

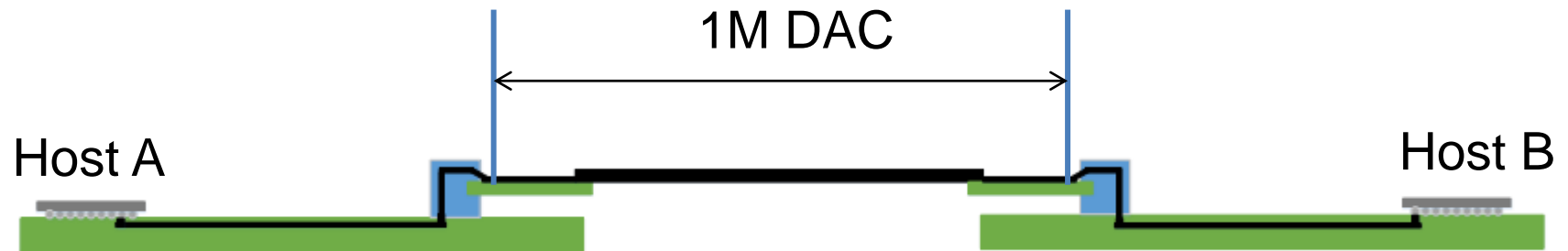
A 224 Gbps-PAM4 1 Meter DAC Long Reach Channel and Its Characteristics: Design A

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Background and Introduction (I)

- An important use case of 224 Gbps-PAM4 is the cable reach (CR) with a 1 Meter DAC.

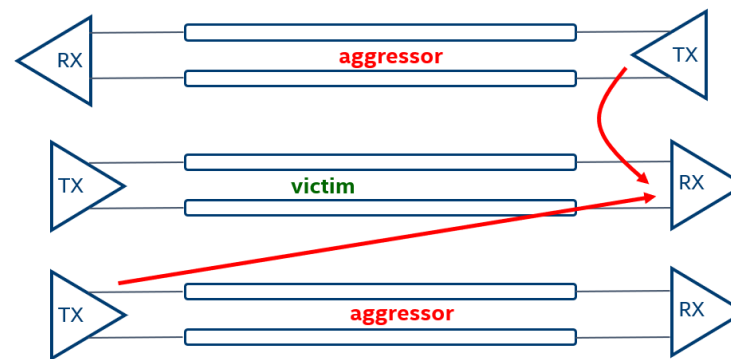
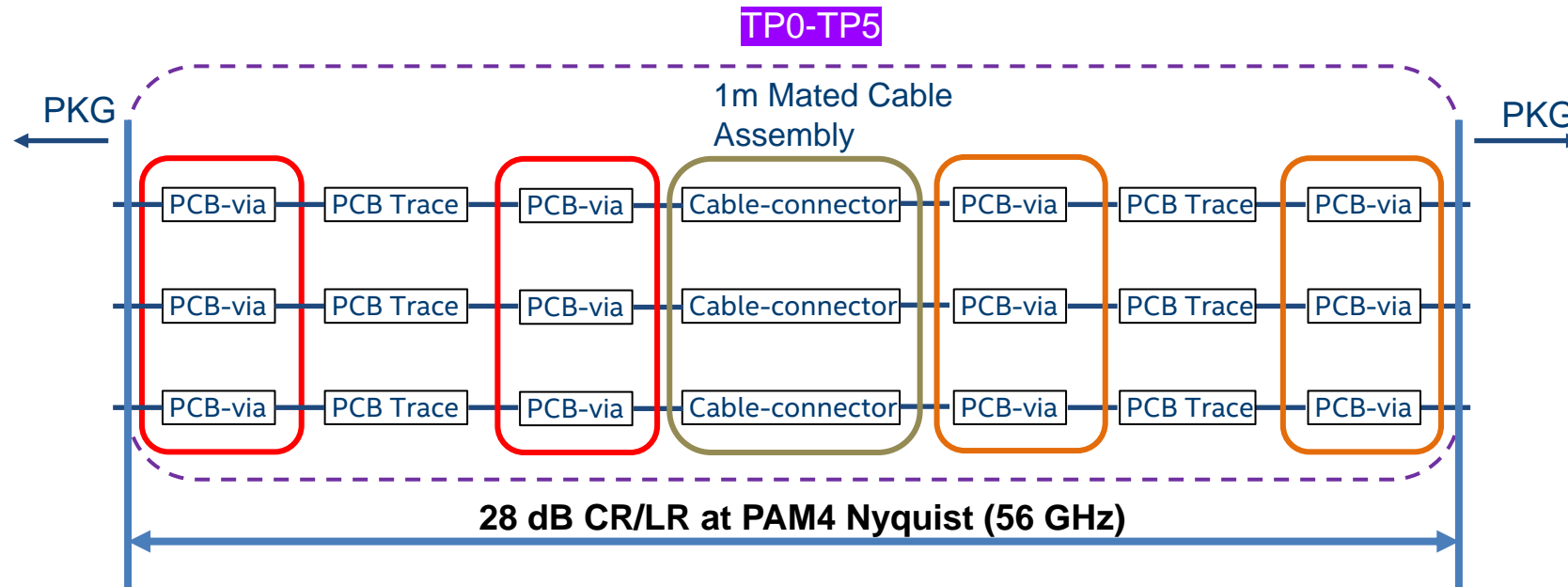


