C03 & E05. (It was suggested that the strategy should be to first identify the RFI affected data & discard the same before being included in the plots);

Action plan suggested (c 24 June) to be followed in the near future :
(a) to resolve the conflict between beam width measurements reported by regular PMQC tests vs those obtained from the beam fitting code vs expected values -- is there an issue of definition (or use of some constants)?
(b) to test "final" feed combination with next gen LNA alongwith final version of hood + FE box
(c) to test the alternate (shortened) cone2 design

(iv) Also, GP to work out the sensitivity curves for the expected parameters for this range : first version has been done, may need some refinement. There is some indication that some of the drop in sensitivity at ~ 750 MHz may be due to slight (10%) increase in Tlna -- this needs to be investigated in some more detail. Refined analysis with 2 different (fixed) values for T_lna show that the range of variation of T_lna over 600 to 750 MHz can explain the change in sensitivity seen in the expected curve. To check about options for retuning this LNA design; meanwhile, can test the commercial off-the-shelf broadband LNA available in the lab (which may have constant T_lna of about 30K) to see if it can be used to test flatness of the response across the band. Meanwhile, ANR to look at the existing LNA design critically to see what are the characteristics and what can be done to improve the Tlna vs freq. Also, can there be a matching problem? Agreed to take the 250-500 LNA PCB and adapt the ckt for 550-900, with the aim to improve the Tlna at high frequencies.

13 May status : expected curves made for varying values of Tlna, Eff and RL and some differences can be seen clearly : low freq (~600 MHz) matches with Tlna constant at 19 deg; high freq (~800 MHz) matches with Tlna of 28 deg -- consistent with known / measured Tlna variation -- to try to retune for ~ 19 deg across the band (or higher at low freqs), starting with simulation (can use the 250-500 PCB and chassis);
RL variation : varies from about -10 to -20 : there is scope for improvement at edges of the band (HRB can go back to simulation at some time to see); also 65% constant efficiency shows some improvement, esp at high freq side -- not sure what this is due to and what can be done to recover this... Need some follow-up.

(v) any new ideas? discussion of 19 Dec 2013 came up with following action items:
(a) design Kildal ring feed at 750 MHz using v2b dipole -- 14 dB RL achieved (over what BW?) -- first results from sample unit (tried on C10), including varying stool height, and the conclusion was that it is not as good as C2D2B (see earlier discussion) -- this can be taken as closed (May 2015).
(b) try simulation of CDF250-500 scaled by factor of 2 (including with different dipole sleeve combinations) -- maybe after (a) is done; status update needed; this is also now not relevant and could be closed (May 2015).

(c) design Dual-ring feed 550-900 MHz (intial BFRs can be made for 650 & 800 MHz)
-- waiting for above items to complete; also not relevant now (May 2015)
(d) modified version of cone-dipole based on patent by Shefai + ... (1991) : refers to Kildal paper of 1982; recommends additional choke structure just below the cone but protruding out to lambda/4 : supposed to improve (a) cross-polar (E-H match) by 30 dB; (b) reduce back-lobe and (c) ???; agreed to cross-check the date of the paper on which our cone-dipole is based; agreed to build a prototype using cone2 (why not cone1?) matched to lambda at 750 MHz -- this was done and tested on C10 (see results reported above) and was NOT found to give results better than original C2D2b design (turned out to be similar to C1D2b performance); can be taken as closed (c. 10 June 2015).

22 Jul update : reduced cone-length feed version put on C2 antenna; results displayed by HRB - no improvement in angular size vs freq; existing feed will be restored in C2;

==> Summary : feed removed from C2 and original 610 coax feed restored; modified hood being made ready at w'shop; will come by end of this week; all the electronics for it is ready; and FE box is also ready; can go up by middle of next week, provided fixed ht stool can be made ready; likely antenna is C2; some work from mechanical side is needed. Plan would be to have this up on the antenna for about one month; and then take a call for final mass production.
Discussion with mechanical : new hood + feed will come to GMRT by Sunday / Monday ; stool in MS can be made at GMRT and ready alongwith hood + feed; long-term plan for production of feed+hood and stool (in SS) to be done.

1.9 Design of new RFCM card (v3) -- from 22 Jul & before (SSK/Imran/Sougata) :
RFCM card (v1) was built as part of generating spares for Lband system and fully tested for all control functionalities -- for Lband, as well as for 250-500 FE box (alongwith patch card); it was agreed that since this RFCM card can not do monitoring (without further changes), old RFCM card + patch card will be used for present in the new FE box; will upgrade later to new RFCM card with monitoring capabilities included. Later, 5 monitoring points were added to the existing card, tested ok.
Plan was to enhance the design of v1 by explicitly adding the monitoring facilities & full compatibility with new MCM card so that it can be used in all FE systems.
A prototype version of the v2 PCB was designed, sent for fabrication, assembled, tested and incorporated into one Lband feed (which is now on W1) -- it still had some unresolved issues about bringing out the TTL lines and to take in the 8 monitor points : appropriate connectors need to be put for this; new PCB (v3) was designed and sent for fabricationl; 12 nos had been fabricated, received, assembled & tested; all cards were found ok, but not yet integrated into a box -- agreed to complete this before going ahead with mass production (~ 120 cards may be required in the long run); v3 card was then tested ok in different conditions : L-band system on W6, 327 FE box that is now on C11, 130-260 box on C10 etc.. PCBs for mass production quantities were done and components required were procured; plan is to assemble and use as needed. Pending issues are as follows :

(i) report : first draft was discussed : generally ok, but needs additions about monitoring points and internal review (c 4 Feb 2015); some significant changes were made and 2nd version was released and discussed (13 May 2015) : details of the work done is very good; need a few changes : motivation for making new RFCM card to be explained better in introduction; more detailed comparison between original and final card to be added in redesign section;
27 May : Imran is working on the modifications; can check after 2 weeks.
10 June : not much progress on this in last 2 weeks; can check again after 2 weeks.

8 Jul : no progress reported.
22 Jul : no update.
==> updated report has been submitted.

1.10 Next Gen Common Box -- from 22 Jul (ANR/SSK) : Like 250-500 FE box, final version of Common Box needs to be assembled and tested : final power & temp monitor (are in hand), interface to Rabbit card (work in progress), design of new RFCM card (work in progress), new arrangement for power supply distribution; a block diagram of the new box has been prepared and circulated and accepted after some modifications and improvements; it was agreed that old boxex can be re-used (no need for making new boxes), except for the issue whether new MCM card can be inside or needs to be outside the common box (the former option would be preferable); action items to be looked into :

(i) The interface card in common box needs extra PCBs due to wear and tear of existing PCBs. One to one copy of the card to be made as a new PCB, on lower priority. Work is in progresss (Sougata); may be ready to go for fabrication by 1st or 2nd week of April -- not yet ready to go for fabrication (13 May);
27 May : was at low priority earlier, but need to increase priority now. Sougata will get back by next meeting.
10 June : will go for fabrication this week.
22 Jul : PCB has come, populated & under test;
==> testing not yet completed.

(ii) FE team has worked out a plan for integrating the Rabbit card inside, which requires to swap the interface card to the other side of the box; to ease the wiring problem, the centre plate needs to be cut into 2 pieces; some issues about stacking of power detector with broadband amplifier need to be addressed; integrated power supply card is included in this scheme; media converter added to allow for additional capability of fibre connect from top to bottom (as an alternate to shielded eth cable or serial link on RS485) -- FE team plans to mount it outside; confirmed that RS485 serial link will be supported as default option, and that eth over Cu is not viable; sample unit assembled and looks ok; wiring is ongoing -- to check if ready for testing now.
24 June : FE group's work completed; Telemetry group needs to test Rabbit card etc.
8 Jul : FE has tested the box fully using current MCM card; now it needs to be tested with Rabbit card interface, with existing command structure (!) -- need a discussion with telemetry team about this !

(iii) getting sample box ready : to take one old common box, get new plates made, put dummy boxes and work out the wiring scheme : mechanical items were completed for the sample box and all the items were available, including Rabbit card enclosure, slow-rise power supply card etc; wiring was to start after completing the layout -- this needed to be redone as things did not fit into the box in the first attempt; mechanical issue due to space crunch, required swap switch PCB and chassis to be redone. Swap switch PCB + chassis now ready and being tested; after that will be ready for integration in the box; sample unit assembled and looks ok; final wiring is ongoing (13 May)
27 May : VBB, Ganesh and Anand are working on it, but delayed due to 250-500 related matters; can check status after 2 weeks. Should be ready by now ?
24 June : Nothing pending with the FE group (wiring completed);
8 Jul : Box ready (see above); longer term plans : have 2 older style CB ready; and 2 of the new, modified ones ready and then start the cycling process on the antennas. For that main items required will be post amp (for remaining 14 antennas only);

Rabbit card in shielded enclosure (to be supplied by telemetry); new power supply card; new interface card and power + temp monitors. May be possibe to do one in 3 weeks, as far as wiring is concerned; can use the boxes that come down, except that front plate assembly will need to be changed to accommodate ethernet connection; outer shell of the box can be reused, like in FE box case.
==> 2 new boxes are ready with all electronics and wiring; one (maybe both) are tested using existing MCM card; Rabbit card with box has been mechanically integrated; now awaiting testing via serial connection using (a) online V2 (b) existind command set. Ops group is going for option (b) and have already implemented 10 out of 23 commands and then monitor part has to be done, and being done with 100 m long serial cable. When completed, will put the Rabbit card inside common box and test with each FE box, and then a final combined RFI test before moving to antenna.

1.11 Calibration scheme with radiator at apex of antenna -- from 22 Jul & before (SSK/PAR/SRoy/DO/YG): Current set of issues being tracked are as follows :

(i) testing of dynamic range of old vs new electronics on specific antennas :
First round of tests were done on C0 and C1 (both old electronics); C4 was the first antenna with new electronics that was tested (in Dec 2013) and compared with C1 (old electronics); informal / short report was produced, which showed that : 1 dB compression pt has improved by 6 to 8 dB (from -6 to -10 dBm to about -1 to 0 dBm); change in phase (and also ampl?) with change in elevation shows cyclic variation -- may be due to position shift? W1 was identified for testing repeatibility on new electronics, in addition to repeating on C4 itself (though it has old common box).

Summary of new results :
Sensitivity and 1 dB compression point results look ok; stability of ampl and phase response need some interpretation; fair amount of new data is available which needs to be studied and the summary understood and then taken up for discussion -- this was done, and conclusions about 1 dB compression point are reasonably clear and ok (need to compare with results from signal flow analysis results); for the ampl and phase varn with antenna position, the results and conclusions are not very clear, but there appears to be some indication of the variations; a more detailed study with a couple of concrete follow-up options may be considered; agreed to complete the 1 dB compression point comparison with SFA; to repeat tests on either C0 or C1 to check validity of old results

Updates from results extracted from the analysis :
1 dB compression point values shown for C4 and C0 (new and old) show 7-9 dB change between old and new electronics; there is a hint for frequency dependence with reducing improvement at higher freqs; agreed to check with 20 MHz steps of CW radiating signal for both these antennas, in the range of 250 to 500 MHz.
Results replotted to show ampl, phase and elevation vs time on same panel -- there is clear anticorrelation of phase with elevation; for ampl, things are not so clear; for phase there may even be some frequency dependence in going from 150/400 to 1250 MHz; to try the test for broadband response alongwith n/w analyser; also give a copy of the data to SRoy to try plotting ampl/phase vs elevation directly.

Current action items :

(a) confirm when new common box was put on C4 (12th July 2013; sr no 119) -- to correlate with results. PAR to confirm results from data before and after this date.
24 June : No updates for a very long time -- to close or not to close?
8 Jul : can be closed, as there is not much data before July 2013.

(b) to get comparison plots for C4 with old and new radiator antenna : new data taken with new antenna at 327 Mhz : 6 dB ampl and 40 deg ph for elevation angle cycle -- this appears to be larger than that for the old antenna;
24 June : No confirmation of this forthcoming.
8 Jul : ampl loss can be explained due to poor return loss of feed, and extra phase may be added to the signal? item could be noted and closed.

(c) to check the change in 1 dB compression pt against SFA numbers -- this has been done and they compare well; to extend this to test 1 dB compression point at different stages of the chain : from OF i/p to GAB o/p; tests have been done and upto optical receiver output [OF Tx Rx FE CB] 1 dB compression point available; first presentation of results (29th April) :
C4 antenna, 450 610 1170 MHz 3-plots : 1 dB compression point variation with freq - plots shown :
first for 610 MHz :
[FE] saturates at +11 dBm (@input) Blue
[FE+RF amp] serenza +4 dBm (@input) Red
[FE+RF amp+opt Rx] saturates at +0 dBm Pink
next for 250-500 [450 MHz] :
[FE] +4 dBm; [FE+RF amp] -6 dBm ; [FE+RF amp +opt Rx] -11 dBm at 1170 MHz (L-band) :
[FE] +1 dBm; [FE+RF amp] +1 dBm; [FE+RF amp+opt Rx] -2 dBm
Conclusion : while FE system provides for the designed head-room, for some cases, later sub-systems restrict that dynamic range; needs discussion to chart out future course of action.
Some discussion of the results -- reasonable first order match between measured and SFA values; some consistency checks are needed.
8 Jul : overall this looks all right, except maybe for repeatibility tests; can modify the agenda item accordingly and close some aspects.

(d) to repeat on another antenna with new electronics and one with old : W1 had been identified, and work for RF cable and antenna mounting related arrangements was completed and tests were to be done -- agreed to defer this for some time.
this is not being pursued; instead can try on C11 and C13; instead of W1, C4 in in progress? to confirm status of this activity.
C4 has one of the new antenna; put one more of new radiator antenna in dish with old electronics, and old radiator in C11 or C13 kind of antenna. Check current status.
Repeat for C4 -> C13 antenna (honeybee issue led to delay; maybe can be done by 30-Apr-15; to check current status.
27 May : 1 dB compression point tests now done for C13 also; details, alongwith comparisons, to be sent shortly.
10 Jun : first results from C13 discussed : getting similar power levels as C4, except for 3-5 dB kind of differences (for 325 MHz) and other wavebands also... shown that the Aronia radiator works ok down to 150 MHz.
8 Jul : results for C4 and C13 for 3 wave-bands (610, 250-500 and Lband) at 3 stages of Rx chain are available : to compare these to check repeatibility; then identify a 3rd antenna. If this succeeds then the main goal of the 1 dB expt can be taken as met; only when new wave-band is installed (e.g. 550-900, 130-260).

(e) to check meaning of results from other wavebands that have been done.
tabulation / report to be made ready in a week -- to check status of this.
8 Jul : see above for a summary.

8 Jul : long-term prospects : agreed to generate a concept note for long-term usage,

with pros and cons listed for detailed discussion later on; Pravin to make the seed version and circulate.

(f) to share the data with SRoy to get the plots done for the variation with antenna position (elevation etc) & then work on interpretation : results from plots of ampl or phase vs elevation angle show clear distinctive shape for the ph vs angle and less clear shape of ampl vs angle; also there is slow secular variation of ampl and phase with time; to try and model ph vs angle with a mathematical form and see what physical phenomenn matches that form; first attempting at fitting with a mathematical fn has been tried; new data now with SRoy; on 1 Apr15, SRoy has sent an update on the analysis done by him on long stretch of data from 8 april 2013 (!); plots made vs az and ele (instead of time) show no strong evidence for systematic variations with ele. This needs to be checked and discussed and understood; no other updates on any other item, as RFI team has not done any work in this area in the recent weeks.
SRoy has sent some fresh plots of ampl vs elevation -- don't quite show the expected behaviour -- need to check carefully, and also get phase vs elevation.
27 May : SRoy has now made some plots of phase vs elevation and they do show a sinusoidal pattern -- this needs some discussion and some follow-up action; agreed to try to separate into 2 categories : one for increasing ele and one for decreasing else.

10 June : meanwhile, new data taken by FE team and discussed briefly : may be 0.5-0.8 dB gain varn and 5-8 deg phase varn with elevation wit the latter more systematic. FE team to give final summary and also circulate data to SRoy -- this is still pending !

8 Jul : summary by SRoy : ampl variation is not confirmed to be smooth or systematic variation that can be fit with a mathematical function; whereas the phase varn does seem to show a clear pattern which can be modeled; SRoy agreed to summarise the conclusions so far, incuding any difference seen with old and new radiator antenna..

(g) new tests with sweeping of RF to check 1 dB compression points with finer resolution over the band -- some tests have been done at 610 band and after corrections, fairly good match for gain curve is seen, but some variation in the 1 dB point with frequency... to try 250-500 with old antenna in steps of 25 MHz at C11 and C13. 1 dB step data in ealier plots above ; 25 MHz step data collection planned; to check current status.
22 Jul : to be done at C10;

(ii) Understanding change of amplitude with change in antenna elevation :
SRoy has done the basic calculations but needs to cross check against the beam width of the feed to estimate the amount of deflection / shift between feed and transmitter at apex required to produce the measured change in signal level.
Test done by Subhashis by rotating the feed : power falls by a factor of about 4 with about 600 counts from the 0 reference position (-700 to +200 arcmin range) : fitting a gaussian to the voltage pattern (asymmetric) gives a HPBW of about 21 deg (about 15 deg for power pattern); this gives about 2 deg for 0.5 dB change in power. SRoy to refine the calculations (including other antennas) and also check Raybole's new report on this matter and summarise for a discussion.
drop in power is 4 sec out of 20 sec ==> 15 deg is 3 dB beamwidth (ok with other test of SRoy); ==> about 2 deg for 0.5 dB change; if converted to lateral shift of the feed, it may be close to 1 m -- to check alternative interpretation about rotation about feed axis by the require angle. not clear if the matter has been

resolved or not; SRoy has circulated a first draft note; agreed to discuss during the meeting of 13 Aug; meanwhile, SRoy to circulate a drawing to illustrate the geometry. both documents have been circulated, and a discussion is required... some discussion about the analysis done by Subhashis : whether lateral translation of feed converted into an angular shift is enough? does the transmitter beam pattern make a difference? how much rotational offset of the feed would produce the same change.

(iii) deployment of new broadband antenna : suitable unit (from Aronia) had been identified and ordered : 2 nos with slightly different freq coverage are there -- looks like will work from 100 MHz to few GHz (hence OK for our use); one unit mounted at C4 and tested with broadband noise source covering all GMRT frequencies; found to work ok to first order, but there are some frequencies where there is loss of power -- being studied; also, tested with varying power levels of noise source and data is being aanlysed; first version of report has been circulated; few points raised are : why 1 dB compression pt changes dramatically for some of the frequencies e.g. 327 vs 393; to check consistency of results with earlier for same frequency; then check change in ampl and phase response for other freq; to check the angular pattern of the new antenna and compare with the earlier dipole antenna that was used -- to check what has been done and discuss the new results; to send one data set from old measurements to SRoy for same kind of plot; to cross-check measurements of old and new at the same frequency; some data has been shared with SRoy; preliminary look has been taken and more detailed anaysis is ongoing and results can be discussed two weeks from now.
SRoy wants to check if correct parameter is being used for antenna coordinate; also to make the plots for couple of other data sets to verify the issues.
One unit has been installed in C13 dish, and used for 1 dB compression tests (before, it was used at C4); for future plans, to try and put on one antenna like C10 where most of the wideband feeds are present and obtain response from 120 to top of Lband in 5 MHz steps to see if this radiator is sufficient for all GMRT bands.

10 June : No updates; to check 2 weeks later for updates.

1.12 Walsh switching arrangement in FE -- from 22 Jul & before (SSK/SCC/PAR) : Some tests have been done on the bench by FE group; first draft of report has been circulated. Current action items are :

(i) to devise a simple test using Lband system + radiation from apex to demonstrate the working of the system (on any antenna) -- agreed to try and couple this with the new test set-up at W1; agreed that CW test can be done to check functioning of modulation scheme when other tests are done at W1; FE team tried 4 antenna test including C13 but could not get a definitive answer; appears that the problem was due to improper test cable used at antenna base; new cable with all cores connected was made and used; further, it was found that Walsh eeprom IC has been removed from all antennas be BE team -- restored in W1, and tests done : this looks like working satisfactorily in first round testing. To go to next step of getting the signal to receiver room and check on oscilloscope (one pol can still be going to the VVM at antenna base); 2nd step will be to talk to BE team and get the end to end test going. Antenna base tests completed (instead of C04, done at W1 - why ?); demodulation at receiver room not done yet -- to check status of these activities.

(ii) further, Walsh switching has been tested on C4 with astroomical source : loss of correlation happens when Walsh is turned ON (need to understand upper and lower bit in Walsh); next step is to match it with the demodulator in the back-end system.

Summary : radiation test from apex done at W1 to show that Walsh switching is happening; astronomical source test done with Walsh on-off at C4; in addition C11 and C13 are Walsh-ready and should be tested in similar mannaer; after that, to take up discussion with back-end team about extending test to demodulation side; C13 tested ok in both pols; C11 : required change in IC of Walsh gen ckt; result shows one poln work and one not working -- to confirm if working or not. Work on verifying that Walsh works is pretty much over; need to work with BE team to do end to end test.

Fresh set of tests to be planned after MTAC, using the following standard procedure : get all antennas including one under test to fringe; then turn on Walsh for just the antenna under test and verify the loss of fringe for this antenna (for both pols); if does not work, then appropriate debug to be done to localise the problem in FE box, cable or Walsh generation circuitry; also item on upper and lower bit need to be understand. To try this for all 250-500 antennas with new v2 FE box. Test report of 7th May shows fairly decent results, except for issues related to C1 and C13; some isues with Walsh EPROMs -- BE team is re-installing original Walsh EPROM in all CSQ antennas.

27 May : C13 needs check of cabling / wiring as Walsh bit is not reacing to top; EPROM installation done for 9 out of 14 antennas -- to check remaining 5 antennas.

1.13 OF links : new and old, from 22 Jul and before (PAR/SSK) : This involves getting the new, broadband links installed on all 30 antennas and working properly, as well as maintaining the fibre joints efficiently. Following are the action items:

(i) installation of new, broadband links :
22 antennas installed : C0, C1, C2, C3, C4, C5, C6, C8, C9, C10, C11, C12, C13, C14, E2, E6, W1, W4, W6, S2, S4, S6.
Further, S3 was completed and released; next was S1, which took a long time for telemetry team to complete their part; next was W5, but units made ready for this were diverted to replace units on W4 to fix the problem there (early May 2015); retuned units were installed on W5 (10 June); next antenna : E3 (26th antenna).
8 Jul : E3 is completed, telemetry yet to be done; next is E4.
22 Jul : E4 completed (telemetry also); E5 taken up now; W2, W3 & E5 remains;
==> work under progress; will meet 15 Sep target.

(ii) maintenance issues of installed broadband links : see action item under 250-500 system... : 2 antennas C14 and W4, old units replaced by new (which are thermal cycled); remaining will be done if problems are seen. To check if there are any updates on this.
8 Jul : no new action on this.

(iii) long-term maintenance of OF field joints : Growing evidence for problems with older joints (over last 10-20 years); need some kind of consolidated approach to address the problem. Likely causes : nature and condition of splicing equipment? Nature of cover / protection provided? ... Agreed to get the statistics of the old field joints over time, including a comparison of the losses seen with fresh measurements -- this exercise may take 2-4 weeks; meanwhile, urgent attention is required for the field joint near W1 as it is affecting W4 and W3 significantly. There is a technical problem that the newer kits are not compatible with our existing cable and old kits are not availabel -- 2 options ongoing : trying through Chinese company and also workign with mech group for additional support structure.

Trying to understand the problem : fibre cable used is the same type as original; however, the splice kit for new cables is incompatible with older cables -- this problem is from about 2007 / 2010 onwards?; claim is that joints made before this are ok, as the quality of the material in the older (Australian) ones are better.
except if there is a problem of break or crack in the protective coating or the kit.
basic list shows ~ 40 cuts (80 joints) distributed over the array; agreed to produce the table alongwith the loss values; then one can look at the worst losses and compare with other external factors like location, environmmetn and old vs new kit etc.
30 nos of new kits (15 joints) have come; these look quite good and fairly cheap and should meet all the requirements for different kinds of joints; first trial may happen by MTAC. New kits will be used for the joint near W1 identified earlier.
W1 & W3 being done during current MTAC -- to check current status.
W1 to be done on 6-7 May'15; thereafter, take up W3.
13 May : joint at W1 reworked completely -- connection to W3 was the highest loss; next target is joint near W3 -- to be confirmed after checking new OTDR data.
27 May : OTDR data is taken but not yet fully analysed; to check again after 2 weeks.
10 June : analysis of data is ongoing; meanwhile, problem of high optical loss in W6; now made working by putting a higher power laser at 1310 on forward link.
24 June : Measured signal-to-noise was compared between W05 & W06; latter is better by 10 dB due to new optical transmitter used -- this laser has much lower noise (-155 dBm compared to older one with -125 dBm); to discuss and decide future course of action.
8 Jul : relooking at the field joints : may need to do one more near W3, but better not to touch it now; for high power laser at 1310 for telemetry + LO (forward link), W6 soln can be tried on other extreme arm antennas : may have one more in stock; need to find more in the market.
==> indent has been placed for laser; no action on results from OTDR analysis right now.

2. RFI related matters :

2.1 RFI from different spectral lines -- from 22 Jul and before (PAR/SSK) : this covers RFI from TV signals (from cable to terrestial systems + boosters), aviation and radar systems, police wireless and such like.

Summary of the various issues is as follows (specific action items are dealt with later, in the next section) :

(a) TV lines : Cable TV leakage does not appear to be a problem; present thinking is that the lines seen are from terrestial TV transmitters -- mostly in 175 to 229 MHz range. Need a comprehensive list of terrestial TV transmitters in neighbourhood (with large enough range) and their frequencies, and to check which ones are expected to affect us : updated document shows about 17 transmitters around GMRT area -- based on information gathered from DD personnel and web. Not all of these are seen by GMRT antennas (some are very low power ~ 10 to 100 W, including UHF transmitters); the list of ones seen at GMRT is 11 transmitters : 2 of them are at same freq : Junnar & Sangamner; all are analog TV transmitters, except Mumbai DTT (digital transmission at 471.25 to 477.25 MHz). See specific action items below under (ii).

(b) civil aviation related lines -- these may be of 2 kinds : airport radars (e.g. near 1090 MHz?), and transponders on aircraft (and counterparts at airports?) -- these are generally at lower frequencies (TBC). Lines seen near 1030 and 1090 : interrogation at 1030+/- 3.5 from airport and response from aircraft at 1090+/- 5

with width of about 20 MHz. In addition to these lines, 108 to 140 MHz is used by ATC -- again stronger near W-arm antennas. Need a comprehensive list of known / expected lines from civil aviation related activities near GMRT -- the list of lines have been identified in the main document (below). See specific action items listed below under (iii).

(c) any other sources of spectral line RFI : e.g. police wireless etc -- need to be discussed and characterised : work ongoing with omni-directional antenna and disc-cone antenna; police wireless is in 159 to 163 MHz; there are some reports that there is increasing amounts of such activities in GMRT area (earlier it was more eastern side; now also seen in southern side). See specific ation items below under item (iv).

(d) lines from satellites : these include US military satellites (240 MHz region), host of GPS satellites (in L-band), a Russian military satellite system (6 satellites, 24x7, with 12 hr period, single line from each satellite; max of 5 lines are seen : 483.0, 483.5, 484.0, 484.25) etc; plan is to identify as many of these as possibles and then work on algorithms for real-time prediction of when a given observation / pointing will be affected by these (see appropriate action items below and elsewhere)

(e) other, unidentified lines : new RFI was reported in 270-290 range (not quite matched with MUOS frequency) only one incident has been reported so far (?) -- needs to be cross-checked; line seen at 485 MHz (very narrow, almost a CW) -- may be due to radar wind profiler -- needs to be confirmed; see specific action items under item (v) below.

Current action items :

(i) to generate comprehensive report on list of lines seen around GMRT and their RFI influence : updated report with list of lines around GMRT getting ready ; have used log-periodic + disc-cone + actual GMRT data for making final compilation. Highlights of the results : lines are color coded as per different sources of RFI e.g. mobile phone, TV, civil aviation. Good amount of information appears to be captured here -- discussed in fair detail during Dec 2014 : agreed to modify title of report; to clearly mark lines not seen in GMRT region; to think of separate version of table (for external circulation) that has ONLY lines seen at GMRT; to think of prediction algorithm for GPS satellites (similar to military satellites). Updated version circulated in first week of March; some feedback had been given in email reply; additionally, still need to look at ways of marking which lines are seen at GMRT and which are not (including those which are not there all the time), and also to check the figures and have only the ones that are useful or adding value. Revisions to be done to the report and updated version to be produced. Check status -- report being refined; check current status.
10 June : ready for circulating again for a recheck -- has it been done?
22 Jul : report circulated (c. 24-Jun-2015); discussed briefly : need 4 columns for GMRT feeds; currently 3)
==> work ongoing to modify for 4 main bands of GMRT + a few other improvements and will be circulated soon.

(ii) For TV lines :
(a) check for evidence for Mumbai digital TV transmission near 470 MHz : there is some evidence for terrestial TV at 471.25 and 477.25; needs to be cross-checked and confirmed that it is Mumbai digital TV. Level of lines appears to vary from antenna to antenna -- need to do a careful check of this aspect.

Difficult to check at W6 (maint), W5 (no broadband system), can try in W4 (may be seen in E6 also due to reflections?) -- need follow-up.
W6 471-477 MHz digital TV Tx [plots were displayed]; police wireless (tbd in W5) confirmed to be 'Mumbai digital TV' (from direction ?)
W6 plots at 471-477 MHz are suspected to be Mumbai digital TV -- may need a bit more of confirmation.
==> confirmed.

(b) noticed that 540 TV line still leaks through for some antennas (also maybe true for the 175 TV line?) -- need to check if this is due to shift of the filters or not enough rejection of the line. To work with operators (via a note) to ask for feedback on occurrence and strength of 540 line in GWB data. Can also work with Ankur's data to check... Are there any updates on this?
(c) can we take the strongest TV line & characterise if it saturates the electronics or not? Maybe only Junnar TV at 189 & 194 MHz satures only W6 (needs to be confirmed).
Wider notch filter has been put in W5 and W6 as a precautionary measure... need some way to resolve the matter. W6 antenna results plot shown -- what is the conclusion?
W6 data (at lowest elevation; moving from north to south) shows no harmonics of the TV lines and hence may not be saturating -- need to check LNA gain upto 400 MHz to confirm; also all TV lines to be identified in the band against the list circulated in 2014 for known transmitters near GMRT.

(iii) For civil aviation : some follow-up is needed to see if they saturate the W-arm antennas : may be saturating only W6, but needs to be confirmed -- will do as soon as W6 is released from feed cage painting. There may be some evidence for saturation due to 1090 civil aviation line, for short durations only. Need to confirm this matter.
==> this may be the case but needs firm confirmation.

(iv) For police wireless : to discuss with admin if the information about their transmitters (esp the fixed ones) can be obtained -- needs to be followed up.
Raybole and Solanki have planned to visit (alongwith DIC work in Pune) -- this has happened now -- check outcomes and follow-up plans.
JKS + PAR visited police wireless office for discussion; strong police Tx now at Giravli hill -- installed 6 months back (may be causing the saturation); need to send a letter stating GMRT's concern; then their technical people will plan visit to GMRT.
Measurement plots shown 150 MHz (civil avaition line); may need notch filter for 164 MHz police wireless?
Current tests (e.g. data at W6 at lowest elevation) shows saturation at times when the police wireless is the strongest -- need to have the power reduced, as part of the ongoing negotiations with rural police. To get latest update on this.

10 June : Girawali transmitter now running at 15 W (down from 18 W earlier; found 10 W to be too low) -- checked that saturation is avoided for W6 and S6 at low elevations; one set of new measurements made near Giravali by RFI team, yet to be analysed.
==> waiting for complete analysis of data and final comments from RFI team.

(v) New lines :
(a) to check all the RFI lines in 250-500 band (at least 4 have been identified); new cluster of lines seen in GWB output : 332 to 344 Mhz -- need urgent follow-up ! some initial tests have been done looking at specific antennas -- not seen; needs some follow-up. Check status.
(b) to confirm status of about new RFI in 270-290 range; any updates?

(c) follow-up on Russian satellite sytem : exact range of frequencies (483 to 484 MHz or just 483 to 484.25?), how many lines?, trajectory of the satellites?, not seen in low elevation scans?
(d) new lines seen in around ~ 340-350 MHz : seen in few antennas, in one pol only; not yet understood. Any updates?
==> no clear origin for 270-290 and maybe 340-350 ?

(vi) omni-directional antenna needs repair and replacement also; processing for 10 nos (including remote location sensing) was ongoing -- order had been placed; all 10 nos arrived around mid-Jan; one unit opened to verify the components; 2 units assembled and performance tested and found ok; plan to mount 3 antennas at 3 different heights on the wind tower of servo.. change in plans... to discuss the goals of the exercise and decide -- to be discussed alongwith prioritisation of all the RFI related jobs.
To try and make it work at one remote antenna site and show that it works.
==> some measurements done and will be takne up for discussion.

2.2 Radiation from CAT5 cable -- from 22 Jul & earlier (SSK/PAR): Follow-up on action from 3 Apr 2013 (!): to install shielded CAT5/CAT6 cable in conference room as trial and finalise the scheme for all other public places in the building: first report had been circulated that combines testing of switches and CAT5 cables; conclusion was that use of shielded cable makes significant difference to the discrete lines as well as to broadband RFI. Agreed to go ahead with controlled expt in GMRT Conf room to quantify the improvement; tests had been completed, and report showed not much change in radiation level with and without shielded CAT-5 cable in conference room (!) -- maybe dominated by RFI from other equipment in the room? Agreed to move ahead by extrapolating from the results of testing of Miltech + switch : to try and estimate the cost of material and labour (time) for changing to shielded cable + connector in all the unshielded rooms of the building; discussion on 16 Jul 2014 : table of invetory of un-shielded cables currently in use (94 copper lines); total length ~ 1200 metres; procurement of shielded cable was initiated; data was submitted by RFI team, and an updated document had been circulated; about 900 m cable (3 rolls) + crimping tool need to be ordered (enough connectors are available); total investment is about Rs 1.7 lakhs : agreed to go ahead with this; item was under negotiation about details of the pricing (Rs vs $ quotes due to difference in value); meanwhile, work had started using existing spare CAT5 cables (old stock) to replace older cables in various labs, as per their requirements; conference room & canteen annexe has also been done; meanwhile, folder for main order was followed up and it appears that there is no choice but to go with the Rupee quote and hence total outlay will be ~ 5 lakhs.

Current action items :
(i) Status of completion of the work in different labs and rooms : conf room, canteen annexe, EPABX room and all engineer's rooms, user's room are done; rest are waiting for main order to supply. delivery has happened now (29 Apr 15); can initiate the work with consultation of digital team...

(ii) To check status of final order and availability of cables, connectors, crimping tools etc; finally, order is gone; to confirm expected date of delivery; finally, after a lot of delay, items received on 28 Apr 2015. To check if anything more is on order or needed; otherwise close this item. This can be closed.

(iii) Need to work out a scheme for proper long-term maintenance with OF and computer group : at the level of PAR to MU it has been discussed -- SSK to send an email to

formalise the arrangement; cables, connectors, tools given to Mangesh; a concluding discussion may be required with computer group. YG to bring up with BAK -- need to try and close the matter. Item discussed in meeting of 13 May : not clear what is the best way to close it...

2.3 Effect of military satellite RFI in 243 band -- from 22 Jul & before (PAR/SSK/SN) : follow-up action on testing for saturation effects, decision about appropriate location of switchable filter, possibility about control room (ops group) being able to come up with algorithm for prediction (for users); results for tests done by pointing to the satellite (and tracking for some time) show increase in total broadband power of about 12-15 dB on the strongest satellites (others are weaker) -- this leads to harmonic at ~ 500 MHz also visible; there is good evidence that the FE is saturating as harmonics level does not change with changing OF attenuation; current action items are as follows :

(i) filter related action items : to try a test where filter is inserted in the path (for 2 antennas) -- done for E2 & C6 and check effect on other bands (610 and Lband); need to decide if we want this filter in a switchable mode (at FE box or Rx room) or permanently in the path or not at all ! does the answer depend on the strength of the signal? not clear... trial results on one channel of C6 was to be circulated for getting feedback... ssome results were displayed by Ankur. filters are still there in C6 & E2 -- can be checked.
22 Jul : both filters (Ch-1) on C6 & E2 have been removed now;

(ii) to test saturation effects and limiting angular distance from satellites : we need to quantify at what angular distance do the signatures of non-linearity (harmonics) show up; agreed to try for a plot that shows power in the RFI band as a function of angle from the satellite; and also to quantify when the alarm turns on; to do the finer experiment to find the angle range that avoids saturation and to plot power in fundamental and harmonic as a function of angle from satellite.

Some action items are as follows :
(a) 2 kinds of tests done : keep Az fixed and move in Ele and vice-versa : yields +/- 2.5 deg as the width over which saturation is seen -- tested for 2 satellites which show saturation. To confirm status of this and see if final conclusion can be drawn. Waiting for couple more measurements.

(b) It appears that 2 out of the 6 satellites have 2 deg limit for saturation. Can we put this as the default limit for all the satellites? Ops group to generate statistics of the duration of encounters in the current set-up. This needs to be followed-up, including checking the log that Santaji has created.

(c) Need accurate positions of the satellites -- to be tried using GMRT antennas itself?

All these data have been taken; waiting to be analysed -- this should give more accurate positions of the satellites. Check status of this work.
Az-El data taken Az=26deg El=59deg
2 datasets give 2 different AzEl for satellite (!); need more measurement to confirm which is 'better' coordinate [for giving alarm]-- methodology and results to be discussed in further detail.
One curve seen with az constt and ele changing and appears there is an elevation offset of 2 deg or so; need better understanding of the experiment.

22 Jul : Report on military satellite made; displayed & discussed : GMRT measured coordinates (from +- 2.5 deg Az-El scans) match well with that listed in web pages (literature);
==> agreed that this shows useful and good results; can be summarised in a note; coordinates of these satellites can be finalised and used by the alarm system.

(iii) Ops group to investigate and come up with alarm algorithm to use in control room, after getting the relevant data from PAR. Present aim to cover 3 scenarios :

(a) real-time alarm in the control room -- SNK has implemented this, but may need some retuning (some refinement of coordinates is needed)

(b) for a given source at a given time, for a given frequency, predict the effect, including a facility for running through an obs file -- this is TBD;

(c) post-facto : given log of an observation (lta and servo files?) analyse how much data affected by satellite RFI -- this is also TBD.

email from SNK gives some details about implementation and testing for (a); Giving refined coords is still pending; (b) and (c) are still pending.

SN to look into the matters with SNK. SN updated that SNK has completed the implementation for all the 3 options (a, (b) & (c) -- waiting for more accurate coordinates to get improved results; can we get a demo ?

There was a joint discussion with PAR, SNK and SN; satellite data /information given by PAR to SN;

10 June : new expt has been done to track satellites and refined positions have been obtained; will be testing shortly to confirm this; GPS satellite data has been given to Santaji on a trial basis. To check current status of this.

22 Jul : see update given earlier;
Agenda item needs to be rationalised and rewritten...

==> SN to confirm with SNK if a demo can be arranged for parts (b) & (c) above, using the refined coordinates.

