Feasibility of Unretimed 4x25G Host to Module "cPPI-4"

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Sept 15 2011

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Chicago

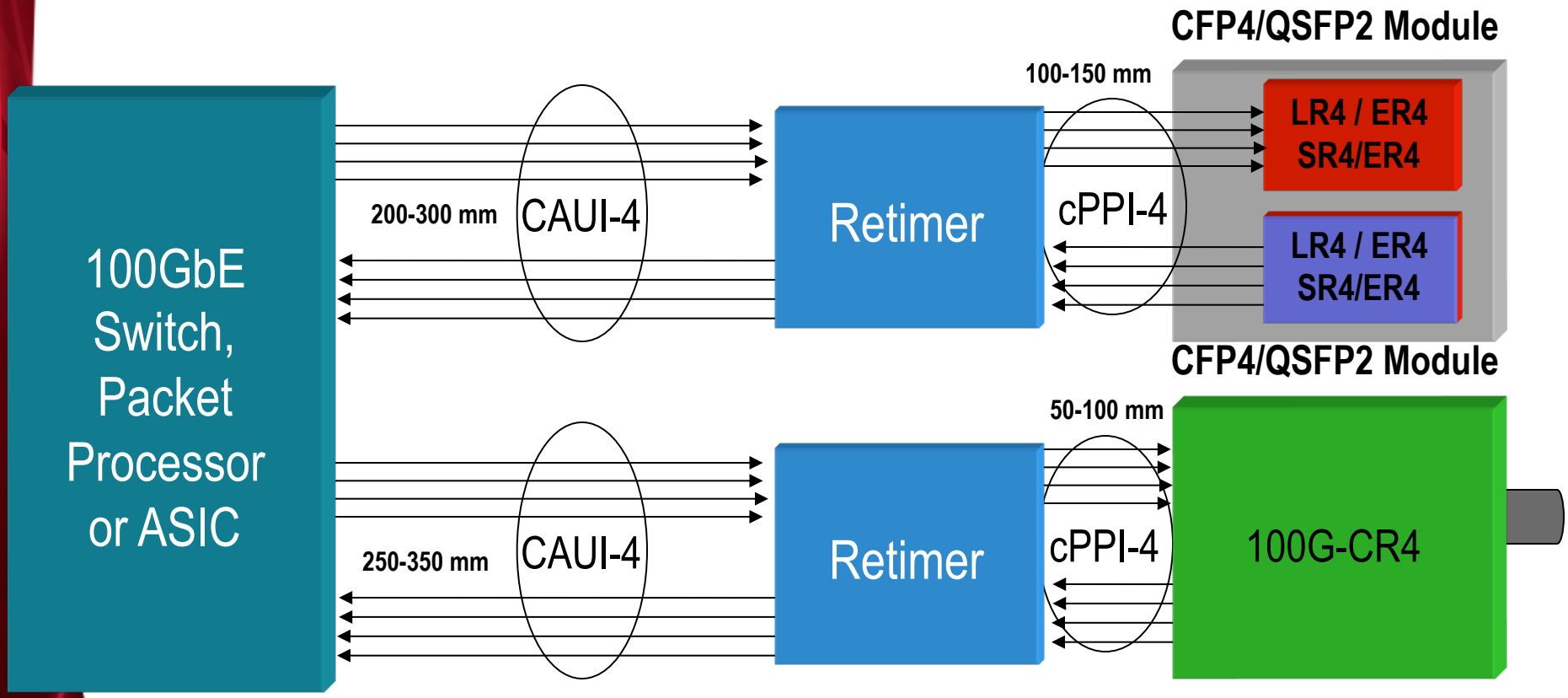
Overview

- cPPI-4 architecture
- Proposed cPPI-4 /100GCUI budget
- How to realize cPPI-4
- cPPI-4 channel based on Quattro II connector
- Measured and simulated cPPI-4 transmit eye

Acknowledgment: To TE (Formerly Tyco Electronics) for providing model and boards for this effort.

