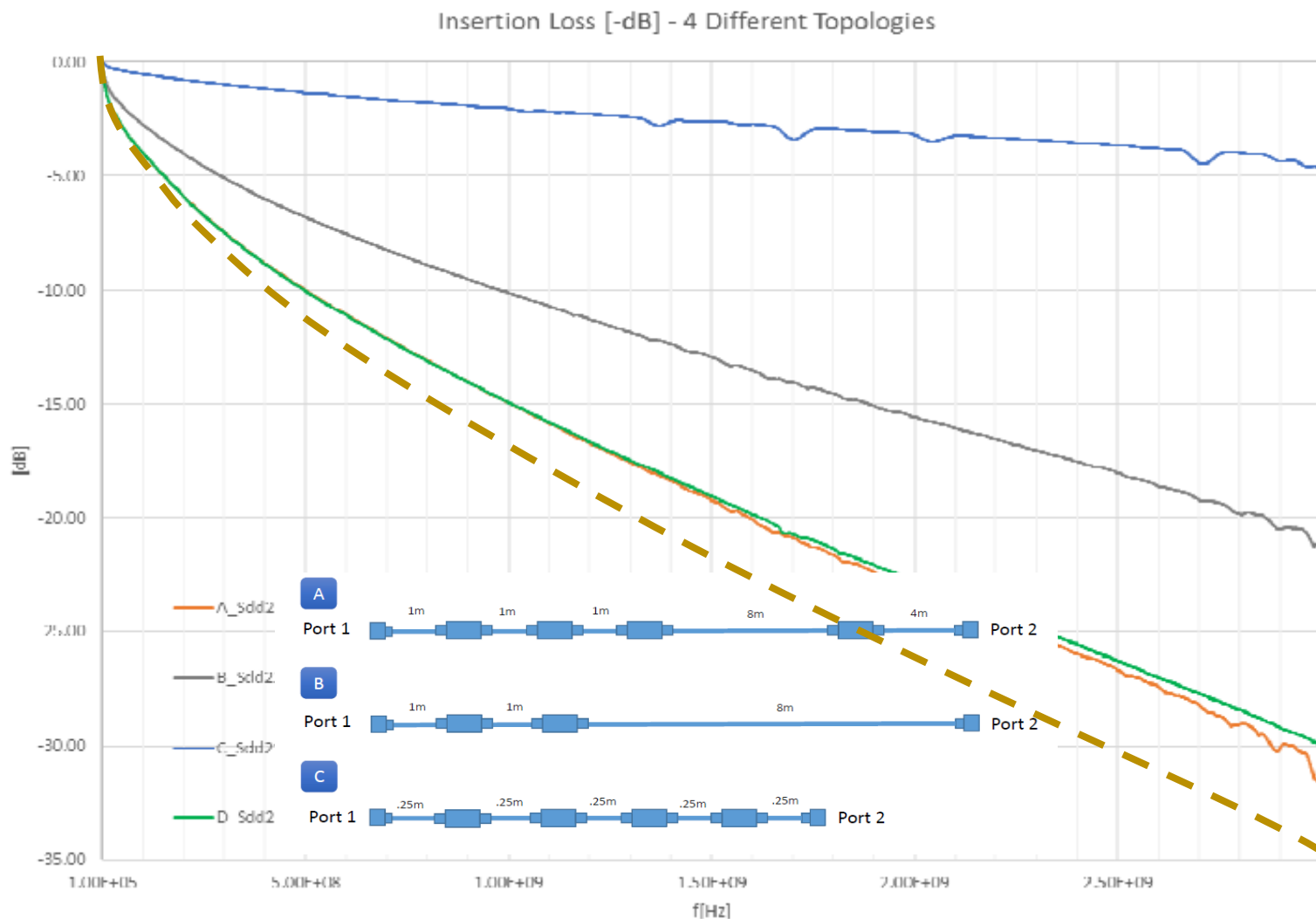
The background features a dark blue gradient with several concentric, glowing circular rings in shades of cyan and light blue. A large, stylized, light blue arrow points from the bottom left towards the center. The overall aesthetic is technical and futuristic.

Channel Requirements for Optimum/Robust PHY Design 10GBASE-T1

Ramin Farjadrad
Aquantia Corp.

