

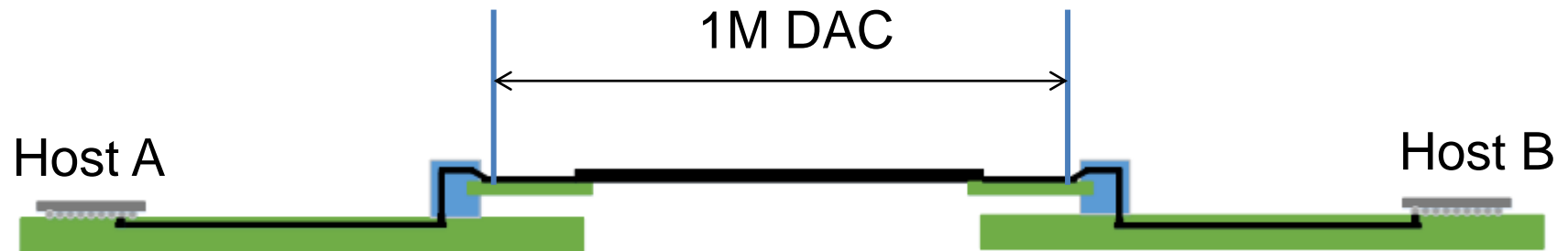
# **A 212.5 Gbps-PAM4 1 Meter DAC Long Reach Channel and Its Characteristics: Design C**

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# Background and Introduction (I)

- An important use case of 212.5 Gbps-PAM4 is the cable reach (CR) with a 1 Meter DAC.

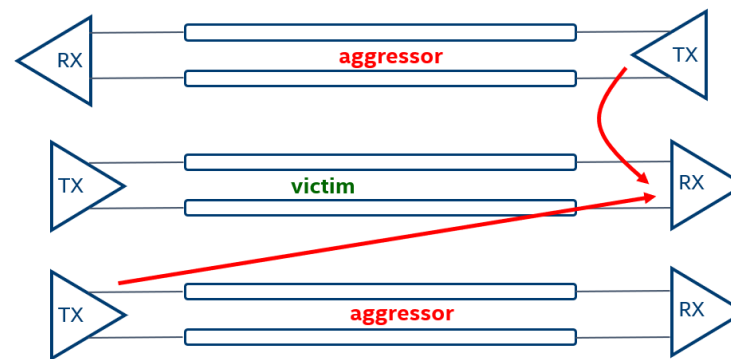
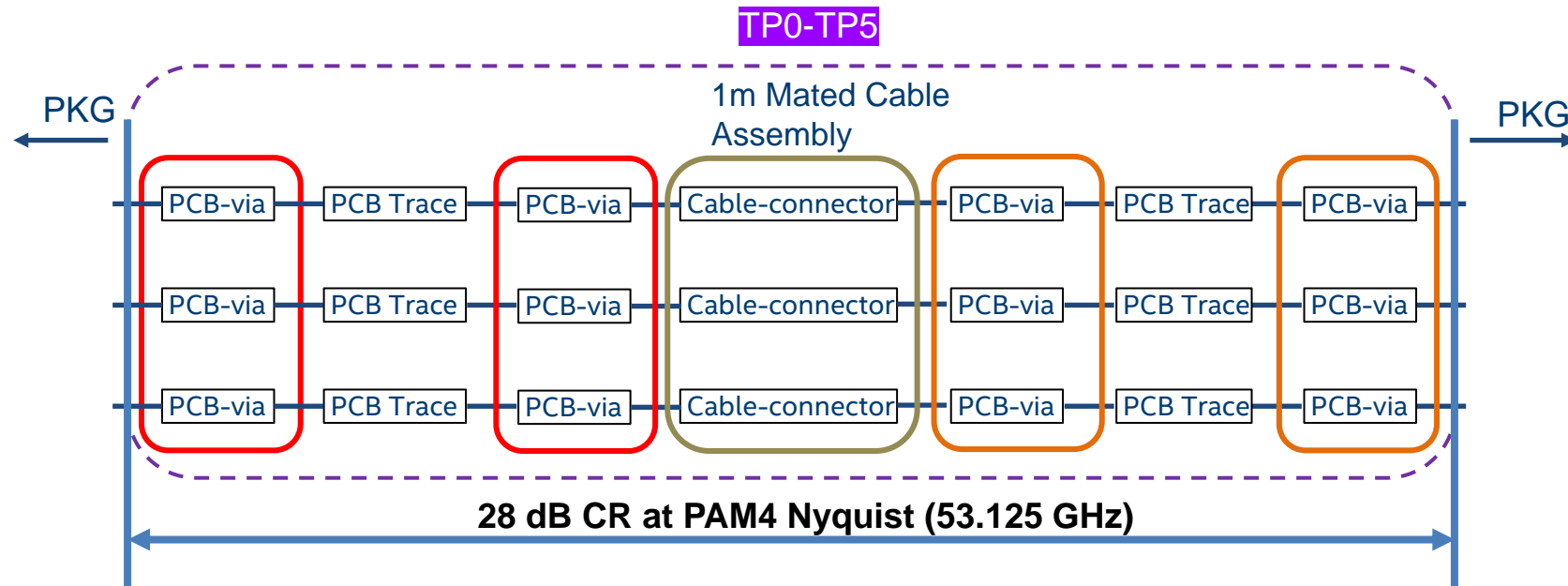


