A 224 Gbps-PAM4 High-Loss Chip-to-Module Channel with 92 Ohm Impedance and Its Characteristics

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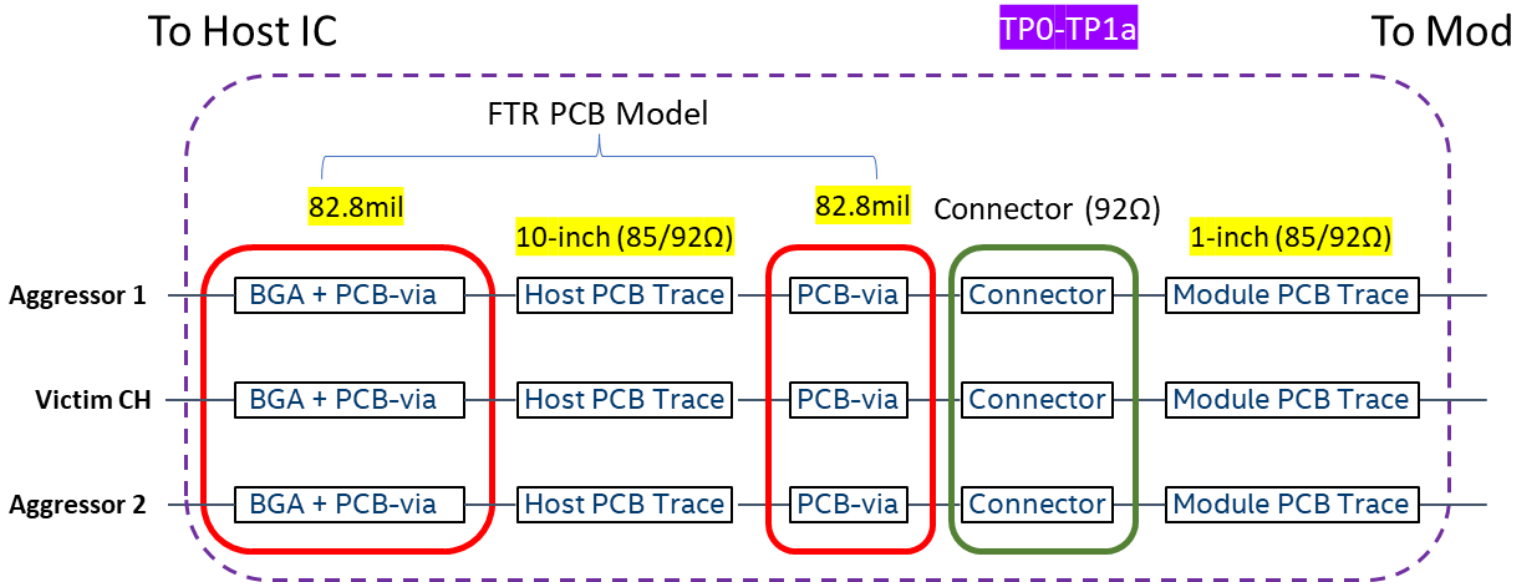
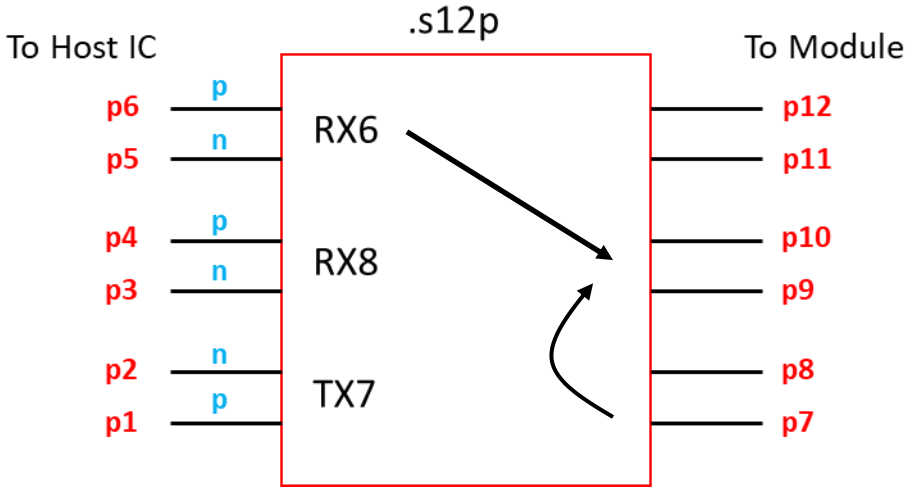
Background and Introduction

- Update to Q4'22 presentation *"A 224 Gbps-PAM4 High-Loss Chip-to-Module Channel and Its Characteristics"* (oif2022.498.00), with
  - Channel PCB impedance be changed to 92 ohm, a proposed change for 224 Gbps channel
- Progress history
  - 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