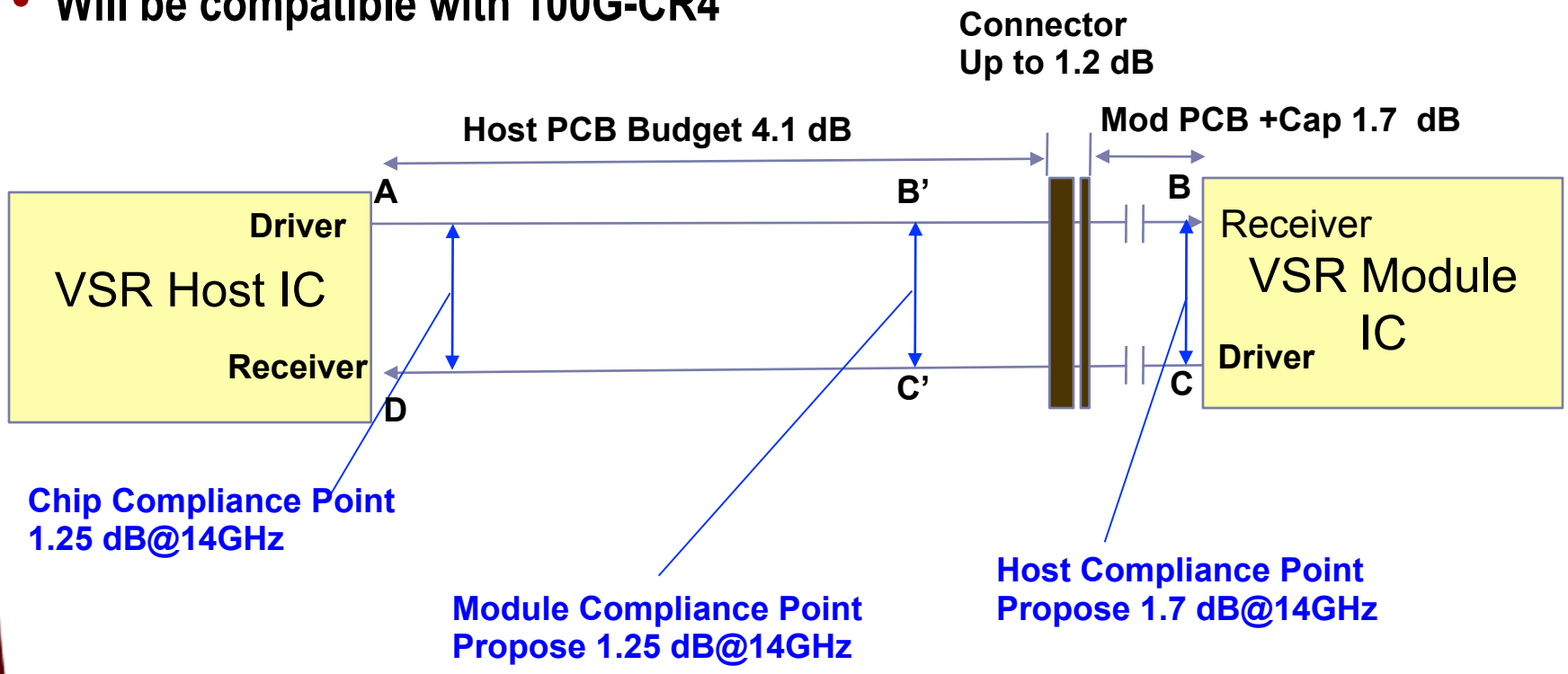
Next Generation PMD Implementation Based on cPPI-4

- cPPI-4 is unretimed interfaced need to support existing LR4/ER4 as well as new PMD's in development 100G-CR4/SR4/FR4



cPPI-4 Architecture and Reference Points

- Follows 802.3 CL86(nPPI) and CL85
- Will be compatible with 100G-CR4



cPPI-4 Proposed Channel Loss Budget

- Attach cPPI-4 with 7 dB loss budget can support unretimed optical PMDs as well as100GCU copper cables

Traces	FR4-6	N4000-13	N4000-13SI	Megtron 6
Loss at 12.85 GHz /in	2	1.5	1.2	0.9
Connector loss at 14 GHz*	1.2			
Loss allocation for 2 Vias in the channel	0.5			
Max Module PCB Loss/DC Blocks at 14GHz*	1.7			
PCB Trace Length Assuming 7 dB Loss Budget	1.8000	2.4000	3.0000	4.0000

