

# A 212.5 Gbps-PAM4 High-Loss Chip-to-Module Channel and Its Characteristics

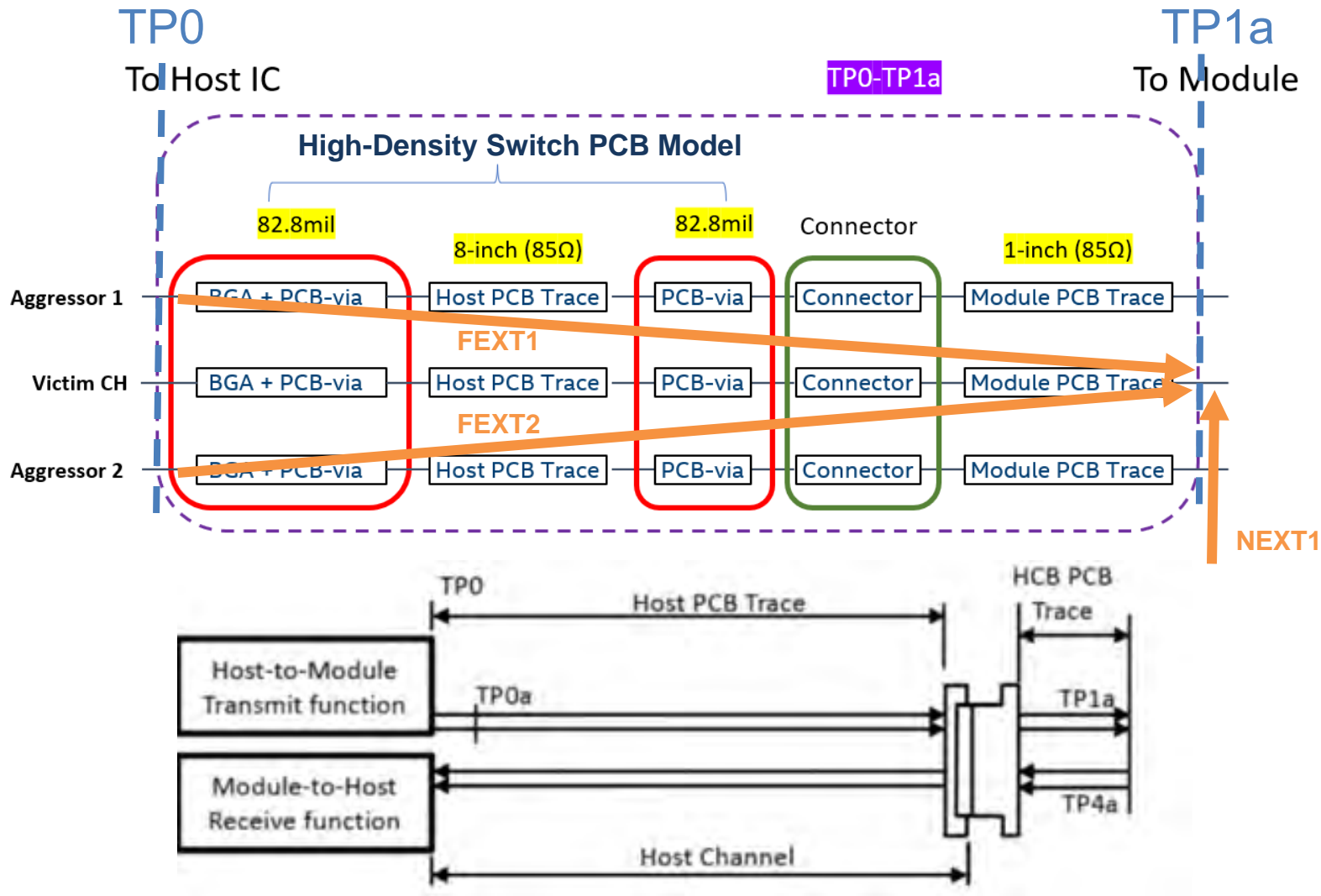
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# Background and Introduction