==> next part of this is to see if it can be applied to other satellites :
first in choice is for the GPS satellites, which is more complicated because the satellites are moving -- this is being looked into right now. Next target would be the Russian military satellites (will need to get the coordinates)

2.4 Mobile phone RFI -- from 22 Jul & earlier (SSK/PAR) :
Progress on identifying the operators at and around E06, and in Nagar, Junnar directions : letter had been sent to BSNL, some follow-up action was on -- they had agreed to change to 1800 at 3 locations (Ale, Gulanchwadi & Pargaon Mangarul) : one location (Pargaon Mangarul) tower has been swithced over to 1800 by BSNL; Alephata tower -- 2 sectors changed to 1800 (what about the rest?); for Gulanchwadi tower -- work is pending (as per latest update from BSNL officials); RFI team to verify these changes by visit to the sites & by checking the GMRT data (compare old vs new data), and summarise their finding -- some new tests are done and looks like there is improvement; Gulanchwadi needs reminder to BSNL. Appears that BSNL has no spare hardware to move from 900 MHz to 1800 MHz; eventually will move when additional

units become available -- no commitment about time frame; check if there is any change in status; latest update : looks like end of September for any work by BSNL? check with BSNL reveals, no change in situation; if no change till end Oct, to decide whether to escalate to higher level or not.
update on 10dec14 : BSNL has finally done at Gulanchwadi -- this is now verified that power in 950 has come down and 1800 has gone up in that direction. Letter needs to be sent (to confirm if it is to be a letter or request or appreciation)
-- YG and PAR to discuss and resolve the matter. Also, to discuss the way forward with the next step on this topic.
==> not much action on this now.

3. Operations :

3.1 Interfacing of FE with new M&C system -- from 22 Jul & earlier (SN/NS/CPK) : Naresh + Charu & Sougata + Rodrigues were working on this; will have full set-up of FE + Common box, but will start with M&C of common box using Rabbit card : initial h'ware connectivity may not be too much work as 32 lines have to be mapped to 16 lines on interface card; low level software for bit pattern setting may be enough to demonstrate basic connectivity; after that, packaging will be the issue to be sorted out. Action items:

(i) basic set-up was made working, and tested (by Rodrigues + others); difficulty of communicating via Rabbit to FE appears was resolved with demo of some commands by Rodrigues et al : initially 2-3 basic control commands, later all the commands (except Walsh) were tested and cleared; brief report from Rodrigues summarises the work done; logic + softawre for monitoring commands (6-7 FE + CB monitors) need to be implemented; Charu and Sougata are identified to work together on the monitoring functionality with guidance from Raj where needed. Check current status of this.
27 May : waiting for Charu to finish report of FPS testing with Rabbit; meanwhile, to see if one assembled Rabbit + shielded box can be given to FE team to complete the wiring (to check status of box #2 with PAR and Sanjit) -- can go ahead with couple of boxes without shielded connector.

10 June : FPS testing report is finished and work will start now.
3 stages of the work : FE Rabbit to FE system (local at FE lab); from tel lab to Rabbit + FE system in FE lab (serial and ethernet options) -- need to verify that the monitoring is working all right.

24 June : Walsh commands also incorporated now;

8 Jul : present status : computer to dummy Rabbit card to FE Rabbit card all on eth link; monitoring now being tested for CB and then will do FE; then can try serial link from dummy Rabbit to FE Rabbit; finally, to look at option of current online path via antcomm to FE Rabbit to interface code.

(ii) to look ahead at the plans for the packaging of Rabbit inside common box and integrated tests with serial link, and then later moving to trials with eth link
13 May : since we are getting close to having the common box ready, a plan needs to be worked out; agreed to come back with a joint plan (Ops + FE) in 2 weeks time.
27 May : to run the test from telemetry lab and FE lab to simulate antenna base to focus and run 100 m serial link and also ethernet link; need to order some serial link cable used in the antenna.

==> see discussion above.

3.2 Development of M&C software -- from 22 Jul & before (JPK/RU/SN/NGK/SJ) :

(i) taking up EPICs based PoC version for putting additional functionality :
basic loading (and unloading) of the EPICS has been done successfully on the machine; now need to connect Rabbit card and test existing PoC software and then go to the new adition to be done; Joardar and Yogesh had made a fresh installation of the software (under Debian linux) and demo software was working fine; first test with Rabbit card (with v2 subsystem) to OF system was done successfully; agreed to develop the software first for OF attenuators; a SOP to make running of things easier was prepared by JPK; a new module was being made for fibre optic link (old one was for GAB); first attempt was to take the given code and modifying / editing it to do both monitor and control -- to produce a short report describing this phase of work; development of new module to implement the same functionality -- working for monitoring and trying for control (to discuss with JPK and come back); script for installation of EPICS + peripherals was getting ready.
Latest status : for monitor side : able to get data and display; working on command flow for control side; some extra information may be required. Check current status and future plans. See if this can be closed or needs to continue.

(ii) plans for tasks for next phase of work for new M&C software : architecture definition and UI definition tasks had been completed; next phase of work for implementation of design for 3 antenna system has been started; 3 phases of work identified : core, business logic, web application; ~ 6 months per phase; first phase was started, kick-off meeting has happened and work is ongoing; the issue of which Linux OS should be used : CentOS or enterprise, instead of Fedora (for rapid changes) has been discussed with TCS and final choic is to go with Fedora20. Since this is a SKA prototype, issues of alignment with the TelMgt design are being taken up; also, impact of SKA decision to go with TANGO as the platform are being evaluated; much of this to converge by end of April, even as work on design of eninges etc is continuing. Joint meetings have happened between GMRT software team and SKA TelMgt team and consensus plan is being worked out -- admin procedure needs to be initiated. Meanwhile, other work has already started and is on-going relating to the engines -- to check status of this.
27 May : writing of test cases is going on; some issues found and resolved; not much discussion in the last couple of weeks, maybe; to update current status of the work.
22 Jul : 38 functional test cases reviewed for Phase-I & documentation completed; TANGO prototype design & feasibility have been completed;
==> first demo of some of the prototypes expected shortly; single antenna system expected by mid-Sep. YG to check for more formal feedback on joint activity of TelMgt team and GMRT TCS team; also a discussion session with Vikas tbd on 6th Aug.

(iii) M&C software in-house : this is a mix of Online V2 and other developments that are useful for all M&C platforms (need to separate out these issues at some level): tests done with switch + rabbit card at antenna base and used for commands and monitoring of the OF system -- this path is cleared. Testing with GWB corr at first level by interfacing to existing dassrv structure and environment also done; webpage based display done; some routines in astropy added; some additional code added for diagnostics purposes; Santaji has built web based monitoring for temp/wind/3-phase power etc -- tested ok; need to separate out online V2 items from overall web-based tools for enabling absentee observing.
During MTAC of Oct 2014, 3 antennas (C1, C4 & C6), 2-sub-systems tested, using 2 rabbit cards; servo system tested in servo lab and in C1 antenna (all commands tried

out); draft report circulated;
Communication to FPS being tested; NOVAS library interface done in C, Perl, Python and PHP -- can be utilised by any of the new software developments.
During MTAC of April 2015, 16 antennas tested with eth link from central building and one Rabbit card controlling OF and sentinel with commands sending with python and GUI interface. Set-up to be kept switched off during regular GTAC time.
No fresh updates; report writing is going on; meanwhile, work started on shared memory design for sharing of the information.

24 June : work in progress for communication from Online to rabbit cards (antenna base & FE box) via serial port [via ethernet already completed]; OnlineV2 draft report with NGK, to be finalized by 30-Jun-2015.
22 Jul : Draft report in circulation within the group;
==> report has been finalised and may have been submitted to library.

3.3 Long-term plans for evolution of M&C systems -- from 22 Jul and before (JPK/RU/CPK/SN) : MoM of Sep 2014 meeting identified following urgent / immediate action items :

(i) Verification of compatibility of switching equipment at antenna base and CEB to be compatible with HRS requirements -- CPK and Nayak to ensure the same; to check if this has been done and item can be closed? Still waiting for confirmation.
SN to check with CPK and come back. THIS IS A SIMPLE MATTER, PENDING FOR A LONG TIME!
Note circulated by CPK; 2 changes proposed :
(i) TCS's document for hardware req. says 10 years operation : needs to be changed to 3-5 years (to be able to get vendors);
(ii) power for server class machine stated : < 500 W; this will be hard to get; ~ 600 W may be preferable.
To check feedback from TCS and take up for discussion; just waiting for formal confirmation from TCS and make a formal note and then item can be closed.
22 Jul : formal note made & item closed now!

(ii) To discuss and finalise optimised packet format for Command/Data response with the Rabbit card -- RU + JPK with YG.
Agreed to wait till March 2015 for a detailed check of what the existing framework offers and what is required for next gen system and decide if any changes needed.
Outcome of current discussion : online V2 already has a packet structure; during TCS prototype development, one version of protocol was defined and used; JPK to cross-check if that will be sufficient to meet the present needs; also, telemetry team is agreed that whatever changes are needed to modify on Rbabit side to meet this requirement, will be done by the team.
Latest status (15 Apr 2015) : JPK is reasonably confident that version developed during TCS proto development is fine; online V2 has 2 kinds : one for servo and one for the rest. Team is internally agreed that whatever changes are needed for the final TCS version, then can handle internally. may need to track the development of the packet structure for next gen SKA proto system? Agreed to have a note generated after finalisation of pkt structure for new system; check current status.
22 Jul : Packet format for Phase-I work has been completed; can be closed now ? Yes.

(iii) To discuss and agree upon a unique set of Rabbit commands per sub-system -- Nayak to coordinate with team; RU to put out the list of currently implemented commands (with parameters) and matter can be taken forward from there for checking sutiability for different requirements; 'list of currently implemented commands' circulated; agreed to bring out the list of commands needed for the next gen system

and compare with list sent by RU and quantify the extra amount of work to be put in by the team. May need special focus on high level commands for FE system? Pending for JPK to produce the list of commands -- that has happened now, and can be looked at and taken up for discussion next time. To take up for discussion.
27 May : many of the commands are same; there are some cases on commands not (yet) covered in one system; agreed to keep two branches of the Rabbit code meant for the two M&C systems and make sure that bug fixes are common to both. Item can be closed now? Yes.

(iv) Hardware at antenna base : JPK to circulate a background note for antenna base computer system and then item can be taken up for a larger discussion -- not done yet. Pending for note from JPK -- reminded to bring this out soon; check status -- still pending.
22 Jul : technical note is in progress;

4. Back-ends :

4.1 Documenation at various levels -- from 29 Jul and before (BAK + team) :
To complete basic, internal documentation (at ITR level) and then move to the point where formal publications of relevant items can be done.
Current action items are as follows (many are pending for long durations now !):

(i) Detailed design doc : analog back-end was being done by Hande : 2nd version had been circulated in April. Next level of document going down to chassis level is to be made ready -- chassis level doc will take about 2 months; was deferred till end Oct 2014; and then deferred till end of Dec 2014; 2nd version had ~50% chassis level inputs; to be completed by end-Jan'15; needs some more time as 2nd LO scheme inputs are alos being folded in; work in progress; may take another month -- can check in mid-May. This is now pending for quite some time !
27 May & 4 June : progress is slow, but going on. What is the current status?
10 June : ongoing... 24 June : will take ~ 1 month (end-July);
till 29 Jul : no progress !
==> Hande still busy with something else.

(ii) ITRs + publications for analog back-end systems to be taken up : Sandeep and Navnath to look into that; pending for a fairly long time; SCC to look into this and come back on this by 11 Mar -- SCC and Navnath have had one discussion and will follow-up after MTAC. 29 Apr : list of items to be done has been prepared now; work has been started by Navnath. To check current status.
27 May : not much progress in last 2 weeks; to pick-up now. Current status?
4 & 10 June : not started yet; to start now.
till 29 Jul : no progress reported !
==> Navnath and Sweta to work on this now and have a version by end of Aug.

(iii) ITRs + publications for digital backend : ITR was completed by SHR; after some follow-up, SHR and BAK started work on modifying GWB ITR to convert to a paper; first version has been circulated; needs to be taken up for discussion between YG, BAK and SHR.
27 May : not yet reviewed and discussed, but meanwhile SHR can look at it from the point of view of improving by putting in the latest work on expansion to 16 antenna, dual GPU system.
4 & 10 June : will get into this once GWB-III release work is completed
1 to 29 July : no progress reported !

==> to try and take this up now, as GWB-III release is almost done.

4.2 Analog back-end : LO setting related issues -- from 22 Jul & before (BAK) :
There are at least 2 differen issues that remain to be resolved :

(i) problem with LO setting using FSW resulting in reduction of correlation in GWB (compared to LO from sig gen) : understanding is that 10 MHz reference is at the edge of the locking range; shifted to 105 MHz based reference -- this appears to solve the correlation problem; however, this appears to show phase jumps whenever it is reinitailised; trial and error tests showdd that using 50 MHz reference avoids this problem for GWB.
Latest tests (1 April) show that with 10 MHz reference, the correlation coefficients are fine; would like to test bit more before confirming and releasing. However, mixed results during further tests in MTAC (with 10 MHz) : for longer baselines there is drop in cross-correlation;
105 MHz phase jumps; unclear & confusing; but with 50 MHz ref. both issues absent;
Current conclusion (27 May 2015) is that 50 MHz reference works ok for giving proper corrln on all baselines, as well as no phase jump on reinitialisation -- would like to switch to this in the long run, for both GAB and existing system at antenna base; higher priority is to fix the problem at antenna base (BE team to come back with a proposal) and then tackle for GAB (as there is not much of an issue of reinitialisation for GWB, and 105 can be used for some more time).
10 June : right now planning for the set-up to be built for antenna base...
24 June : Solution found using 50 MHz reference; issue now is to identify method for generation of the 50 MHz.
22 Jul : confusing result : phase jump seen at 50 MHz reference ? [last 2-3 weeks full day monitoring] -- to check status of this.
==> not clear about 50 MHz -- will need more testing; to use 105 MHz for now.

4.3 Analog back-end : completion of 30 antenna system -- from 22 Jul & before (BAK):
16 antenna system completed (from cabling from OF to cabling to corr wall panel);
24 antenna system also released (mid-April 2014); and now 30 antenna system has also been completed (July 2014). Pending action item :

(i) long-term plans for power supply and ethernet switches to be discussed : for power supply, discussion is as before; ethernet switch : there may be a complication about accommodation 24 port switch in terms of space and layout; 8-port switch was tested for RFI (with and without shielded CAT5 cable -- old 2013 report + new Jul 2014 report) and it is clear that there is some RFI even after shielded CAT5 cable is used. Possibilities for shielding box for 8-port switch discussed; BE team to check about space for putting a shielded box around the 8 port switch; Hande and Raybole have discussed the matter and it is agreed to try and design a shielded box that allows the switch to occupy a 1U slot in the backside of the GAB racks. Raybole is working on design of shielded box and is ready to order material for this; first sample box was ready; controlled tests show very good RFI rejection (report is awaited) -- can check after report comes and finalise on mass production. (true for both ps and eth units) --- shielded box finalized; 12 nos ordered in work shop. Components required have been ordered; first box will be tested and then order for rest will be cleared;
There was a problem about modification of the drawing -- has been resolved; now to check where and how the mass production will be done. Waiting for first proto unit from w'shop to come; to check status and time scales.
27 May : work under progress in w'shop. 10 June : work still ongoing...
24 June : enclosures (boxes) for the ethernet switch have arrived from Workshop; also one sample box for power supply which is found acceptable -- RFI shielding

mesh needs to be added - given back to Workshop;
22 Jul : boxes came from W/S; one box being populated - next RFI test planned;
if successful, go for x11 more power supplies;
==> one unit fully ready and will go for RFI testing shortly; vendor related issue
for order of the remaining SMPS (15 nos) -- may have 8 week delay.

(ii) status of work for having i/p side RF filters : plans with FE group for sharing
mass production units; agreed that it is ok with FE group to share the designs,
provided BE team is ok with the performance specs; ok to include BE requirements in
order of PCBs and components (cost sharing to be worked out accordingly); however,
BE group to take care of mass assembly separately, as it will be done with in-house
manpower by FE group for their filters. BE group has completed design of 8:1 switch
to be used for this. Meanwhile, 4 BPF filter chassis (from FE group) + 2 nos of
8:1 sw chassis + one straight through path -- found difficlut to fit it one PIU;
agreed to go ahead with single chassis plan for the main 5 BPFs + one switch; second
switch and other sub-band filters to be put outside, within the PIU. Prototype unit
was completed by BE team; agreed to get the PCBs from FE group (supply the board
to them) and then check the integrated filter performance against the single filter.
In ther interim, prototype unit using existing PCBs with chassis was assembled in
the PIU and tested in-situ.
Final configuration will have direct path + one 100 MHz LPF path + main band
filters for each band, with one 8:1 switch; FE team will buy the substrate board and
give to FE for getting the PCBs and will buy their own components to populate the
PCBs they will receive.
13 May : PCBs for low frequency band ready; chassis for Lband ready (!);
waiting for LF chassis; Lband and 550-900 PCBs will come from FE group. Mech boxes
awaited; check current status.
27 May : no change in status; following up with w'shop.
10 June : 25 chassis have been received for 250-500; not yet ready for assembling a
prototype unit.
24 June : (x25) Chassis for all Low-Frequency & High-Frequency usage now available;
PCBs available only for the Low-Frequency usage, which are being populated; to be
completed by 09-Jul-2015;
22 Jul : filter reflection higher than expected; BE group now exploring 'new' filter
design; to take up for discussion and resolve.
==> BE team may be able to make these workable with tuning and change of values of
components; YG to chek with FE team about the implications of this. Also, only
250-500 and 130-260 have come; other 2 are still awaited from FE team.

(iii) appropriate attenuator settings for Lband & 250-500 done; 610 band was being
finalised -- updated table had been circulated; few iterations were done and a
more accurate updated table for 16 antenna system has been circulated; also, agreed
that BE group will do monthly monitoring and report the status (for all the 3 bands)
-- regular monitoring was to be started in May 2014, but took some time to get
organised; montly reports will come regularly from June onwards. To discuss how to
handle interpretation of the results and iterations to change the attenuator settings
for future, as there are evolving changes happening in the FE systems. One round of
measurements has been made and set-up is reasonably stable (may need a PC to be
arranged?); will take some more time till regular monthly monitoring data can be
meaningfully discussed. PC has been arranged; need to start the regular monitoring
now; set-up is sort of in place; first round of checkign will happen during the MTAC.
first round of readings has been taken and some summary will be sent shortly.
Results not yet circulated internally; BAK to check with team.
Tests are now done regularly; need a way to share the summary of the results for

taking appropriate follow-up action.
Raw data is being uploaded on plan website; Atul Ganla looking into some intelligent interpretation and summarising of the results.
Started work on making plots showing the variation with epoch for any antenna; will resume after MTAC is over. Should be having first results by now?
27 May : still pending. 10 June : work is ongoing...
24 June : Analogue Back End check /test (for 'attenuation' values leading to power equalization) happens regularly every Monday; one band at a time - so every 4 weeks a full set is available; new student working on analysis - to be completed in 3-4 weeks (end-July'15).
==> analysis work is still going on.

4.4 GPU corr (GWB-II) : release of 4 node, 8 input, 200/250/400 MHz version -- from 29 Jul & before (SHR/SSK/BAK/DVL/YG) :
agreed to make 4 T7500 nodes with C2050/C2075 Fermi GPUs + remaining 4 T7500 nodes as host machines (to take care that these are the ones that transient pipeline uses presently so that sharing is possible); this should have ALL basic modes : total intensity and full polar IFR modes; IA + PA BFR modes with process_psr pipeline attached; full GUI support; to come up in trial code section without affecting the presently released mode. Action items :

(i) beam modes in GWB II : new version with separate kernel (outside phase shift kernel) for beam formation has been developed (compute load is 7% increase on 2050 GPU); IA mode tested; PA mode completed and tested; phasing implemented & tested; process_psr pipeline has been completed and released; first version of SOP has been released; pending action items :

(a) last version of GWB-II (ver4) expected end of April, with the following new features : 16k channel support in GUI and SOP; multiple choice for beam integration and # of channels; pulsar beam header ver1 (limited number of parameters); for more than 2K channels in correlator, need modified shell script -- this needs to be understood. Most of these changes have been done & tested; GUI for 'ver4' needs to be done by Nilesh (who is on long leave) -- will happen after 16 May. To check current status and see if this can be closed.
27 May : SHR and NSR to test upto 8 and 16 K channels to see if o/p side i/o works ok; if yes, then no further changes; if no, then to change the MPI calls as done in GWB-III (and make GUI and SOP compatible with that).
10 June : ver 4 tested for 8 and 16 k channels; GUI level change has been done; dasmon needs to be modified for more than 2K (upto 16K) -- being done by NSR; beamformer will also need to be tested.
24 June : GUI for correlator part completed (except for 'dasmon'); GUI for beam-former will take 2 weeks (08-Jul-2015);
1 July : SSK to talk with NSR to close the loose ends.
14 Jul : work on changes to dasmon has begun.

(b) header for beam mode data : to be taken up & incorporated alongwith the PA mode; SSK has done first round (part I), and discussion between YG and SSK has happened and next version (part II) is underway;
20 May : header part I has been done for GWB-II and III (need to confirm for GWB II). header part II will be done later, only for GWB-III
27 May : new version of GWB is under test which has part I header; part II will come in the next release.
Check status for GWB II and close, and move remaining items to GWB-III agenda.
10 June : new version of GWB is under test which has part I header; part II header

will come in the next release; part I header will come in GWB-II ver4 & GWB-III ver2.
24 June : GWB-II next (and final) version release in 2 weeks (08-Jul-2015); will have flexibility of upto 16K channels;
1 Jul : to ensure that loose ends are closed by 8 Jul and v4 released.
29 Jul : work is underway to completed and release v4 of GWB-II.

(c) availability of online monitoring tools for beam data : psr_mon was successfully installed, compiled and tested (for 16k channels?) on node 52, node 53, gwbh2 & gwbh3; now installed on the new host machines also; installing pmon needs polycos, psr catalog etc -- confirm if completed and released on the new host machines?
pmon done in off-line mode on GWB-III, will convert to real-time and also port to GWB-II; currently working on real-time mode of psr_mon and pmon for GWB-II. these are under test by SSK; pmon for GWB-III needs to be tested and cleared -- SSK to check and place the final working pmon code in the right place on GWB-III beam host machine (27 May).
17 June : offline version working on GWB-III (v2) and real-time version to be tried.
1 July : SSK close to finishing the real-time version for GWB-III.
14 Jul : online had problem with psr_mon -- now corrected but needs testing (~ 1 week)
22 & 29 Jul : not clear if tests completed and system ready for release or not.
==> GWB-II ver 4 (final version) is now released ! To check if any open issues remain; if not, close this agenda item.

(d) meanwhile, work for incorporating new code developed by Rajora by adding shared memory interface is ongoing (both of these can go directly to GWB-III?) -- to check status of this; 13 May : work now resumed with summer student Balaji looking at it. New features related to bandshape plot and profile plot have been added and filtering part has been tested; need to start looking at shm part; agreed to move this to GWB-III agenda.
4 Jun : new features related to bandshape plot and profile plot have been added and filtering has been tested; need to start looking at shm related aspect; also, see agenda under RFI filtering.
1 Jul : work in progress.
29 Jul : updated code is working; tested and showing good results for off-line analysis (for GSB & GWB); basic tests of real-time mode have been carried out for GSB shm and shown to be working ok.
==> quick updates from YG on current status and possibility for KDB et al to use.

(ii) spikes in channels that are power of 2 : this problem needs to be discussed, understood and fixed. SHR has done several tests, including using digital noise source; effect is seen in packetised corr also; checked with offline analysis of raw voltage data acquired through Roach board, and with digital noise generated on Roach board -- appears that problem is seen only in data coming through the ADC path only? further, trying single ADC streams or channels (compared to the interleaved data streams that come normally) still shows the spikes in the streams; slower FPGA clk rate also doesn't show any difference -- it appears to be natively present in the ADC data; to check if the power level of these spikes is constant and how much below the mean passband level; varying i/p power level of broadband noise source at ADC allows characterisation of input power level at which spikes show up; looks like occuring at multiples of 128 ch (for 2K spectrum); to check the level as seen in cross of two such signals -- some test results have been sent by Reddy recently; can take up for discussion, including tests with 2 different clk sources...
To correlate against new results coming from histogram testing by Niruj & Kaushal -- some further work is needed here; KDB and NMR to check and report back; can move this also under GWB-III ?

27 May : to cross-check with GSB voltage data taken and put through similar analysis of histogram and spectrum.
10 June : tested with two different Roach boards with two different clk sources and corrln is still seen, including when sig gens are not locked to same source.
24 June : GSB raw voltages to be read & analysed [at GWB-III];
14 Jul : work has started, can expect some results by next week.
29 Jul : tests done with GSB raw voltage data also show some spurious lines -- needs some thinking and investigaton about possible causes and issues.
==>

4.5 RFI filtering -- from 22 Jul & before (KDB/BAK/YG) : aim is to develop and implement RFI detection and mitigation algorithms at different stages of the back-end : both in time domain and in frequency domain, and for interferometric and beam modes. The overall plan is as follows :
(a) For impulsive, time domain RFI : First version of real-time RFI filtering block was added to packetizer of GWB-I (in one input out of two) with different options like replace by median or by constant or by digital noise source sample or clip to a threshold via s'ware registers) -- basic tests were done and found ok; trials with real antenna signal split into 2 copies and checking both self and cross outputs proved somewhat harder; further, design (with some optimisation of FPGA resources) was ported to GWB-II; agreed for time domain tests using either corr self powers or 2 IA beam signals; some tests with varying sigma were tried on antenna signals (results?); data taken with pulsed noise source input also; new results circulated and discussed; agreed that the basic scheme appears to be working ok; to try 3 versions of the scheme, with different options for the statistics; agreed to support 3 modes : continuous update; update on request; external update; this has been demonstrated in tests on GWB-II; need 3 separate versions of design (with optimisations) -- agreed we will carry forward the full design and then, when final baseline is established, the reduced modes can be made available. Meanwhile, design compilation for 4, 6, 8 bit inputs completed; utilisation (for one analog channel) : 41%, 19% and 17% (for total design) for 4 K window; tests were done to see if there is some biasing by digitally splitting the antenna signal -- confirmed ok, i.e. mean level changes for lower thld happens for replacement with zero or replacement with noise but not for clipping; next part is testing with two different methods of generating thld statistics : shown that a priori stats works better for rejecting RFI infected data. Agreed to carry forward, for now, only 8 bit design -- other options can be brought up whenever needed.
Further, the design was optimised to fit on Roach board in the GWB-III design -- first for 2 filters out of 4 channels on each Roach board at 800 MHz (with compensated delay in the 2 other channels) -- this was implemented and shown to be working; dynamic window size control was also implemented -- shown to work upto 8k size for 800 MHz, 8 bits (will be adapted for 4 bits, as needed).

(b) For spectral domain, narrow band RFI : implementation of MAD filter across time (MFAT) and MAD filter across channels (MFAC) done on MATLAB and tests with simulated and real data carried out; basic tests show that, for spectral RFI that is steady with time MFAC works better than MFAT, except that there are issues when the RFI is near the edge of the pass band (or in the stop band region) -- proper normalisation of the bandshape may be needed to improve the performance?

(c) For beamformer output (for impulsive, time-domain RFI) : code developed by Shiv Rajora as part of the wpmon work (see also item XX(yy) above) for finding impulsive RFI in the data, tracking it for individual channels based on the DM and masking appropriate data while creating the dedispersed time series has been tested and

needs to be refined and finalised;

(d) For beamformer output (for narrow band, spectral line RFI) : work needs to be initiated, which should borrow from the routine for (b) above.

Some action items are as follows :

(i) pulsed noise generator (PNG) ckt with additive noise source shown to be working -- can now be used for demonstrating RFI cancellation on visibility data. Some new tests were done : basically working ok; but would like to go down more realistic duty cycle; also, there appears to be some saturation like problem which is not clear; team can discuss and decide the growth path of a new PNG.
New results circulated; report of PNG inter-channel coupling - located where the couplign occurs; to follow-up on current status and discuss future plans.
BE team to discuss locally, and resolve the matter. To check if there are any updates.
10 June : some disussion has taken place and may have update in next few days.
24 June : Coupling reduced drastically after changing the coupling from resistive to inductive;
==> this is ok now and can be closed.

(ii) to work out proper scheme for testing -- KDB has circulated a proposed scheme, which is now been refined and accepted; to discuss and check if results are available. Some tests have been done and results discussed : scheme appears to be working fine; need better quantification of the results.
(noise + RFI) & only noise : filtered vs unfilterd comparison -> filtered (noise + RFI) gives higher cross-correlation; to check latest results and conclusions -- mostly done, and conclusions are reasonable; can move to real-life tests now -- check if any updated are available on this.
10 June : antenna tests not yet showing a conclusive result (correlator + beamformer results)

22 Jul : regular tests are being carried out for comparison between GWB-II & III (a SOP for running these has been created); results look fairly 'good'; to take up for discussion.
==> scheme is working ok with a well defined SOP using only GWB-II. This can be closed, and attention can be tested to regular testing and results from the same.

(iii) book-keeping : trying to work out the packing scheme, with the understanding that jumbo packet size is taking up. Need to discuss long-term plans for this.
1-bit flag implementation has been started; need a discussion for agreeing on the option for double rate sampling and how to structure the packets. Need to move this discussion forward.
Summary of discussion avaiable as a note [passing RFI flag bits thru the chain] how to use it is not decided yet; some follow-up discussions have happened; to check latest status.
10 June : recalled that test needs to be done with 4K packet size to see that corr works ok.
24 June : Today 4K design is under test;
==> to test GWB-III and report back.

(iv) spectral line filtering needs to be taken up for discussion -- first results have been circulate for projected back-end systems; a concept note has been generated for this; some feedback has been sent by YG; need a follow-up discussion

on this matter. To examine if the best place to test spectral line filtering may be beamformer output.
==> agreed to build up the test and experince on wpmon and then move to main correltor.

(v) filtering of beamformer output needs to be taken up : time domain impulse RFI filtering has been demonstrated in the work done by Shiv Rajora and is being followed up by Balaji (summer 2015); spectral line filtering needs to be introduced for this data.
10 June : to have a discussion between Balaji, Kaushal and YG.
24 June : Discussion has taken place; Balaji continuing tests
==> already discussed.

4.6 Power and cooling requirements for projected back-end systems -- from 22 Jul and earlier (GSJ/BAK/RVS/YG) : This includes plans for monitoring the temperature on the GSB and GWB nodes so that health of the systems can be kept track of as various changes to the heat load and air flow are made in the corr room for putting in the full GWB system. Specific action items are :

(i) scheme for monitoring of processor temperatures for GSB : for the main compute nodes : new package for temp monitoring requires slightly different version of kernel than what is used on the main GSB nodes; new kernel was installed on a few nodes and following 2 issues came up : new kernel on 2 compute nodes may have been causing the buffer loss problem (new kernel was rolled back to the old one); and for the current kernel on gsbm2, the high time resolution mode did not work (gsbm2 kernel was rolled back to the previous version that was there); for the first matter, follow-up was done with a controlled test -- node18 and 19 test was repeated and some degradation of performance confirmed; agreed to put new kernel on ALL the GSB nodes and test again : 3-4 hours' data collected with all nodes with new kernel; analysis showed a few occasions of buffer loss; comparison with normal GSB kernel showed that it doesn't show buffer loss; agreed to try new kernel once more; also to check for possible causes of buffer loss with new kernel; tests done with 16 and 32 MHz, 256 channels -- tending to show statistical difference in buffer loss; confirmed that there is a difference between in the 16 and 32 MHz modes; discussion between SSK and GSJ to try once more with kernel change only one node and examine the log file carefully and report back.
GSB data old & new kernels taken; 17-43 nodes completely new kernel gives heavy buffer loss; (old kernel have very small buffer loss ; old does not support temp monitoring).
More tests have been done and it appears that GSB is rather sensitive to the exact choice of kernel. Agreed that this item can be closed at this point.
No further action items here.

(ii) to add temp monitoring package on all GWB nodes : to check if this is feasible and has been done or not -- agreed that this can be done easily and that we should implement on all the GWB-II and GWB-III nodes. To make a list of machines which have it and then put it on all the machines; to reuse the earlier code for logging the data, plotting it, and also to add an option to generate a warning if the value exceeds some threshold; to think about a real-time version of the warning algorithm. ready to run on GWB -- agreed to go ahead and test; to think about long-term monitoring tool that shows the temp of all the GWB nodes.
To ensure that code starts every time GWB nodes are rebooted; to work a bit more about plan for bringing the results to a common place for visualisation.
Discussed a few possible options ranging from MPI to sockets to cross mounted disk systems -- to decide on concrete action plan.

installed "lmsensor" on all the GWB-III machines and working ok; right now using cross-mounted disks on 3 GWB-III machines; browser based tool for monitoring the data is working ok; cycle for 7 days for preserving the data. To see how this can be evolved.
Right now running on 1 compute m/cs and 1 host m/c of GWB-III (waiting to install on other m/cs); refining the scheme for cross-mounting of disks; auto-restart and halt scripts; cgi script for plotting on monitor can be made more intelligent.
H1 & cor5 cor5 packages installed; auto-restart completed; cross-mounting of disks : to use old scheme.
Installed on 2 more and ongoing; for cross-mounting : not using autofs, but using old scheme of cross-mounting via /etc/fstab; auto-restart is done (every 30 secs).
Current status of the scheme shown (live !) appears to be working very well;
can think of seeing if any additional performance parameters e.g. CPU load, IO load can be monitored. To write a technical note on the work done -- make take some time.
CPU load is already there; for I/O load, need to do some work.
27 May : looking at tools for network monitoring (e.g. Cacti) to see if it is suitable; if not, then would go back to a simple perl script. To start looking at writing a technical note (including the GSB experience).
10 June : Cacti software tested on a trial m/c; will move to gwbh1....
24 June : Cacti software tests completed for 'gwbh1' & 'gwbh2' nodes; other nodes yet to be done [other nodes need internal connections ...]
==> most of the parameters avaiable in Cacti except data on Inf -- may need an additional piece of software (qualplot);

4.7 Layout of final system in corrator room (racks, cooling etc) -- from 29 Jul and before (IMH/BAK) :

YG to transfer material from other week's agenda.
Agreed to move forward with the order for 6 nos of racks.

4.8 Next-gen time & frequency standards -- from 15 Apr & before (NDS/BAK) :
(i) brief update from BE team from visit to NPL was provided in last discussion; waiting for detailed report to be circulated draft (maser report already circulated)
complete report has been circulated today -- need to schedule a discussion.
not much progress; need to follow-up and discuss within the group also, to work out a possible "plan".
First discussion has happened between NDS, BAK and YG -- need a follow-up !!
==> to try and schedule a meeting tomorrow with Swami to move forward with the plans for civil etc for the active option...

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Minutes of the weekly Plan meeting of 23 Sep 2015

1. FE & OF related :

1.1 Update on results from test range -- pending from 26 Aug & before (HRB/SSK) :

(i) Tests of ver1 550-900 CDF and CSIRO feeds at test range : new results with VVM set-up, after installation of new encoder + notch filter for mobile band, showed : for ver2 550-900 CDF : reasonable E-H match at 610 and then degradation in shape and matching at 700 & 800; partially supported by older measurements from Dec 2013 (with slightly different set-up). Further, results for dipole-2a & dipole-2b with cone v2 show that the degradation of pattern with frequency is worse for v2a than with v2b; radiation pattern measurements have been done with 50 MHz step & using CW signal; comparison with simulation results is awaited. Current restuls and action items are :
(a) first order comparison of C1 dipole 2B vs C2 dipole 2B measurements : C1 D2B shows better E-H match at 610 ; C2 D2B shows good E-H match at 700; and appears to be decent even at 800, though 3 dB width may be changing; agreed to make plots vs freq for 3 dB and 9-11 dB widths, and for taper of E and H at fixed dish angle of 62.5 to check mismatch in taper, for both the feed versions.
First results from the measurements for the plots of 3 dB and taper values vs freq show evidence for change of properties with freq as well as asymmetry of the pattern (as had been seen in the earlier plots also); agreed to try to compare with results from C1 + D2b (make fresh measurements, if needed).
Repeat tests for C2 + D2b sent by HRB which show repeatibility with earlier results; FE team to check C1 + D2b data and complete the comparison -- fresh data needed to be taken for this (earlier records "don't exist"); radiation pattern tests done for C1 + D2B -- comparison plots to be sent soon.
(b) Phase centre of ver1 550-900 CDF and CSIRO feeds needs to be done -- phase centre measurements for C2 + D2b can be tried at the range.
Waiting for comparision report to be done and then follow-up for deciding next course of action.
12 Aug : HRB has reviewed the situation with the existing set-up which is found to be in functional shape; however, they would like to energise the set-up with the transmitter at the further distance (on other bldg), as they suspect that the set-up with sig gen at the main bldg with OF transmission to tx site can have varitions with temperature to be a cause of errors, in addition to possible reflections from gnd and nearby objects; will try with sig gen at transmitter (2 persons required) and compare results with one test case.
26 Aug : no updates.
==> no updates; some work may happen next week.

1.2 Phase centre tests for 250-500 CDF -- from 26 Aug and before (HRB/GSS): to test with 100 to 200 mm height change (around default of 1280 mmm) in 250-500 feed on one antenna to see how much change in sensitivity is seen. Tests done on c6 using feed with shortened support legs of the cone (instead of shortened stool) -- comparison of results for 1180, 1280 (default) and 1380 : 1280 & 1380 show slightly better sensitivity at low freq (250-400) but at higher frequencies they match with 1180 (which is quite flat throughout freq range); agreed to try for 1480 to see if there is a monotonic behaviour; also compare with simulation results of GSS. Consolidated

results tend to show that the latest level at 1180 height does show a slightly better response; a final confirmation is needed about the optimum performance from the measurements; confirmed that we can't go below 1080 by further cutting the support legs of the cone; also, current adjustable stool will not work for 325 MHz face due to welded nature of existing stool; agreed with HSK to reproduce one more adjustable stool with modifications learnt from present experience, and try on one CSQ antenna (C6?) by removing the Lband feed, shifting the cone-dipole with new stool to this face and using the existing 250-500 FE box on it; tried on C6 during MTAC period (Oct 2014), but measurements could not be completed as antenna was required for L-band GTAC observations. Current action items :

(i) Agreed to go back to C8 at a later point of time (after 550-900 measurements are completed) -- deferred for now.
(ii) Meanwhile, FE team to go over all the available measurements and produce a consolidated summary -- this is pending for some time now !
15 Jul : HRB is in the process of generating the note to coordination (to identify which antenna & when adjustable stool for L-band or 610 ?)
12 Aug : action items : to produce the summary of existing results for 250-500 and prepare for these tests once adjustable stool is fully functional.
26 Aug : email circulated by HRB today with plots of measured deflection for 3 stool heights (1180, 1280 and 1380 mm) -- can take up for detailed discussion next week.
==> agreed to do a more refined set of measurements with the new, adjustable stool, after finishing the work on 130-260 feed.

1.3 Comparison of observed performance vs theoretical calculations for feed + dish performance and system sensitivity -- from 26 Aug & before (SC/GP/HRB) : The aim here is to be able to compare performance of (a) feeds (b) feeds + dish (c) overall antenna sensitivity with the theoretical calculation and expectations. There were 2 parts of this work : first was initiated by feeds group in the FE team (G Shankar etal) to use the NRAO code to work out aspects related to (a) & (b) above; the second was initiated by Gaurav to work out the expected deflections for different uGMRT bands (taking into account all the factors affecting the performance); these two attempts (bottoms up and top down) have now met mid-way and it is time to combine the efforts and come up with a final, optimised way of looking at things :

(i) Phase efficiency computation has to be linked to the aperture efficiency computation (NRAO's eff. program, modified for GMRT specific paramters) : work is ongoing, alongwith Sougata (was expected to take 4 weeks -- till mid-Sep2014); code was being ported to matlab; also, original NRAO fortran program can be made to run to give some initial cross-checks? code had been ported from the C version that student had written to Matlab but results were not matching with expected behaviour; then tried to port original fortran version to matlab (was to be fully done by end-Jan / early-Feb 2015), but had problems in getting sensible results; agreed to try and see if original NRAO Fortran code can be compiled & executed -- this was done ! (after identifying appropriate compiler, making necessary syntax changes etc) and first results were to be circulated by 23 Apr 2015, with first trial for Lband : inputs are E-H pattern at 10 deg interval, plus specific value at 62.5 deg, plus various efficiencies -- mesh leakage and RMS efficiencies (phase eff is taken as unity), plus dish geometry (right now coded inside) including a square piece for blockage; output is spill-over and taper eff, cross-polar eff and overall eff (some are with and without blockage); plan was to cross check outputs against blue book values and rationalise against relevant docs and inputs; later, to extend this for all the other bands for which results are available in the blue book; current model takes the following inputs : mesh geometry, mesh deviation in

rms, feed pattern for E & H with 10 deg resln, taper value at 62.624 deg, gnd temp; blockage is hard-coded inside right now (alongwith quadripod legs etc).

