Report

on

STUDY OF RFI AMBIENCE IN AND AROUND GMRT

by
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Student Training Programme,
GMRT.

Guided by

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ACKNOWLEDGMENTS

We express our deepest gratitude to our **Shri Suresh Kumar** and **Shri Pravin Raybole** for their invaluable guidance, blessings and constant encouragement and support.

We are very grateful to the **Center Director Shri Swarna K Ghosh** and **Dean Yashwant Gupta** for providing us with an environment to complete our project successfully.

We also thank all the staff members of GMRT for their help in making this project a successful one.

Finally, we take this opportunity to extend our deep appreciation to our **family** and **friends**, for all that they meant to us during the crucial times of the completion of our project.

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Report on

STUDY OF RFI AMBIENCE IN AND AROUND GMRT

I. INTRODUCTION

A lot of work has been done on RFI at and around GMRT. Most surveys within GMRT relate to characterisation of RFI generated in-house by antenna motors, diesel generator sets, different modular cabinets, electric power transformers, etc.

A detailed RFI map of region in the vicinity of GMRT was desired as it is thought that it would aid radio astronomers at GMRT in selecting observing bands free from RFI. Also, if RFI is known to exist at a certain location or in certain direction then observers may avoid observing in that direction and allow the object of interest to rise up further and away from the horizon so as to avoid RFI from plaguing their observations. With this in mind a detailed RFI survey was undertaken.

II. METHODOLOGY

The RFI survey was carried out using the following equipment; Spectrum Analyser, Log Periodic Dipole Array (LPDA), Sirenza amplifier for LPDA, GPS, etc.

Google Earth was used for marking out locations 1, 2, 4, 8 and 16 km away from GMRT's Central Complex in all four directions – North, South, East and West. The probable path to these locations was also charted out using Google Earth. Maps showing these details were printed and filed for future reference.

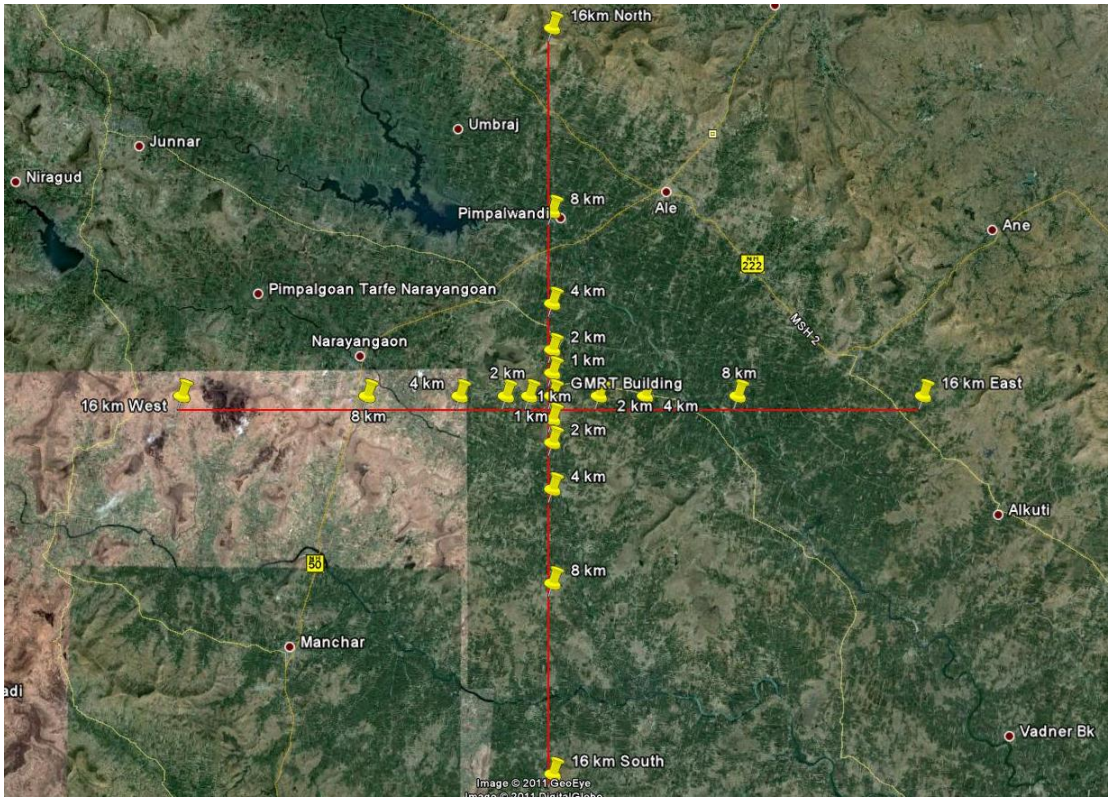


Fig. 1

At each location the LPDA was mounted on its tripod at least 5 feet away from the vehicle carrying the equipment. Efforts were taken to minimize RFI generated by sources like mobile phones (everyone in the vicinity was requested to switch off their mobiles), car (car radio and ignition was switched off), bikes (were allowed to pass away to at least 20 m away from LPDA),

portable petrol engines used while fumigating crops (farmers were requested to switch them off until after readings), etc.

The antenna was pointed in each direction and four sets of readings (0-500 MHz, 500-1000 MHz, 1000-2000 MHz and 0-2000 MHz. 10,000 points were taken for each reading to) were taken on spectrum analyser using average mode. Average mode was used to obtain only those RFI that are always present. This way spurious RFI which is spontaneous was avoided. This procedure was followed at all locations during the survey. Each location was tracked using GPS which enabled us to narrow down the location point to within ±3 meters. Locations which were not approachable due to difficult terrain or if they were in the middle of a field where the vehicle could not negotiate a path were substituted by another alternate location as close as possible to the actual location. The GPS coordinates of all the locations where the RFI reading was taken were logged and these details have been included in the map printouts. The readings were stored on a pendrive since the spectrum analyzer had a facility to allow data to be stored on a USB pendrive. The data was further processed in MS Excel to obtain superimposed graphs of different locations with LPDA pointing in each direction.

The following nomenclature was used in the maps. “1 km East of GMRT Complex” denotes the location where RFI should be measured. It is represented of map by yellow pin. “RFI 8kmE” denotes the location where RFI readings were taken. Thus “RFI 8kmE” refers to that location which is 8 km East of GMRT Building and is represented on map by a blue star. Same nomenclature is used for all four directions.

Since the graph show the power level inclusive of the 20 dB gain offered by the Amplifier it should be read as 20 dB less than the represented reading.

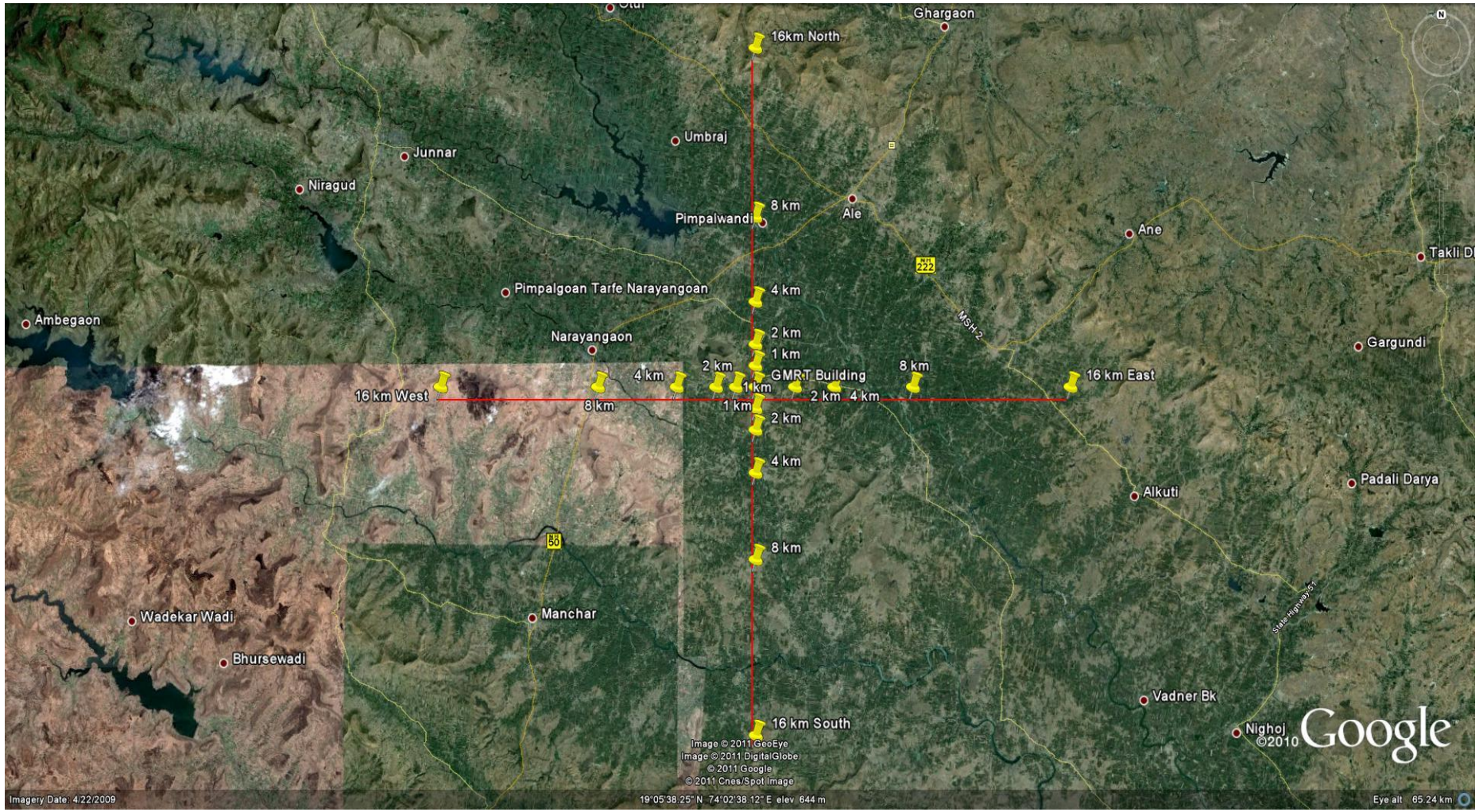
Changes in noise floor on some graphs may be attributed to different averaging times.

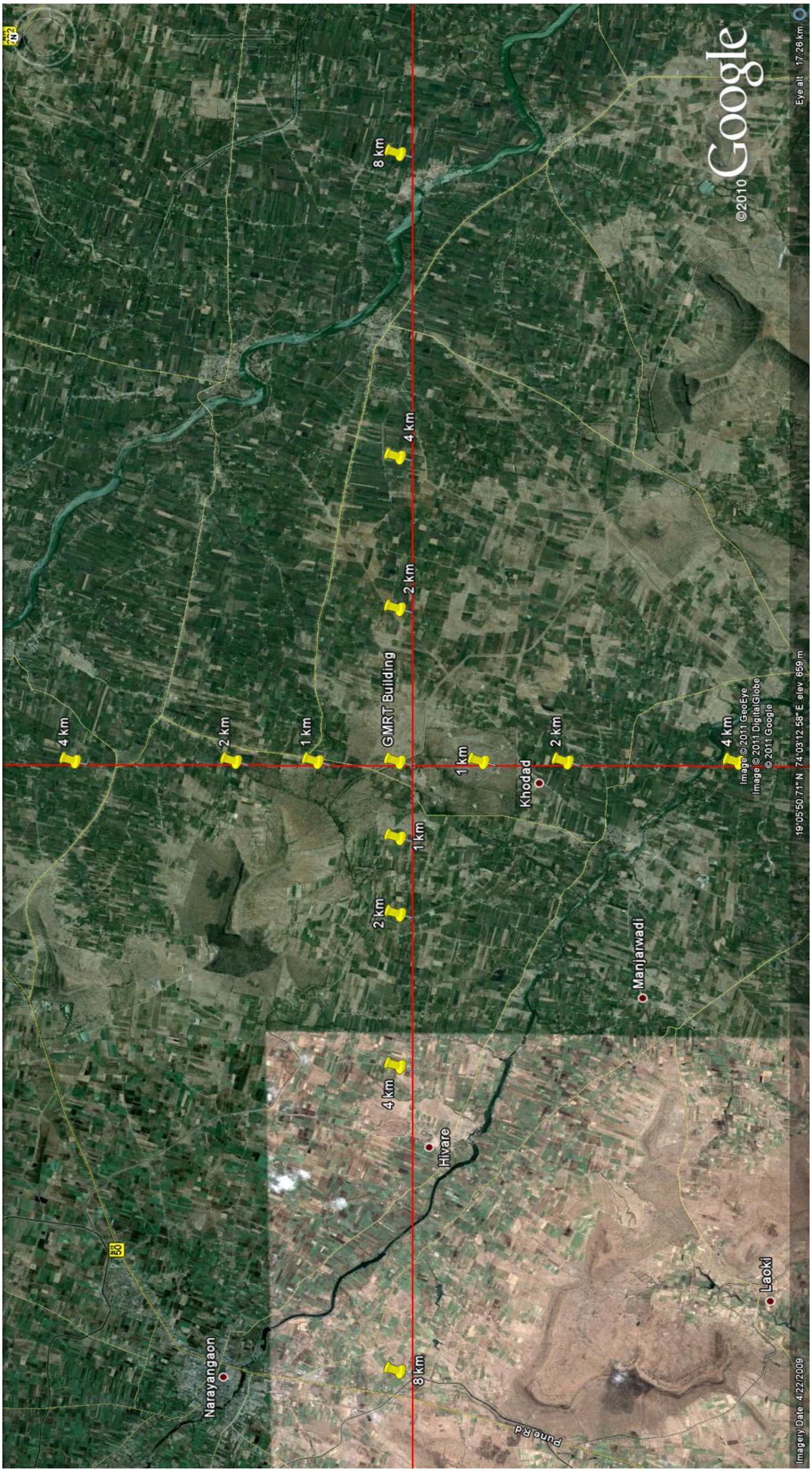
III. OBSERVATIONS

The region around GMRT where readings were taken is shown in Fig. 2 and Fig. 3 below.

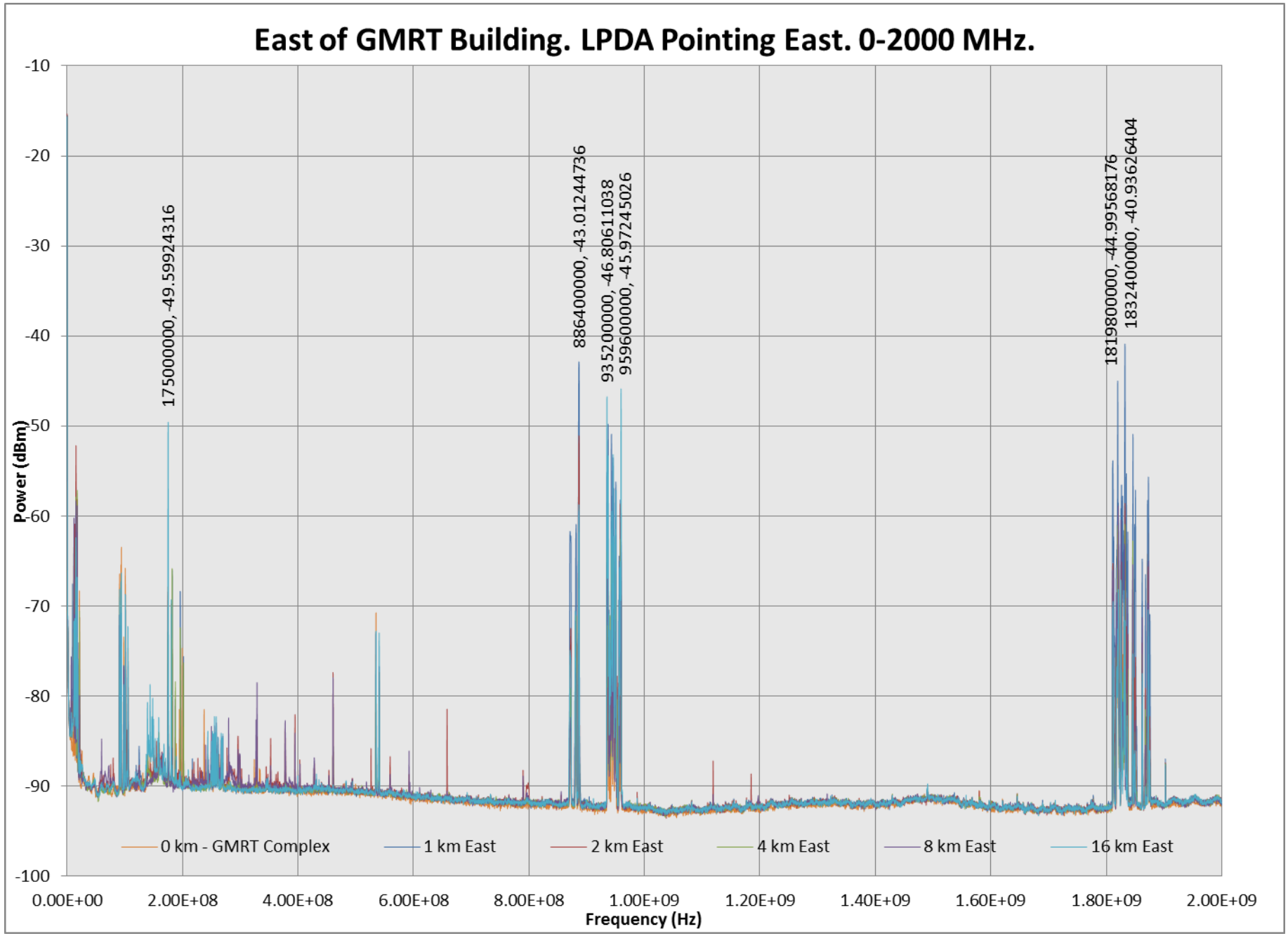
Graphs for each frequency are then shown below in the following order – East, North, South and West. Graphs for 0-2000 MHz, 150 MHz, 235 MHz, 327 MHz, 610 MHz, 1060 MHz, 1170 MHz, 1280 MHz and 1390 MHz frequencies are plotted.

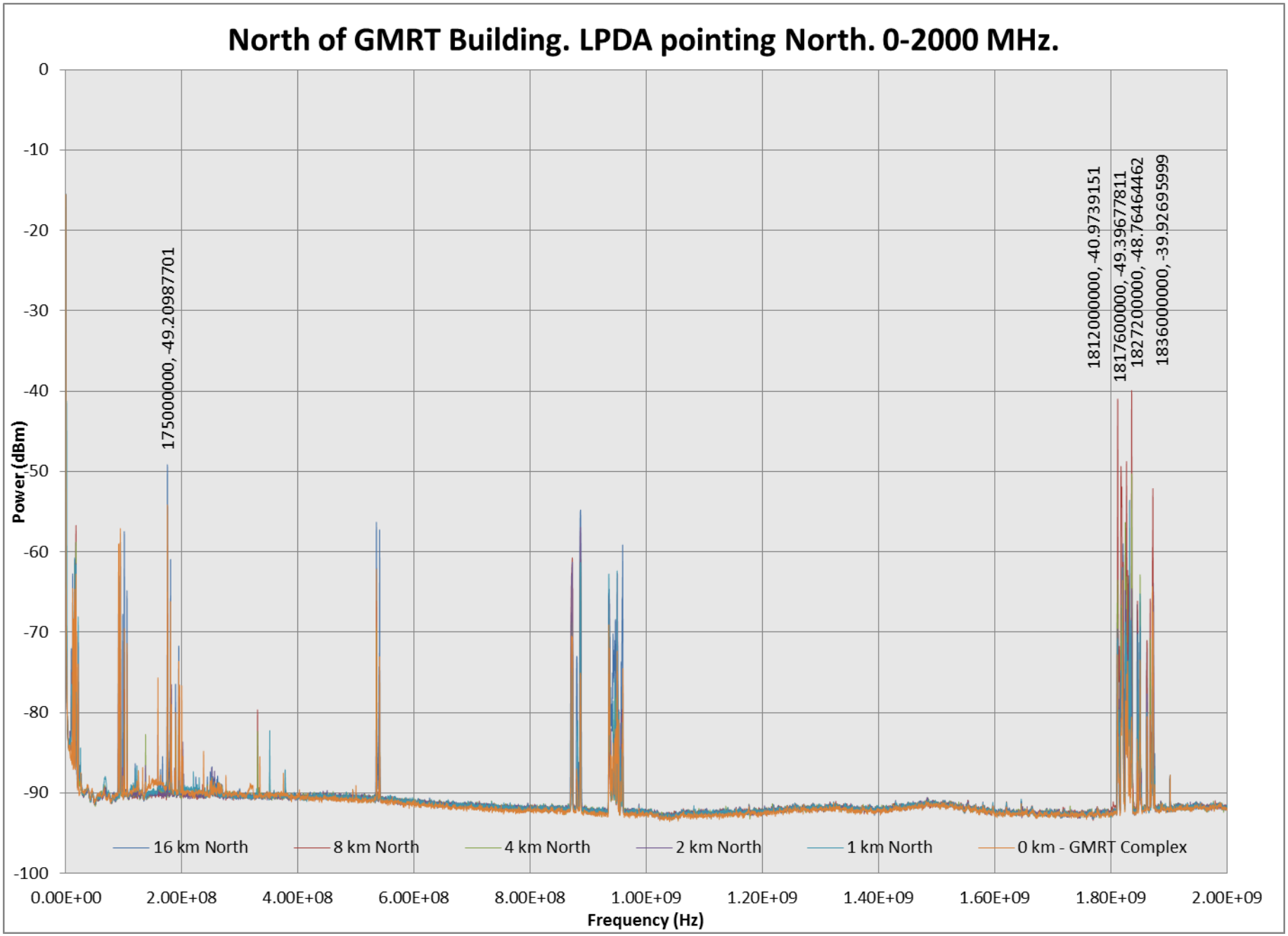
Also given is the path taken to reach each location by car using guide points for easy navigation using GPS.

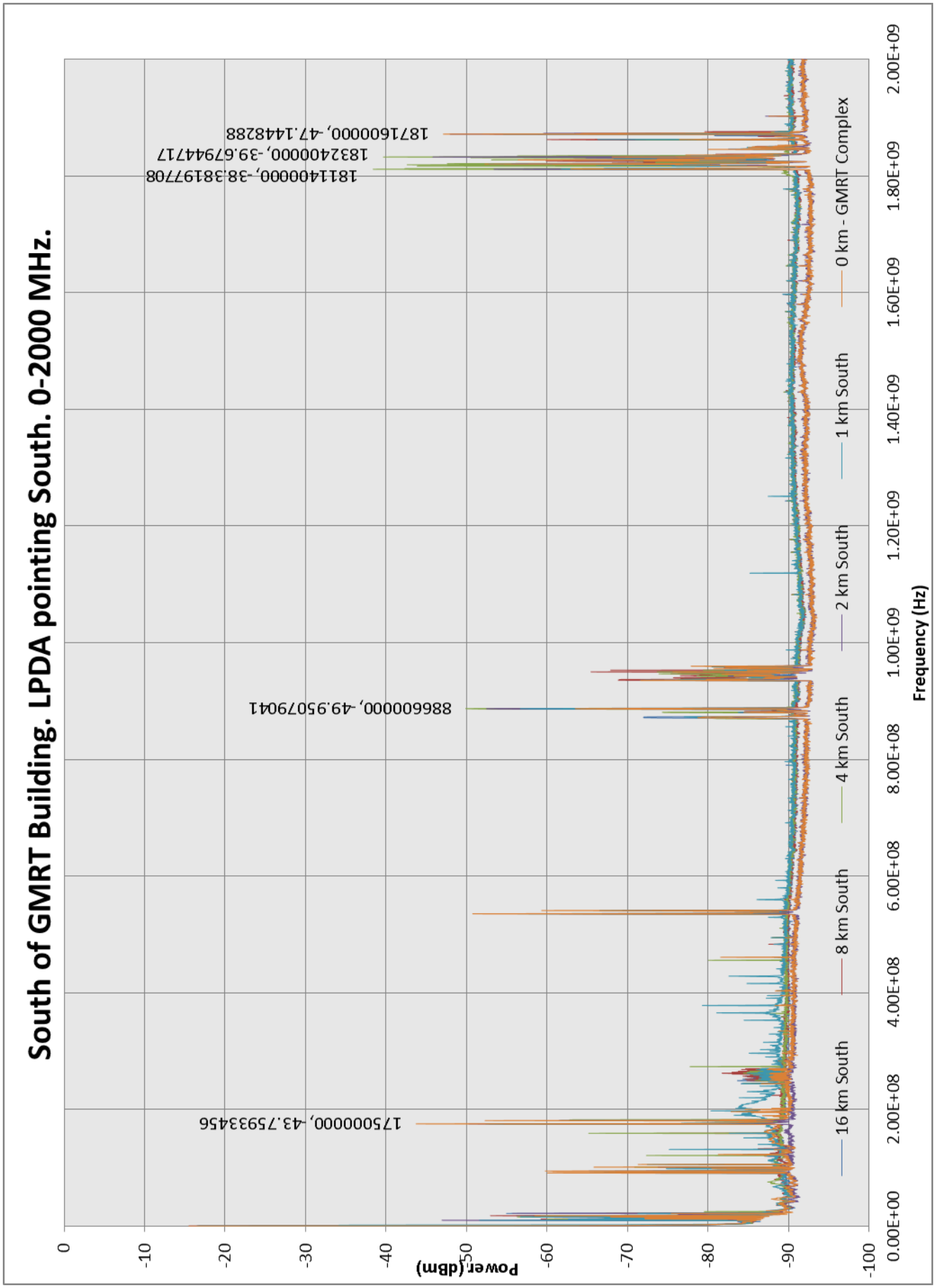

Ghargaon
16km North
Umbraj
Junnar
Niragud
Pimpalwandi
8 km
Ale
Ane
Takli D
Pimpalgoan Tarfe Narayangoan
4 km
Ambegaon
Narayangaon
2 km
1 km
GMRT Building
8 km
16 km East
Gargundi
16 km West
4 km
2 km
1 km
2 km 4 km
8 km
1 km
2 km
4 km
Alkuti
Padali Darya
8 km
Wadekar Wadi
Manchar
Bhursewadi
Vadner Bk
16 km South
Nighoj
Image © 2011 GeoEye
Image © 2011 DigitalGlobe
© 2011 Google
© 2011 Cnes/Spot Image
©2010 Google
Imagery Date: 4/22/2009
19°05'38.25" N 74°02'38.12" E elev 644 m
Eye alt 65.24 km

