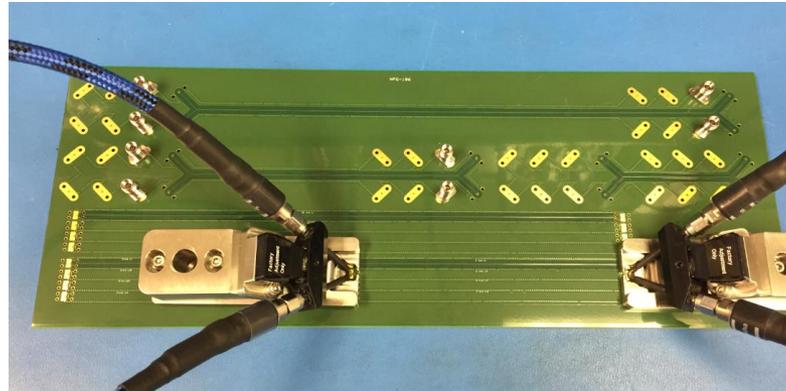
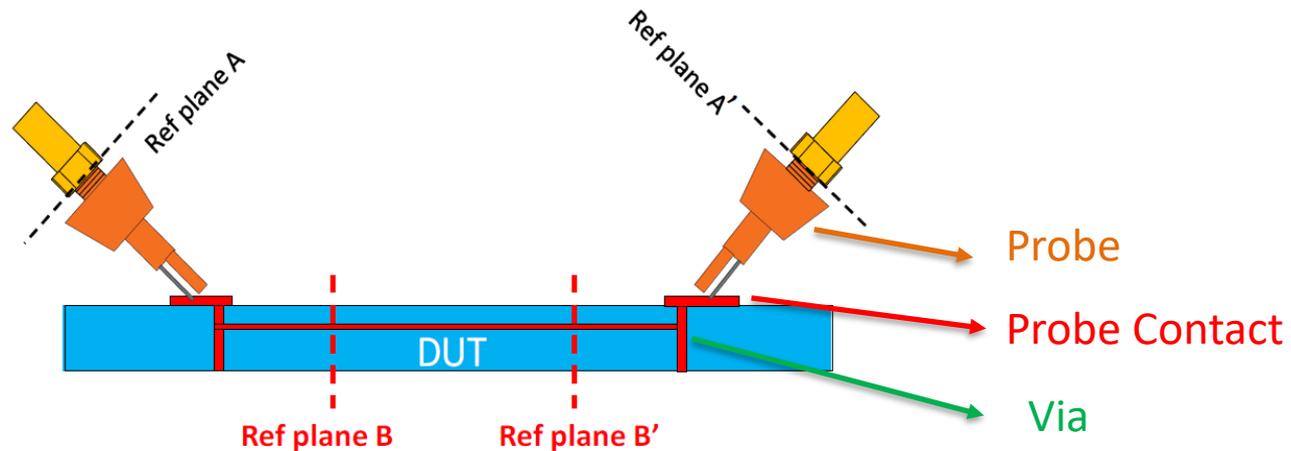


# D-Probe De-embedding



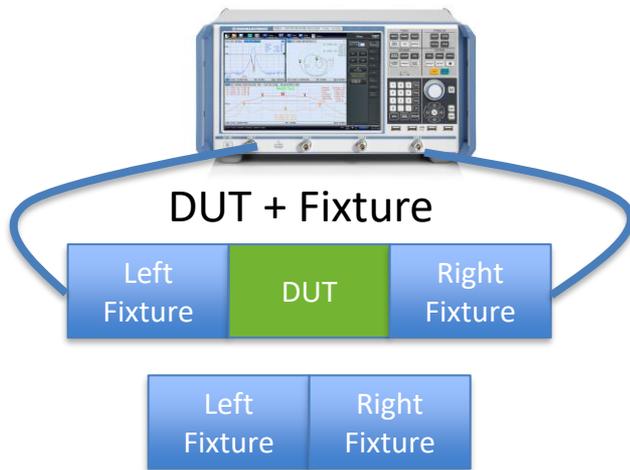
**PacketMicro, Inc.**  
**2312 Walsh Avenue, Suite A, Santa Clara, CA 95051**