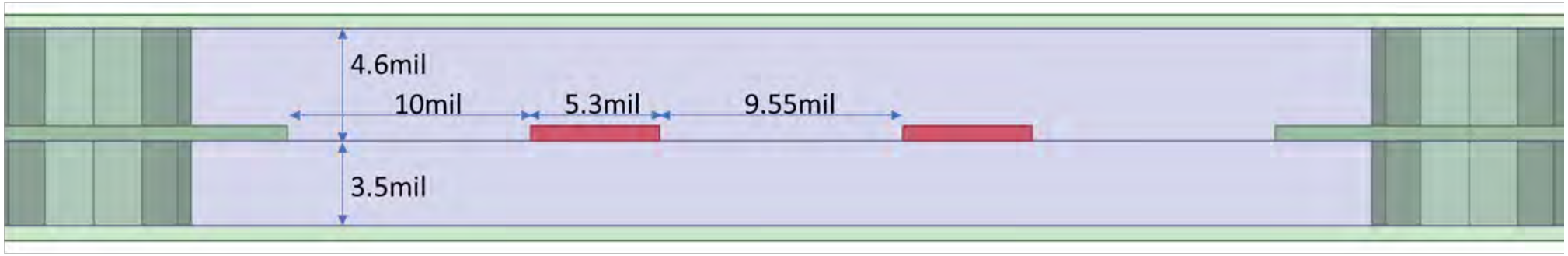
C2M Channel


To Host IC
TP0-TP1a
To Module
FTR PCB Model
82.8mil
10-inch (85/92Ω)
82.8mil
Connector (92Ω)
1-inch (85/92Ω)
Aggressor 1
Victim CH
Aggressor 2
BGA + PCB-via
Host PCB Trace
PCB-via
Connector
Module PCB Trace

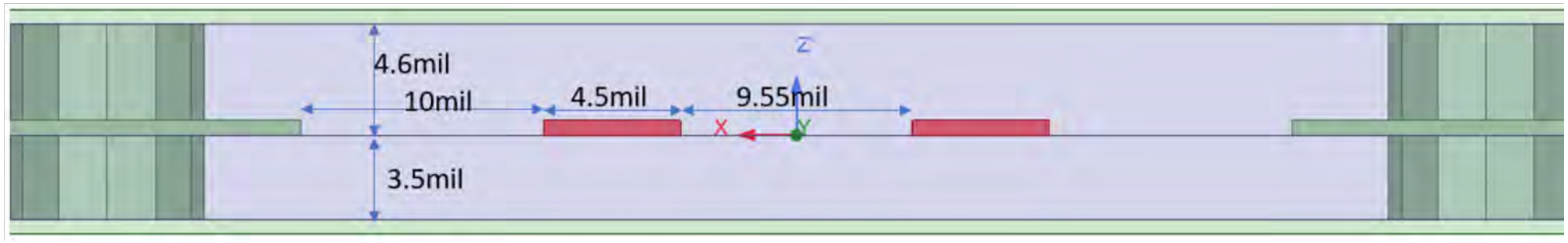

.s12p
To Host IC
To Module
p6
p5
p4
p3
p2
p1
p
n
RX6
RX8
TX7
p12
p11
p10
p9
p8
p7

