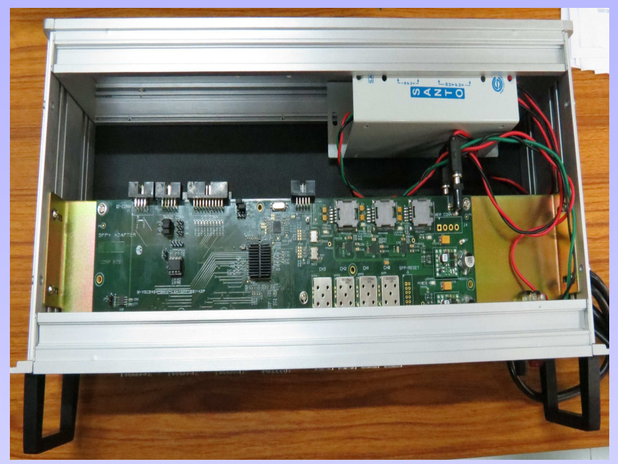
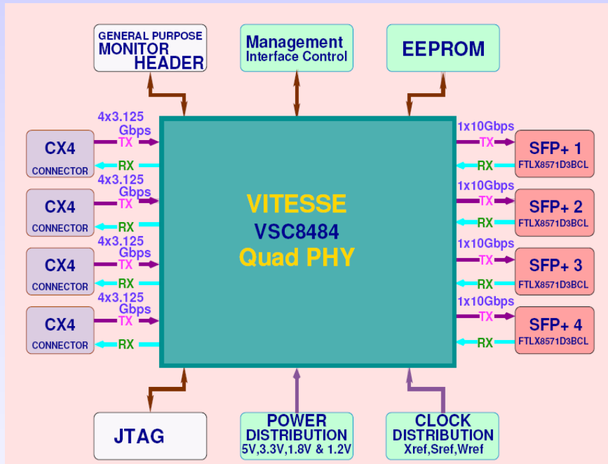
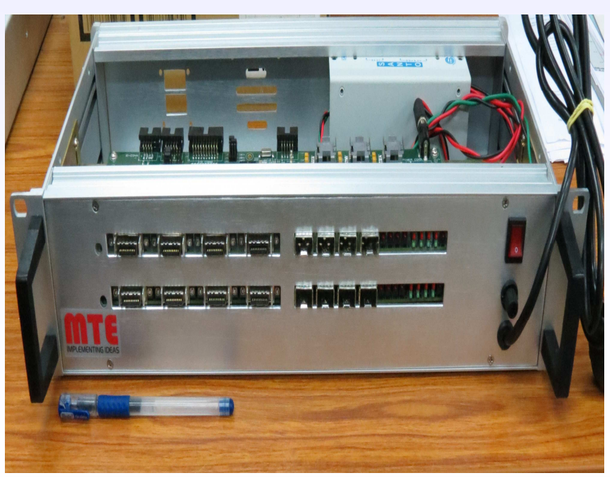
Cost Effective Eight Port CX4 to SFP+ Adapter

Digital Backend Group, Giant Metrewave Radio Telescope, NCRA-TIFR
and Mechatronics Test Equipment (I) Pvt. Ltd., Pune , India







Introduction

- Re-configurable Open Architecture Computing Hardware (ROACH) is a general purpose FPGA board based on Xilinx Virtex-5 targeted towards astronomy signal processing applications, developed by the CASPER group.
- ROACH board is equipped with four CX4 connectors for high speed data transfer over 10 GbE. Each CX4 interface receives four data lanes from FPGA at 3.125 Gbps (max) per lane.
- For a multi-station digital backend, the data needs to be transferred between different ROACH boards via commercially available 10GbE switches.
- As the industry moves toward the SFP+ standard, large port switches with the CX4 interface is getting obsolete. Hence an adapter unit capable of converting CX4 standard to SFP+ standard is necessary.
- Giant Metrewave Radio Telescope's (GMRT) digital back end team and Mechatronics Test Equipment (I) Pvt. Ltd. (MTE) , Pune have designed, developed, and tested an eight port CX4 to SFP+ adapter for interfacing ROACH unit with commercial switches

Adapter board design details

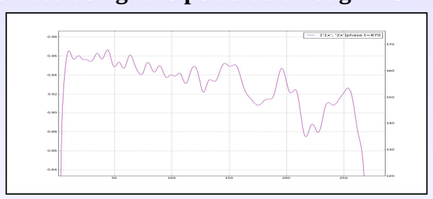
- The primary function of the adapter board is to serialize data over four lanes each at a speed of 3.125 Gbps each into a single 10Gbps lane. For this purpose the XAUI to SFP+ transceiver PHY chip from Vitesse VSC8484 is selected. It is a quad PHY which can handle four parallel 10GbE channels.
- The circuit features low jitter clock distribution, regulated power supply, EEPROM, and reset control for appropriate functioning. The board is also equipped with header connectors for I2C, MDIO and GPIO interfaces. They are used for control and debugging purpose.
- The adapter unit has eight ports in order to handle the CX4 to SFP+ conversion for two ROACH boards. This is achieved by using Quad-PHY chips in one adapter unit.

Unit details

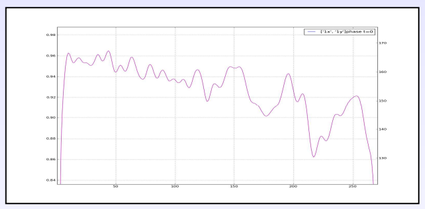
- The unit is a standard 2U rack mountable enclosure which contains two adapter boards, SMPS and cooling arrangement. The adapter board has eight layers which are divided into power and signals considering the signal integrity. The unit has a power consumption of approximately 40W which is supplied through a 75W SMPS. Cooling arrangement is provided using fans powered through AC mains.

Testing & Results

- Basic loopback tests on 10GbE ports showed acceptable data integrity on all ports simultaneously at full data rate.
- Further to this, a 4-antenna 400MHz packetized full Stokes correlator was tested using CX4 network and switch and subsequently replaced with SFP+ network (via CX4-SFP+ unit) and switch.



Normalized Cross Correlation with only CX4 interface



Normalized Cross Correlation wiith CX4 to SFP+ unit.

Advantages

- CX4-SFP+ conversion helps overcome the CX4 standard obsolescence problem. Hence ROACH-1 boards can be used for processing more antennas using SFP+ network switch which is the current standard for 10GbE data transfer
- The Unit can be used for Roach board to PC data transfer using the current technology NIC cards and also as a general networking component at 10Gbps.
- This adapter unit is economical compared to the commercially available counterpart. As per our initial estimates this adapter unit will cost about one fourth of the cost of a commercial one.

Conclusion

- CX4-SFP+ adapter units can be used in the implementation of digital back-ends, as SFP+ becomes a popular standard for 10GbE data transfer. The unit described here is a low-cost and compact solution for processing signals from multiple antennas using Casper correlator designs.

Contact

- **For any other technical queries , please email :** Kaushal Buch , Email : kdbuch@gmrt.ncra.tifr.res.in , Bhupesh Patil , Email : bhupesh.patil@bitmapper.com.
For pricing or purchase related queries , please email : mtepl@vsnl.net ; purchase@bitmapper.com