Considerations for HSSG Cu cable assembly interconnect specifications

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Presentation objectives

- Considerations for 802.3ba Cu cable assembly interconnect specifications

Contributors

- Galen Fromm, Jim McGrath - Molex
- Jens Aumann, Leoni High Speed Cables

Supporters

- Dan Dove, ProCurve Networking by HP

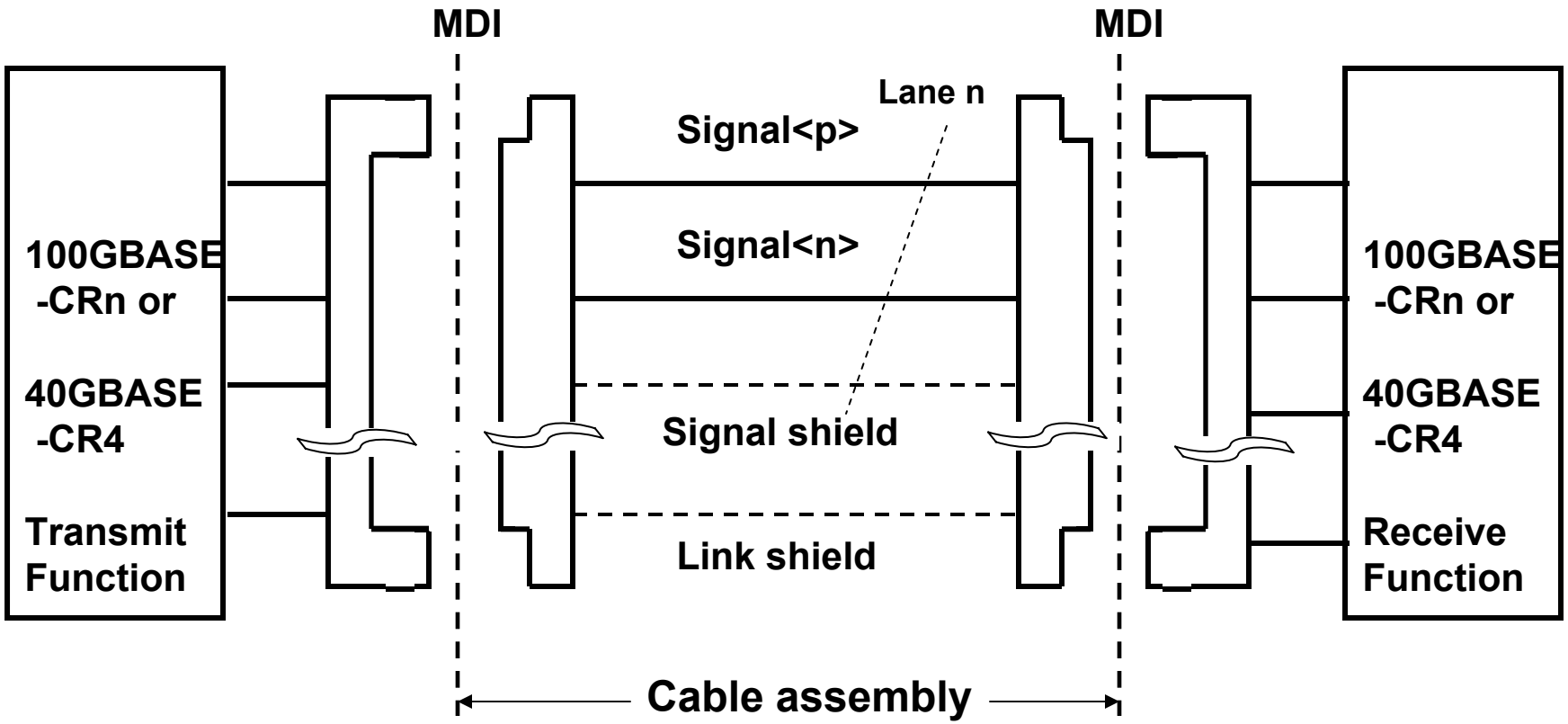
HSSG Objectives

- Support full-duplex operation only
- Preserve the 802.3 / Ethernet frame format utilizing the 802.3 MAC
- Preserve minimum and maximum FrameSize of current 802.3 standard
- Support a BER better than or equal to 10^{-12} at the MAC/PLS service interface
- Provide appropriate support for OTN