Some results were shared (c 17 Jun 2015) :
at 327, the code gives 68.4, 66.6 & 66.4% for 259, 270 & 290 MHz;
at L-band it is 43.2%, for 259 K.

Sougata produced a note about the usage of the code and the various input & output parameters, and tried varying different parameters to understand the effect on the output; discussion on first version of this led to the following : various factors going into the efficiency and temperature terms getting identified; agreed that these need to be described in more detail and brought out in a clear note, including drawings where needed (can work jointly with GP); good agreement found for Lband (shown earlier) and 235, 325, 610 feeds with blue book values; agreed to go ahead with 250-500 system.
12 Aug : updated note by Sougata taken up for discussion : clearer definitions of some of the terms now possible; effective gnd temp : black body + green house effect!; comparison of Tsys and Eff with blue book show decent match (can highlight the differences in the contributing terms; extension to 250-500 done : need better comparison of the difference at 327 MHz; non monotonic behaviour with frequuncy of some of the terms; Sougata and GP to combine their efforts and plan to present a talk of 1 hr at GMRT and then at NCRA.
26 Aug : updates from Sougata : using feed patterns from Raghu's thesis, efficiency calculations for 3 freqs of Lband have been done and compared with values in blue book -- decent match (5% or better) -- to check with GSS about cases where it goes to 4-5%; also to try with flared feed pattern to see the trade-off between taper, spill-over and mesh eff. However, at 4 other frequencies (corresponding to the sub-band centres) the patterns given by Raghu produce a slightly different set of efficiencies (looks like these are slightly wider than the 1000, 1200 & 1400 patterns); this needs to be investigated and checked with GSS. Further, expected deflection has been calculated for the 4 subbands and compared with blue book and control room values (the first 2 are higher than control room values).
==> no significant clarifications from GSS; further confusion as some measured patterns are used and these give worse spill over efficiency at most of the bands and hence significant drop in overall eff (except maybe 1200 MHz) -- this needs to be understood.

(ii) calculation (based on reference paper) of expected deflection & comparison with measurements to check the sensitivity being achieved :
(a) GSS had developed refined version of code that is more relevant for GMRT (to compare with 250-500 or 500-1000 feed data) : cross check of results from code wrt curves from Kildal paper was confirmed (0.3 dB drop for 0.5 lambda offset); for GMRT specific case of 250-500, efficiency factor as a function of freq over the band, using the data for the measured feed pattern, was implemented; after correcting one error in the code, better result (9.9 dB vs 11.6 dB expected) was achieved; further, a realistic phase response (instead of 1.0) was included by reading data from a file; results (reported on 19th Mar) showed better match between measured and expected deflections for the 250-500 system : 327 -- 12.8 dB vs 12.4 dB; 400 -- 12.8 dB vs 12.2 dB; 450 -- 12.4 dB vs 11.4 dB; 500 -- 11.2 dB vs 11.0 dB (some re-work needed for lower frequencies?); computed results (based on change in efficiency due to shift of phase centre) show likely drop in sensitivity by about 1.4 dB from 250 to 500; this is now to be folded into the net sensitivity / deflection curves made by GP (see below);
(b) plans to extend this to 550-900 system -- was waiting to get measured values

from test range; data for cone2 + dipole2b exists; needs to be run through NRAO code to get the efficiency factor -- will happen soon; when data is available for cone1 + dipole2b, same can be done.
20 May & 1 Jul : pending for item (ii) to be completed.
12 Aug : this can now be updated based on the earlier results reported above;
==> for going from efficiencies to expected deflection, need the sky background at the calibrator position -- to be supplied by Ishwar and Dharam.

(iii) Comparison of computed results with measurements for 250-500 band : initial results for good antennas at 250-500 (other than C6) with default height of 1280 (and for C6 with reduced height of 1080) showed that computed values are actually better at high freq end for 1080, which is different from the observations which are showing droop at high freq for 1080 (in conflict with first results reported above); computed results, which were for 1180 to 1480 in 4 steps, were extended to 1080 & 980 and 1180 was found to give the best response (note : this is for a particular value of ph centre based on range measurements); computations were extended to much smaller values (down to 580 mm) and latest results show a peak in the response around 580 o 780 (!), which are in sharp contrast to the experimental results which were carried out in the range 1080 to 1480 mm and showed optimum performance around 1280 mm -- this needs closer scrutiny of the simulation code and experimental results; with new code, it may be possible to recheck the calculations and then can take up for discussion to rationalise; code is running; but first being used for the cross-checks described above; will go to new 250-500 etc after that.
20 May & 1 Jul : also pending for item (ii) to be completed.

(iv) Comparison of measured & expected sensitivity curves :
Scheme for (re)calculation of expected values across the broad bands to be finalised (and added to measured curves) : curves with constant QH value and variation of T_lna with freq were incorporated; model for the main BPF was also put in; after that antenna efficiency factor (based on measurements with 4-5 points across the band) was added by interpolating the measured values; return loss of the feed was added to the above and the result now matches much better with the data -- all this was done for 250-500 band; subsequently, the formula was revised to change the constant factor, which resulted in some discrepancy in the mean deflection values, and also some cases where the measued deflection is higher than the theoretical values -- these issues to be understood and resolved; after some cross-checks and refinements (dir coupler loss values, source flux from Baars et al, recalculated constant etc) -- spot value of 13.0 dB at 325 for CasA compares well with 12.7 used in control room; antenna efficiency factor still needs to be determined a bit more carefully -- agreed that both the efficiency terms (which includes default ap eff + phase eff, from measurements on test range) and the RL term whould be kept and the product should be used;

(v) cross-check the flux values and get updated numbers with DVL's help :
Around 20 May 2015, DVL had generated a table of 5 MHz apart flux values (covering entire uGMRT range?) for all the main sources, which can now be used by GP in the detailed formula; simple comparison with formula is folded in when comparing with control room values; GP had done a cross-check at 325 with the existing and new value of flux and finds new value is higher (leading to 14 dB expected deflection!); to check one or two more spot freqs (like 610); DVL & ICH have agreed to look into the matter and resolve the broader issues (17 Jun 2015);
15 and 29 Jul : no updates on this matter.
12 Aug : from ICH and DVL : finding comparable sky backgnd -- 5 deg away may not be enough for all bands; hence some refinement is needed -- work is ongoing.

Agreed that ICH & DVL to provide the flux and sky temp values (for cold sky and actual background) and FE team to provide all the efficency factors.
==> ICH walked through the report he and DVL are finalising; there are 2 off-src positions (east and west) at the same sky background as the calibrator and the complete calculations for these are done and final deflection in dB is given; can provide Tsky values to FE team; new procedure to be operationalised from next cycle onwards.

(vi) to get clear confirmation about which all terms are included in the efficiency factor currently being used in the calculations. Some results may be available from the NRAO code calculations?; till then the interpolated values are being used.
4 & 17 Jul : remains status quo till NRAO code issue is completely resolved.

(vii) develop the model for Lband : information gathering had been started -- feed pattern (efficiency) at 3 individual freqs available, and measurements available for 5-6 frequencies (?); agreed to work with the 3 pt data, do simple interpolation and see what kind of curve is produced; first order calculation of model had been done, including RL of feed, notch filter alongwith BPF etc -- Sanjit + Gaurav had put the curve for expected deflection alongwith the measurement results to do the comparisoyn, and this was added to the weekly plots; results showed shape mismatch at high freq side of the band (good match with data at low freq end), and an extra bump at 800 MHz; the bump was explained due to combination of BPF and mobile notch filter -- may need sharper BPF cut-off to avoid it; for the high freq mismatch, the best guess at present (Jul 2015) is that the sensitivity curve being used is not realistic enough (though feed RL is included) and inverse calculation of the drop in sensitivity required shows a very steep drop just after 1450 -- this needs to be understood. current action items :
(a) 1 or 2 antennas with response better than theoretical esp at lower edge of Lband -- need to be checked;
(b) shape mismatch at high freq end needs to be resolved (why RL drop + BPF is not enough to kill the response?)
12 Aug : not yet resolved; may need detailed feed pattern at 1400 and above for this... to look at Raghu's thesis.
==> see some of the discussion above.

(viii) a note summarising the overall scheme to be generated and discussed : updated note from GP was discussed : this is much more detailed now; need to cross-check :
(a) the variation of Tgnd with frequency -- understood that this is due to the fact that Tgnd in blue book is a func of Tmesh and Tspillover and hence will be a func of frequency; item can be closed?
(b) add points for existing control room values -- this is done and is closed.
(c) replot with better y-axis resolution -- this is done & can be closed.
(d) 250-500 and 550-900 look reasonable; Lband has some extra features that need to be understood (see details above);
(e) could start looking at 130-260;
(f) to vary parameters for 550-900 to understand the 3 dB droop from low to high -- this has been done and has provided useful information (looks like Tlna may be issue)
1 Jul : updated note has been circulated, including DVL & ICH (YG to follow-up)
12 Jul : Sougata + GP to do this jointly & confer with DVL + ICH as mentioned above.
==> Sougata and GP to circulate first draft of the document; and then a talk can be scheduled depending on how solid and ready it all looks.

1.4 Total power detector for FE & common boxes -- from 26 Aug & earlier (GP/ANR/SSK):
plans for final scheme : 20 dB coupler for CB and 10 dB coupler for FE (at final

output) with common 20 dB amplifier (Galli-52 instead of Sirenza); feed-thru vs connectorised arrangement also resolved; after lab tests (including monitoring via MCM channel) in FE and common box, sample units installed in C4 FE box and E2 common box. Some other details are as follows :
For common box : data from 2 units installed on E2 showed basic things working ok: first round of testing showed 11 dB deflection (12.4 dB expected) on Cass-A; later on Crab, getting 5.5 to 6 dB (6.6 dB expected); flat-top on-source waveform was understood to be due to quantisation of step size of detector levels (least count issue); script / SOP created for automated running of tests;
For FE version : 2 units had been assembled and found to give identical performance as per specs; problem of feed-thru vs connector was resolved in favour of feed-thru (as per original chassis design); all testing completed in the lab; first units (on C4) showed problems -- traced to incorrect mapping of channels etc.; new units (batch of 20) that were assembled showed unexpected change in detector o/p due to grounding problem which was corrected (manually) for 10 units and final PCB for mass production was modified for this change; script for automating the observations has been done an released by GP. The issue of RC time constant was taken up, resolved and closed (c. 22 Apr 2015); final report was submitted (c. 22 Apr 2015), with most of the outstanding issues resolved.

The remaining pending action items now being followed are :

(i) To decide upon long-term plan for power monitoring : GP to generate a short note about the proposed scheme for this; some discussions on 11 Mar 15 about exactly what this note should specificy (over and above the SOP); GP produced a note for the procedure to be followed -- need to move to a strategy document for running the program on a long-term basis; meanwhile, Shilpa was identified as the person to implement the monitoring strategy (maybe weekly tests; MCM to be turned ON for collecting data & then put OFF); first version of strategy document was discussed (20 May 15) -- need to add some more details about the strategy : how and why of the test observations being planned, and then give the procedural part; updated version discussed (17 Jun 15) -- looks better and can be released to Shilpa as ver1 for trying out;
29 Jul : This has been done and this aspect of strategy doc can be closed. Regular observations by Shilpa is also going fine -- to follow the progress of that.
12 Aug : regular tests are happening.
26 Aug : weekly data is being taken and analysed by GP -- results to be circulated.
==> results from 4-5 weeks of data has been compiled; will be circuated shortly.

(ii) possibilities for automating data reading, analysis and plotting also discussed -- GP has now implemented automated program for plotting CB, FE power levels (both chans) and 3 temp monitor values (2 in FE and 1 in CB) in one go from a file containing data for X nos of antennas is ready; this has been tested with the above data sets; agreed that it is generic but not tested for anything other than temp and pwr; can be generalised for all channels of all 30 antennas but can be taken up at lower priority; also, does not have a user friendly interface; current actions :

(a) agreed that working version of code + SOP to be fully released asap : SOP has been released; GP had prepared a note about analysis procedure (using matlab) -- it was discussed and found basically ok, except for hard coded locations of GP's machine -- this is linked to decision about who will be doing the analysis : FE team to check best way to address this and come back with suggestion.
12 Aug : agreed with the team to make the code accessible on one of the common machines in FE lab. GP to work out the procedure and small SOP for this.

26 Aug : work TBD.
==> SOP has been circulated; need to find a test agent / customer to try it out.

(b) development of user level GUI : SSK took up the matter with SN and Shilpa was identified as the person to take care of both GUI development and also ensure regular running of the tests, as per strategy document; matter was discussed and cleared with ICH also (4 Jun 15); GP had discussed with Shilpa about requireemnts (15 Jul 15) and work is in progress for a UI for visualising the data / results -- this can go ahead; after that a UI for creating the obs file required for different test runs can be developed.
12 Aug : work is progressing, GP to check and report updates.
26 Aug : UI for the analysis / visualisation is going on (some consultation with SNK leading to a more generalised version for 30 antennas).
==> GP needs to check latest status and give feedback.

1.5 Installing and testing of temperature monitors in front-end & common boxes -- from 26 Aug (VBB/SSK) : scheme for fitting two temp monitors (one for LNA, one for FE box) for tests on bench, followed by antenna tests and installation: lab test with manual readings had been done (showed 15 deg temp difference between LNA body and FE box (open)); work was ongoing to study online data from 3 antennas : W1 (130-260 FE box), W4 (250-500 FE box) and E2 (common box) was tested ok, and some long duration tests had been carried out; meanwhile, C4 & C10 fitted with dual temp monitors in FE box, and C13 with monitor in both FE & CB -- some tests had been done but data was not sensible due to unresolved issues in the wiring of the existing common box units that prevents desired data to come on expected channels in online monitoring set-up ! Agreed to select a few antennas (maybe W1, C13, E2) for proper monitoring after resolving the issue, and for the rest, keep putting the temp monitors and maintain a log of which ones work in online monitoring; later, correct the wiring whenever a common box is taken for maintenance or upgrade (same argument applies for power monitor also). Combined SOP for temp monitoring and total power monitoring was been prepared and released. Current action items :

(i) Analysis of the data : C13 & E2 both channels temp monitor available at online output (fixed for C13 one ch FE & both chans in CB, and E2 both chans in CB); some test data had been taken; also, some data had been collected for 6-7 antennas; first results for ~ 5-6 antennas (LNA + FE box) + 2 antennas (CB) for 3 hr duration shows some basic behaviour but not clear how well things are working; to try two things : (a) to check if any old data of longer duration (from last 2-3 months) is available (b) to try a longer run, even for one antenna like W4 which is under maintenance; some of the short data stretches have been looked at; at least one 6 hr data has been taken; report has been updated and submitted to library for uploading; longer stretch of data and analysis of that is still pending.
Finally data from one long run (on E02) was obtained -- showed decent results for a first attempt : temp of FE and CB following each other; with LNA temp a bit below but tracking (with some delay maybe?);

Current action items :
(a) need more confirmation runs to establish repeatibility -- fresh data taken, but some problems with FE monitor stopping after 1.5 hrs; broadband system was removed from E02, and tests shifted to C13, but had problems with CB temp monitor not available (20 May 15); back to E02 (17 Jun 15), but still having some problems; finally, some useful data from the regular monitoring tests -- 2-3 hrs on 3-4 ants : basic results look reasonable, but there is enough variability between antennas (and between FE, LNA and CB values) to cause some concerns; agreed to keep getting

data, including couple of long runs.
15 Jul : One set of data taken for long stretch (on W4) & analysed; results need to be circulated.
(b) regular monitoring can be folded into strategy doc for power monitoring : this was done, with the aim of one hour once a week + one 8-12 hr slot.
29 Jul : one long run data has been acquired; couple of comments for improvement : see if an ambient temp measurement can be included, and cross-check with another run to check LNA vs box temperature behaviour.
12 Aug : new long-run not yet available; for ambient temp monitoring : Sanjit to help make a standard set-up.
26 Aug : still waiting for a long run of data and also waiting for interfacing with Sanjit to add ambient temp monitoring capability.
==> ambient monitoring should be possible in the near future; one long data stretch has been taken around mid-Aug, but diurnal variation is not very evident; may need one more long run towards end of this cycle.

(ii) Other related issues : plans to add monitoring of temp in OF rack at antenna base and also the RF power...
29 Jul : can be kept pending for some time.
26 Aug : will start after completing 30 ant OF system.
==> provision has been made for new Rabbit card; to check if it may be possible with existing MCM card.

1.6 Spare LNAs for L-band feeds -- from 26 Aug & before (SSK/ANR) : we had 32 feeds; 2 were not working (1 has been dismantled for making drawings of new feed) due to lack of electronics spares -- mostly device failures (including some new ones?); some new LNAs were successfully assembled by Gopi and failed feeds for C3,W1,E2 & E5 were fitted with these and found working ok. Also, one spare feed was assembled and installed on W1 and working fine. It was agreed to have at least 5 LNAs assembled and available as spares -- initial lot of 10 was assembled and used up; finally (c 20 May 2015), status quo situation was that 2 fully assembled spare feeds (i.e. 4 LNAs) ready for use, and no extra LNAs available (from old design).
Current action items :

(i) alternate LNA designs : to see if design used for 550-900 can be modified for 1-2 GHz use; to also check the design done by Abhay Kulkarni and see if it can be improved for our needs; design files had been obtained and were being checked by GP and ANR : model files converted to match simulator used by us; component models in software had to be downloaded; also ultralam2000 that was used is not available in the market now; agreed to simulate with ultalam2000 first to check ckt works ok; then concentrate only upto 2 GHz and change substrate to RT 5870 (easily available); simulations matching with original results completed; simuation reproduced ok with RT 5870; trying to tune the design to required specs of gain (30 vs 34), Tlna (~28 or better); in terms of NF target is to go from 0.4 to 0.3, and maybe at cost of reduced BW; Feb-Mar 2015 : now getting close to Tlna of 28-30 across the band; overall gain is also very good ~ 38 dB; but 4 db slope across the band needs to be adjusted (due to some missing feedback in the ckt design?); move from s2p to non-linear model completed successfully -- did not disturb the results; May 2015 : couple of prototype units completed to get a working solution : gain is 28-30 dB (not high enough), Tlna is 28-30 K (bit on the higher side) -- increase in gain may be difficult as it is a 2-stage design (?); 3rd unit was made and after some retuning, achieved some improvement in gain (~ 32 dB now across the band with no slope), and Tlna is 31-28-27-31 over 1060 to 1390, and S11 & S22 are below -10 over the entire band; few more PCBs were assembled (and extra chassis were obtained);

current action items :

(a) to try for improved Tlna
(b) decide for trying out on antenna
12 Aug : some improvement in Tlna reported : 23 to 25 K mostly and 31 to 33 dB repeatibility tested on 3 units; further tuning possible (but need AWR to start working again -- both PC and dongle solutions progressing); to select one CSQ antenna (not short baseline) and put up spare feed with these 2 LNAs and do careful measurement of deflection before and after.
26 Aug : AWR problems are resolved (dongle has come and put on server and AWR is now working); unit will go up on C02 today (without noise cal injection) and can be left on test for a few weeks.
==> unit is now on C02; antenna base measurements showed ok deflection (comparable to existing system); to check in existing data about change in sensitivity; can leave in C02 for some more time to check stability.

(ii) possibilities for new LNA with Tantrayukt (Yogesh Karandikar) : item was taken up for discussion, following the visit of YK in Dec 2014 : to check if YK has got results from his first prototype for 500 to 1500 and then take the matter forward; some email updates from Yogesh (Apr 2015) -- getting close to fabricating the first batch of the LNAs; also, NDA needs to be completed, and EoI process may need to be carried out -- these are being looked into; 15 Jul : YK has first version of LNA ready for testing and would like to do that at GMRT; visit happened 27-29 July and follow-up action items are :
(a) to fnalise the modus operandi for usage of our lab facilities : can we work out the equivalent consultation time and offer that as a package deal.
(b) to complete the NDA asap
(c) discuss items where we would like his consultancy
12 Aug : FE team to work on item (a) and YG on (b) and take up for discussion 2 weeks later.
26 Aug : FE team to work out cost for rental of measurement instruments.
==> first estimate of cost has been made by FE team -- to cross-check and see...

1.7 Completion of spare L-band feeds -- from 26 Aug & before (SSK/ANR) : Target to have a total of at least 5 (out of 8) working spare feeds (from mechanical to electronics) : 30 antennas had working Lband feeds, but there were no spares, though we had 2 feeds; one unit was assembled back from the feed that was dismantled for making the drawings -- this was completed and installed on W1 (one feed is now in the regular 'maintenance cycling' of feeds); 32nd unit was there in Pune wshop and was shifted back after assembling by mech group and then fitted with electronics; it uses newly fabricated push-type (presss-fit) probes; after 2 LNAs were made ready (see above) this feed is now available as the 2nd spare feed. Furthermore, 6 new feeds were made (via outsourcing) in 2 batches of 3 nos; in the first set of 3, 2 nos had wrong size of horn and had to be corrected by the vendor; all 3 needed new covers as old ones were not suitable; second set of 3 feeds from Akvira : OMT + horn + cover; hence, total of 8 spares CAN become available; note that weight of 3 latest feeds is 18 kg more (72 vs 61 kg) than earlier feeds -- now accepted as 'fait accompli' !

Following issues need to be resolved currently :

(i) having sufficient number of spares : only one spare feed available right now; matter of requirement for 15m feed also discussed : can take the electronics from the existing OH feed and put in a spare feed and give to 15m dish; may need to

change filter bank also -- to be taken up when required by JNC (may be in Sep 2015).
12 Aug : one working feed still there; 2nd feed will get new LNAs (as above) and will be going up for tests; for shortage of post-ampl + phase switch (due to mixer going obsolete) -- substitute device has been identified but it may not work for Lband (due to slope) -- this will work for 550-900; to find few spares in the market (or from our old stock).
26 Aug : only one working spare now (not counting the one going to go to C2 today); one coming down from C2 will need some servicing (less deflection in one band). VBB looking for spares in old stock and GP has indented for 10 nos at $100 each; for replacing the OH feed on 15m dish : take one of the 3 extra spare feeds and retrofit the electronics from the OH feed into it -- but will need to replace main BPF, sub-band filters and maybe LNAs (if retuning does not work) -- this activity will start after 15th Sep and can be done on lower priority.
==> unit from C02 needs both poln amplifiers to be changed -- spares are available; meanwhile, one fully ready spare feed is there; 15m work has not started yet.

(ii) other electronics : sub-band filter bank is the main item missing; it was found that the sub-band filter ckts spares don't work as one gnd line (for switch ckt) is missing in the films from RRI (!) -- to try with a wire providing the gnding ckt; alternate is to start using the new design -- this shows good performance for individual filters, but integrated unit is giving poor performance for selection of 1280 -- problem with the switch (new make is not giving same performance as original make) and this is affecting both reuse of old filter PCBs and also the new design; looking for original make (MACOM) and also trying a different switch (Hitite, which means new PCB); new PCB designed with Hitite switch (will need additional patch PCB to convert logic levels; one chassis (for 2 pols) made available for testing; new design still not working for 1280. After isolating the filter from the switch, response was found to be fine; found some issue about the layout on the PCB for the Hitite case and PCB was redone -- received, populated and tested : looks like still not producing proper results? Finally problem tracked to the amount of grounding : added a metal plate below and screws to provide additional ground area -- now both MACOM and Hitite designs are working ! Modified PCB layout being done (for both cases) -- design sent for fabrication around 10th May; both PCBs assembled & tested (15 Jun 15) : results showed MACCOM response is better; Hitite is showing some shift in some of the sub-bands; recommendation is to go with MACCOM;
current action items are :
(a) to check and confirm whether 10 dB extra amplifier for 1390 is needed or not : detailed look at results show new filter is better in shape (and insertion loss) but still not good enough to dispense with the extra amplifier at 1390 (1 Jul 15) -- to check if this item can be concluded and closed.
(b) to assemble sample units for both channels and put on one antenna and compare with existing system : when new PCBs come (from Argus), will assemble in both channels (with ampl) and put in one antenna.
29 Jul : work in progress.
12 Aug : filter is assembled; need to add the 10 dB amplifier and test; may be ready for putting on antenna by next week; can check after 2 weeks.
26 Aug : 2 PCBs (for 2 poln) from Argus show difference in response : shift of 15-20 MHz in 2 sub-band and one sub-band not working; remaining 3 PCBs to be tested to check; may need to explore another vendor.
==> 5 PCBs were made, 4 were assembled; 3 could be made ready & tested; unit to unit shift of 15-20 MHz or maybe more is seen; agreed to take 2 best matching units and put on one antenna and see the performance -- can be integrated into the C02 feed that is waiting for new LNAs, and find best opportunity to put on antenna.

1.8 Testing of LBand wideband systems on 30 antennas -- from 26 Aug (SKR/PAR/SSK) :
(to maintain a proper log of action taken on individual antennas during these tests and debugging activities); data being taken fairly regularly since June 2014; issues being looked at and their histories are as follows (some of these are dynamic and keep changing as problems occur and are fixed and new ones pop up) :

(a) antennas with poor deflection overall : C1 in early 2015 (cable problem); C14 slightly low (1 dB) (Apr 2015); C3 slightly low & W4 one chan not working (May 2015); C1 both chans 1 dB & C11 ch2 (Jun 2015); see action items below.

(b) antennas with deflecton changing over the band (less at high frequencies) :
checked if pointing offset can explain this -- not found relevant; was shown that it happens for cases where the RF power level (at laser input) is too low -- confirmed with a more careful set of tests (and plots) for few selected antennas (including make good ones look bad by increasing OF attenuation), and demonstrated in deflection test report of 11 Nov 2014; to check if appropriate reasons for low power levels can be identified.
Mar 2015 : S4 had low power for long time -- was solved with change of RF PIU in OF system (!); C8 ch2 being investigate; problem seen for E6 but power level is ok;
Apr 2015 : OF attenuation needed to be changed from (default) -20dB to -11dB for a few antennas (eg W1 ?);
May 2015 : low sensitivity in C3 shows this kind of slope across the band in deflection.
Jun 2015 : E6 is now added to this list (C3 was not available) -- to check with JP about pointing related for E6; go backwards in the record to check when C3 problem started;
see specific action items below.

(c) antennas with improper off/on bandshapes : low power level or excessive slope e.g. W1 (was there for several months); C4 and W6 also;
Apr 2015 : cable faults found (& rectified) in C4 & W6; Mar2015 data does not show
Jun 2015 : W4 showed problem in 1 chan : was due to splitter and now fixed; W1 feed has been replaced by spare unit and slope is seen in the LNA of unit brought down -- one LNA has been retuned, second one is being done; C2 also shows this problem -- will do in-situ tests to check the cause;
see specific action items below.

(d) antennas with ripple in the band (this is mostly due to cable problems or loose connectors) :
Apr 2015 : C3 & C12 showed problem -- traced to loose connectors (after tightening they are OK); and Mar2015 data does not show any major problems.
Jun 2015 : S6 showd ripple; maybe cable problem? gone in Jul 2015 : may have gone away due to tightening of connections?
see specific action items below.

(e) antennas with significant RFI in the band :
some possible lines are (full set of known lines now given at end of test report):
airport radar : 1030 and 1090 (3 MHz BW)
GPS signals : 1176.0 & 1176.45, 1191.80 & 1204.70 + some at 1280 (will need predictive algorithm)
mobile signals : rejection is not equally good in all antennas -- needs to be checked.
unknown ones : 1137.5 (distance measuring equipment in aircraft?); 1320, 1470-1480 (maybe related to 4G), something near 1540.
see specific action items below.

Current action items :

(i) there is a good data base from sometime in 2013 onwards -- can we have a well-defined algorithm for comparison of different data sets and getting statistical conclusions? -- to look at developing a tool for this; a basic tool was developed : overplotting of on and off is possible and clear patterns can be picked up. To check for next level of sophistication of the tool. Tirth has started looking into things; expect some feedback from him by end Aug.
12 Aug : new pie-chart records showing different types of failures over last 3 yr period; need to cross-check the numbers it is showing...

(ii) learnings from the latest data :
data from 22 July, shows a few (2-3) antennas with low deflection e.g. C1, W4 (feed replaced); C1 needs to be investigated. Some antennas (C11) showing some extra RFI; also, one line seen at 1137.5 -- suspected to be distance measuring instrument on aircraft. Antennas checked for strength of mobile signal received : C9, C10, C14, E2, S1, S3, S4 and W5 show higher than -20 dBm in single carrier power level.
12 Aug : new data taken today -- not yet fully analysed, but results discussed in brief: quite a few antennas are down; quite a few showing poor deflection, and sloping with freq : C03, E03, E06; agreed to follow-up at least one or two of these (C3 and E6) to track when the problem started and to check OF vs FE and then decide follow-up action.
C1 very low, C2 no deflection -- these are being looked at.
1180 1230 MHz lines seen predominantly in these tests (to checkf if both are GPS).
26 Aug : waiting for detailed updates from Sanjit on 12 Aug data + follow-up on known issues.
==> this week's data not yet ready for analysis/discussio; last data from 8 Sep discussed : 25 antennas were working; most have decent deflection results; S06 may have some problem; E03, E06 not showing slope anymore (seen till 12 Aug) -- need a proper history of the events for this; C1 problem was due to bad cable -- changed only last week; C2 feed problem -- brought down for repair;

new RFI seen at 1520 to 1560 (only this epoch) : may be international mobile satellite communication ? -- needs urgent follow-up

New item : issue of default attenuation of 10:10 for full Lband appears to be overkill, but SFA predicts that; actual spread is as much as 10 dB.

1.9 Switched filters at different stages of receiver -- from 26 Aug & before (SSK):
2 main categories of switched filters are needed : (a) switched filter banks inside FE boxes (these are mostly covered under agenda items of the respective FE systems) (b) switched filter banks in rx room for additional, selective filtering of the RF signal before it goes to GAB system; (c) monitoring set-up in rx room (at o/p of OF system); these are being designed using the new switches : 2, 4, 8 way switches with different possible configurations;

Current action items are as follows :

(i) for rx room monitoring at OF o/p : note that these circuits are connected to the nonitor ports of the OF system; first design did not give enough isolation at highest freq of operation and hence new design was done; ckt for 2:1 and 4:1 versions was mdae ready & tested -- 25 dB isolation achieved; drops to 17 dB with frequency for 8:1 switch -- now getting improved rejection : better than 25 dB below 1 GHz; goes down to 16 dB above 1 GHz; the leakage between the signals with this switch is

still unacceptable; trying another switch (MACOM make) which terminates unused inputs while selecting the desired input (will be used in the final 30:1 monitoring system), and gives 40 dB isolation; new switch + modified design with additional isolation switch and power supply isolation done : achieving 35 dB at Lband and more than 50-55 dB at lower frequencies, with all channels powered; will be tested in monitoring system for 16 antenna set-up. 8 antenna system completed and under test; appears to be working ok; assembly for 16 antenna system is ongoing; components are available for full 64 input (32 antenna) system.

Current action itesm :
(a) to look at test results of 8 antenna system -- especially the isolation results :
Around 20 May 15 : isolatio numbers (at 3 spot freqs) ~ -40 db to -35 db for adjacent ports and ~ -40 to -70 for other ports; lab tests on integrated system (15 Jul 15) show 35-55 dB; to check if it holds for 16 antenna system.
26 Aug : no formal circulation of results yet.

(b) to do an additional test with signal injected at Tx i/p at antenna also :
done finally (15 Jul 15) and demonstrated to give 35-55 dB isolation.
26 Aug : no formal circulation of results yet.

(c) to completed 16 antenna system (4 units wired and ready) : initial system made ready (20 May 15), showed ripple in one of the 8:1 units; later (17 Jun 15), there was problem of dip in 1390 region that required additional grounding in relevant part of the ckt; by 1 Jul 15, had good results for 14 antennas, but still some issues related to driving of digital lines...
15 Jul : above problem persists; need to increase fan-out capacity by improved design;
29 Jul : work in progress; to wait and see.
12 Aug : fan out problem solved; 16 antenna system completed; now adding 8 more.
26 Aug : about further expansion beyond 16 antennas : see below.

(d) to summarise the design in a note -- work yet to start?
12 Aug : to aim for a basic report by next meeting.
26 Aug : this is NOW become the highest priority and there has been NO circulation of ANY results so far; agreed to stop work on expanding beyond 16 antennas till these results have been circulated in a brief report and looked at.
==> agreed to generate the report urgently; meanwhile, to stop work on further development (24 antenna system has been completed).

(ii) for rx room switched filterbank : prototype system was been developed; tests were done and performance found ok; report describing the design and characterising the performance was produced, circulated and discussed (22 Apr 2015) -- was in quite good shape, with results for different filter combinations. Final version was sent to Dongare by Ankur around 20 May 2015. Pending issue is about availability of space in rx room for housing these units -- agreed to keep this pending (on low priority) till final requirement for this system is clear.

1.10 Finalisation of 550-900 FE box -- from 26 Aug (IK/ANR/SSK) : to produce a block diagram for the 550-900 FE box; then to start seeing which units are ready, which need to be done; which may need to be combined into single units etc; roughly same number of components as 250-500 box, slight difference in the arrangement of notch filters; size of sub-band filter chassis will be different; agreed to start this layout work in paralle with the work on common box layout -- Imran+Ganesh looking at it, with Bhalerao's help. A basic block diagram was produced by Imran and discussed (Jun to Jul 2015), and some of the aspects were clarified.

Current action items :

(i) dir coupler not available -- being designed fresh; 2 options done and PCB sent for manufacture (to Mohite, then changed to Argus) -- Apr-May 2015; first tests without chassis look ok; tests with chassis for 2 designs (with different substrates) tried (May 2015): one design is better in terms of insertion loss (~ 004-0.06 vs 0.06 to 0.08) and variation of coupling over the band (3 dB vs 6 dB); selected design was to be tested with noise source + LNA + feed load in the lab; integration could not be completed as the 1st version of the "hood" not big enough (4 Jun 2015); agreed to complete antenna tests without this noise coupling (fall back option is to use the 2nd coupler whose size is smaller); took a lot of time for new, bigger hood to be made and delivered; finally, chassis with type N connectors assembled inside the new hood...
12 Aug : chassis with type N connectors has been assembled alongwith new hood; FE box in DC wiring stage; will get done this week and should go to antenna (E02) by earlier next week.
26 Aug : unit is ready to go to E02 (was down due to UPS wiring problem) -- will happen this week.
==> unit has been on E02 for over 2 weeks now; seems to be working ok; to check for some user level tests; meanwhile 3rd unit is getting ready (to check about feed).

(ii) post-amp + phase switch to be combined on one PCB + chassis that matches with size of Lband post-amp + ph swtich system and RF on-off will be added to it; proto yet to be made (see discussion earlier).
17 Jun : PCB layout is ready and will be sent for fabrication shortly.
1 Jul : PCB sent for fabrication (to Techno Ckt).
29 Jul : some PCB has come but not both sides that are required; this will hold up integration of box #2; agreed to go without RF on-off, using the Lband unit (same as done for C10 box).
12 Aug : Lband unit is with the new device (see above) which needs to be tested (by Sougata) and then integrated into the current box being assembled; still waiting for mirror image side of the PCB.
26 Aug : missing PCB has come and tested ok; will be integrated into next box #3 (2nd unit with final hood design) which will come in 2-3 weeks.
==> new PCB is going into the 3rd unit (now being assembled).

(iii) main FE box : prototype is now ready and demonstrated -- looks in good shape; testing to start shortly; prototype of DC + LNA combo with feed will be ready in 2 weeks time (by 20 May).
20 May : DC wiring is completed; RF routing work is going on.
4 Jun : this is completed and will be tested on the bench with the hood today and go to C10 tomorrow (5th).
17 Jun : this box is working ok on C10 and the design can be taken to be the final version, except noise injection connection is not made and tested to the hood.
1 Jul : just waiting for unit to be assembled with new hood and tested on the bench and then the item can be closed.
29 Jul : one completed and sent to C10; 2nd and 3rd getting ready (see above).
12 Aug : 2nd unit is in DC wiring stage; 3rd one will be taken up after that.
26 Aug : 2nd unit completed and will go on E2 this week; 3rd one will come up in 2-3 weeks time with the hood (see above).
==> see points above; meanwhile, agreed to initiate the work for the mass production of the mechanical components : feed with dipole; hood structure (batch of 10)

1.11 New filters for Lband -- from 26 Aug & before (ANR/SSK) : Sample Lband

full-band BPF had been designed -- has no slope with freq and better insertion loss, and maybe a better option than the existing main BPF; similarly, prototype design of new sub-band filters (with better insertion loss) has also been done. Detailed results for the main BPF shows that the BW is slightly less than existing BPF : 500 MHz (965 to 1465 MHz), instead of 590 MHz (890 to 1500 MHz) -- this gives better rejection to mobile band signals, but has implications for final usable BW of L-band system; furthermore, an improved notch filter has been designed for the 850-950 mobile band (-60 dB vs -45 dB at 900 MHz), alongwith a LPF for cutting off the 1800 mobile band has been designed -- 3 dB cut-off freq of 1650 MHz. The matter was presented to the users in Friday meeting on 9th May 2014, and it was agreed to generate a note about this proposal, for clearance in the GSG. This was done and matter was discussed in GSG of 13 Nov 2014 and it was cleared to proceed on the following: new BPF + mobile notch filter to replace existing filters in FE box; LPF to be put in common path at antenna base as a common facility for all bands; to be taken up as a case-by-case replacement job, whenever a unit comes down for some maintenance work. Meanwhile, plans for mass production need to be worked out.

Current action items :

(i) status of mass production :
(a) for the LPF (Jul 2015) : 10 units of 1650 LPF had been fabricated out of 40 PCBs available; it was agreed to order PCBs (stripline) for 70 nos using existing eps10 board; both pols to be combined in one rail-type chassis (35 nos needed);
29 Jul : 10 are completed; can go ahead and do more antennas and both channels.
26 Aug : mass production to continue beyond 10 nos, if chassis is available.
(b) for the main BPF : PCB + chassis for new BPF ready for 40 nos (30 antennas + 10 spares) -- this can be closed.
(c) for the new notch filter : 60 nos had been made (PCB + chassis) of which 30 have been used in existing system; all 60 ordered and received (29 Jul 2015); sub-item can be closed.
(d) to include these items in Ankur's spreadsheet : Lband new filters now included (BPF is completed); sub-band filter information also added (17 Jun 2015); updated spreadsheet was circulated and it contains the new information (1 Jul 2015); plan is to transition to a web-based tool for long-term tracking of progress;
15 Jul : the spreadsheet is now available for online viewing;
29 Jul : this appears to be ok and can be closed
26 Aug : can close all others except item (a) above.
==> to cross-check availability of chassis against item (a) above and see if it can be closed.

(ii) status of installation :
(a) agreed to put 10 nos of 1650 LPF in one channel of 10 antennas which have 250-500 broadband system installed; initially, 1650 filter was put in one poln of C10 on a trial basis -- appears to remove the 1800 mobile signal and does not appear to affect other bands; shows about 0.5 dB insertion loss; agreed to put available 10 nos in ch1 of 10 antennas in central square.
15 Jul : installed in 8 antennas so far -- list to be given to NSR for updating the webpage; watch and wait for some time.
26 Aug : installed in one channel each in 10 antennas (to be confirmed by Ankur); also to check with NSR if the update shows on his page.
==> to close the matter with confirmation of entries in NSR's table.