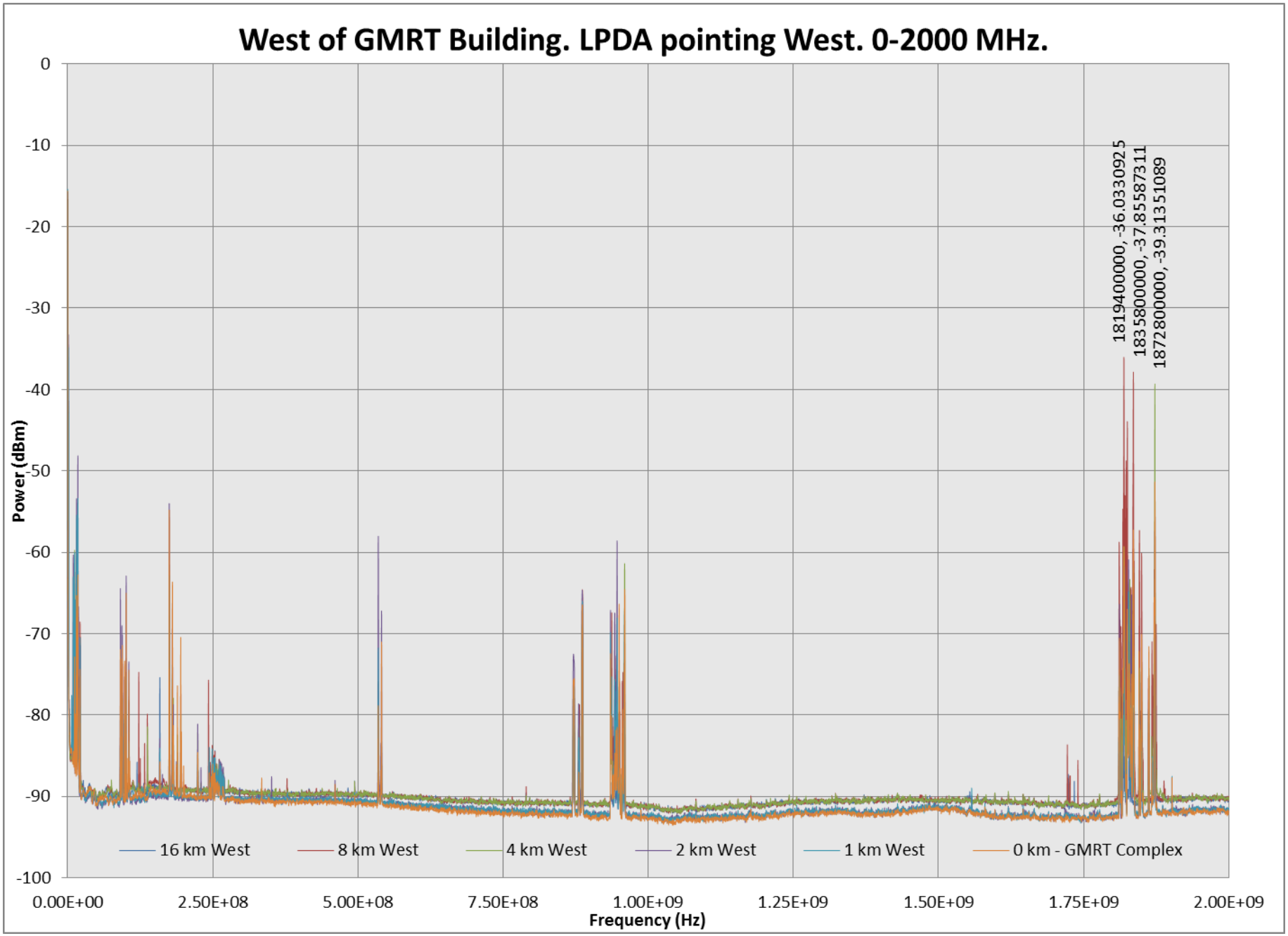


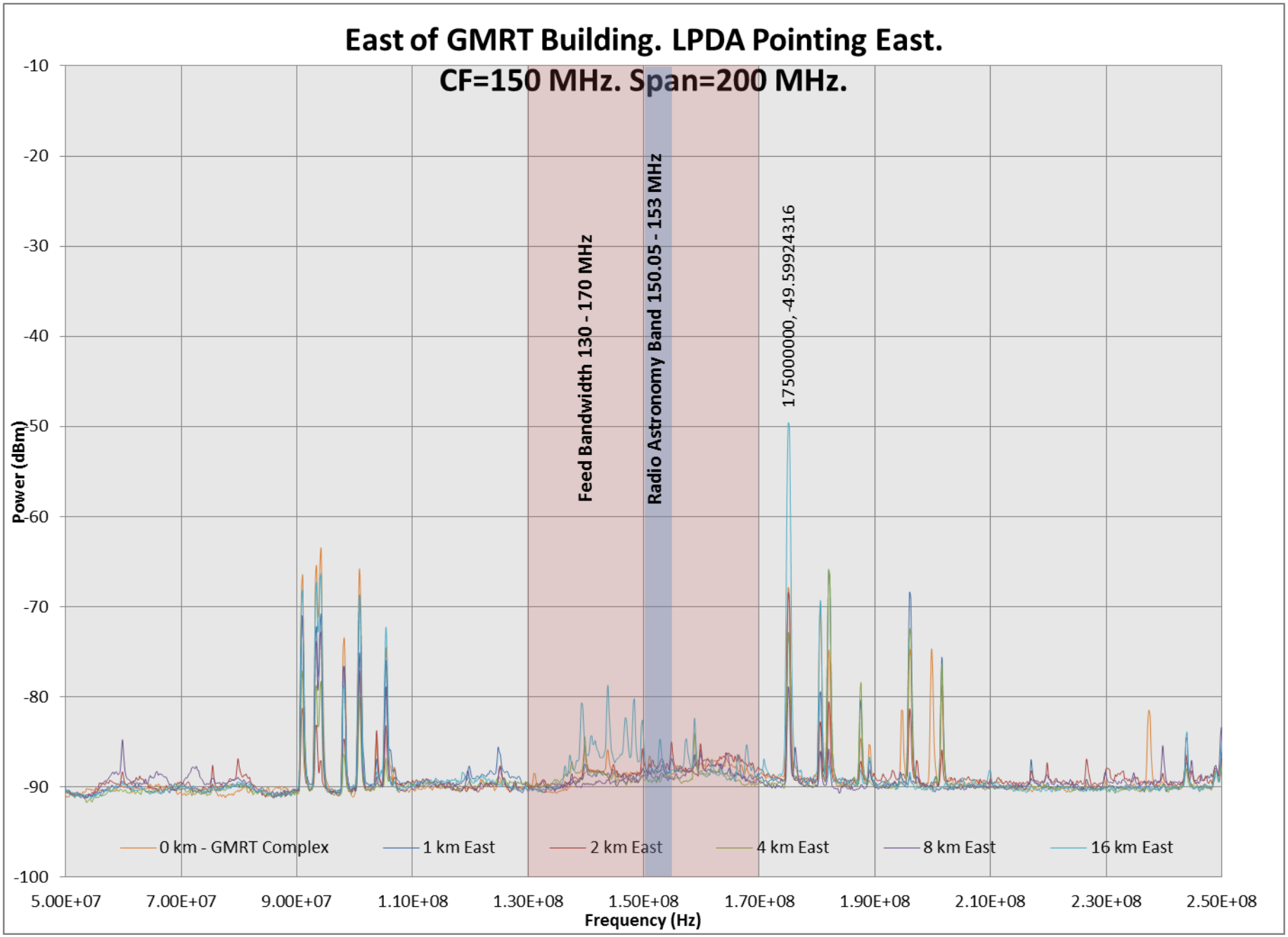
GMRT Building
1 km
2 km
4 km
8 km
Khodad
Manjarwadi
Hivare
Narayangaon
Laoki
Pune Rd
Google
©2010
Image © 2011 GeoEye
Image © 2011 DigitalGlobe
© 2011 Google

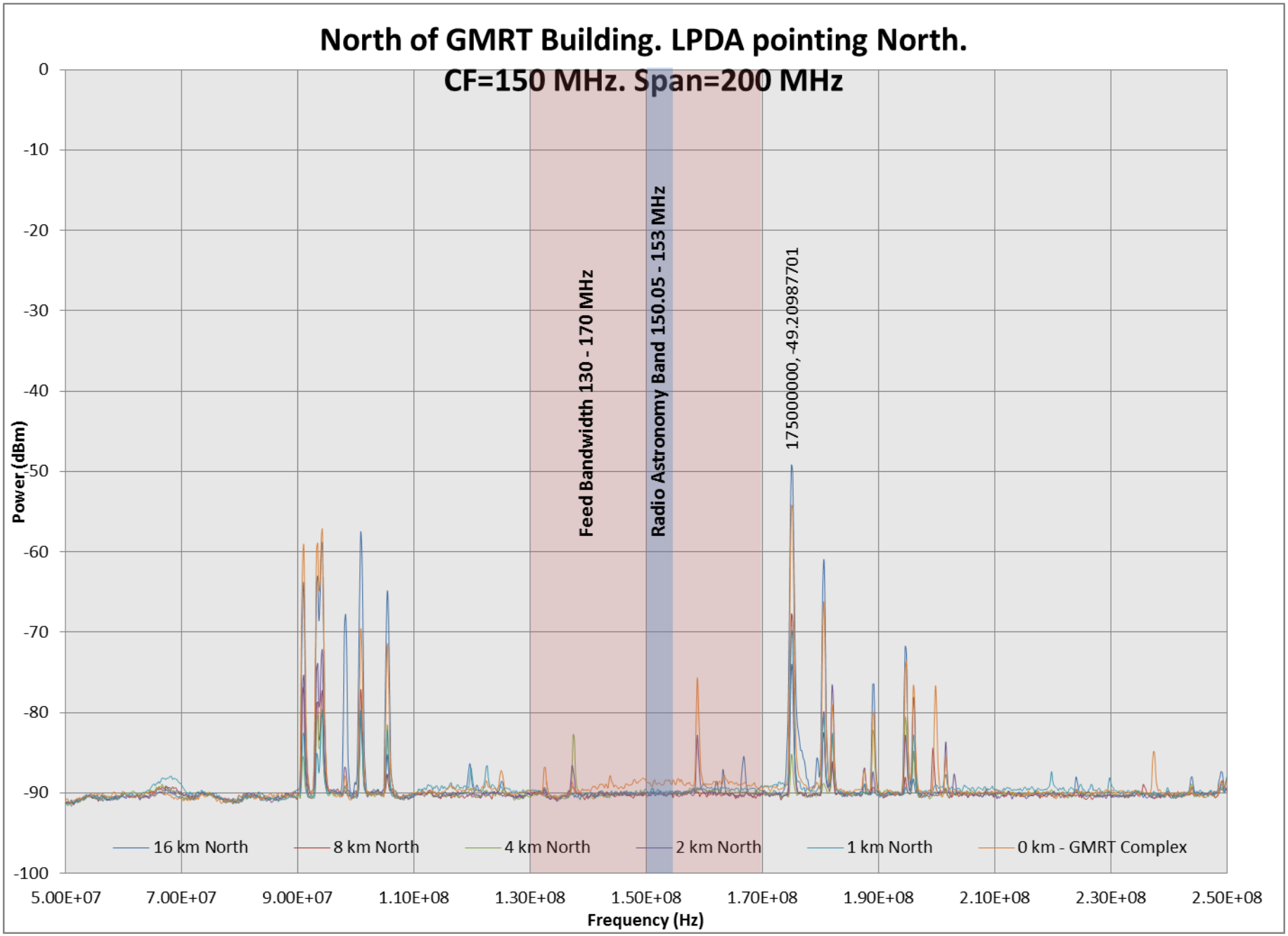

East of GMRT Building. LPDA Pointing East. 0-2000 MHz.
Power (dBm)
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
0.00E+00
2.00E+08
4.00E+08
6.00E+08
8.00E+08
1.00E+09
1.20E+09
1.40E+09
1.60E+09
1.80E+09
2.00E+09
Frequency (Hz)
175000000, -49.59924316
886400000, -43.01244736
935200000, -46.80611038
959600000, -45.97245026
1819800000, -44.99568176
1832400000, -40.93626404
0 km - GMRT Complex
1 km East
2 km East
4 km East
8 km East
16 km East

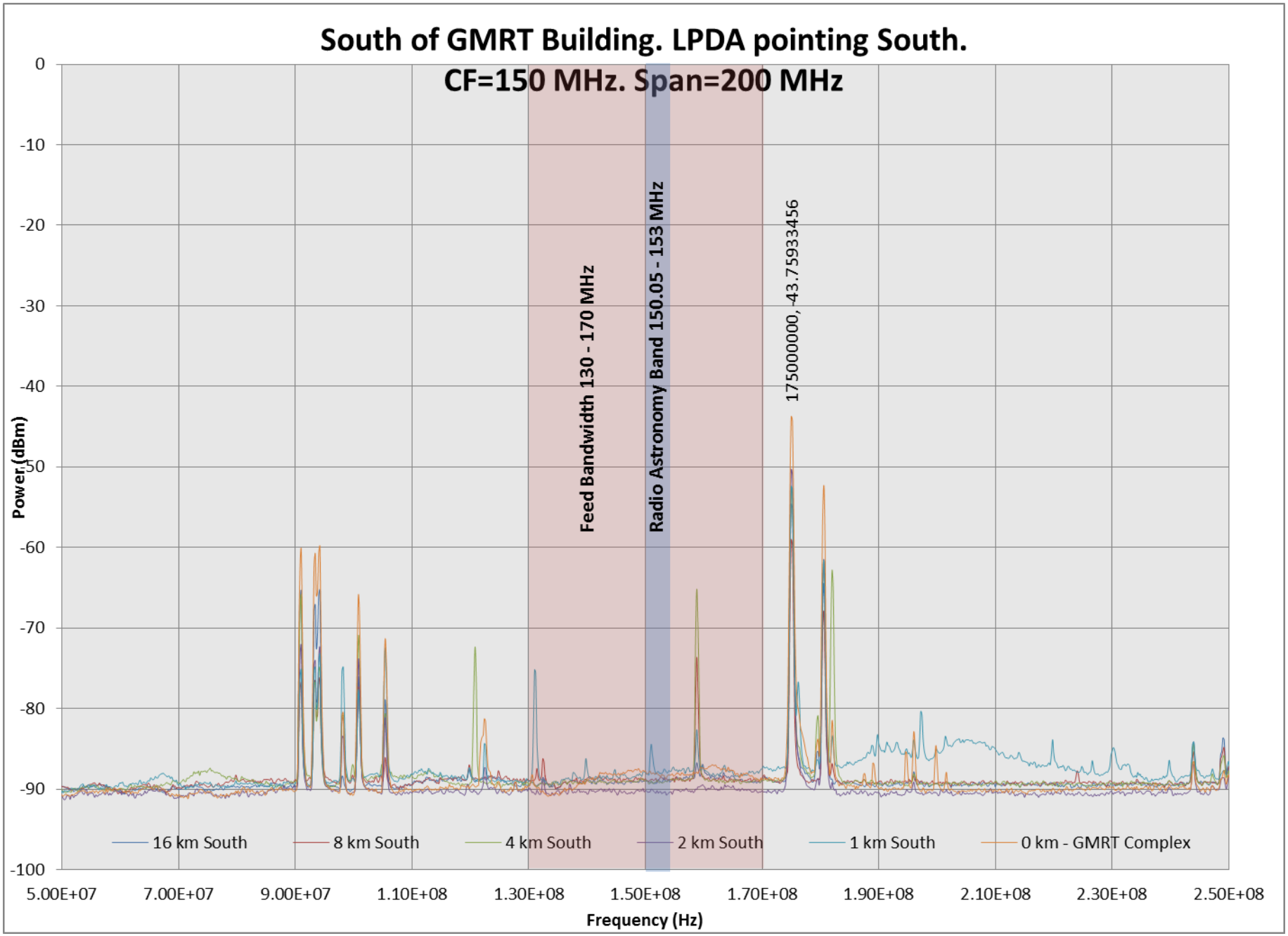

North of GMRT Building. LPDA pointing North. 0-2000 MHz.
Power (dBm)
Frequency (Hz)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
0.00E+00
2.00E+08
4.00E+08
6.00E+08
8.00E+08
1.00E+09
1.20E+09
1.40E+09
1.60E+09
1.80E+09
2.00E+09
175000000, -49.20987701
1812000000, -40.9739151
1817600000, -49.39677811
1827200000, -48.76464462
1836000000, -39.92695999
16 km North
8 km North
4 km North
2 km North
1 km North
0 km - GMRT Complex

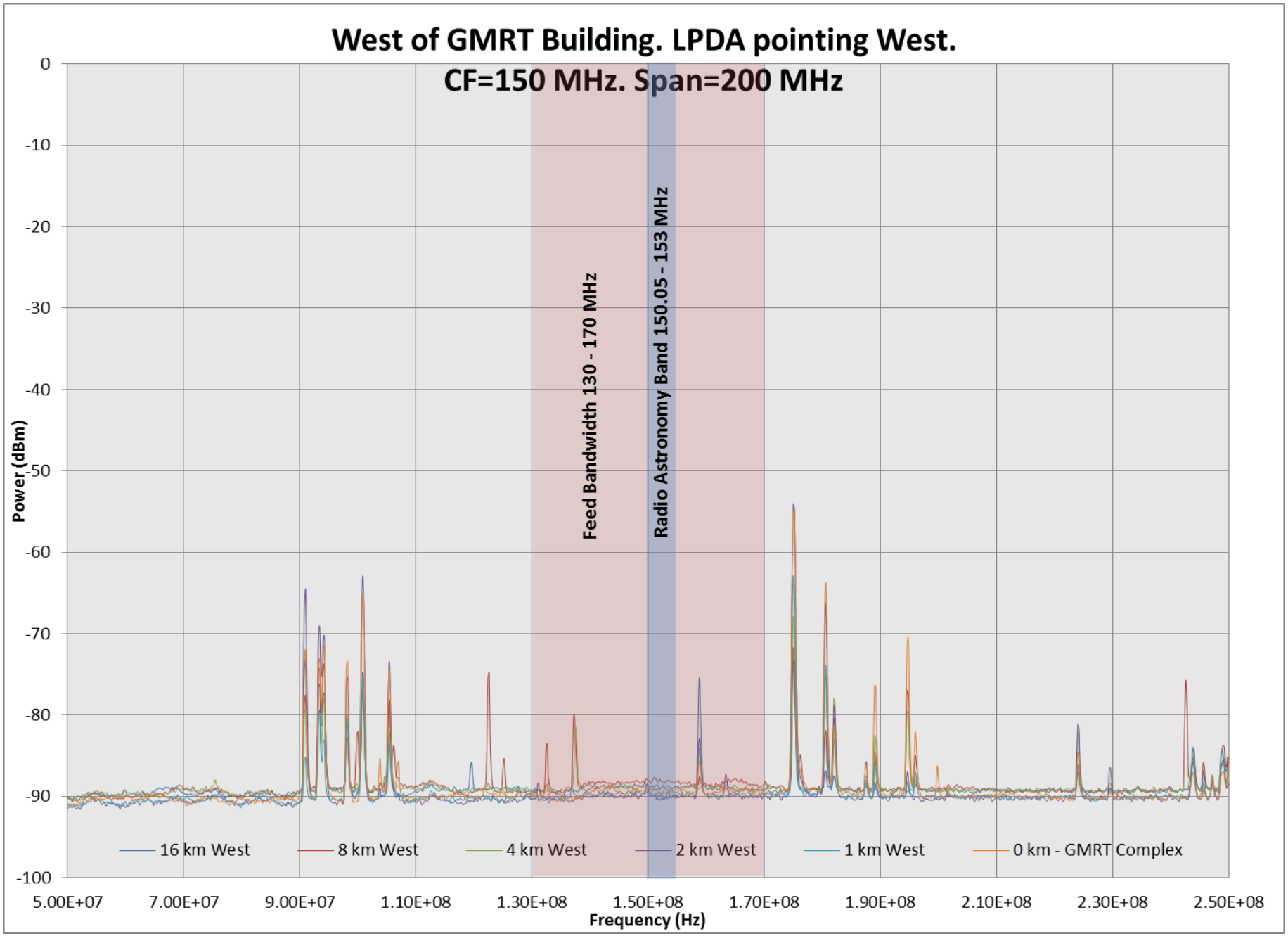

South of GMRT Building. LPDA pointing South. 0-2000 MHz.
Power (dBm)
Frequency (Hz)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
0.00E+00
2.00E+08
4.00E+08
6.00E+08
8.00E+08
1.00E+09
1.20E+09
1.40E+09
1.60E+09
1.80E+09
2.00E+09
16 km South
8 km South
4 km South
2 km South
1 km South
0 km - GMRT Complex
175000000, -43.759334 56
886600000, -49.950790 41
1811400000, -38.381977 08
1832400000, -39.679447 17
1871600000, -47.144828 8

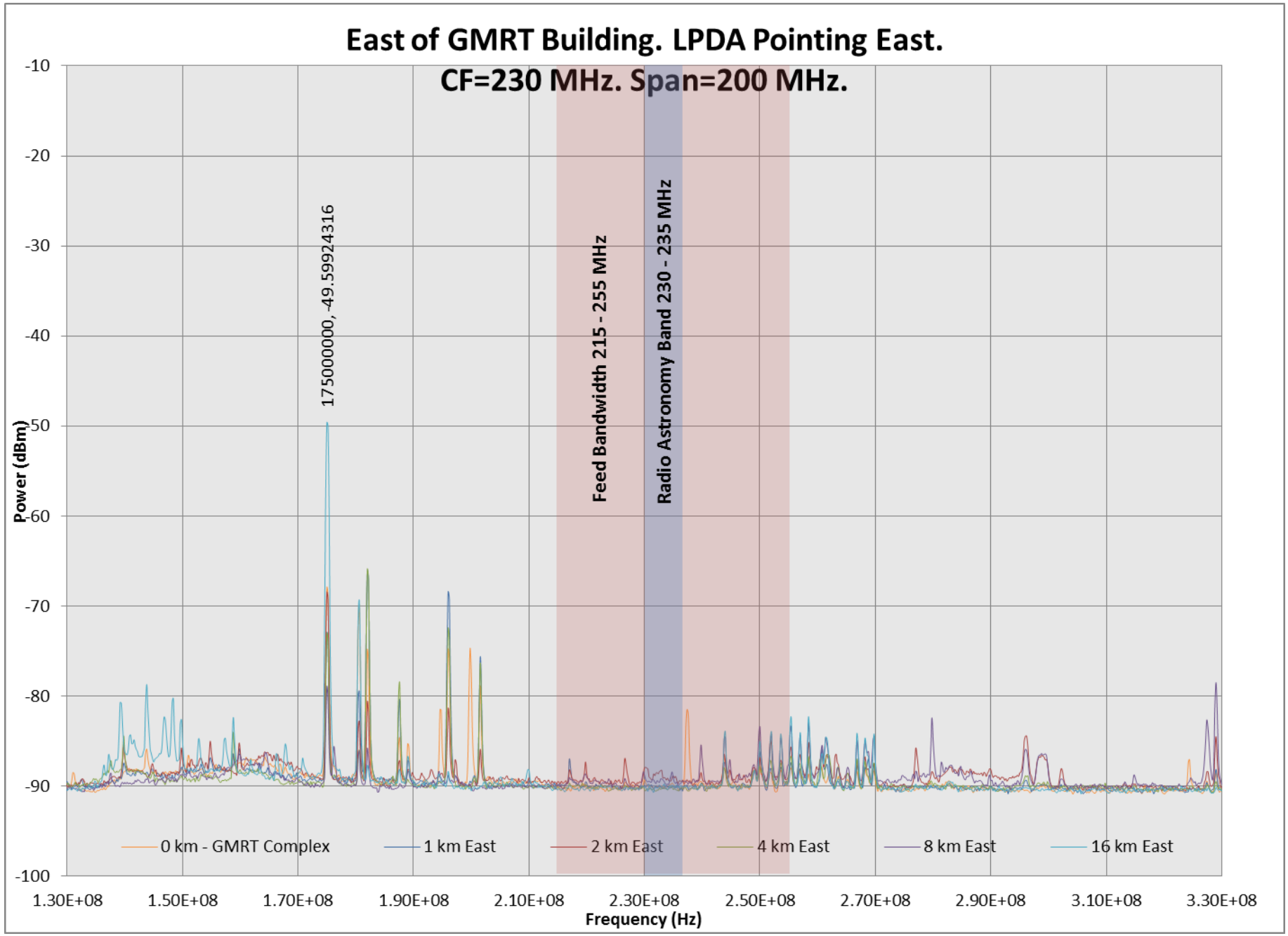

West of GMRT Building. LPDA pointing West. 0-2000 MHz.
Power (dBm)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
0.00E+00
2.50E+08
5.00E+08
7.50E+08
1.00E+09
1.25E+09
1.50E+09
1.75E+09
2.00E+09
Frequency (Hz)
1819400000, -36.0330925
1835800000, -37.85587311
1872800000, -39.31351089
16 km West
8 km West
4 km West
2 km West
1 km West
0 km - GMRT Complex

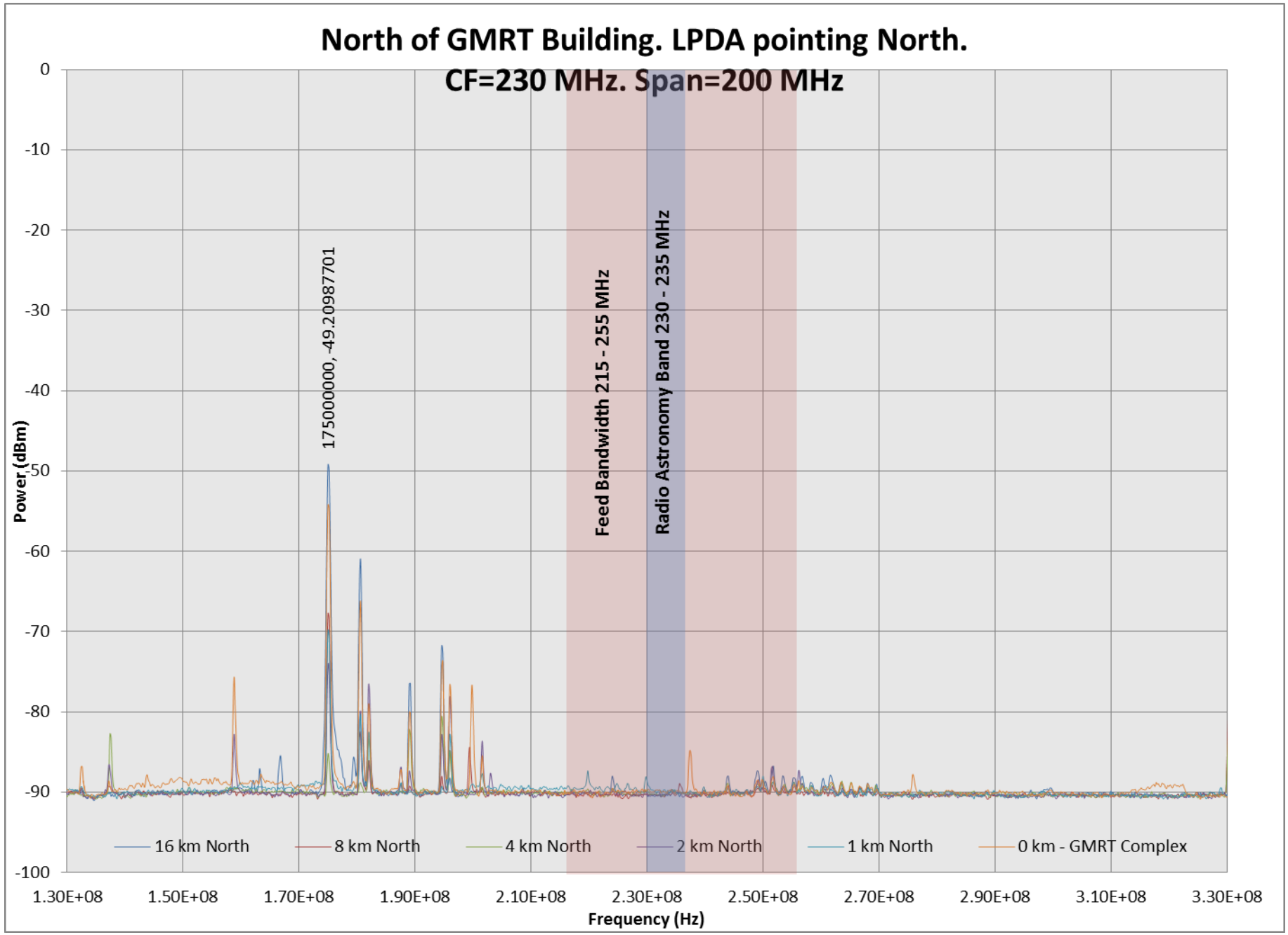

East of GMRT Building. LPDA Pointing East.
CF=150 MHz. Span=200 MHz.
Feed Bandwidth 130 - 170 MHz
Radio Astronomy Band 150.05 - 153 MHz
175000000, -49.59924316
Power (dBm)
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
5.00E+07
7.00E+07
9.00E+07
1.10E+08
1.30E+08
1.50E+08
1.70E+08
1.90E+08
2.10E+08
2.30E+08
2.50E+08
Frequency (Hz)
0 km - GMRT Complex
1 km East
2 km East
4 km East
8 km East
16 km East