Trace Model

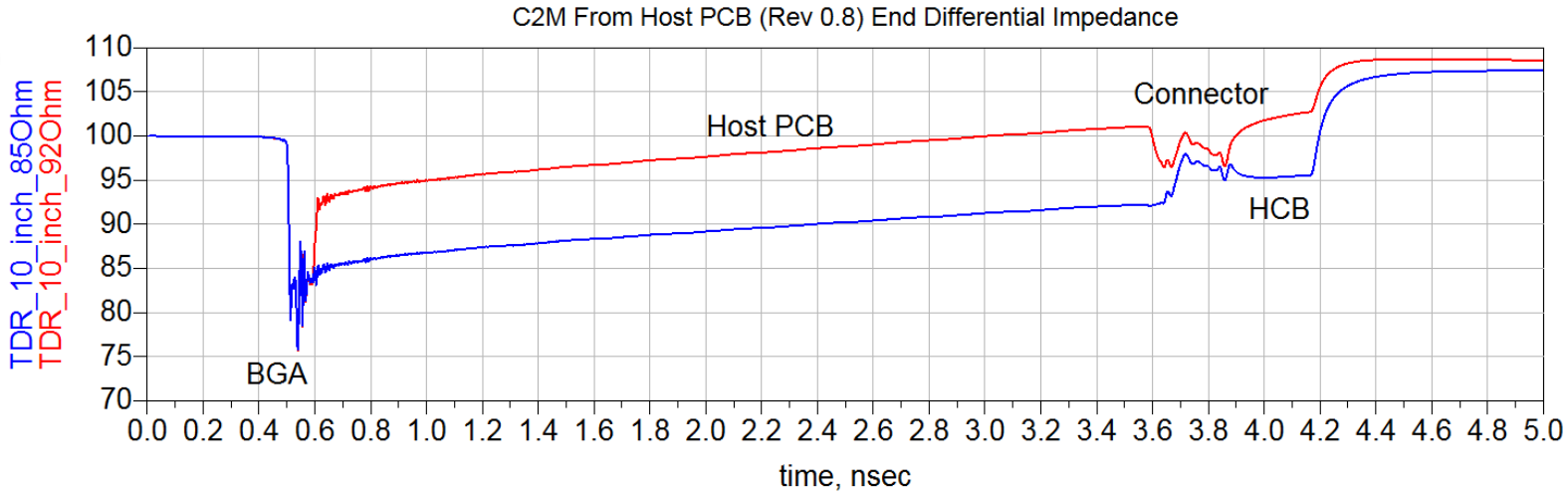
85 Ω



92 Ω

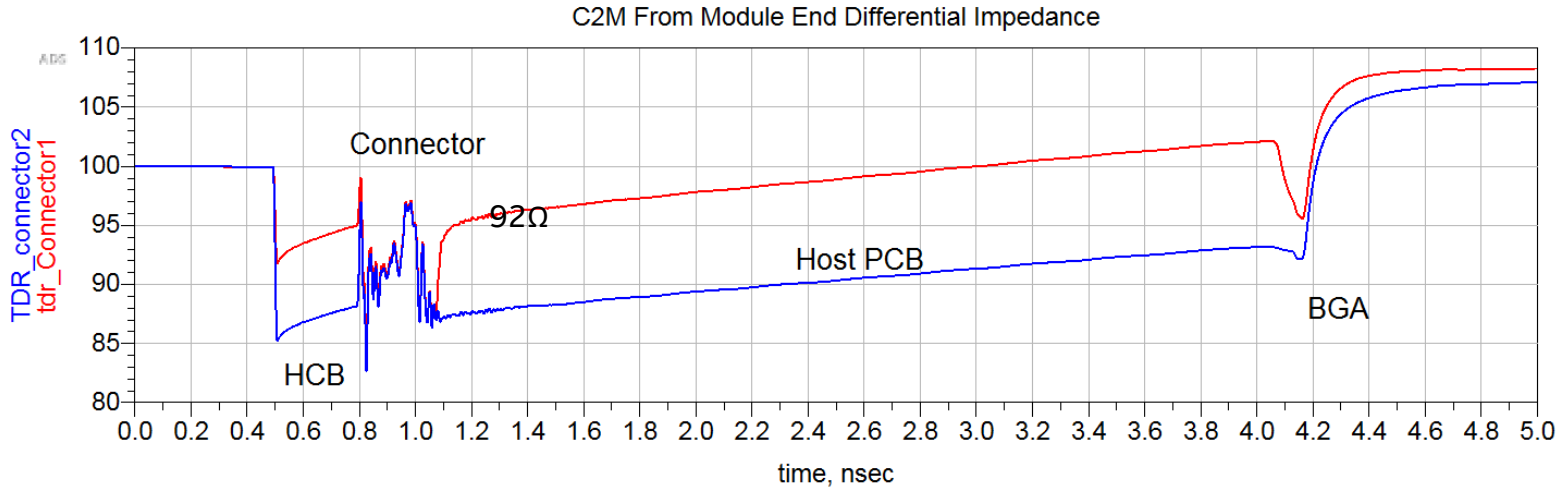


TDR Comparison

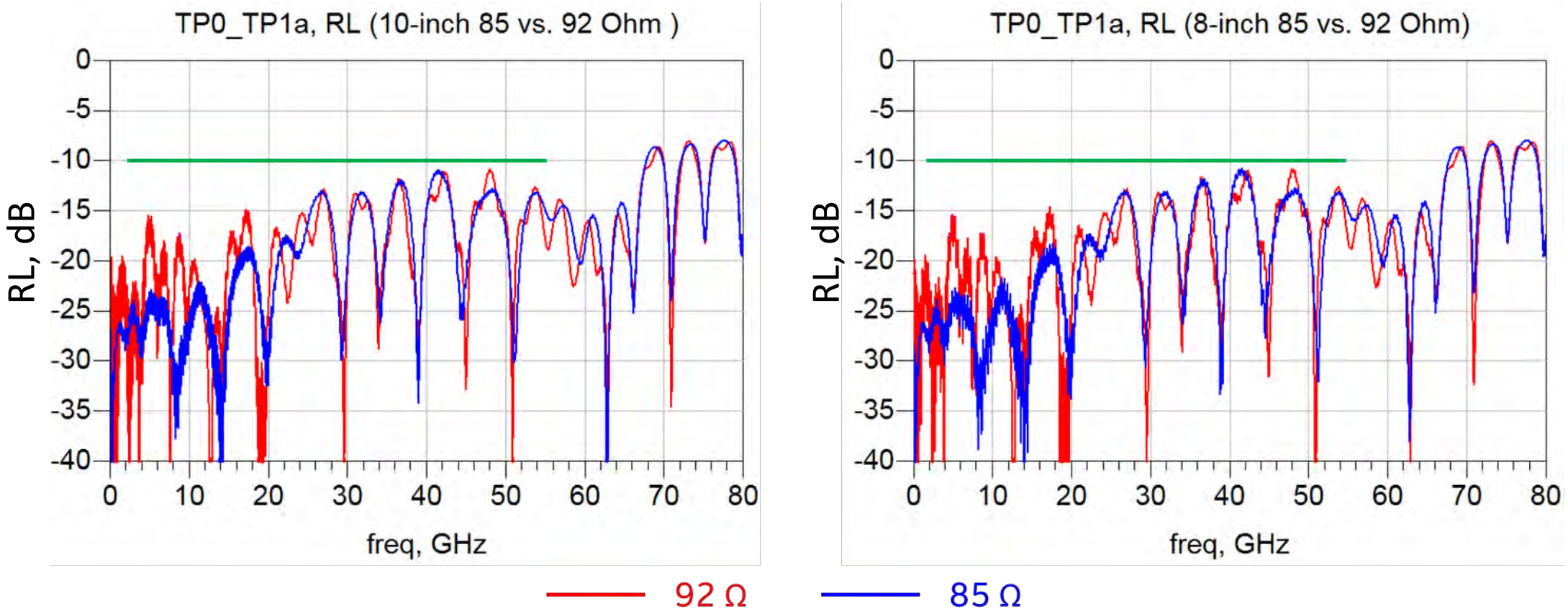


92 Ω

85 Ω