(b) also agreed to move the 70 MHz HPF to just before the signal enters existing IF system (instead of just after the signal enters the ABR cage); tried for one antenna

(C4 ?); discussion with ABR team did not converge as planned; right now, LPF and HPF put in series and put on top of the rack. To confirm the final status (for all 30 antennas) and close the matter.
26 Aug : confirmed that HPF is restored in all antennas to earlier configuration and 1650 LPF is being added in series (cascade) with it.
==> item can be closed.

2. RFI related matters :

2.1 Some of the broader issues related to RFI -- from 19 Aug (PAR/SSK) :
(i) verification of in-house RFI measuring scheme with controlled expt with different res BW and with continuum and line RFI sources.
(ii) absolute calibration of RFI power that will reach antenna.
(iii) testing of RFI produced by GMRT bldg vs environment, using GMRT antennas : controlled test to be scheduled.
To have a follow-up discussion on these topics.
26 Aug : PAR not present; agreed to have a detailed discussion next week.

2.2 Discussion relating to Industrial RFI survey -- from 26 Aug & before (PAR/SSK) : revised docs (from 2009 and 2012 discussions) had been circulated by RFI group and were discussed in 5 June 2013 meeting (is the document too exhaustive?); new survey planned with main aim to generate updated database which will be useful to pinpoint likely hotbeds of RFI in the industrial areas in addition to finding those without NOC; after months of planning and discussion with DIC, was finally conducted during 23-27 June with 4 teams; covered Ambegaon and Junnar talukas ~ 40-50 villages in each; ~ 40-80 working industrial units (large number are closed down or never existed!). Some of the progress is as follows :
A form had been prepared for use in the survey and had been discussed in detail and agreed that it is suitable for use; about 70% of existing data had been entered into this form; agreed that this activity would be superseded with making a database of equipment and NOC record for the existing industries found in the survey; this data entry now completed for all 3 regions : Junnar, Ambegaon and V-K industrial estate; some highlidhts from the database : of the total list, a significant number of industries are closed down, and another significant factor are no longer traceable; about 1/3 of the original are still working (ignoring poultry which is about 1/4, but is considered RFI-friendly). A follow-up meeting with DIC took place on 30th Sep 2014. Summary is as follows :
a. To maintain proper record of the data of existing and future industries in the same format. The data format and data base was shared with them during the meeting.
b. Complete list of the villages in Zone I to Zone IV is submitted to them, based on which they can decide the issuing of NOC for industries in different regions (and also outside?).
(c) DIC to issue NOC to the old units which are working in the GMRT identified zones, with guidelines from the GMRT

Matters had been stuck for some time due the issue of payment to DIC team for some of the expenses incurred during the survy work. This has been resolved, following the meeting between PAR + JKS and DIC office, on 27 Apr 2015.

Also, we don't have formal declaration of "no industrial zone" decision -- need to find a way to formalise this.

Some of the present action items are as follows :

(i) To cross-check the list against the ones which have NOC, to identify those which don't have NOC and initiate appropriate follow-up action :
(a) identify those operating without NOC clearly in our database -- Govardhan, sugar factories near W6 and S6, old unit of DJ exporst, any more? is the final count available now?
(b) to approach DIC to work out a procedure for issuing NOCs to such old units : DIC will be sending the standard form to them, and it will come to us for clearance; we need to be careful about to whom we say "yes" in retrospective manner, so as to avoid setting up a precedent of giving NOC to somebody with wrong kind of equipment already installed & running ! Possibilities for improvement can be suggested to them. Some work to start on this by NCRA giving a first list of names to DIC for initiating action.
29 Jul : meeting with DIC last week (with JKS) : docs about 30 km zone handed over (formal doc from Mantrayala to be obtained by JKS later); data about villages within 30 km zone also handed over;
12 Aug : email update from PAR : NOC related to old units Govardhan, Sugar Factory and Overseas Exports Ltd (Near D J Export Ltd.) were discussed with DIC officials. The same will be discussed once again during visit of Mr. Dekate to the GMRT. The date is not finalized yet.

(ii) Related topic : units that have NOC and grow in size to exceed the norms -- what is to be done. One unit just under 2 km away on highway -- should be told "NO" and see if he will shift beyond 2 km. Also to check if our norms can be tightened further for differentiating between less harmful and more harmful industries -- to check the procedure used for establishing the norms.
17 Jun : records show that one unit located at 1.93 km was given clearance (2009) for a serum making plant.
29 Jul : item discussed in detail about possible options for moving beyond 2 km : to shift sub-station + genset to 100 m beyond 2 km limit and put underground cable from there to supply point, and test by GMRT team before final NOC.
Letter to be sent to DIC with this feedback.
12 Aug : email update from PAR : The corresponding draft letter was sent to the director with all possible suggestion to move beyond 2kms distance.

(iii) To follow up with DIC about single phase welding units : they have requested letter from GMRT to collect information from users around GMRT antennas; after discussion with NCRA admin (ABJ + JKS), agreed to follow 2-pronged approach : send letter to DIC authorising the survey, and also approach gram panchayats to collect the data; letter delivered to DIC (mid-July); to check if action initiated with gram panchayats.
29 Jul : discussion about collecting information from gram panchayats about other, smaller unauthorised industries (e.g. welding units) -- discussion with new person who will visit GMRT in the near future.
12 Aug : email update from PAR : We are waiting for the visit of Shri. Dekate (DIC) to the GMRT, during which it will be discussed.

(iv) during the survey, some units which are likely to be important from RFI point of view have been identified for detailed studies later on -- some work can start in parallel with completion of database, beginning with the bigger units; measurements (using LPDA) for 2 big industrial units in Junnar & Ambegaon area completed; no new ones have been done (about 10 more need to be done); results for the 1st two have been analysed & no strong RFI is seen other than the ambience due to powerlines etc. To check current status of this.

1 Jul : email update from PAR : regarding measurement of rfi from bigger industries other than two still pending. In the mean while we have visited transformer installations for power line interference measurement.
email update from PAR : presently we are visiting transformer installation site on the west arm. After completion of the work we will start industry related RFI measurement.

(v) To try and formalise the declaration of 'no industrial zone' around the GMRT : to request JS(ER) for help ? Can be brought up in the NMB?

26 Aug : no updates as PAR not present.

2.3 Transformer RFI revisited -- from 26 Aug and before (PAR): Team has been doing a check on transformer RFI and the updated results from this will be available soon -- will need to see how this compares with the earlier round of this work.
Comparison of old and new data is in progress. Only 6 locations are common between new and old data (!) -- many new installations are coming up ! No clear conclusions have been drawn from the study; also more data needs to be taken to cover a larger number of transformers -- to wait for an update from RFI team.
20 May : some of the old data has been found (2005-06 & 2006-07 surveys) and there is likely to be some more data from 2008-2012 period -- to fill up the details properly; to try and extract the following : (i) typical time constant for failure / malfunctioning of a xmer and (ii) most common types of RFI problems : fuse links, bad transformer, cut joints...
4 Jun : older data have been found and are being added to a combined data base (old data were upto 2 km and new data is upto 1 km only -- but has more transformers !); one unit near W1 may need urgent attention -- to get the history of this and initiate the action.
17 Jun : still waiting for consolidated report! meanwhile, electrical has initiated action on the urgent case near W1.
1 Jul : updated transformer related data will be sent out in next couple of days; work has been initiated by electrical with MSECTL for W1.
15 Jul : Older data needs to be added to already tabulated [2006/7; 2007/8; 2015]; current table shows 37 out of 58 transformers show problem in 'fuse link'; to decide follow-up action.
29 Jul : all data is now combined into one spreadsheet; there is still significant non-overlap between old and new coverage -- agreed to cover some more of the ones done earlier; also start looking at the worst problems in the new data.
12 Aug : electrical team is first checking and fixing our transformers and then will go for external ones; some difficulty in getting cooperation from MSECTL for ext locations (even W1 problem is not fixed).
additional email update from PAR : On the west arm 65 transformer location are completed for west arm near W04,W05, W06 antenna; and 20 transformer installation near S01 and S02 antenna site. The analysis of the data has not been done due to antenna work in the GCC duty. It will be done in the next week.
26 Aug : some progress in discussions with MSEDCL; work on DPs near W1 may happen this week or next (Fri, Sat & Sun are their preferred dates).
==> W1 area has been done; now working around Khodad near C13 area -- RFI team needs to check the improvement.

2.4 RFI from air conditioning systems -- from 26 Aug (PAR) :
RFI from new Air Conditioning system (VRV) at NCRA building has been measured [at 3-m distance from x1 & x3 compressor/(s)]; need to compare with RFI from single AC units e.g. in antenna shell, in GMRT main bldg etc.

Need a joint discussion with electrical to move the issue forward.
12 Aug : agreed to examine what can be done with the canteen annexe AC units for isolating the digital control circuitry and then conducting controlled tests;
26 Aug : will start work on one of the ACs in the canteen annexe; RFI team will do one measurement (in next day or two) before the changes are made.
==> work will happen in canteen annexe units within next week.

2.5 RFI testing of LED lights for GMRT labs & building -- from 26 Aug and much before (PAR/SSK/RVS) :
Electrical group has indented for 5 W lamps + X Watt tube lights (after samples had been tested for RFI and cleared) -- delivered units had 5 W and 7 W lamps; the 7 W lamps were found to generate RFI (not to be used at GMRT); tubelights (50 nos?) also failed the test; hence, only 5 W bulbs found suitable ! RFI testing of mass installation was also done and found ok; agreed to install in canteen as first location; these were checked for RFI after about 6 months usage and found ok; thence, cleared for mass procurement and installation in different locations; 30 nos of the original 50 nos of 5W LED lamps were installed in corridor & lab areas; indent was raised for additional quantities; these were delivered (how many?), and this new batch was tested for RFI as per earlier procedure and found to be ok; additionally, RFI team tested the units that have failed in the first 6 months or so of use -- these results are covered in the latest report, wich summarised 2 yrs of tests -- no RFI found from partially or completely failed units being powered on; agreed that report can be given to interested vendors for improving the products; sample batch of Syska make tested and found NOT ok.

Current action items :
(i) to confirm current quantity purchsed and installed : 50 nos purchased (and installed mostly in the corridors); an additional 200 nos have been received last month (Feb 2015); plan is to put them in guest house rooms, hostel rooms, guest house corridor, and labs as per choice of users -- almost all are used up; agreed that 200 nos more can be ordered; checking with party for single batch supply (ok);
4 Jun : indent has been placed but not yet in order phase.
12 Aug : order placed; delivery expected in next week or so.
26 Aug : shipment has arrived; request sent to RFI group for random sample checks.
==> units showed significant RFI; found that it is actually 7W unit, instead of 5W ! consignment sent back to vendor, now waiting for resupply.
(ii) light from 5W units is not sufficient at some locations : to try to have arrangement for putting 2 units in parallel on same connection (for more Lumens); fixture is being made ready (abandoned) and now looking for off-the-shelf options? to confirm current status.
1 Jul : could not find complete off-the-shelf solution; now trying for some hybrid.
29 Jul : work is in progress and two sample units have been made.
12 Aug : still trying to get the final reflector into the design; sample unit to be installed in canteen annexe.
26 Aug : sample unit has been installed in canteen annexe with 3 lamps and it appears to be all right. Few more such units can be made for such rooms (and some of the offices); to try for a variant with slightly less reflectivity for lab use.
==> modified version with ivory coating is pending;

(iii) do we need to worry about failure rate of the units? (~ 10 have failed so far); agreed to wait for the statistics from the present lot of 200 (looks like it may not be a serious issue ?) -- need to wait for new stats to become available.
4 Jun : agreed to work out a scheme of keeping track of the failures -- need an update on this.

1 Jul : electrical to maintain the statistics.
29 Jul : no new action right now.
26 Aug : no new action here as electrical is keeping track.

3. Operations :

3.1 Mass production of shielded box for MCM cards -- from 26 Aug & before (SN/CPK/HSK): RFI test report of Akvira vs Physimech showed Akvira is better and this was selected. Testing of new MCM card in shielded box, with final configuration was done and report was very positive, and it was agreed to go ahead with the mass production of this shielded box; RFI group to complete 2 more prototype units and then hand over matter to Ops group, which was to discuss with RFI and Mech groups to get all the inputs and finalise the plans for placing the order on Akvira : drawings for 2 types of box : with & without provision for SPI port on chassis + 1 serial port on each box; parts list for RFI shielding materials to be ordered; list of possible vendors etc; Final target is for 60 + 10 (spares) shielded boxes; was order sent for 70 nos, with one prototype to be delivered first, and batch-wise delivery after that; sample box of Rabbit + switch + media converter + Miltech PC combination was tested on 4th Dec 2014 : results match with earlier tests using prototype units.
Two minor points conveyed to vendor : size of one of the opening and assembly of the side plates. Finally, 70 shielded boxes (for Rabbit MCM) were delivered; agreed to keep them in storage and use as needed; for procurement of the RFI material and components, list was prepared and confirmed with RFI group and indent ready (total cost ~ 33 lakhs (including items for shielding of the switch?) with line filter included (?) ; to check current status of indenting and ordering.
enquiry has gone (combined for both items); quotes have come on the higher side : problem with total now exceeding 25 lakhs whereas the original indent did not!
to investigate the reason for the increase in costs (look like 2 items may be the culprit?); to try to split into 2 equal parts, with repeat order, after checking with party about holding the prices.
20 May : recent clarification from the party is that 2 of the connectors (which are needed for bringing in DC power) have costs increase of ~ 7 x (300 $ each for a pair); modification suggested is to use the normal data connector for bringing in power (15 V, ~ 1 Amp) -- can parallel all available pins; can check with vendor and then put modified purchase order, dropping the 2 connectors.
4 Jun : going ahead with the scheme of getting power from normal data connector -- test set-up needs to be made and run for some time; to confirm with purchase that order has gone.
17 Jun : order has not yet gone -- CPK to check and see what is holding this up.
1 Jul : order for connectors appears to have gone.
15 Jul : Order has gone; to confirm expected date of delivery.
29 Jul : one month more for delivery.
26 Aug : no change in status.
==> connectors have been delivered; cables still awaited.

3.2 Mass production of shielded box for switch enclosure at antenna base -- from 26 Aug and before (SN/CPK/HSK) : Detailed RFI tests show that the shielded enclosure appears to be working quite well; RFI team handed over the information and material to Ops Group for initiating mass production; last round of confirmation to finalise the drawings done; Ops group started on the work requisition for this box (as well as the box for the Rabbit card), in cooperation with mechanical group; target is 35 nos of these shielded enclosures; order placed for 35 nos, with one prototype to be delivered first, and batch-wise delivery after that. All 35 boxes delivered

(c. Feb-Mar 2015); for ordering the components : list made in conjunction with tha for Rabbit card box (see item 3.1 above);
15 Jul : CAT5 cables (for these switches) ordered; delivery expected in 2 months;
26 Aug : no change in status.
==> see above.

3.3 Planning for proper UPS & space utilisation for new equipment at antenna base -- from 26 Aug & long before (SN/CPK/RVS) : long-term plans for intallation of final UPS system and proper utilisation of the space at antenna base. Follow-up on 14 Aug 2013 discussion on first report : 2nd report was generated and detailed discussion took place on 5 Feb 2014; successive follow-up & final agreement on way forward (alongwith updated report) reached c. May 2014.

Some highlights are as follows :

(a) Regarding electrical loads : power drawn by different sub-systems estimated carefully, alongwith actual sample measurements on a few different antennas, for both existing systems as well as upgrade systems; effect of in-rush current at switch on also considered; total current requirement of 10 A for the ABR systems + servo control electronics found to be sufficient; hence 3 kVA UPS is adequate; agreed that, if needed, peak load requirement (e.g. in-rush current) can be balanced out by synchronised delayed switching on of different units -- this is already implemented to some extent at present. Final load requirements have been carefully checked and tabulated in the updated report.

(b) Regarding electrical wiring : agreed to have separate isolated supplies for (i) servo drive system (without UPS) (ii) servo control electronics (with UPS) and (iii) ABR electronics (with UPS); one common 3 KVA UPS with split o/p (2 KVA + 1 KVA for servo and ABR respectively) each with its own isolation transformer is the ideal solution; the new UPS can have the isolation transformer(s) integrated into it, without increasing its footprint (only height may go up); updated wiring diagram has been produced by RVS in consultation with SKB and others, and is available alongwith the udpated report.

(c) Regarding space utilisation : new UPS can be located in the space between the ABR and servo racks -- this has been done in one antenna with the new UPS and appears to work ok; existing servo FPS units can be left where they are; if isolation transformer can be moved out from the rack, then space in that common rack is enough for all growth plans of FE and OF systems; this leaves some empty space in ABR rack bottom that can be utilised for further growth of telemetry system; all new servo growth to be accommodated in the servo racks (or in-situ replacement of existing units); extraneous items in the surrounding of the racks (electrical fittings etc) can be relocated, as far as possible, to make it convenient for people visiting for work. Most of these issues have been captured in the updated report. Matter discussed in GSG meeting of 13th Nov 2014. This item can now be taken to the logical conclusion : net outcomes can be summarised and follow-up action to be finalised.

Main list of actionable items are as follows :

(i) ordering of 10 nos of UPS : order has been placed; delivery expected end-Jan. 5 units had arrived and tested for RFI -- failed; some modifications were required; additional issue of PF of the UPS -- improved to ~ 0.6 & accepted (will add capacitor band at ABR for further improvement); first unit available for use c 20 Apr 2015); installed in C10, replacing existing UPS, alongwith 3 ph wiring arrangement (6 May);

2nd unit is ready (only xmer is needed) -- will go to C00; remaining 8 units with modification in 10-15 days -- should be with us in one month (early June); extra cost will be absorbed in next batch, which can be for 22 nos and will cross 25 lakhs -- to check with purchase about the procedure for handling this : amendment or include in next order?
29 Jul consolidated :
(a) RFI test report on all 9 units is available and all are found to be ok at 80% of full load -- this aspect is now closed;
(b) units installed in C00 & C10 and 2 more in progress in CSQ (C4 and C14); remaining 6 to go in arm antennas -- S1 & S3 completed; C13 has old UPS;
(c) for clearing the payment for these 10 units : agreed upon to amend the existing order to include the extra amount (finally came to Rs 21K per unit, dominated by cost of transformer);
(d) for going beyond 10 units : a new party is showing interest in taking up the job; to check original with party if he will hold the prices (or give a discount) for additional units; finally agreed to go with 10 more with Ador and 1 unit to new party (Aircon) and then decide upon the last 10 units.
12 Aug : payment not yet completed (in progress); 11 new units (10 + 1) processing started.
26 Aug : bills received and will be getting cleared; indents to be raised for the 10 + 1 new units.
==> payment is cleared; 9 out of 10 units installed and 3 units giving tripping problem -- waiting for vendor to investigate.

(ii) final wiring diagram for servo + ABR is needed : modified wiring diagram was prepared by electrical and shared with servo (4 Aug 2014); meanwhile, discussions with BLDC supplier convereged : now ok to ground the neutral of the main 3 phase transformer; extra EMI filter may be required (RVS confirmed it to be only Rs 10,000 per antenna) + only one set of line-filters will be required. Action items :

(a) RVS had circulated updated wiring diagram (done in consultation with servo) which included inputs from MACON (via servo group) which suggested radiation shield between the BLDC rack and other racks. Finally, updated diagram providing sufficient shielding distance had been prepared and circulated (c Feb 2015) : no objections received; agreed to implement in one or two antennas, with few units of the line filter on trial basis; new input from servo for extra load to be added for PC104 related item -- to check current status.
29 Jul : no immediate action items here?
12 Aug : servo control rack + PC104 added in C10 : this is not as per agreement -- TBC and discussed with servo.
26 Aug : item under discussion (including in SMEC meeting) -- yet to be resolved.
==> electrical & servo have discussed the matter, including joint tests at C10, and all are agreed to go ahead with the additional load of servo control rack : measured current is around 3.2 A and it is acceptable; PF has to be checked.

(b) for the EMI filters : contact with party (Schaffner) was proving difficult to establish (to try other parties also?). finally, EMI filters indented (enquiry gone), waiting for quote from Schaffner.
4 Jun : order as been placed; delivery date is end July (only 4 nos being ordered).
1 Jul : 4 units received; one installed in C10; can install second in C00 and talk to servo about which 2 other antennas to install (including one new BLDC antenna); decide after 2-4 weeks to order more units (10 more).
29 Jul : EMI filter installed in 4 antennas; servo wants to test the performane with the EMI filter and then give final clearance -- to check if this can be expedited;

meanwhile can start the paperwork for more filters.
12 Aug : RVS to check with servo (via email) and meanwhile processing for 10 nos.
26 Aug : indent has been raised and enquiry is under process.
==> order has gone for 10 more units.

(c) meanwhile, agreed to try the test of sharing the xmer between servo and other loads, via two sets of AC line filters (that already exist) : to choose either C00 or C10 after discussion with servo, for the initial tests.
20 May : heating in servo transformer is found to be significant (even without adding the additional load) and the load in each phase is ~ 6-9 Amp (much less than rating of 15 Amp); likely causes :
old vs new lot of xmer : new lot has different core & heats up more -- to be checked
THD -- can be measured for each phase
PF -- can be measured for each phase
aging -- to check mechanical features by visual inspection etc; calendar age
weather -- can the inside of the concrete shell be kept a bit cooler?
allowed range of temperature for xmer to be checked (80 is for old one; 120 is the value it goes for new one);
to check the above issues, including actual temperatures reached, and come back with numbers and conclusions for follow-up.
17 Jun : work is ongoing and detailed tests will be done in next 2 weeks time.
1 Jul : 2 fans added in C10 xmer cover to help circulation; temperature reached with full load on servo xmer is about 78 deg -- to confirm if ok with servo and then replicate the scheme in C00 and then converge towards mass production.
29 Jul : in 3 antennas cooling of transformer with fans tested and found to give 20 deg improvement -- this design can be finalised;
12 Aug : this aspect can be closed.

(d) Meanwhile, on a trial basis, with a change-over switch, the extra ABR load can be added and checked for heating etc in C10. (increase in load is expected to be about 30%).
4 Jun : expt done in C10 for 10 mins : full load put on xmer (~ 2 kVA, up from ~ 1 kVA) total current ~ 8 A (up from ~ 4 A); PF changed a bit (improved!); THD increased to upto 90-120% (from 70%); 1 deg temp increase noticed. To discuss with servo and see if the test can be run for a longer duration.
1 Jul : tests for longer duration being done (see above); THD increase may be due to the Mosfet property of the UPS. To try and find a series filter unit of appropriate (lower) current capacity.
29 Jul : series filter of higher rating available; need to find one with lower rating;
12 Aug : identified one possible supplier.
26 Aug : need updates from RVS.
==> with 13 A unit THD reduction was shown; now trying to get 10 A unit -- negotiating the price with vendor.

(iii) making 1 or 2 antennas as model where all the configurations are made as per the recommendations : finally, agreed to use both C10 and C00.
At C10 : 3 kVA UPS was installed, but was feeding power to ABR only; later, servo shift PC104 load to UPS (isolation transformer still in use?); switch boards / extension boards shifted to safe level.
At C00 : 4.5 kVA UPS, with 2 isolation transformers, was installed with ABR rack connected on it; PC104 load was added to it subsequently; relocation of elec boards was pending. Following items being followed up :
(see also email update from Nayak & Jitendra on 22 April)

(a) agreed to put the FE power supply in the proper location in both antennas -- space was made ready (after removing delay contactor) in C10; agreed to do in C00 also; turns out that relocation of extn board is also needed to relocate the FE pwr supply -- SSK to ensure that this is done for C00 and C10. Need a status check.
(b) ask servo to confirm FPS drive location is in keeping with the agreed diagram : needs to be slightly shifted and servo is ok with it -- check if done at C00 & C10.
(c) RVS to circulate an email about the updates and finalisation of layout in C0 and C10 for replicaton in all antennas. This was done and some feedback from FE and BE teams received, and following items being looked into :
* shifting of sentinel "yellow box" (PSB + BR) -- check if done at both antennas and confirm plans for other antennas.
* alternate arrangement for keeping the phone : to change to hook phones that can be hanged -- check if done at both antennas.
* directive to keep AC flow downwards in default conditions : prepare stickers and put in 2 locations in shell -- check if done or not.
* contactor and timer for delayed start is obstructing FE pwr supply (can be removed once UPS is there?) : right now, agreed to shift; done in C10? -- check and confirm current status.
4 Jun : JPK visited antennas with FE person (Satish Lokhande) and Nandi to look at mechanical arrangements that may be needed to effect some of the changes; some solutions are being worked out, without violating the available space; yellow box shifting done on both antennas; sample phone units with proper buzzer arrangement done in C10, can be done in C00 (IP phones vs normal phones -- to be looked into by Ops group); contactors and timers have been removed in both antennas. Once the ps is put on new rails, the rearrangement would be complete.
17 Jun : mech and Ops have looked at it; estimate of down time to be brought up in coord meet.
1 Jul : adjustments in the rack will be done this week for C10 (may not need antenna to be down).
2 Jul : in C10, the EMI filter position needs to be shifted. FE power supply can be put in C10 -- FE team to try out the change with FE supply.
12 Aug : in C10, location for FE power supply was tested, with some additions; agreed to put on a permanent basis; and same change can be initiated for C00.
26 Aug : FE supplly in C10 is a dummy load (can be left there); will check if load in C00 can be live one or not. With this C10 can be taken to be in final shape; now to bring C00 to the same level.
==> C10 is all done; in C00, servo is not yet connected on UPS, all other works are completed -- to check with FE team if FE supply can be put in C00.

(iv) to improve the RFI shielding of the antenna cage, starting with the model antennas : check for unshielded cable and pipe entries in model antenna shell, including unused holes and punctures, and initiate appropriate corrective steps.
RVS to make a list of all the punctures in both C00 and C10 and bring for discussion.
Work had started at C10 for this; 22 Apr : pictorial report by RVS : AC plumbing; AC line filters; servo cables (BLDC + FPS) crossing; RF cables entry points; OFC cables crossing; plus a few more; RVS to send an email to all concerned, for identification of cables, entry & exit points and unused holes / punctures. Need a discussion with RFI team about measures to prevent the RFI leakage from the punctures. Current action item :
RVS and SSK/PAR to classify the various kinds of punctures and then RFI team to suggest solutions for each category, including plugging of unused punctures.
20 May : discussed with PAR also to move this forward; to check current status & plans.
1 Jul : some work had been done in earlier days (TLV, NVN times) and electrical is beginning to replicate that (similar soln has been used in ISRO cage); meanwhile,

RFI team is workign on the formal solution; also procedure for plugging the holes
is being evolved.
29 Jul : Pravin has made the list of punctures and status and provisions : punctures
of AC power -- may not need to worry about it; .... Pravin to circulate the results;
also, to circulate documnents on standard practice for such shieldings...
26 Aug : PAR has circulated a document with standard practices and now RFI team needs
to apply these to come up with recommended solutions for the various punctures.
==> no updates on this.

(v) also agreed to populate C0 & C10 with Rabbit, switch, PC (with shielding) as
and when available -- these 2 antennas can be used for next gen M&C work to add to
C4,C6,C12 to make a total of 5. Work in progress; JPK to keep track of this aspect.
Agreed to start activity of populating during MTAC for C00 and C10, and next to
C8 and C11; and then, if needed, to C4, C6, with aim to have 5 antennas ready.
Action has been initiated for C00 and C10 : one shielded box with Rabbit cards +
one switch with shielded box ready; 2nd unit getting ready.
Will need to make some of the other changes to make space for the final
arrangement; also 2 sets of units to be made ready. Check current status.
4 Jun : see updates in email from JPK. (to fold in the results from this !!!);
ethernet shielded box needs support structure in the rack for installation -- will
require in-situ welding etc; Rabbit card shielded box does not need any additional
mechanical work for mounting. Issue about physical monitoring of switch working
inside the shielded box.
1 Jul : Ops group and mech team to look into mounting of ethernet shielding box
(without welding, if possible); monitoring of switch inside the box is solved by
fibre team;
12 Aug : switch + Rabbit card in shielded assembly installed in final location in C10.
26 Aug : can plan an inspection to C10 this week.
==> no updates except those given above.

3.4 New, improved Miltech PC -- from 26 Aug and earlier (CPK/SN/PAR) :
Two units of Miltech PC with two changes (more screws on panels + panel mount
pwrline filters instead of chassis mount) were under test : conclusion was that
PC ok from all aspects. Pending action items :
Untitled event
(i) agreed to initiate the purchase of 10 nos of the final version above -- indent
had been raised for 10 nos (including some spare accessories?); current status of
the PO : order sent; expected date of delivery 31st Dec -- trying to expedite, if
possible; note from vendor informing about delay due to late arrival of m'boards :
end of Jan is new delivery date. "still under test" reply from vendor -- to see if
delivery date estimate can be got. SN to follow-up with BRJ on an urgent basis.
22 Apr : update from vendor to purchase : 3 units have failed and heat sink is being
redesigned; will take some more time; no response from party for a long time; Nayak
to request Sureshkumar to make a visit and check; confirm if there are any updates,
and decide future course of action.
4 Jun : some response from vendor got by SSK (15th June date has been given) -- to
follow-up with a visit and f2f meet if possible next time.
1 Jul : item not supplied yet; vendor is still facing problem with overheating of CPU;
SSK to try and visit him next time to get first hand information.
15 Jul : visit has taken place; x10 machines are under test; expected soon;
29 Jul : no fresh updates from the party; SSK to check again...
12 Aug : no updates at present.
26 Aug : some communication from Miltech to SSK that delivery will happen in one week;
CPK to talk to purchase to send a letter threatening cancellation.

==> action has not yet been taken.

Additional item : To initiate the discussion on specification of the server class machine needed for the system -- both for user facilities (to support absentee observing) and for new M&C system.

4. Back-ends :

4.1 Documenations at various levels -- from 26 Aug and before (BAK+others) :
To complete basic,internal documentation (at ITR level) and then move to the point wehere formal publications of relevant items can be done.
Current action items are as follows (many are pending for long durations now !) :

(i) Detailed design doc : analog back-end was being done by Hande : 2nd version had been circulated in April. Next level of document going down to chassis level is to be made ready -- chassis level doc will take about 2 months; was deferred till end Oct; and then deferred till end of Dec; 2nd version had ~50% chassis level inputs; to be completed by end-Jan'15; needs some more time as 2nd LO scheme inputs are also being folded in; work in progress; may take another month; check in mid-May.
27 May & 4 Jun : progress is slow, but going on. 10 Jun : still ongoing...
24 Jun : will take ~ 1 month (till end-July) !
1, 15, 22, 29 Jul : no significant update.
5, 12, 19 Aug : Hande is still busy with some other activities; hence delayed further.
26 Aug : one version expected by Hande by end of this week; LO for 2nd channel will get added later on.
9 Sep : next version for dual LO support and RF filter bank details will be released by 14 Sep.
==> ver3.0 released by Hande on 14th Sep; only cabling details need to be addeed to complete the document in the next month or so.

(ii) ITRs + publications for analog back-end systems to be taken up :
(a) analog back-end : Sandeep and Navnath to look into that; pending. Work pending for some time; team to review and pick up the activity. BAK to follow-up.
SCC and Navnath have had one discussion and will follow-up with BAK; not much progress; may take it up next month, after MTAC; list of items to be done has been prepared; work has been started by Navnath; to check current status; not much progress in last few weeks, but will pick up now (27 May).
4 Jun : not started yet -- to start now. 10 Jun : same status as 4 Jun !
1, 15, 22, 29 Jul : no progress reported.
5 Aug : Navnath and Sweta to work on this now and have a version by end of Aug.
12 & 19 Aug : work is ongoing, and is on track.
26 Aug : work on track.
9 Sep : first draft will be sent to GC on 9 Sep.
==> first draft in internal circulation.

(iii) ITRs + publications for digital back-end systems : ITR was completed by SHR (quite some time ago; after some follow-up, SHR and BAK started work on modifying GWB ITR to convert to a paper; first version has been circulated; needs to be taken up for discussion between YG, BAK & SHR
27 May : not yet reviewed and discussed; but agreed that meanwhile SHR can look at it from the point of view of improving by putting in the latest work on expansion to 16 antenna, dual GPU system.
4 & 10 Jun : will get into this once GWB-III release work is completed.

24 Jun : can start work now on incorporation of new GWB developments.
1, 15, 22, 29 Jul : no progress here also.
5 Aug : to try and take this up now, as GWB-III release is almost done.
12 & 19 Aug : not started yet.
26 Aug : need a discussion with SHR.
==> no progress on this.

4.2 : Power supply for GAB : from 26 Aug and before (NDS/BAK) : Two options are possible : linear vs SMPS. Comparison note with all pros & cons (convenience + price vs RFI properties) was produced; agreed that present (c. Aug 2014?) set-up of 30 ant GAB (with 5 spare SMPS supplies on order) can run for 6 months or so ; final decision can be taken later on. 4 SMPS units that had come were used to get 4 racks with SMPS and 4 racks with linear / CVT supplies; meanwhile, shielded box was designed for the SMPS by RFI team -- RFI report showed good performance; agreed to go ahead with it for mass production; meanwhile, SMPS installed in 4 racks; 12 new boxes with RFI shielding planned -- 8 are needed in the system, and 4+1 will be spare; mech group was to place the order for 12 nos (after BE & RFI teams check the drawings); drawing had errors (!); needed modifications; was stuck due to PC problems; finally cleared by early Jun 2015, and one sample was to be made in-house to clear everything; required fans etc ordered by PAR (Jun 2015); 12 boxes for SMPS awaited from workshop (to be outsource); prototype unit tested around 17 Jun 2015 -- required some modifictions;
15 Jul : 10-12 boxes have come; all except SMPS available; full set available or x5 boxes, except SMPS which is under order;
29 Jul : first unit getting wired which will be tested by RFI team before final acceptance and mass production.
12 Aug : unit wired and ready for testing
26 Aug : unit wired and tested for RFI (found acceptable, informally, formal report awaited); will be installing in situ today; will start work on the others with the aim to replace all 8 with shielded SMPS. Need additional SMPS supplies (15 nos are on order).
==> one unit installed in situ; work on to complete 4 units; waiting for remaining SMPS units to come.

4.3 Enabling independent LO for 2 polarisations -- from 26 Aug (NDS/BAK) : to get current summary of this effort and plan action items.
26 Aug : work on providing separate synth for each polarisation (by adding the PIU) is on-going. All CSQ antennas + 3 in E arm completed (5 racks); 3 more racks to go. Release testing is done from control room commands.
==> 6 racks, out of 8, are completed.

4.4 Power equalisation schemes for new back-ends -- from 26 Aug and before (SSK/NSR/BAK/SRoy): Need updates on both of the following :

(i) option 1 : using detectors in GAB and local feedback loop -- monitoring set-up was made ready; DKN worked on code (using algorithm taken from NSR); first round of testing showed problems like detector output saturation -- gain adjustment checked and problem fixed; basic power equalisation algorithm was first tested ok with 4 antennas, and then expanded to more antennas; comparative study of this scheme with the GWB-based scheme to see if there are any differences or pros and cons wad done : do GAB power equalise and look at GWB bandshapes; complete the loop by doing GWB power equalise and checking GAB o/p. Test completed both ways, first for 4 antennas and then later for 8 antennas (extended to more?); BE team is ready to release for use by operators -- a basic SOP to be generated and released. Current actions :

(a) to completed the SOP and release the set-up -- check if this can be closed : yes.
(b) to run this alongwith GWB bandshape check to help debug problems in GAB -- can be formalised as a debug tool to be run by PMQC periodically; DKN to make the test procedure for control room use; check current status.
17 Jun : still pending with DKN.
29 Jul : BAK to check and get back.
12 Aug : BE team to decide about usefulness of PMQC procedure & proceed accordingly.

(ii) option 2 : using correlator self outputs and computing gain corrections :
basic scheme is implemented & working; more general implementation of a user controlled ALC mode aims for the following 4 modes of operation
(see MoM of 3 Oct 2013 !) :
(1) on demand -- this is the current released mode.
(2) repeatable at some interval specified by the user -- can it be script based?
Sanjay has completed the core coding; a wrapper is being done by SRoy; to be taken up for discussion.
(3) automatic, should adjust in response to a stimulus in the input power -- needs a discussion.
(4) should provide a reliable power monitoring scheme -- needs discussion.

Issues that came up are as follows :
Accuracy of attenuaton values and repeatibility of settings : 5% (0.25 dB) ok; agreed to add median calculation feature; to check if a feature to predict the expected change in attn for a given change in sky direction can / needs to be added; better option for saving the attenuation values for future use / reference to be defined; logging of results to be looked into; agreed to have a document that summarises all of the above and spells out the main requirements (from user point of view) and possible solution options / techniques; detailed discussion has taken place between SRoy, BAK, SSK and YG on 14Aug2014 -- main conclusions and present action items are as follows :

(a) attenuator values : aim is to check if measurements match with specs (within +/- 0.25 dB); initial test results for 3-4 units (at one epoch) had been reported by BE team (found acceptable); pending items (for BE team) are :
* to check the constancy of the values across the band;
* to repeat the tests for vayring i/p power levels with constant o/p power;
* to repeat the tests on different epochs to verify constancy with time;
* to work out plan for calibration table for each attenuator (after above results).
Test data were taken and analysed by BE team and results reported; SRoy had done some cross-checks on these; tests have been done with varying i/p range from -37 to -17 dBm also and behaviour of attenuator appears to be all right. SRoy to cross-check the results and confirm if we are ok, and if this aspect can be closed.
SRoy has sent some plots from his analysis of the data and some follow-up is needed to see in what operating regime we are hitting the non-linear range of the GAB system.
BAK to look at the results from SRoy and send an email.
22 Apr : "linear range" available depends on absolute input power level; but there is enough for our desired range of operations -- it may vary from one RF band to another and a note will be needed to define the working zone and avoidance zone for each RF band. Agreed that all other aspects can be closed except for the note -- check status of this.
29 Jul : to check the status of the note...
12 Aug : need a note describing tests done & outcomes -- to be record for future.
26 Aug : work on note is still pending.
==> this is still pending.

(b) requirements document to be updated to reflect the outcomes of the disussions e.g. better clarity about the 3 modes of operation etc. -- SRoy has produced an updated version : needs to be checked to see if it can be cleared.

(c) self data (from correlator data stream) to be saved in shared memory ring buffer of ~ 30 mins depth for further processing tasks to work on (should also work off a recorded lta file); also median calculation feature to be added; some work was done by NSR to write raw data to file for 10 mins duration; to convert this to shm and also to add a feature for calculating median values every 2 sec or so and saving these to a file for long durations. SRoy to work with NSR to implement these (take help from SSK where needed); some progress from NSR's side on median calculations;
22 Apr : SRoy reported that NSR now has a version that is able to save the median values in a file, as multiple rows -- to convert in to multiple columns version; not yet started work on shared memory version. Any recent updates? Waiting for NSR to be back on 15 May.
17 Jun : NSR has not yet had a chance to do this; should happen in next 2 weeks.
29 Jul : this change has been done now; but facing some issue about extra time taken for writing with format change -- SRoy has suggested a solution; then SRoy to take up follow-up action on this.
26 Aug : no updates from SRoy.

(d) testing of bandpass shape (ampl and phase) for different values of attenuation : 6 out of 7 antennas showed less than 5% percent and 5 degrees change in ampl and phase over 5 dB change in attenuation. SRoy to follow-up to see how much is the intrinsic varn of the GWB corrln level with change in input power level -- SRoy analysed the data provided by DVL and found that behaviour is acceptable for the range of i/p power variation tested which is about factor of 5 (~ 7 dB); plan to extend this to larger range: set power level on galactic plane calibrator to about 80 or so; then go to calibrator away and equalise to 350 -- larger change in attenuation (~ 12 dB) required -- can check if corrln coeff (bandshape) remains ok or not; SRoy would like to now try the test with upto 10 dB variation in attenuator values to see how the bandshape changes; 22 Apr : test has been done, but there appears to be some problem with the data quality -- may have to be repeated again; SRoy to check for free slots for this.
17 Jun : SRoy will be scheduling in the near future.
29 Jul : needs a black slot (SMTS) request for the slot; 3-4 hrs; can also get white slot.
26 Aug : no updates from SRoy.
==> email update from SRoy : tests done, brief update for 10 dB change in 250-500 band for 16 antennas : got 15-20% change in ampl and < 20 deg in phase; except for 5 antennas giving 50-60% change in ampl.