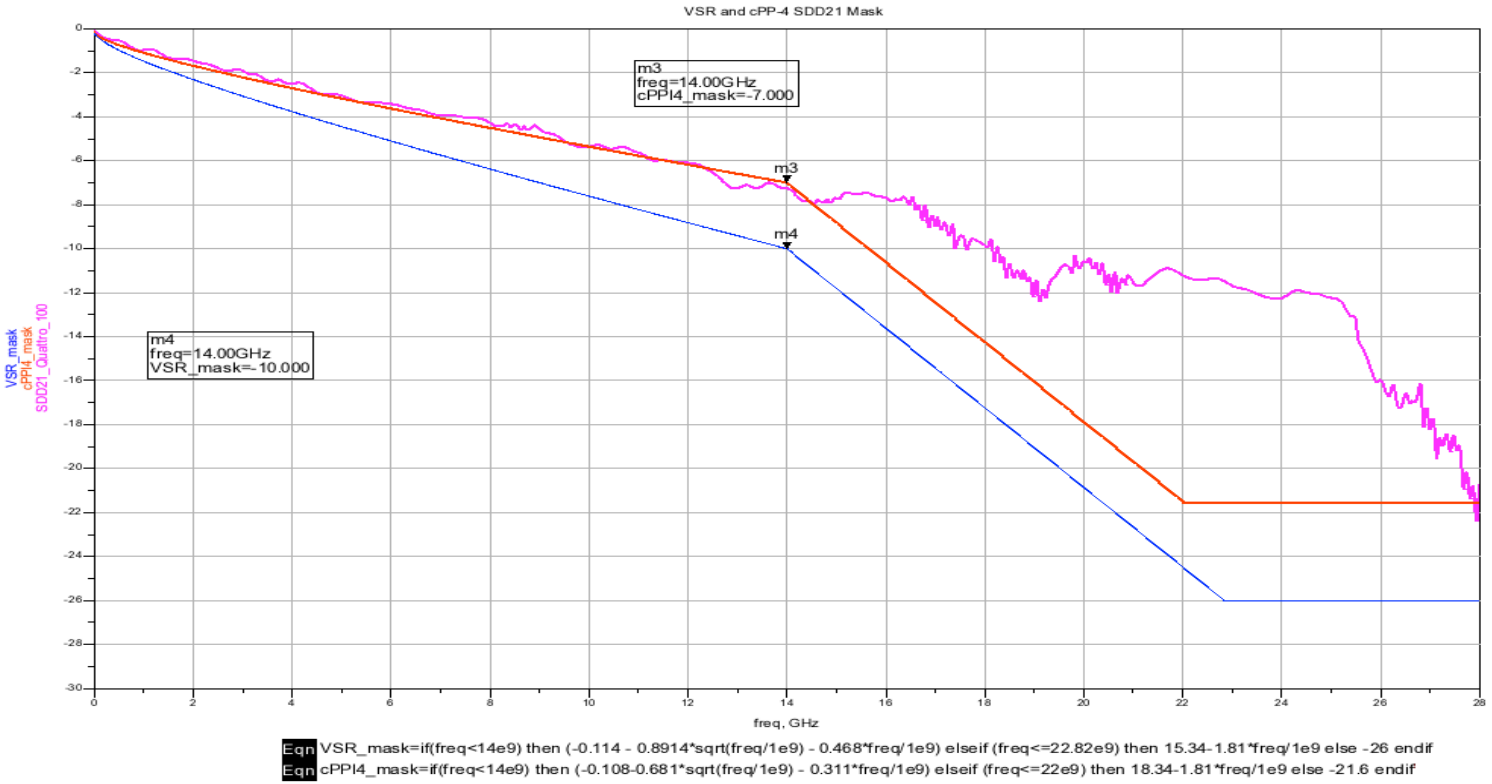
* For 100 GbE operation since the HCB and connector are specified for operation up to 28GBd there will be 0.2-0.3 dB unallocated margin.