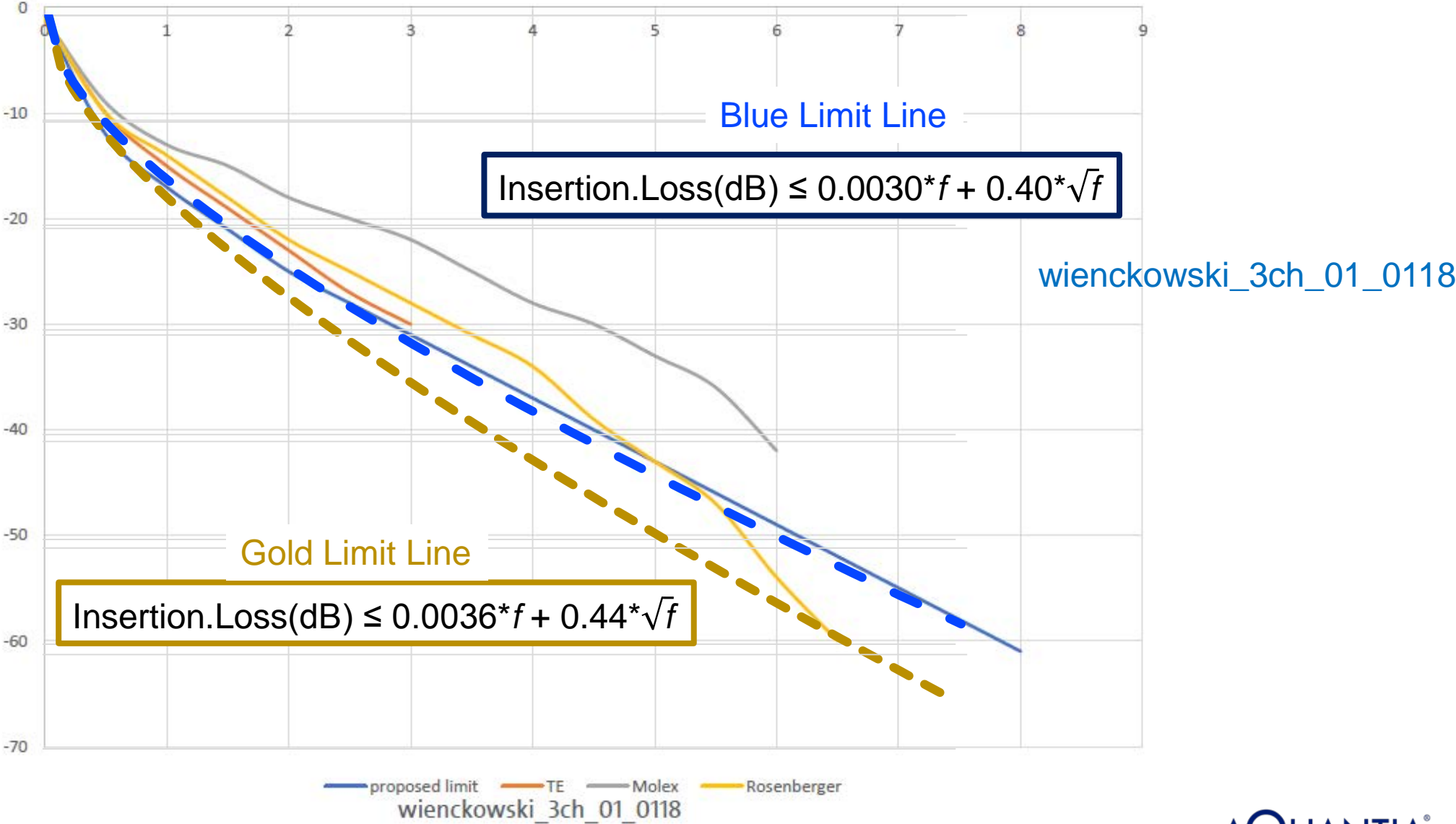
Group 10G: Insertion Loss



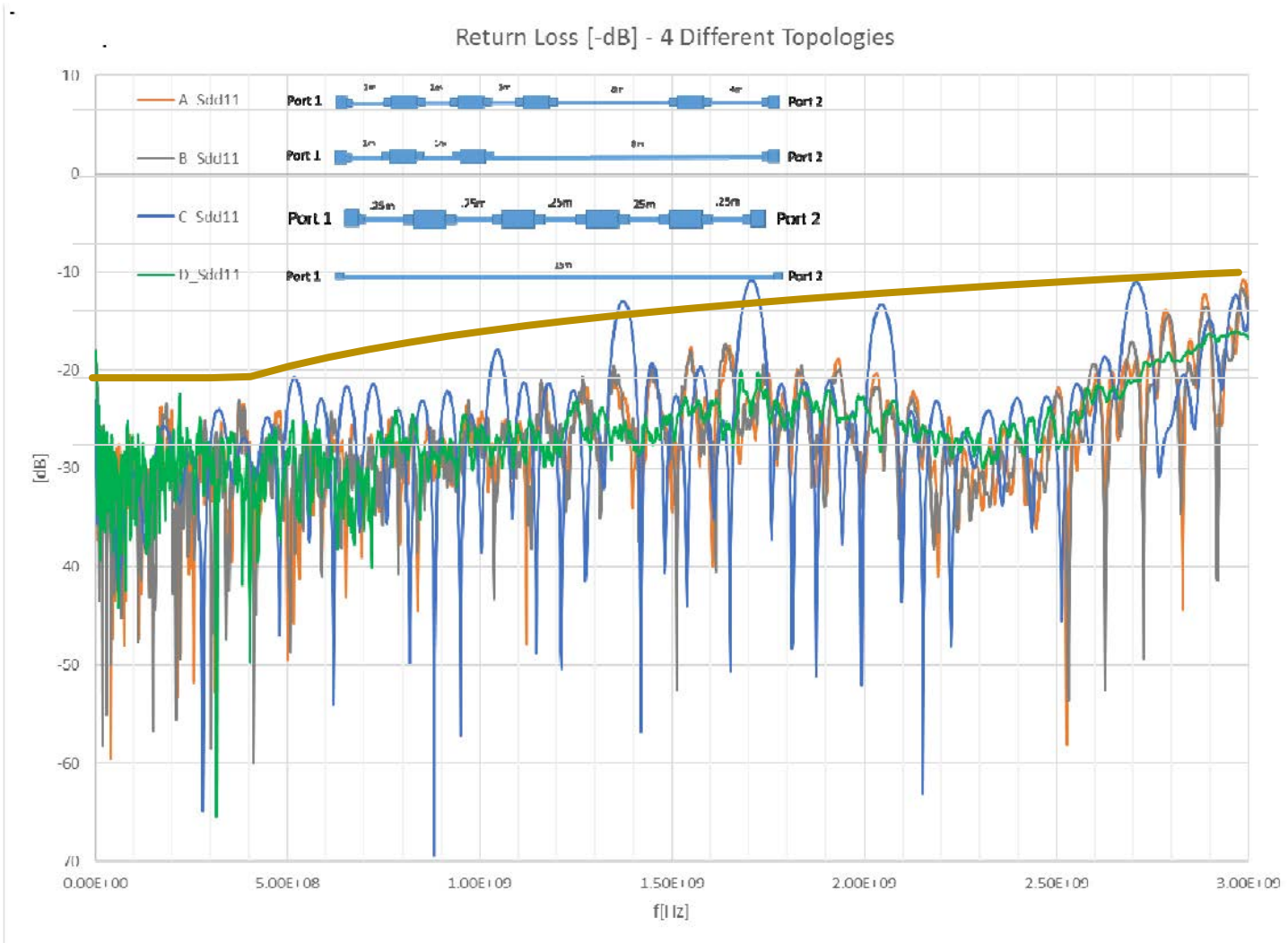
- DiBiaso Channel A: Worst-case target STP proposed at Sept. 2017 IEEE 802.3ch Standards meeting
 - 15m STP + 4 inline Connectors
 - Cross Section=0.09mm² (28AWG)
 - Certified up to 3GHz
 - Potential 20% degradation at 105C
 - Highly preferred for
 - Low Costs
 - Availability
 - Maturity

Bergner & DiBiaso, IEEE Sept. 11 2017 (DiBiaso_3ch_01a_0917)