- The channel loss budget between the host bump-to-bump (or TP0d-TP5d) is determined/bounded by the SERDES technology and capability, which is trending  $\leq 40$  dB, for 212.5 Gbps-PAM4 signaling.

# Background and Introduction (II)

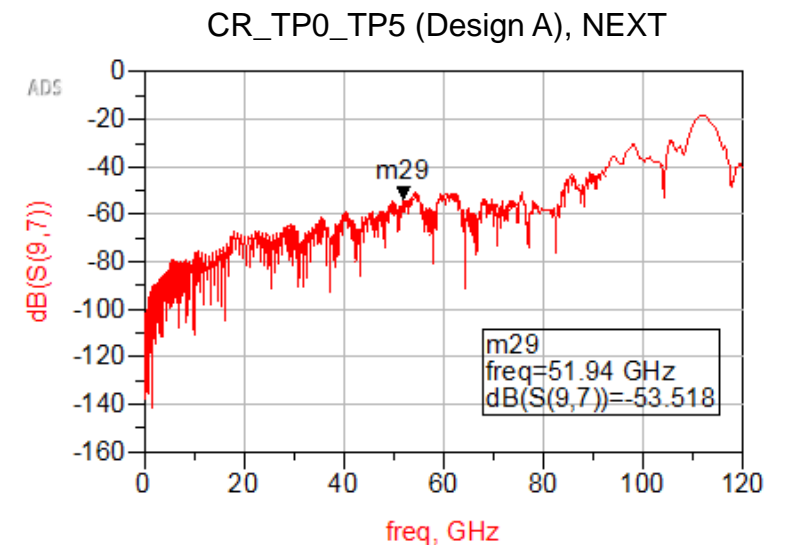
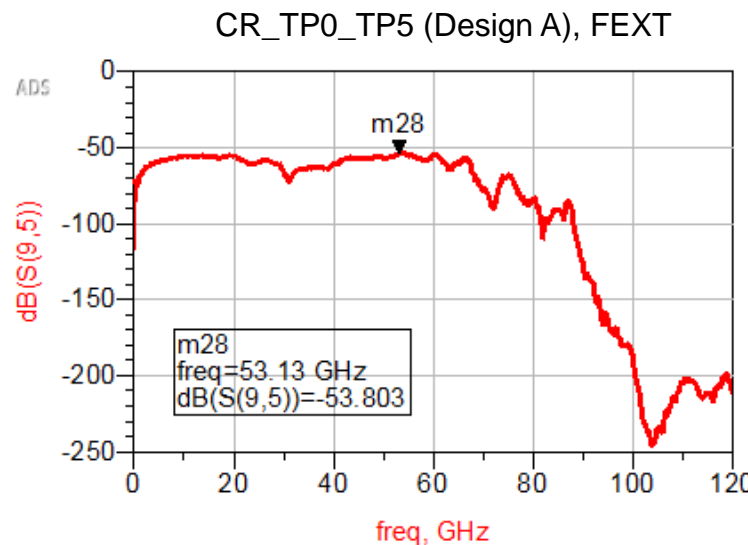
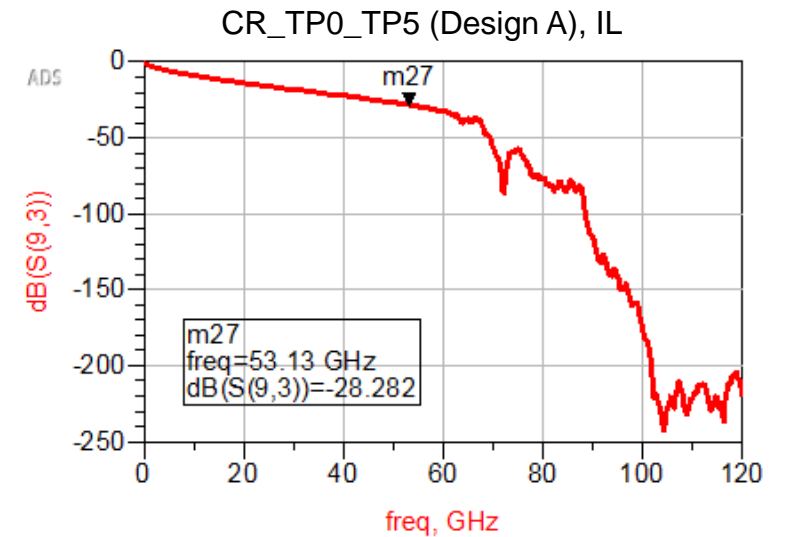