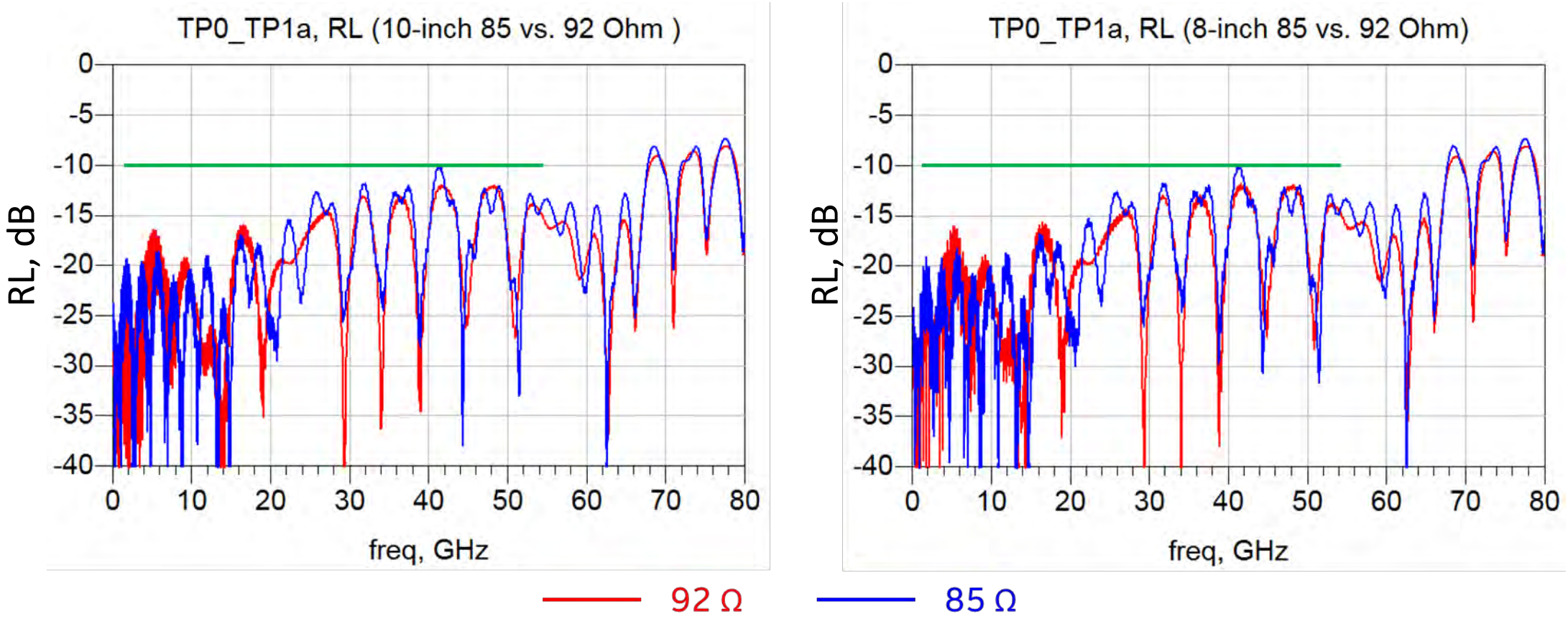


Return Loss Comparison – 85 Ω Termination



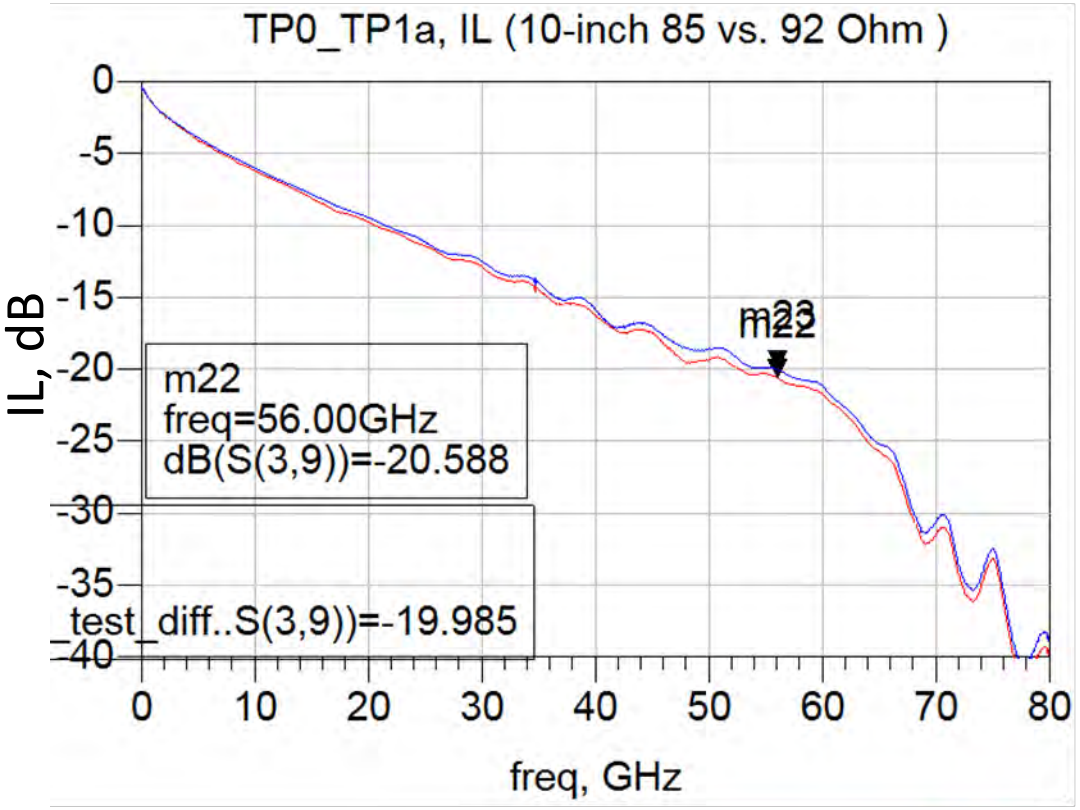
85 Ω showed better return loss than 92 Ω with 85 Ω termination