4.5 GPU corr (GWB-III) : next gen system -- from 26 Aug & before (SHR/SSK/GSJ/BAK) : Design and delivery of 32 input (16 ant dual pol or 32 ant single pol) system; uses 8 Roach boards + 8 compute machines (with final 36 port switch) + 4 host machines, installed in 4 old racks & made ready with wiring + cabling complete (c. Feb 2015?); tested with analog noise source; new code with 2 x 10 Gbe I/O + improved logic for assigning specific threads to each core + set-up with environment variables completed (tested for 200 MHz / 8 bits and 400 MHz / 4 bits, 16 inputs and working ok with no pkt loss); modified ferrules were put on cables & GWB-III (v1) has been released with full online control (c Mar 2015); final connections to GWB-II and III can be chosen by the user on the wall panel; confirmed that GSB, GWB-II, GWB-III can ALL be run simultaneously with full online control; updated SOP has been released; basic user

level tests have been carried out (DVL) and by and large system appears to be work ok.

Later GWB-III was expanded to dual-GPU version, as it became clear (c. Mar 2015) that existing code for corr + beamformer is exceeding real-time by 9% for full 400 MHz BW for 16 inputs correlation (will become worse for final, 32 input system); options looked at were : 2 K20s per host, double-GPU card, K20 + K40 per host, 2 K40s per host, 32 host machines (with single GPU); agreed to try out 2 K20 option; first results from dual-GPU code (6 May) were encouraging and have led to GWB-III (v2) : 16 antenna dual pol, 8 node system with 2 K20s on each node : total intensity & full polar correlator + IA and PA beams (16K spec chans and 1.3 msec integration) for 200 MHz 8 bits and 400 MHz 4 bits; tested to work ok with equal load between the two GPUs; also ready for testing on 2 K40s -- results may be available soon; issue of sharing between K20 and K40 needs to be looked carefully for the value of the slice and also the drivers for both GPUs working simultaneoulsy. Tests have been done using noise source; now ready to try with real antenna signals (done 4 Jun); GUI development under progress.

Current action items :

(i) Various kinds of tests of GWB III (v1 & v2) :

(a) basic user level tests : DVL had carried out some tests; pending problems have been call sheeted and will be checked again to see if fixed or not (most are related to upstream systems) -- most of these basic issues were closed; however, more recently (c 20 Aug 2015), DVL pointed out some subtle issues seen in the data when analysed in detail inside AIPS : offsets between RR & LL; dropouts in visibilities for some durations etc. SSK to follow-up, cross-check and report back on these.
26 Aug : some discussion has happened on this, and SSK has given a reply; may still be worth looking at GWB3.1 data to identify the nature of the problem.
==> 3 kinds of problems reported that are not fully resolved : drop-outs in visibility; varn of visibility with baseline length -- ICH to confirm if this is a channel dependent phenomenon or baseline dependent phenomenon; oscillations of amplitude solution across the band (while the phase is well behaved).

(b) to check if new SOP supports flexible connectivity for user -- this required manual editing of the files (explained in SOP), which is not desirable;
2 possible options discussed for getting flexi
29 Jul : completion of SOP (by Nilesh) and multi-subarray testing (Sanjay) are remaining to be done; to discuss layout of the SOP.
12 Aug : to check if SOP should be branched for developer's manual and user's manual.
26 Aug : need a confirmation about sub-array testing; SOP has been refined; but some further refinement may be needed; to clarify the size of shm for beamformer data chain and check its implication on integration time.
==> basic sub-array tests done and looks ok;

(c) testing the 400 MHz BW mode : basic changes to the code for the 400 MHz, 4-bit mode had been done and basic tests were ok for 16 inputs (delay correction also working ok); some pending tasks are :
* choice of which 4 bits to use needs to be finalised (right now it is set for 4 MSbits) : what algorithm is needed? can it be made a user choice?;
* extendng to full 400 MHz BW : computationally, GWB-III (v1) does NOT sustain this for all 32 inputs -- safe limit is 300 MHz (including beams ON); full 400 MHz for 32 inputs implemented in v2 and released; needs to be tested by user.
12 Aug : tests to be done in next couple of weeks with new SOP should decide this.

26 Aug : no user level tests done so far.
==> tests generally ok; may need to check mapping of power equalisation count with the ADC level / GAB power output.

(d) checking of beam modes : all basic beam modes are working; phasing has also been verified; note that phasing will work only if beam mode is turned on (!) -- this was fixed in the v2 code.
12 Aug : user level tests of phasing ran into problems -- due to change of net sign convention in the LTA files (!) -- temporary fix was put in : to be discussed and resolved; further tests of beam mode showed problems of "double pulses" from all pulsars -- this was tracked down to some issue in the way data was being distributed to the 2 GPUs -- now fixed and released for tests (to understand implications of this on interferometry data).
26 Aug : the above issue is resolved and some other comments on beam mode are as above.
==> generally ok now.

(ii) to discuss and agree the various modes to be provided in different releases of GWB-III, folding in long-term planning (to take up from email exchange of 22 Apr and later) : one round of discussion happened; updated version has circulated by BAK (29 Jul 2015); need to see about porting it to the format of a table of modes, as in GSB; to cross-check for any refinements.
26 Aug : options to be provided in GWB3.2 are as spelt out in the latest SOP -- can be cross-checked.
==> generally ok.

DDC update : 2 antenna single node ver now at 50% with 32 pt filter -- improved kernel optimisation of the ops. now trying for 8 node code.

(iii) choice of integration time for beam data (for v1 & v2) : in the original design 128 was default pre-int (on GPU); later (in v2), it was made variable (upper limit 1024, lower limit ?) -- needs to be tested, and constraints in the range of parameter choice needs to be established);
29 Jul : table of possible combinations for v2 has been circulated; lower and upper limits for sampling interval are calculated based on disk writing speed and gulp size; the former needs to be changed to be limited by GPU memory or I/O speed. Also a table about memory usage is available.
12 Aug : brief discussion to work on the above and update the table.
26 Aug : see comments above.

(iv) beam data header for GWB-III (v1 & v2) : current status to be confirmed
1 Jul : v1 has no header; v2 will have part I header and v3 will have final part II version.
12 Aug : v2 has binary header; would be useful to have an ascii header and to have the code for reading binary header; to be discussed and finalised.
26 Aug : need a follow-up discussion with Sanjay.

(v) psr_mon and pmon tools for beam data monitoring for GWB-III (v1 & v2) : current status to be confirmed :
1 Jul : real-time version to be made ready for v2 by SSK (see earlier comment also)
29 Jul : ready for release, as per email update by SSK.
12 Aug : to check present status.
26 Aug : no updates from Sanjay -- need a follow-up with him.

(vi) tests with dual K40 system in GWB-III (v2) :

17 Jun : one of the 8 is running with dual K40 as default; at some point, bench marking can be done wrt dual K20.
12 Aug : basic tests done, results are as follows :
for 400 MHz full polar with 2 PA beams, 16k channels, 2.6 s : 80%+73% vs 64%+58%
for 200 MHz full polar with 2 PA beams, 16k channels, 2.6 s : 50%+42% vs 37%+31%
future requirements : 32 antennas MAC, PFB, DDC, folding of visibility data to be accounted for; to analyse the situation and come up with an action plan, including some of the "next gen" prospects (cuda 7.0, 16-bit versions, other optimisations?)
26 Aug : to get break-up between FFT and MAC and then do the scaling for 64 inputs and other issues.
==> no updates, as K40 is giving some problems at 400 MHz mode.

(vii) tests with K20 + K40 sytem in GWB-III (v2)
17 Jun : this is stuck because of driver related issues as pointed out by SHR; can defer till we try cuda 7.0 and then see.
1 - 29 Jul : no updates.
12 Aug : dual K20 + K40 may not be that significant, given the above results. This sub-item can be closed.

4.6 Next gen improvements : GWB-III v3 (32 inputs) and GWB-IV (64 inputs) -- from 26 Aug and before (BAK/SHR/...) :

(i) final range of channels to be handled : GWB-III (v2) will be up to 16K channels; extension to 32K channels to be looked into (I/O issues will need to be tackled); increasing integration beyond 0.6 can be a solution.
17 Jun : changing integration time may be easier option for now -- to be tried at a later date (maybe after 15 Sep).
12 Aug : to be deferred for now.

(ii) new features to be added in next versions of GWB code :
(a) correction for net_sign[] flipping (LSB/USB modes) -- need discussion;
(b) multi-subarray -- some progress achieved (see below);
(c) 4 beam capability;
(d) time + DUT corrections -- some progress reported (see below);
(e) all off-line utilities with backward compatibility;
(f) feature for folding visibilities with pulsar period;
(g) PFB implementation;
(h) shift to 2 inputs per Roach board.
(i) various optimisation options for the code.
Some of these can be delayed for some time, depending on prioritites.
26 Mar : multi-subarray implemented and tested, including online interface; needs some more testing for getcmd mode; DUT corrections coded, but not yet fully tested; both of these work upto 32k channels but some testing may still be needed; see also 22 Apr email of BAK and follow-up discussions); to see if action items can be firmed up for this.
4 Jun : for ver 2 : lower beam integration possible, beam header as above, multi-subarray ok; will have off-line utilities, without backward compatibility; DUT corrections will be in; net sign correction done; 4 inputs per Roach used;
for ver 3 : 4 beam capability, visibility folding; PFB
17 Jun : 4 beam and PFB are part of the plan for ver3; to check about vis folding later on.
1 Jul : ver2 items are ok; ver3 items needs to be finalised shortly.
15 Jul : multi-subarray design complete and testing in progress -- appears to be working, but GUI needs improvements (delay & fringe computations etc).

29 Jul : email update from SSK : multi-subarray mode ready for release -- SOP to be updated by NSR.
26 Aug : need a discussion with SSK and NSR for items (a), (b), (d); other items can be taken up later on.
==> DUT is done for 3.2

(iii) long-term items like provision for control of FPGA and other peripherals (like sig generator) for different modes : agreed to identify one PC for control of all the peripherals related to GWB; this m/c can / is interfaced to online via a socket and GUI can send commands via this -- already done for loading of FPGA files, needs to be extended for other applications; for other things like turning RFI rejection or Walsh modulation on/off, writing to registers in powerPC would work all right; agreed to start working towards implementing scheme in GUI for taking additional parameters that allow different bof files to be loaded; agreed that these flags need not go into ltahdr but can go in the user log as setting parameters (can also be there in gpu.hdr); agreed to go ahead with discussion with NSR for implementing the logic for allowing support of multiple corr modes that use different BOF files; other action items to be taken up later; BAK to talk with NSR / SSK to work out the time frame for having it in place.
17 Jun : needs to be tried out; can be taken up after v2 is released.
1 Jul : scheme needs to be tried out at some time by NSR, when a bit free.
12 Aug : deferred for now.

(iv) incorporation of DDC : this is important requirement, to be done asap : Agreed to try on one node of GWB-II or GWB-III and get back to earlier situation and see exactly what are the issues. SHR has circulated an update; first part is that it appears that the current realisation is properly implementing a DDC; only the filter BW needs to be decoupled from the decimating factor and do a careful set of tests; in the long run, better filters with sharper cut-offs may be required (can check with nvidia about availability of std library functions for such applications); second aspect is to check about the nature or format of the o/p to see whether I & Q components are ok for further work or whether we need / can have the real voltage representation of the o/p signal.
new tests still pending; to check about nvidia primitives; to check about I,Q version vs real output possibilities.
26 Mar : independent DDC has been developed by UG and tested and appears to be working ok; to circulate summary of test results to see if more parameter space needs to be explored... test results found OK; note being prepared.
22 Apr : DDC code has been incorporated in 2-antenna GPU correlator and under tests to clear unresolved issues -- see also latest update from UG in May : need follow-up discussion on this.
20 May : email update from UG stating that the mode is basically working -- need a more detailed discussion about the status and plans.
4 Jun : agreed that basic mode is working ok; to check the issue of normalised cross in the stop band region. may not be released in ver2, but should be there in ver3 (Sep release).
17 Jun : bit more testing with noise source; generating proper delay and fringe to be ensured; overlap between data segments for proper FIR operation will be needed; to check total compute requirement.
Need a status update and discussion on the latest situation.
1 Jul : final choice of specific code to be used has been made (between work done by UG and earlier code); porting from one node to multi-node system should not be an issue; still need to test delay and fringe with DDC on; also FIR edge effects at blk boundary to be checked.

15 Jul : Basic DDC completed; Problem : 90% time usgae (with DDC itself ~ 60%); needs optimization;
12 Aug : may needto look at the FIR filter and optimize.
26 Aug : to work out the DDC load for a realistic 32 input 200 MHz correlator and see how much spare time is available; also quantify the effect of reducing the number of taps from 51 down to about 16.

(v) porting from CUDA 5.0 to CUDA 7.0 : to work out a plan for doing this
1 Jul : this needs to be looked at.
29 Jul : no updates.

(vi) full beam header : plans to be discussed and finalised.
1 Jul : also needs a discussion.
29 Jul : no updates.

(vii) RFI filtering capabilities : for corr and beamformer
1 Jul : needs a coordinated discussion...
29 Jul : no discussion. [see separate discussion]

(viii) spikes in channels that are power of 2 : this problem needs to be discussed, understood and fixed. SHR has done several tests, including using digital noise source; effect is seen in packetised corr also; checked with offline analysis of raw voltage data acquired through Roach board, and with digital noise generated on Roach board -- appears that problem is seen only in data coming through the ADC path only? further, trying single ADC streams or channels (compared to the interleaved data streams that come normally) still shows the spikes in the streams; slower FPGA clk rate also doesn't show any difference -- it appears to be natively present in the ADC data; to check if the power level of these spikes is constant and how much below the mean passband level; varying i/p power level of broadband noise source at ADC allows characterisation of input power level at which spikes show up; looks like occuring at multiples of 128 ch (for 2K spectrum); to check the level as seen in cross of two such signals -- some test results have been sent by Reddy recently; can take up for discussion, including tests with 2 different clk sources...
To correlate against new results coming from histogram testing by Niruj & Kaushal -- some work needed here -- KDB & NMR to check and report back.
27 May : to cross-check with GSB voltage data taken and put through similar analysis of histogram and spectrum;
17 Jun : tested with two different Roach boards with two different clk sources and corrln is still seen, including when sig gens are not locked to same source.
24 Jun : GSB raw voltages to be read and analysed (at GWB-III).
14 Jul : work has started, can expect some results by next week;
22 Jul : test data has been taken; update expected shortly.
29 Jul : tests done with GSB raw voltage data also show some spurious lines -- needs some thinking and investigation about possible causes and issues...

(ix) further optimisation of the GWB-III code (SHR/SSK) : different optimisations have been suggested and tried and these need to be further refined and ported to the GWB-III code:

(a) optimised XPGU for GMRT (with Vinay of nvidia) : is showing ~20% improvement -- needs to be confirmed and then incorporated; ready to upgrade to CUDA 6.0?; results from R2C vs C2C (with callback) to be finalised and then decide about incorporating.
SHR has done the basic porting of XGPU in GMRT code to GWB-III. Summary : xGPU has been ported and shown to work; gets 20% speed-up overall; but works only in full

polar mode (!); other modes need change in xGPU code; output shuffling work in real-time for present time,freq combination, but may not work for faster rates and finer channels... agreed to halt xPGU work and concentrate on 2-GPU per host GMRT correlator code. No further action on this for now.

(b) another concern is about data ordering at XGPU o/p vs LTA format requirement -- needs to be quantified in order for changes in (a) to be meaningful; note : Vinay has already written the code that does this on the CPU.
Currently using unoptimised routine which will work for about 4k channels; for larger number, optimised version will be needed. See item (a) above.
29 Jul : no discussion and no action on this for now.

(x) trying new ideas like FP16 etc to be discussed.
29 Jul : to be taken up after v2 is released.
12 Aug : defer for now.

4.7 Testing leakage, coupling and correlated noise in new back-end chain -- from 26 Aug & before (BAK/YG/++) : detailed tests had been done by Vikram Jaiswal (with SSK, SHR and YG) and report has been circulated; for GAB systems, some follow-up action for testing the leakage has been initiated; procedure for testing to be done with GWB-II release modes clarified and tried out -- new tests show significantly different results for cross-coupling for GAB+GWB; maybe due to synth LO (old tests) vs sig gen LO (new tests), whereas earlier tests used synth LO; new report had been circulated that showed significantly reduced coupling; agreed to repeat the original, user level tests done by YG & VJ to see if things are different now ; agreed to try the ADC noise input and north pole sky tests and see what results come out;
2nd round of tests done, show leakage of 2-4% (consistent with first round results of 1-3%) -- to check with SCC whether all user level tests (done earlier by YG + Jaiswal) have been covered; some user level tests done with north pole and different leakage found for lower and higher LO settings -- needs to be understood.
From Aug-2014 : <= 4% leakage; FE+GAB+GWB (L-band) ~ 40% leakage.
Need to organise a detailed discussion on this.
1 Jul : no fresh updates, except maybe to organise a fresh set of tests with GWB-III.
29 Jul : not discussed.
26 Aug : not discussed.

4.8 Walsh modulation : prototype set-up on Roach board -- from 26 Aug & before (SCC/BAK): plans of BE team for implementing prototype scheme -- basic unit for switching using sq wave signal from GPIO pin tested ok; was put in PoCo correlator and was being tested; walsh waveform delay functionality was added -- can set delay from 1 to 2^32 clk samples (!); with this, variation of correlation with delay was tested using noise source inputs and found ok; Walsh patterns were put on the Roach board (not many FPGA slices needed) -- there was some mismatch between CPLD and FPGA waveforms that was resolved and all FPGA waveforms were shown to be ok; dmodulator on FPGA was implemented; final delay setting algorithm was done (1 Jul 2015) to provide upto 500 msec of delay (fro 128x4 Walsh length) with resolution of 5 nsec (FPGA clk);

list of targets and action items is as follows :

(i) issue of accuracy of oscillator being used and synchronisation of starting -- both need to be resolved; see updates below.

(ii) to develop and optimise the hunting algorithm :

15 Jul : a version of the hunting algorithm developed - tests in lab done; tests in progress with C1 antenna; it takes 20 minutes to lock; further optimization leads to ~ 10 minutes lock time (is this acceptable); to discuss plans for future -- see updates below.

(iii) to demonstrate cancellation of unwanted signals in ADC card and/or GAB; first, need to run a test where pattern from external source can be synchronised to the pattern generated in the FPGA -- this requires being able to hunt and correct for the unknown delay !
1 Jul : this is yet to be demonstrated and is likely to be coupled to item (ii)

26 Mar email updates from SCC : the test is going on with pocket correlator to check effect of walsh pattern delay on normalized cross. CH-1 walsh modulated and CH-2 delaying walsh pattern by 50uS and check effect on normalized cross. The testing software is ready and will be tested soon. The design don't take much resources only 2-3% of fpga. To check if first results from tests are available.
New feature : Walsh pattern generated on fpga can be grabbed on PC and plotted. tests of correlation change with delay change will come in next few days.

20 May : Actual Walsh patterns show multiple peaks of full correlation amplitude (!); 50% duty cycle Walsh shows only 2 peaks -- this becomes one peak once the sign is also considered. To redo the 60 Walsh patterns with sign of correlation to check number of +ve peaks and their exact value.

4 Jun : able to correct the sign problem, but still issue of multiple peaks etc -- needs to be looked into.

1-15 Jul : coarse hunting with 4 ms step is working; 'finer steps' at basic clk rate also completed;
29 Jul : first tests done with astronomical signal with modulation at FE and demodulation at BE (alongwith hunting algorithm) -- locks in about 10 mins; gives back proper correlation; but appears to drift rather quickly -- need to check the cause for this.
26 Aug : the cause of the drift is now established to be samll frequency offset between the modulator and demodulator clocks; may need to shift to 1 MHz clock signal at antenna that is locked to a reference -- will need a change in the PCB; appears that the scheme of using the noise gen and modulating only in one polarisation to calibrate the delay may wiork out (will also require a change in the control ckt to enable Walsh only for one polarisation); some issue of standing wave in normalised cross as a function of channel number for actual modulator + demodulator?

5. Other items :

5.1 New python assembly design -- from 26 Aug (HSK/SSK) : FE group wants the python configuration in E6 to be adopted for all antennas -- FE and mech have dicussed about plans for modified python assembly that will give additional protection to cables; mech group had circulate a short note on their view of the matter, alongwith photos; this was discussed and existing vs E6 system was compared; Action items :

(i) modified E6 design with hinge-like support was installed on C4 (July 2014); agreed to watch the set-up on C4 and do periodic inspection for checks of (a) damage to hose (b) hose clamps (c) water entry etc -- first inspection was done after 2

months (mid-Sep 2014) by mech and fe teams; subsequently, inspection was done (around mid-Nov?) and a video of the same was circulated; scheme appeared to be working ok; however HSK felt that this scheme with hinge may not be good in the long run -- this was discussed in detail; the hinge arrangement on C4 is NOT exactly same as the E6 arrangement (!); the C4 design does not completely solve the problem; agreed that E6 set-up does solve the problem (!); agreed that it can be replicated if needed.

(ii) IGUS cable wrap -- new technology prototype to be developed and tested on quadripod : a) hose without wire impregnation b) entire hose assembly (both could be tried as long-term solutions).
Quotes for both items received : item (a) is Rs 10k for 10m (4 antennas); item (b) is 60k each -- will try on the quadripod test range; items received; basic assembly made ready; finally, installed on test range around Oct 2014; tested ok without cabling (video available); then populated with cables by FE team for further testing; proto model made fully ready; this set-up uses a slightly different arrangement of fixed members, along with the IGUS hose; will work as well as the E6 design.

Agreed to : (a) replicate the test arrangement on 2 antennas, one with normal hose and one with IGUS hose (b) to check how much extra cable can be accommodated in the existing hose and (c) look for wider diameter assembly (32 to 40 mm or more).

Email update from HSK : (i) hose procurement in progress under cash purchase (ii) spare assembly with old type hose will be prepared for 2 antennas in time for installation during Mar-April 2015 MTAC (ii) spare assembly with new IGUS hose will be also be prepared for 2 antennas for installation during MTAC (iv) extra hose of 38/40 mm is being procured and assembly preparation is in progress -- will be ready by 1st week of April.

26 Mar : 2 sets of hose assembly are ready for use -- two antennas to be selected : maybe W1 + one. HSK says no scope for adding more cables in existing; wider assembly of 38/40 mm is getting ready -- can go to antenna directly (W4) and add optical fibre cable as a test case.

6 May : 2 Finolex-type hose assemblies (with normal dia) made ready for use in 2 antennas as an improved version of E6 assembly. IGUS hose assembly (with normal dia) 2 units are also ready; agreed to put one of each kind using C4 and W1 as test antennas. Wider hose (50 mm) under procurement -- it is a Teflon based product -- will need to be tested for temperature and then made into an improved E6 assembly and tried out.

26 May (email update from HSK): 2 sets of assembly of Finolex pipe made ready were given to FE group for putting cables etc and returned on 21st May; one set of Igus hose assembly also given to FE group to make ready, and returned on 25th May; now preparing to install on C4 and W1 antennas within a week.

17 Jun : Igus type hose assembly installed on C4 -- had some problems (2 iterations), now done on 3rd iteration with another modification; old E6 design with Finolex pipe will be installed on W1 early next week.

1 Jul : C4 installed and working, but video yet to be made; W1 to be installed soon (wind problems slowing down the work); to wait for few weeks to assess the performance.

29 Jul : C4 running for over one month and W1 for 3 weeks; can wait for one more

month; meanwhile some accelerated testing is required -- can be done on maint day via control room.

26 Aug : no updates.

5.2 Problem of access to FE boxes with 500-1000 CDF feed -- from 26 Aug & before (HSK) : Update on new solution being designed by Mech group -- tested in situ and found working ok; agreed to use this for present; for future where bigger and heavier boxes will come into play, mech group will think of an improved solution, including an option for removing one feed and bringing the stool inside the basket; a few options explored by mech group, with target of 1800 mm height for boxes with max weight up to 150 kg (?), quotes received from some parties, processed and order placed; inspection done (in Bangalore) in mid/late Nov 2014; some simple improvements suggested to vendor (guard rail, simple clamping arrangement for item); platform delivered at GMRT (early-Dec 2014), tested and found ok, including the modifications that had been suggested; trials had been happening on ground; ready to test with actual antenna operations -- waiting for new crane to be operational (why can't it be done with the HLPs ?) : confirmed that not a good idea to carry it to remote locations in HLP basket; hence, crane has to go (as item is too heavy to be easily handled by humans) ! Crane is now ready for use (Apr-May15); to try the test on one antenna with crane + HLP + platform; to coordinate with FE team; by end May 2015, markings made in the basket and hole made and first use tried out;

12 Aug : used in W6; to try for a few more times and then see how it is going.
26 Aug : no updates.

5.3 New FE boxes and testing with reflective paint -- from 26 Aug (HSK/SSK) : In the first attempt (late 2014 / early 2015), two kinds of paints were identified by mech group -- Luxotherm HT400 and HT600; from one set of 6 new boxes, following 3 boxes were prepared by mech team and given to FE team for testing : (i) plain box with powder coating (ii) box painted with HT400 (iii) box painted with HT 600; the test results (early 2015) showed that neither of the 2 new paint options worked to reduce the diurnal temperature swing, as compared to the plain box; around Mar-Apr 2015, mech group agreed to look for alternative paint options, as it was felt that HT400 and HT600 may not be truly "reflective" type paints; c. 6 May 2015, a product called summer cool (made by excel coatings) was identified and sample procurment was initiated; in addition, modified version of materials used in 15m as well as in GMRT antenna shell cage to be used on 2nd box and 3rd box, and compared to normal box; by end of May 2015, the test with summer cool was completed and the results circulated : maybe 3-4 deg improvement compared to normal box;

Mid-June 2015 : mech group wants to try with one expt with summercool on top and PU based insulating material (Stopaque) on the inside.

12 Aug : instead of Stopaque make, Unishield has been procured and test will be done soon in coordination with FE, depending on ambient conditions.
26 Aug : no updates.

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Minutes for the weekly Plan Meeting of 30 Sep 2015

1. FE & OF related :

1.1 Documentation : follow-up on level 2 (ITR) -- from 9 Sep and earlier (SSK+team):
(i) Check status of new items : work was ongoing for

(a) spares for 1420 feed -- to be taken up after temperature monitor report is completed (which is done mid Mar) -- VBB to talk to SSK to work out the contents. No progress on this; agreed that to have an upate on this 2 weeks later (27 May) still pending for discussion between SSK & VBB.
8 Jul : issue about who is the FE person responsible for this ! (S Ramesh vs VBB); SSK to check and come back (maybe SSK can help S Ramesh to do this?).
5 Aug : SSK will work with Ramesh to start with earlier report and update to reflect the new changes made while making the new Lband spares.
9 Sep : no updates.

(b) OF & RF monitoring schemes : OF power monitoring (starting from initial version from Gehlot) -- to be done by Sanjit; RF power monitoring (to be named as "Broadband RF monitor"), from scratch -- by Pravin, Sanjit and Ankur; was deferred to after MTAC (Apr 2015); then waiting for some test results from newly assembled system; preliminary report on OF monitoring by Sanjit Rai discussed on 27 May 15 : has good amount of material, including sample results etc, but needs improvements about the layout of the block diagram, terminology used, functional blocks etc and a section that emphasises the future growth path and plans a little bit (e.g. long term monitoring 24x7 and transfer to online etc).
8 Jul : revised version of OF monitor doc discussed : blk diags are much better now, a few small iprovements are needed; some of the pictures could be moved next to the corresponding blk diagrams and labeled; blk diagram and scheme as to how multiple antennas are handled needs to be added; some description of which antennas behave good and which don't and possible causes for poor behaviour; future plans and scope to be added. Work on RF monitoring report to be started soon.
5 Aug : RF monitoring : work yet to start (PAR to be encouraged to start soon); OF monitoring : most of the suggested improvements have been done; only a bit more detail is needed about antennas showing good or poor behaviour, alongwith possible reasons and future plans for tackling this issue.
19 Aug : One report has been circulated today -- to check if it is for OF or RF ?
9 Sep : no further updates.
==> updated version of OF monitoring report discussed -- has most of the suggested changes incorporated and can be finalised; for the RF monitoring update is not yet ready.

(c) Test & characterisation set-up for OF system : Sanjit will be looking into this. Set-up to be ready in 2 weeks (18-Mar-15) & then report will come; work ongoing (Sanjit + SSK) -- first draft is with SSK for review; some feedback has been given by SSK, to include some new measurements and also drawings of test set-up, change of linearity / dynamic range with level, temp stability of bias point etc. Updated draft discussed (24 Jun 15) - needs to be implemented (addition of Block Diagram; some tests ...).
8 Jul : work is ongoing, some modifications have been done; one measurement of phase

stability is pending.
22 Jul : Phase stability measurement carried out (x1 set); data collected for amplitude & bias stability of optical transmitter also; report to be completed.
5 Aug : phase stability measurement for 8 km of exposed fibre behind the lab shows significant phase varn with temp; now need to compare with similar or longer length of buried fibre to antenna, for comparison. AFter that, report can be finalised.
9 Sep : no further updates.
==> some improvements done, but actual comparison test of antenna fibre vs exposed fibre not yet done -- will try during MTAC.

(ii) Also, can we look at which ITRs may be ready for conversion to NTRs : it was thought that filter design work can be taken up for this, once the ITR is done. For the 250-500 filter, paper has been accepted for publication in IEEE (Sougata & Anil).
Pending action items :
(a) agreed that the 550-900 filter work can be looked at for a paper : Imran is looking at that -- will come back shortly with a proposal for presentation in paper content; Imran urged to look into it; discussion between Imran and SSK has taken place -- Imran has made a rough first draft and is working on refining it.
8 Jul : no progress on this item; may need a discussion.
5 Aug : Work has started on preparing the draft and will be circulating first version internally in about a week.
9 Sep : no further updates.

(b) to check what else can be taken up for publication -- defer for now.

1.2 OF system NTR -- from 9 Sep & much, much earlier (SSK): can this be initiated now, leading to a journal paper publication? agreed to take the first draft of what was done for the MWSky paper & build on the OF section of it towards a first draft of NTR / paper. PENDING FOR VERY LONG NOW. SSK looking at specific formats and content / scope of the paper; some thinking about what to include and flow and format : to focus on RF over fibre for radio astronomy applications, for GMRT. First draft expected 1st week of June -- to check status.
8 Jul : SSK described an outline document showing the plan, layout and some of the features (including some equations and expressions and tables); SSK needs a bit more time to collect more material (including results and measurements) and then will be ready to organise the contents.
5 Aug : SSK will circulate a first draft of contents by this week.
9 Sep : no new updates.
==> first draft is 6 pages of text (without any figs, at least 6 are planned); to circulate and get some comments.

1.3 Noise temp & gain vs temperature for new LNAs -- from 9 Sep & before (VBB/SSK): Results for new 250-500 LNA show ~5 to ~55 deg K varn in Tlna for variation of 0-60 deg K in env chamber, and gain change is ~ 0.2 to 0.3 dB -- confirmed with new test that waits for temp to stabilise after giving 10 deg steps (tests are now done with one monitor in contact with the device and one in the box, alongwith chamber temp monitor); repeatibility has been tested ok with 2nd round of experiment.

Results from testing of 130-260 LNA show about 35 to 40 deg K variation in Tlna over 0-60 deg and 0.6 to 0.8 dB (drop) in gain with increasing temp.

Results for 550-900 LNA are similar : 35 to 40 deg K change in Tlna with 0-60 deg change in temp, and gain change is 0.04 to 0.36 dB -- results obained for two epochs for both cases and found to be repeatable.

Results for Lband LNA also done, with similar amplitude of swing : ~ 35 deg K change in Tlna (at 1300 MHz) with 0-60 deg K change in ambient temp; however, the lowest temp value reaches 5 deg K (!), which is a bit hard to believe.

Current action items :
These constitute a nice set of measurements; now need to understand what may be the cause : what is the expected variation for the device (same is used in both stages of all the 3 LNAs) and what is the expected sensitivity to bias point variations with temp -- these issues need to be looked at in some detail now.

(i) Agreed to verify measured values against the data sheet specs; check for bias pt variation with temperature (empirically) and compare with data sheet; also try Lband amplifier; expt has been tried to measure bias voltage but it is difficult as the probe affects the bias voltage and LNA behaviour changes; to check if any another method can allow the test to be done; no other option has been found yet.
24 June : required information not available from the data sheets;
8 Jul : still no progress in finding reliable methods for in-situ measurement.
19 Aug : some tests have been done : after changing bias as per datasheets, in 1 hour at different temps (5/10/30/45 C) - no change seen in noise temp; report will come shortly.
9 Sep : no new updates so far.

(ii) in parallel to check existing schemes (in lit) for temperature compensation of bias pt (assuming that this is the cause of the problem); agreed that this can be taken up -- start with a simple google search; any updates?
10 June : no action taken; agreed for VBB to take a look at this matter.
8 Jul : VBB has tried new scheme with active (transistor based) bias instead of the passive bias. Basic scheme appears to be working as LNA performance is not affected; variation of bias voltage with ambient temp (inside the chamber) has been measured; now to try to adjust bias pt to get best performance of the LNA (concentrating on Tlna) and then put it in the chamber to see effect of temp variation; to do the same with original design and compare the results.
22 Jul : replacing chip-resistor (100 ppm/deg C -> 25 ppm/deg C)
5 Aug : work on testing the active bias ckt with temp in chamber is ongoing; better stability chip resistors -- list of required values and possible part nos (and vendors) identified and to be circulated to see if items can be found more easily at TIFR Mumbai or to be ordered by GMRT team.
9 Sep : no new updates.

(iii) to check option for artificial heating of LNA to constant temp (via a TEC); SSK had initiated some enquiries to see if some suitable products may be there.
10 June : no follow-up on this topic.
8 Jul : SSK has found some potential products in the market and will see if sample items can be procured.
22 Jul : 13 W heating element with thermostat identified; programmable over -10 to 60 deg C; to work on a scheme using this device.
5 Aug : indent has been raised; but this device will not fit inside the LNA chassis (only in the main box); to continue to look for products that are suitable to put inside the LNA chassis.
19 Aug : cash purchased item is small [being checked if it will fit & may take heavy current; 6 Amp ? New power supply]
9 Sep : no new updates so far.
==> plan is to make a sample unit with 4 such Peltier coolers with additional Al

plate to give thermal isolation -- will require a different kind of chassis; FE team to finalise the plan and circulate.

(iv) The very low T_LNA (~ 5 K) seen at Lband issue being looked into by using 'new calibrated noise source' which just arrived : first look at data with new noise source shows results which are more sensible : absolute values of Tlnas are higher and easier to believe; variation with chamber temperature is a bit less over the range; other general comments : at all RF bands, the Tlnas with old and new noise source are showing an increase of 10 to 20 K ! Further, 2 different measurements of Lband, inside and outside the chamber are NOT giving matching results -- needs to be checked with use of the same LNA. Also to check other outside locations for testing : DIAT, IITB, Sameer etc; SSK has checked with DIAT and Sameer -- can try at Sameer Mumbai : SSK to send the info to YG for writing an introductory letter; tests with same LNA not done yet -- to check with VBB.
10 June : VBB agreed to complete the test and report by next time (2 weeks later).
8 Jul : LNA test may not be possible now, as no spare LNA is available (!); YG to send the letter.
9 Sep : no new updates so far.

1.4 Testing of 130-260 system -- from 9 Sep & before (HRB/GSS/SSK/NK) : Analysis so far, from 2 antenna installation (C10 & W1) shows that deflection and sensitivity at 150 is better than existing 150 feed + receiver; at 235 it may be slightly less than existing system; need firm tests to establish this, including interferometric tests using 3 or more antennas; initially, since wideband FE box was not available, tried to put feed in place of the 235-610 feed in one antenna and use the existing 235 MHz band receiver for doing the test -- this didn't quite work out, and caused fair bit of confusion; finally installed on 150 face on S3 and replaced the 150 FE box with a 235 FE box to carry out the tests; results showed C10 and W1 deflection matching quite well (and only 0.6 dB less than expected at 235); but S3 showed about 1 dB further less deflection -- suspected to be due to the narrow band FE box; agreed to install new braodband 130-260 FE box when ready; 2 more boxes were made -- 3rd unit was installed on S3, and 4th was installed on E2 (25 May 2015).

Current action items :

(i) plans for sensitivity tests and results from these : consolidates summary from total power deflection tests by HRB and NK is as follows (interferometric tests have been difficult, due to various reasons) :
-- C10, W01, S02 (all 3 new feeds + receivers) behaving very similar, which is good;
-- sensitivity at 150 MHz is better than existing systems (and keeps getting better till 170 MHz) : the linear increase is almost 2x and NK to check if it can be explained by changing Tsky with frequency; this was analysed by NK (10 June 2015) and shown that the expected variation of sky background can explain the observed change in sensitivity quite well; may need to add the effect of Tlna into the calculations; this matter can be closed?
-- sensitivity from 200 to 230 is better than (a) existing 150 system (?) and (b) existing 235 system;
-- however, sensitivity from 230 to 250 is worse than existing 235 system (almost 2x worse at the peak at 240 MHz in the existing system); cross-over point is 230-240 region; this needs to be understood and improved.
-- there are prominent oscillations in the sensitivity of new systems in 200 to 240 MHz range : this needs to be understood;

The last 2 bullet items need to be understood and resolved.

9 Sep : One of the action item was for HRB to try variation of focus distance using adjustable stool with hydaulic cylinder. This has been installed on E02 on 01/09/15, and awaiting for some test results from this exercise.
==> tests have started, but only 1 reading per day and some issues with stool still being resolved.

(ii) there are RFI lines which ned to be properly identified -- can take up for discussion in RFI section.
22 Jul : cable TV lines or system saturation ?? being studied;
9 Sep : no new updates so far.

(iii) Regular monitoring of the antennas with the new systems by Sougata (from 22 April 2015 onwards) : regular testing appears to have starated -- Sougata showed first sample plots; some antenna measurements (W1) showed more noise; S3 looked relatively clean; C10 was not available; one more round of new data was sent (27 May); from now on, 4 antennas will be available.
24 June : update expected next week (01-Jul-2015); The plate of the feed on S3 has fallen off !
8 Jul : plate has been repaired; cause has to be studied more carefully for long-term solution; may also look into reducing the weight; no new data taken;
22 Jul : Results from 14-Jul-2015 data on Cas-A (~ 9:45 AM); lot of RFI seen; 140 - 155 looks like a clean, strong band; report to be circulated by Sougata.
5 Aug : old data (14 Jul tests) discussed again : S3 has funny increase in power around 140 MHz during off-source, leading to poor deflection; E2 also shows slightly poorer quality of deflection plot. New set of data may come this week and can cross-check the above effects.
19 Aug : deflection tests of 12Aug15 displayed C10, S3 & W1 (E2 not avaulable BLDC) comparions with 'old' system : deflections (~ 1.5 dB less at 235); 150 OK or higher than 'old'; C10 & S3; W1 there is some problem (no deflection); spikes in 240-260 range [satellite RFI?] (C10) whcih has extended band pass; 'off' source not same for Ch1 & Ch2 for all anatennas (?)
9 Sep : no fresh updates so far.
==> new set of tests on Crab taken, generally data looks ok and consistent between the 4 antennas.