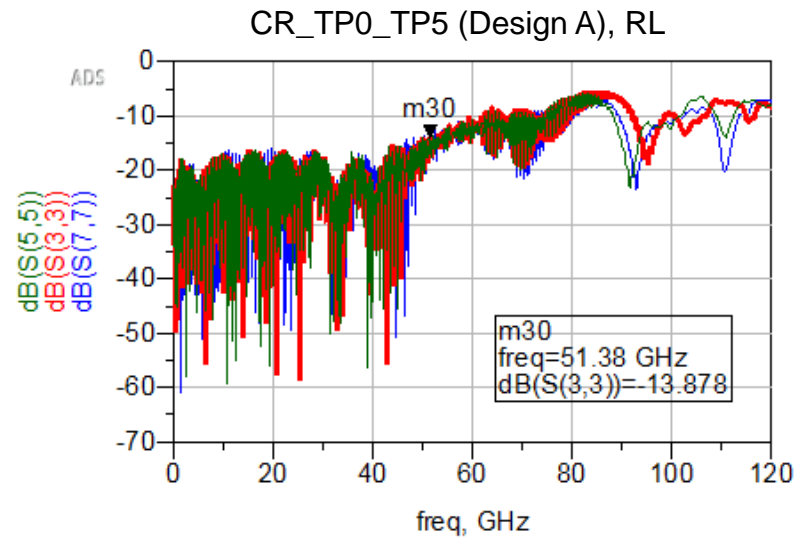
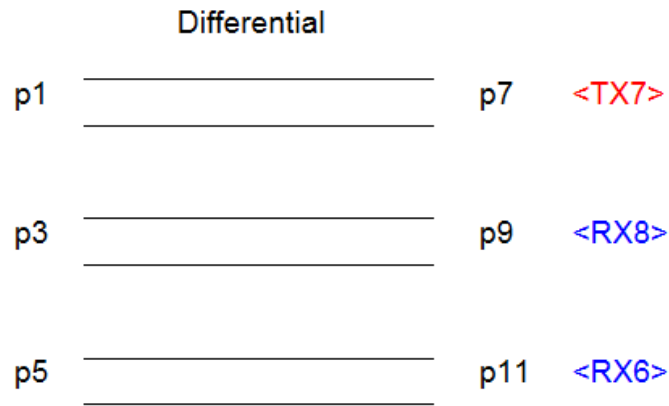
- We leveraged our established/validated CR channel design tool-flow-methodology (TFM) (e.g., [1],[2]) and the latest connector and DAC technologies to create this CR ball-to-ball channel Design C to support 1 Meter DAC with 212.5Gbps-PAM4 signaling.

