10GBASE-CX4

Physical Layer Specifications

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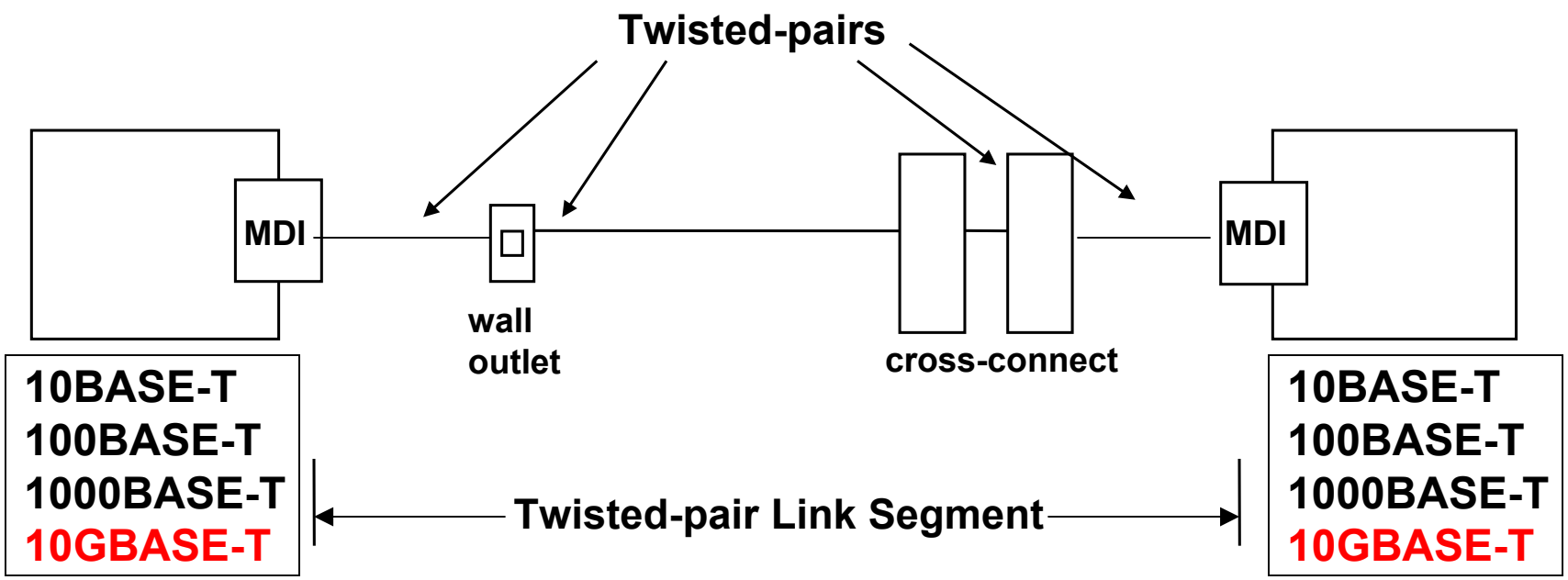
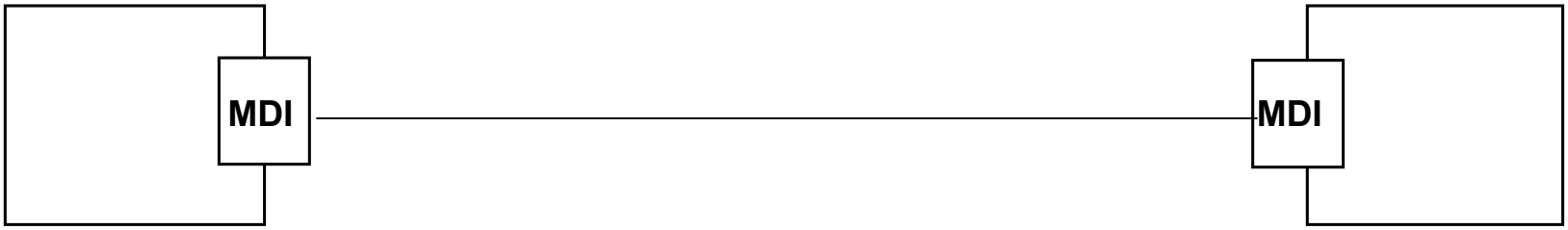
Twisted-pair Link Segment



CX4 Link Segment



- The term ‘link segment’ refers to eight channels with four receive channels and four transmit channels.