Group 10G: Insertion Loss Limit Line

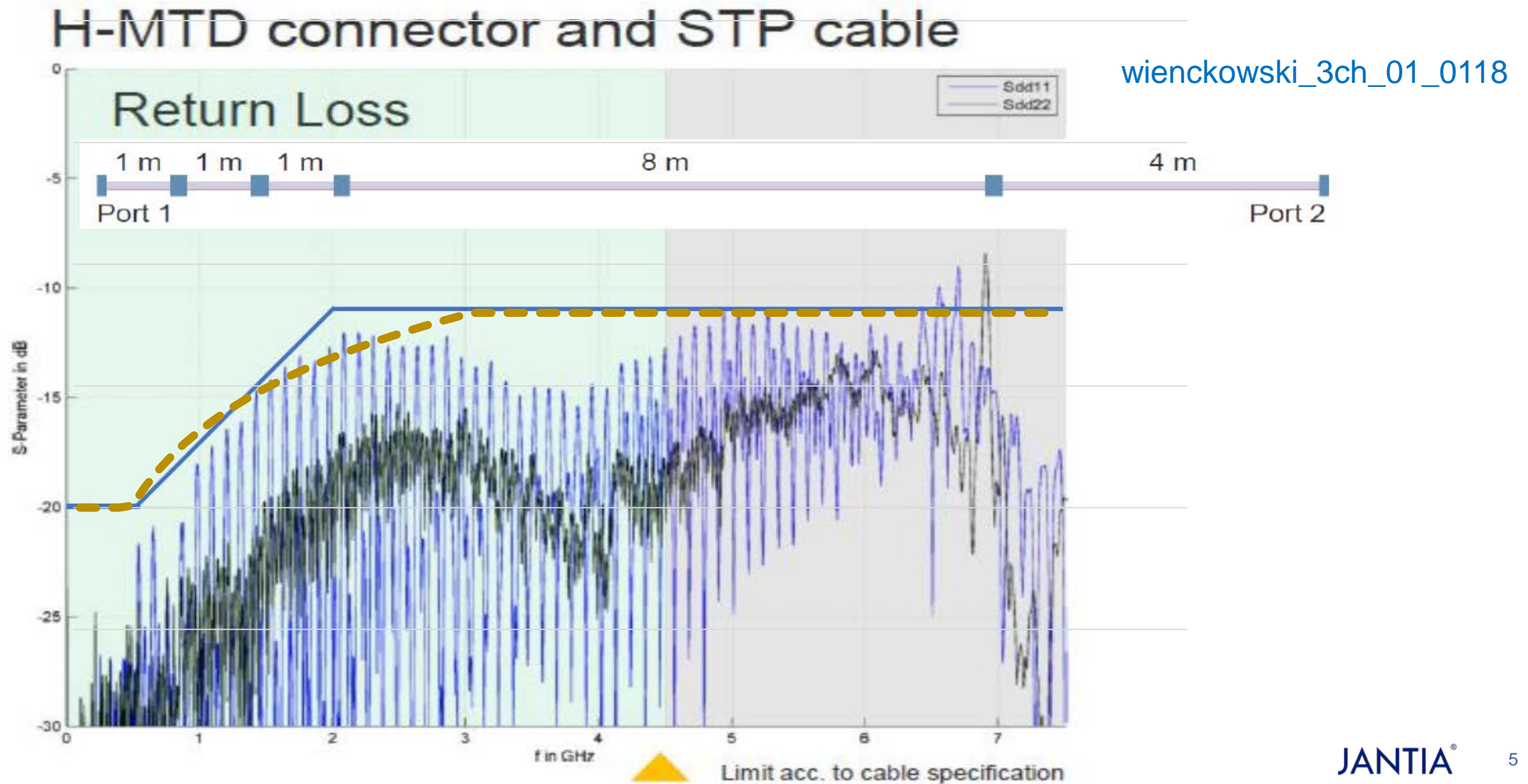


Group 10G: Return Loss (HMD Connectors)



- DiBiaso cable assembly combinations used as an initial reference for cable and connectors for Return Loss as well
- Channel C with 4 inline connectors but very short reach (~1.25m) shows as an outlier that can be ignored
 - Short cables with same impedance mismatches always demonstrate worse return loss because lower IL reduces the RL as well
 - Higher RL for short cables are non issues, as link SNR is already high