# De-embedding Approaches



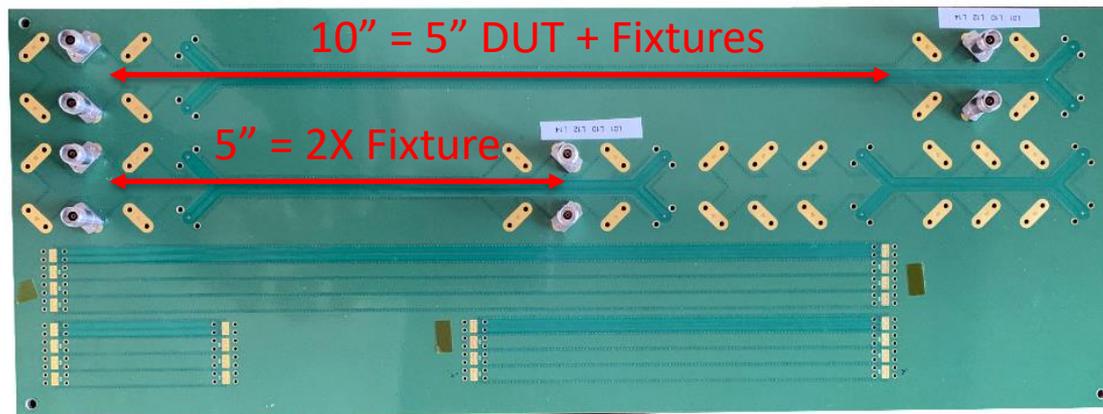
- **De-embedding with 2X Thru fixture (Best)**
  - Removing the effects caused by probes, probe contacts, and PCB vias.
- **De-embedding by treating 2 Probes as the 2X Thru**
  - Removing the effect caused by the probes and probe contacts
- **De-embedding with a typical probe S4P from PacketMicro**
  - This is the least accurate one because of the difference in probes and probe launches

# 2X Thru De-embedding



2x thru fixture

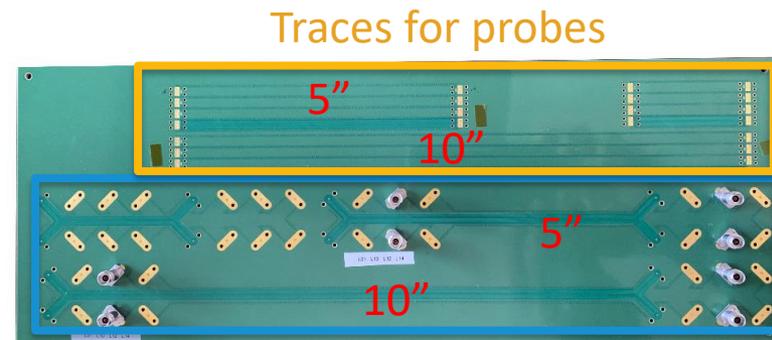
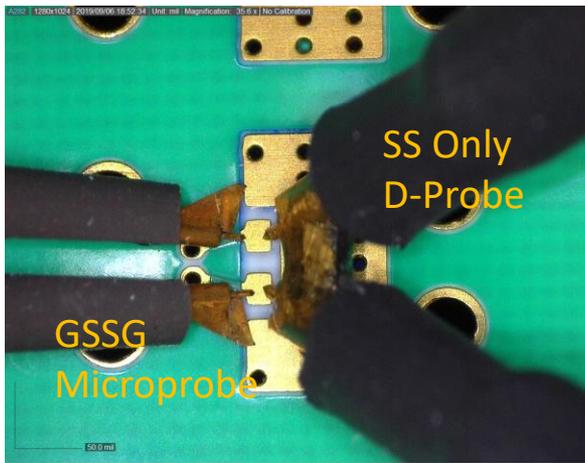
- **2X-Thru De-embedding Method:**
  - Accurate: comparable accuracy to traditional TRL technique
  - Simple: only one 2x thru fixture is needed
  - Tool: Smart Fixture De-embedding AITT-SFD Tool



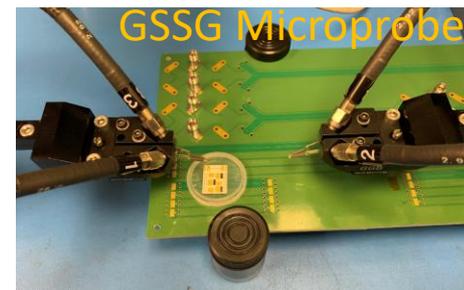
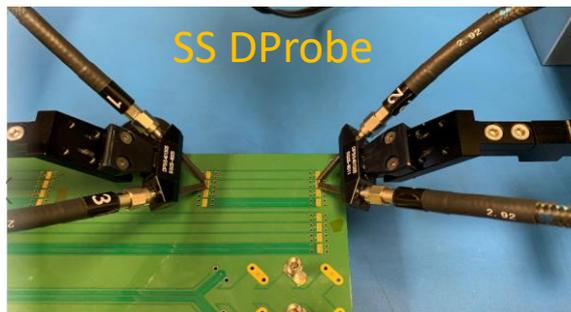
# 40 GHz Delta-L 4.0 Test Board