- Specifications for a link segment apply equally to each of the eight channels.

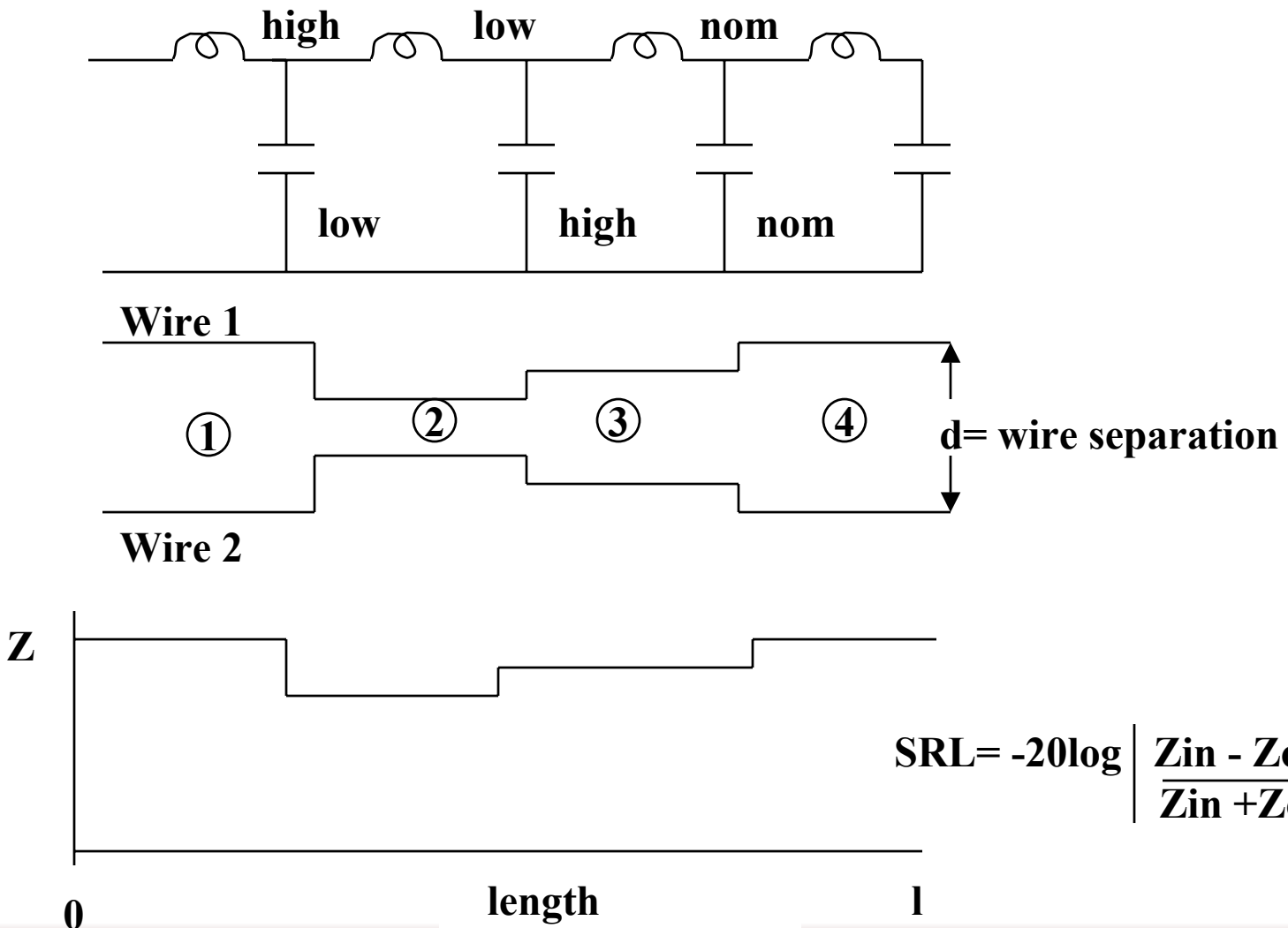
Channel Return Loss

- **Channel return loss includes:**

– **Macro Structures** - Impedance mismatches between cables and connecting hardware. Peak losses are related to the magnitude and phase of the mismatches (distance between connectors and lengths of cable).