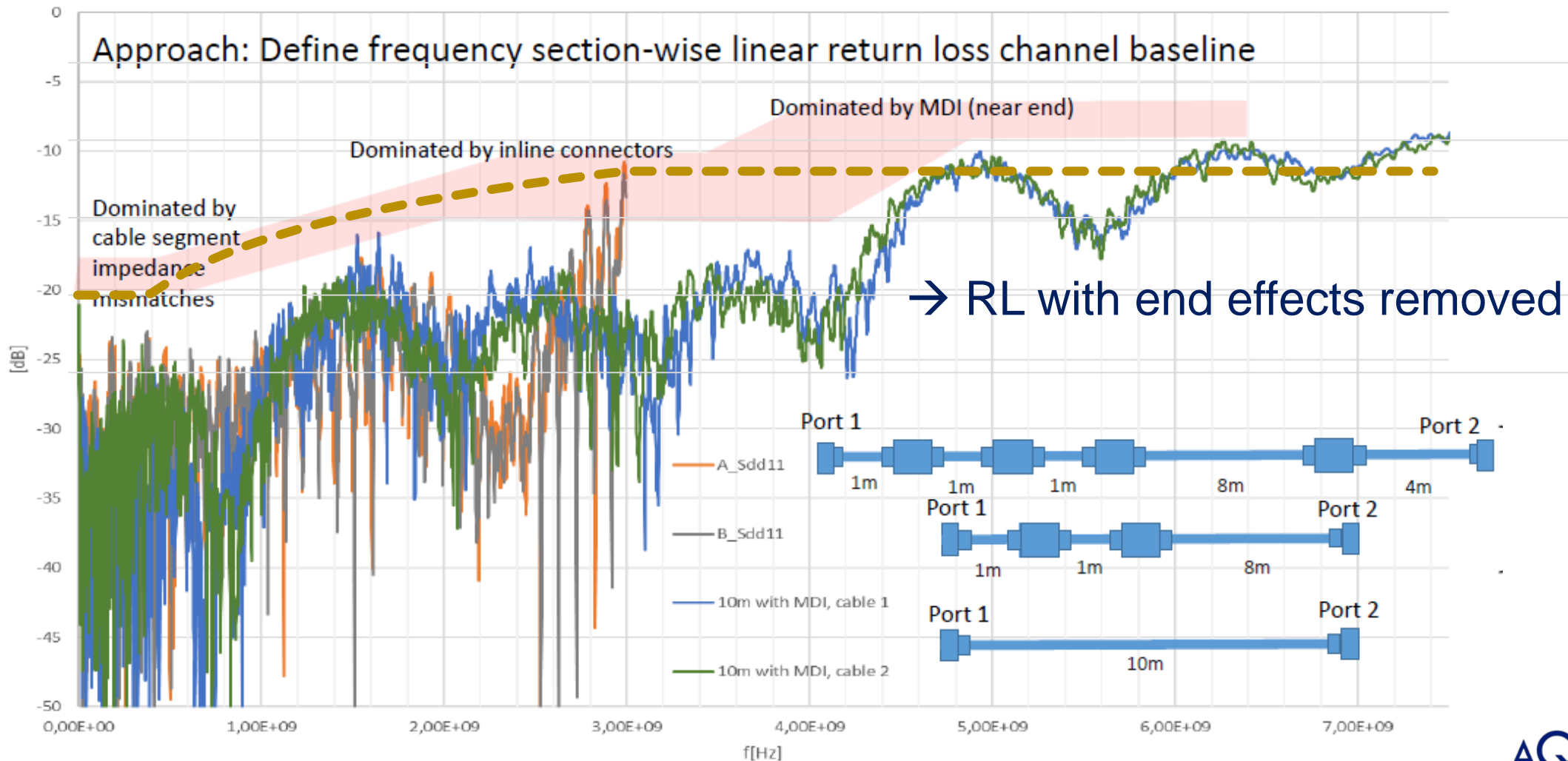
Group 10G: Return Loss (H-MTD Connectors)