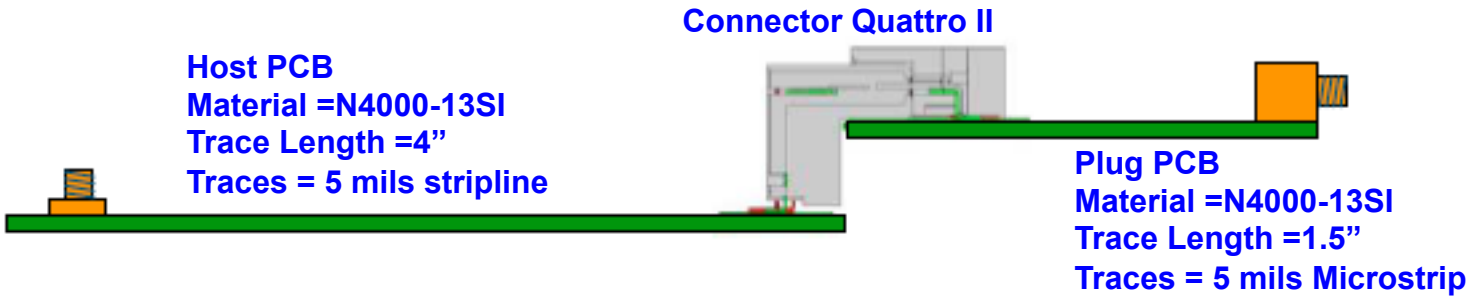
How to Realize cPPI-4

- **cPPI-4 is an unretimed interface and overall SI will be more challenging than retimed CPPI-4 interface**
  - Retimed interface will not give SFP+ like density for 100 GbE the only other option to unretimed interface is to move away from pluggable optics
- **Support existing 100GBase-LR4/ER4 does add extra constraint on the interface as the link budget must close without FEC**
  - ER4 also has additional VECP degradation that further burden the interface but use of an equalizer can reduce this penalty
- **What scheme need be considered**
  - Better connector and with improved host SI
  - Closed loop method to adjust host transmitter de-emphasis
  - KR like transmitter optimization
  - Light EDC
  - FEC can be considered for new PMDs 100GBASE-SR4/FR-4
    - See http://www.ieee802.org/3/100GCU/public/sept11/bhoja_01_0911

cPPI-4 Channel Based on TE Quattro II

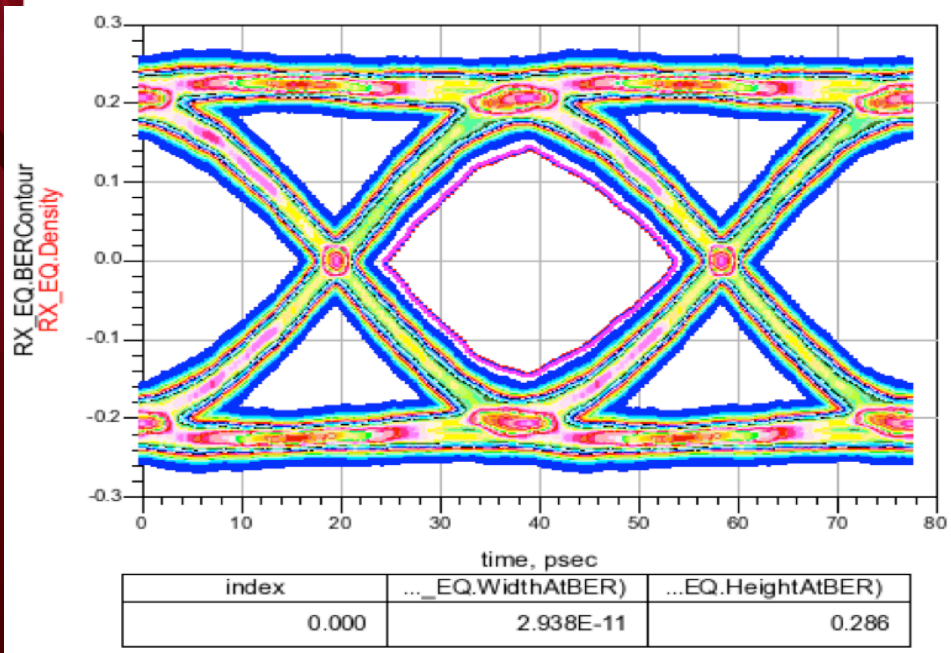
- VSR mask also shown





Far End Transmitter Eye

- **Simulated and measured eye for 4” Quattro II Channel at 25.7 GBd**
  - Channel loss 7.1 dB @14 GHz