- The channel loss budget between the host bump-to-bump (or TP0d-TP5d) is determined/bounded by the SERDES technology and capability, which is trending ≤ 40 dB, for 224 Gbps-PAM4 signaling.

Background and Introduction (II)

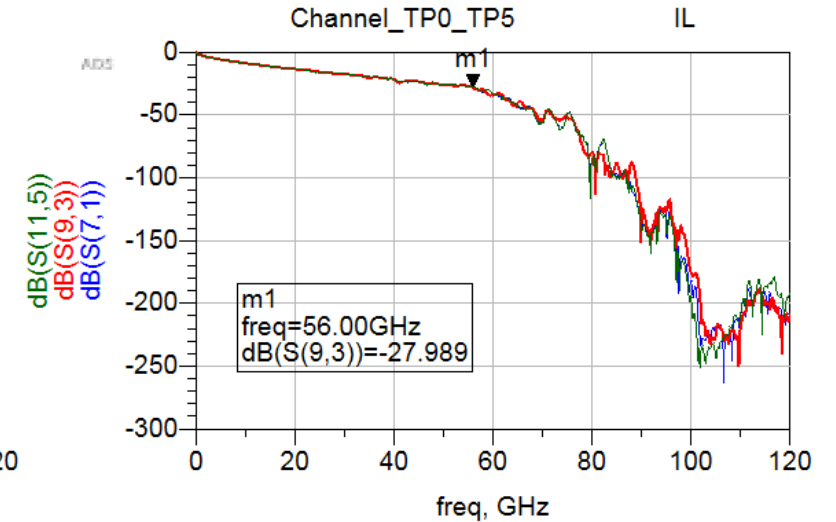
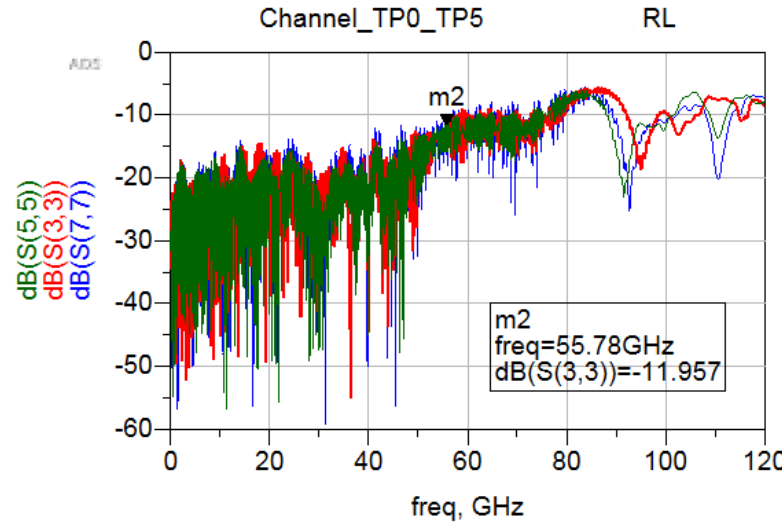
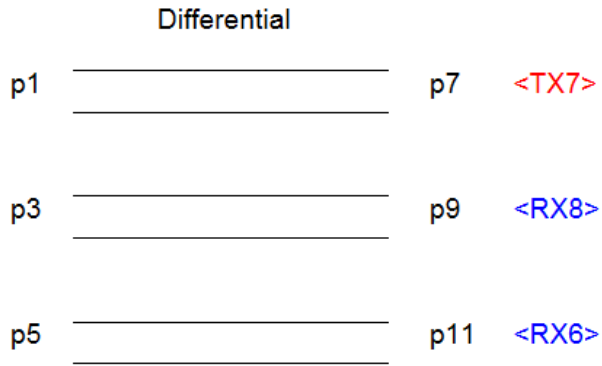
- We leveraged our established/validated CR channel design tool-flow-methodology (TFM) (e.g., oif2022.066.00) and the latest connector and DAC technologies to create this CR ball-to-ball channel Design A to support 1 Meter DAC with 224Gbps-PAM4 signaling.