– **Micro Structures** - Cable impedance roughness referred to as a structural return loss. Often modeled as a random sequence of peak-to-peak impedance variations centered about the nominal. Peak losses are related to the magnitude of the peak-to-peak random impedance variation and the length of the impedance variation. Peaks are observed at high frequency related to length of the random impedance.

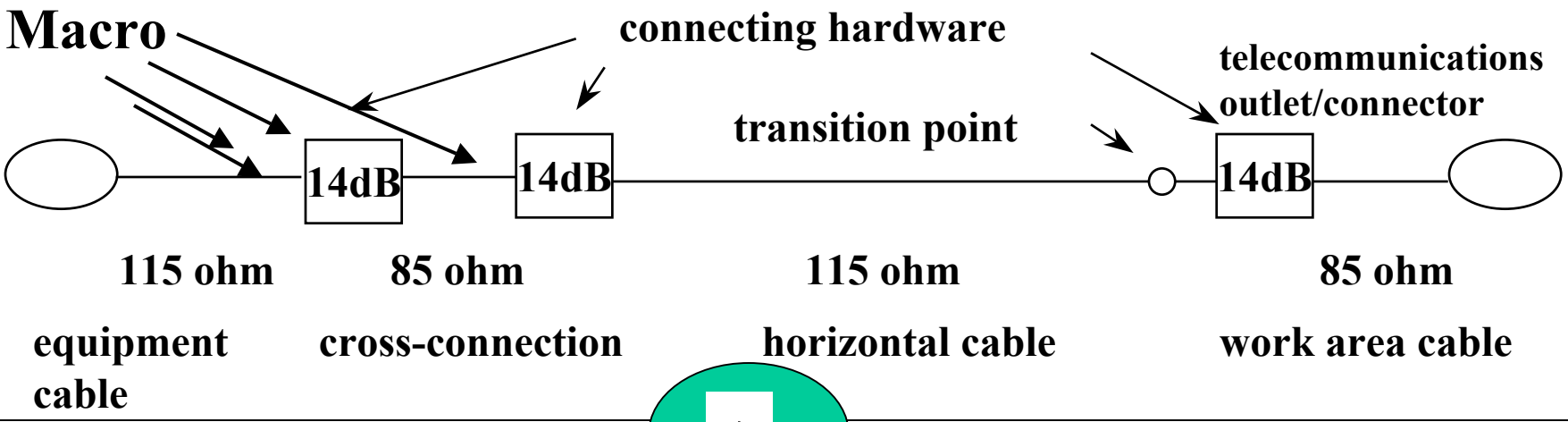
Structural Return Loss (SRL) - Structural Variation Associated With Impedance Variations Of A Cable[1]