- Support a MAC data rate of 40 Gb/s
- Provide Physical Layer specifications which support 40 Gb/s operation over:
  - at least 100m on OM3 MMF
  - at least 10m over a copper cable assembly
  - at least 1m over a backplane

- Support a MAC data rate of 100 Gb/s
- Provide Physical Layer specifications which support 100 Gb/s operation over:
  - at least 40km on SMF
  - at least 10km on SMF
  - at least 100m on OM3 MMF
  - at least 10m over a copper cable assembly

100GBASE-CRn and 40GBASE-CR4 link



Cu cable assembly: considerations for 40 Gb/s

- Evaluate usage of 10GBASE-KR (Clause 72) and 10GBASE-CX4 to specify 40GBASE-CR4
  - For commonality with 40 Gb/s backplane proposal:
    - 64b/66b PCS
    - Signaling speed 10.3125 Gbd (per lane)
    - Optional FEC sublayer (TBD)
- Evaluate usage CX4 for commonality with twinaxial cable assembly usage and specifications (plug-and-play over all specified distances)
    - S-parameters (+ additional parameters i.e., group delay, etc..)
- QSFP MSA – 10 Gb/s lane operation demonstrated up to 10 meters of twinaxial cable
- Group delay differences between backplane and twinaxial cable assemblies (64b/66b spectra versus 8b/10b)

Copper cable assembly: PHY lane options discussed

- Support a MAC data rate of 100 Gb/s
- Provide Physical Layer specifications which support 100 Gb/s operation over:
  - at least 10m over a copper cable assembly
  - 10 x 10 Gb/s lane
  - 4 x 25 Gb/s lane (TBD)
  - 5 x 20 Gb/s lane (TBD)

- Support a MAC data rate of 40 Gb/s
- Provide Physical Layer specifications which support 40 Gb/s operation over:
  - at least 10m over a copper cable assembly
  - 4 x 10 Gb/s lane

Cu cable assembly: considerations for 100 Gb/s

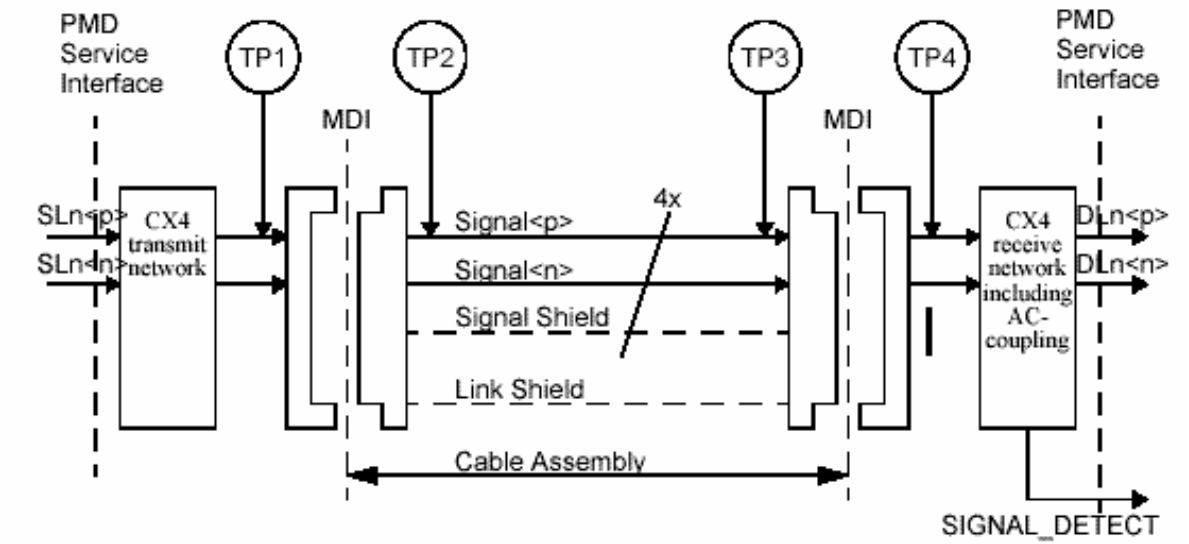
- Commonality with 10 x 10 Gb/s lane option and 4 x 10 Gb/s lane option