# 212.5 Gbps-PAM4 CR Channel Structure



Component	TP0-TP5 Insertion Loss (dB) @ 53.125GHz
	<i>Design C</i>
PCB via	1.5 dB
PCB Trace	8.25 inch (TX+RX, 1.27 dB/inch)
Cable Assembly	16.3 dB
Total	28.3 dB

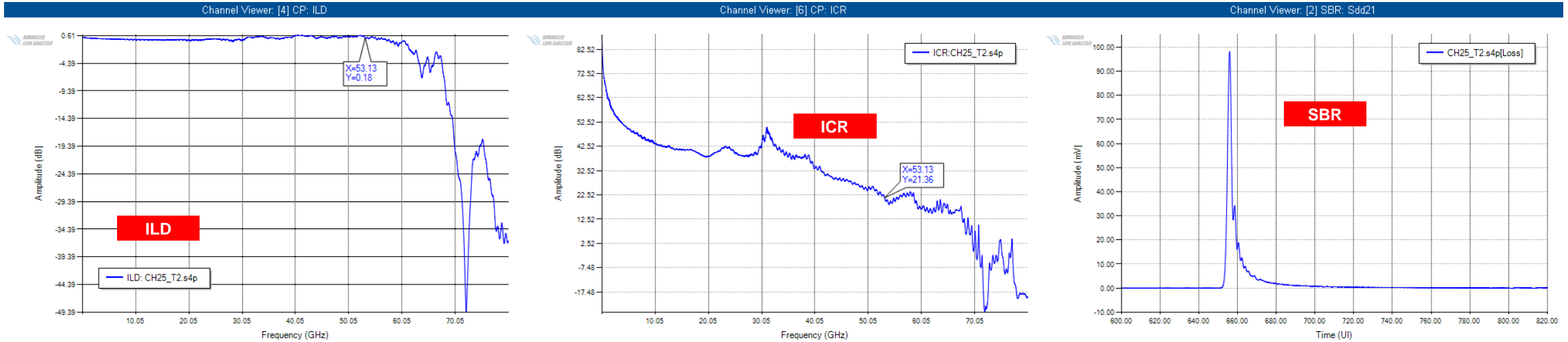
# 212.5 Gbps-PAM4 CR Channel Characteristics (I)