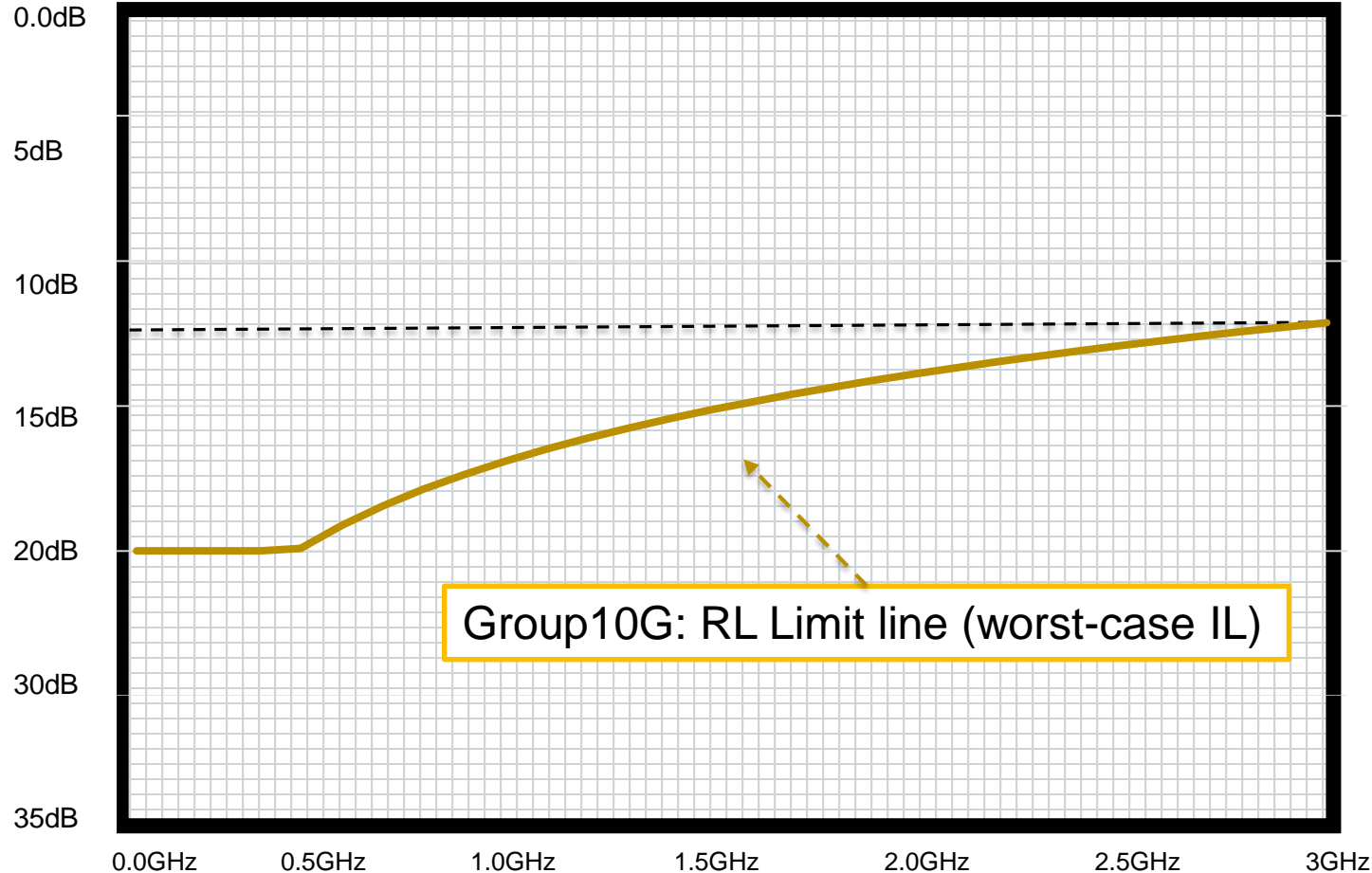
Group 10G: Return Loss (HMD Connectors)