(iv) Other issues :
(a) possibility of sub-band filters discussed : not clear if it is required, except for RFI related issues (space in FE box will not be a problem) -- agreed to keep pending for now.
(b) to check items for longer term : most of the items required are there; noise source and coupling needs to be integrated;
19Aug : this has been done and prototype unit is put on C10
(c) QH + dir coupler : new PCB for QH + dir coupler with noise injection port was designed and manufactured (TechnoCkt); combined unit with QH + dir coupler + noise splitter (for 2 channels) was assembled and tested -- basic performance looked ok; noise coupling has slope ~ 5-6 dB across the band; unit was put in box #4 (on E2?); 10 units were assembled and data was taken to test repeatibility; results of this (and basic design + performance) to be summarised in a brief note; to plan to install in at least 2 of the 4 antennas for field tests.
8 Jul : brief report brought up for discussion : shows basic design of QH + noise injection system with 4 boxes tested; results look pretty good for insertion loss, phase change, and noise coupling -- small variation from unit to unit for the last item, may be because of accuracy of the length of the wireline that is cut; right

now integrating alongwith RFCM card in box #s 5 & 6; when ready, will replace existing box on 2 of the 4 antennas.
5 Aug : one modified box is ready to replace existing box on C10; 2nd unit will be made on this C10 box. Report to be updated and released.
19 Aug : installed on C10; awaiting feedback on the performance.
9 Sep : no fresh updates so far.

1.5 Testing of 250-500 FE receiver system -- from 9 Sep & before (ANR/SSK) :
15 antennas have the new feed installed (remaining feeds are kept in storage) and 10 antennas have been fitted with the broadband FE box (with 2 spare units). This quantity is now (June 2015) going up again as 16 + 2 antenna target for 15 Sep 2015 is to be met.
Note that the new configuration of QH + dir coupler + LNA is working ok in the new FE boxes (e.g. C1) but it needs to be checked individually for each new box that is made ready.

Characterisation and testing of installed systems (using monthly data): Main tasks and issues that occur (in a somewhat dynamic fashion), alongwith their historical record, are as follows (FE team to maintain a proper log of action taken on individual antennas during these tests and debugging activities) :

(a) antennas with improper off/on bandshapes : low power leve or excessive slope, also variation of level with epoch (for standard settings);

(b) antennas with poor deflection overall :
In the early days (May 2015) E6 was found band and after many changes (including change of dipole as it had poor return loss) the problem was traced to use of metal screw in place of teflon (this was a one-off case?); after that, there were strong lines seen and FE box was replaced with spare; E6 ok now (10 Jun 15); similarly, C13 showed problems in Feb 2015 data -- it appears to be ok now in recent tests (Jun 2015); plots showed C11 low in both channels -- later data showed significant ripple in ch2 for almost all settings of attn value -- finally traed to faulty OF attn unit; C11 deflection ok after that (Jun 2015); W6 both chans showed about 1 dB down; new FE box put there and appears to be ok (old box went to E4 !);

(c) antennas wth deflection changing over the band (usually, less at higher freqs):
C8 showed drop in deflection with freq -- this is a modified Kildal feed (not cone dipole) -- to be replaced at the earliest.
W4 showing RF band extending 8-10 MHz beyond the normal cut-off at 500 MHz

(d) antennas which show ripple in the band (either in ON or OFF or in deflection), or signs of oscillations and instabilities : ripples are usually due to cable problems or loose connections, and oscillations / instabilities are more due to problems with LNA (though bad cables & connections can also produce some effects);
E2 was showing problems around 8 Jul 2015 (but ok on 22 Jul).
W1 ch2 showing problems around 10 Jun 2015.

(e) antennas with significant RFI in the band : need to keep a track of this, esp new lines and also antenna specific RFI; recent report generated with list of lines shows 4 lines within 250-500 MHz : from satellites? more recently (29 Apr 15) strong RFI seen in most antennas near 400 MHz; latest data (May 2015) shows RFI near 470 MHz (Mumbai digital TV), and lines near 484 MHz (Russian satellite system);

(f) failure rate of new FE electronics : about 1 in 2 months over last 5-6 months

(May 2015)? main reasons : oscillations? device failures? loose connections?

Specific action items are as follows:

(i) specific antenna problems being followed up :
(a) check if C8 modified Kildal feed replaced with cone-dipole.
24 June : C8 has recently got the cone-dipole feed put up (this being the 16th antenna); new 250-500 FE box to be put up tomorrow (25 Jun); it was not working properly (8 Jul); became ok after tightening of python (22 Jul) -- need status upate.
(b) check deflection of S4 and E4 (has FE box taken from W4)
(c) check status of E2 for ripples
(d) check status of S2 for ripples

19 Aug : C8 is fine now; all Ae fringing & deflection as expected; C6 & W4 have CH1 CH2 difference; S6 needs check at FE output; C11 shows ripples (only OFF source)
9 Sep : from recent tests (8 Sep, on 13 antennas) :
(a) difference in power from the 2 channels : C06, C10 & C12; for C12, found problem in OF Rx (rectified); for C06, likely to be cable problem in OF Rx (tbc); C10 is not very large (2-3 dB).
(b) Ripple : Ch1 of C12 and Ch2 of C13 -- not repeating, hence not pursued;
(c) E04 Ch2 : deflection not proper & attn not setting -- traced to broken cable (not clear exactly where?), maybe due to dry solder; to confirm if repaired.
(d) E02 : less deflection -- under investigation
(e) W04 : band not setting -- confirmed problem at antenna base set-up : to report status.
==> W04 problem solved;

(ii) W4 problem : several tests and checks have been done (including new cable with modified connector pins); exact issue not clear; finally, main RF cable change was done and deflection tests appeared to be ok, but later results showed one ch dead -- debugging shifted the focus to the OF Tx system, where bad cable in RF PIU was found which fixed the problem (including ripple?); looks like first 10-12 OF units may not have been tuned for full temp range of variation; can be done now with the env chamber. This is being tried in W4 now and result will be clear in about a week. Similar retuning has been done for C14; meanwhile, entire OF system has been replaced by new unit; also 250-500 box has been brought down (replaced with narrow band system), rechecked thoroughly and some units have been swapped and now ready to go back to antenna -- to check current status of this matter.
10 June : finally, a new box was put and old box is being fitted with new LNAs; now deflection is ok, but BPF filter on HF side seems to be extending beyond the normal range -- needs to be checked.
19 Aug : see above.

(iii) learnings from the latest test data :
last discussion was around 8 Jul for results from 30th June tests : results for 13 out of 16 antennas available; some antennas working very well, but also some problematic ones; to check if new data set is available.
19 Aug : see above.

(iv) Appropriate off-source location : new results 27 Mar 15) show some difference in the deflection taken wrt cold sky (Npole) & the OffCasA source (from online) with the former giving slightly higher deflection (~ 1 dB) at 375 MHz -- may have some frequency dependence; also, absolute value of deflection appears to have reduced

(to ~ 11 dB) from the early days (~ 12 dB) -- agreed to do a systematic study of last 1 yr data with 1-2 month sampling; sample data from C4 & C0 displayed (remaining to be studied before conclusion) -- to check if done; also to cross-check role of pointing offsets, location of Sun etc.; sample plots for ~ 1 yr span for few antennas discussed; looks like Npole gives higher sensitivity than Off-CasA; to put all available data on one plot to check for any systematic variations with time.
10 June : analysis extended from 2013 to 2015 and appears to show that deflection taken with Npole as off source is 1.5 to 2 dB better than off Cas-A location -- trend seen for 3 antennas; can check for couple more; discussion with DVL and ICH showed that the off-CasA source is NOT a cold spot in the sky -- it is a spot with same background as that of CasA ! Hence, the calculations and results have to be interpreted accordingly !
8 Jul : ICH and DVL working on this; Ankur to show the data to ICH for comments.
5 Aug : discussion on this is under progress; need some clarity about the Tsky backgnd values.
23 Sep : matter was discussed in 23 Sep meeting, and ICH + DVL are close to releasing their final report on this. Effect on 250-500 band measurements due to different off-source locations can be evaluated post facto and compared with the results.

(v) FE team to maintain a log of the issues found and work done (antenna wise); some discussion took place about possible options (hard copy and soft copy); FE team to think and come back with possible way forward.
24 June : FE team proceeding with hard copy format.
9 Sep : no further discussions or updates; matter can be close here?

(vi) Academic colleagues from NCRA ready to look at the data for helping with long-term statistics and user-level interpretation : can the raw data be made available for use (past and future)?
8 Jul : agreed to provide raw data for one epoch to Tirth for understanding.
22 Jul : data given recently to Tirth, who is looking into it.
9 Sep : Tirth has shown first order results to YG and some discussion has taken place towards carrying forward the analysis and reporting outcomes to this forum. YG to follow-up with Tirth.

1.6 Mass production of 250-500 FE receiver system -- from 9 Sep & before (ANR/SSK) : 15 antennas have the new feed installed (remaining feeds are kept in storage) and 10 antennas have been fitted with the broadband FE box (with 2 spare units). Note that the new configuration of QH + dir coupler + LNA is working ok in the new FE boxes (e.g. C11) but it needs to be checked individually for each new box that is made ready. First version (v1) of FE box was installed on C13; final version (v2) of new FE box was installed on C11 and found working ok except for Walsh problems. Meanwhile, GSG cleared to go ahead with mass production; making of LNAs for 30 antennas (plus use as spares for existing 325 MHz system) were finalised and item was closed (27 May 2015). Current action items towards mass production are :

(i) number of antennas completed : 16 are done now; details of combinations of old and new electronics to be made available (Nilesh table will have); 2 more antennas to be done to take target to 18 (3 in each arm + 9 in CSQ, avoid 3 short baseline antennas); have 2 old 325 FE boxes as spares (note : possible issue of wideband feed with narrow band FE box).
9 Sep : target of 18 antennas has been met for 15 Sep deadline; need to cross-check that all the 18 antennas have the required feed + LNA + BPF + notch filters as the minimum configuration; to discuss plans for moving forward beyond this target.

(ii) spurious bandshape / instability of LNA -- was not seen in the lab, except when i/p was loose or not connected -- this could be typical for all units? need to check about this; various tests were done in the lab and spurious lines were seen under some conditions of thermal cycling; there is an issue with central pin of QH (at both i/p and o/p side); at o/p side problem was fixed by ordering special connectors; may need same solution for i/p side (at cable connector i/p); sample machined pins were got from workshop for making a trial version of the cable; tested with FE box in the lab, and then tried on W4 to see if it solves the problem of oscillation seen there -- did not make a difference (!); however, since there is a fundamental mismatch, better to make this as a permanent feature; to check with Amphenol and Radiall if they will make to order for this (temporary solution is to get the changes done in workshop); plan is to have all new boxes with new connectors with sharpeend central pins; however, it is not clear that this is solving the problem of spurious effects in the bandshapes.

E6 oscillation reproduced in the lab with feed connected; tested with impedance stub connected in place of feed; can produce oscillation and stable behaviour by changing the stub length -- impedance going down from 50 and below; another LNA is stable with full variation of stub length; hence control tests can be done now to try and isolate design vs quality issue, both for QH and LNA and the combination.

Current effort ongoing to tune the ckt to improve RL at (small) cost to Tlna; in addition, to check for quality control on the ones that have come down from the antennas; also to monitor continuously at high temp to see if that stimulates the problem; 2 LNA units were modified to get better RL over 250-500 band without loss in Tlna and Gain (27 May 2015) -- but there is still a line seen when put with the stub; to try with stub on n/w analyser; to try the swap between LNA and other QH.
2 LNAs were tuned to give below -10 dB RL upto 600 MHz, without compremise of gain or noise temp (10 June 2015); however, when integrated with QH and tested, the gain response does not remain the same and when the units are connected to Sp An, the response is not good, and some lines are also seen (which is not the case for the originally tuned LNA); it appears that the retuning may have affected some of the components that are important for stability -- to put these back to the original values (or even towards the other direction) and try to change others which improve the RL...

Action items can be summarised as follows :

(a) plans for procuring modified connectors for i/p side :
yet to check with the manufacturers to see if standard item is available or not.
22 Jul : 'Radiall' connectors solve this (enough stock); feed to FE (input of FE : cable connector type-N male); visit to Amphenol : not happened yet [MOQ : bulk order needed ??; to explore custom made solution also.
5 Aug : agreed to go forward with a visit to Amphenol factory at Chennai / office at B'lore for finalising the plans for custom made connector for matching input cable to QH.
9 Sep : no fresh updates on this so far.
==> visit is planned in near future; required samples to take are now available; discussion on with the vendor.

(b) to confirm if any quality issues have been found in the PCBs that have come down in FE unis from working antennas :
looks like this has no relevance to the problem and this item can be closed.
5 Aug : closed.

(c) current status of retuning of LNAs to improve stability :
no further progress this time, as ANR busy with 550-900 amplifier.
22 Jul : conclusion appears to be in the direction of using the original design (as any of the modifications tried have not shown improvement) -- will need combined tuning 2 LNAs with QH).
5 Aug : agreed and closed.

(iii) status of QH, noise source, coupler etc : QH is available for all 30 antennas; current version of noise source, power splitter, directional coupler etc were tested before putting up in C13; but in-situ tests showed that the power level (deflection) of the noise was not sufficient; traced to faulty functioning (unequal distribution) of power divider module; alternate approach (using resistive components) seems to work ok : equal powers on both channels ~ 4.5 dB for E-Hi cal, no need to reduce coupling from 20 dB. Also, additional issue of 7 dB slope over the band (due to coupler) and 4 dB due to noise source; agreed to a change in the layout of noise module -- to try and reduce the 4 dB slope, increase the noise power slightly, reduce temperature sensitivity etc; more compact PCB with constant current source, shorter track lengths etc) was made and first results showed fairly flat (+/- 1 dB) spectrum over 200-600 MHz.

Current action items are :

(a) First two of the new noise source units are on C11 (box #2) and S02 (box #1); 3rd unit should be up on antenna now. To check status of noise cal tests by DVL for these antennas -- test results have been under circulation and can be taken up for discussion; meanwhile, some changes and corrections have been made, may be useful to do one more round of tests.
10 June : the results need to be looked at carefully and conclusions need to be agreed upon by all concerned and then follow-up action needs to be decided.
24 June : 4 units showing repeatable performance in the lab; from noise cal tests : S02, C11 & C13 gave identical 6 dB gradient across ~ 200 MHz range;
8 Jul : except for C13, all the new ones have the improved noise coupling circuitry can check the list of antennas and repeat the measurements.
19 Aug : except for C13 all have new improved noise coupling circuitry;
9 Sep : no fresh updates; will need some new user level tests to be carried out to check the new systems.

(b) for new PCB : agreed to check on 2-3 more units for repeatibility & also thermal cycling and then finalise plans for mass production : one more unit has been made but work held up due to shortage of switch needed for control of noise level; meanwhile, thermal cycling tests passed ok. 30 nos of switches were procured, wired & 2 new units were tested (data appeared to repeat well, but final record is not available). To circulate the results for discussion, even while conintuing with the 30 nos. VBB to circulate the results -- has not happened yet.
10 June : VBB agreed to circulate the results.
8 Jul : results for one LNA connected to different noise source units shows good repeatibility; and one noise source + LNA combination over 0 to 60 deg in evn chamber shows constant noise power level (across the band); with this issue can be cleared for mass production; could think of including results in next version of the FE document.
5 Aug : mass production of PCB and chassis completed; only noise module to be soldered when needed.
19 Aug : this item can be closed ?

(c) discussion about the 7 dB slope due to coupler : to be deferred for now.

(iii) plans for sub-band filters for 250-500 MHz system -- results from sample units with all 4 sub-bands over plotted showed roll-off is a bit slow on the higher freq side compared to existing L-band sub-band filters, but insertion loss is better; lab tests with manual settings using patch card + old MCM card done successfully, and sample units assembled in the new FE box put on C13; meanwhile, new, integrated unit that is more compact was developed : one chassis with 4 filters (on 2 PCBs)? plus separate chassis for switch; following are the pending action items :

(a) prototype PCB for this had come and was tested : worked ok, except for small difference in 2 pols; maybe due to unit to unit variations?; one more PCB was given to Argus to make with stricter tolerance (less than 10%) to see if that fixes the problems (Shogini was unable to meet the specs); this new PCB from Argus had problem meeting 4 mil requirement : 3 sub-bands ok; 360-460 band had some issues -- slight shift in the band, and repeatibility of units not assured; hence agreed to design with 4.5 mil spacing for all subbands (may lose 3-4 MHz BW in each subband); design was made and sent to Argus and after receipt of PCB 2 filters for each of 2 pols were made ready and 1 filter was tested; out of 4 units, 3 were sort of same and acceptable, but 1 was quite different; after discussions, another set of all sub-band filters was sent to Argus -- these were also found to be problematic;
3-pronged approach : Argus is ready to try and correct the problem -- should go ahead with one sampe; alternate fabricators : Epiton from Ahmednagar is ready to take the job (Atlantis from H'bad may also take it); 3rd option is to try simulating with 5 mil spacing and see what results are available.
13 May : 5 mil spacing design done (with loss of 3 MHz BW) and sent to Argus; 4.5 mil order going to Epiton; Atlantis is ready to try 4.0 mil -- waiting for quote; not pursuing 4.5 mil with Argus; 5 mil has come from Argus; waiting for chassis; waiting for other PCBs from Epitome and Atlantis.
27 May : 4.0 mil PCB from Atlantis has come and comparison with 4.0 mil of Argus : Atlantis appears to be better for the 2 lower bands and Argus appears to be better for the 2 higher bands ! Agreed to try 2 more samples each (for higher and lower bands resp) with these 2 parties. For 5.0 mil from Argus only one sample has come and shows expected shift -- need to compare when 2nd unit comes; to check current status on this.
10 June : one unit each from Argus and Atlantis is still awaited; may come by next week; can check status after 2 weeks (24 June).
24 June : Argus performance better at higher frequencies & Atlantis at lower frequencies; x4 units tested (from Argus) show very consistent behaviour - frequency reproducibility within ~ 50 kHz;
8 Jul: new set of PCBs from Epitome : higher 2 sub-bands tested ok for 2 units, lower 2 sub-bands yet to be tested; also waiting for balance 2 units from Atlantis for low sub-band.
22 Jul : Sougata's report on 250-500 sub-band filter fabrication : all 3 vendors' results reported (Epitome, Atlantis & Argus) : BEST is Argus ! (x4 units for each of the 4 sub-bands show excellent consistency; x4 PCBs from same batch/run); Epitome not explored fully (ony x1 unit tested); to have a follow-up discussion and take a decision.
5 Aug : final outcome is 4 mil track PCBs for all sub-bands to be done with Argus; out of the 7 antennas which already have sub-band filters, 2 maybe with 4.5 mil, others are with 4 mil final design; PCBs for 6 more antennas have been ordered -- will come in a week or so.
19 Aug : items have reached Pune.

9 Sep : no fresh updates on this.
==> 4 nos in 1st round match with each other; 6 nos in 2nd round match with each other, but are off from 1st batch ==> 8-10 MHz shift of the sub-bands; to try a careful measurement of the PCBSs with digital camera or lens and see; also role of variation of dielectric over a single sheet can be contributing.

(b) plans for mass production : switch PCB (20 nos) were available, along with sample chassis; agreed to first put on one antenna; if found acceptable, then go for mass production; compact v2 was installed on C11 and worked fine (tests completed); agreed to give order for mass production alongwith final sub-band filter PCBs; for the switch item itself, 100 nos were available (120 needed); confirmed that this switch is not used in other circuits, hence quantity can be finalised; chassis requirement has been worked out and request has been put (for how many?); mass production spreadsheet getting ready (by Temkar); meanwhile, 30 nos chassis to come next week (~ 11-Mar-15); spreadsheet still in internal circulation -- changes being made as per suggestions of ANR; has been checked after internal circulation -- needs a few small improvements before releasing.
10 June : spreadsheet is ready; will be circulated shortly.
8 Jul : Temkar spreadsheet is not yet released; meanwhile, Ankur spreadsheet is now online, with modification access control only for the owner; read access for others.
14 antennas with feed + FE + CB and 16 antennas with feed ; one in 3 weeks can be done; may be useful to put spares also on antennas, so that user can have better chance of getting 16 antennas.
5 Aug : Temkar spreadsheet content is finalised; will be making it online soon; other items above resolved at other places (to rewrite the agenda).
9 Sep : to check status of spreadsheet

(iv) post amp + slow rise ps : Hitite 740 new stock for 30 antennas available; slow rise power supply -- agreed that this would be useful for the post amp in common box, but not really required for FE box; new design was done and PCB was ordered & tested Ok; agreed to give this for mass production to cover common box requirements for 30 antennas; mass production PCBs had come, few cards were populated and tested ok; agreed to mass produce, once the layout for the box is finalised and sample unit is integrated successfully in the prototype box. no specific action item here.

(v) Walsh testing for 250-500 : early tests showed both channels working in C13, but only one channel working in C11 -- box was brought down to check Walsh + problem of spurious bandshape of LNA; current action items :
(a) C11 FE box tested in the lab -- Walsh working ok in both channels -- may be a common box problem or D49 PIU? finally, cable from antenna base to top was found to be faulty -- replaced; agreed to test C11 (alongwith S2 and C13) to verify that everything is working fine; was waiting for C11 antenna to be released; finally, tests were done, and working on 2 antennas (C11 and maybe S2) was confirmed; to confirm for C13 and C00.
C13 problem needs to be solved; remaining issues are related to Walsh PROM; 9 antennas can be used. To plan another round of tests at 250-500 to check status.
10 June : C13 is a wiring problem being looked into this week for fixing.
24 June : C13 problem has been fixed; 250-500 tests show : only S06 with problem, rest x23 antennas show good performance;
5 Aug : 25 antennas tested at 250-500; remaining 5 can't be tested as Walsh is not generated at antenna base due to different IF circuitry in D49 PIU. Same 25 antennas working at Lband also.
9 Sep : no fresh updates.

1.7 Final version of 250-500 FE box -- from 9 Sep and before (ANR/SSK/HSK) : modelling showed that existing size of box is not adequate (inspite of double deckering of chassis); deeper FE boxes are needed -- 15 cm longer box was made (wt of new empty box was 15 kg) after mech group confirmed that this is ok (present depth is 468 mm, can be increased to 700 mm; also, rear member in the cage can be removed to further increase depth); also total weight of populated box will go up by a significant amount. One such bigger box was populated as a prototype and put up on C13 and tested; increased size and weight of prototype new box makes it unwieldy to handle at the focus and is a potential problem; FE group worked on compacting the contents to shrink it back to the old size, with minimum increase in weight : some of the smaller units were integrated into single units; milled chassis were replaced by plate+rail chassis wherever possible; ver2 box with everything fitting inside the original box (now 19 kg, down by 9 kg) completed and tested in the lab; unit #1 installed on C11 and tested fairly one; later, it came down for checking Walsh and some other problems.
Present status is as follows : C13 has original (heavier) new box; 1st unit of final (v2) box (which went originally to C11), is now on S2; 2nd unit of final box is on C11.

Current action items :

(i) installation of new boxes : 3rd unit of final v2 box was expected to go on C00 (Temkar responsible for final testing & release) -- was finally put on C00; however, oscillations were seen -- brought down and tested in the lab; LNA was changed & box was installed back at C00; deflection test results showed working ok, and appears to be holding fine so far (27 May); check current status of this; also, update about plans for next box, and schedule for reaching 16+ antennas at 250-500.
10 June : COO seems to be working fine; next box went to W4 to replace the old one (which will be refurbished and put on next antenna); rate of 1 per month is quite feasible, except for the problem of sub-band filters; agreed to put up the new boxes as they get ready, without waiting for sub-band filters and retrofit as needed; target is to reach 18 by 15th Sep; question is how many are up now? 13 were confirmed, including C8 (FE team to provide exact status) -- may need to do one in 3 weeks.
24 June : C08 to go up this week.
8 Jul : C08 is up but there are some performance issues being looked at right now. Actual present count to be confirmed (see item above).
22 Jul : now problem at C8 not seen; to confirm present status.
==> due to problems with notch filters (see above), agreed to not put filters with more than 10 Mhz shift of the sub-bands; otherwise to continue with one per 3-4 weeks; 19th unit is getting ready.

(ii) choice of reflective paint for the final FE boxes needs to be made : a few different options available (ref : APK, HSK) -- need to identify the best option; methodology of the tests to be done -- empty box to be painted and tested in parallel with control unit (without paint) using in-situ tempearture measuring device; issue of possible clash with powder coating needs to be understood.
3 types of FE boxes handed over by mech groupt to FE team : (a) plain box with powder coating (b) box painted with HT400 (c) box painted with HT 600; initial results from 5 day continuous run, having 4 curves : ambient showed large increase at sunrise (even a spike to 55 deg); for the box temperatures, results were slightly confusing as one box under test and power coating box tracked each other very well and other box under test behaved worse than these 2 (!); also there is extra cooling in the night ! Further tests also appeared to show that this is not working out; FE team prepared a brief report with the data and their conclusions;

issues discussed were : current coating thickness 0.7 mm, to try higher value [can that help ?? skin depth much smaller]; are we using the correct type of paint?
new options for reflective paint were discussed on 26 Mar 2015 -- mech group did some follow-up; some inputs from web-search and from Dr.Shenoy were used to identify proper paint;
Later (27 May 2015) tests were done with SummerCool make of IR reflective paint; at the peak of the ambient temp, the reduction in temp is about 8 deg from ambient and about 4 deg wrt powder coating; at the minima, all are the same (which is somewhat surprising); some follow-up actions identified :
agreed to try with thermocol layer inside in both the boxes; to also try with the insulating foam used in antenna shell; Kale awaiting 2nd brand of reflective paint.

10 June : some new tests have been done; update by Sanjit shows that the best results are still for the SummerCool coated box (the one using the material used in the antenna shell gives intermediate results); to wait for the 2nd brand of reflective paint (from HSK) and then decide the next course of action; also mech group wants to do one test using thin layer of insulating material on the inside of the box (see relevant agenda item in alternate week)
24 June : new insulating material (for trial) expected from HSK; what about status of 2nd brand of paint?
8 Jul : action items pending with HSK; no updates today.
9 Sep : no new updates so far.

1.8 Status of improved 500-1000 MHz CDF -- from 9 Sep & earlier (HRB/GSS/SSK) : there are 3 different versions of dipole (v1, v2a, v2b) and 2 versions of cone (v1 with 66 deg and v2 with 70 deg) in trial phase; 3 test feeds have been built using these :
ver1 : dipole v1 + cone v1 : RL is OK, deflection is not good & falls with freq
ver2a : dipole v2a + cone v2 (mesh?) : RL is good; deflection is OK & flat with freq
ver2b : dipole 2b + cone v2 (solid?) : RL is VG; deflection is good but not flat.

Simulation results for different combinations of the above were carried out and discussed in detail : it appears that dipole (rather than cavity) is dominant for deciding the RL behaviour (and also H-plane taper?); cone appears important for E-plane taper; best results for RL and good beam pattern match over large freq range appear to be for dipole v2b (triple sleeve) with cone v1 (66 deg).

Current action items are as follows :

(i) Running the simulations :
(a) Simulations with denser mesh case (higher order basis functions): new simulations were done with finer planes rather than with higher order basis functions; this needs to be confirmed; also, 50 MHz shift that is seen needs to be understood; also explore default number of current elements in simulation (from 19 Dec 13 meet); discussion with WiPLD indicates that increase in PolDeg may make a difference; tried with some changes in values of PolDeg related but no change in the results is seen; to contact WIPLD to see if they have a case study that exemplifies these effects and then decide the future course of action. WIPLD had sent a response but it had not been tried as PC was down;

(b) PC problems : licensed version of windows7 was obtained and installed on the lab PC but still had problems : may be some hardware issues (hanging or shut down); finally, after several months, all problems resolved & PC working properly (c. early March 2015)! however, still some problems : display goes blank at times; replaced with another PC, occurence reduced but problem persists; finally (around 10 June 2015), tried on a

different PC in the same lab (to explore if problem is due to 'older' version of PC/ hardware)
24 June : Now WiPld working on x2 different Dell PCs; to decide future course of action.
8 Jul : need to decide on an action item here.
22 Jul : to look into PC procurement for this.
5 Aug : some solution is being worked out by YG for the PCs.
19 Aug : new HP (i7) PC being made ready for use.
9 Sep : software installed on new PC and operational; actual work will resume soon.
==> set-up is stable and actual design work can start soon.

(ii) there is noticeable difference in simulated and measured RL curves which needs some study also (it appears that agreement was better for 250-500 CDF?); to check if new simulations make any difference or not (the same can be compared for the test range pattern measurement results for the two feeds?) -- this is not being actively followed right now.

(iii) deflection tests for different combinations of dipole & cavities (as mentioned above) for varying distance from focus using a variable height stool to see which design gives optimal performance :

After a lot of effort, a reasonable set of results on Cass-A obtained for the different combinations of feed : 750 MHz Kildal feed turned out to be very similar in response to Cone1-Dipole2); Cone1-Dipole2b as well as Cone2-Dipole2b gave results similar to CSIRO feed plots obtained in ~ 2011; later, it was discovered that using short length cables to minimse the loss made a significant difference to the results.

for cone2 + dipole2b at optimal ht of 1260 mm + matching short length cables (0.6 m instead of 1.4 m) was tested on C10 -- showed measurable improvement ~ 1 dB over most of the band (!); further reduction to 0.3 m cable appeared to produce another ~ 0.5 dB of improvement (!!) over most of the band; agreed to follow-up with LMR low loss cable; tests done with new arrangement of QH + LNA mounted on plate and kept right next to the feed showed another ~ 1 dB increase in sensitivity at 610, but no improvement by 800 (note that this was a different LNA and not the same one used in the FE box, with the matching connectorisation); further tests with LNA used with CSIRO feed (SMA coupler may be producing some loss), mini-circuit LNA (very bad result); best result is for ~ 0.15 m long cable connecting feed to LNA directly with type-N;

for cone1 + dipole2b, peak was found to be around 1310-20 mm ht; also a new version of the CDF was introduced with a "choke".

Deflection plots for one chan for above 3 combinations were discussed (13 May 2015): cone2+dipole2b gives the best overall deflection curve; cone2+dipole2b + choke gives almost identical curve to cone1+dipole2b (!) and both are worse than c2+d2b.

Agreed to confirm 2nd poln is similar in behaviour & to get beam shape plots done asap; to prepare comparative chart with CSIRO feed results for taking to GSG level. Most of these matters were resolved, tests were done and results were presented in GSG of 8 June 2015 and clearance to go ahead with C2D2b design was obtained; now, need to close the loose ends and move forward.

Around 5 June 2015 : prototype C2D2b feed was replaced with new unit (with better stool arrangement?) and first round of deflection tests with this showed slightly lower deflection compared to earlier (for Cyg-A and also Cas-A); also, first beam

shape tests showed slightly larger (~10%) value than expected (e.g. ~ 50' instead of ~ 45' at 610), also the prototype version showed Az values to be ~ 50 larger than expected -- all of these issues need to be understood and resolved.

10 June : in order to move forward after GSG : 2nd prototype put on C10 on 5th June, now has final FE box (hood) with 15 cm semi-rigid cable; fresh data for deflection and beam shape for both channels has been taken over the last few days, and the conclusions need to be checked and understood.

24 June : HRB summarized results from tests conducted over last few days/nights which are very satisfactory (as a 'final' option); (about ~ 1 dB peak-to-peak noise/ oscillation is attributed to test equipment (needs to be confirmed); also spikes in beam size plots attributed to RFI (needs to be confirmed); meanwhile, HRB would like to try with a modified version of cone2 (reduced length of the cavity) to see if it affects the beamwidth.

Comparison of beam shapes for the 3 feed combinations to see which is better : quick results from PMQC data (at 610) give some indication that cone1+dipole2b has slightly broader beam (?) -- need to get full RF test data taken and analysed, for both cases; finally plots of beamwidth vs frequency obtained from Manisha's program were obtained (May 2015) : showed ele and az beamwidths varying with freq, but with some difference in slope, and also absolute values are higher than expected (x2 for Ele and x4 for Az); finally (early June) these issues were sorted out and a series of measurements were done from ~ 6th June 2015 onwards. These showed that C1D2B has a beamwidth that matches closely with the "expected" curve and the same was true for the C2D2B with choke, whereas C2D2B clearly showed about 10% larger beams than "expected". These need to be followed up for checking repeatability and understanding the discrepancies.

24 June : Displayed plots (beam size vs frequency) from measurements on different dates show great variation (some even theoretcally impossible - like too narrow angular size) - for antennas S06, C03 & E05. (It was suggested that the strategy should be to first identify the RFI affected data & discard the same before being included in the plots);

Action plan suggested (c 24 June) to be followed in the near future :
(a) to resolve the conflict between beam width measurements reported by regular PMQC tests vs those obtained from the beam fitting code vs expected values -- is there an issue of definition (or use of some constants)?
(b) to test "final" feed combination with next gen LNA alongwith final version of hood + FE box
(c) to test the alternate (shortened) cone2 design

22 Jul update : reduced cone-length feed version put on C2 antenna; results displayed by HRB - no improvement in angular size vs freq; existing feed will be restored in C2;
5 Aug summary : feed removed from C2 and original 610 coax feed restored; modified hood being made ready at w'shop; will come by end of this week; all the electronics for it is ready; and FE box is also ready; can go up by middle of next week, provided fixed ht stool can be made ready; likely antenna is C2; some work from mechanical side is needed. Plan would be to have this up on the antenna for about one month; and then take a call for final mass production.
Discussion with mechanical : new hood + feed will come to GMRT by Sunday / Monday ; stool in MS can be made at GMRT and ready alongwith hood + feed; long-term plan for production of feed+hood and stool (in SS) to be done.

19 Aug : stool is ready [with hood it will be installed on C2] next week; update expected from Manisha+HRB next week;
9 Sep : some comparisons have been done using the code from Manisha; results reported by HRB need to be discussed.
==> summary of the tests (comparison of online measured beamwidths with values obtained from fitting the RF deflection measurements) appear to be that existing feed gives widths that match with the theoretical expected value at 600 and then goes a bit below by 700; for the new feed it is consistently above theoretical by 4-5' (all the way upto 850 / 860 MHz).

(iv) Also, GP to work out the sensitivity curves for the expected parameters for this range : first version has been done, may need some refinement. There is some indication that some of the drop in sensitivity at ~ 750 MHz may be due to slight (10%) increase in Tlna -- this needs to be investigated in some more detail. Refined analysis with 2 different (fixed) values for T_lna show that the range of variation of T_lna over 600 to 750 MHz can explain the change in sensitivity seen in the expected curve. To check about options for retuning this LNA design; meanwhile, can test the commercial off-the-shelf broadband LNA available in the lab (which may have constant T_lna of about 30K) to see if it can be used to test flatness of the response across the band. Meanwhile, ANR to look at the existing LNA design critically to see what are the characteristics and what can be done to improve the Tlna vs freq. Also, can there be a matching problem? Agreed to take the 250-500 LNA PCB and adapt the ckt for 550-900, with the aim to improve the Tlna at high frequencies.

13 May status : expected curves made for varying values of Tlna, Eff and RL and some differences can be seen clearly : low freq (~600 MHz) matches with Tlna constant at 19 deg; high freq (~800 MHz) matches with Tlna of 28 deg -- consistent with known / measured Tlna variation -- to try to retune for ~ 19 deg across the band (or higher at low freqs), starting with simulation (can use the 250-500 PCB and chassis);
RL variation : varies from about -10 to -20 : there is scope for improvement at edges of the band (HRB can go back to simulation at some time to see); also 65% constant efficiency shows some improvement, esp at high freq side -- not sure what this is due to and what can be done to recover this... Need some follow-up.
19 Aug : redesigned LNA 25K T_lna; (no 7 dB slope); Eff calculation remains to be done.
9 Sep : no fresh updates on this.

(v) any new ideas? discussion of 19 Dec 2013 came up with following action items:
(a) design Kildal ring feed at 750 MHz using v2b dipole -- 14 dB RL achieved (over what BW?) -- first results from sample unit (tried on C10), including varying stool height, and the conclusion was that it is not as good as C2D2B (see earlier discussion) -- this can be taken as closed (May 2015).
(b) try simulation of CDF250-500 scaled by factor of 2 (including with different dipole sleeve combinations) -- maybe after (a) is done; status update needed; this is also now not relevant and could be closed (May 2015).
(c) design Dual-ring feed 550-900 MHz (intial BFRs can be made for 650 & 800 MHz) -- waiting for above items to complete; also not relevant now (May 2015)
(d) modified version of cone-dipole based on patent by Shefai + ... (1991) : refers to Kildal paper of 1982; recommends additional choke structure just below the cone but protruding out to lambda/4 : supposed to improve (a) cross-polar (E-H match) by 30 dB; (b) reduce back-lobe and (c) ???; agreed to cross-check the date of the paper on which our cone-dipole is based; agreed to build a prototype using cone2 (why not cone1?) matched to lambda at 750 MHz -- this was done and tested on C10 (see results reported above) and was NOT found to give results better than original

C2D2b design (turned out to be similar to C1D2b performance); can be taken as closed (c. 10 June 2015).

1.9 Design of new RFCM card (v3) -- from 9 Sep & before (SSK/Imran/Sougata) : RFCM card (v1) was built as part of generating spares for Lband system and fully tested for all control functionalities -- for Lband, as well as for 250-500 FE box (alongwith patch card); it was agreed that since this RFCM card can not do monitoring (without further changes), old RFCM card + patch card will be used for present in the new FE box; will upgrade later to new RFCM card with monitoring capabilities included. Later, 5 monitoring points were added to the existing card, tested ok. Plan was to enhance the design of v1 by explicitly adding the monitoring facilities & full compatibility with new MCM card so that it can be used in all FE systems. A prototype version of the v2 PCB was designed, sent for fabrication, assembled, tested and incorporated into one Lband feed (which is now on W1) -- it still had some unresolved issues about bringing out the TTL lines and to take in the 8 monitor points : appropriate connectors need to be put for this; new PCB (v3) was designed and sent for fabricationl; 12 nos had been fabricated, received, assembled & tested; all cards were found ok, but not yet integrated into a box -- agreed to complete this before going ahead with mass production (~ 120 cards may be required in the long run); v3 card was then tested ok in different conditions : L-band system on W6, 327 FE box that is now on C11, 130-260 box on C10 etc.. PCBs for mass production quantities were done and components required were procured; plan is to assemble and use as needed. Pending issues are as follows :

(i) report : first draft was discussed : generally ok, but needs additions about monitoring points and internal review (c 4 Feb 2015); some significant changes were made and 2nd version was released and discussed (13 May 2015) : details of the work done is very good; need a few changes : motivation for making new RFCM card to be explained better in introduction; more detailed comparison between original and final card to be added in redesign section;
27 May : Imran is working on the modifications; can check after 2 weeks.
10 June : not much progress on this in last 2 weeks; can check again after 2 weeks.
8 Jul : no progress reported.
5 Aug : updated report has been submitted; item can be closed?
9 Sep : need to check status and decide action.
==> Report submitted to webpage. Item can be closed.

1.10 Next Gen Common Box -- from 9 Sep (ANR/SSK) : Like 250-500 FE box, final version of Common Box needs to be assembled and tested : final power & temp monitor (are in hand), interface to Rabbit card (work in progress), design of new RFCM card (work in progress), new arrangement for power supply distribution; a block diagram of the new box has been prepared and circulated and accepted after some modifications and improvements; it was agreed that old boxex can be re-used (no need for making new boxes), except for the issue whether new MCM card can be inside or needs to be outside the common box (the former option would be preferable); action items to be looked into :

(i) The interface card in common box needs extra PCBs due to wear and tear of existing PCBs. One to one copy of the card to be made as a new PCB, on lower priority. Work is in progresss (Sougata); may be ready to go for fabrication by 1st or 2nd week of April -- not yet ready to go for fabrication (13 May);
27 May : was at low priority earlier, but need to increase priority now. Sougata will get back by next meeting.
10 June : will go for fabrication this week.

22 Jul : PCB has come, populated & under test;
5 Aug : testing not yet completed.
19 Aug : still waiting for tests to be completed.
9 Sep : no new updates.
==> all functionality except MCM on/off tested and cleared; may be some PCB track related issue with the control transistor.