## TP0-TP5 Characteristics (DC-53.125GHz)

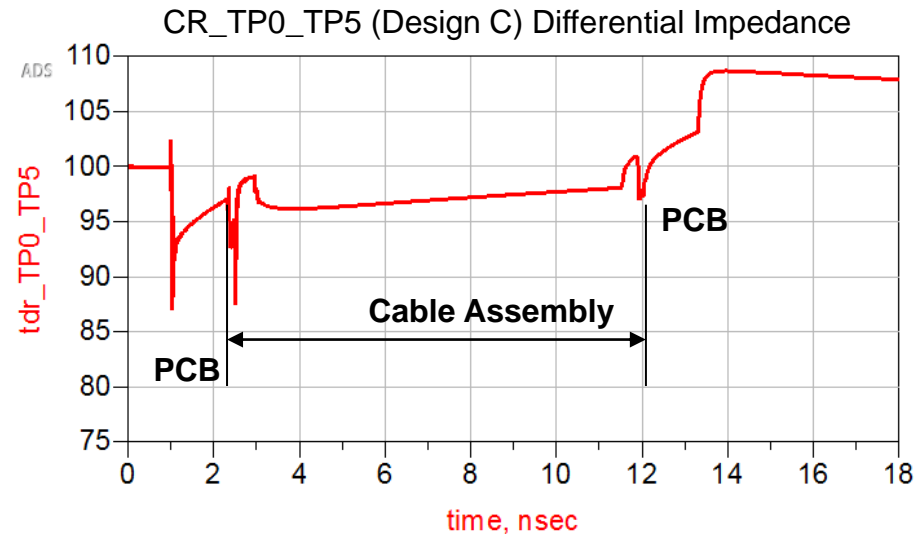
- IL: 28.3dB @ 53.125GHz
- RL ≈ 13.5dB (<53.125GHz)
- FEXT < 53.8dB (<53.125GHz)
- NEXT < 53.5dB (<53.125GHz)

# 212.5 Gbps-PAM4 CR Channel Characteristics (II)

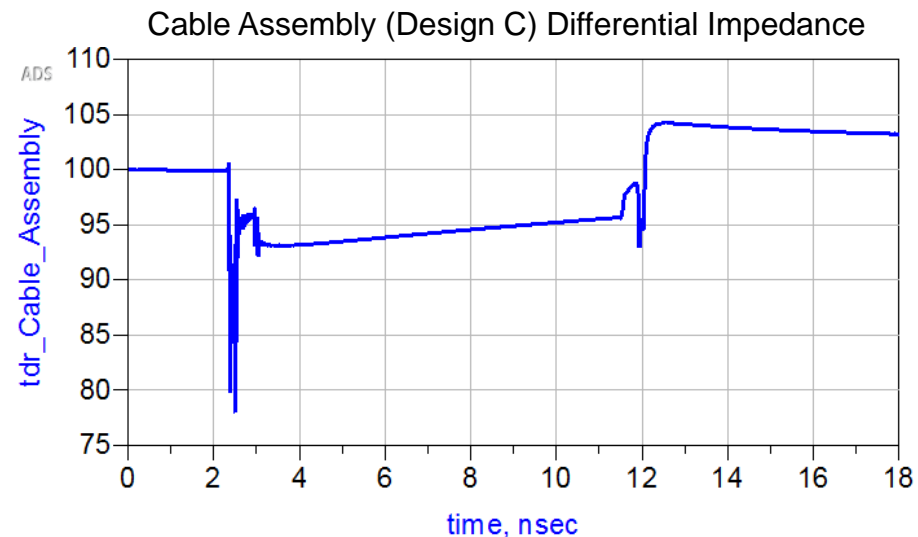


- **ILD  $\sim < \pm 1$  dB ( $< 53.125$ GHz)**
- **ICR  $> 21.36$  dB ( $< 53.125$ GHz) (2FEXT+1NEXT used)**

# 212.5 Gbps-PAM4 CR Channel Characteristics (III)



- Cable Assembly p-p discontinuity 23  $\Omega$
- PCB p-p discontinuity 16  $\Omega$



*[S] parameter BW DC-120GHz*

# Summary

- We have created a CR channel Design C 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 28.3 dB at 53.125 GHz
  - RL  $< \sim 13.5$  dB at  $\leq 53.125$  GHz
  - FEXT  $< 53.8$  dB, NEXT  $< 53.5$  dB, at  $\leq 53.125$  GHz



# References

- [1] [https://www.ieee802.org/3/dj/public/23\\_05/li\\_3dj\\_07a\\_2305.pdf](https://www.ieee802.org/3/dj/public/23_05/li_3dj_07a_2305.pdf)
- [2] [https://www.ieee802.org/3/dj/public/23\\_05/li\\_3dj\\_09a\\_2305.pdf](https://www.ieee802.org/3/dj/public/23_05/li_3dj_09a_2305.pdf)