## ○ Traces:

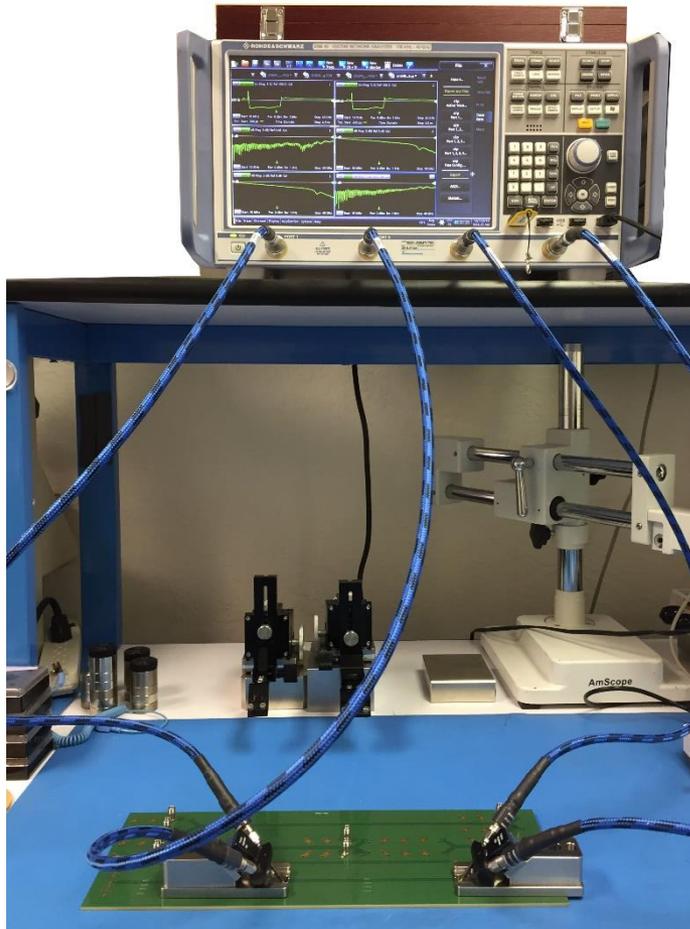
- L01 (microstrip) 5", 10" traces
- L12 (stripline) 5", 10" traces