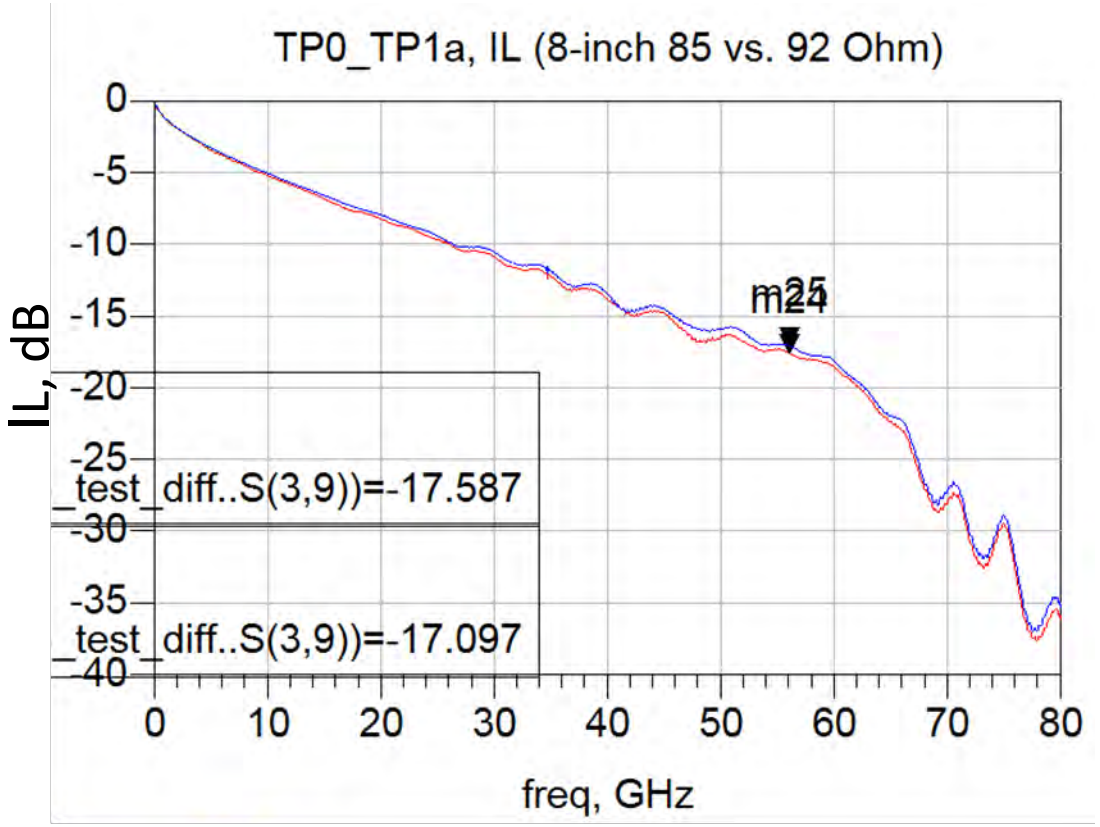
Return Loss Comparison – 92 Ω Termination