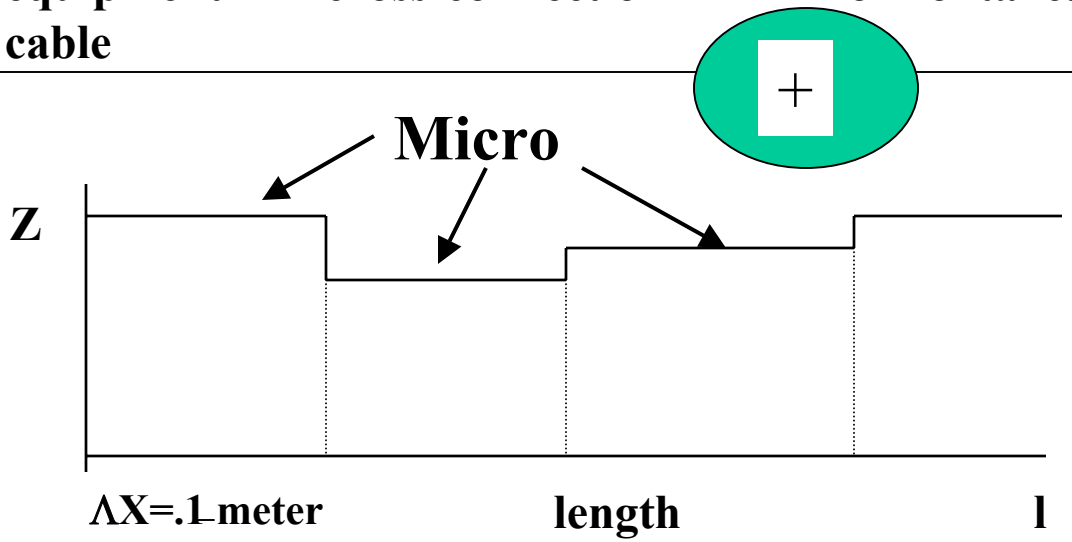


1 Relating The Structural Return Loss Of Cable Pairs To The Associated Attenuation Deviation And Delay Jitter - H.W. Frersen - 44th IWCS

1000BASE-T Return Loss - Cabling Impedance Mismatches and Structural Impedance Variations Of A Cable