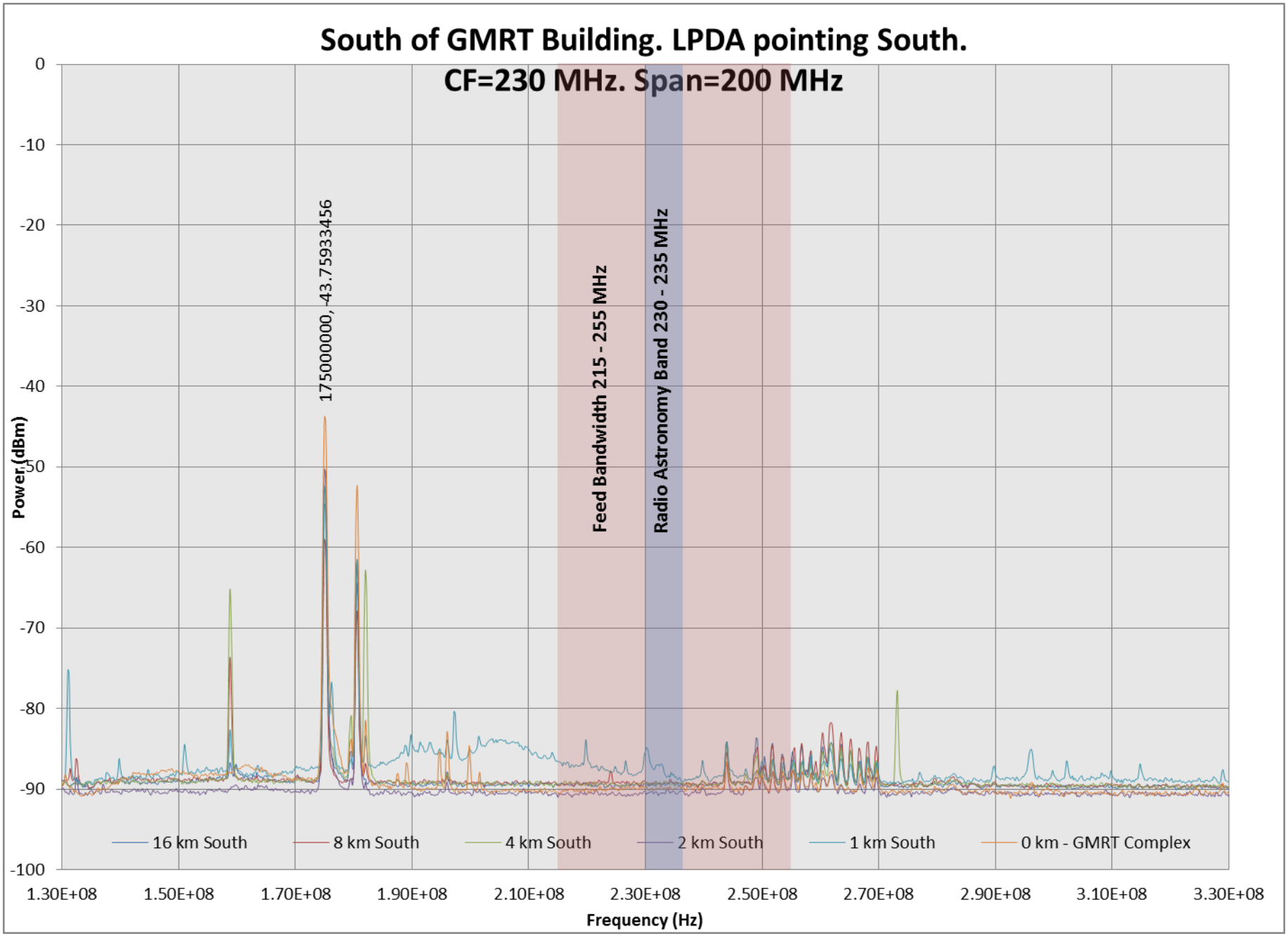

North of GMRT Building. LPDA pointing North.
CF=150 MHz. Span=200 MHz
Feed Bandwidth 130 - 170 MHz
Radio Astronomy Band 150.05 - 153 MHz
175000000, -49.20987701
Power (dBm)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
5.00E+07
7.00E+07
9.00E+07
1.10E+08
1.30E+08
1.50E+08
1.70E+08
1.90E+08
2.10E+08
2.30E+08
2.50E+08
Frequency (Hz)
16 km North
8 km North
4 km North
2 km North
1 km North
0 km - GMRT Complex

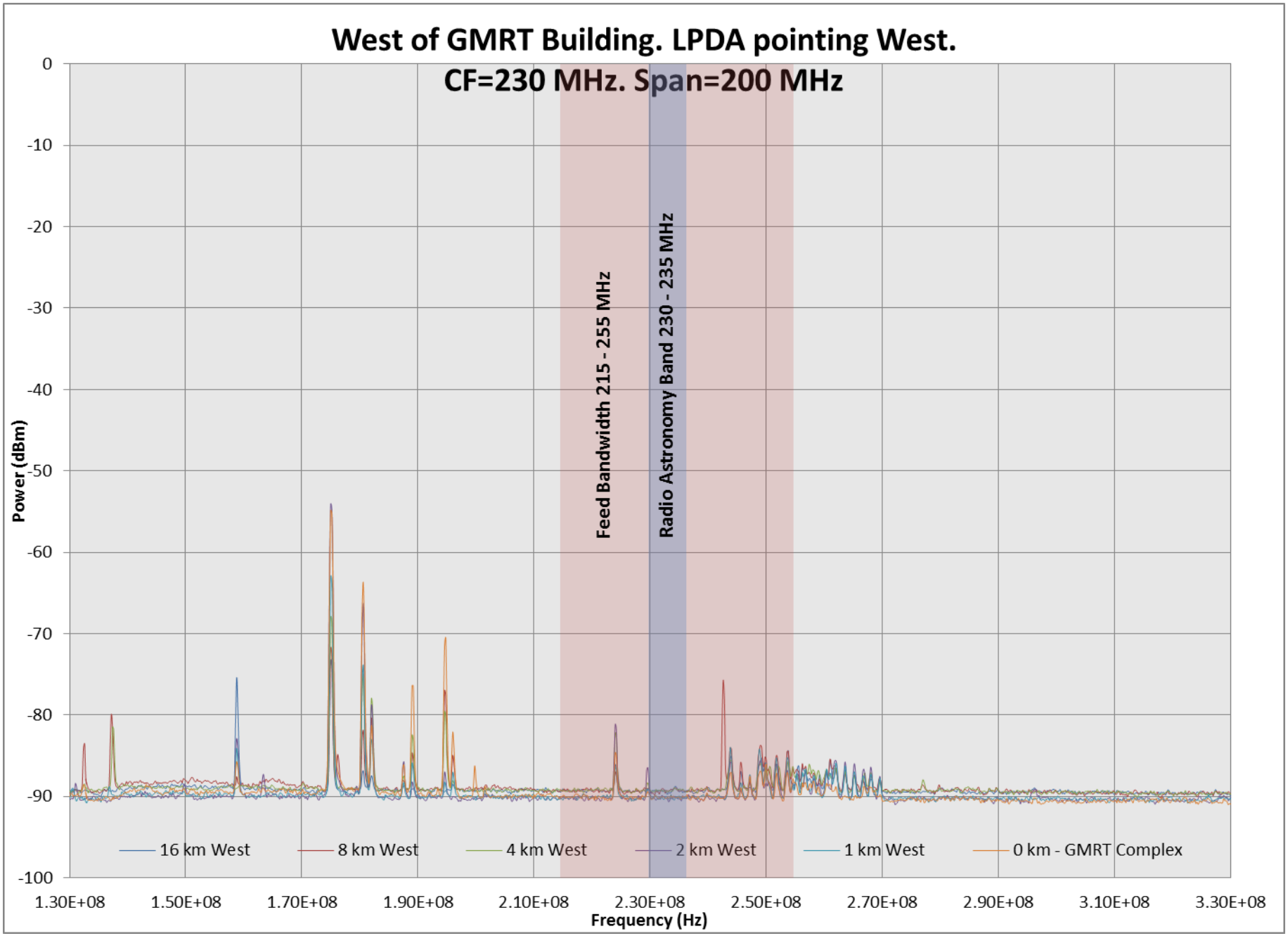

South of GMRT Building. LPDA pointing South.
CF=150 MHz. Span=200 MHz
Feed Bandwidth 130 - 170 MHz
Radio Astronomy Band 150.05 - 153 MHz
175000000, -43.75933456
Power (dBm)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
5.00E+07
7.00E+07
9.00E+07
1.10E+08
1.30E+08
1.50E+08
1.70E+08
1.90E+08
2.10E+08
2.30E+08
2.50E+08
Frequency (Hz)
16 km South
8 km South
4 km South
2 km South
1 km South
0 km - GMRT Complex

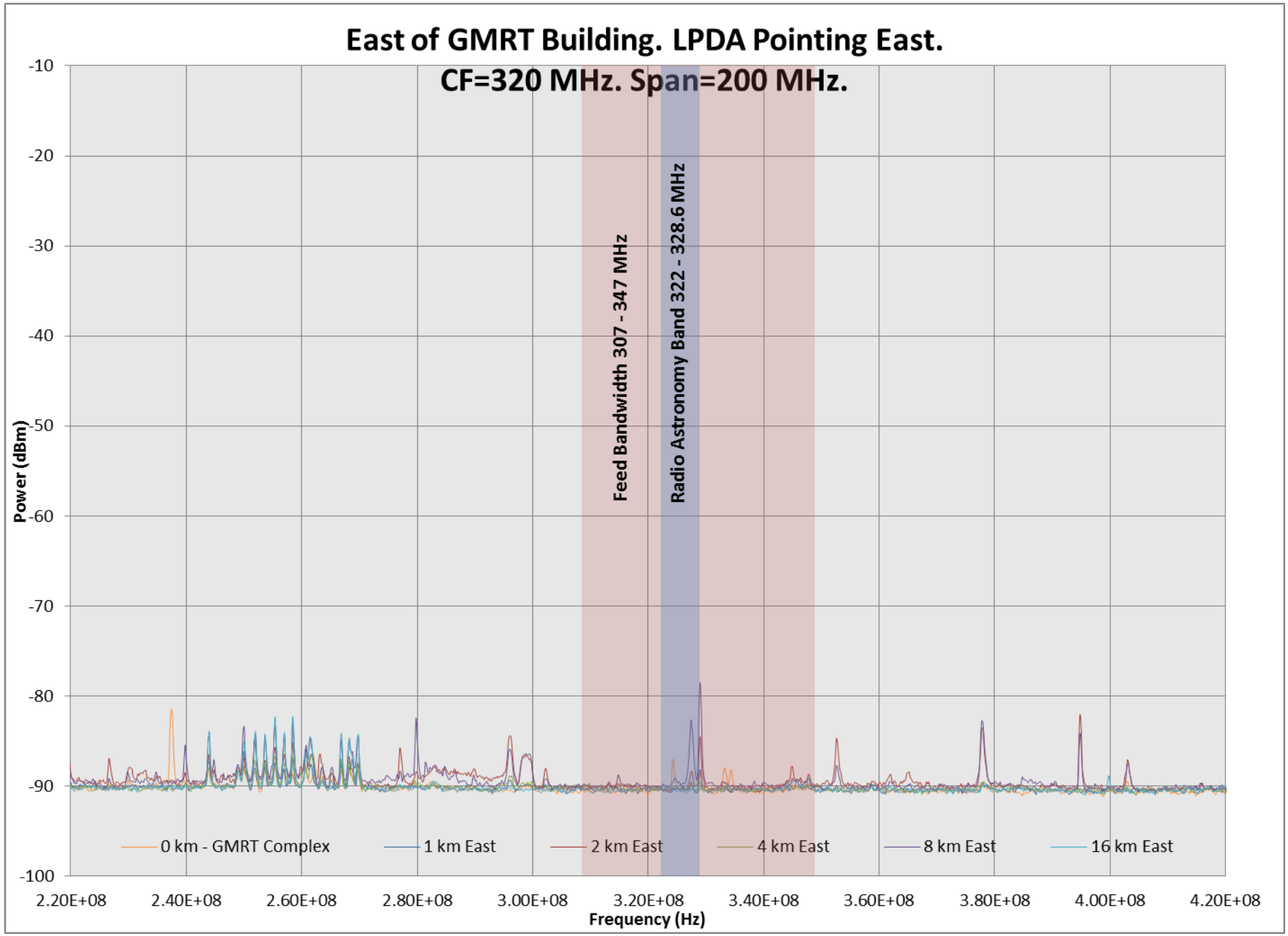

West of GMRT Building. LPDA pointing West.
CF=150 MHz. Span=200 MHz
Feed Bandwidth 130 - 170 MHz
Radio Astronomy Band 150.05 - 153 MHz
Power (dBm)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
5.00E+07
7.00E+07
9.00E+07
1.10E+08
1.30E+08
1.50E+08
1.70E+08
1.90E+08
2.10E+08
2.30E+08
2.50E+08
Frequency (Hz)
16 km West
8 km West
4 km West
2 km West
1 km West
0 km - GMRT Complex

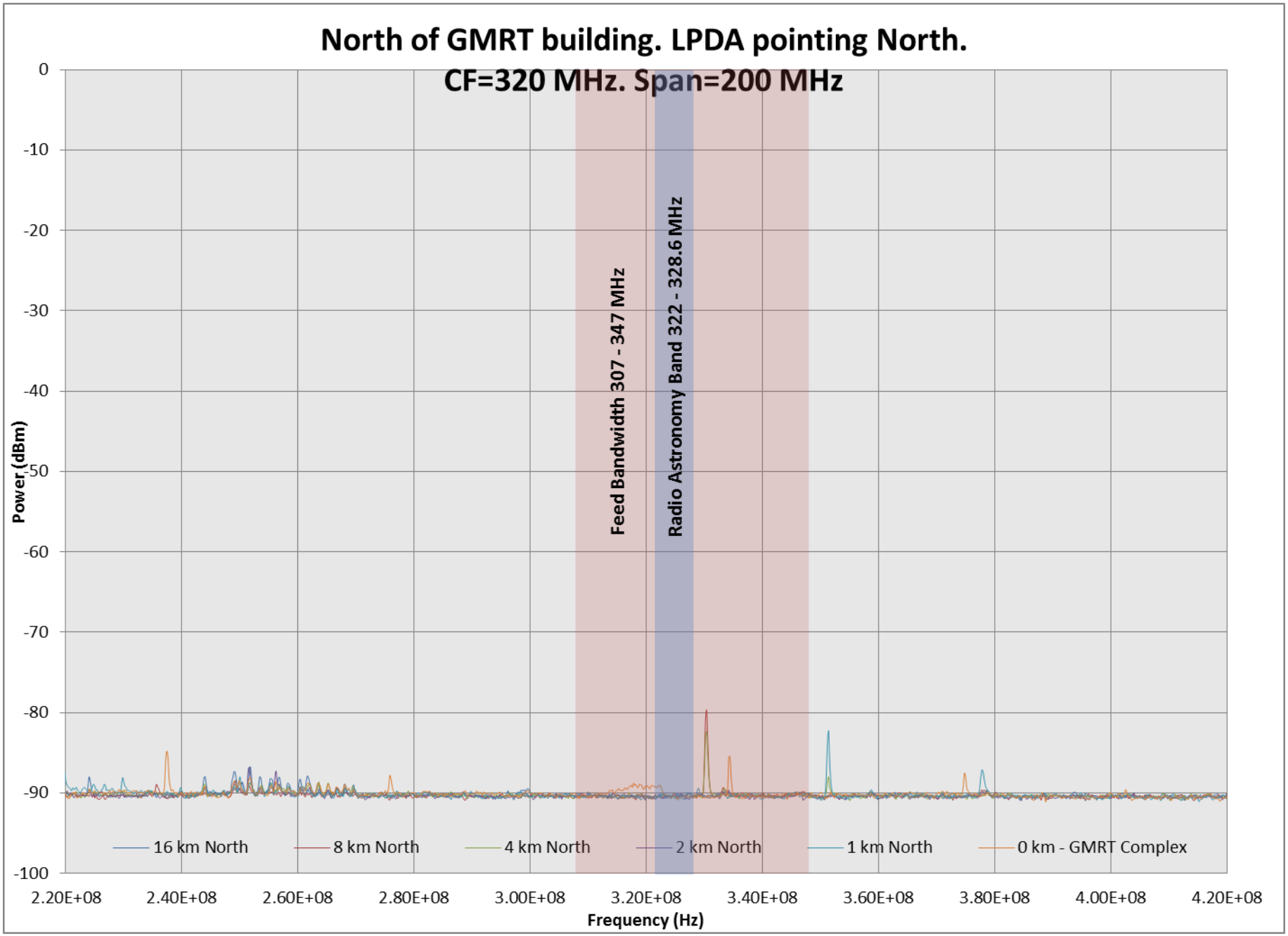

East of GMRT Building. LPDA Pointing East.
CF=230 MHz. Span=200 MHz.
175000000, -49.59924316
Feed Bandwidth 215 - 255 MHz
Radio Astronomy Band 230 - 235 MHz
Power (dBm)
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
1.30E+08
1.50E+08
1.70E+08
1.90E+08
2.10E+08
2.30E+08
2.50E+08
2.70E+08
2.90E+08
3.10E+08
3.30E+08
Frequency (Hz)
0 km - GMRT Complex
1 km East
2 km East
4 km East
8 km East
16 km East

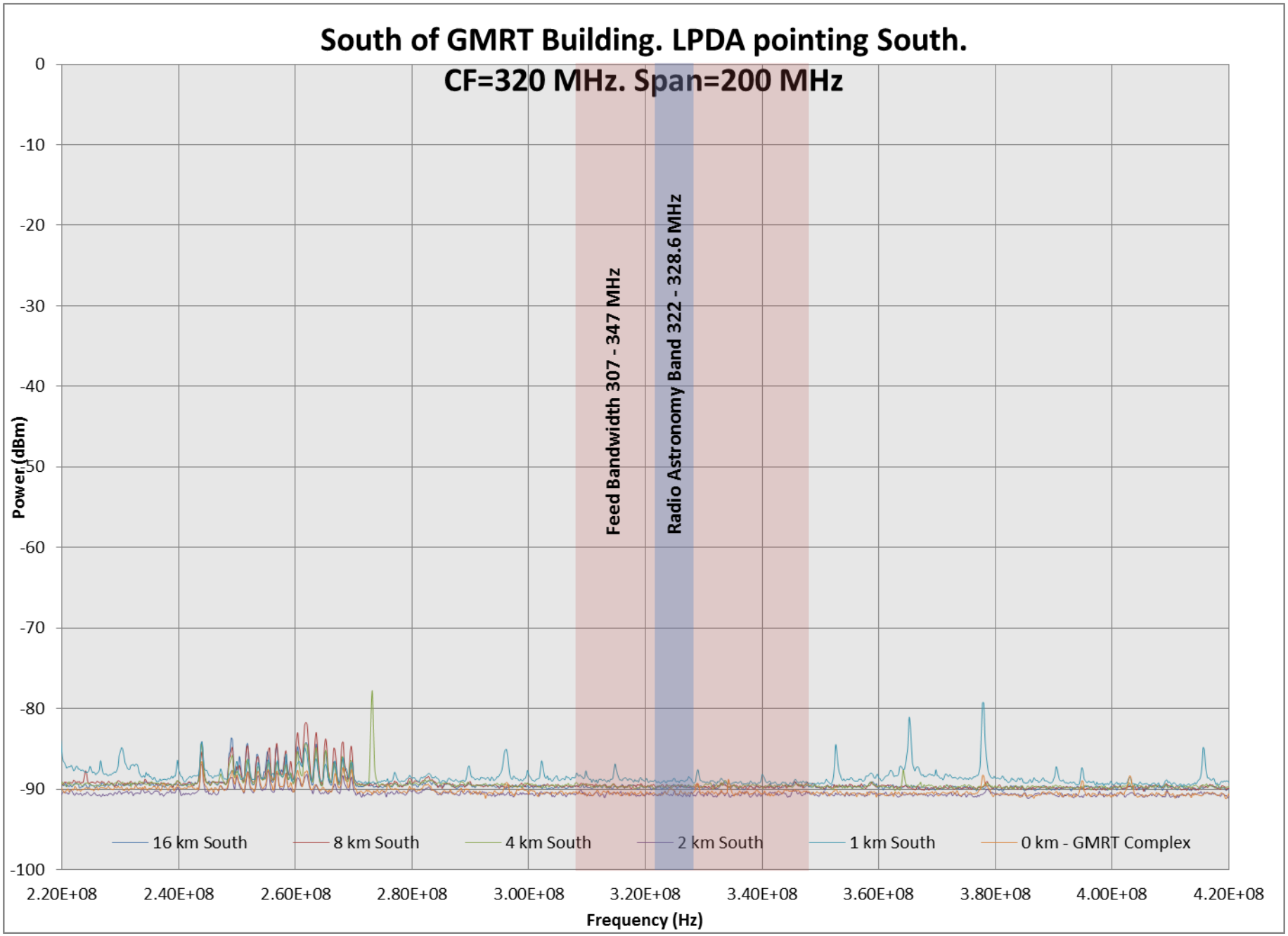

North of GMRT Building. LPDA pointing North.
CF=230 MHz. Span=200 MHz
175000000, -49.20987701
Feed Bandwidth 215 - 255 MHz
Radio Astronomy Band 230 - 235 MHz
Power (dBm)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
1.30E+08
1.50E+08
1.70E+08
1.90E+08
2.10E+08
2.30E+08
2.50E+08
2.70E+08
2.90E+08
3.10E+08
3.30E+08
Frequency (Hz)
16 km North
8 km North
4 km North
2 km North
1 km North
0 km - GMRT Complex

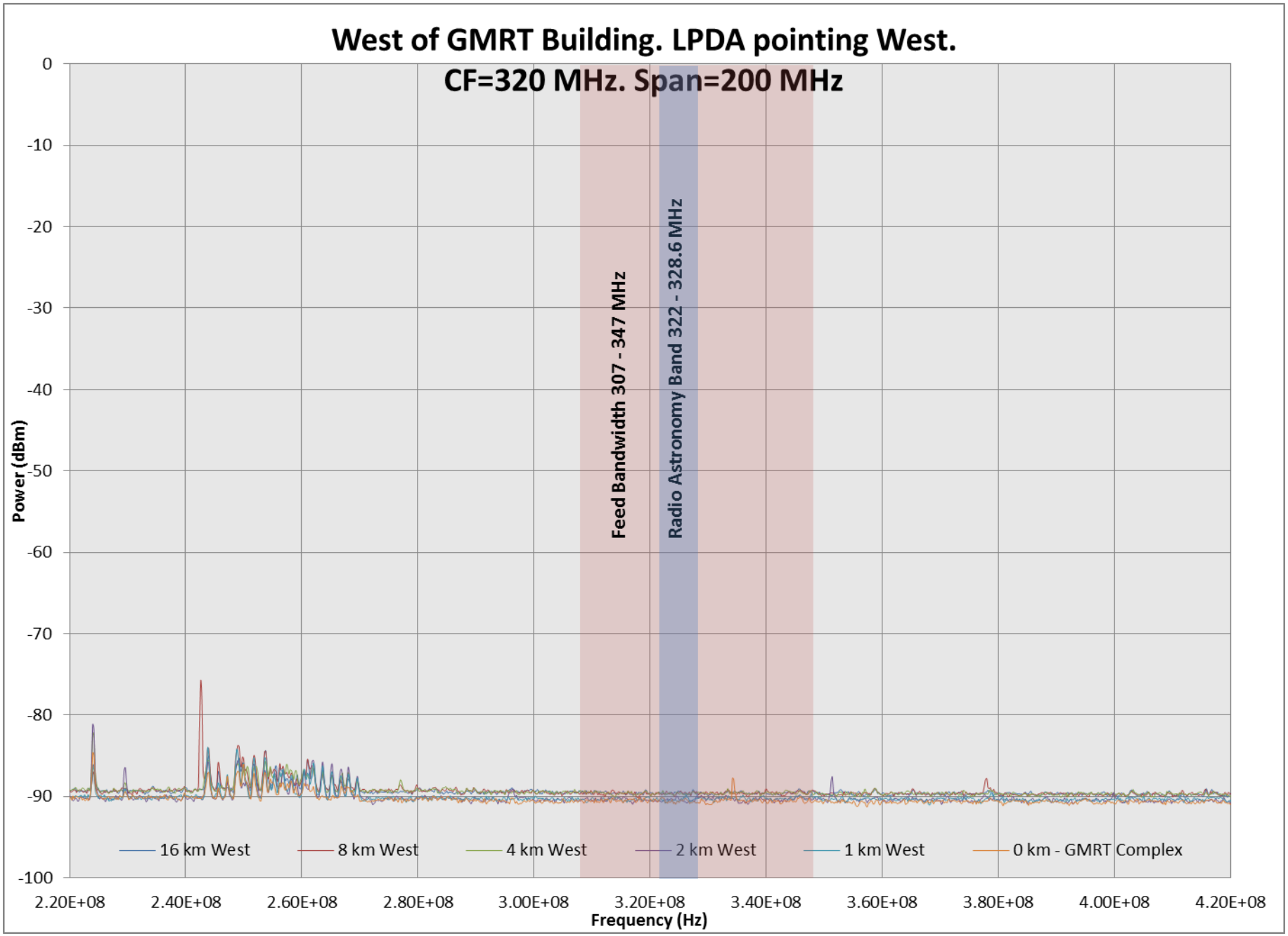

South of GMRT Building. LPDA pointing South.
CF=230 MHz. Span=200 MHz
175000000, -43.75933456
Feed Bandwidth 215 - 255 MHz
Radio Astronomy Band 230 - 235 MHz
Power (dBm)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
1.30E+08
1.50E+08
1.70E+08
1.90E+08
2.10E+08
2.30E+08
2.50E+08
2.70E+08
2.90E+08
3.10E+08
3.30E+08
Frequency (Hz)
16 km South
8 km South
4 km South
2 km South
1 km South
0 km - GMRT Complex