224 Gbps-PAM4 CR Channel Structure



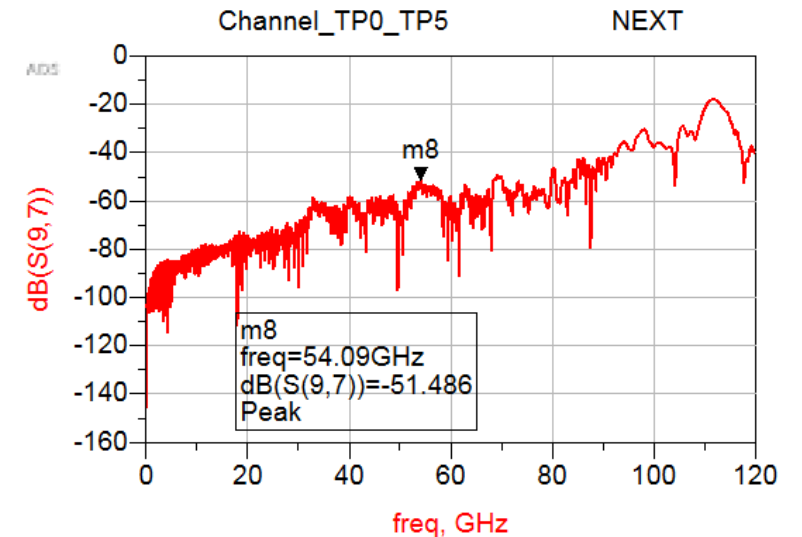
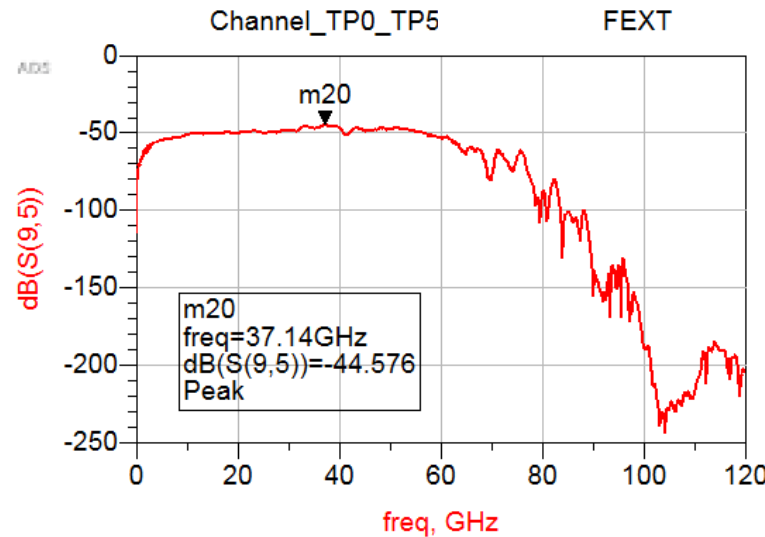
Component	TP0-TP5 Insertion Loss (dB) @ 56GHz
	<i>Design A</i>
PCB via	1.7 dB
PCB Trace	7.5 inch (TX+RX, 1.3 dB/inch)
Mated Cable Assembly	17.0 dB
Total	28.0 dB