- Commonality with SMF and MMF lane options
  - 4 x 25 Gb/s
  - 5 x 20 Gb/s

S-parameter interconnect specifications

- S-parameters are sufficient to specify interconnect-induced signal impairments e.g.,
- Measured:
  - -Insertion loss
  - -Return loss
  - -Crosstalk
    - -NEXT
    - -FEXT
- Computed:
  - -PSNEXT
  - -PSELFEXT
- Limits:
  - -Measurement based
  - -InfiniBand

10GBASE-CX4 Cable assembly



For 10GBASE-CX4 - All cable assembly measurements are to be made between TP1 and TP4 as shown in the Figure illustrated above.

802.3ap Channel Parameters

- **Channel measurement reference: TP1 to TP4.**

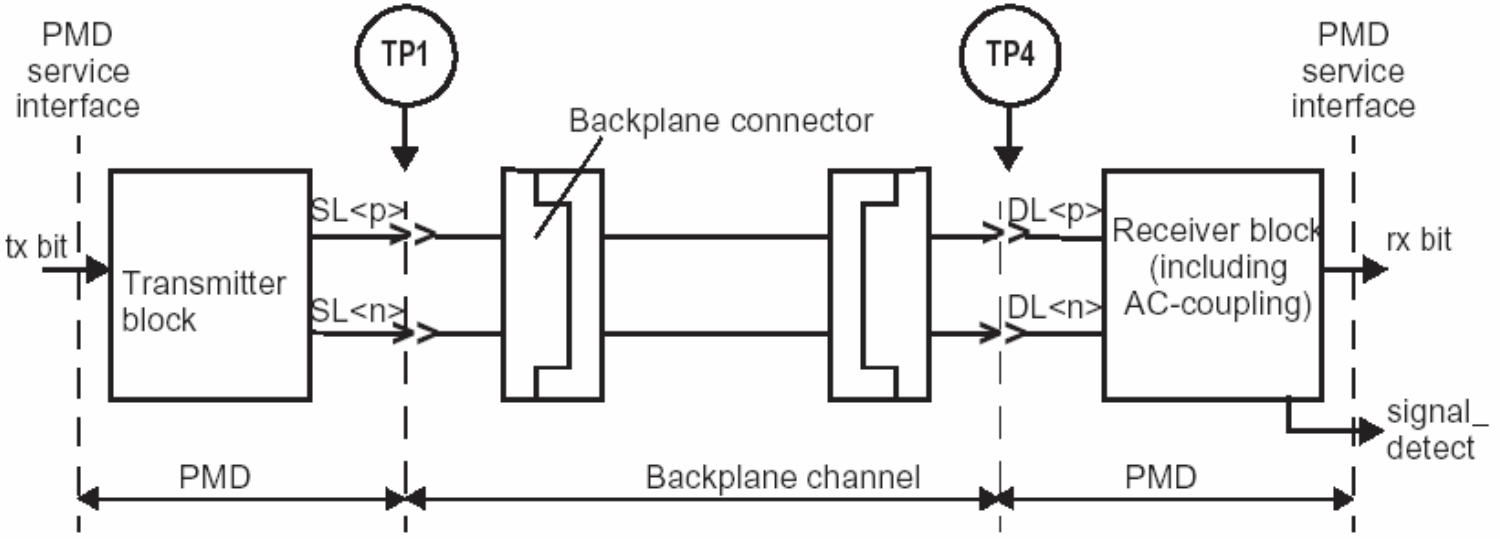


Figure 70–1—Link block diagram

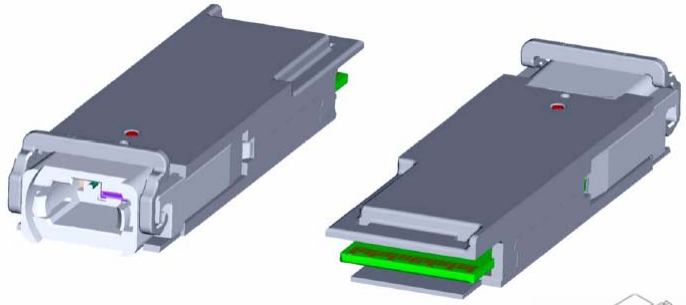
- **Measured**
  - **Insertion Loss**
  - **NEXT**
  - **FEXT**
  - **Return Loss**
- **Computed**
  - **Insertion loss deviation**
  - **Insertion loss to crosstalk ratio**
  - **PSNEXT, PSFEXT, PSXT**
- **Limits**
  - **To support existing platforms (ATCA)**

Cable board connector – QSFP - 38 ckt

- Infiniband Copper

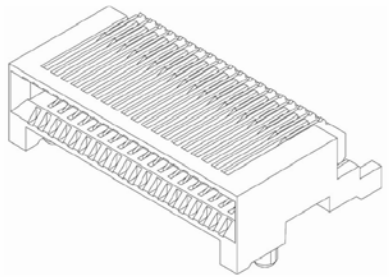
- Annex A5: Pluggable Interfaces: CATx, Copper and Optical
  - -Pluggable QSFP FOR 4x, 8x and 12x
  - -Multiple 4x QSFP pluggables used for 8x or 12x links