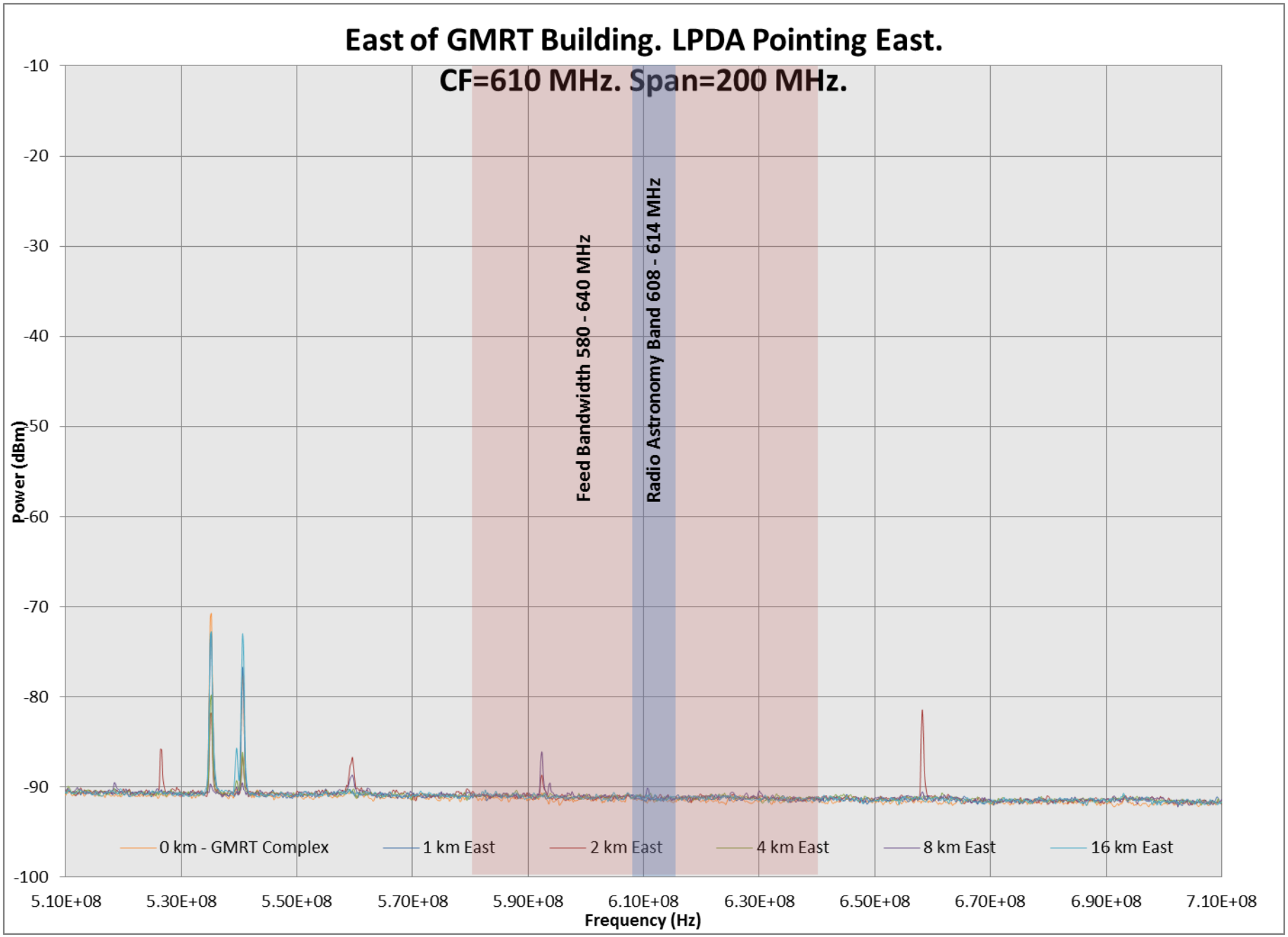

West of GMRT Building. LPDA pointing West.
CF=230 MHz. Span=200 MHz
Feed Bandwidth 215 - 255 MHz
Radio Astronomy Band 230 - 235 MHz
Power (dBm)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
1.30E+08
1.50E+08
1.70E+08
1.90E+08
2.10E+08
2.30E+08
2.50E+08
2.70E+08
2.90E+08
3.10E+08
3.30E+08
Frequency (Hz)
16 km West
8 km West
4 km West
2 km West
1 km West
0 km - GMRT Complex

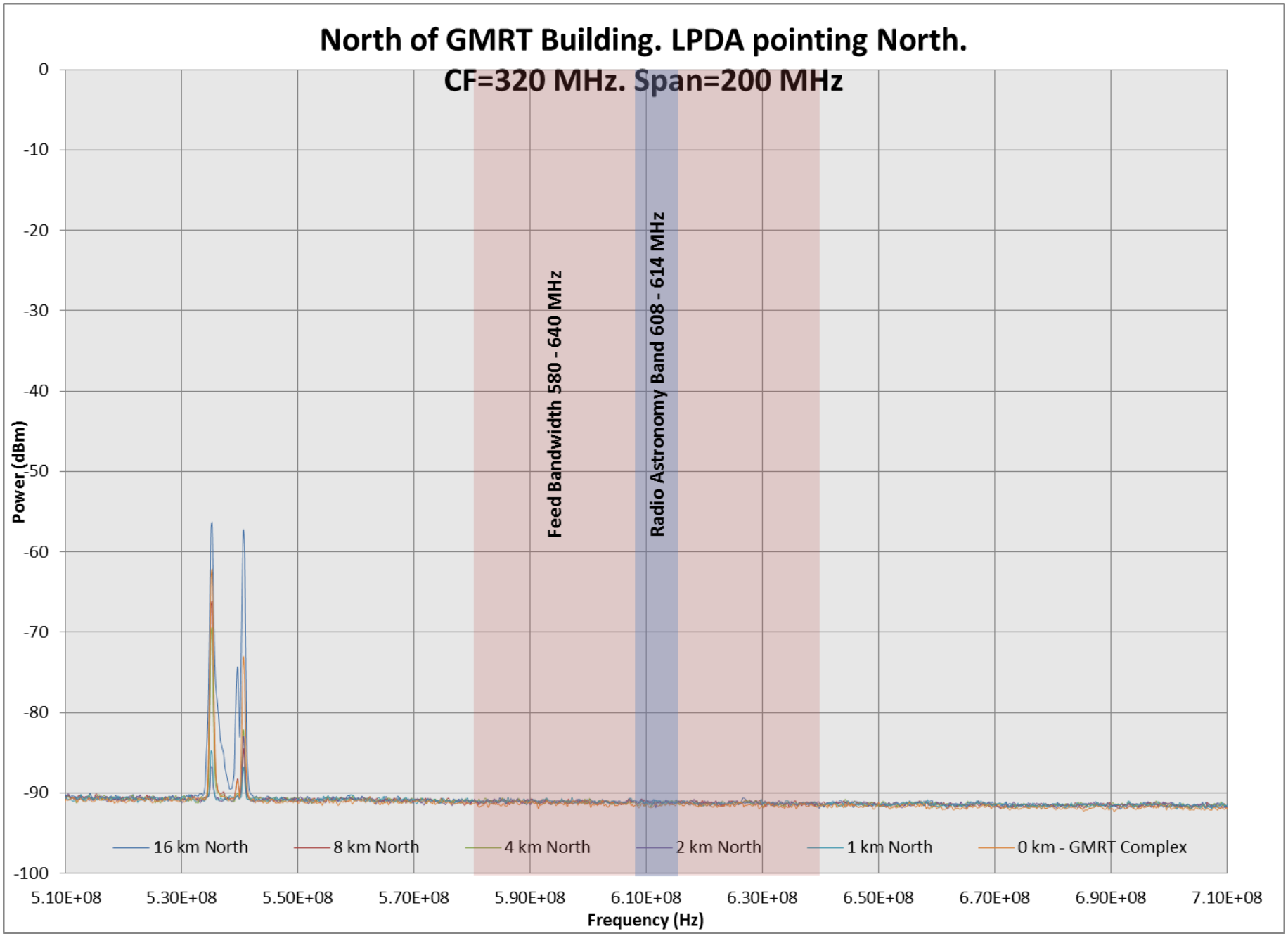

East of GMRT Building. LPDA Pointing East.
CF=320 MHz. Span=200 MHz.
Feed Bandwidth 307 - 347 MHz
Radio Astronomy Band 322 - 328.6 MHz
Power (dBm)
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
2.20E+08
2.40E+08
2.60E+08
2.80E+08
3.00E+08
3.20E+08
3.40E+08
3.60E+08
3.80E+08
4.00E+08
4.20E+08
Frequency (Hz)
0 km - GMRT Complex
1 km East
2 km East
4 km East
8 km East
16 km East

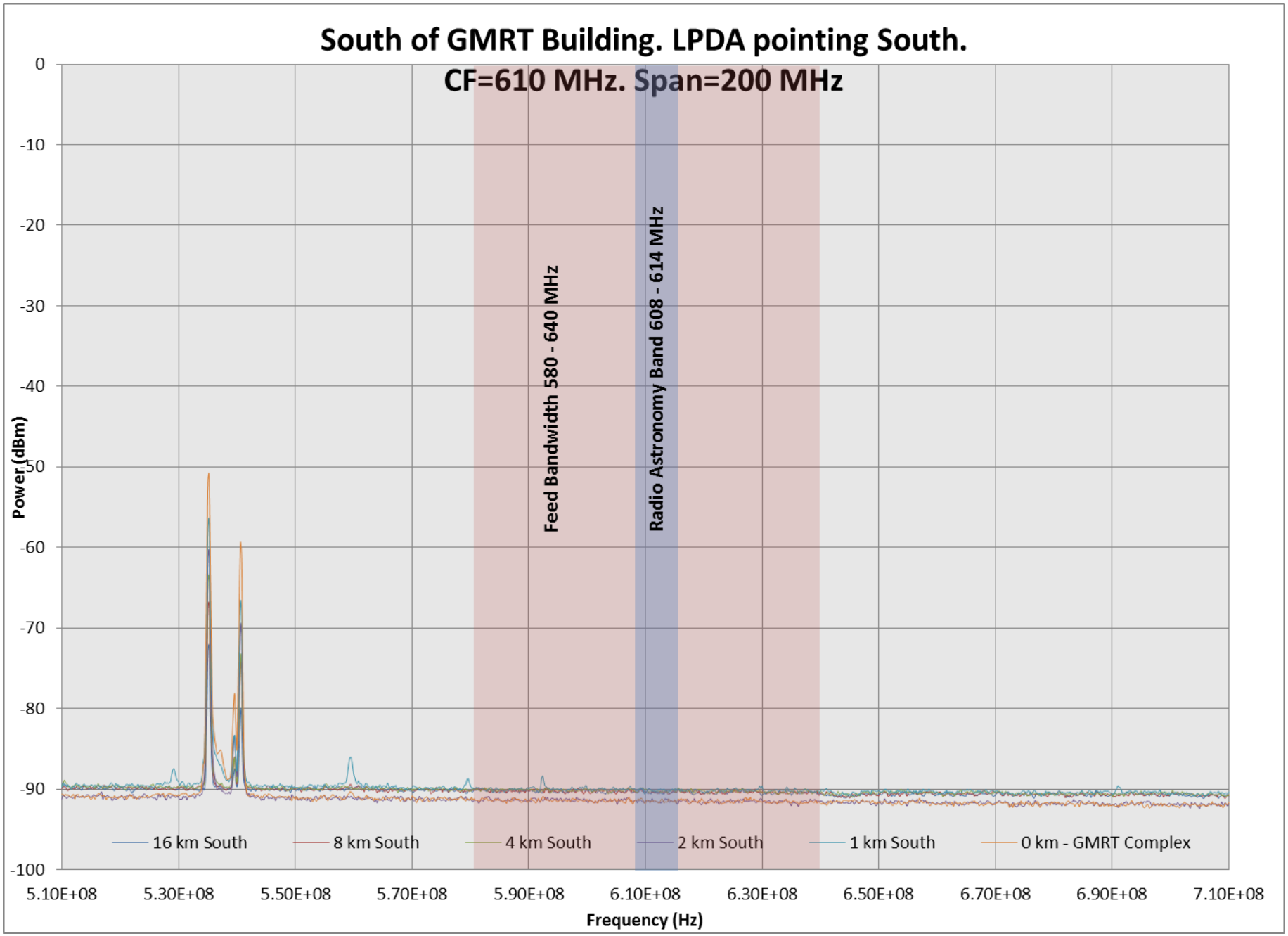

North of GMRT building. LPDA pointing North.
CF=320 MHz. Span=200 MHz
Feed Bandwidth 307 - 347 MHz
Radio Astronomy Band 322 - 328.6 MHz
Power (dBm)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
2.20E+08
2.40E+08
2.60E+08
2.80E+08
3.00E+08
3.20E+08
3.40E+08
3.60E+08
3.80E+08
4.00E+08
4.20E+08
Frequency (Hz)
16 km North
8 km North
4 km North
2 km North
1 km North
0 km - GMRT Complex

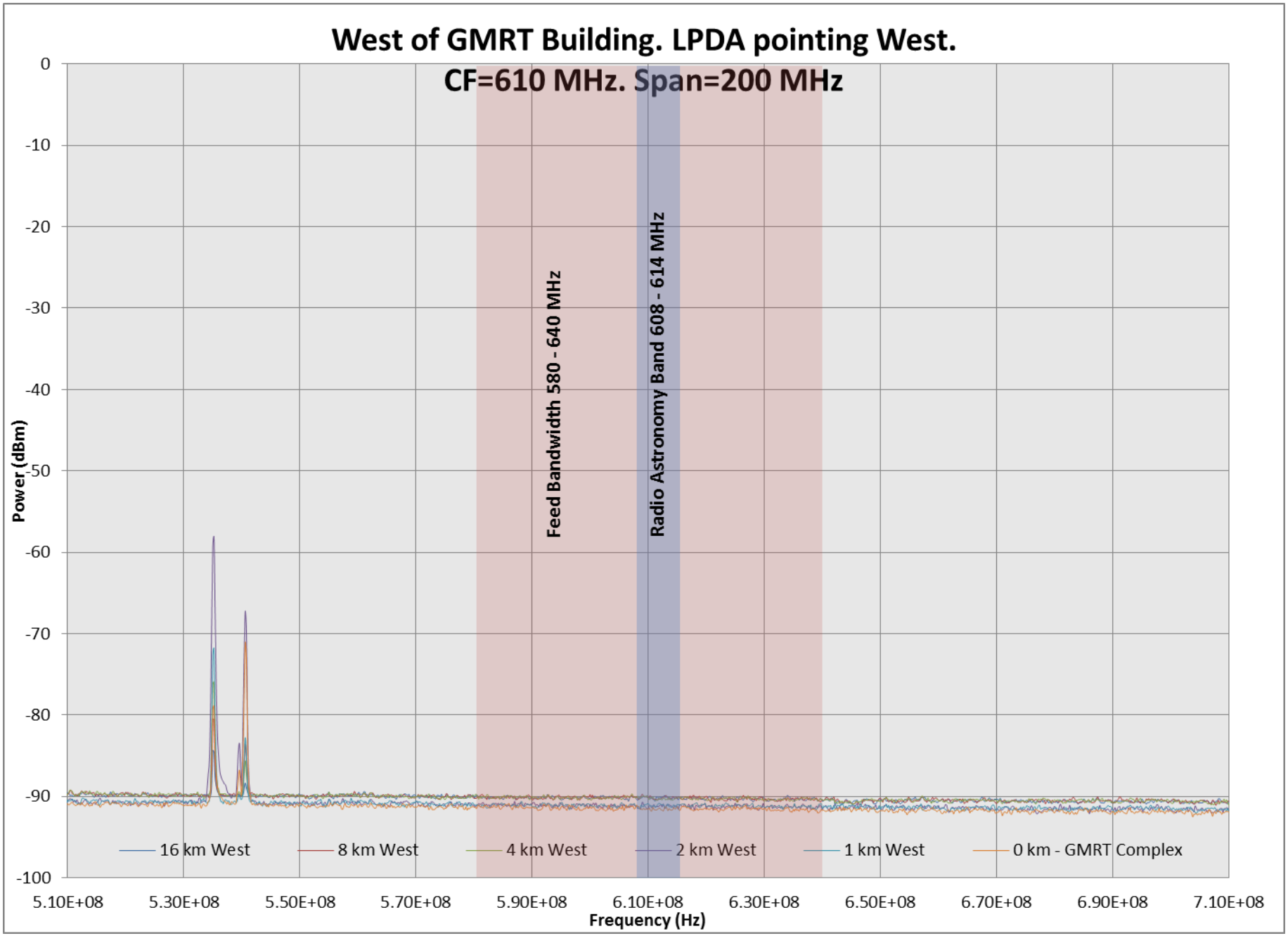

South of GMRT Building. LPDA pointing South.
CF=320 MHz. Span=200 MHz
Feed Bandwidth 307 - 347 MHz
Radio Astronomy Band 322 - 328.6 MHz
Power (dBm)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
2.20E+08
2.40E+08
2.60E+08
2.80E+08
3.00E+08
3.20E+08
3.40E+08
3.60E+08
3.80E+08
4.00E+08
4.20E+08
Frequency (Hz)
16 km South
8 km South
4 km South
2 km South
1 km South
0 km - GMRT Complex

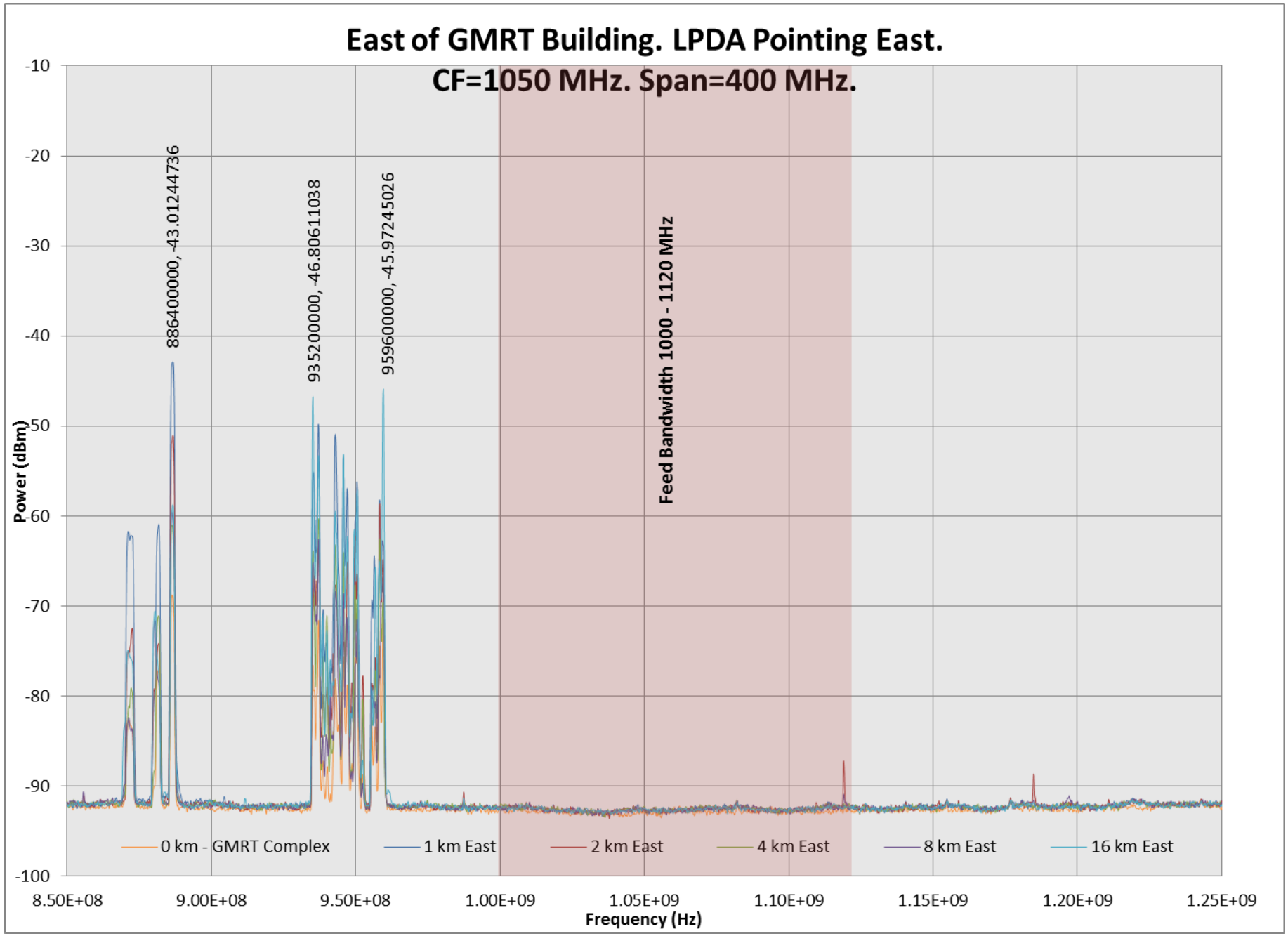

West of GMRT Building. LPDA pointing West.
CF=320 MHz. Span=200 MHz
Feed Bandwidth 307 - 347 MHz
Radio Astronomy Band 322 - 328.6 MHz
Power (dBm)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
2.20E+08
2.40E+08
2.60E+08
2.80E+08
3.00E+08
3.20E+08
3.40E+08
3.60E+08
3.80E+08
4.00E+08
4.20E+08
Frequency (Hz)
16 km West
8 km West
4 km West
2 km West
1 km West
0 km - GMRT Complex

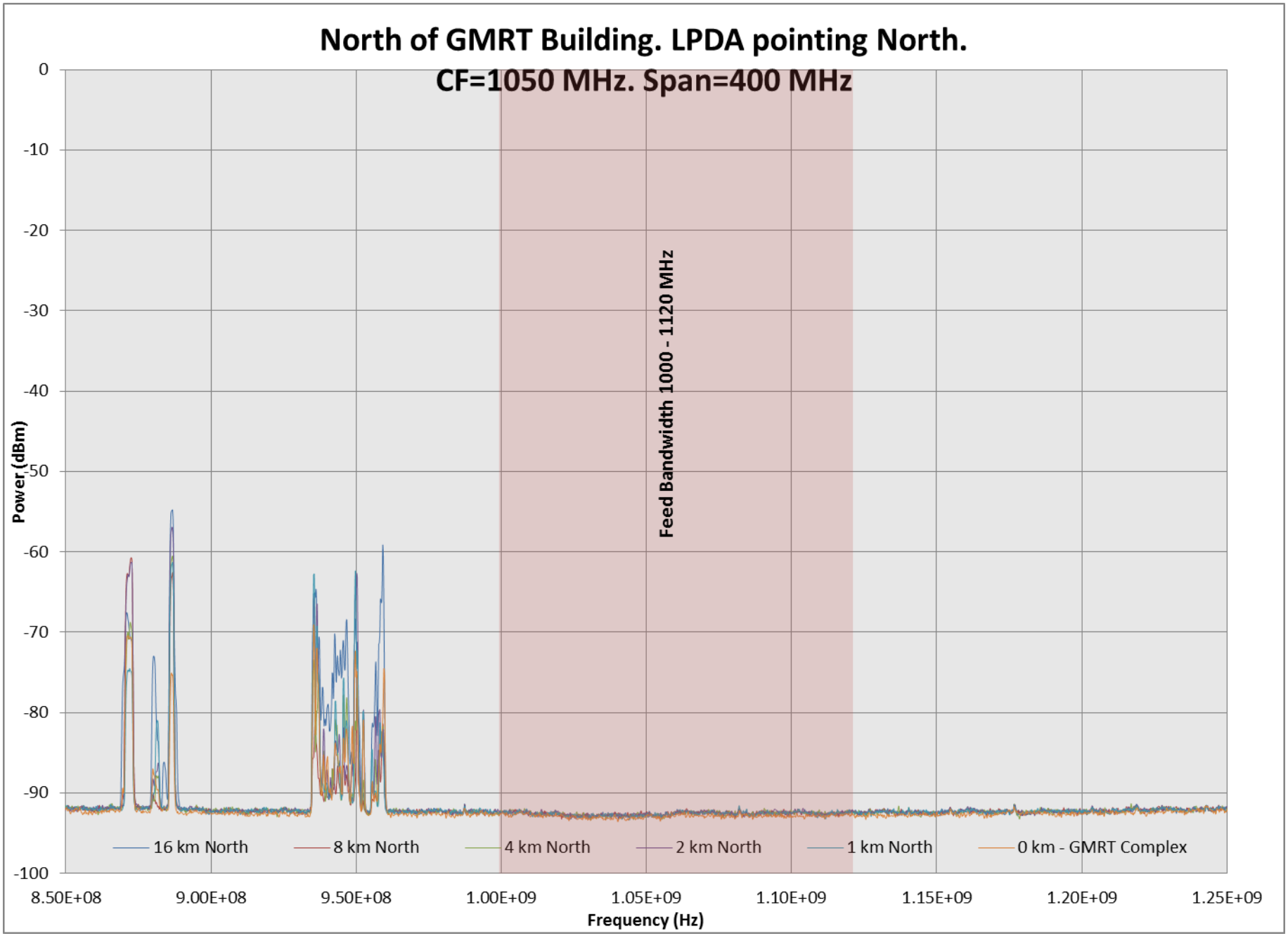

East of GMRT Building. LPDA Pointing East.
CF=610 MHz. Span=200 MHz.
Feed Bandwidth 580 - 640 MHz
Radio Astronomy Band 608 - 614 MHz
Power (dBm)
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
5.10E+08
5.30E+08
5.50E+08
5.70E+08
5.90E+08
6.10E+08
6.30E+08
6.50E+08
6.70E+08
6.90E+08
7.10E+08
Frequency (Hz)
0 km - GMRT Complex
1 km East
2 km East
4 km East
8 km East
16 km East