224 Gbps-PAM4 CR Channel Characteristics (I)



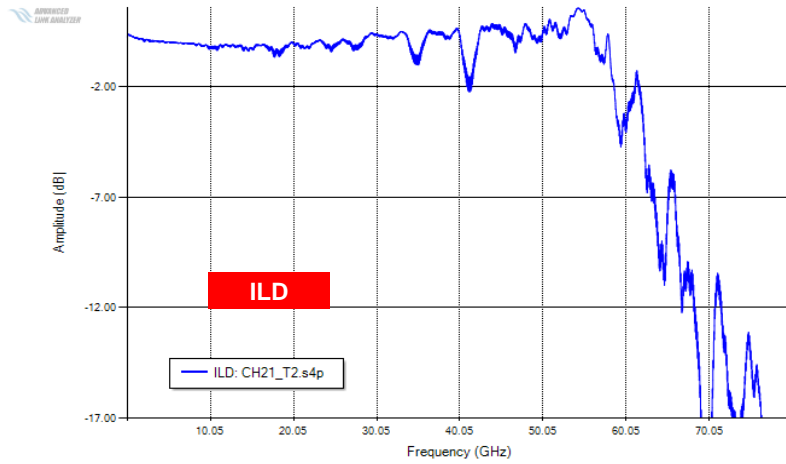
TP0-TP5 Characteristics (DC-56GHz)

- IL: 28.0dB @ 56GHz
- RL <~ 12dB (<56GHz)
- FEXT < 44dB (<56GHz)
- NEXT < 51dB (<56GHz)