92 Ω showed better return loss than 85 Ω with 92 Ω termination

Insertion Loss Comparison – 85 Ω Termination

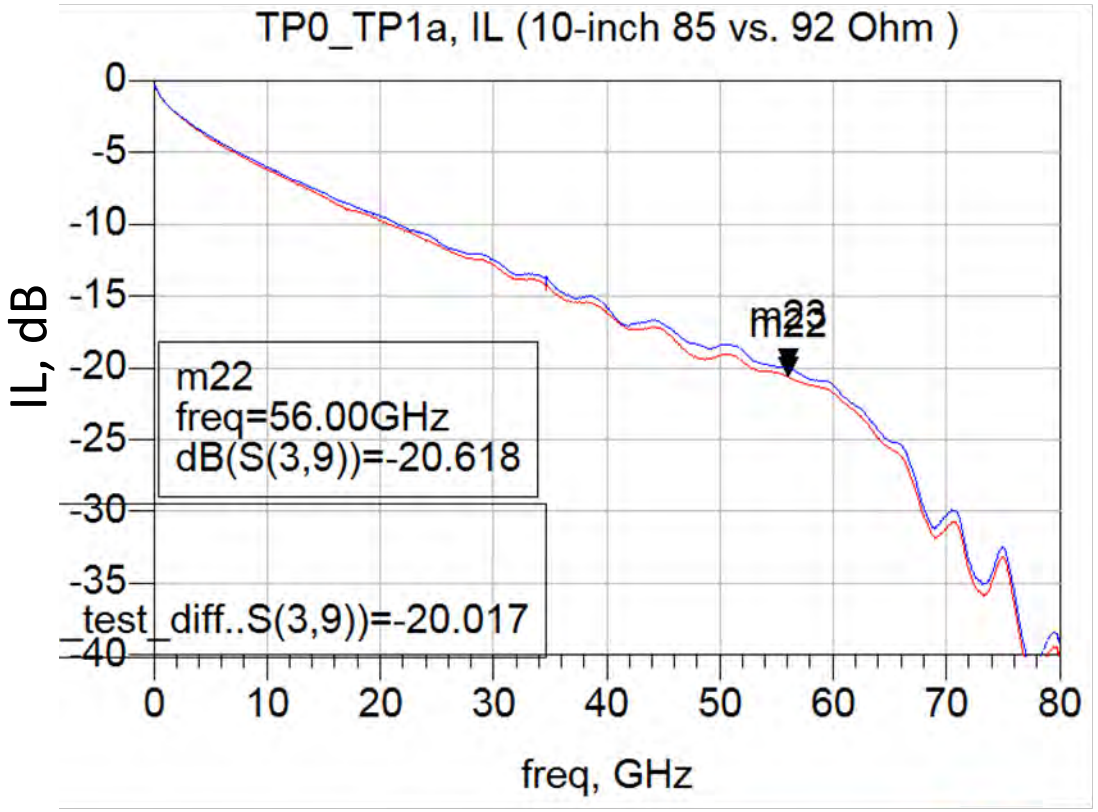


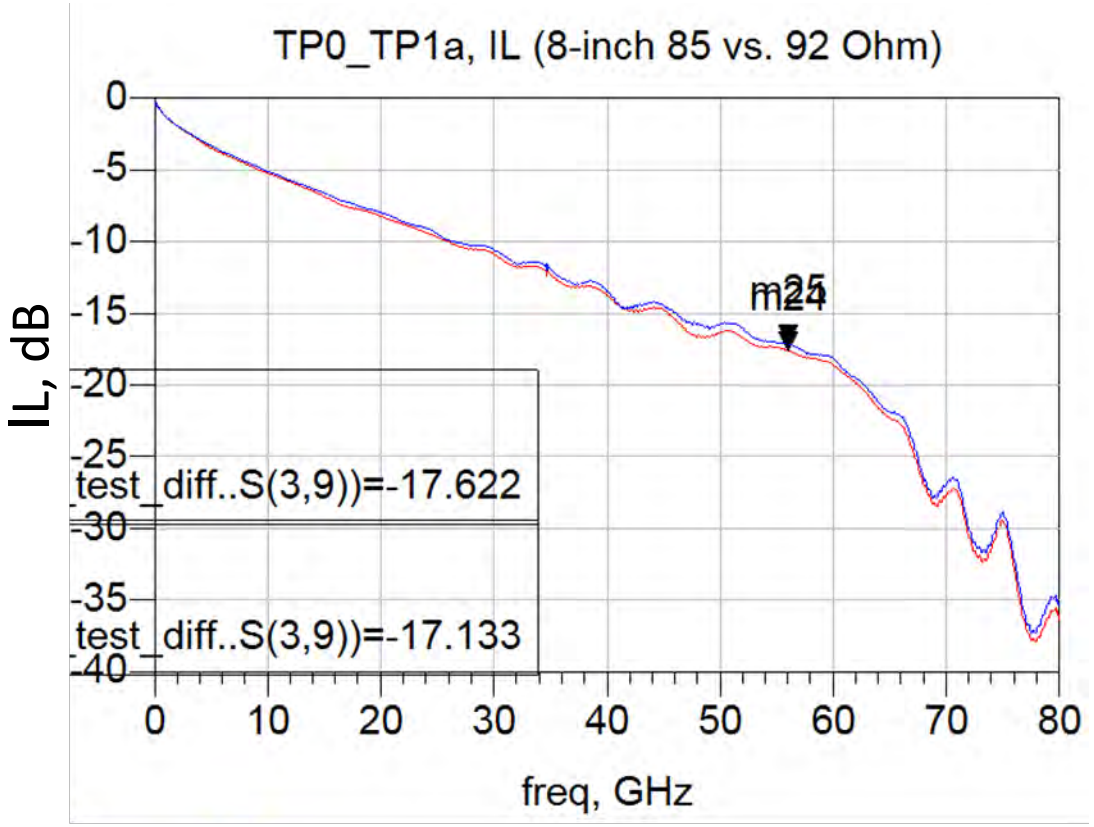


92 Ω 85 Ω

92 Ω showed ~ 0.6 dB worse insertion loss than 85 Ω for a 10-inch board with 85 Ω termination
~ 0.5 dB worse for an 8-inch board