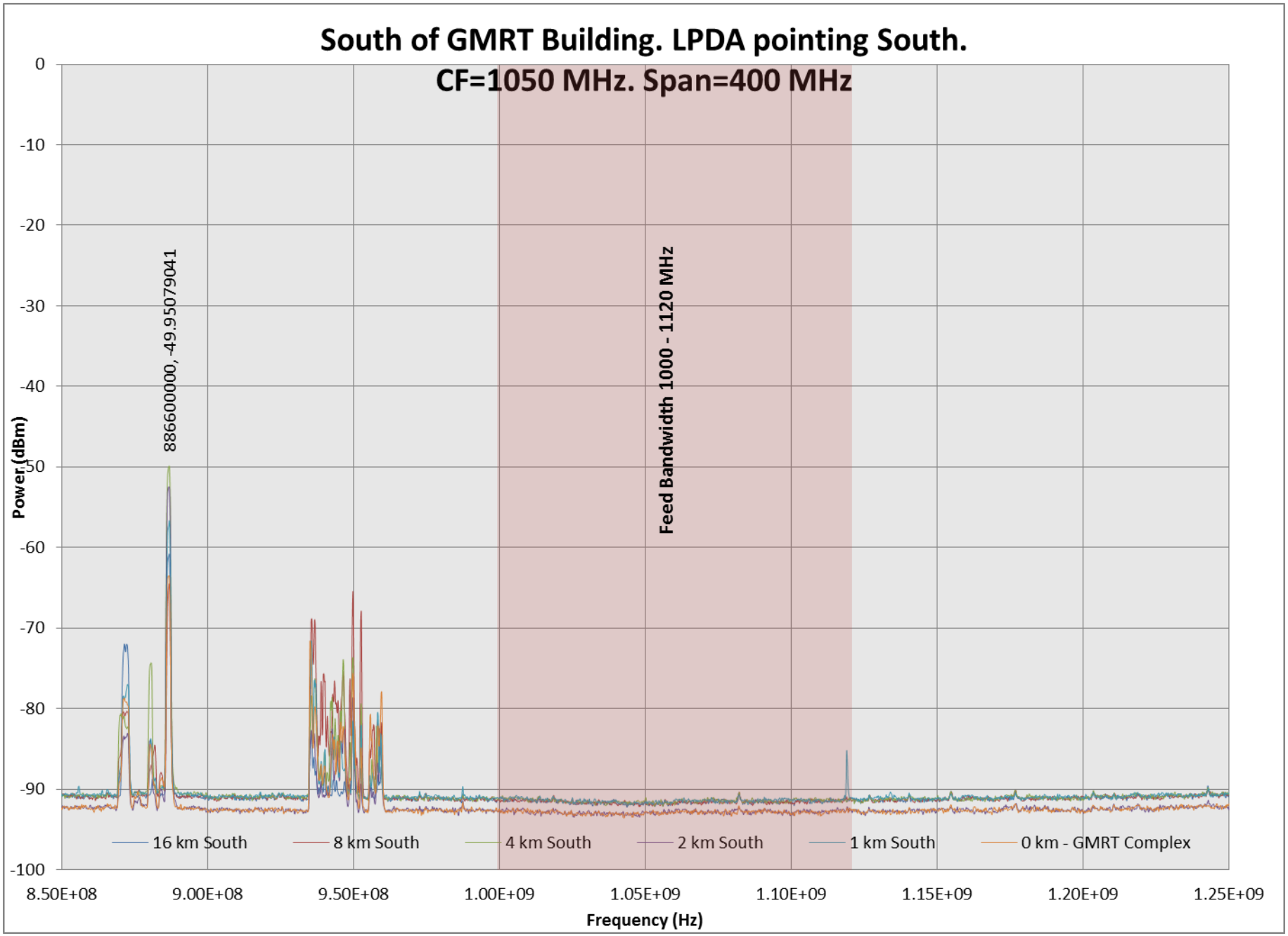

North of GMRT Building. LPDA pointing North.
CF=320 MHz. Span=200 MHz
Feed Bandwidth 580 - 640 MHz
Radio Astronomy Band 608 - 614 MHz
Power (dBm)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
5.10E+08
5.30E+08
5.50E+08
5.70E+08
5.90E+08
6.10E+08
6.30E+08
6.50E+08
6.70E+08
6.90E+08
7.10E+08
Frequency (Hz)
16 km North
8 km North
4 km North
2 km North
1 km North
0 km - GMRT Complex

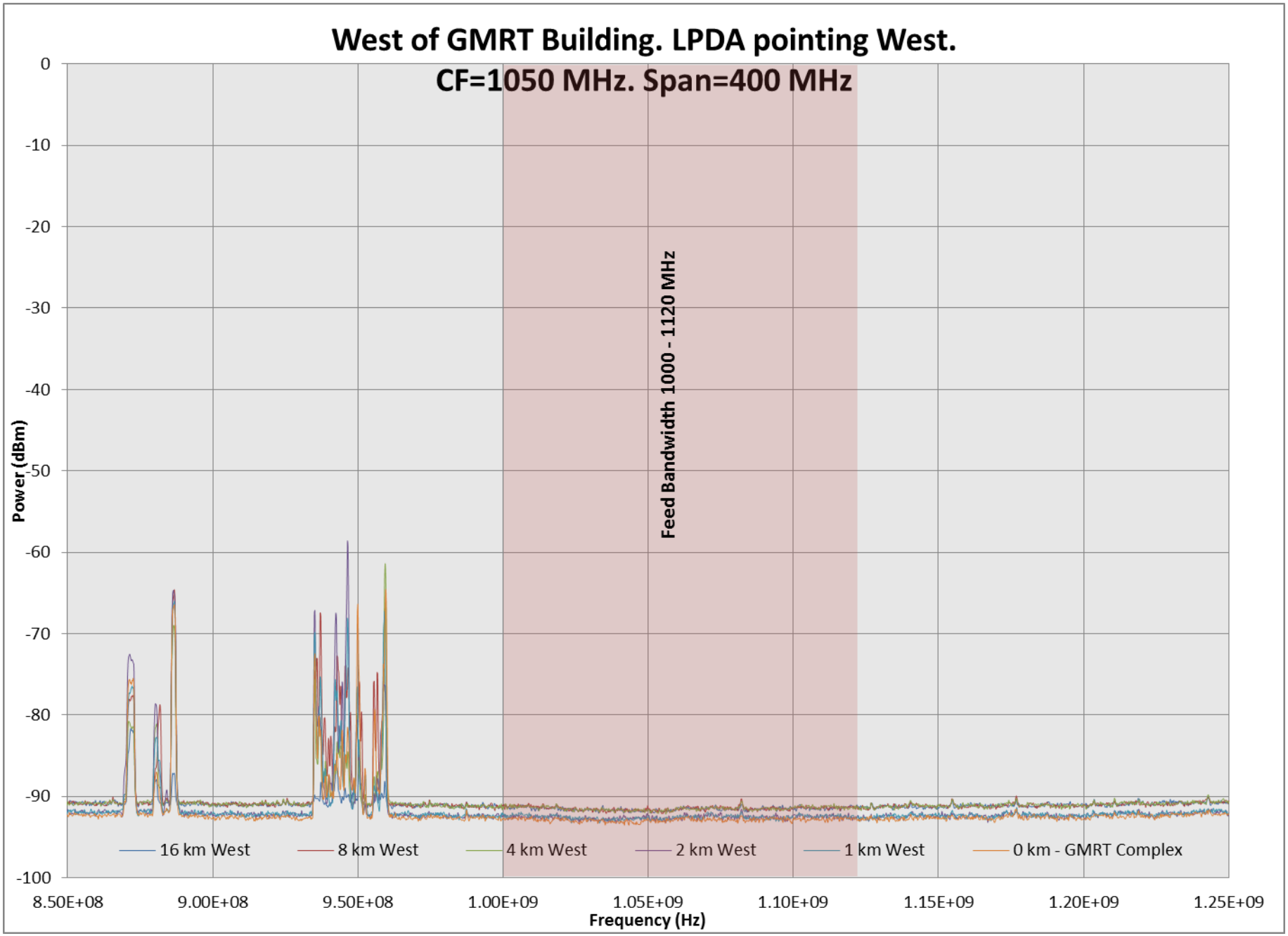

South of GMRT Building. LPDA pointing South.
CF=610 MHz. Span=200 MHz
Feed Bandwidth 580 - 640 MHz
Radio Astronomy Band 608 - 614 MHz
Power (dBm)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
16 km South
8 km South
4 km South
2 km South
1 km South
0 km - GMRT Complex
5.10E+08
5.30E+08
5.50E+08
5.70E+08
5.90E+08
6.10E+08
6.30E+08
6.50E+08
6.70E+08
6.90E+08
7.10E+08
Frequency (Hz)

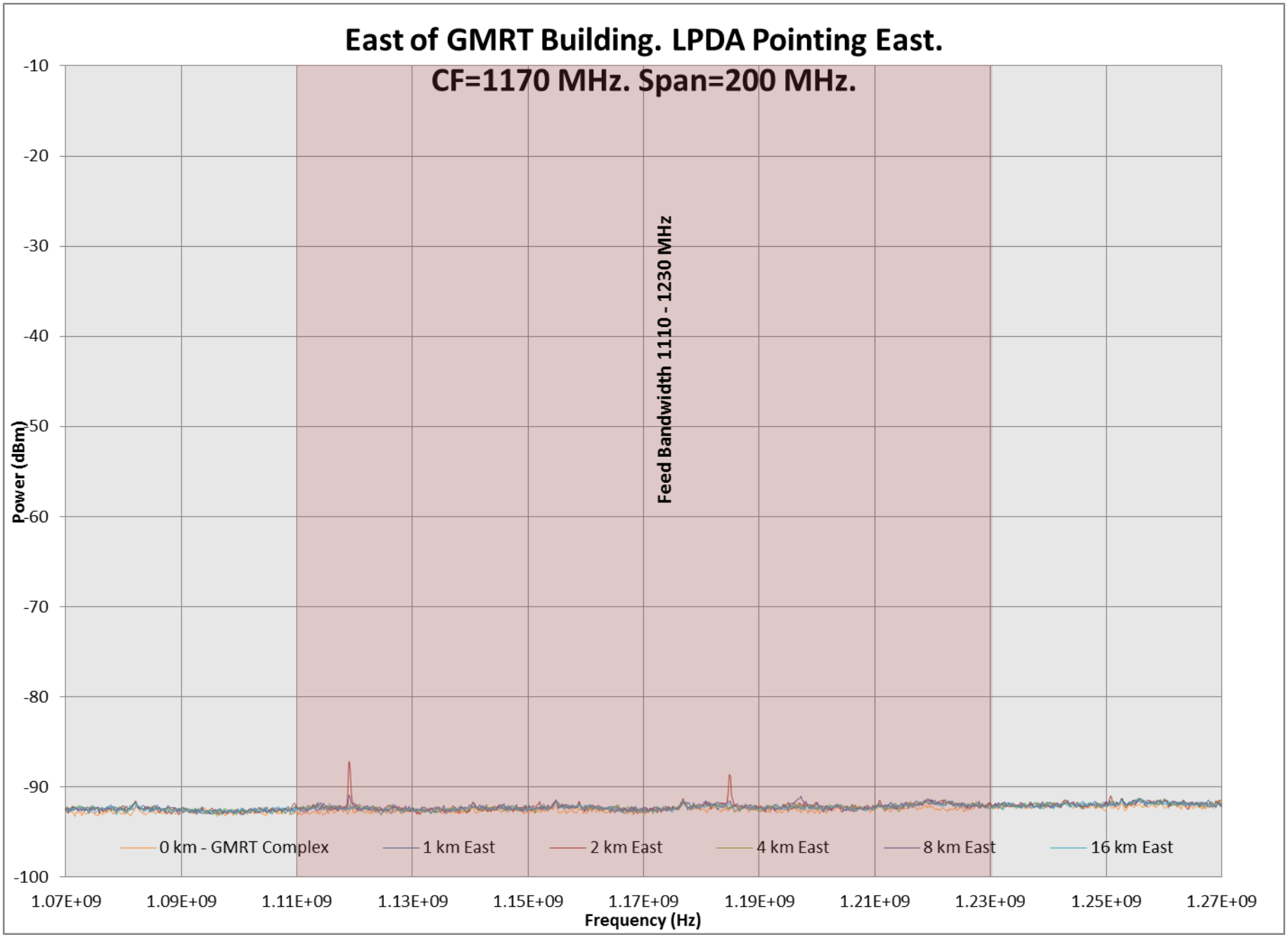

West of GMRT Building. LPDA pointing West.
CF=610 MHz. Span=200 MHz
Feed Bandwidth 580 - 640 MHz
Radio Astronomy Band 608 - 614 MHz
Power (dBm)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
5.10E+08
5.30E+08
5.50E+08
5.70E+08
5.90E+08
6.10E+08
6.30E+08
6.50E+08
6.70E+08
6.90E+08
7.10E+08
Frequency (Hz)
16 km West
8 km West
4 km West
2 km West
1 km West
0 km - GMRT Complex

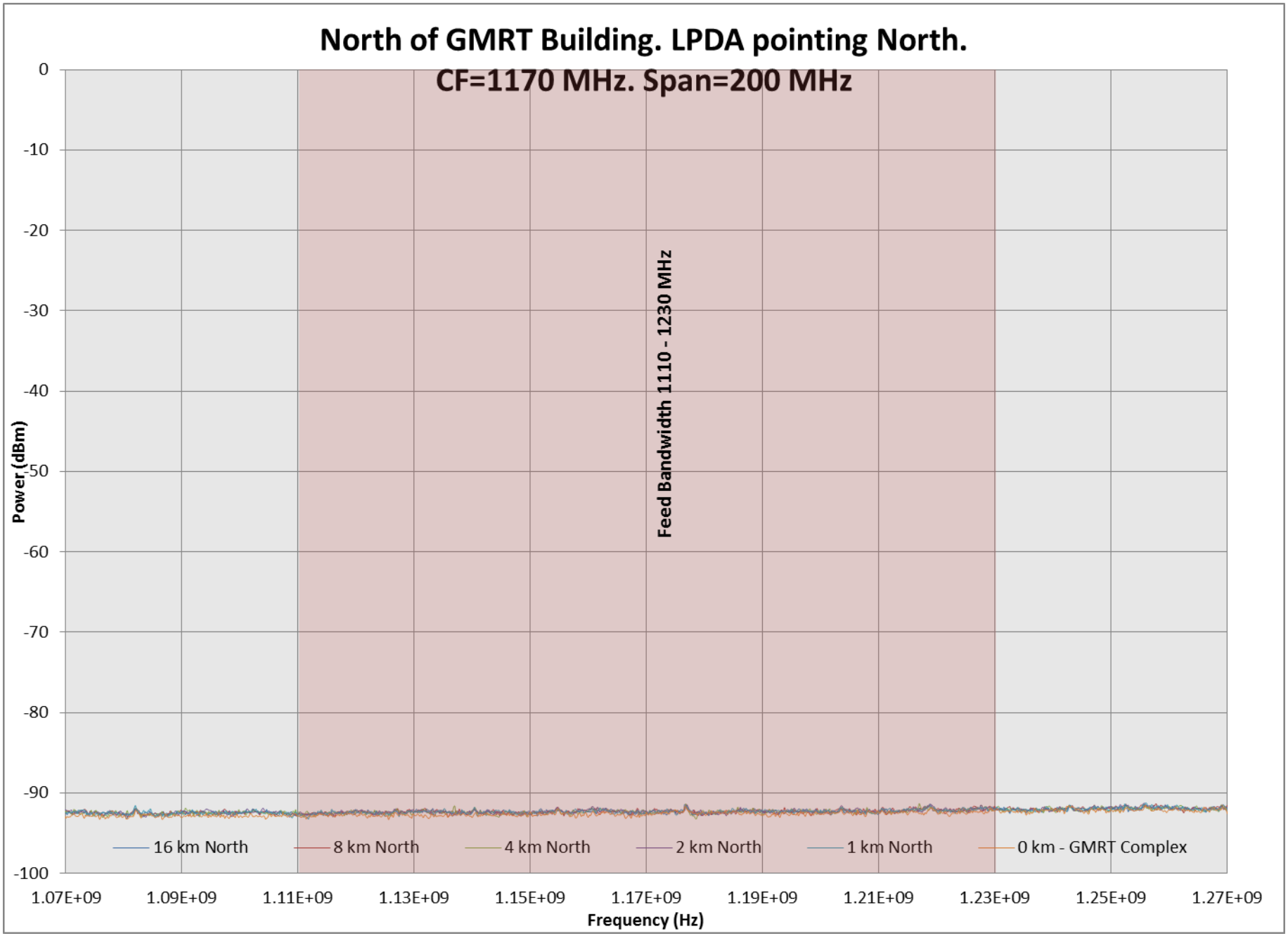

East of GMRT Building. LPDA Pointing East.
CF=1050 MHz. Span=400 MHz.
886400000, -43.01244736
935200000, -46.80611038
959600000, -45.97245026
Feed Bandwidth 1000 - 1120 MHz
Power (dBm)
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
8.50E+08
9.00E+08
9.50E+08
1.00E+09
1.05E+09
1.10E+09
1.15E+09
1.20E+09
1.25E+09
Frequency (Hz)
0 km - GMRT Complex
1 km East
2 km East
4 km East
8 km East
16 km East

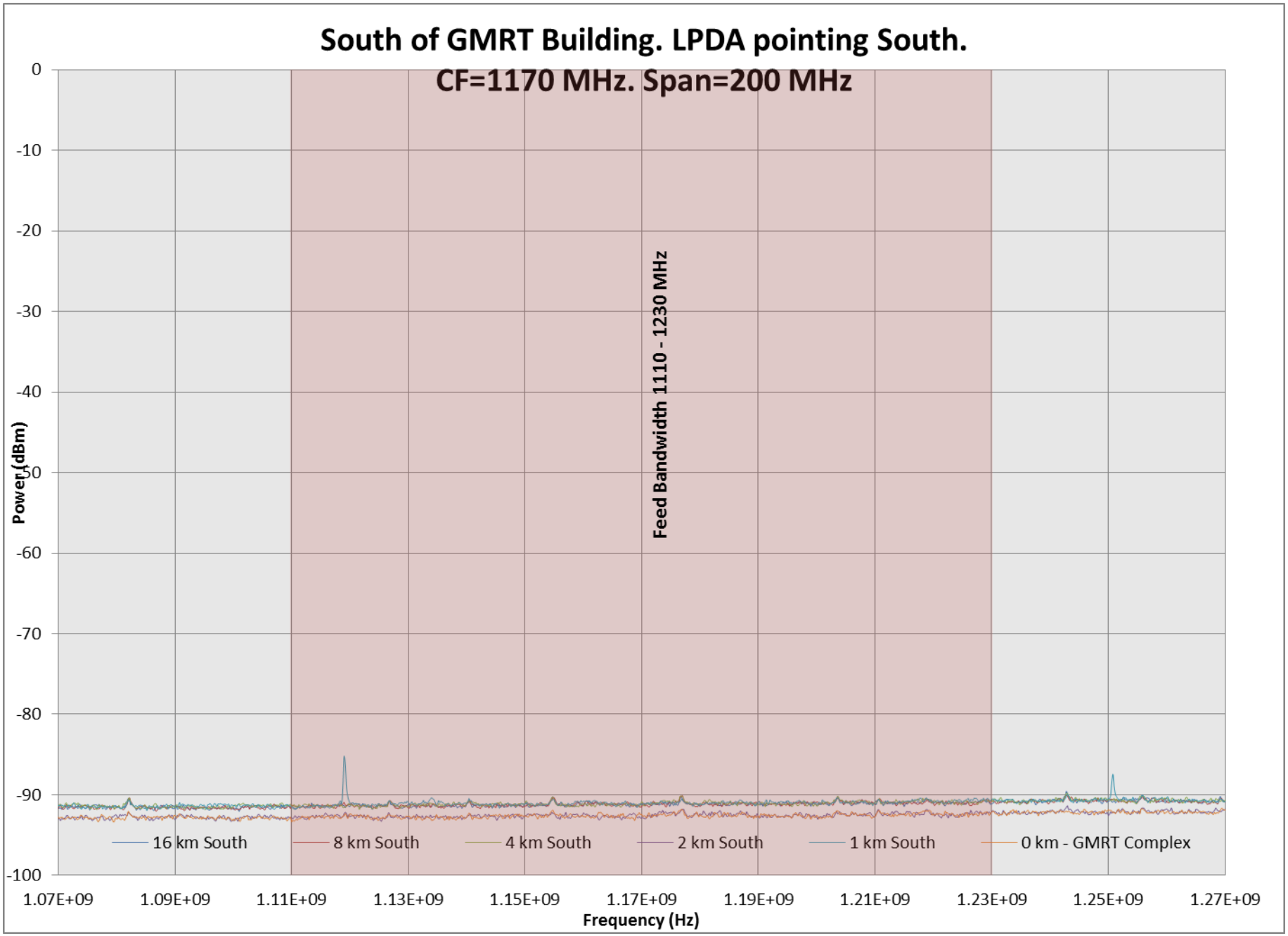

North of GMRT Building. LPDA pointing North.
CF=1050 MHz. Span=400 MHz
Feed Bandwidth 1000 - 1120 MHz
Power (dBm)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
8.50E+08
9.00E+08
9.50E+08
1.00E+09
1.05E+09
1.10E+09
1.15E+09
1.20E+09
1.25E+09
Frequency (Hz)
16 km North
8 km North
4 km North
2 km North
1 km North
0 km - GMRT Complex

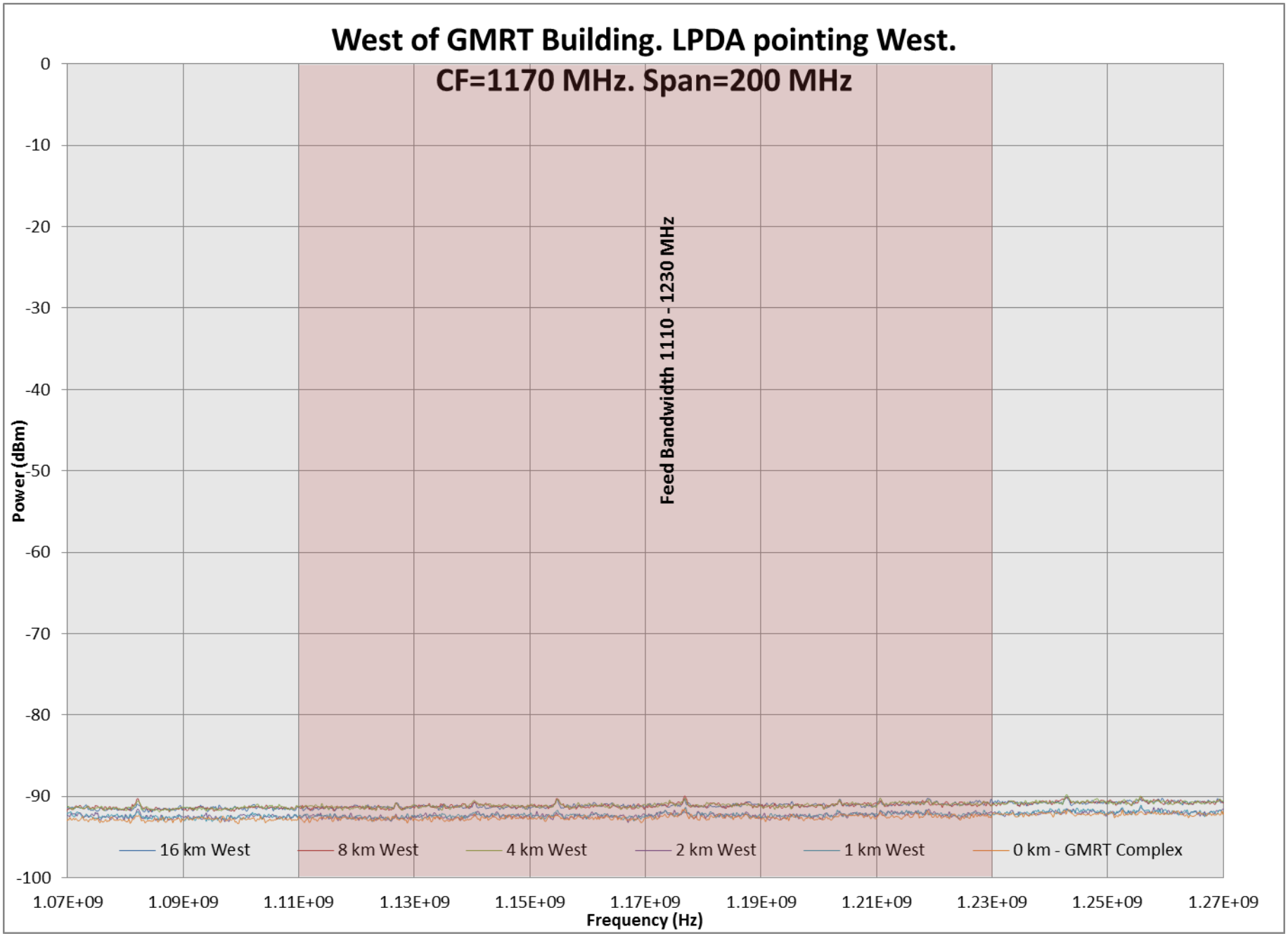

South of GMRT Building. LPDA pointing South.
CF=1050 MHz. Span=400 MHz
886600000, -49.95079041
Feed Bandwidth 1000 - 1120 MHz
Power (dBm)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
8.50E+08
9.00E+08
9.50E+08
1.00E+09
1.05E+09
1.10E+09
1.15E+09
1.20E+09
1.25E+09
Frequency (Hz)
16 km South
8 km South
4 km South
2 km South
1 km South
0 km - GMRT Complex

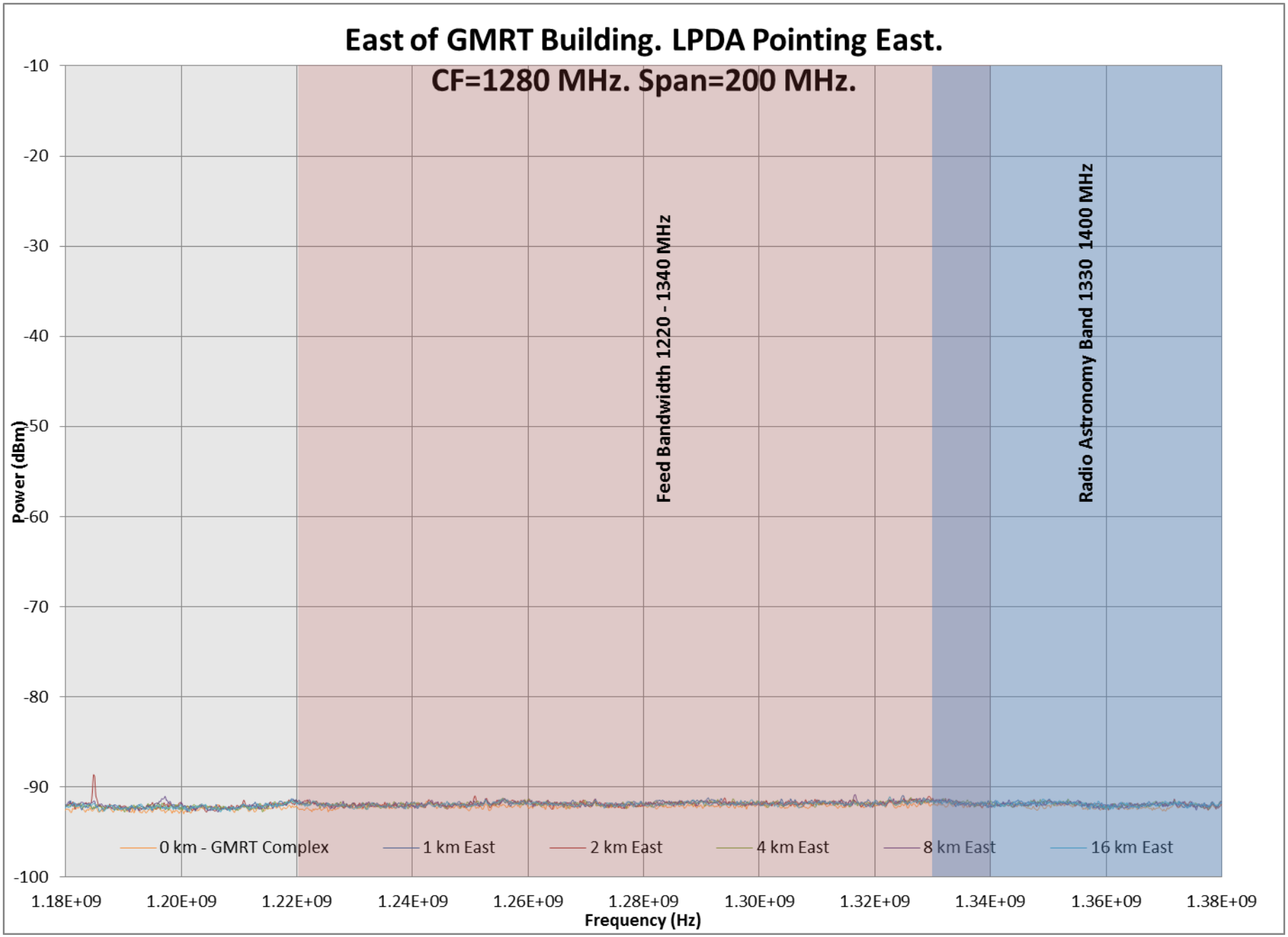

West of GMRT Building. LPDA pointing West.
CF=1050 MHz. Span=400 MHz
Feed Bandwidth 1000 - 1120 MHz
Power (dBm)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
8.50E+08
9.00E+08
9.50E+08
1.00E+09
1.05E+09
1.10E+09
1.15E+09
1.20E+09
1.25E+09
Frequency (Hz)
16 km West
8 km West
4 km West
2 km West
1 km West
0 km - GMRT Complex