Return Loss [-dB] - 3 Topologies

Bergner_DiBiasco_3ch_01b_0118



Group 10G: Return Loss Limit Line



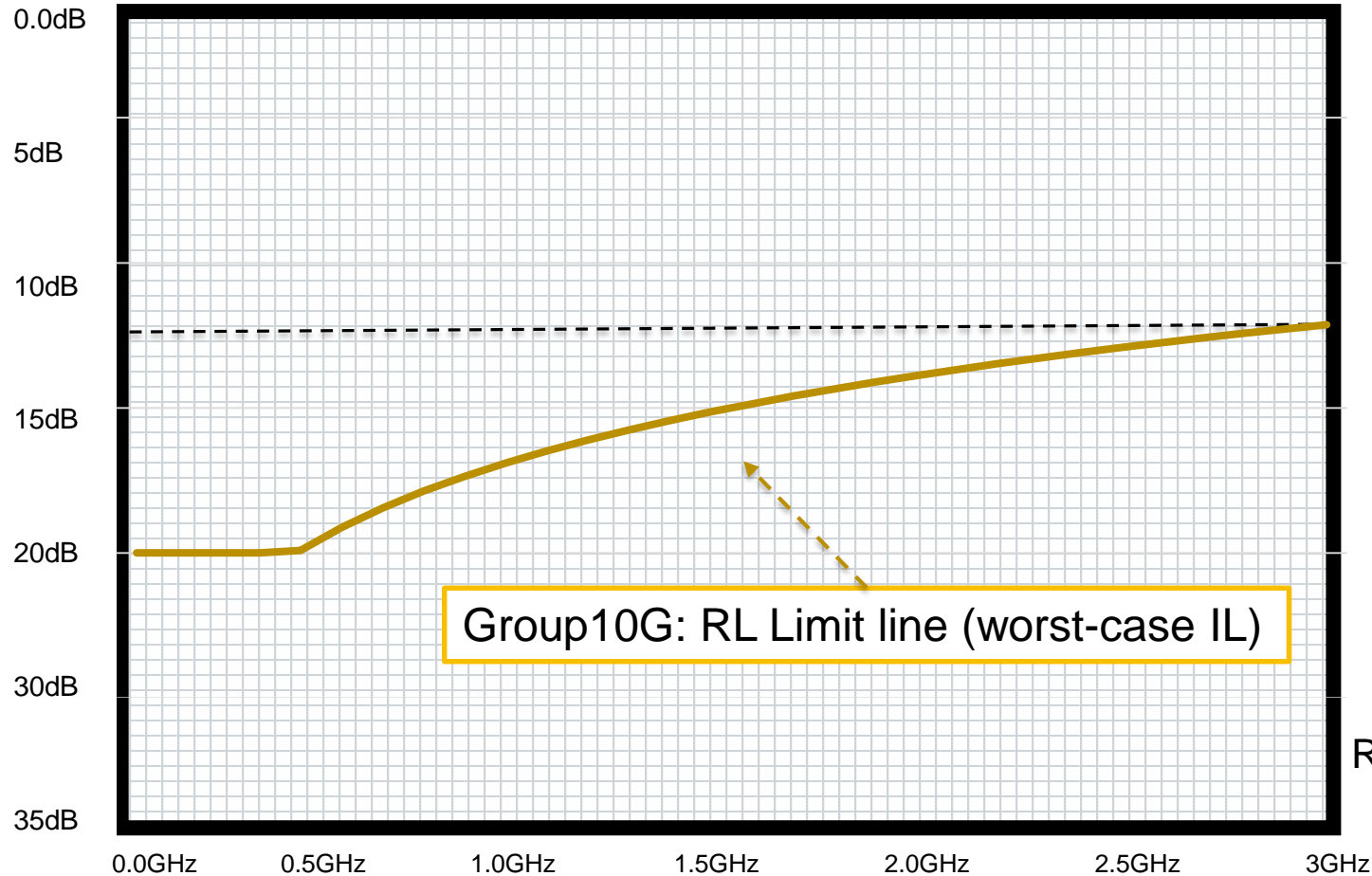
- To limit the reflected signals power due to the channel impedance mismatches, the cable assembly must meet the following return loss spec

- For cable with worst-case IL (limit line)

$$\text{Return.Loss(dB)} \leq \begin{cases} 20\text{dB} & 10 \leq f < 500 \\ 46.9 - 10\log(f) & 500 \leq f < 3000 \\ 12\text{dB} & 3000 \leq f < ?? \end{cases} \quad (f \text{ in MHz})$$

- We should better define RL limit line above 3GHz once we pick an optimum modulation for 10GBASE-T1 that determines the signaling bandwidth, otherwise we'll be setting unnecessary RL requirement on the cable

Group 10G: Return Loss Limit Line



- To limit the reflected signals power due to the channel impedance mismatches, the cable assembly must meet the following return loss spec

- For cable with worst-case IL (limit line)

$$\text{Return.Loss(dB)} \leq \begin{cases} 20\text{dB} & 10 \leq f < 500 \\ 46.9 - 10\log(f) & 500 \leq f < 3000 \\ 12\text{dB} & 3000 \leq f < ?? \end{cases}$$

(f in MHz)

- RL as function of cable IL@3GHz

$$\text{Return.Loss(dB)} \leq \begin{cases} 13 + 0.2 \cdot \text{IL}_{3\text{G}} & 10 \leq f < 500 \\ 39.9 + 0.2 \cdot \text{IL}_{3\text{G}} - 10\log(f) & 500 \leq f < 3000 \\ 5 + 0.2 \cdot \text{IL}_{3\text{G}} & 3000 \leq f < ? \end{cases}$$

(IL_{max} in dB)



Thank You