- Update to Q3'22 presentation “224 Gbps Chip-to-Module Link Simulation and Analysis Update 2” (oif2022.355.00), with
  - Updated chip-to-module channel which is based on a real/practical high-density/radix switch device and board design
- Progress history
  - Update to Q2'22 presentation “224 Gbps Chip-to-Module Link Simulation and Analysis Update” (oif2022.174.01), with
    - Updated chip-to-model COM configuration and analysis results
    - Time-domain link simulation results
  - Update to Q3'21 presentation “212/224 Gbps Chip-to-Module Link Simulation and Analysis” (oif2021.446.00), with
    - Latest C2M channel model(s)
    - Proposed CEI-224G-LR-PAM4 reference TX (oif2022.067.00)
    - Proposed CEI-224G-LR-PAM4 reference die/package model (oif2022.065.02)
    - TP1a reference scope RX based on the proposed CEI-224G-LR-PAM4 reference RX AFE (oif2022.067.00)

# C2M Channel Topology



## Channel Configuration Summary

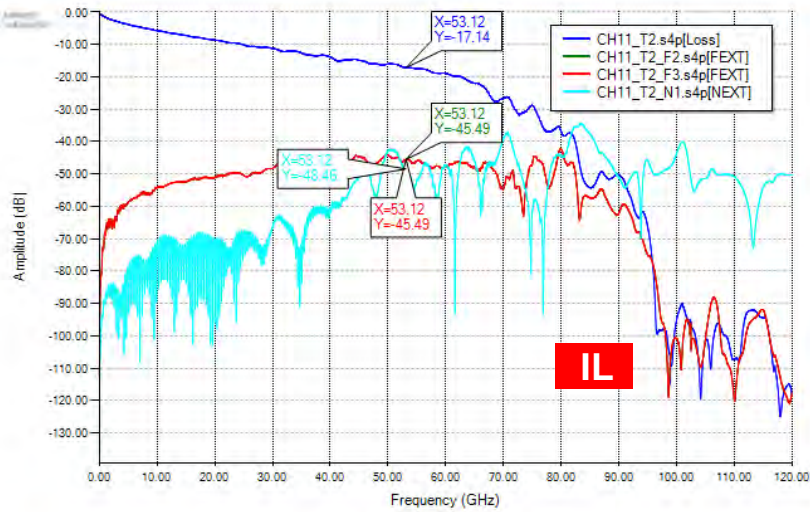
- 2 Channels were analyzed
  - CH11: Shown on the left
  - CH12: Same as CH11 with 10-in Host PCB
- Crosstalk
  - 2 FEXT
  - 1 NEXT

## Insertion Loss Break Down

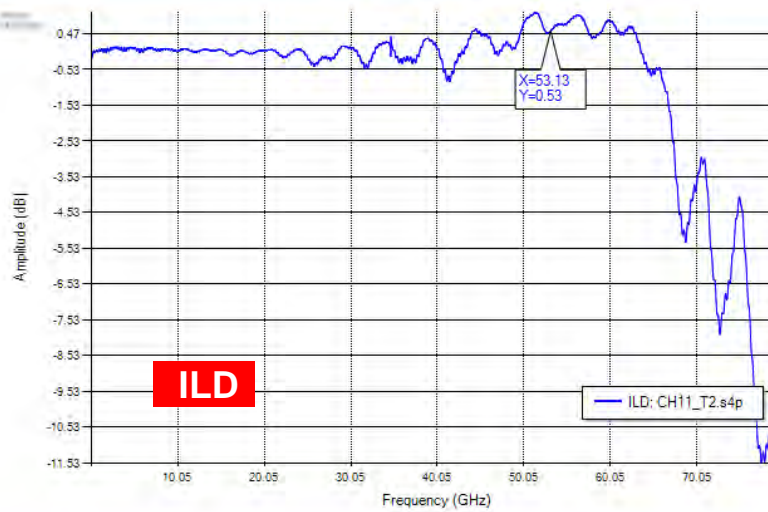
Component	Insertion Loss (dB) @ 53.125GHz	
	CH11 (8-in)	CH12 (10-in)
BGA via	0.95	
PCB	11.2	14.2
Connector via	0.95	
Connector	1.5	
Module card	2.37	
Total	17.14	20.03