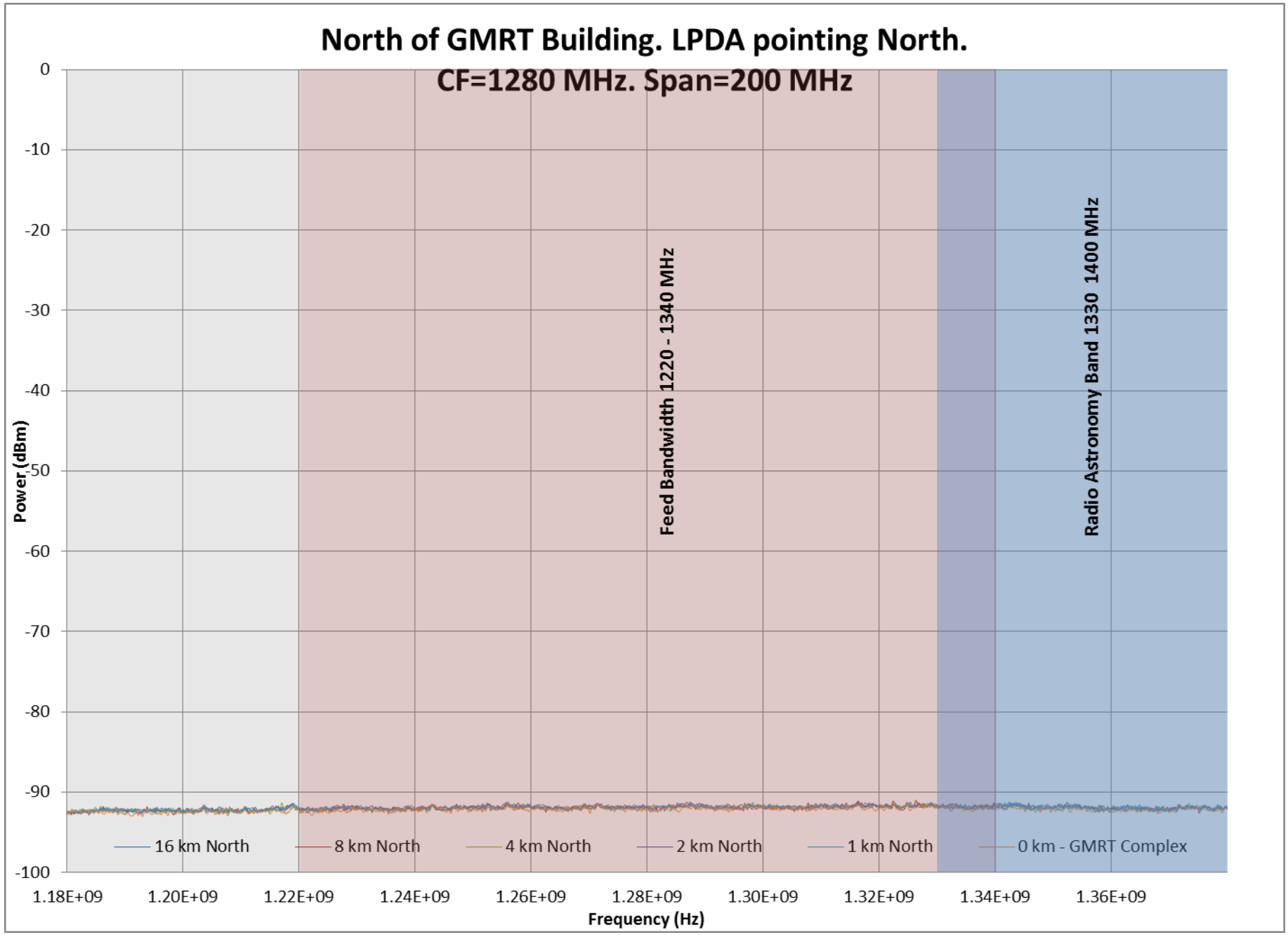

East of GMRT Building. LPDA Pointing East.
CF=1170 MHz. Span=200 MHz.
Feed Bandwidth 1110 - 1230 MHz
Power (dBm)
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
1.07E+09
1.09E+09
1.11E+09
1.13E+09
1.15E+09
1.17E+09
1.19E+09
1.21E+09
1.23E+09
1.25E+09
1.27E+09
Frequency (Hz)
0 km - GMRT Complex
1 km East
2 km East
4 km East
8 km East
16 km East

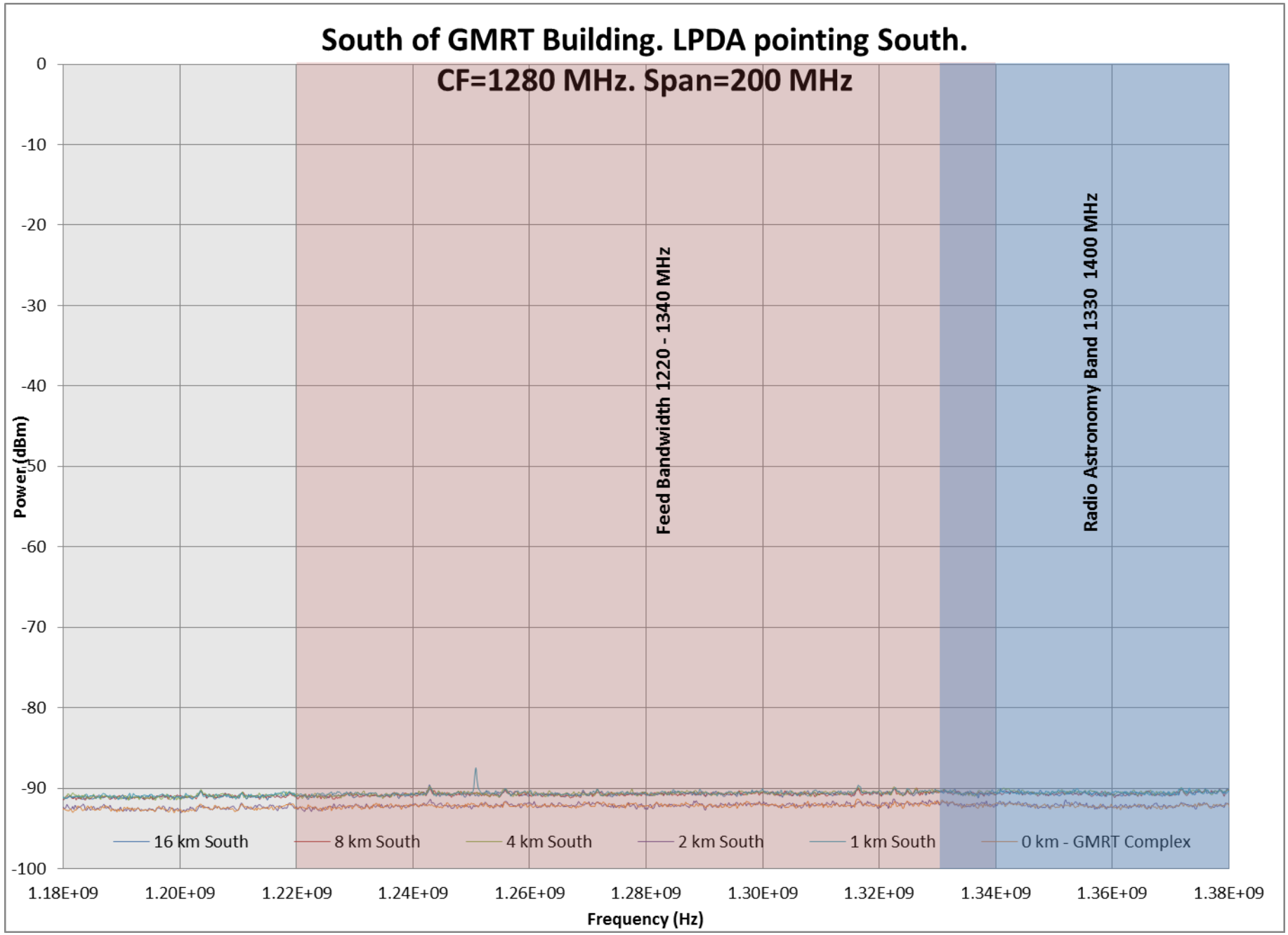

North of GMRT Building. LPDA pointing North.
CF=1170 MHz. Span=200 MHz
Feed Bandwidth 1110 - 1230 MHz
Power (dBm)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
1.07E+09
1.09E+09
1.11E+09
1.13E+09
1.15E+09
1.17E+09
1.19E+09
1.21E+09
1.23E+09
1.25E+09
1.27E+09
Frequency (Hz)
16 km North
8 km North
4 km North
2 km North
1 km North
0 km - GMRT Complex

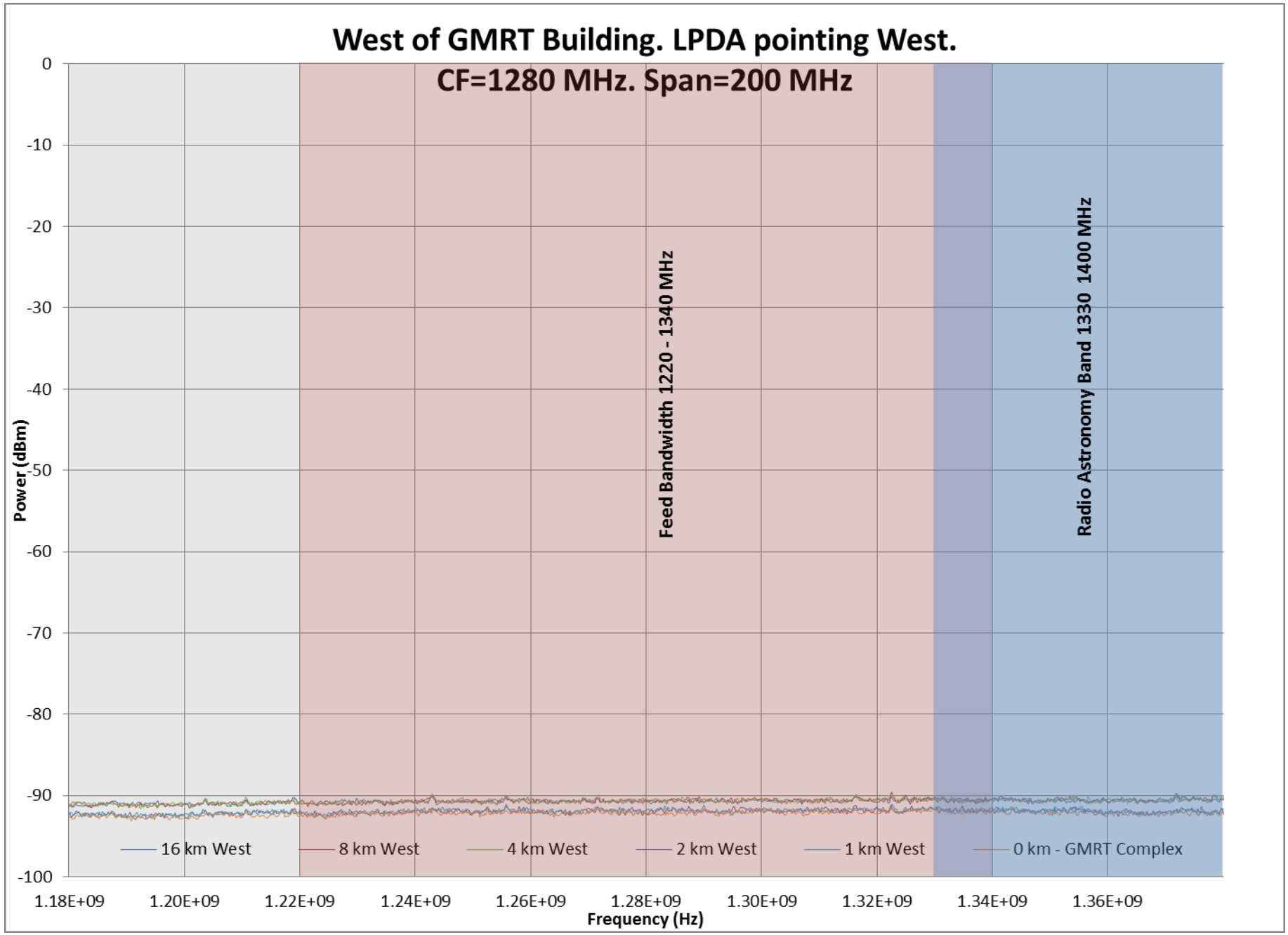

South of GMRT Building. LPDA pointing South.
CF=1170 MHz. Span=200 MHz
Feed Bandwidth 1110 - 1230 MHz
Power (dBm)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
1.07E+09
1.09E+09
1.11E+09
1.13E+09
1.15E+09
1.17E+09
1.19E+09
1.21E+09
1.23E+09
1.25E+09
1.27E+09
Frequency (Hz)
16 km South
8 km South
4 km South
2 km South
1 km South
0 km - GMRT Complex

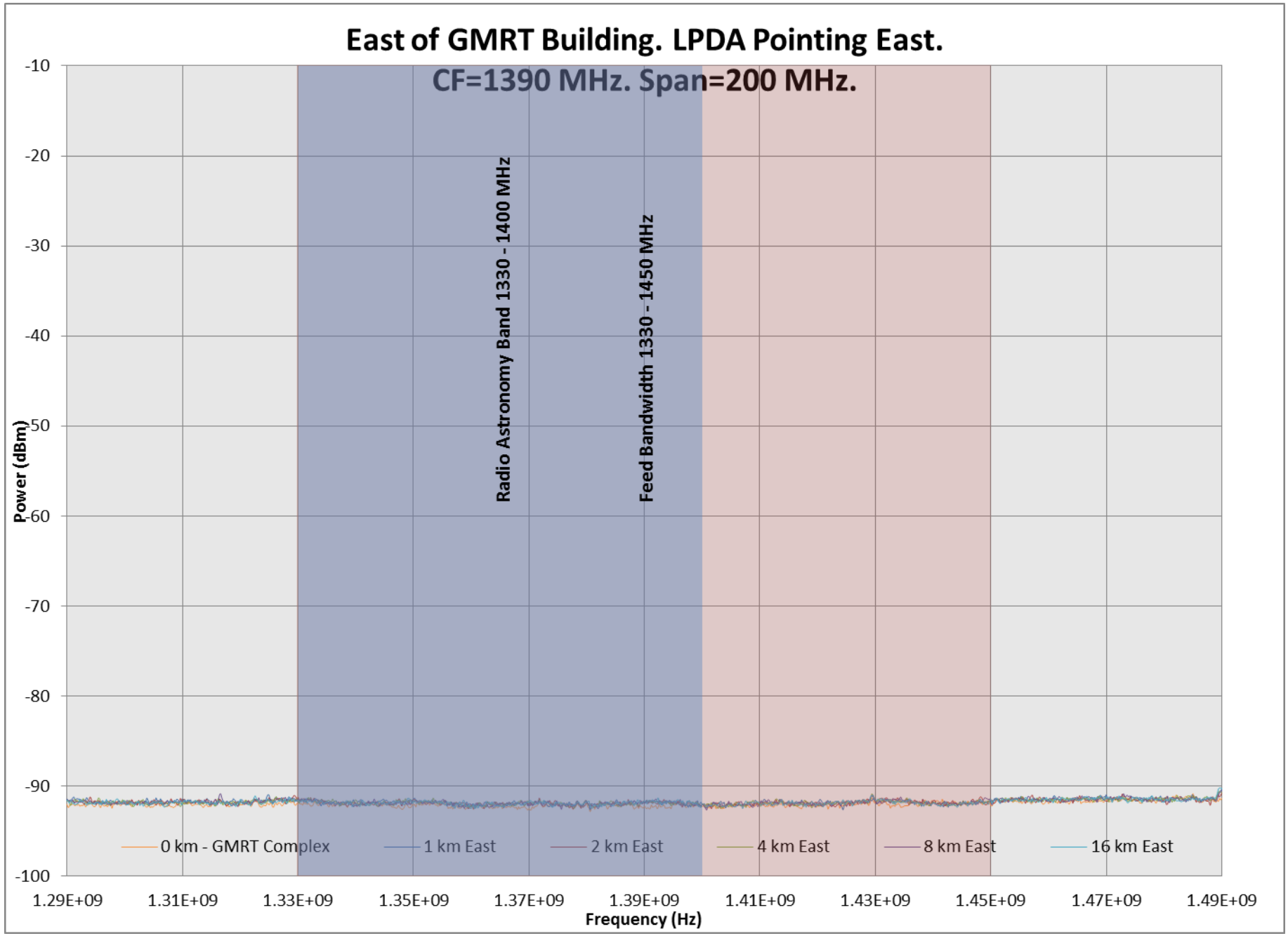

West of GMRT Building. LPDA pointing West.
CF=1170 MHz. Span=200 MHz
Feed Bandwidth 1110 - 1230 MHz
Power (dBm)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
1.07E+09
1.09E+09
1.11E+09
1.13E+09
1.15E+09
1.17E+09
1.19E+09
1.21E+09
1.23E+09
1.25E+09
1.27E+09
Frequency (Hz)
16 km West
8 km West
4 km West
2 km West
1 km West
0 km - GMRT Complex

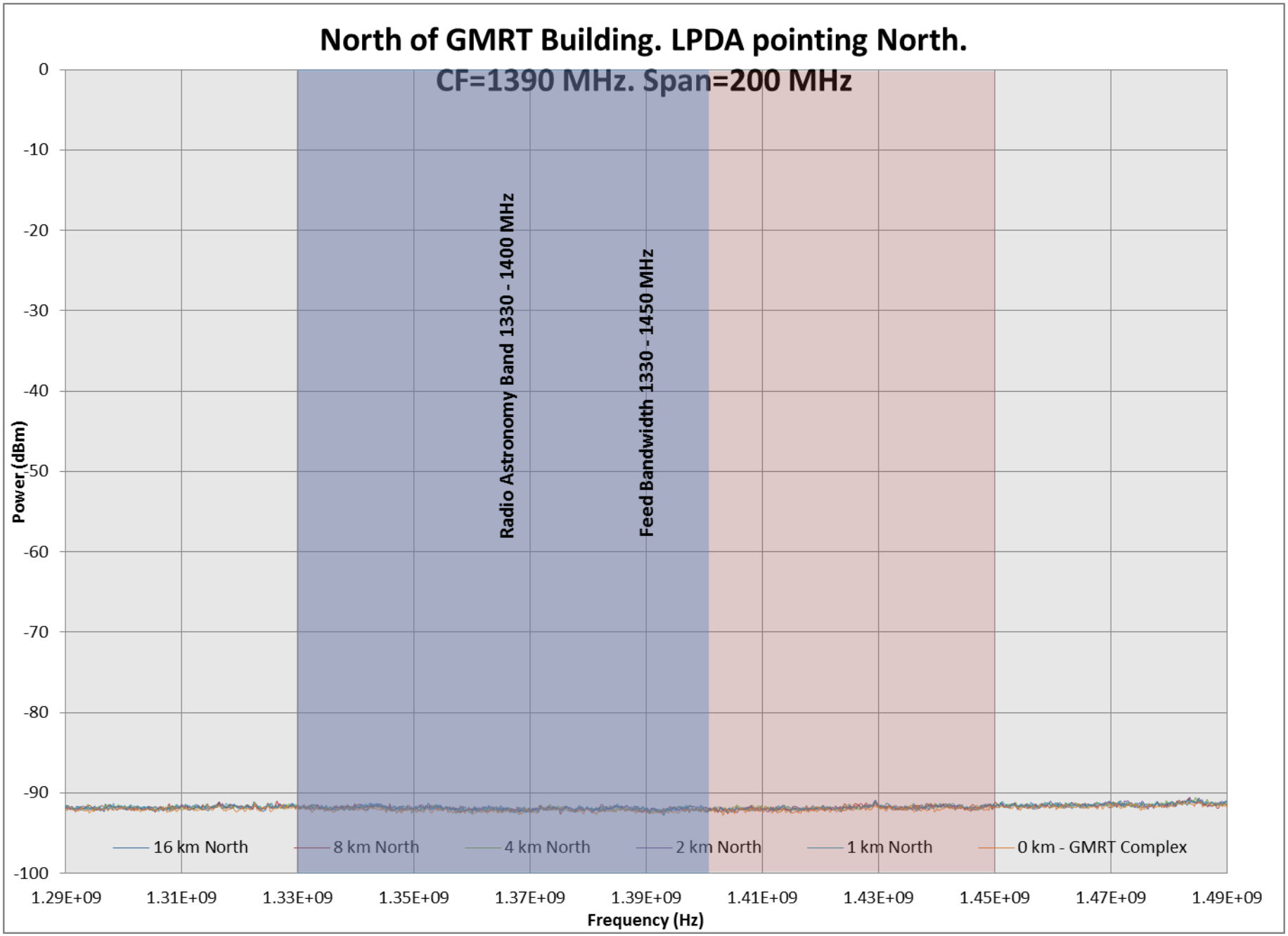

East of GMRT Building. LPDA Pointing East.
CF=1280 MHz. Span=200 MHz.
Feed Bandwidth 1220 - 1340 MHz
Radio Astronomy Band 1330 1400 MHz
Power (dBm)
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
1.18E+09
1.20E+09
1.22E+09
1.24E+09
1.26E+09
1.28E+09
1.30E+09
1.32E+09
1.34E+09
1.36E+09
1.38E+09
Frequency (Hz)
0 km - GMRT Complex
1 km East
2 km East
4 km East
8 km East
16 km East

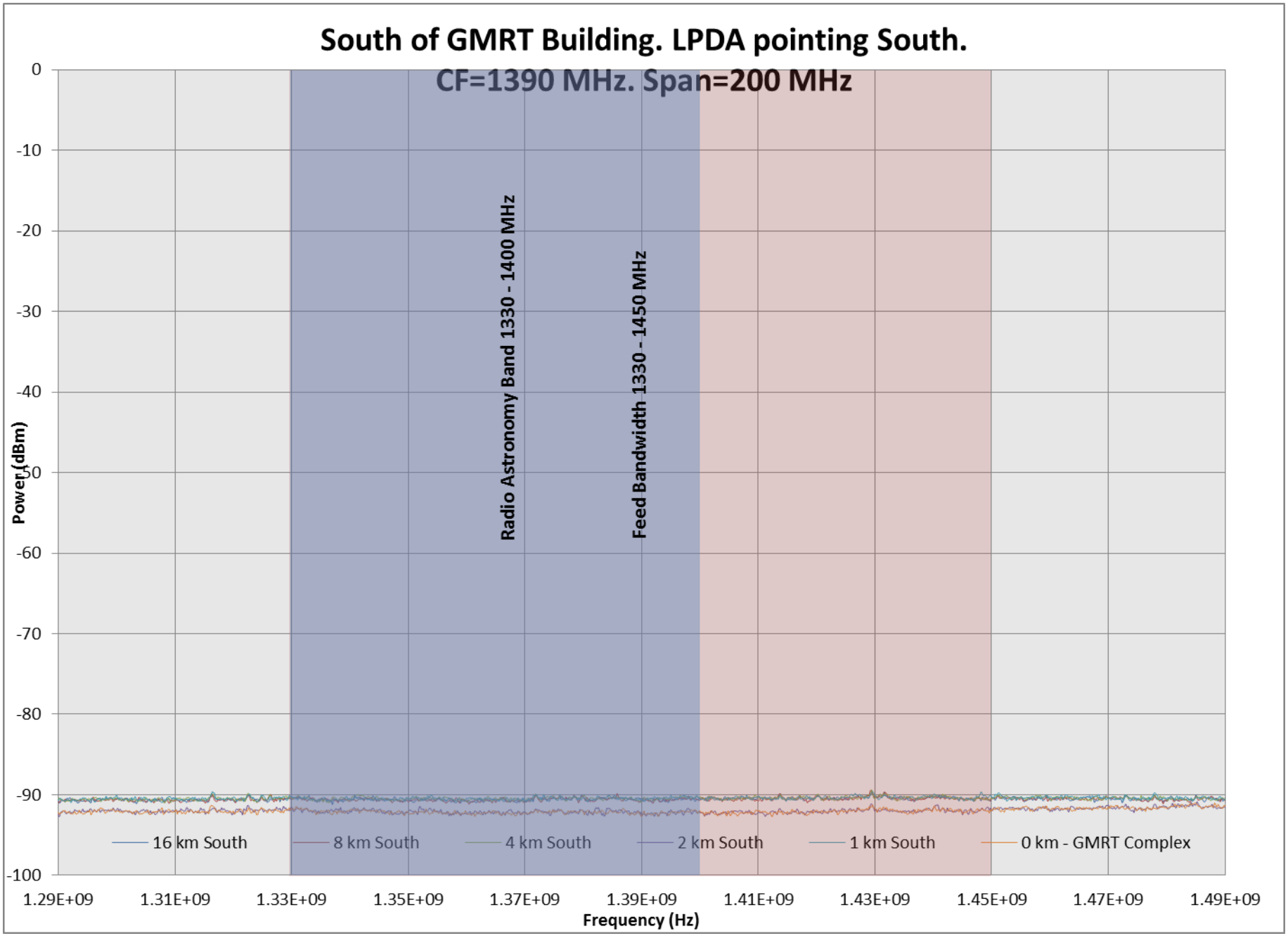

North of GMRT Building. LPDA pointing North.
CF=1280 MHz. Span=200 MHz
Power (dBm)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
Feed Bandwidth 1220 - 1340 MHz
Radio Astronomy Band 1330 1400 MHz
16 km North
8 km North
4 km North
2 km North
1 km North
0 km - GMRT Complex
1.18E+09
1.20E+09
1.22E+09
1.24E+09
1.26E+09
1.28E+09
1.30E+09
1.32E+09
1.34E+09
1.36E+09
Frequency (Hz)