Insertion Loss Comparison – 92 Ω Termination





92 Ω 85 Ω

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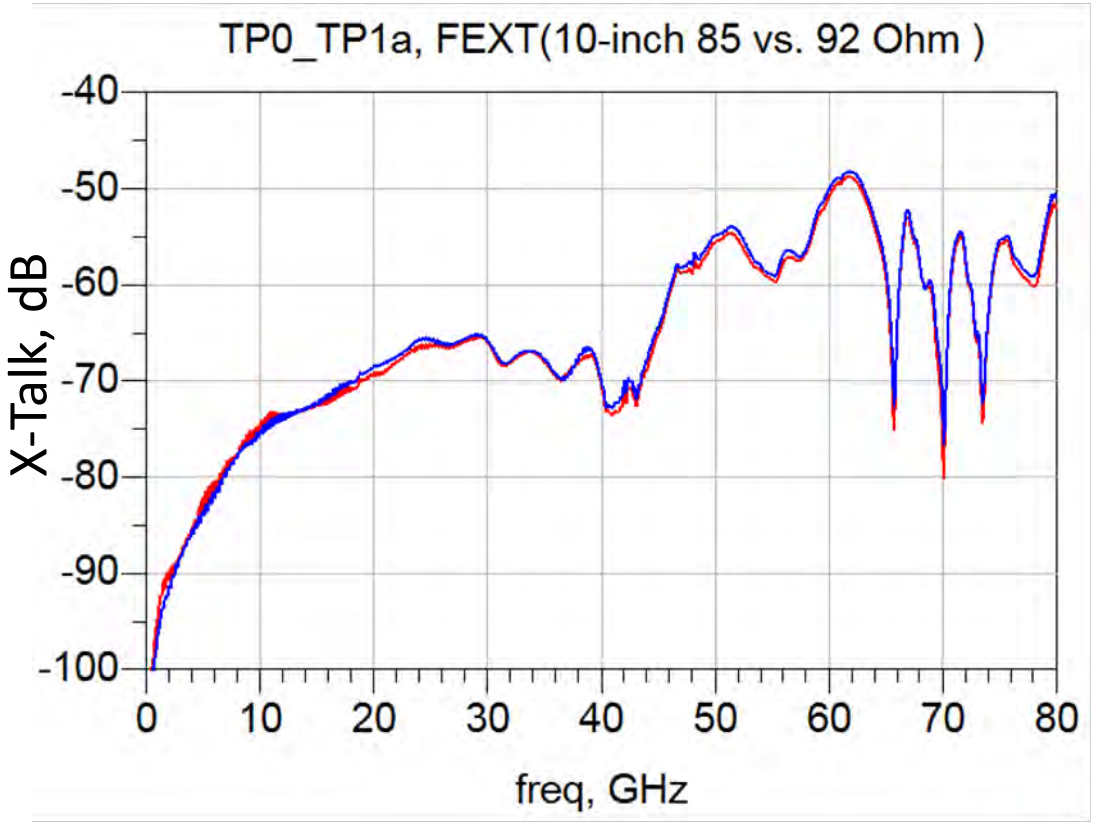
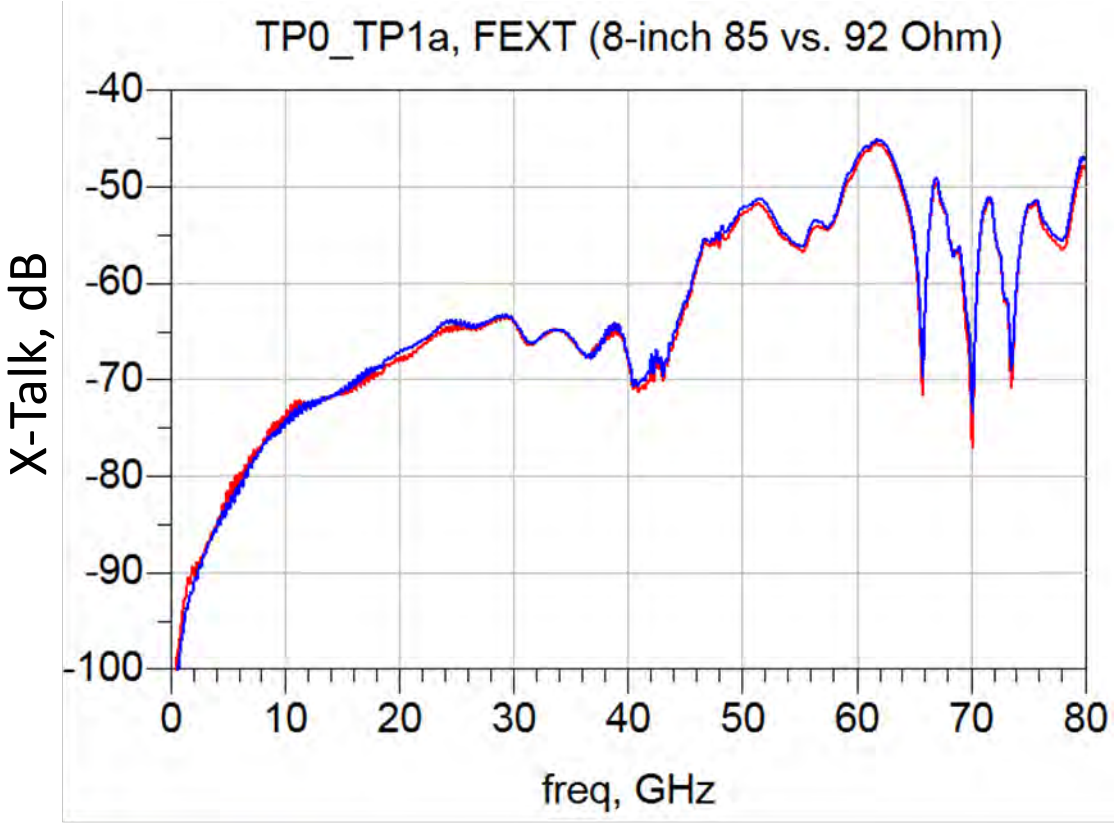
Cross Talk Comparison – 85 Ω Termination