# C2M Channel Characteristics (CH11)

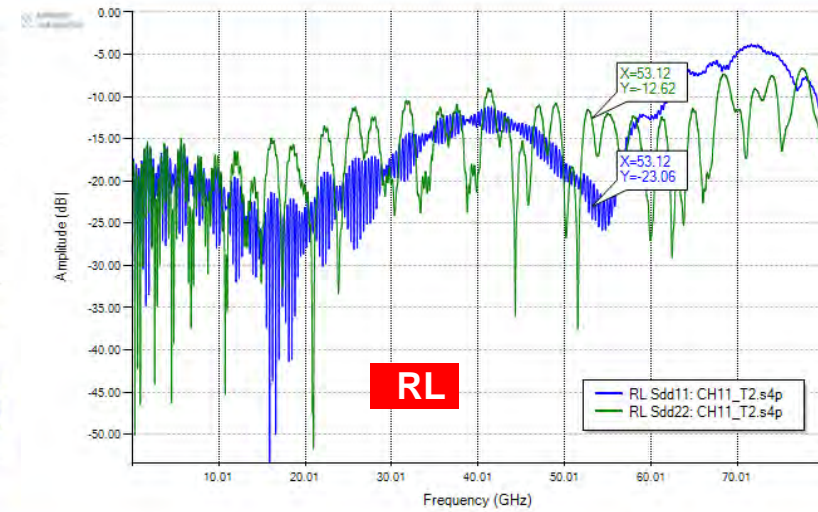
Channel Viewer: [0] FR: Sdd21



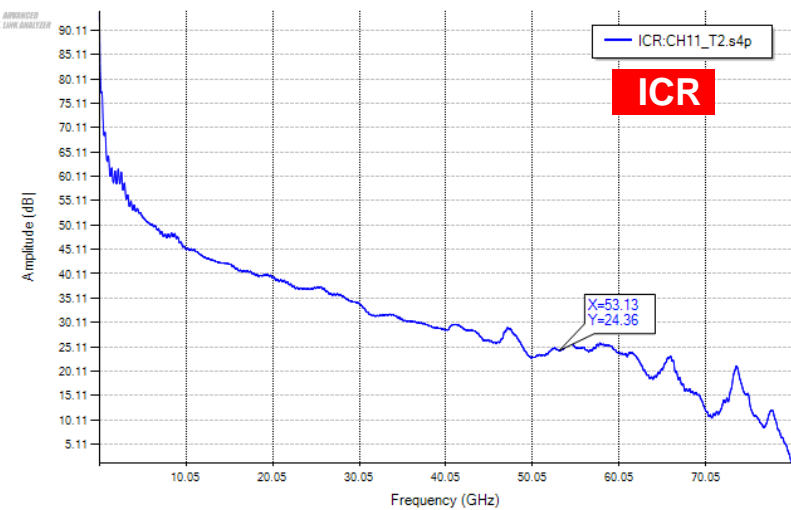
Channel Viewer: [2] CP: ILD



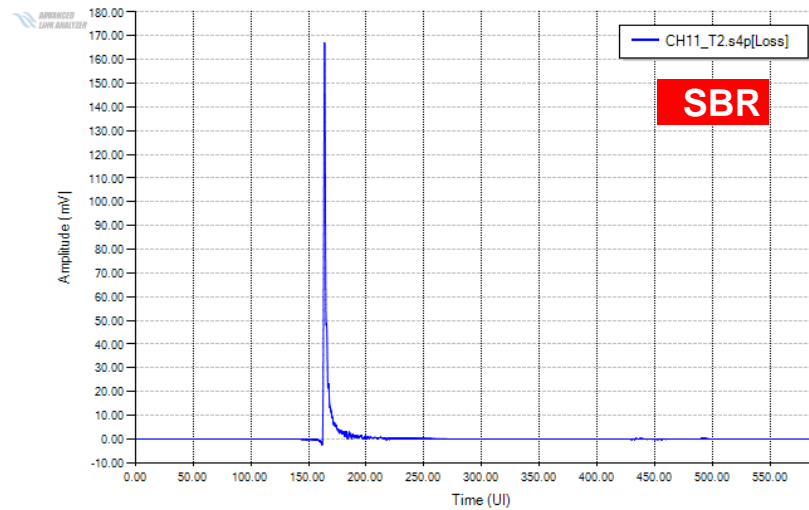
Channel Viewer: [3] CP: Return Loss



Channel Viewer: [4] CP: ICR



Channel Viewer: [1] SBR: Sdd21

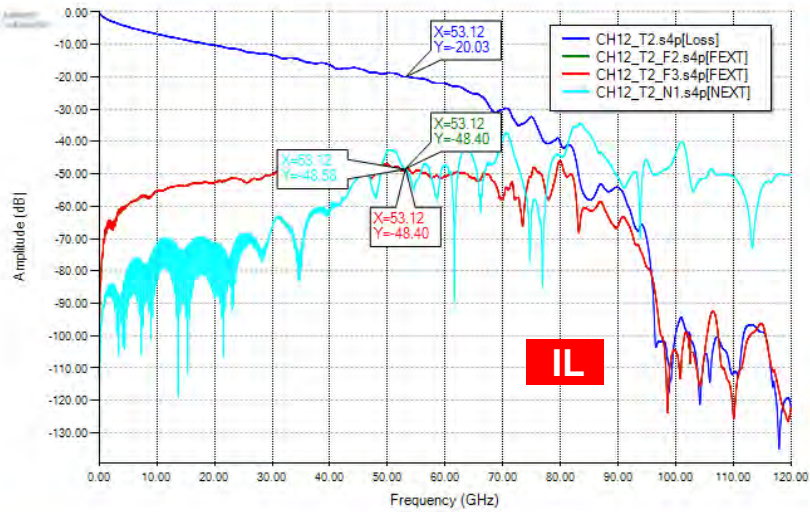


- IL: 17.14dB @ 53.125 GHz
- ILD ≈ 1dB
- RL ≈ 10dB
- FEXT ≈ 46dB NEXT ≈ 48dB, ICR ≈ 24.36dB