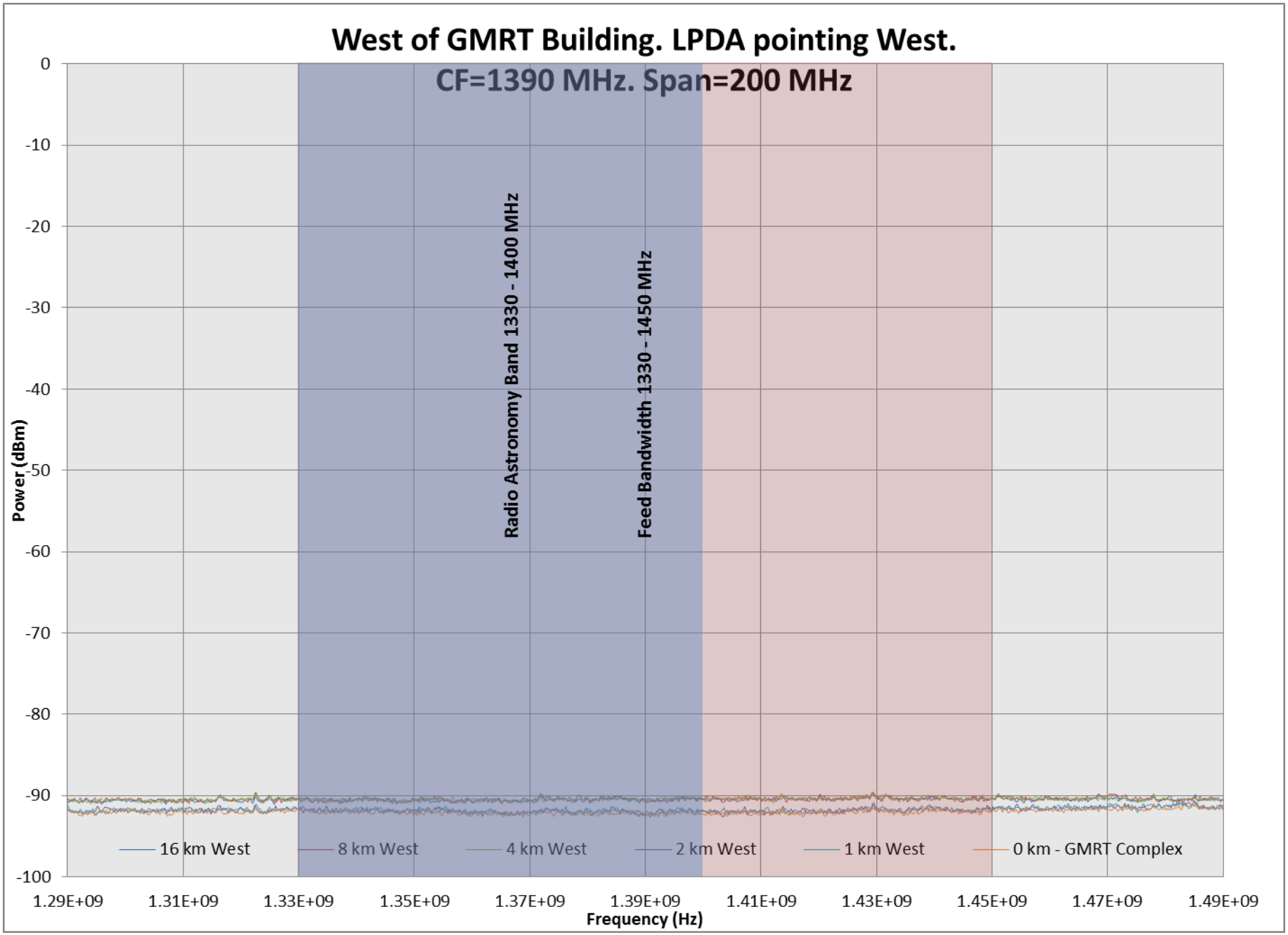

South of GMRT Building. LPDA pointing South.
CF=1280 MHz. Span=200 MHz
Feed Bandwidth 1220 - 1340 MHz
Radio Astronomy Band 1330 1400 MHz
Power (dBm)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
1.18E+09
1.20E+09
1.22E+09
1.24E+09
1.26E+09
1.28E+09
1.30E+09
1.32E+09
1.34E+09
1.36E+09
1.38E+09
Frequency (Hz)
16 km South
8 km South
4 km South
2 km South
1 km South
0 km - GMRT Complex


West of GMRT Building. LPDA pointing West.
CF=1280 MHz. Span=200 MHz
Power (dBm)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
Feed Bandwidth 1220 - 1340 MHz
Radio Astronomy Band 1330 1400 MHz
16 km West
8 km West
4 km West
2 km West
1 km West
0 km - GMRT Complex
1.18E+09
1.20E+09
1.22E+09
1.24E+09
1.26E+09
1.28E+09
1.30E+09
1.32E+09
1.34E+09
1.36E+09
Frequency (Hz)


East of GMRT Building. LPDA Pointing East.
CF=1390 MHz. Span=200 MHz.
Radio Astronomy Band 1330 - 1400 MHz
Feed Bandwidth 1330 - 1450 MHz
Power (dBm)
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
1.29E+09
1.31E+09
1.33E+09
1.35E+09
1.37E+09
1.39E+09
1.41E+09
1.43E+09
1.45E+09
1.47E+09
1.49E+09
Frequency (Hz)
0 km - GMRT Complex
1 km East
2 km East
4 km East
8 km East
16 km East


North of GMRT Building. LPDA pointing North.
CF=1390 MHz. Span=200 MHz
Radio Astronomy Band 1330 - 1400 MHz
Feed Bandwidth 1330 - 1450 MHz
Power (dBm)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
1.29E+09
1.31E+09
1.33E+09
1.35E+09
1.37E+09
1.39E+09
1.41E+09
1.43E+09
1.45E+09
1.47E+09
1.49E+09
Frequency (Hz)
16 km North
8 km North
4 km North
2 km North
1 km North
0 km - GMRT Complex


South of GMRT Building. LPDA pointing South.
CF=1390 MHz. Span=200 MHz
Radio Astronomy Band 1330 - 1400 MHz
Feed Bandwidth 1330 - 1450 MHz
Power (dBm)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
1.29E+09
1.31E+09
1.33E+09
1.35E+09
1.37E+09
1.39E+09
1.41E+09
1.43E+09
1.45E+09
1.47E+09
1.49E+09
Frequency (Hz)
16 km South
8 km South
4 km South
2 km South
1 km South
0 km - GMRT Complex


West of GMRT Building. LPDA pointing West.
CF=1390 MHz. Span=200 MHz
Radio Astronomy Band 1330 - 1400 MHz
Feed Bandwidth 1330 - 1450 MHz
Power (dBm)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
1.29E+09
1.31E+09
1.33E+09
1.35E+09
1.37E+09
1.39E+09
1.41E+09
1.43E+09
1.45E+09
1.47E+09
1.49E+09
Frequency (Hz)
16 km West
8 km West
4 km West
2 km West
1 km West
0 km - GMRT Complex


1 km East of GMRT Complex
19°06'03.17"N
074°02'57.64"E
Camera Alt 1.86 km
Shrimant Nagar
19°05'49.05"N
074°03'29.04"E
19°05'48.10"N
074°03'33.75"E
1 km East of GMRT Complex
Image © 2011 DigitalGlobe
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©2010 Google
Imagery Date: 2/23/2007
2006
19°05'55.04"N 74°03'15.35"E elev 668 m
Eye alt 1.86 km


2 km East of GMRT Complex
Camera Alt 1.79 km
19°05'50.17"N
074°04'00.48"E
19°05'48.10"N
074°03'33.75"E
1 km East of GMRT Complex
Shrimant nagar
19°05'47.83"N
074°04'07.47"E
Shiroli Davkharmala
©2010 Google
© 2010 Google
Image © 2011 DigitalGlobe
Imagery Date: 2/23/2007
2006
19°05'41.89" N 74°03'48.48" E elev 654 m
Eye alt 1.79 km


4 km East of GMRT Complex
Camera Alt 2.59 km
19°05'48.15"N
074°05'16.50"E
4 km East
2 km East of GMRT Complex
19°05'47.83"N
074°04'07.47"E
Shiroli Davkharmala
Shiroli
Manbhav Ashram
19°05'42.58"N
074°05'07.55"E
19°05'42.98"N
074°05'15.42"E
19°05'33.58"N
074°04'28.44"E
19°05'24.47"N
074°04'56.81"E
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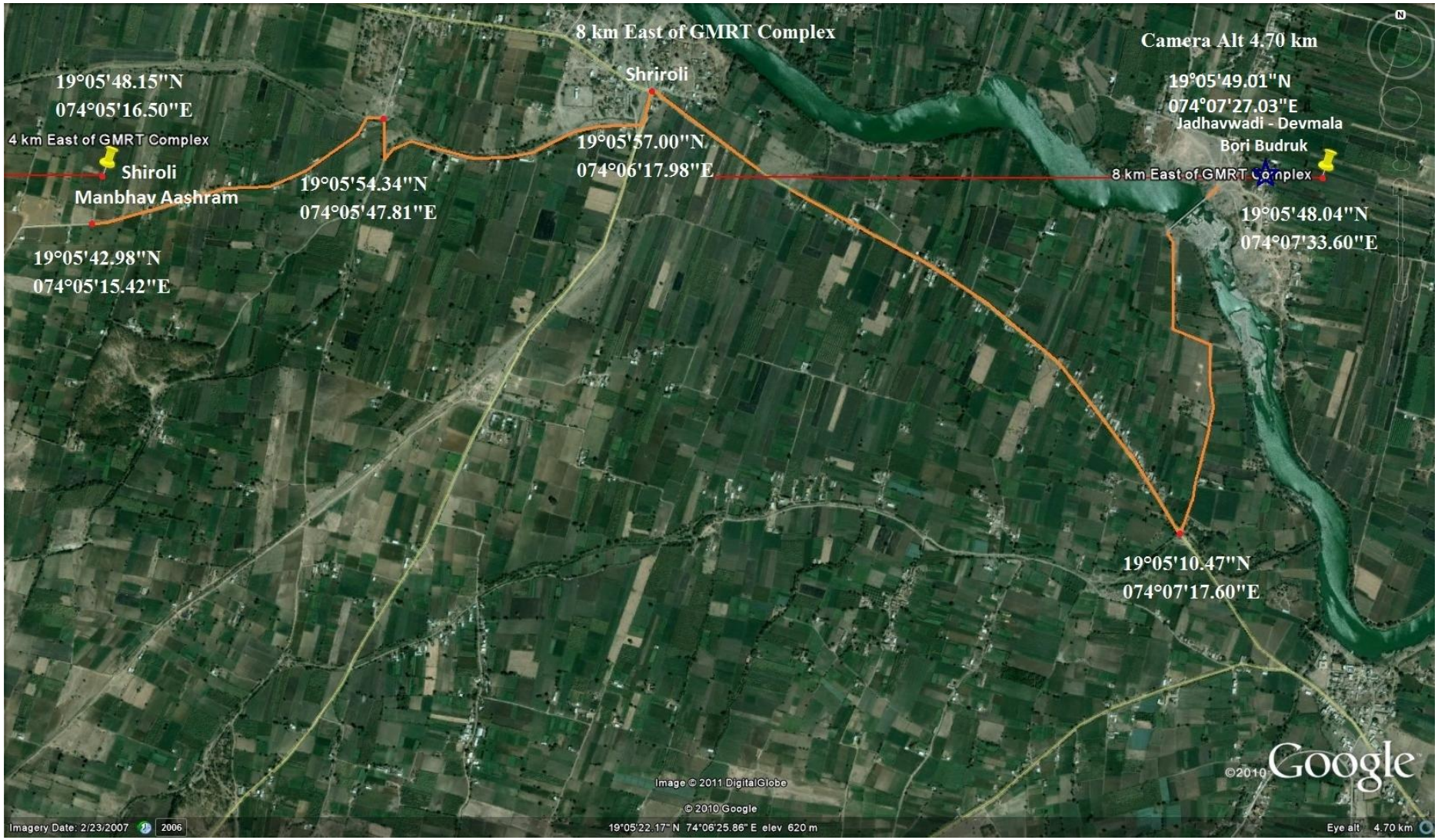
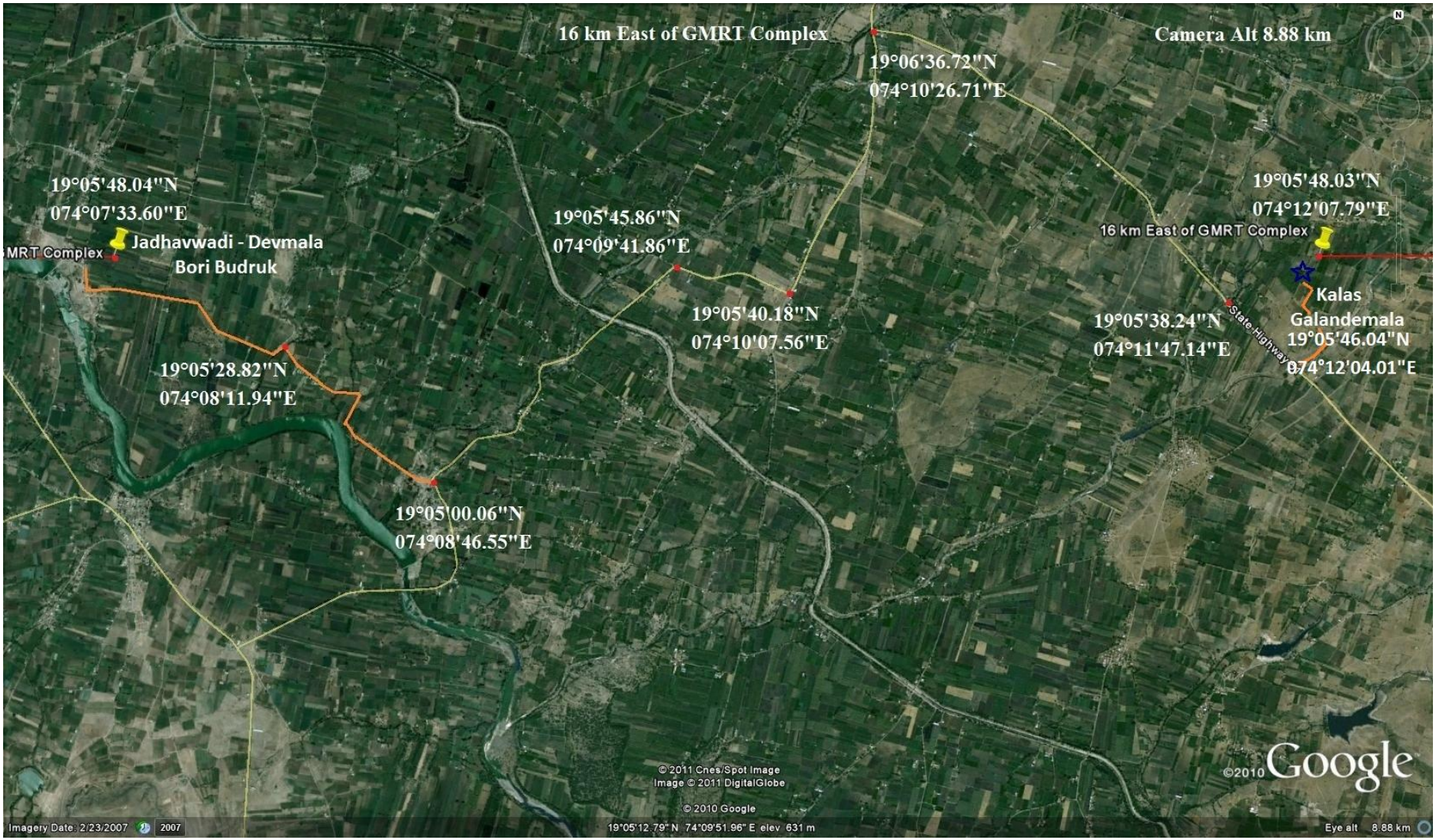
© 2010 Google
Image © 2011 DigitalGlobe
Imagery Date: 2/23/2007
2006
19°05'43.97" N 74°04'43.25" E elev 635 m
Eye alt 2.59 km


8 km East of GMRT Complex
Shriroli
19°05'57.00"N
074°06'17.98"E
Camera Alt 4.70 km
19°05'49.01"N
074°07'27.03"E
Jadhavwadi - Devmala
Bori Budruk
8 km East of GMRT Complex
19°05'48.15"N
074°05'16.50"E
4 km East of GMRT Complex
Shiroli
Manbhav Aashram
19°05'54.34"N
074°05'47.81"E
19°05'42.98"N
074°05'15.42"E
19°05'48.04"N
074°07'33.60"E
19°05'10.47"N
074°07'17.60"E
Image © 2011 DigitalGlobe
© 2010 Google
©2010 Google
Imagery Date: 2/23/2007
2006
19°05'22.17" N 74°06'25.86" E elev 620 m
Eye alt 4.70 km


16 km East of GMRT Complex
19°06'36.72"N
074°10'26.71"E
Camera Alt 8.88 km
19°05'48.04"N
074°07'33.60"E
Jadhavwadi - Devmala
Bori Budruk
MRT Complex
19°05'45.86"N
074°09'41.86"E
19°05'40.18"N
074°10'07.56"E
19°05'48.03"N
074°12'07.79"E
16 km East of GMRT Complex
Kalas
Galandemala
19°05'46.04"N
074°12'04.01"E
19°05'38.24"N
074°11'47.14"E
State Highway
19°05'28.82"N
074°08'11.94"E
19°05'00.06"N
074°08'46.55"E
©2011 Cnes/Spot Image
Image © 2011 DigitalGlobe
© 2010 Google
©2010 Google
Imagery Date: 2/23/2007
2007
19°05'12.79" N 74°09'51.96" E elev 631 m
Eye alt 8.88 km


1 km North of GMRT Complex
Camera Alt 2 km
G.M.R.T.
Complex
19°05'46.04"N
074°12'04.01"E
19°06'20.41"N
074°02'59.26"E
1 km North of GMRT Complex
GMRT
Khodad
19°06'22.83"N
074°02'59.25"E
1 km North of GMRT Complex
19°06'24.8"N
074°02'59.5"E
19°06'23.64"N
074°03'02.08"E
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Image © 2011 DigitalGlobe
©2010 Google
Imagery Date: 2/23/2007
2006
19°06'07.74" N 74°02'58.89" E elev 660 m
Eye alt 2.00 km


2 km North of GMRT Complex
Camera Alt 1.86 km
19°06'20.41"N
074°02'59.26"E
of GMRT Complex
19°06'22.83"N
074°02'59.25"E
1 km North of GMRT Complex
Bhorwadi Khodad
19°06’54.5”N
074°02’56.0”E
m North of GMRT Complex
19°06'52.91"N
074°03'59.23"E
19°06'58.70"N
074°02'59.24"E
19°06'23.64"N
074°03'02.08"E
19°06'56.39"N
074°03'07.16"E
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©2010 Google
Imagery Date: 2/23/2007
2006
19°06'38.47" N 74°03'02.35" E elev 657 m
Eye alt 1.82 km


4 km North of GMRT Complex
Camera Alt 2.71 km
19°06’52.91”N
74°02’59.23”E
2 km North of GMRT Complex
19°06’58.70”N
74°02’59.24”E
19°07’46.42”N
74°02’58.10”E
Sutarthike
4 km North of GMRT Complex
19°07’58.05”N
74°02’59.23”E
19°06’56.39”N
74°03’07.16”E
Bhorwadi
19°07’28.30”N
74°03’21.67”E
Bhorwadi
©2010 Google
Image © 2011 DigitalGlobe
©2010 Google
Imagery Date: 2/23/2007
2006
19°07'30.25" N 74°03'05.84" E elev 647 m
Eye alt 2.71 km

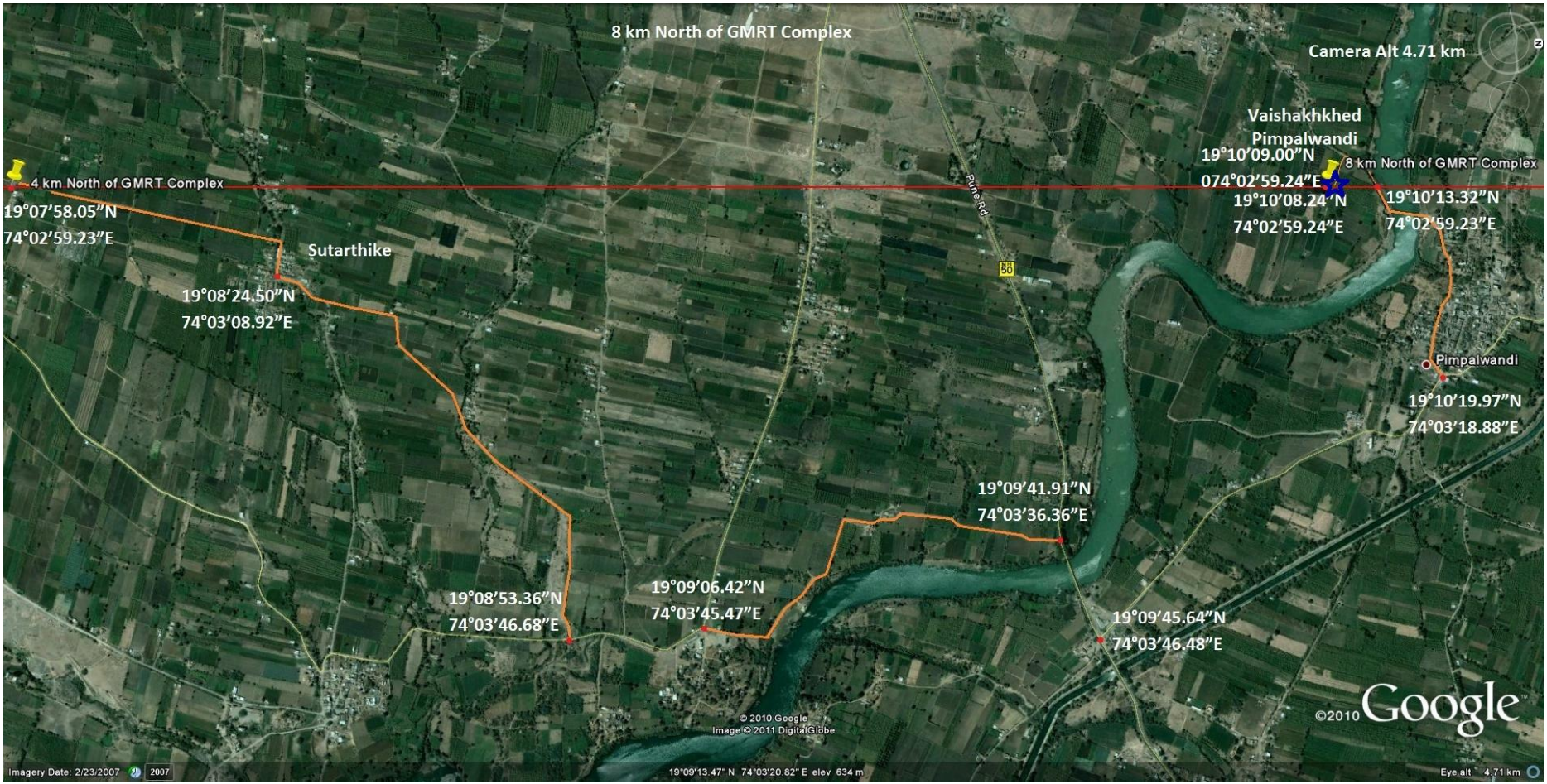
8 km North of GMRT Complex
Camera Alt 4.71 km
Vaishakhkhed
Pimpalwandi
19°10’09.00”N
074°02’59.24”E
8 km North of GMRT Complex
4 km North of GMRT Complex
19°07’58.05”N
74°02’59.23”E
19°10’08.24”N
74°02’59.24”E
19°10’13.32”N
74°02’59.23”E
Pune Rd
50
Sutarthike
19°08’24.50”N
74°03’08.92”E
Pimpalwandi
19°10’19.97”N
74°03’18.88”E
19°09’41.91”N
74°03’36.36”E
19°08’53.36”N
74°03’46.68”E
19°09’06.42”N
74°03’45.47”E
19°09’45.64”N
74°03’46.48”E
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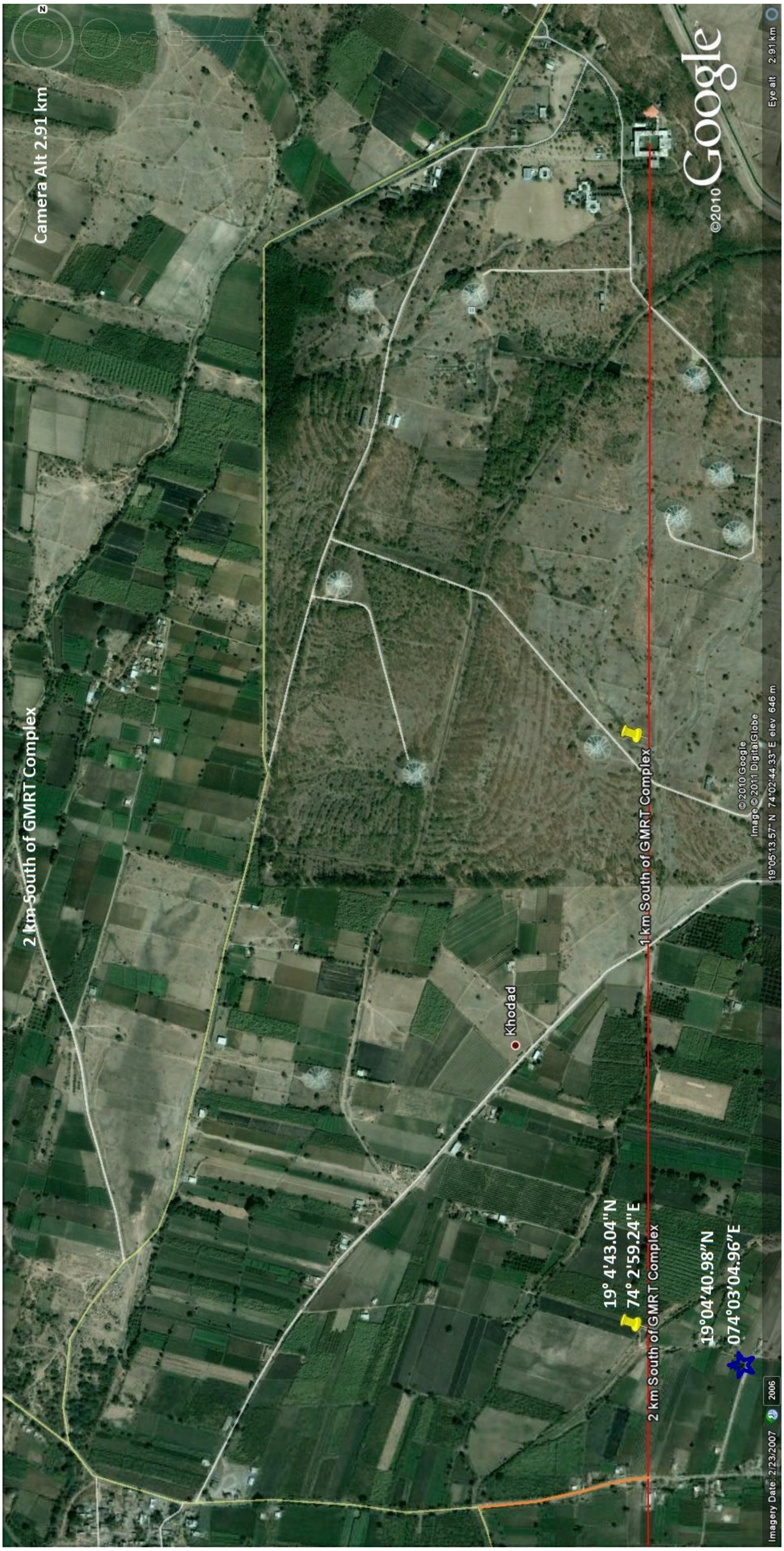
Image © 2011 DigitalGlobe
©2010 Google
Imagery Date: 2/23/2007
2007
19°09'13.47" N 74°03'20.82" E elev 634 m
Eye alt 4.71 km