(ii) FE team has worked out a plan for integrating the Rabbit card inside, which requires to swap the interface card to the other side of the box; to ease the wiring problem, the centre plate needs to be cut into 2 pieces; some issues about stacking of power detector with broadband amplifier need to be addressed; integrated power supply card is included in this scheme; media converter added to allow for additional capability of fibre connect from top to bottom (as an alternate to shielded eth cable or serial link on RS485) -- FE team plans to mount it outside; confirmed that RS485 serial link will be supported as default option, and that eth over Cu is not viable; sample unit assembled and looks ok; wiring is ongoing -- to check if ready for testing now.
24 June : FE group's work completed; Telemetry group needs to test Rabbit card etc.
8 Jul : FE has tested the box fully using current MCM card; now it needs to be tested with Rabbit card interface, with existing command structure (!) -- need a discussion with telemetry team about this !
19 Aug : tested with MCM5; now waiting for Rabbit card based testing (see below).

(iii) getting sample box ready : to take one old common box, get new plates made, put dummy boxes and work out the wiring scheme : mechanical items were completed for the sample box and all the items were available, including Rabbit card enclosure, slow-rise power supply card etc; wiring was to start after completing the layout -- this needed to be redone as things did not fit into the box in the first attempt; mechanical issue due to space crunch, required swap switch PCB and chassis to be redone. Swap switch PCB + chassis now ready and being tested; after that will be ready for integration in the box; sample unit assembled and looks ok; final wiring is ongoing (13 May)
27 May : VBB, Ganesh and Anand are working on it, but delayed due to 250-500 related matters; can check status after 2 weeks. Should be ready by now ?
24 June : Nothing pending with the FE group (wiring completed);
8 Jul : Box ready (see above); longer term plans : have 2 older style CB ready; and 2 of the new, modified ones ready and then start the cycling process on the antennas. For that main items required will be post amp (for remaining 14 antennas only); Rabbit card in shielded enclosure (to be supplied by telemetry); new power supply card; new interface card and power + temp monitors. May be possibe to do one in 3 weeks, as far as wiring is concerned; can use the boxes that come down, except that front plate assembly will need to be changed to accommodate ethernet connection; outer shell of the box can be reused, like in FE box case.
5 Aug : 2 new boxes are ready with all electronics and wiring; one (maybe both) are tested using existing MCM card; Rabbit card with box has been mechanically integrated; now awaiting testing via serial connection using (a) online V2 (b) existind command set. Ops group is going for option (b) and have already implemented 10 out of 23 commands and then monitor part has to be done, and being done with 100 m long serial cable. When completed, will put the Rabbit card inside common box and test with each FE box, and then a final combined RFI test before moving to antenna.
19 Aug : see comments recorded under Ops agenda (check and rationalise)

1.11 Calibration scheme with radiator at apex of antenna -- from 9 Sep & before (SSK/PAR/SRoy/DO/YG): Current set of issues being tracked are as follows :

(i) testing of dynamic range of old vs new electronics on specific antennas :
First round of tests were done on C0 and C1 (both old electronics); C4 was the first antenna with new electronics that was tested (in Dec 2013) and compared with C1 (old electronics); informal / short report was produced, which showed that : 1 dB compression pt has improved by 6 to 8 dB (from -6 to -10 dBm to about -1 to 0 dBm); change in phase (and also ampl?) with change in elevation shows cyclic variation -- may be due to position shift? W1 was identified for testing repeatibility on new electronics, in addition to repeating on C4 itself (though it has old common box).

Summary of new results :
Sensitivity and 1 dB compression point results look ok; stability of ampl and phase response need some interpretation; fair amount of new data is available which needs to be studied and the summary understood and then taken up for discussion -- this was done, and conclusions about 1 dB compression point are reasonably clear and ok (need to compare with results from signal flow analysis results); for the ampl and phase varn with antenna position, the results and conclusions are not very clear, but there appears to be some indication of the variations; a more detailed study with a couple of concrete follow-up options may be considered; agreed to complete the 1 dB compression point comparison with SFA; to repeat tests on either C0 or C1 to check validity of old results

Updates from results extracted from the analysis :
1 dB compression point values shown for C4 and C0 (new and old) show 7-9 dB change between old and new electronics; there is a hint for frequency dependence with reducing improvement at higher freqs; agreed to check with 20 MHz steps of CW radiating signal for both these antennas, in the range of 250 to 500 MHz.
Results replotted to show ampl, phase and elevation vs time on same panel -- there is clear anticorrelation of phase with elevation; for ampl, things are not so clear; for phase there may even be some frequency dependence in going from 150/400 to 1250 MHz; to try the test for broadband response alongwith n/w analyser; also give a copy of the data to SRoy to try plotting ampl/phase vs elevation directly.

Current action items :

(a) confirm when new common box was put on C4 (12th July 2013; sr no 119) -- to correlate with results. PAR to confirm results from data before and after this date.
24 June : No updates for a very long time -- to close or not to close?
8 Jul : can be closed, as there is not much data before July 2013.

(b) to get comparison plots for C4 with old and new radiator antenna : new data taken with new antenna at 327 Mhz : 6 dB ampl and 40 deg ph for elevation angle cycle -- this appears to be larger than that for the old antenna;
24 June : No confirmation of this forthcoming.
8 Jul : ampl loss can be explained due to poor return loss of feed, and extra phase may be added to the signal? item could be noted and closed.

(c) to check the change in 1 dB compression pt against SFA numbers -- this has been done and they compare well; to extend this to test 1 dB compression point at different stages of the chain : from OF i/p to GAB o/p; tests have been done and upto optical receiver output [OF Tx Rx FE CB] 1 dB compression point available; first presentation of results (29th April) :
C4 antenna, 450 610 1170 MHz 3-plots : 1 dB compression point variation with freq - plots shown :

first for 610 MHz :
[FE] saturates at +11 dBm (@input) Blue
[FE+RF amp] serenza +4 dBm (@input) Red
[FE+RF amp+opt Rx] saturates at +0 dBm Pink
next for 250-500 [450 MHz] :
[FE] +4 dBm; [FE+RF amp] -6 dBm ; [FE+RF amp +opt Rx] -11 dBm at 1170 MHz (L-band) :
[FE] +1 dBm; [FE+RF amp] +1 dBm; [FE+RF amp+opt Rx] -2 dBm
Conclusion : while FE system provides for the designed head-room, for some cases, later sub-systems restrict that dynamic range; needs discussion to chart out future course of action.
Some discussion of the results -- reasonable first order match between measured and SFA values; some consistency checks are needed.
8 Jul : overall this looks all right, except maybe for repeatibility tests; can modify the agenda item accordingly and close some aspects.

(d) to repeat on another antenna with new electronics and one with old : W1 had been identified, and work for RF cable and antenna mounting related arrangements was completed and tests were to be done -- agreed to defer this for some time.
this is not being pursued; instead can try on C11 and C13; instead of W1, C4 in in progress? to confirm status of this activity.
C4 has one of the new antenna; put one more of new radiator antenna in dish with old electronics, and old radiator in C11 or C13 kind of antenna. Check current status.
Repeat for C4 -> C13 antenna (honeybee issue led to delay; maybe can be done by 30-Apr-15; to check current status.
27 May : 1 dB compression point tests now done for C13 also; details, alongwith comparisons, to be sent shortly.
10 Jun : first results from C13 discussed : getting similar power levels as C4, except for 3-5 dB kind of differences (for 325 MHz) and other wavebands also... shown that the Aronia radiator works ok down to 150 MHz.
8 Jul : results for C4 and C13 for 3 wave-bands (610, 250-500 and Lband) at 3 stages of Rx chain are available : to compare these to check repeatibility; then identify a 3rd antenna. If this succeeds then the main goal of the 1 dB expt can be taken as met; only when new wave-band is installed (e.g. 550-900, 130-260).

(e) to check meaning of results from other wavebands that have been done.
tabulation / report to be made ready in a week -- to check status of this.
8 Jul : see above for a summary.

8 Jul : long-term prospects : agreed to generate a concept note for long-term usage, with pros and cons listed for detailed discussion later on; Pravin to make the seed version and circulate.

(f) to share the data with SRoy to get the plots done for the variation with antenna position (elevation etc) & then work on interpretation : results from plots of ampl or phase vs elevation angle show clear distinctive shape for the ph vs angle and less clear shape of ampl vs angle; also there is slow secular variation of ampl and phase with time; to try and model ph vs angle with a mathematical form and see what physical phenomenn matches that form; first attempting at fitting with a mathematical fn has been tried; new data now with SRoy; on 1 Apr15, SRoy has sent an update on the analysis done by him on long stretch of data from 8 april 2013 (!); plots made vs az and ele (instead of time) show no strong evidence for systematic variations with ele. This needs to be checked and discussed and understood; no other updates on any other item, as RFI team has not done any work in this area in the recent weeks.

SRoy has sent some fresh plots of ampl vs elevation -- don't quite show the expected behaviour -- need to check carefully, and also get phase vs elevation.
27 May : SRoy has now made some plots of phase vs elevation and they do show a sinusoidal pattern -- this needs some discussion and some follow-up action; agreed to try to separate into 2 categories : one for increasing ele and one for decreasing else.

10 June : meanwhile, new data taken by FE team and discussed briefly : may be 0.5-0.8 dB gain varn and 5-8 deg phase varn with elevation wit the latter more systematic. FE team to give final summary and also circulate data to SRoy -- this is still pending !

8 Jul : summary by SRoy : ampl variation is not confirmed to be smooth or systematic variation that can be fit with a mathematical function; whereas the phase varn does seem to show a clear pattern which can be modeled; SRoy agreed to summarise the conclusions so far, incuding any difference seen with old and new radiator antenna..

19 Aug : SRoy had circulated summary of his analysis and conclusions and YG had sent a set of comments; some of the discussions : ph vs el model done for older transmitter, but can also be shown for Aronia transmitter; sign change of phase variation appears to be there between old unit and Aronia, but also between two different epochs of old unit; ampl variations not so clear...

FE team plans to fit Aronia transmitter on C10 by next week and repeat a set of tests for the broad band antennas.

Question about nature of noise source testing of receiver system : to check about the possibilities and come back for a discussion about noise calibration.

(g) new tests with sweeping of RF to check 1 dB compression points with finer resolution over the band -- some tests have been done at 610 band and after corrections, fairly good match for gain curve is seen, but some variation in the 1 dB point with frequency... to try 250-500 with old antenna in steps of 25 MHz at C11 and C13. 1 dB step data in ealier plots above ; 25 MHz step data collection planned; to check current status.
22 Jul : to be done at C10;

(ii) Understanding change of amplitude with change in antenna elevation :
SRoy has done the basic calculations but needs to cross check against the beam width of the feed to estimate the amount of deflection / shift between feed and transmitter at apex required to produce the measured change in signal level.
Test done by Subhashis by rotating the feed : power falls by a factor of about 4 with about 600 counts from the 0 reference position (-700 to +200 arcmin range) : fitting a gaussian to the voltage pattern (asymmetric) gives a HPBW of about 21 deg (about 15 deg for power pattern); this gives about 2 deg for 0.5 dB change in power. SRoy to refine the calculations (including other antennas) and also check Raybole's new report on this matter and summarise for a discussion.
drop in power is 4 sec out of 20 sec ==> 15 deg is 3 dB beamwidth (ok with other test of SRoy); ==> about 2 deg for 0.5 dB change; if converted to lateral shift of the feed, it may be close to 1 m -- to check alternative interpretation about rotation about feed axis by the require angle. not clear if the matter has been resolved or not; SRoy has circulated a first draft note; agreed to discuss during the meeting of 13 Aug; meanwhile, SRoy to circulate a drawing to illustrate the geometry. both documents have been circulated, and a discussion is required...

some discussion about the analysis done by Subhashis : whether lateral translation of feed converted into an angular shift is enough? does the transmitter beam pattern make a difference? how much rotational offset of the feed would produce the same change.

(iii) deployment of new broadband antenna : suitable unit (from Aronia) had been identified and ordered : 2 nos with slightly different freq coverage are there -- looks like will work from 100 MHz to few GHz (hence OK for our use); one unit mounted at C4 and tested with broadband noise source covering all GMRT frequencies; found to work ok to first order, but there are some frequencies where there is loss of power -- being studied; also, tested with varying power levels of noise source and data is being aanlysed; first version of report has been circulated; few points raised are : why 1 dB compression pt changes dramatically for some of the frequencies e.g. 327 vs 393; to check consistency of results with earlier for same frequency; then check change in ampl and phase response for other freq; to check the angular pattern of the new antenna and compare with the earlier dipole antenna that was used -- to check what has been done and discuss the new results; to send one data set from old measurements to SRoy for same kind of plot; to cross-check measurements of old and new at the same frequency; some data has been shared with SRoy; preliminary look has been taken and more detailed anaysis is ongoing and results can be discussed two weeks from now.
SRoy wants to check if correct parameter is being used for antenna coordinate; also to make the plots for couple of other data sets to verify the issues.
One unit has been installed in C13 dish, and used for 1 dB compression tests (before, it was used at C4); for future plans, to try and put on one antenna like C10 where most of the wideband feeds are present and obtain response from 120 to top of Lband in 5 MHz steps to see if this radiator is sufficient for all GMRT bands.

10 June : No updates; to check 2 weeks later for updates.

1.12 Walsh switching arrangement in FE -- from 9 Sep & before (SSK/SCC/PAR) : Some tests have been done on the bench by FE group; first draft of report has been circulated. Current action items are :

(i) to devise a simple test using Lband system + radiation from apex to demonstrate the working of the system (on any antenna) -- agreed to try and couple this with the new test set-up at W1; agreed that CW test can be done to check functioning of modulation scheme when other tests are done at W1; FE team tried 4 antenna test including C13 but could not get a definitive answer; appears that the problem was due to improper test cable used at antenna base; new cable with all cores connected was made and used; further, it was found that Walsh eeprom IC has been removed from all antennas be BE team -- restored in W1, and tests done : this looks like working satisfactorily in first round testing. To go to next step of getting the signal to receiver room and check on oscilloscope (one pol can still be going to the VVM at antenna base); 2nd step will be to talk to BE team and get the end to end test going. Antenna base tests completed (instead of C04, done at W1 - why ?); demodulation at receiver room not done yet -- to check status of these activities.

(ii) further, Walsh switching has been tested on C4 with astroomical source : loss of correlation happens when Walsh is turned ON (need to understand upper and lower bit in Walsh); next step is to match it with the demodulator in the back-end system.

Summary : radiation test from apex done at W1 to show that Walsh switching is happening; astronomical source test done with Walsh on-off at C4; in addition C11

and C13 are Walsh-ready and should be tested in similar mannaer; after that, to take up discussion with back-end team about extending test to demodulation side; C13 tested ok in both pols; C11 : required change in IC of Walsh gen ckt; result shows one poln work and one not working -- to confirm if working or not. Work on verifying that Walsh works is pretty much over; need to work with BE team to do end to end test.

Fresh set of tests to be planned after MTAC, using the following standard procedure : get all antennas including one under test to fringe; then turn on Walsh for just the antenna under test and verify the loss of fringe for this antenna (for both pols); if does not work, then appropriate debug to be done to localise the problem in FE box, cable or Walsh generation circuitry; also item on upper and lower bit need to be understand. To try this for all 250-500 antennas with new v2 FE box. Test report of 7th May shows fairly decent results, except for issues related to C1 and C13; some isues with Walsh EPROMs -- BE team is re-installing original Walsh EPROM in all CSQ antennas.

27 May : C13 needs check of cabling / wiring as Walsh bit is not reacing to top; EPROM installation done for 9 out of 14 antennas -- to check remaining 5 antennas.
9 Sep : no new updates on these matters.

1.13 OF links : new and old, from 9 Sep and before (PAR/SSK) : This involves getting the new, broadband links installed on all 30 antennas and working properly, as well as maintaining the fibre joints efficiently. Following are the action items:

(i) installation of new, broadband links :
22 antennas installed : C0, C1, C2, C3, C4, C5, C6, C8, C9, C10, C11, C12, C13, C14, E2, E6, W1, W4, W6, S2, S4, S6.
Further, S3 was completed and released; next was S1, which took a long time for telemetry team to complete their part; next was W5, but units made ready for this were diverted to replace units on W4 to fix the problem there (early May 2015); retuned units were installed on W5 (10 June); next antenna : E3 (26th antenna).
8 Jul : E3 is completed, telemetry yet to be done; next is E4.
22 Jul : E4 completed (telemetry also); E5 taken up now; W2, W3 & E5 remains;
5 Aug : work under progress; will meet 15 Sep target.
19 Aug : work ongoing for last 2 antennas, W2 & W3, will complete by 15 Sep.
9 Sep : on track to complete all 30 antennas by 15 Sep target !
==> all 30 antennas completed.

(ii) maintenance issues of installed broadband links : see action item under 250-500 system... : 2 antennas C14 and W4, old units replaced by new (which are thermal cycled); remaining will be done if problems are seen. To check if there are any updates on this.
8 Jul : no new action on this.

(iii) long-term maintenance of OF field joints : Growing evidence for problems with older joints (over last 10-20 years); need some kind of consolidated approach to address the problem. Likely causes : nature and condition of splicing equipment? Nature of cover / protection provided? ... Agreed to get the statistics of the old field joints over time, including a comparison of the losses seen with fresh measurements -- this exercise may take 2-4 weeks; meanwhile, urgent attention is required for the field joint near W1 as it is affecting W4 and W3 significantly. There is a technical problem that the newer kits are not compatible with our existing cable and old kits are not availabel -- 2 options ongoing : trying through Chinese

company and also workign with mech group for additional support structure.

Trying to understand the problem : fibre cable used is the same type as original;
however, the splice kit for new cables is incompatible with older cables -- this
problem is from about 2007 / 2010 onwards?; claim is that joints made before this are
ok, as the quality of the material in the older (Australian) ones are better.
except if there is a problem of break or crack in the protective coating or the kit.
basic list shows ~ 40 cuts (80 joints) distributed over the array; agreed to produce
the table alongwith the loss values; then one can look at the worst losses and compare
with other external factors like location, environmmetn and old vs new kit etc.
30 nos of new kits (15 joints) have come; these look quite good and fairly cheap
and should meet all the requirements for different kinds of joints; first trial may
happen by MTAC. New kits will be used for the joint near W1 identified earlier.
W1 & W3 being done during current MTAC -- to check current status.
W1 to be done on 6-7 May'15; thereafter, take up W3.
13 May : joint at W1 reworked completely -- connection to W3 was the highest loss;
next target is joint near W3 -- to be confirmed after checking new OTDR data.
27 May : OTDR data is taken but not yet fully analysed; to check again after 2 weeks.
10 June : analysis of data is ongoing; meanwhile, problem of high optical loss in W6;
now made working by putting a higher power laser at 1310 on forward link.
24 June : Measured signal-to-noise was compared between W05 & W06; latter is better by
10 dB due to new optical transmitter used -- this laser has much lower noise (-155 dBm
compared to older one with -125 dBm); to discuss and decide future course of action.
8 Jul : relooking at the field joints : may need to do one more near W3, but better
not to touch it now; for high power laser at 1310 for telemetry + LO (forward link),
W6 soln can be tried on other extreme arm antennas : may have one more in stock;
need to find more in the market.
5 Aug : indent has been placed for laser; no action on results from OTDR analysis
right now.
19 Aug : both are still pending final outcome being circulated.
9 Sep : no new updates on this matter.
==> repair work in W-arm being planned due to ongoing road work.

2. RFI related matters :

2.1 New item : discussion on 3 aspects -- from 9 Sep and before (PAR/SSK) :
(i) verification of in-house RFI measuring scheme with controlled expt with
different res BW and with continuum and line RFI sources.
(ii) absolute calibration of RFI power that will reach antenna.
(iii) testing of RFI produced by GMRT bldg vs environment, using GMRT antennas :
controlled test to be scheduled.
9 Sep : item not discussed.
==> some controlled tests will be conducted for item (iii); meanwhile some checks
on SA settings etc are going on to verify the performance.

2.2 RFI from different spectral lines -- from 9 Sep and before (PAR/SSK) : this
covers RFI from TV signals (from cable to terrestial systems + boosters), aviation
and radar systems, police wireless and such like.

Summary of the various issues is as follows (specific action items are dealt with
later, in the next section) :

(a) TV lines : Cable TV leakage does not appear to be a problem; present thinking is

that the lines seen are from terrestial TV transmitters -- mostly in 175 to 229 MHz range. Need a comprehensive list of terrestial TV transmitters in neighbourhood (with large enough range) and their frequencies, and to check which ones are expected to affect us : updated document shows about 17 transmitters around GMRT area -- based on information gathered from DD personnel and web. Not all of these are seen by GMRT antennas (some are very low power ~ 10 to 100 W, including UHF transmitters); the list of ones seen at GMRT is 11 transmitters : 2 of them are at same freq : Junnar & Sangamner; all are analog TV transmitters, except Mumbai DTT (digital transmission at 471.25 to 477.25 MHz). See specific action items below under (ii).

(b) civil aviation related lines -- these may be of 2 kinds : airport radars (e.g. near 1090 MHz?), and transponders on aircraft (and counterparts at airports?) -- these are generally at lower frequencies (TBC). Lines seen near 1030 and 1090 : interrogation at 1030+/- 3.5 from airport and response from aircraft at 1090+/- 5 with width of about 20 MHz. In addition to these lines, 108 to 140 MHz is used by ATC -- again stronger near W-arm antennas. Need a comprehensive list of known / expected lines from civil aviation related activities near GMRT -- the list of lines have been identified in the main document (below). See specific action items listed below under (iii).

(c) any other sources of spectral line RFI : e.g. police wireless etc -- need to be discussed and characterised : work ongoing with omni-directional antenna and disc-cone antenna; police wireless is in 159 to 163 MHz; there are some reports that there is increasing amounts of such activities in GMRT area (earlier it was more eastern side; now also seen in southern side). See specific ation items below under item (iv).

(d) lines from satellites : these include US military satellites (240 MHz region), host of GPS satellites (in L-band), a Russian military satellite system (6 satellites, 24x7, with 12 hr period, single line from each satellite; max of 5 lines are seen : 483.0, 483.5, 484.0, 484.25) etc; plan is to identify as many of these as possibles and then work on algorithms for real-time prediction of when a given observation / pointing will be affected by these (see appropriate action items below and elsewhere)

(e) other, unidentified lines : new RFI was reported in 270-290 range (not quite matched with MUOS frequency) only one incident has been reported so far (?) -- needs to be cross-checked; line seen at 485 MHz (very narrow, almost a CW) -- may be due to radar wind profiler -- needs to be confirmed; see specific action items under item (v) below.

Current action items :

(i) to generate comprehensive report on list of lines seen around GMRT and their RFI influence : updated report with list of lines around GMRT getting ready ; have used log-periodic + disc-cone + actual GMRT data for making final compilation. Highlights of the results : lines are color coded as per different sources of RFI e.g. mobile phone, TV, civil aviation. Good amount of information appears to be captured here -- discussed in fair detail during Dec 2014 : agreed to modify title of report; to clearly mark lines not seen in GMRT region; to think of separate version of table (for external circulation) that has ONLY lines seen at GMRT; to think of prediction algorithm for GPS satellites (similar to military satellites). Updated version circulated in first week of March; some feedback had been given in email reply; additionally, still need to look at ways of marking which lines are seen at GMRT and which are not (including those which are not there all the

time), and also to check the figures and have only the ones that are useful or adding value. Revisions to be done to the report and updated version to be produced. Check status -- report being refined; check current status.
10 June : ready for circulating again for a recheck -- has it been done?
22 Jul : report circulated (c. 24-Jun-2015); discussed briefly : need 4 columns for GMRT feeds; currently 3)
5 Aug : work ongoing to modify for 4 main bands of GMRT + a few other improvements and will be circulated soon.
19 Aug : updated table with channel widths and spacing wherever determined; also separated by GMRT bands now; also more information about various GPS systems in terms of frequencies and BW; to check the latest version that has been mailed and get back to PAR.

(ii) For TV lines :
(a) check for evidence for Mumbai digital TV transmission near 470 MHz : there is some evidence for terrestial TV at 471.25 and 477.25; needs to be cross-checked and confirmed that it is Mumbai digital TV. Level of lines appears to vary from antenna to antenna -- need to do a careful check of this aspect.
Difficult to check at W6 (maint), W5 (no broadband system), can try in W4 (may be seen in E6 also due to reflections?) -- need follow-up.
W6 471-477 MHz digital TV Tx [plots were displayed]; police wireless (tbd in W5) confirmed to be 'Mumbai digital TV' (from direction ?)
W6 plots at 471-477 MHz are suspected to be Mumbai digital TV -- may need a bit more of confirmation.
5 Aug : above is confirmed; to decide future course of action
(b) there is some evidence that the lines in top half of 130-260 band may be due to cable TV n/w? Need a discussion.
19 Aug : this appears fairly obvious that these are terrestial TV transmitters -- should be possible to identify each of these from the info that RFI team has (Sougata to look into this).
==> cable TV appears to be present more widely than thought earlier, not just the W-arm area; appears one "node" at each village; may need shielded box designed specially for this.

(b) noticed that 540 TV line still leaks through for some antennas (also maybe true for the 175 TV line?) -- need to check if this is due to shift of the filters or not enough rejection of the line. To work with operators (via a note) to ask for feedback on occurrence and strength of 540 line in GWB data. Can also work with Ankur's data to check... Are there any updates on this?
(c) can we take the strongest TV line & characterise if it saturates the electronics or not? Maybe only Junnar TV at 189 & 194 MHz satures only W6 (needs to be confirmed). Wider notch filter has been put in W5 and W6 as a precautionary measure... need some way to resolve the matter. W6 antenna results plot shown -- what is the conclusion? W6 data (at lowest elevation; moving from north to south) shows no harmonics of the TV lines and hence may not be saturating -- need to check LNA gain upto 400 MHz to confirm; also all TV lines to be identified in the band against the list circulated in 2014 for known transmitters near GMRT.

(iii) For civil aviation : some follow-up is needed to see if they saturate the W-arm antennas : may be saturating only W6, but needs to be confirmed -- will do as soon as W6 is released from feed cage painting. There may be some evidence for saturation due to 1090 civil aviation line, for short durations only. Need to confirm this matter.
5 Aug : this may be the case but needs firm confirmation.

19 Aug : this is confirmed; may need to check W5 also; may need to explore special filter for this for some antennas?

(iv) For police wireless : to discuss with admin if the information about their transmitters (esp the fixed ones) can be obtained -- needs to be followed up.
Raybole and Solanki have planned to visit (alongwith DIC work in Pune) -- this has happened now -- check outcomes and follow-up plans.
JKS + PAR visited police wireless office for discussion; strong police Tx now at Giravli hill -- installed 6 months back (may be causing the saturation); need to send a letter stating GMRT's concern; then their technical people will plan visit to GMRT.
Measurement plots shown 150 MHz (civil avaition line); may need notch filter for 164 MHz police wireless?
Current tests (e.g. data at W6 at lowest elevation) shows saturation at times when the police wireless is the strongest -- need to have the power reduced, as part of the ongoing negotiations with rural police. To get latest update on this.

10 June : Girawali transmitter now running at 15 W (down from 18 W earlier; found 10 W to be too low) -- checked that saturation is avoided for W6 and S6 at low elevations; one set of new measurements made near Giravali by RFI team, yet to be analysed.
5 Aug : waiting for complete analysis of data and final comments from RFI team.
19 Aug : waiting for short note from RFI team summarising the matter.
9 Sep : no updates.
==> a report on the entire police wireless matter i still pending...

(v) New lines :
(a) to check all the RFI lines in 250-500 band (at least 4 have been identified); new cluster of lines seen in GWB output : 332 to 344 Mhz -- need urgent follow-up ! some initial tests have been done looking at specific antennas -- not seen; needs some follow-up. Check status.
(b) to confirm status of about new RFI in 270-290 range; any updates?
(c) follow-up on Russian satellite sytem : exact range of frequencies (483 to 484 MHz or just 483 to 484.25?), how many lines?, trajectory of the satellites?, not seen in low elevation scans?
(d) new lines seen in around ~ 340-350 MHz : seen in few antennas, in one pol only; not yet understood. Any updates?
5 Aug : no clear origin for 270-290 and maybe 340-350 ?
19 Aug : no updates on these two (plus there may be some more from Lband tests by YG)
9 Sep : no updates.
==> new line detected at 402.75 MHz due to uplink from ISRO weather stations (like one in our N'gaon colony) to INSAT ! May be around 4-5 such stations in GMRT vicinity. Also, possibility of down link tranmission from ISS at around 620 MHz (3 lines) is a (weak) possibilty.

(vi) omni-directional antenna needs repair and replacement also; processing for 10 nos (including remote location sensing) was ongoing -- order had been placed; all 10 nos arrived around mid-Jan; one unit opened to verify the components; 2 units assembled and performance tested and found ok; plan to mount 3 antennas at 3 different heights on the wind tower of servo.. change in plans... to discuss the goals of the exercise and decide -- to be discussed alongwith prioritisation of all the RFI related jobs.
To try and make it work at one remote antenna site and show that it works.
5 Aug : some measurements done and will be takne up for discussion.
9 Sep : no updates.

2.3 Radiation from CAT5 cable -- from 9 Sep & earlier (SSK/PAR): Follow-up on action from 3 Apr 2013 (!): to install shielded CAT5/CAT6 cable in conference room as trial and finalise the scheme for all other public places in the building: first report had been circulated that combines testing of switches and CAT5 cables; conclusion was that use of shielded cable makes significant difference to the discrete lines as well as to broadband RFI. Agreed to go ahead with controlled expt in GMRT Conf room to quantify the improvement; tests had been completed, and report showed not much change in radiation level with and without shielded CAT-5 cable in conference room (!) -- maybe dominated by RFI from other equipment in the room? Agreed to move ahead by extrapolating from the results of testing of Miltech + switch : to try and estimate the cost of material and labour (time) for changing to shielded cable + connector in all the unshielded rooms of the building; discussion on 16 Jul 2014 : table of invetory of un-shielded cables currently in use (94 copper lines); total length ~ 1200 metres; procurement of shielded cable was initiated; data was submitted by RFI team, and an updated document had been circulated; about 900 m cable (3 rolls) + crimping tool need to be ordered (enough connectors are available); total investment is about Rs 1.7 lakhs : agreed to go ahead with this; item was under negotiation about details of the pricing (Rs vs $ quotes due to difference in value); meanwhile, work had started using existing spare CAT5 cables (old stock) to replace older cables in various labs, as per their requirements; conference room & canteen annexe has also been done; meanwhile, folder for main order was followed up and it appears that there is no choice but to go with the Rupee quote and hence total outlay will be ~ 5 lakhs.

Current action items :
(i) Status of completion of the work in different labs and rooms : conf room, canteen annexe, EPABX room and all engineer's rooms, user's room are done; rest are waiting for main order to supply. delivery has happened now (29 Apr 15); can initiate the work with consultation of digital team...

(ii) To check status of final order and availability of cables, connectors, crimping tools etc; finally, order is gone; to confirm expected date of delivery; finally, after a lot of delay, items received on 28 Apr 2015. To check if anything more is on order or needed; otherwise close this item. This can be closed.

(iii) Need to work out a scheme for proper long-term maintenance with OF and computer group : at the level of PAR to MU it has been discussed -- SSK to send an email to formalise the arrangement; cables, connectors, tools given to Mangesh; a concluding discussion may be required with computer group. YG to bring up with BAK -- need to try and close the matter. Item discussed in meeting of 13 May : not clear what is the best way to close it...

19 Aug : item not discussed for some weeks now; not clear about the best way to move forward on this.
9 Sep : item not discussed.

2.4 Effect of military satellite RFI in 243 band -- from 9 Sep & before (PAR/SSK/SN) : follow-up action on testing for saturation effects, decision about appropriate location of switchable filter, possibility about control room (ops group) being able to come up with algorithm for prediction (for users); the military satellites in the 230-240 MHz band were taken up as the test case; results for tests done by pointing to the satellite (and tracking for some time) showed increase in total broadband power of about 12-15 dB on the strongest satellites (others are

weaker, with harmonic at ~ 500 MHz also visible; there was good evidence that the FE is saturating as harmonics level does not change with changing OF attenuation;

Current action items are as follows :

(i) filter related action : as a test case, filter was inserted in the path for 2 antennas (E2 & C6) to check rejection (and also effect on other bands like 610 and Lband); results were to be circulated for discussion (some results were shown by Ankur?); need to decide if we want this filter in a switchable mode (at FE box or Rx room) or permanently in the path or not at all ! does the answer depend on the strength of the signal? not clear...; meanwhile (22 Jul 15) filters in C6 & E2 (btoh ch 1) have been removed now;
To decide future course of action here.
19 Aug : can defer further discussion on role of filter till warning system's efficacy is fully tested out.

(ii) to test saturation effects and limiting angular distance from satellites :
we need to quantify at what angular distance do the signatures of non-linearity (harmonics) show up, and what should be the activation limit for the alaram; various tests were done to test this -- Az fixed and move in El and vice-versa : this yielded +/- 2.5 deg as the width over which saturation is seen (tested for 2 satellites); more tests were done covering larger number of satellites and some confusing results were obtained; there was a suspicion about the accurate coords for the satellites; agreed that it may be possible to get accurate coords from the GMRT tests.

22 Jul : Report was displayed & discussed : GMRT measured coordinates (from +- 2.5 deg Az-El scans) match well with that listed in web pages (literature);
5 Aug : agreed that the work now shows useful & good results; can be summarised in a note; coordinates of these satellites can be finalised and used by the alarm system.
19 Aug : summary : in real-time, it appears to work well; only total # of satellites being tracked needs to be confirmed.
9 Sep : no new updates.

(iii) alarm algorithm to use in control room : Ops group (SNK) to implement after getting the relevant data from PAR. Present aim is to cover 3 scenarios :

(a) real-time alarm in the control room -- SNK has implemented this, but may need some retuning (some refinement of coordinates is needed)
(b) for a given source at a given time, for a given frequency, predict the effect, including a facility for running through an obs file -- this is TBD;
(c) post-facto : given log of an observation (lta and servo files?) analyse how much data affected by satellite RFI -- this is also TBD.

10 Jun : SN updated that SNK has completed the implementation for all the 3 options above; waiting for more accurate coordinates to get improved results;
22 Jul : new expt has been done to track satellites and refined positions have been obtained; these are now being used by SNK;
5 Aug : SN to confirm with SNK if a demo can be arranged for parts (b) & (c) above, using the refined coordinates.
19 Aug : SNK confirms that version for cmd file is almost working and that for LTA file needs to be done; agreed to complete and release as a package for all users.
9 Sep : no new updates.
==> PAR to get an update.

(iv) next part of this is to see if it can be applied to other satellites :
first in choice is for the GPS satellites, which is more complicated because the satellites are moving -- this is being looked into right now, and coords have been given to SNK; next target would be the Russian military satellites (will need to get the coordinates).
19 Aug : PAR has located a software that gives the positions of all GPS satellites of all known constellations and can be used in conjunction with SNK -- this needs to be tested.
9 Sep : no new updates.
==> to follow-up wihth SNK.

2.5 Mobile phone RFI -- from 9 Sep & earlier (SSK/PAR) :
Progress on identifying the operators at and around E06, and in Nagar, Junnar directions : letter had been sent to BSNL, some follow-up action was on -- they had agreed to change to 1800 at 3 locations (Ale, Gulanchwadi & Pargaon Mangarul) : one location (Pargaon Mangarul) tower has been swithced over to 1800 by BSNL; Alephata tower -- 2 sectors changed to 1800 (what about the rest?); for Gulanchwadi tower -- work is pending (as per latest update from BSNL officials); RFI team to verify these changes by visit to the sites & by checking the GMRT data (compare old vs new data), and summarise their finding -- some new tests are done and looks like there is improvement; Gulanchwadi needs reminder to BSNL. Appears that BSNL has no spare hardware to move from 900 MHz to 1800 MHz; eventually will move when additional units become available -- no commitment about time frame; check if there is any change in status; latest update : looks like end of September for any work by BSNL? check with BSNL reveals, no change in situation; if no change till end Oct, to decide whether to escalate to higher level or not.
update on 10dec14 : BSNL has finally done at Gulanchwadi -- this is now verified that power in 950 has come down and 1800 has gone up in that direction. Letter needs to be sent (to confirm if it is to be a letter or request or appreciation)
-- YG and PAR to discuss and resolve the matter. Also, to discuss the way forward with the next step on this topic.
19 Aug : draft of letter discussed; looks ok and YG can finalise by tomorrow.
9 Sep : no fresh updates.
==> letter still pending.

3. Operations :

3.1 Interfacing of FE with new M&C system -- from 9 Sep & earlier (SN/NS/CPK) :
Naresh + Charu & Sougata + Rodrigues were working on this; will have full set-up of FE + Common box, but will start with M&C of common box using Rabbit card : initial h'ware connectivity may not be too much work as 32 lines have to be mapped to 16 lines on interface card; low level software for bit pattern setting may be enough to demonstrate basic connectivity; after that, packaging will be the issue to be sorted out. Action items:

(i) basic set-up was made working, and tested (by Rodrigues + others); difficulty of communicating via Rabbit to FE appears was resolved with demo of some commands by Rodrigues et al : initially 2-3 basic control commands, later all the commands (except Walsh) were tested and cleared; brief report from Rodrigues summarises the work done; logic + softawre for monitoring commands (6-7 FE + CB monitors) need to be implemented; Charu and Sougata are identified to work together on the monitoring functionality with guidance from Raj where needed. Check current status of this.

27 May : waiting for Charu to finish report of FPS testing with Rabbit; meanwhile, to see if one assembled Rabbit + shielded box can be given to FE team to complete the wiring (to check status of box #2 with PAR and Sanjit) -- can go ahead with couple of boxes without shielded connector.
10 June : FPS testing report is finished and work will start now.
3 stages of the work : FE Rabbit to FE system (local at FE lab); from tel lab to Rabbit + FE system in FE lab (serial and ethernet options) -- need to verify that the monitoring is working all right.
24 June : Walsh commands also incorporated now;
8 Jul : present status : computer to dummy Rabbit card to FE Rabbit card all on eth link; monitoring now being tested for CB and then will do FE; then can try serial link from dummy Rabbit to FE Rabbit; finally, to look at option of current online path via antcomm to FE Rabbit to interface code.

(ii) to look ahead at the plans for the packaging of Rabbit inside common box and integrated tests with serial link, and then later moving to trials with eth link
13 May : since we are getting close to having the common box ready, a plan needs to be worked out; agreed to come back with a joint plan (Ops + FE) in 2 weeks time.
27 May : to run the test from telemetry lab and FE lab to simulate antenna base to focus and run 100 m serial link and also ethernet link; need to order some serial link cable used in the antenna.
5 Aug : see discussion earlier.
19 Aug : almost all commands are implemented on Rabbit and tested in Tel lab and will be ready for testing with FE + CB arranement in FE lab by next week or so (will be testing with full length cable).
9 Sep : no new updates (23 Sep had some updates?)
==> all FE and CB control is working, but monitoring is still not working. CPK is looking into it.

3.2 Development of M&C software -- from 9 Sep & before (JPK/RU/SN/NGK/SJ) :

(i) taking up EPICs based PoC version for putting additional functionality :
basic loading (and unloading) of the EPICS has been done successfully on the machine; now need to connect Rabbit card and test existing PoC software and then go to the new adition to be done; Joardar and Yogesh had made a fresh installation of the software (under Debian linux) and demo software was working fine; first test with Rabbit card (with v2 subsystem) to OF system was done successfully; agreed to develop the software first for OF attenuators; a SOP to make running of things easier was prepared by JPK; a new module was being made for fibre optic link (old one was for GAB); first attempt was to take the given code and modifying / editing it to do both monitor and control -- to produce a short report describing this phase of work; development of new module to implement the same functionality -- working for monitoring and trying for control (to discuss with JPK and come back); script for installation of EPICS + peripherals was getting ready.
Latest status : for monitor side : able to get data and display; working on command flow for control side; some extra information may be required. Check current status and future plans. See if this can be closed or needs to continue.