QSFP Module



SFF-8436

QSFP Connector: 38-contact,
right angle surface mount connector

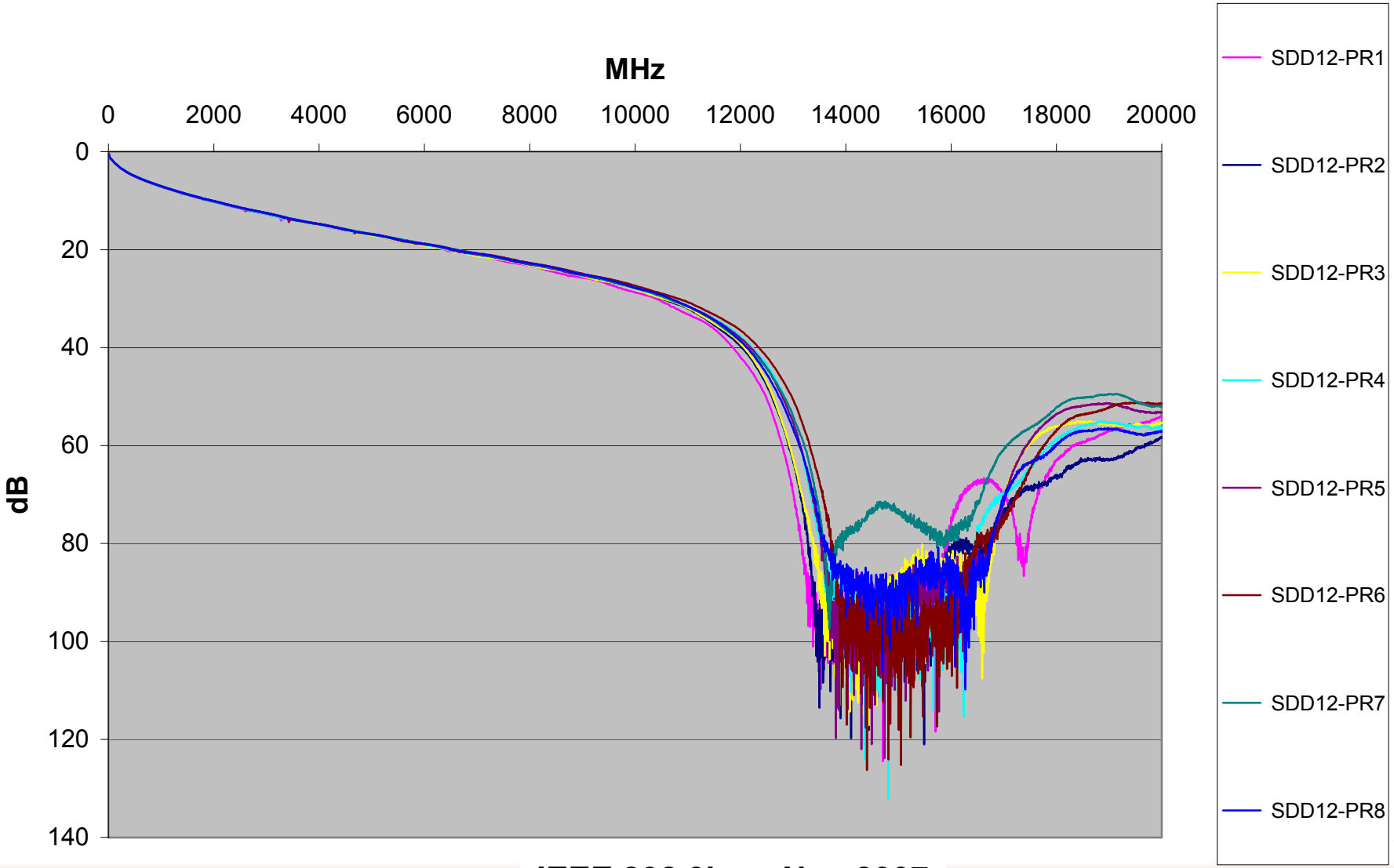


32 - QSFP Ports
1U rack space

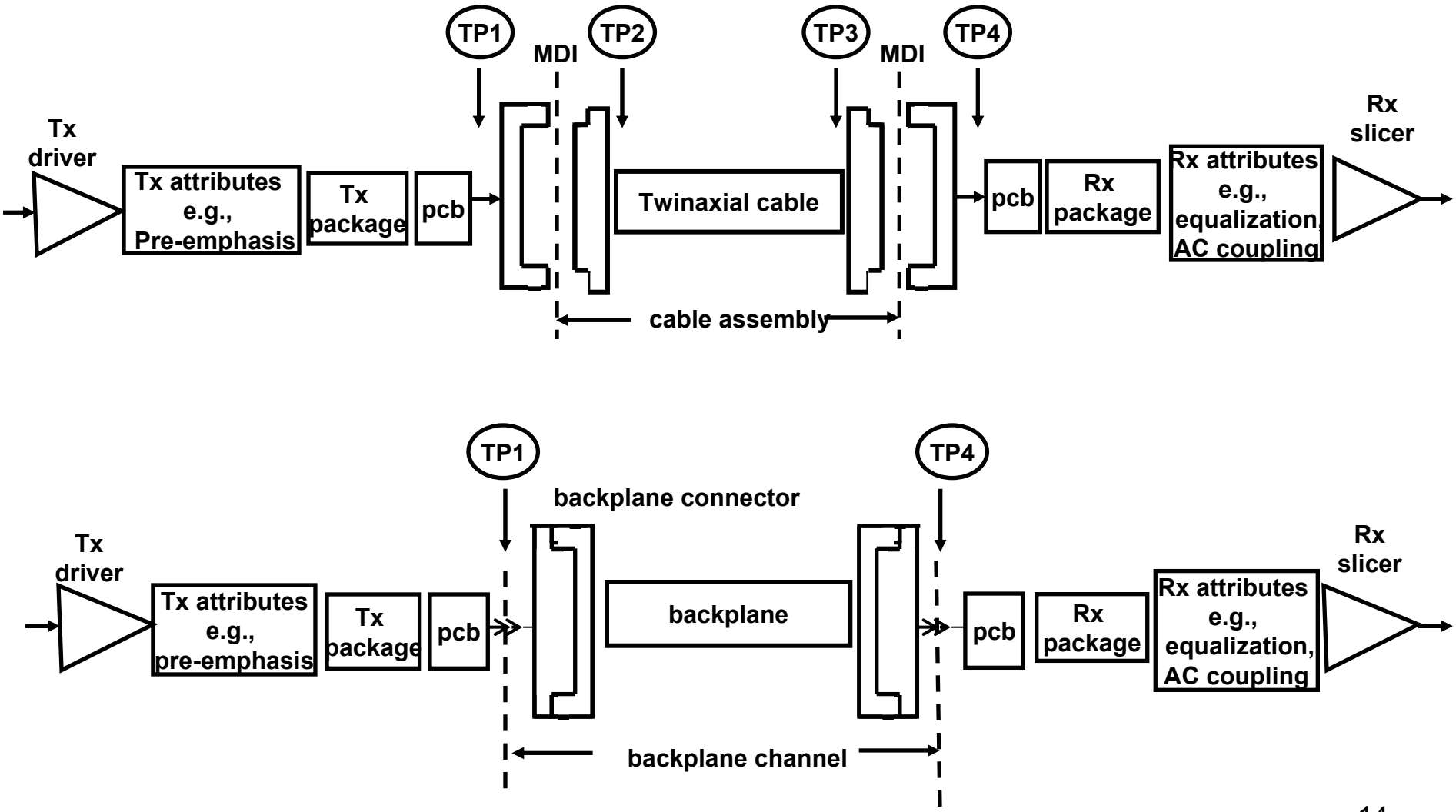
Source: Molex

Cable – 24 AWG twinaxial