16 km North of GMRT Complex
Camera Alt8.25 km
Pimpri pendhar
Forest
19°14’13.59”N
74°02’59.26”E
16km North
19°14’28.46”N
74°02’59.27”E
19°10’08.24”N
74°02’59.24”E
8 km North of GMRT Complex
19°11’03.00”N
74°03’09.10”E
19°10’38.61”N
74°03’08.61”E
Pimpalwandi
19°10’27.37”N
74°03’12.68”E
Pimpari Pendhar
19°12’39.74”N
74°03’07.31”E
19°13’32.10”N
74°02’59.39”E
MSH 2
© 2010 Google
Image © 2011 DigitalGlobe
©2010 Google
Imagery Date: 2/23/2007
2007
19°12'28.24" N 74°03'34.03" E elev 677 m
Eye alt 8.25 km


1 km South of GMRT Complex
Camera Alt 1.90 km
19°05’13.35”N
074°02’59.24”E
1 km South of GMRT Complex
GMRT
Ceter Square
19° 5'15.54"N
74° 2'59.24"E
©2010 Google
© 2010 Google
Image © 2011 DigitalGlobe
Imagery Date: 2/23/2007
2006
19°05'29.62" N 74°03'01.75" E elev 658 m
Eye alt 1.90 km



Camera Alt 2.91 km
2 km South of GMRT Complex
1 km South of GMRT Complex
Khodad
19° 4'43.04"N
74° 2'59.24"E
2 km South of GMRT Complex
19°04'40.98"N
074°03'04.96"E
©2010 Google
© 2010 Google
Image © 2011 DigitalGlobe
19°05'13.57" N 74°02'44.33" E elev 646 m
Imagery Date: 2/23/2007
2006
Eye alt 2.91 km


4 km South of GMRT Complex
Camera Alt 2.90 km
19°03’38.06”N
074°02’58.04”E
4 km South of Central Complex
19° 3'38.04"N
074° 2'59.26"E
2 km South of GMRT Complex
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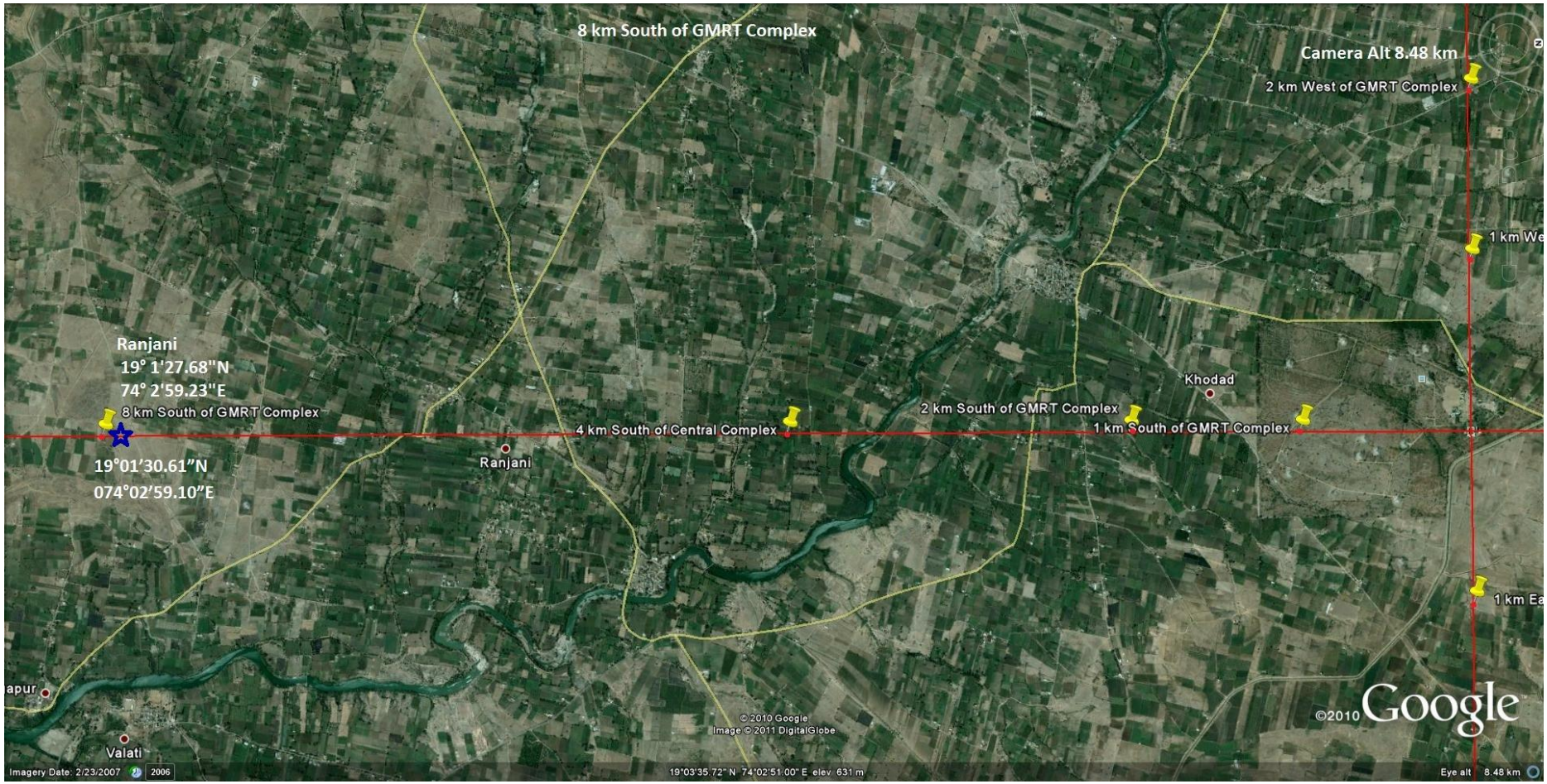
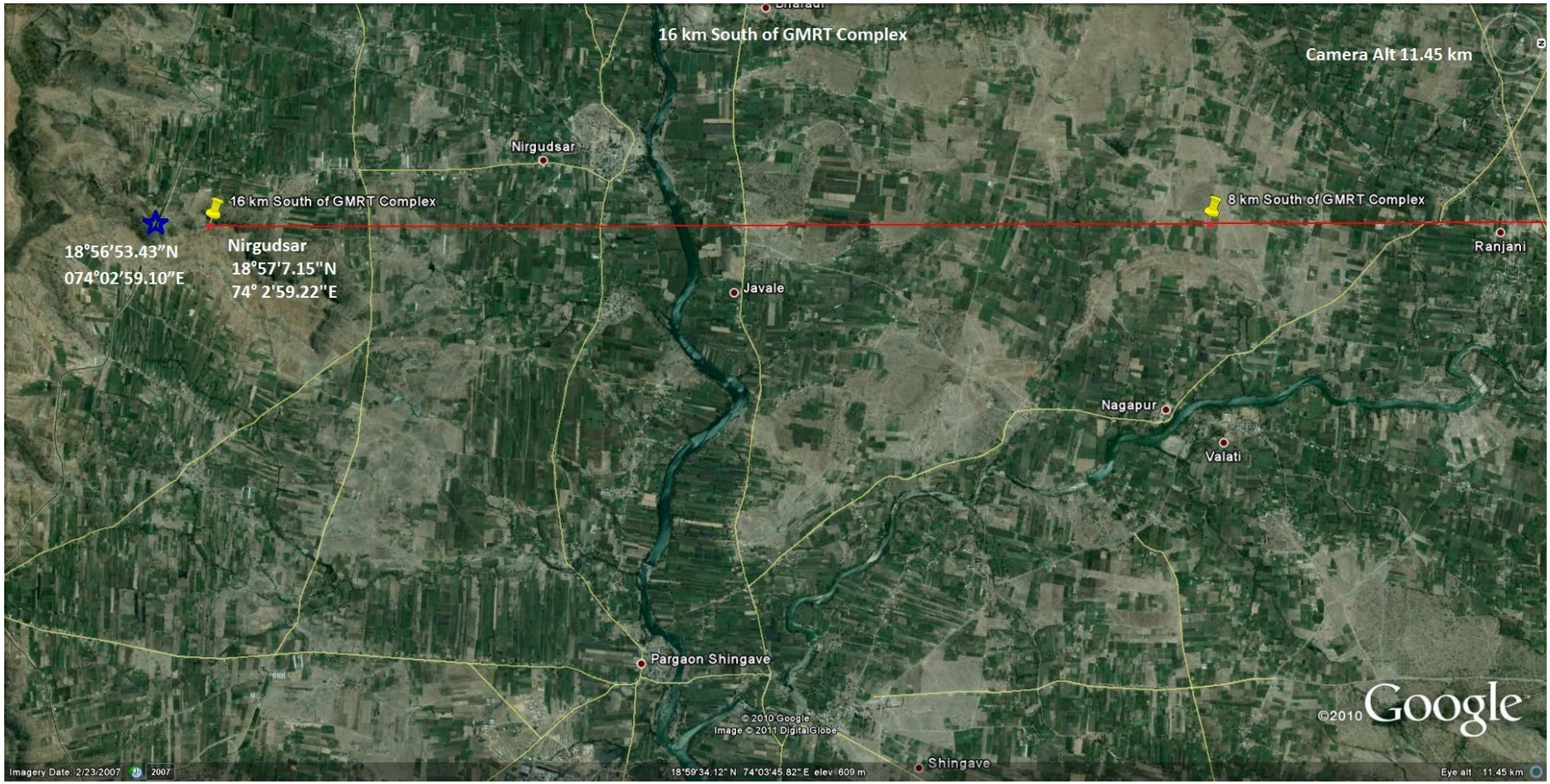
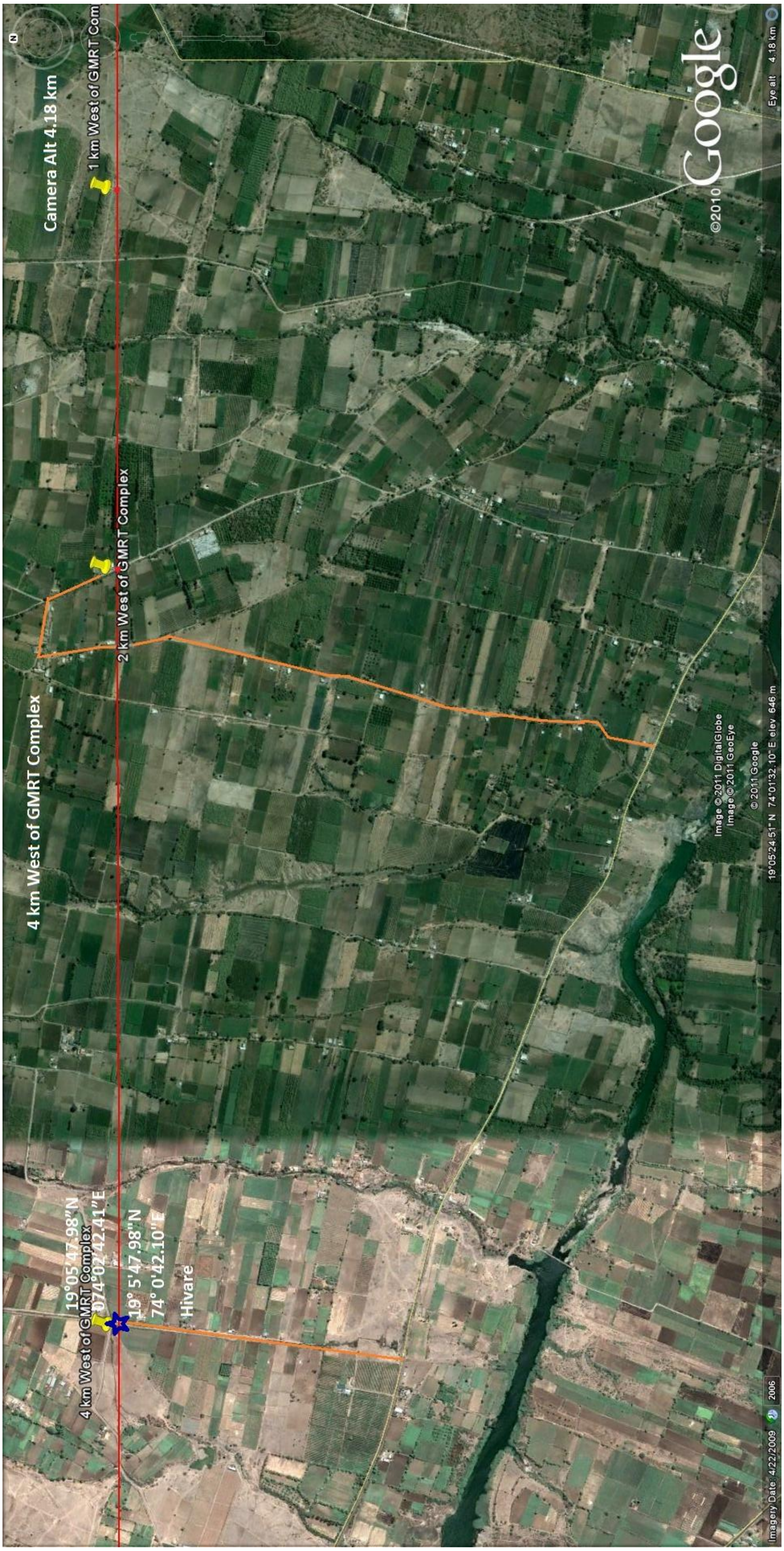
Image © 2011 DigitalGlobe
Imagery Date: 2/23/2007
2006
19°04'14.05" N 74°02'44.83" E elev 628 m
Eye alt 2.90 km


8 km South of GMRT Complex
Camera Alt 8.48 km
2 km West of GMRT Complex
1 km We
Ranjani
19° 1'27.68"N
74° 2'59.23"E
8 km South of GMRT Complex
19°01'30.61"N
074°02'59.10"E
4 km South of Central Complex
Ranjani
Khodad
2 km South of GMRT Complex
1 km South of GMRT Complex
1 km Ea
apur
Valati
© 2010 Google
Image © 2011 DigitalGlobe
©2010 Google
Imagery Date: 2/23/2007
2006
19°03'35.72" N 74°02'51.00" E elev 631 m
Eye alt 8.48 km

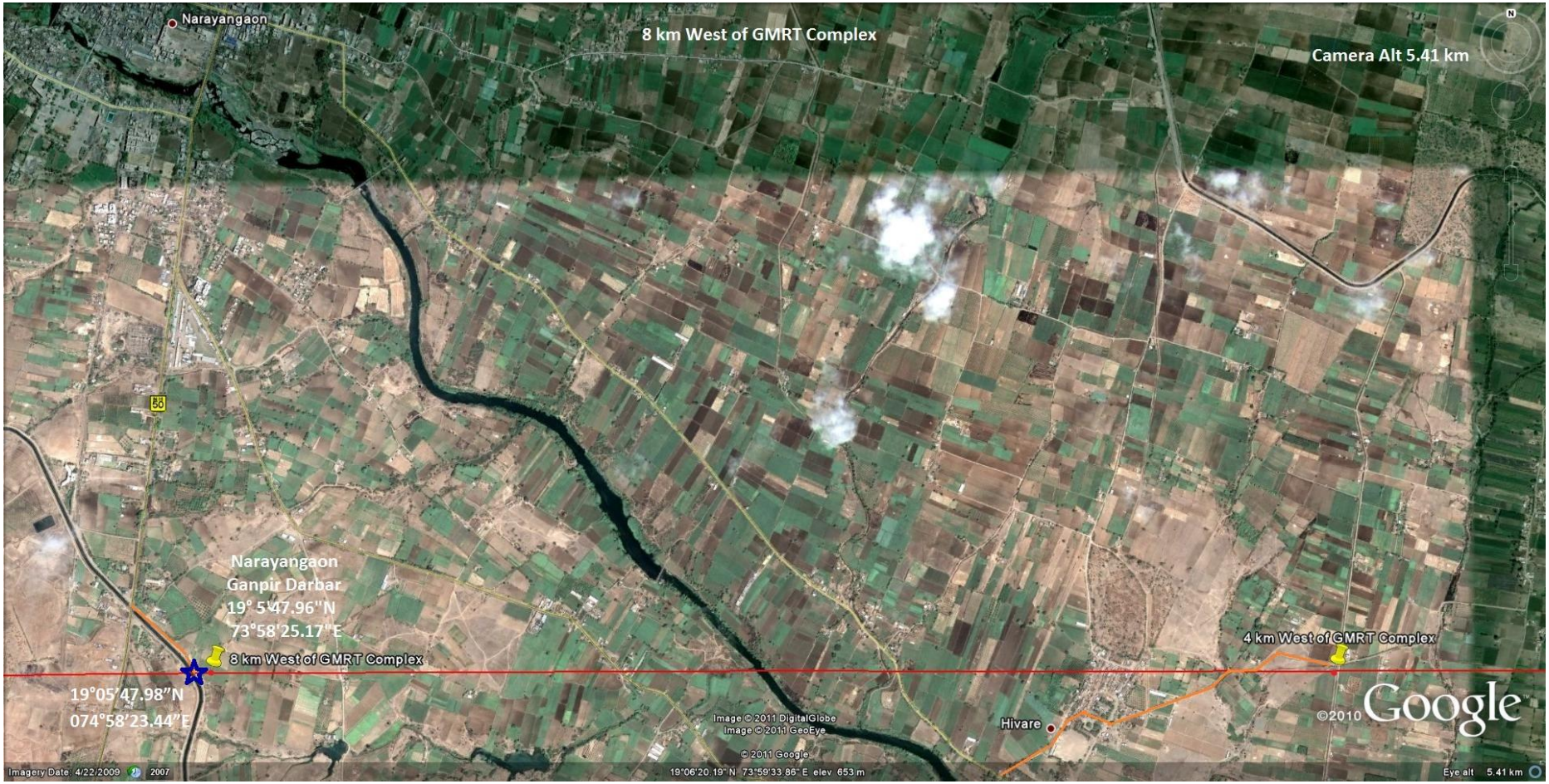

16 km South of GMRT Complex
Camera Alt 11.45 km
Nirgudsar
16 km South of GMRT Complex
8 km South of GMRT Complex
18°56’53.43”N
074°02’59.10”E
Nirgudsar
18°57'7.15"N
74° 2'59.22"E
Javale
Ranjani
Nagapur
Valati
Pargaon Shingave
Shingave
© 2010 Google
Image © 2011 DigitalGlobe
©2010 Google
Imagery Date: 2/23/2007
2007
18°59'34.12" N 74°03'45.82" E elev 609 m
Eye alt 11.45 km

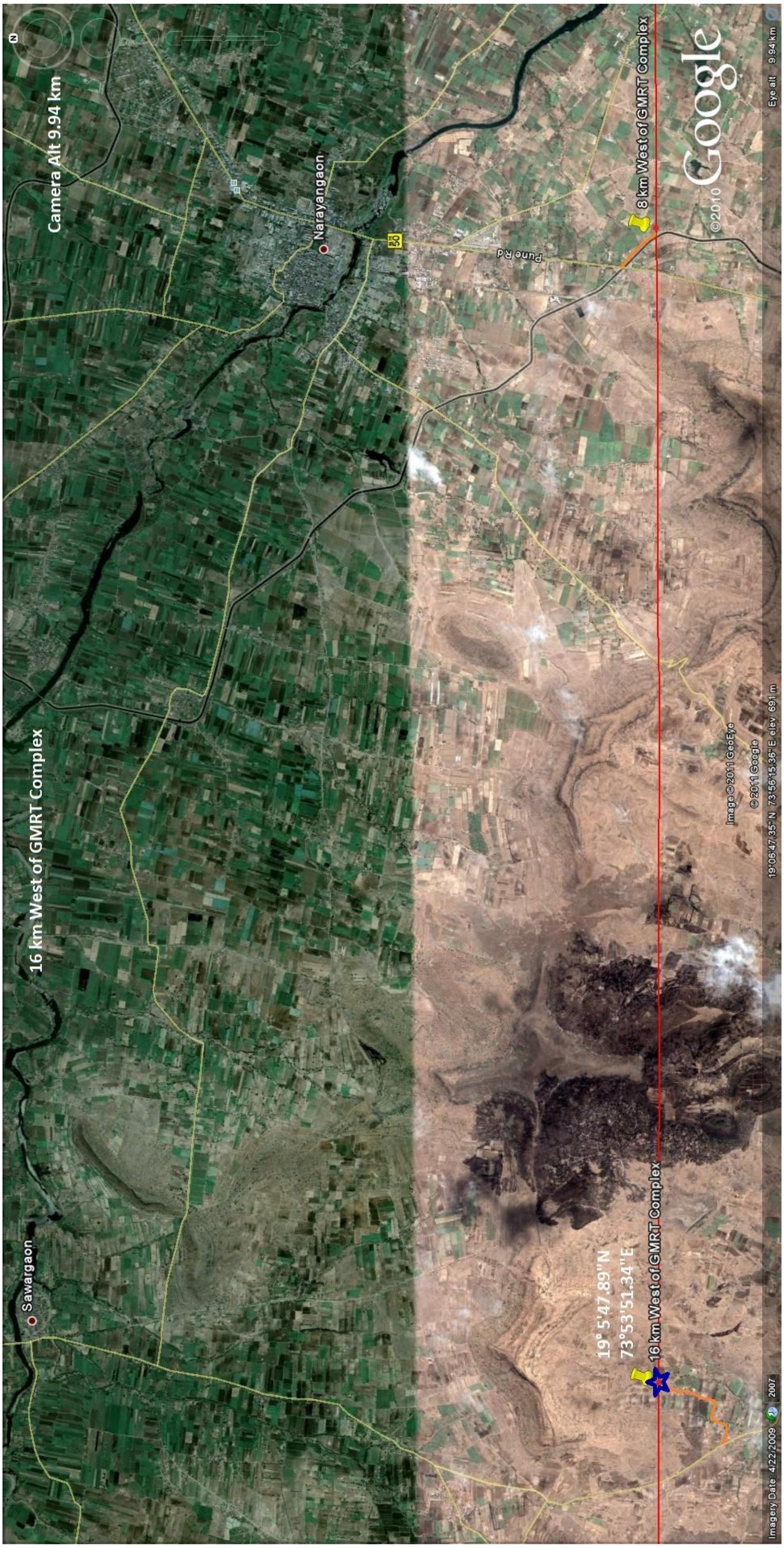

1 km West of GMRT Complex
Camera Alt 2.81 km
GMRT
Khodad
19° 5'47.96"N
74° 2'24.99"E
1 km West of GMRT Complex
Image © 2011 DigitalGlobe
© 2011 Google
©2010 Google
Imagery Date: 2/23/2007
2006
19°06'04.34" N 74°02'42.71" E elev 657 m
Eye alt 2.81 km


2 km West of GMRT Complex
Camera Alt 2.41 km
19° 5'47.97"N
74° 1'50.63"E
1 km West of GMRT Complex
2 km West of GMRT Complex
Image © 2011 DigitalGlobe
©2010 Google
© 2011 Google
Imagery Date: 2/23/2007
2006
19°06'00.01" N 74°02'03.61" E elev 663 m
Eye alt 2.41 km



Camera Alt 4.18 km
1 km West of GMRT Complex
2 km West of GMRT Complex
4 km West of GMRT Complex
19°05'47.98"N
4 km West of GMRT Complex
074°02'42.41"E
19° 5'47.98"N
74° 0'42.10"E
Hivare
©2010 Google


Narayangaon
8 km West of GMRT Complex
Camera Alt 5.41 km
Narayangaon
Ganpir Darbar
19° 5'47.96"N
73°58'25.17"E
8 km West of GMRT Complex
19°05'47.98"N
074°58'23.44"E
4 km West of GMRT Complex
Hivare
Image © 2011 DigitalGlobe
Image © 2011 GeoEye
© 2011 Google
©2010 Google
Imagery Date: 4/22/2009
19°06'20.19" N 73°59'33.86" E elev 653 m
Eye alt 5.41 km


Camera Alt 9.94 km
Narayangaon
Pune Rd
8 km West of GMRT Complex
16 km West of GMRT Complex
Sawargaon
19° 5'47.89"N
73°53'51.34"E
16 km West of GMRT Complex
Google
©2010
Image © 2011 GeoEye
© 2011 Google
Imagery Date: 4/22/2009
Eye alt 9.94 km

IV. CONCLUSIONS

The following conclusions may be drawn from the graphs:-

1. RFI levels within the central square are much lower than outside.

2. Ambient RFI level increases as one goes away from th GMRT Central Square.

3. Mobile phones are major contributors to RFI generated in and around GMRT.

4. The RFI lines falling within the allocated Radio Astronomy Bands and within the System Bandwidth is highlighted.

5.

V. FUTURE SCOPE

Further work would be to obtain contour maps for RFI over the area covered during survey using Matlab. The contour maps obtained may be superimposed over Google Earth maps to give a more user friendly and visual appeal to the work.

Presently only points 90 degrees apart were taken for the readings. If more number of points are taken by taking reading at every 45 degrees so as to get directions North-east, South-east, South-west, etc., a detailed contour map may be plotted.

Also it is intended to provide a facility which will allow the user to produce contour maps for any frequency and direction desired by the user. These contour maps may also be superimposed on Google Earth maps for regions covered during the survey around GMRT. This will effectively allow one to locate the direction of incident RFI.

Apart from the work undertaken it is also suggested that if a file containing data of RFI present is made available to observers would help immensely. The data may be taken using a disc cone antenna already operational at GMRT's RFI lab using similar setup (amplifier, spectrum analyser and additionally a computer running software for grabbing the file and storing it for online users or observers to download). The output from discone antenna could be recorded on averaging and maximum hold mode for 7.5 minutes each to give a file of a total of 15 mins of RFI present. This could be done continuously 24x7. The files available would thus not be too bulky (as recording interval is 15 minutes for one set of average and maximum hold files) and may be stored away for archival. Alternatively RFI files for the duration of radio astronomer's observation may be included in the observation files itself for reference.