(ii) plans for tasks for next phase of work for new M&C software : architecture definition and UI definition tasks had been completed; next phase of work for implementation of design for 3 antenna system has been started; 3 phases of work identified : core, business logic, web application; ~ 6 months per phase; first phase was started, kick-off meeting has happened and work is ongoing; the issue

of which Linux OS should be used : CentOS or enterprise, instead of Fedora (for rapid changes) has been discussed with TCS and final choic is to go with Fedora20. Since this is a SKA prototype, issues of alignment with the TelMgt design are being taken up; also, impact of SKA decision to go with TANGO as the platform are being evaluated; much of this to converge by end of April, even as work on design of eninges etc is continuing. Joint meetings have happened between GMRT software team and SKA TelMgt team and consensus plan is being worked out -- admin procedure needs to be initiated. Meanwhile, other work has already started and is on-going relating to the engines -- to check status of this.
27 May : writing of test cases is going on; some issues found and resolved; not much discussion in the last couple of weeks, maybe; to update current status of the work.
22 Jul : 38 functional test cases reviewed for Phase-I & documentation completed; TANGO prototype design & feasibility have been completed;
5 Aug : first demo of some of the prototypes expected shortly; single antenna system expected by mid-Sep. YG to check for more formal feedback on joint activity of TelMgt team and GMRT TCS team; also a discussion session with Vikas tbd on 6th Aug.
19 Aug : TANGO exploration demo in 1st week of Sep. OF + sentinel Rabbit card sent to TCS. TANGO based arch doc developed by JPK and sent to TCS -- will discuss later this week and will become part of the report.
9 Sep : working with TCS to finalise date for Tango exploration report / demo by 16th or 18th Sep; request for phase-I WO amendment has been initiated by SN.
==> Tango technology configurable node demo is ready to be scheduled; report has gone through 2 iterations; architecture related discussions are ongoing. Servo, GAB, OF and Sentinel are under test at TCS site; FPS has been tested in the lab; will aim for testing all 5 systems (including FE) in coming MTAC at antenna base. For long-term bug tracking, bugzilla server (independent m/c) to be set-up in the telemetry lab; permissions issue may need to be taken care of.

(iii) M&C software in-house : this is a mix of Online V2 and other developments that are useful for all M&C platforms (need to separate out these issues at some level): tests done with switch + rabbit card at antenna base and used for commands and monitoring of the OF system -- this path is cleared. Testing with GWB corr at first level by interfacing to existing dassrv structure and environment also done; webpage based display done; some routines in astropy added; some additional code added for diagnostics purposes; Santaji has built web based monitoring for temp/wind/3-phase power etc -- tested ok; need to separate out online V2 items from overall web-based tools for enabling absentee observing.
During MTAC of Oct 2014, 3 antennas (C1, C4 & C6), 2-sub-systems tested, using 2 rabbit cards; servo system tested in servo lab and in C1 antenna (all commands tried out); draft report circulated;
Communication to FPS being tested; NOVAS library interface done in C, Perl, Python and PHP -- can be utilised by any of the new software developments.
During MTAC of April 2015, 16 antennas tested with eth link from central building and one Rabbit card controlling OF and sentinel with commands sending with python and GUI interface. Set-up to be kept switched off during regular GTAC time.
No fresh updates; report writing is going on; meanwhile, work started on shared memory design for sharing of the information.

24 June : work in progress for communication from Online to rabbit cards (antenna base & FE box) via serial port [via ethernet already completed]; OnlineV2 draft report with NGK, to be finalized by 30-Jun-2015.
22 Jul : Draft report in circulation within the group;
5 Aug : Report has been finalised and may have been submitted to library.
19 Aug : confirmed; this part can be closed.

3.3 Long-term plans for evolution of M&C systems -- from 9 Sep and before
(JPK/RU/CPK/SN) : MoM of Sep 2014 meeting identified following urgent / immediate action items :

(i) Verification of compatibility of switching equipment at antenna base and CEB to be compatible with HRS requirements -- CPK and Nayak to ensure the same; to check if this has been done and item can be closed? Still waiting for confirmation.
SN to check with CPK and come back. THIS IS A SIMPLE MATTER, PENDING FOR A LONG TIME!
Note circulated by CPK; 2 changes proposed :
(i) TCS's document for hardware req. says 10 years operation : needs to be changed to 3-5 years (to be able to get vendors);
(ii) power for server class machine stated : < 500 W; this will be hard to get; ~ 600 W may be preferable.
To check feedback from TCS and take up for discussion; just waiting for formal confirmation from TCS and make a formal note and then item can be closed.
22 Jul : formal note made & item closed now!

(ii) To discuss and finalise optimised packet format for Command/Data response with the Rabbit card -- RU + JPK with YG.
Agreed to wait till March 2015 for a detailed check of what the existing framework offers and what is required for next gen system and decide if any changes needed.
Outcome of current discussion : online V2 already has a packet structure; during TCS prototype development, one version of protocol was defined and used; JPK to cross-check if that will be sufficient to meet the present needs; also, telemetry team is agreed that whatever changes are needed to modify on Rbabit side to meet this requirement, will be done by the team.
Latest status (15 Apr 2015) : JPK is reasonably confident that version developed during TCS proto development is fine; online V2 has 2 kinds : one for servo and one for the rest. Team is internally agreed that whatever changes are needed for the final TCS version, then can handle internally. may need to track the development of the packet structure for next gen SKA proto system? Agreed to have a note generated after finalisation of pkt structure for new system; check current status.
22 Jul : Packet format for Phase-I work has been completed; can be closed now ? Yes.

(iii) To discuss and agree upon a unique set of Rabbit commands per sub-system -- Nayak to coordinate with team; RU to put out the list of currently implemented commands (with parameters) and matter can be taken forward from there for checking sutiability for different requirements; 'list of currently implemented commands' circulated; agreed to bring out the list of commands needed for the next gen system and compare with list sent by RU and quantify the extra amount of work to be put in by the team. May need special focus on high level commands for FE system?
Pending for JPK to produce the list of commands -- that has happened now, and can be looked at and taken up for discussion next time. To take up for discussion.
27 May : many of the commands are same; there are some cases on commands not (yet) covered in one system; agreed to keep two branches of the Rabbit code meant for the two M&C systems and make sure that bug fixes are common to both. Item can be closed now? Yes.

(iv) Hardware at antenna base : JPK to circulate a background note for antenna base computer system and then item can be taken up for a larger discussion -- not done yet. Pending for note from JPK -- reminded to bring this out soon; check status -- still pending.
22 Jul : technical note is in progress;

5 Aug : to see if update is available.
19 Aug : slight modification in role and scope of doc to cover antenna based h'ware; will be done now onwards.
9 Sep : work in progress by JPK, delayed due to various other priorities; section on hardware requirement of ABC has been completed but scope of the document is note on design considerations for the next generation GMRT M&C system.
==> getting close to completion, but still needs to resolve some issues / concepts.

3.4 : Deciding specs and configuration of machines for central servers for M&C system -- new item (JPK/CPK/SN) : to take the specs given in HRS doc and see what would be the eqvt version today; maybe x can go to 2x (to account for change in technology since then); JPK to check against the present quality / specs and come back with final reco for 6 nos of machines.

4. Back-ends :

4.1 Documenation at various levels -- from 9 Sep and before (BAK + team) :
To complete basic, internal documentation (at ITR level) and then move to the point where formal publications of relevant items can be done.
Current action items are as follows (many are pending for long durations now !):

(i) Detailed design doc : analog back-end was being done by Hande : 2nd version had been circulated in April. Next level of document going down to chassis level is to be made ready -- chassis level doc will take about 2 months; was deferred till end Oct 2014; and then deferred till end of Dec 2014; 2nd version had ~50% chassis level inputs; to be completed by end-Jan'15; needs some more time as 2nd LO scheme inputs are alos being folded in; work in progress; may take another month -- can check in mid-May. This is now pending for quite some time !
27 May & 4 June : progress is slow, but going on. What is the current status?
10 June : ongoing... 24 June : will take ~ 1 month (end-July);
till 29 Jul : no progress !
5 & 12 Aug : Hande still busy with some other activities; hence delayed further.
19 Aug : no updates still.
9 Sep : next version for dual LO support and RF filter bank details will be released by 14 Sep.
23 Sep : ver3.0 released by Hande on 14th Sep; only cabling details need to be addeed to complete the document in the next month or so.
==> no action for now.

(ii) ITRs + publications for analog back-end systems to be taken up : Sandeep and Navnath to look into that; pending for a fairly long time; SCC to look into this and come back on this by 11 Mar -- SCC and Navnath have had one discussion and will follow-up after MTAC. 29 Apr : list of items to be done has been prepared now; work has been started by Navnath. To check current status.
27 May : not much progress in last 2 weeks; to pick-up now. Current status?
4 & 10 June : not started yet; to start now.
till 29 Jul : no progress reported !
5 Aug : Navnath and Sweta to work on this now and have a version by end of Aug.
12 Aug : work ongoing.
19 Aug : work is on track.
9 Sep : first draft will be sent to GC on 11 Sep.
23 Sep : first draft in internal circulation.
==> draft is still with BAK.

(iii) ITRs + publications for digital backend : ITR was completed by SHR; after some follow-up, SHR and BAK started work on modifying GWB ITR to convert to a paper; first version has been circulated; needs to be taken up for discussion between YG, BAK and SHR.
27 May : not yet reviewed and discussed, but meanwhile SHR can look at it from the point of view of improving by putting in the latest work on expansion to 16 antenna, dual GPU system.
4 & 10 June : will get into this once GWB-III release work is completed
1 to 29 July : no progress reported !
5 Aug : to try and take this up now, as GWB-III release is almost done.
12 Aug : not started yet.
19 Aug : no updates.
9 Sep : no updates.
==> no progress here.

4.2 Analog back-end : LO setting related issues -- from 9 Sep & before (BAK) : Problem with LO setting using FSW resulting in reduction of correlation in GWB (compared to LO from sig gen) : understanding is that 10 MHz reference is at the edge of the locking range; shifted to 105 MHz based reference -- this appears to solve the correlation problem; however, this appears to show phase jumps whenever it is reinitailised; trial and error tests showdd that using 50 MHz reference avoids this problem for GWB.
Latest tests (1 April) show that with 10 MHz reference, the correlation coefficients are fine; would like to test bit more before confirming and releasing. However, mixed results during further tests in Apr 2015 MTAC (with 10 MHz) : for longer baselines there is drop in cross-correlation; 105 MHz phase jumps -- unclear & confusing; but with 5 0 MHz ref. both issues absent;
Current conclusion (27 May 2015) is that 50 MHz reference works ok for giving proper corrln on all baselines, as well as no phase jump on reinitialisation -- would like to switch to this in the long run, for both GAB and existing system at antenna base; higher priority is to fix the problem at antenna base (BE team to come back with a proposal) and then tackle for GAB (as the issue of reinitialisation is not important for GWB, and 105 can be used for some more time).
10 June : right now planning for the set-up to be built for antenna base...
22 Jul : confusing result : phase jump seen at 50 MHz reference ? [last 2-3 weeks full day monitoring] -- to check status of this.
5 Aug : not clear about 50 MHz -- will need more testing; to use 105 MHz for now.
19 Aug : some data has been taken and being analysed.
Sep 9 : decided to continue with 105 Mhz reference, since 50 Mhz ref also shows problems intermittantly. With 105 Mhz reference phase of LO output may change if unit is powered on/off. So during GTAC power on/off should not be done to system. Parallely we are also looking at other models of synth units which cover the full frequency range and do not have phase jump problem during power on/off.
==> possible replacement for FSW unit has been identified.

4.3 Analog back-end : completion of 30 antenna system -- from 9 Sep & before (BAK): 16 antenna system completed (from cabling from OF to cabling to corr wall panel); 24 antenna system also released (mid-April 2014); and now 30 antenna system has also been completed (July 2014). Pending action item :

(i) long-term plans for power supply and ethernet switches to be discussed : for power supply, discussion is as before; ethernet switch : there may be a complication about accommodation 24 port switch in terms of space and layout; 8-port switch was

tested for RFI (with and without shielded CAT5 cable -- old 2013 report + new Jul 2014 report) and it is clear that there is some RFI even after shielded CAT5 cable is used. Possibilities for shielding box for 8-port switch discussed; BE team to check about space for putting a shielded box around the 8 port switch; Hande and Raybole have discussed the matter and it is agreed to try and design a shielded box that allows the switch to occupy a 1U slot in the backside of the GAB racks. Raybole is working on design of shielded box and is ready to order material for this; first sample box was ready; controlled tests show very good RFI rejection (report is awaited) -- can check after report comes and finalise on mass production. (true for both ps and eth units) --- shielded box finalized; 12 nos ordered in work shop. Components required have been ordered; first box will be tested and then order for rest will be cleared; There was a problem about modification of the drawing -- has been resolved; now to check where and how the mass production will be done. Waiting for first proto unit from w'shop to come; to check status and time scales.
27 May : work under progress in w'shop. 10 June : work still ongoing...
24 June : enclosures (boxes) for the ethernet switch have arrived from Workshop; also one sample box for power supply which is found acceptable -- RFI shielding mesh needs to be added - given back to Workshop;
22 Jul : boxes came from W/S; one box being populated - next RFI test planned; if successful, go for x11 more power supplies;
5 Aug : one unit fully ready and will go for RFI testing shortly; vendor related issue for order of the remaining SMPS (15 nos) -- may have 8 week delay.
19 Aug : RFI testing completed; ready to install in rx room.
9 Sep : Ethernet switch boxes are yet to be supplied by workshop after drilling/ tapping power supply boxes are handed over by workshop and installation of units is being done.
==> no significant updates.

(ii) status of work for having i/p side RF filters : plans with FE group for sharing mass production units; agreed that it is ok with FE group to share the designs, provided BE team is ok with the performance specs; ok to include BE requirements in order of PCBs and components (cost sharing to be worked out accordingly); however, BE group to take care of mass assembly separately, as it will be done with in-house manpower by FE group for their filters. BE group has completed design of 8:1 switch to be used for this. Meanwhile, 4 BPF filter chassis (from FE group) + 2 nos of 8:1 sw chassis + one straight through path -- found difficlut to fit it one PIU; agreed to go ahead with single chassis plan for the main 5 BPFs + one switch; second switch and other sub-band filters to be put outside, within the PIU. Prototype unit was completed by BE team; agreed to get the PCBs from FE group (supply the board to them) and then check the integrated filter performance against the single filter. In ther interim, prototype unit using existing PCBs with chassis was assembled in the PIU and tested in-situ.
Final configuration will have direct path + one 100 MHz LPF path + main band filters for each band, with one 8:1 switch; FE team will buy the substrate board and give to FE for getting the PCBs and will buy their own components to populate the PCBs they will receive.
13 May : PCBs for low frequency band ready; chassis for Lband ready (!); waiting for LF chassis; Lband and 550-900 PCBs will come from FE group. Mech boxes awaited; check current status.
27 May : no change in status; following up with w'shop.
10 June : 25 chassis have been received for 250-500; not yet ready for assembling a prototype unit.
24 June : (x25) Chassis for all Low-Frequency & High-Frequency usage now available; PCBs available only for the Low-Frequency usage, which are being populated; to be

completed by 09-Jul-2015;
22 Jul : filter reflection higher than expected; BE group now exploring 'new' filter design; to take up for discussion and resolve.
5 Aug : BE team may be able to make these workable with tuning and change of values of components; YG to chek with FE team about the implications of this. Also, only 250-500 and 130-260 have come; other 2 are still awaited from FE team.
19 Aug : needs to be taken up with FE and BE teams.
9 Sep : one piu with 130-260 bpf, 250-500 bpf, 100 mhz low pass is ready; 550-900 bpf, L band bpf yet to get pcbs from FE group; Other filters and switch chassis : 25 nos ready, now piu wiring in progress.
==> 2 filters remaining to be finalised and done; can't install till all 4 are ready.

(iii) appropriate attenuator settings for Lband & 250-500 done; 610 band was being finalised -- updated table had been circulated; few iterations were done and a more accurate updated table for 16 antenna system has been circulated; also, agreed that BE group will do monthly monitoring and report the status (for all the 3 bands) -- regular monitoring was to be started in May 2014, but took some time to get organised; montly reports will come regularly from June onwards. To discuss how to handle interpretation of the results and iterations to change the attenuator settings for future, as there are evolving changes happening in the FE systems. One round of measurements has been made and set-up is reasonably stable (may need a PC to be arranged?); will take some more time till regular monthly monitoring data can be meaningfully discussed. PC has been arranged; need to start the regular monitoring now; set-up is sort of in place; first round of checkign will happen during the MTAC. first round of readings has been taken and some summary will be sent shortly. Results not yet circulated internally; BAK to check with team.
Tests are now done regularly; need a way to share the summary of the results for taking appropriate follow-up action.
Raw data is being uploaded on plan website; Atul Ganla looking into some intelligent interpretation and summarising of the results.
Started work on making plots showing the variation with epoch for any antenna; will resume after MTAC is over. Should be having first results by now?
27 May : still pending. 10 June : work is ongoing...
24 June : Analogue Back End check /test (for 'attenuation' values leading to power equalization) happens regularly every Monday; one band at a time - so every 4 weeks a full set is available; new student working on analysis - to be completed in 3-4 weeks (end-July'15).
5 Aug : analysis work is still going on.
19 Aug : Atul is working on the analysis; can check next time for status update.
9 Sep : GAB atten tests SOP is ready and STP student is doing regular tests. Analysis and data plotting software is to be prepared.
==> no new updates (?)

4.4 Temperature and other parameter monitoring of back-end system -- from 9 Sep and earlier (GSJ/BAK/RVS/YG) : This includes plans for monitoring the temperature on the GSB and GWB nodes so that health of the systems can be kept track of as various changes to the heat load and air flow are made in the corr room for putting in the full GWB system. Specific action items are :

(i) scheme for monitoring of processor temperatures for GSB : for the main compute nodes : new package for temp monitoring requires slightly different version of kernel than what is used on the main GSB nodes; new kernel was installed on a few nodes and following 2 issues came up : new kernel on 2 compute nodes may have been causing the buffer loss problem (new kernel was rolled back to the old

one); and for the current kernel on gsbm2, the high time resolution mode did not work (gsbm2 kernel was rolled back to the previous version that was there); for the first matter, follow-up was done with a controlled test -- node18 and 19 test was repeated and some degradation of performance confirmed; agreed to put new kernel on ALL the GSB nodes and test again : 3-4 hours' data collected with all nodes with new kernel; analysis showed a few occasions of buffer loss; comparison with normal GSB kernel showed that it doesn't show buffer loss; agreed to try new kernel once more; also to check for possible causes of buffer loss with new kernel; tests done with 16 and 32 MHz, 256 channels -- tending to show statistical difference in buffer loss; confirmed that there is a difference between in the 16 and 32 MHz modes; discussion between SSK and GSJ to try once more with kernel change only one node and examine the log file carefully and report back.
GSB data old & new kernels taken; 17-43 nodes completely new kernel gives heavy buffer loss; (old kernel have very small buffer loss ; old does not support temp monitoring).
More tests have been done and it appears that GSB is rather sensitive to the exact choice of kernel. Agreed that this item can be closed at this point.
No further action items here.

(ii) to add temp monitoring package on all GWB nodes : to check if this is feasible and has been done or not -- agreed that this can be done easily and that we should implement on all the GWB-II and GWB-III nodes. To make a list of machines which have it and then put it on all the machines; to reuse the earlier code for logging the data, plotting it, and also to add an option to generate a warning if the value exceeds some threshold; to think about a real-time version of the warning algorithm.
ready to run on GWB -- agreed to go ahead and test; to think about long-term monitoring tool that shows the temp of all the GWB nodes.
To ensure that code starts every time GWB nodes are rebooted; to work a bit more about plan for bringing the results to a common place for visualisation.
Discussed a few possible options ranging from MPI to sockets to cross mounted disk systems -- to decide on concrete action plan.
installed "lmsensor" on all the GWB-III machines and working ok; right now using cross-mounted disks on 3 GWB-III machines; browser based tool for monitoring the data is working ok; cycle for 7 days for preserving the data. To see how this can be evolved.
Right now running on 1 compute m/cs and 1 host m/c of GWB-III (waiting to install on other m/cs); refining the scheme for cross-mounting of disks; auto-restart and halt scripts; cgi script for plotting on monitor can be made more intelligent.
H1 & cor5 cor5 packages installed; auto-restart completed; cross-mounting of disks : to use old scheme.
Installed on 2 more and ongoing; for cross-mounting : not using autofs, but using old scheme of cross-mounting via /etc/fstab; auto-restart is done (every 30 secs).
Current status of the scheme shown (live !) appears to be working very well;
can think of seeing if any additional performance parameters e.g. CPU load, IO load can be monitored. To write a technical note on the work done -- make take some time.
CPU load is already there; for I/O load, need to do some work.
27 May : looking at tools for network monitoring (e.g. Cacti) to see if it is suitable; if not, then would go back to a simple perl script. To start looking at writing a technical note (including the GSB experience).
10 June : Cacti software tested on a trial m/c; will move to gwbh1....
24 June : Cacti software tests completed for 'gwbh1' & 'gwbh2' nodes; other nodes yet to be done [other nodes need internal connections ...]
5 Aug : most of the parameters avaiable in Cacti except data on Inf -- may need an additional piece of software (qualplot).

9 Sep : Cacti instaled in gwbh1, gwbh2, gwbh3 gwbcorr1, gwbcorr9 (t630) and tested. qualplot instaled in gwbh1, gwbcorr1 and tested. tempmon needs disks to be mounted on host machine and this needs a proper power on sequence of the nodes & host machines. This is being worked out.
==> looking like 2 schemes : cacti for ethernet and cpu etc; qualplot for infiniband; to see if cacti can access qualplot results for final display...

4.5 Layout of final system in correlator room (racks, cooling etc) -- from 9 Sep and before (IMH/GSJ/BAK) : Layout diagram to be updated and long-term plan for racks to be initiated; 3 different kinds of President racks discussed ("cyber", "cool" + one more?) -- to try and finalise after one more round of discussions including RVS (also, check new vendor Jyoti Tech); as an interim, 2 nos of cyber racks ordered with President. Meanwhile, for GWB-III, 4 nos of half-height racks have been used -- two nos are populated with 4 compute nodes each, third one has 3 host machines + 1 extra machine + clk source etc; fourth one has 8 Roach boards + IFB switch; will need to expand this to 16 Roach boards at some point of time -- may need to add one more half-height rack? One half-height rack is available in hand and can be used when required. For final system, present estimate is 5 full height racks housing 32 Roach boards + 16 compute nodes with 2 GPUs each (+ host machines?). Current action items :

(i) For the 2 President racks : first one has been used for putting GSB related spare nodes etc; second rack being used for trying the arrangement for special cooling (with help from mech group) -- tested with 1 kW load and increasing slowly; loading up to 4 kW tested by comparing the temp difference between input and output air (need to compare with unmodified rack); results so far appear to show that there is about factor of 2 discrepancy in estimated CFM rate and AC plant capacity CFM rate. agreed to include the test with unmodified rack and then circulate the report; with 2 AC vents feeding 5 racks (final number), the estimate is that the available CFM may be marginal -- this needs to be resolved against the CFM discrepancy noted earlier; also to explore additional margin the AC system (joint meeting with RVS and team may be useful);
20 May : intermediate update from report of IMH about discrepancy of factor of 2; measurements with the flow meter show that the amount of air flowing into the corr room is matching with the expectations from the AC system, which means that the utilisation of the cold air by the correlator test rack is only about 50%; method of taking in the cold air from the vent to the rack is being modified to improve the efficiency.
4 Jun : some inprovements in results with better ducting of cold air and 2 stronger fans to better pull the cold air -- now reaching 75% of capacity; to test at floor locations far away from the available vents.
17 Jun : at 5 feet away from vent, getting more than 100% (!)
(b) to decide on plans for ordering more racks.
1 Jul : interim report has been circulated; results appear to indicate that for any typical position of a rack in the room, having fans at the bottom near the input of the cold air (and maybe some ducting for the hot air at the top) should be enough for our requirements; to see if one round with more heat load (2 to 3 x is possible) to see the effect on GSB. To try and see if we can finalise the choice of rack soon and start the procurement.
15 Jul : electrical load simulation using 12 kW heater on a rack -- report circulated; report on choice of rack to be circulated in 1 week (22 Jul 15).
29 Jul : short discussion : updated report on rack layout etc is ready; can go ahead with ordering of relevant racks from President (slightly deeper than standard rack but is still readily available product) -- to be confirmed and action initiated.

5 & 12 Aug : ongoing; do discuss with RVS and HSK about layout of racks in corr room.
Agreed to move forward with the order for 6 nos of racks.
19 Aug : items to be discussd with mechanical have been identified and discussion will happen in the next few days; indent for desired depth rack is ready; will be testing 12 kW heat load next week.
26 Aug : to finalise the models and then ask for bugetary quotes.
9 Sep : Final rack requirements worked out, indents will be raised within a week.
==> enquiry for 6 nos (for final system) has gone out as a general enquiry.

4.6 Procurement of new hardware & accessories required for final GWB system -- from 9 Sep and before (BAK/GSJ) :

(i) purchase of 4 new host machines for GWB III : to decide configuration of host machines (disk i/o to be kept in mind); also to check if SSD is a viable option for recording of data. Investigaiton shows that SSD vs SATA has pros and cons; it may be possible that one class of server may be there that supports both?
4 nos of T620s have come and integrated into GWB-III: 2 are with 16 TB with and 2 with 4 TB -- compute vs host. No pending action items here?
29 Jul : confirm disk storage capacity on the host machins and close the matter.
9 Sep : gwbh1, gwbh2 gwbh3 has 2 X 2 TB disks.

(ii) purchase of remaining compute/host machines (for GWB IV) : PERC card issue needs to be resolved : agreed that we will buy machine that can support upto 12 disks (which means with PERC card) but will have 2 x 2 TB to start with. More disks can be added as needed, and if at all extra slot is needed, PERC can be removed (will support only 4 disks) and backplane has to be changed with a new one (which has to be bought along with the machines);
To decide quantity to order at present : agreed to proceed with 16 nos with full waiver for DELL proprietary item with DELL as the supplier.
Action started to generate the papers; tender waiver is done; and enquiry has been sent -- last date is 30th for the quotes and then tender will be opened.
6 May : sample T630 received from DELL; suitable (CentOS6.5) and CUDA 5.0 loaded and 2 GPU configuration done; 1 dual port 10Gbe card; 1 infiniband card installed; 3 slots still available -- 2 are x4 and 1 is x8 (PERC card is already on the mboard); can test the spare x8 slot and also the 2 x4 slots with appropriate 10Gbe cards.
Power supply problem : not really, as 2 nos x 1060 GPUs did not work, but 2 nos of K20s worked (will be tested with 2 nos of K40s).
20 May : final stages of configuring the T630 for swapping in place of a working T620 in the GWB-III. Meanwhile, to ask for extension of validity by 1 month (from 25th May).
4 Jun : initial set of tests showing that T630 loses packets; tried with lower BW and still getting packet loss; now trying a more recent OS.
17 Jun : still having problems with packet loss; in touch with DELL for resolving the problem; to try T620 with the updated OS; to try T630 in stand-alone mode; may be an issue of NIC card compatibility?
1 Jul : reverse test of upgrading T620 to higher OS has been tried and it works ok; to see if stand-alone T630 test can be tried; to follow-up more closely with DELL.
15 Jul : 'T630 test' continues [packet loss]; no loss observed with x2 10Tb NIC cards (in 1 hour); longer test planned.
29 Jul : latest test results summarised by SHR show that there is one working combination using 2 NIC cards that works; to get back to DELL with the test report for follow-up action; to see if we can go ahead with the order, with 4 of the T630s becoming compute m/cs and the rest becoming host m/cs; to check status of the existing folder and decide course of action.

Sep 9 : An indent for one T620 (from third party) and gpu installation kit is raised. Decided to purchase 8 nos of T630, but need to finalise the processor. Indent will be raised within a week.
==> 4 indents being prepared : 1 no T620; 2 GPU installation kits; 8 nos of T630; 16 nos of K40.

(x) discussion about configuration of GWB to isolate the system from the user : 2 scenarios to be discussed : (i) ICH + YG idea of 3 machine set for each host (ii) software pipe from process_psr to another machine which is the user interface and looks identical to the original process_psr...

(iii) procurement of accessories like network cards, disks, cables etc :
20 nos of CX4 based dual 10 Gbe cards purchased and tested; to confirm that this order is enough to meet our long-term requirements; agreed to produce a formal note about the situation for long-term : to relook at the spares requirement without counting the units already being used in the existing systems (including the PoCo and pkt corr) and buy more if needed; GSJ has produced this list and fresh orders to be done, based on this : 10 Gbe cables and NIC cards (spares); 36-port IB switch; 8 nos of K20s.
c. 4 Jun : 8 nos of K20 have come; IB cables and NIC have arrived; IB switch (36 port) has also come and has been installed in GWB-III. Agreed to put in a repeat order for the 36-port IB switch. Check current status and see if any other accessories need to be ordered.
1 Jul : Order has gone for spare switch.
15 Jul : IB switch is expected soon;
29 Jul : not discussed.
9 Sep : all the items have been received; no fresh updates; to check if item can be closed or any other follow-up is required.
==> if we go with T630, then we may need to buy more 10 Gbe cards.

(iv) new purchase of Roach boards etc : need to have enough Roach1 boards and ADC card; need to invest in Roach2 technology to keep abreast of things; new lot of 12 Roach1, 16 ADCs and 4 Roach2 was procured and Roach1 test set-up was made ready and all the Roach1 and ADC cards above were tested ok; current action items are :

(a) for Roach1 + ADC : summary spreasheet about current stock and usage of Roach1 and ADC created and taken up for discussion; agreed for final configuration of 32 working Roach boards + spares -- to check how many new ones have to be ordered (note : Xport will be missing in the new ones); agreed to go with 1 ADC card per Roach board -- to check how many new ADCs needed.
Confirmed that no new ADCs needed for 1 per Roach board; to order balance number of Roach1 boards.
1 Jul : processing for procurement for balance Roach1 boards (~20) has started; Digicom has confirmed that they will provide.
29 Jul : not discussed.
9 Sep : 20 Roach boards ordered and expected by Nov 2015
==> no action item here, for now.

(b) for Roach2 : to check standard test procedure on CASPER; to check if we need to buy add-on mezzanine card; to check if Roach2 can be seen on USB port using Ubuntu and if some basic tests can be done with this; mezzanine cards were needed in order to use Roach2 -- these were procured, allowing work to start on Raoch2 testing.
20 May : Aniket has been working on testing basic things like mezzanine card; 10 Gbe design etc; can now try to see if PoCo design can be ported to this system.

1 Jul : delay in progress due to sharing of PC with host environment of Roach1 & Roach2.
15 Jul : x1 more server needed (to speed up);
29 Jul : not discussed.
9 Sep : Software environment ready and tested, but to allow simultaneous work with Roach and Roach-2 designs we plan to purchase separate server machine for Roach-2.
==> no specific action right now.

(c) software environment needs to be upgraded (for working with Roach2) : Matlab-Simulink upgrade was ordered and installed on one machine (64-bit), including updated license manager (additionl license is for parallel toolbox); Xilinx ISE v14 was ordered, procured and installed; one existing PC was taken for putting new Matlab, Simulink, ISE v14.2; casper tool flow was also installed; LED blinking on Roach1 tested ok; to try PoCo design (may need some changes?) on Roach1 and then go for packetised design and GWB III design; after that, try these designs on Roach2, taking into account the change in architecture.
26 Mar email updates from SCC : CASPER toolflow for ROACH-2 installed; takes a lot of time for compilation of simple ADC Snap design (almost 45 minutes); also PoCo compilation needs rebuilding of design using new casper libraries. Still the toolflow has some freaky issues. ROACH-2 booting environment has been setup and need to test booting of roach2.
Need more RAM on the machine; installed on machine with 32 GB DDR-III and found significant speed-up of compilation -- sharing with Roach-I server machine.
need to identify another server.
1 Jul : agreed to initiate the process of looking for another server; and to try T7500 as an intermediate option.
29 Jul : not discussed.
9 Sep : separate server for Roach-2 needs to be purchased.
==> plan is to get 2 server machines : one for Roach-1 and one for Roach-2 and use the exiting machine for students work.

4.7 RFI filtering -- from 9 Sep & before (KDB/BAK/YG) : aim is to develop and implement RFI detection and mitigation algorithms at different stages of the back-end : both in time domain and in frequency domain, and for interferometric and beam modes. The overall plan is as follows :

(a) For impulsive, time domain RFI : First version of real-time RFI filtering block was added to packetizer of GWB-I (in one input out of two) with different options like replace by median or by constant or by digital noise source sample or clip to a threshold via s'ware registers) -- basic tests were done and found ok; trials with real antenna signal split into 2 copies and checking both self and cross outputs proved somewhat harder; further, design (with some optimisation of FPGA resources) was ported to GWB-II; agreed for time domain tests using either corr self powers or 2 IA beam signals; some tests with varying sigma were tried on antenna signals (results?); data taken with pulsed noise source input also; new results circulated and discussed; agreed that the basic scheme appears to be working ok; to try 3 versions of the scheme, with different options for the statistics; agreed to support 3 modes : continuous update; update on request; external update; this has been demonstrated in tests on GWB-II; need 3 separate versions of design (with optimisations) -- agreed we will carry forward the full design and then, when final baseline is established, the reduced modes can be made available. Meanwhile, design compilation for 4, 6, 8 bit inputs completed; utilisation (for one analog channel) : 41%, 19% and 17% (for total design) for 4 K window; tests were done to see if there is some biasing by digitally splitting the antenna signal -- confirmed ok, i.e. mean level changes for lower thld happens for replacement with zero or replacement with

noise but not for clipping; next part is testing with two different methods of generating thld statistics : shown that a priori stats works better for rejecting RFI infected data. Agreed to carry forward, for now, only 8 bit design -- other options can be brought up whenever needed.
Further, the design was optimised to fit on Roach board in the GWB-III design -- first for 2 filters out of 4 channels on each Roach board at 800 MHz (with compensated delay in the 2 other channels) -- this was implemented and shown to be working; dynamic window size control was also implemented -- shown to work upto 8k size for 800 MHz, 8 bits (will be adapted for 4 bits, as needed).

(b) For spectral domain, narrow band RFI : implementation of MAD filter across time (MFAT) and MAD filter across channels (MFAC) done on MATLAB and tests with simulated and real data carried out; basic tests show that, for spectral RFI that is steady with time MFAC works better than MFAT, except that there are issues when the RFI is near the edge of the pass band (or in the stop band region) -- proper normalisation of the bandshape may be needed to improve the performance?

(c) For beamformer output (for impulsive, time-domain RFI) : code developed by Shiv Rajora as part of the wpmon work (see also item XX(yy) above) for finding impulsive RFI in the data, tracking it for individual channels based on the DM and masking appropriate data while creating the dedispersed time series has been tested and needs to be refined and finalised;

(d) For beamformer output (for narrow band, spectral line RFI) : work needs to be initiated, which should borrow from / inform the routine for (b) above. This has now (Jul 2015) acieved at first level by the work done by Balaji Venkat following up on Shive Rajora's work, and basic features of MAD-based spectral line filtering have been incorporated; effects of normalisation have been investigated (and shown to make a difference);

Some action items are as follows :

(i) pulsed noise generator (PNG) ckt with additive noise source shown to be working -- can now be used for demonstrating RFI cancellation on visibility data. Some new tests were done : basically working ok; but would like to go down more realistic duty cycle; also, there appears to be some saturation like problem which is not clear; team can discuss and decide the growth path of a new PNG.
New results circulated; report of PNG inter-channel coupling - located where the couplign occurs; to follow-up on current status and discuss future plans.
BE team to discuss locally, and resolve the matter. To check if there are any updates.
10 June : some disussion has taken place and may have update in next few days.
24 June : Coupling reduced drastically after changing the coupling from resistive to inductive;
5 Aug : this is ok now and can be closed.

(ii) to work out proper scheme for testing -- KDB has circulated a proposed scheme, which is now been refined and accepted; to discuss and check if results are available. Some tests have been done and results discussed : scheme appears to be working fine; need better quantification of the results.
(noise + RFI) & only noise : filtered vs unfilterd comparison -> filtered (noise + RFI) gives higher cross-correlation; to check latest results and conclusions -- mostly done, and conclusions are reasonable; can move to real-life tests now -- check if any updated are available on this.

10 June : antenna tests not yet showing a conclusive result (correlator + beamformer results)
22 Jul : regular tests are being carried out for comparison between GWB-II & III (a SOP for running these has been created); results look fairly 'good'; to take up for discussion.
5 Aug : scheme is working ok with a well defined SOP using only GWB-II. This can be closed, and attention can be tested to regular testing and results from the same.
19 Aug : need to run the tests continuously for getting some statistics and conclusions; to work out a scheme for tracking and finding regions of bad RFI in the beam data (which the filter has caught and mitigated) and go to interferometry data for that region to cross-check.
9 Sep : tests carried out on 21/08/15 in beam and intereferometry modes, data analised and in both cases instances of RFI were removed by the algorithm.
==> phase plots also added to the filtering and looks reasonable. other tests with different threshold levels and different replacement schemes and different variants of filtering.

(iii) : updates on time domain filtering algorithm : median of MAD was tried and it appeared to show improvement for long bursts; to check if this recursive method can be an option; to compare it with the case where statistics is supplied exernally.
9 Sep : no fresh updates.

(iv) book-keeping : trying to work out the packing scheme, with the understanding that jumbo packet size is taking up. Need to discuss long-term plans for this.
1-bit flag implementation has been started; need a discussion for agreeing on the option for double rate sampling and how to structure the packets. Need to move this discussion forward.
Summary of discussion avaiable as a note [passing RFI flag bits thru the chain] how to use it is not decided yet; some follow-up discussions have happened; to check latest status.
10 June : recalled that test needs to be done with 4K packet size to see that corr works ok.
24 June : Today 4K design is under test;
5 Aug : to test GWB-III and report back.
19 Aug : GULP based test has been done; now looking at what changes needed in PSRDADA section for 4K packets.
9 Sep : Upendra has prepared a code with 4K packets and this is to be tested for performance vs the original GWB code.
==> needs some debugging.

(iv) spectral line filtering needs to be taken up for discussion -- first results have been circulate for projected back-end systems; a concept note has been generated for this; some feedback has been sent by YG; need a follow-up discussion on this matter. To examine if the best place to test spectral line filtering may be beamformer output.
5 Aug : agreed to build up the test and experince on wpmon and then move to main correlator (see below).
19 Aug : FPGA based implementation on 4 bit real, imaginary output of FFT has also been demonstrated.
9 Sep : wpmon code is being studied, working on isolating the MAD filtering code from the C-program.

(v) filtering of beamformer output : time domain impulse RFI filtering has been demonstrated in the work done by Shiv Rajora and is being followed up by Balaji

(summer 2015); spectral line filtering has also been introduced for this data.
29 Jul : updated code is working; tested and showing good results for off-line analysis (for GSB & GWB); basic tests of real-time mode have been carried out for GSB shm and shown to be working ok.
5 Aug : tests ongoing and being used by KDB and others; plans for further real-time testing on GSB to be worked out; plans for porting to GWB to be worked out.
19 Aug : some discussion about this with various options discussed.
9 Sep : no updates.

4.8 Next-gen time & frequency standards -- from 19 Aug & before (NDS/BAK) :
(i) brief update from BE team from visit to NPL was provided in last discussion; waiting for detailed report to be circulated draft (maser report already circulated) complete report has been circulated today -- need to schedule a discussion.
not much progress; need to follow-up and discuss within the group also, to work out a possible "plan".
First discussion has happened between NDS, BAK and YG -- need a follow-up !!
5 Aug : to try and schedule a meeting tomorrow with Swami to move forward with the plans for civil etc for the active option...
19 Aug : one round of discussions has happened & possible location has been identified;
9 Sep : no updates.

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