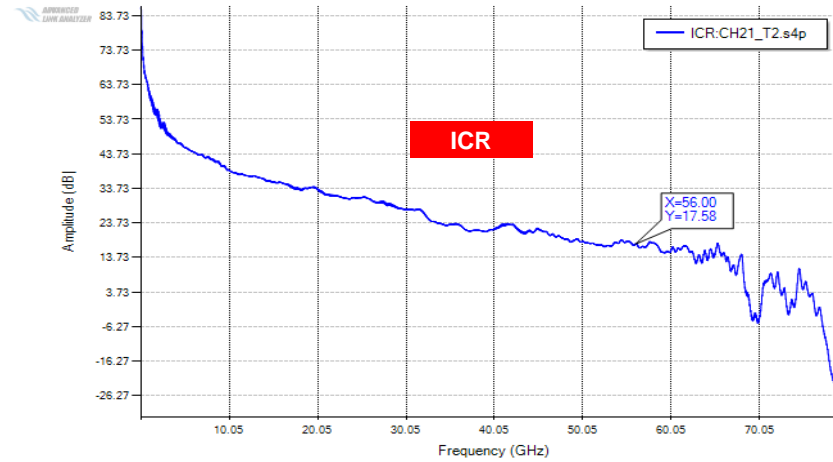


224 Gbps-PAM4 CR Channel Characteristics (II)

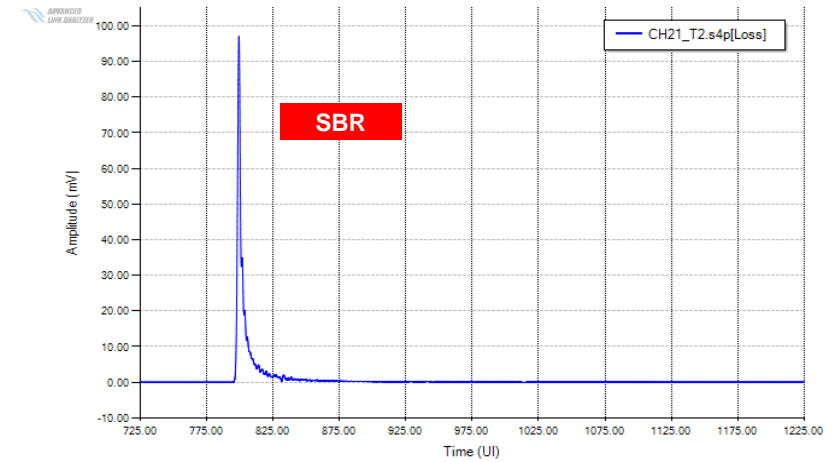
Channel Viewer: [2] CP: ILD



Channel Viewer: [4] CP: ICR

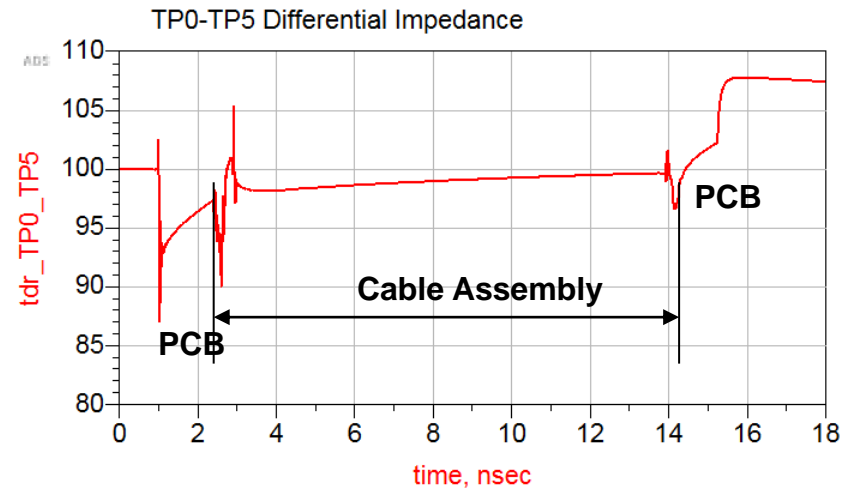


Channel Viewer: [5] SBR: Sdd21

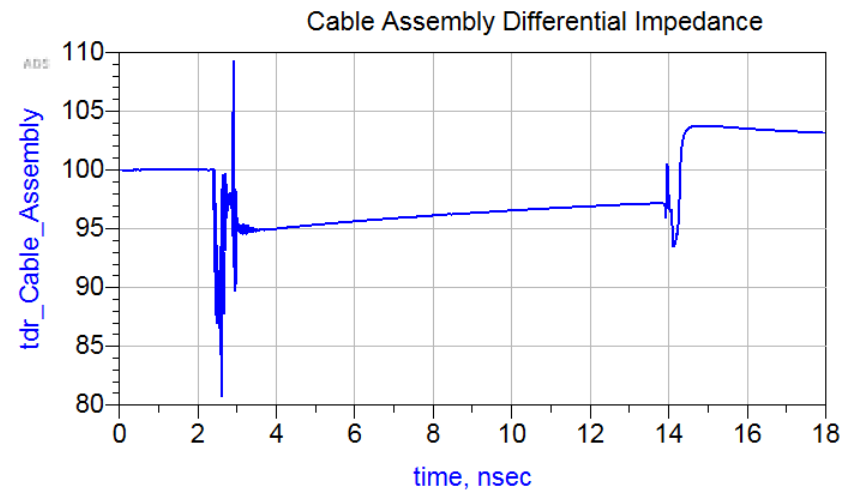


- **ILD \sim \pm 2 dB (<56GHz)**
- **ICR > 17.6 dB (<56GHz) (2FEXT+1NEXT used)**

224 Gbps-PAM4 CR Channel Characteristics (III)



- Cable p-p discontinuity 29Ω
- PCB p-p discontinuity 16Ω



[S] parameter BW DC-120GHz

Summary

- We have created a CR channel Design A supporting 1 Meter DAC.
- This CR channel includes PCB-Vias, PCBs traces, connectors, and 1 Meter DAC.
- This CR channel has:
 - An IL (TP0-TP5) of 28 dB at 56 GHz
 - RL $< \sim 12$ dB at ≤ 56 GHz
 - FEXT < 44 dB, NEXT < 51 dB, at ≤ 56 GHz