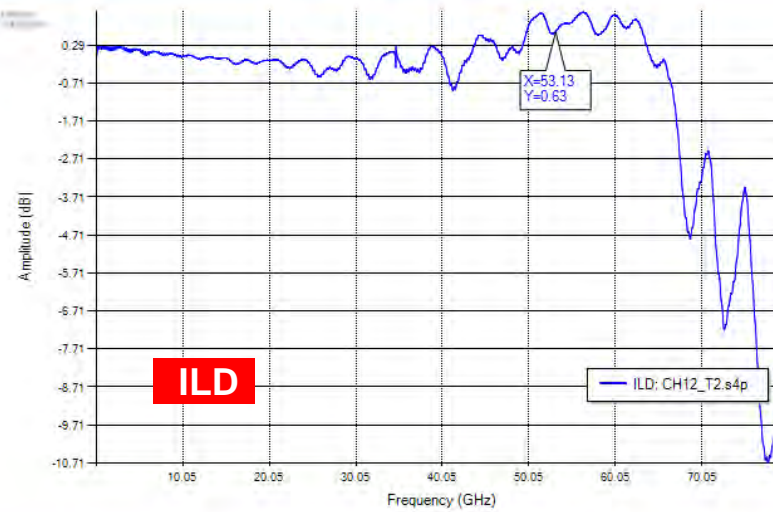


# C2M Channel Characteristics (CH12)

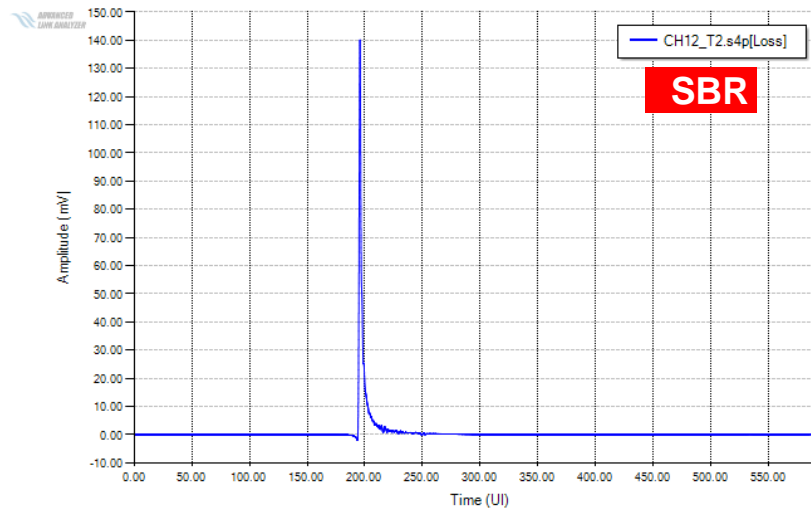
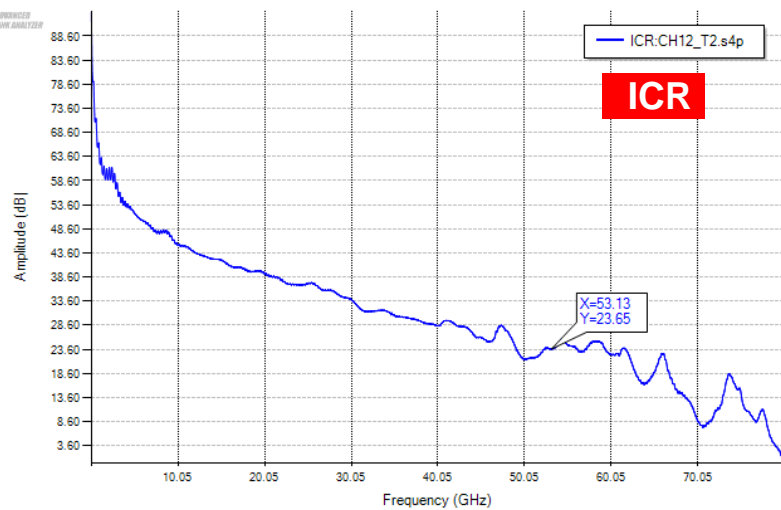
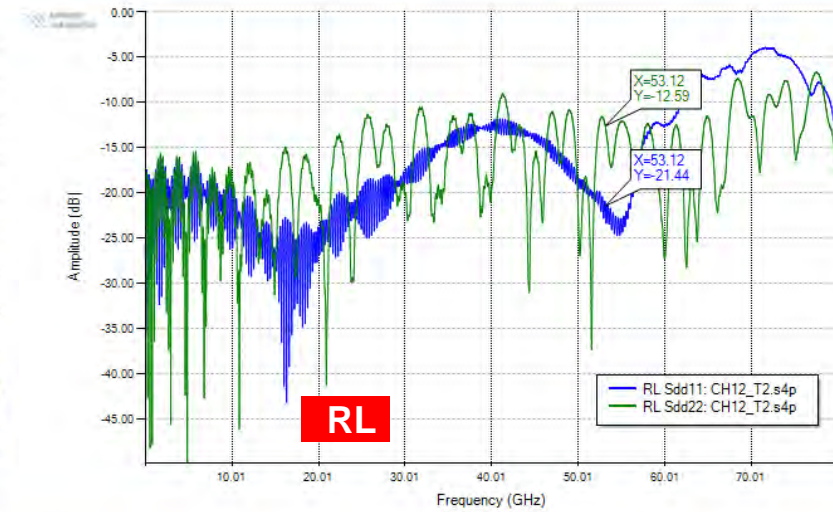
Channel Viewer: [9] FR: Sdd21



Channel Viewer: [6] CP: ILD



Channel Viewer: [7] CP: Return Loss



- IL: 20.03dB @ 53.125 GHz
- ILD  $\approx$  1dB
- RL  $\approx$  10dB
- FEXT  $\approx$  48dB NEXT  $\approx$  49dB, ICR  $\approx$  23.65dB

# Summary

- Updated chip-to-module channel based on a high-density/radix switch device and board design with 8-inch and 10-inch PCB lengths
- Key characteristics (at 53.125 GHz)

Channel	IL (dB)	ILD (dB)	RL (dB)	ICR (dB)
CH11 (w/ 8" Host PCB)	17.14	~1	~10	24.36
CH12 (w/ 10" Host PCB)	20.03	~1	~10	23.65