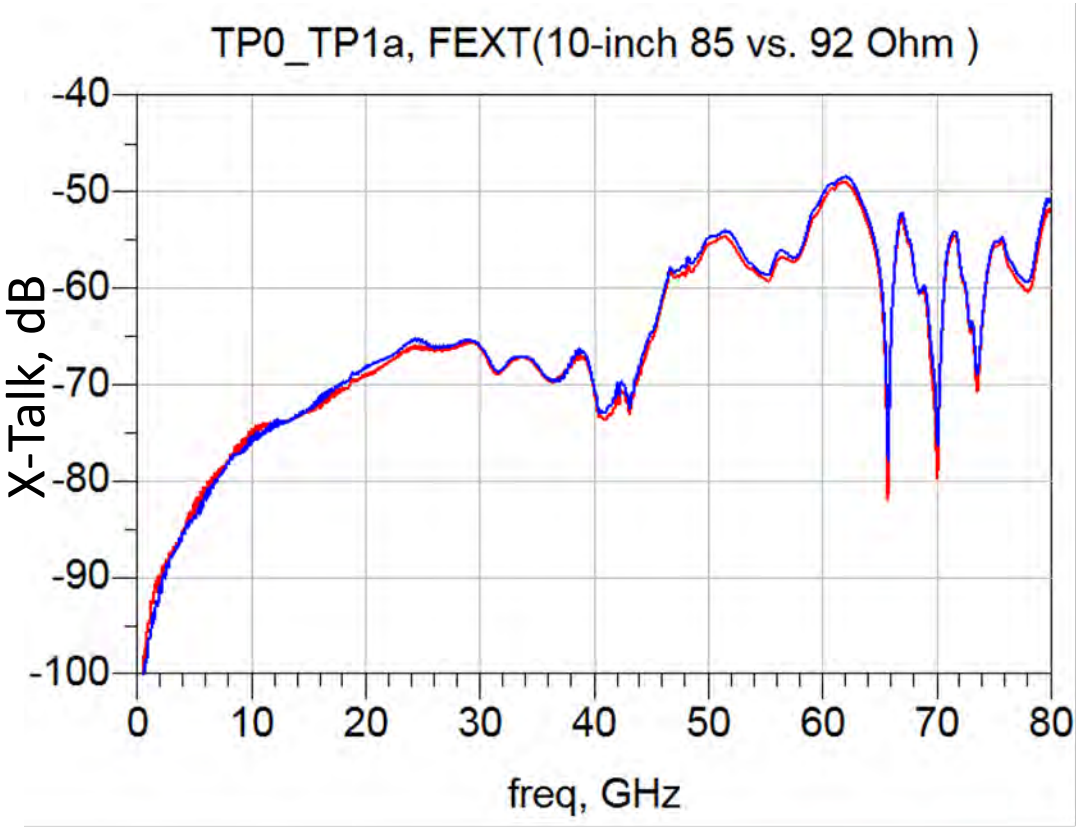


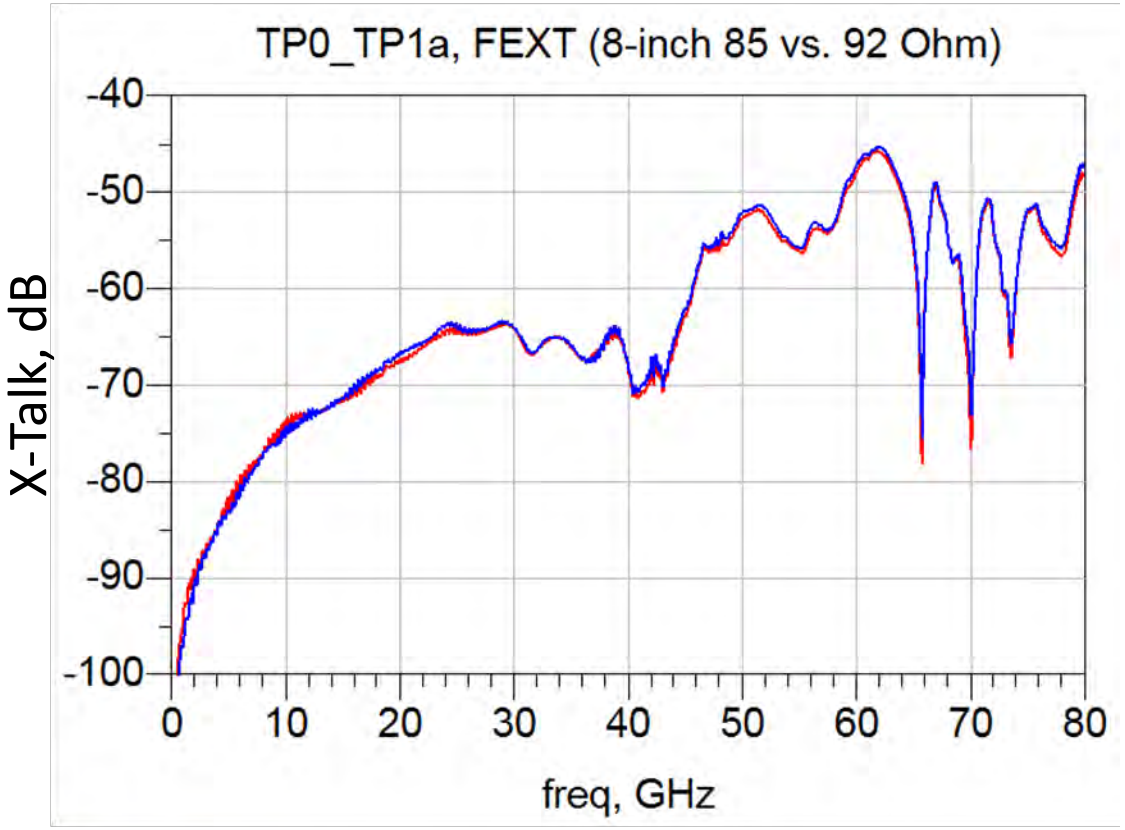


92 Ω 85 Ω

Similar Cross talk performance, 92Ω slightly better due to slightly higher IL (with 85 Ω termination)

Cross Talk Comparison – 92 Ω Termination





92 Ω 85 Ω

Similar Cross talk performance, 92Ω slightly better due to slightly higher IL (with 92 Ω termination)

Summary

- Updated a high-loss chip-to-module channel to 92 ohm impedance based on a high-density/radix switch device and board design
- Key characteristics
  - Results are for 10 inch channel, similar trend for 8 inch channel

Termination	CH RL (92/85 ohm)	CH IL (92/85 ohm)	CH xtalk (92/85 ohm)
92 ohm	slightly better/worse	0.6 dB worse/better	slightly better/worse
85 ohm	slightly worse/better	0.6 dB worse/better	slightly better/worse