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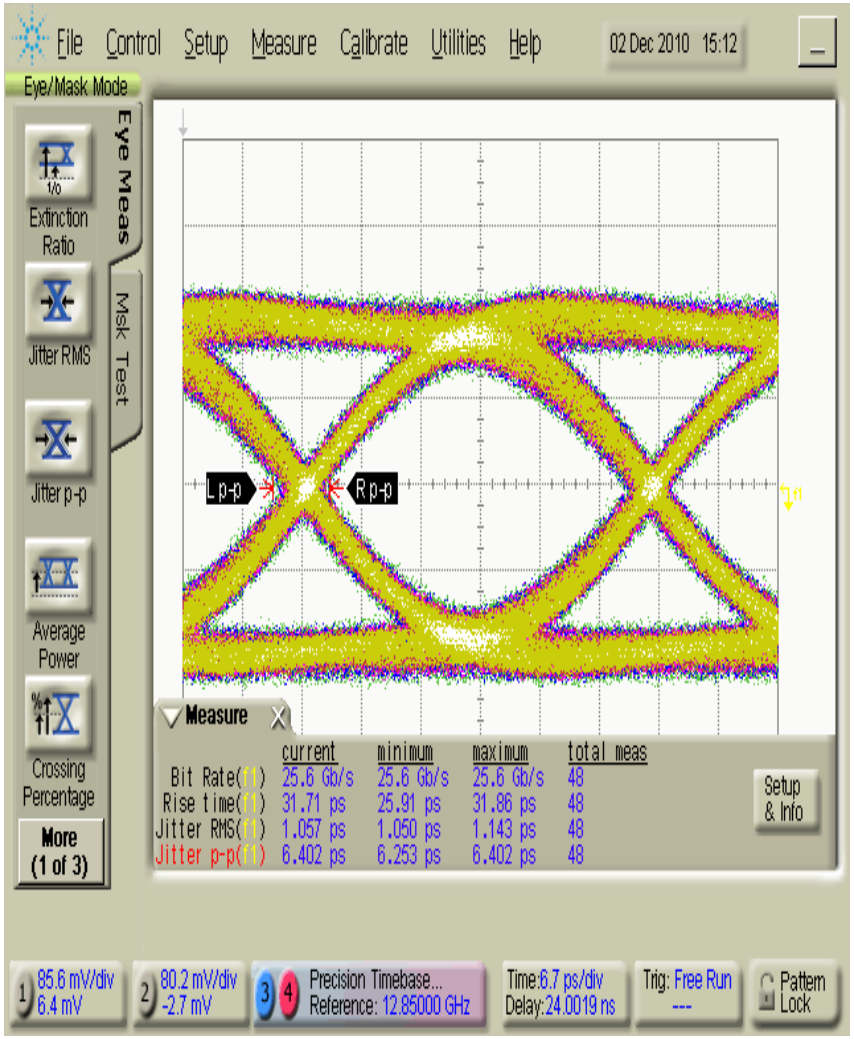
0.000	2.938E-11	0.286



Summary

- **Currently for 100 GbE there is no SFP+ like module available that offers high density, lower power, reasonable cost, and supports full PMD set**
  - The immediate BW need could be addressed with CFP4/QSFP2 unretimed module
  - Longer terms ~5 years pluggable optics may not even be able to address the switch/ASIC BW growth and embedded optics may need to be considered
- **cPPI-4 is the key to enabling next generation higher density CFP4/ QSFP2 modules with lower power, lower cost, higher density**
  - The channel and connectors based on Quattro II and zQSFP are suitable for 25G unretimed operation
  - The SerDes performance can be scaled to 25G for unretimed operation
  - LR4/ER4 25G optical parameters already defined in IEEE 802.3 CL88 will bring additional burden to unretimed interface
  - 802.3 100GCU project will define the CR4 based on linear port variant where EDC and FEC will be available on the host board
  - Scaling SR optics to 25G unretimed is challenging but availability of EDC/FEC in the tool box should address some of these challenges.

Thank You