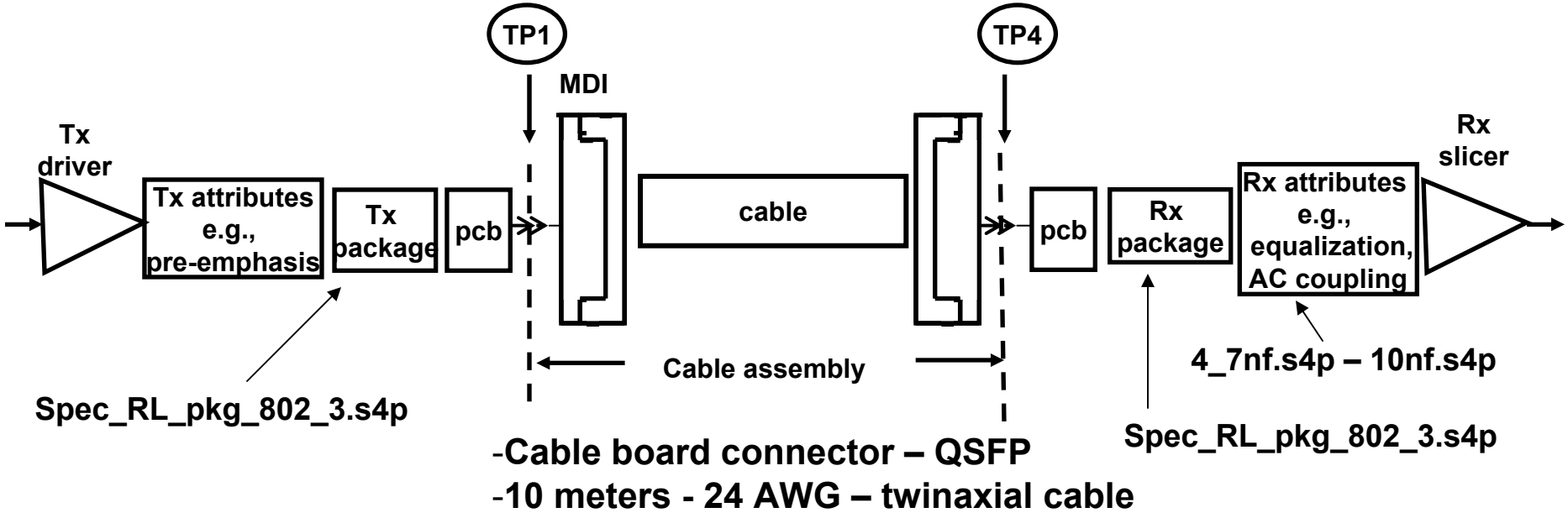
Insertion Loss-10 m-24 AWG



Simulation modeling and test points



Cu cable assembly channel model

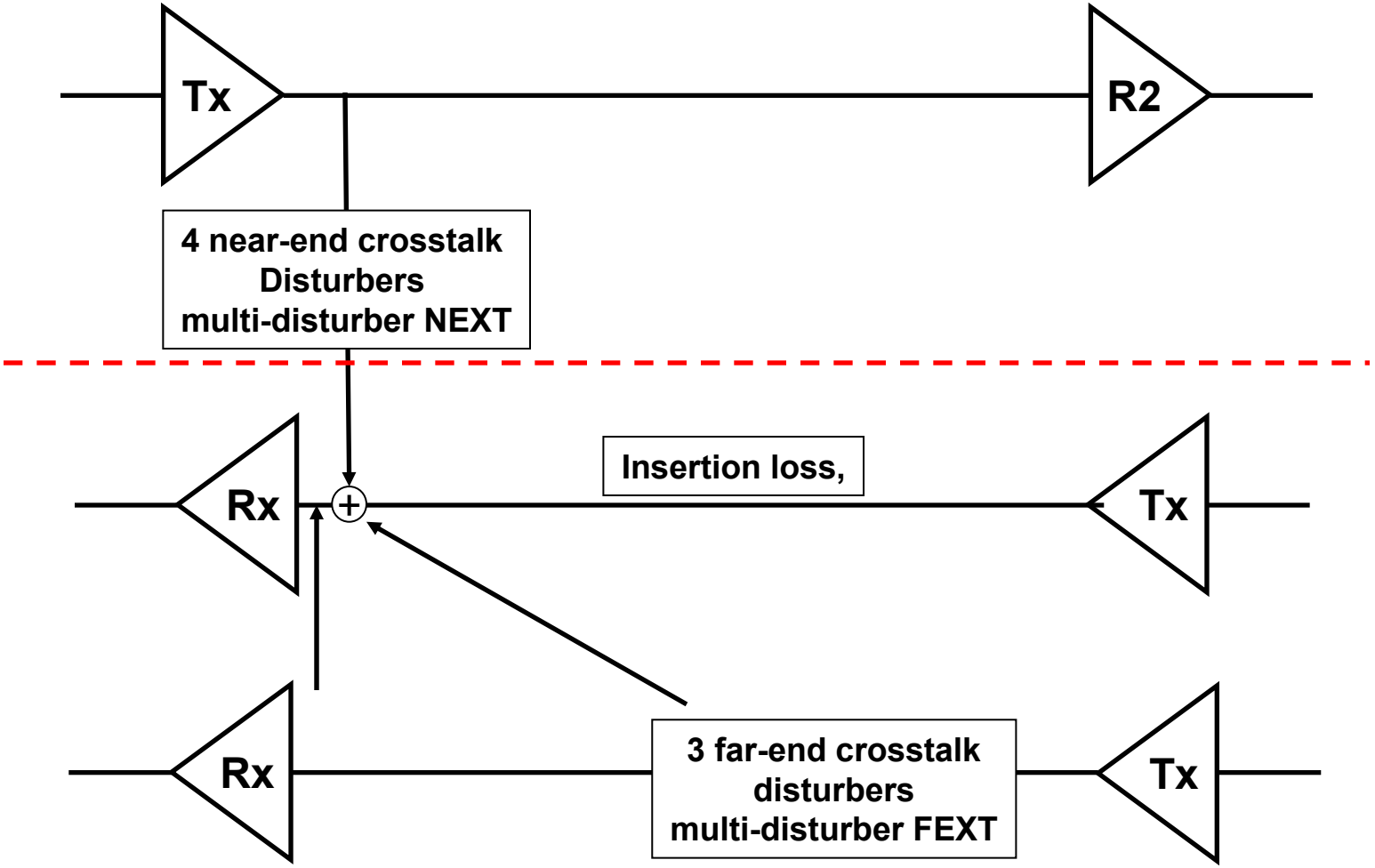


http://www.ieee802.org/3/ap/public/channel_model/index.html#Package%20Models

Worst-case Package Model (*.zip) Richard Mellitz Spec_RL_pkg_802_3.s4p

802.3ap – Channel parameters

- Insertion loss to crosstalk ratio (ICR) computed from S-parameter models and (measurements)



Summary

- **Channel models and simulation models in development to evaluate usage of 10GBASE-KR (Clause 72) for 10 Gb/s lane options.**

- **QSFP cable connector and 10 meters of twinaxial cable considered for 40GBASE-CR4 cable assembly.**