TIA/EIA- 568-A Channel - Cross-connect Topology

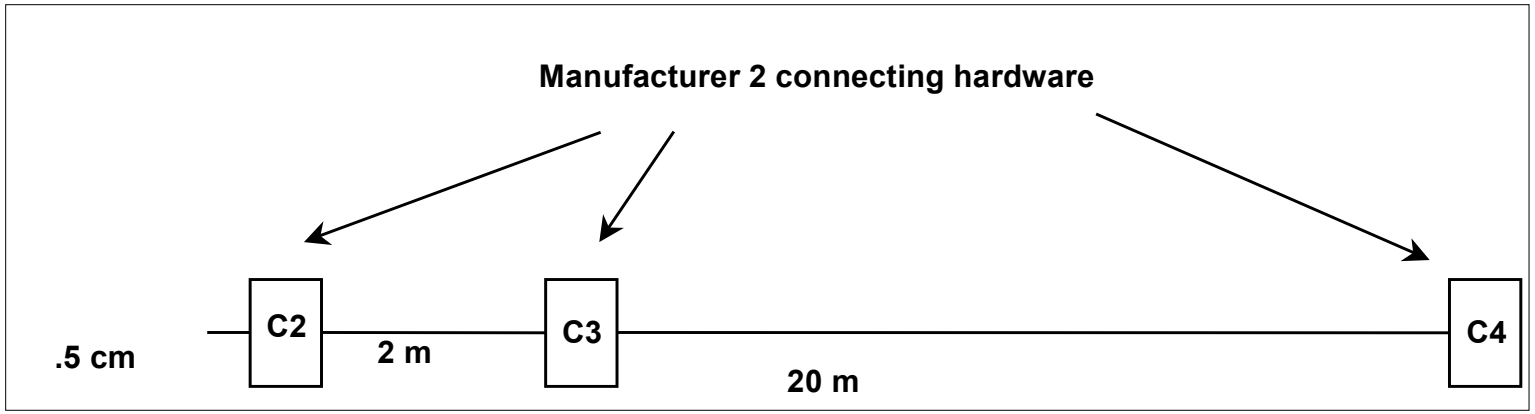




$$RL = -20\log \left| \frac{Zin - 100}{Zin + 100} \right|$$

$$SRL = -20\log \left| \frac{Zin - Zo}{Zin + Zo} \right|$$

1000BASE-T - Return Loss Test Configurations and Measurements



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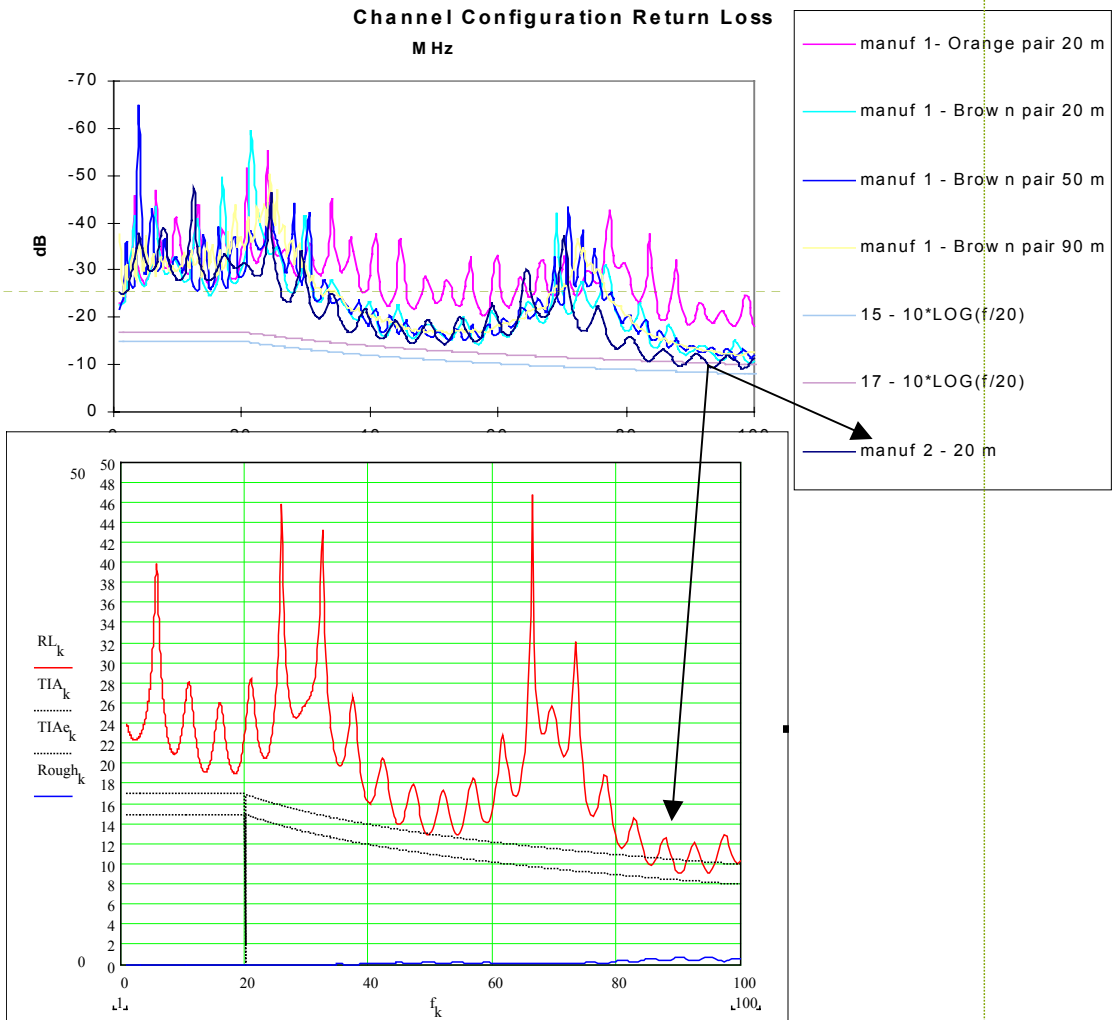
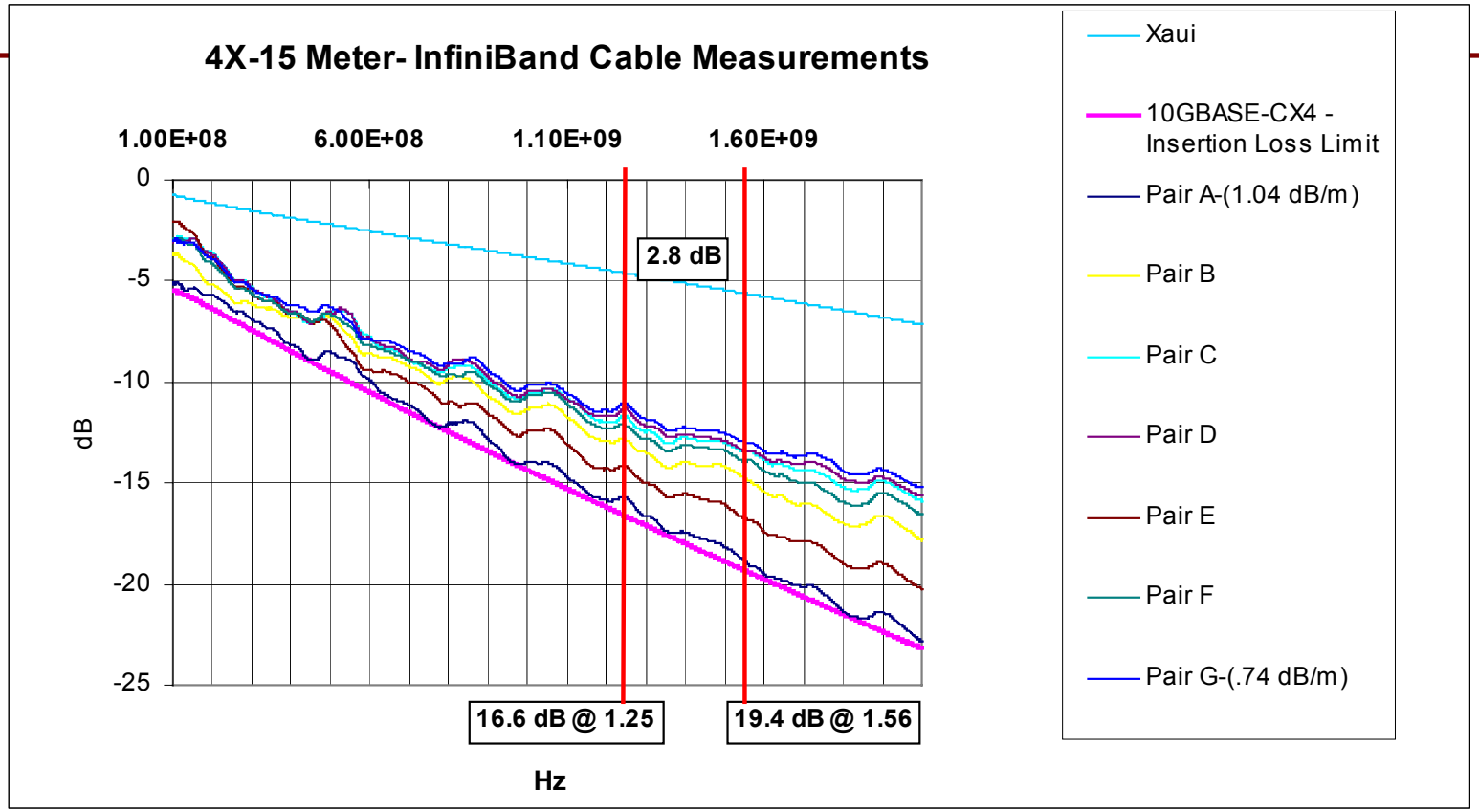


Modeling Methodology

- Model is as described in the IWCS paper using Matrix multiplication where each section is described by an [A,B,C,D] transmission matrix

- A normally distributed random variable was used to model impedance variations along the cable cord length

10GBASE-CX4 Compliance Channel



10GBASE-CX4- Compliance Channel Insertion loss:

The insertion loss of each pair of the CX4 cable assembly shall be:

$$InsertionLoss(f) \le (-2.25\times10^{-4}\cdot\sqrt{f}) + (-6.08\times10^{-9}\cdot f) + \left(\frac{-2.08\times10^{-4}}{\sqrt{f}}\right) - 0.5 \qquad \text{Eq. (54.3)}$$

Summary

- Modeling required to predict worst-case return loss and insertion loss deviation

- Modeling validated for 1000BASE-T can be applied to CX4 topologies