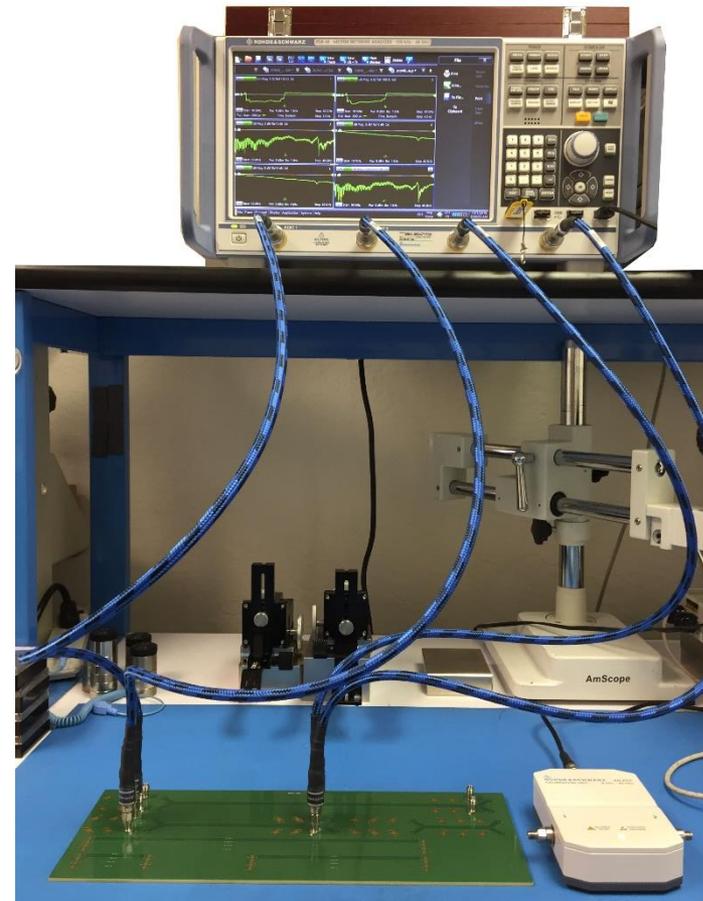
Traces for 2.92 mm connectors



# 40 GHz PCB Testing with R&S ZNB40 VNA

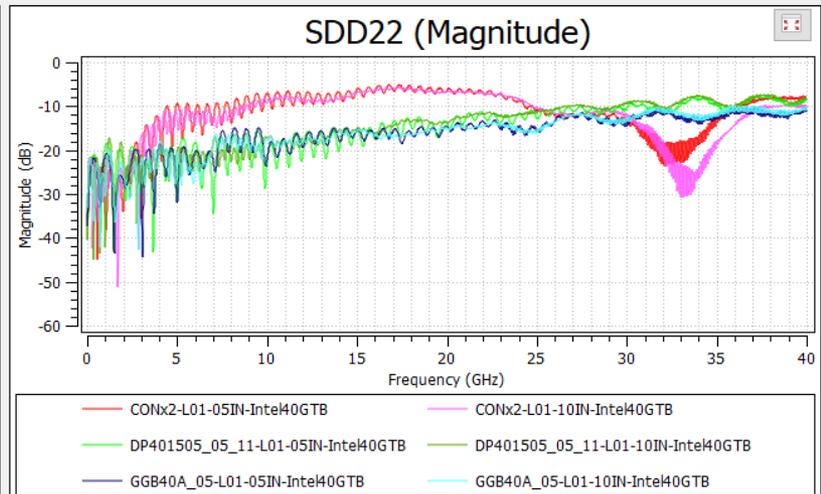
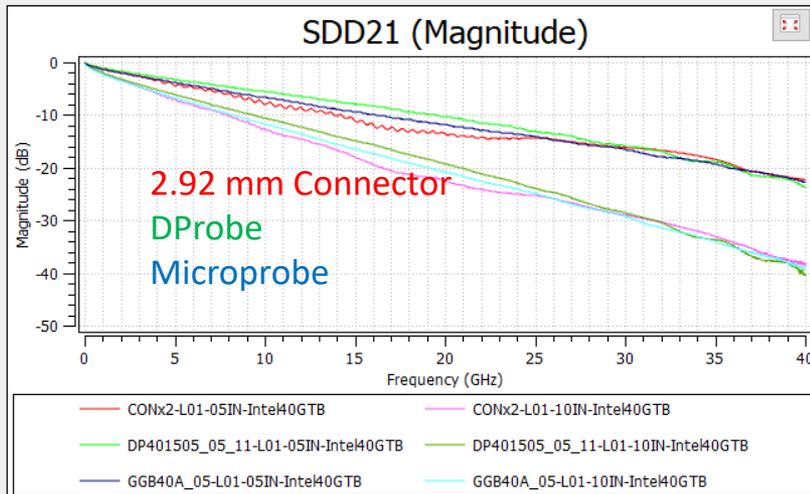
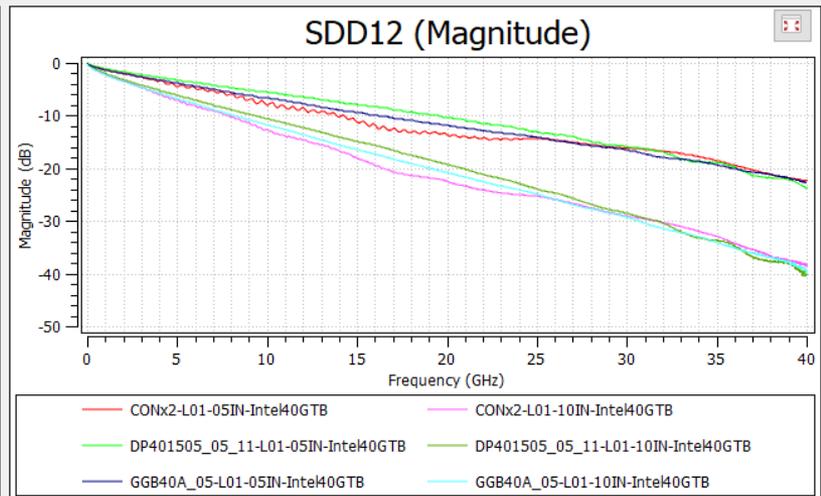
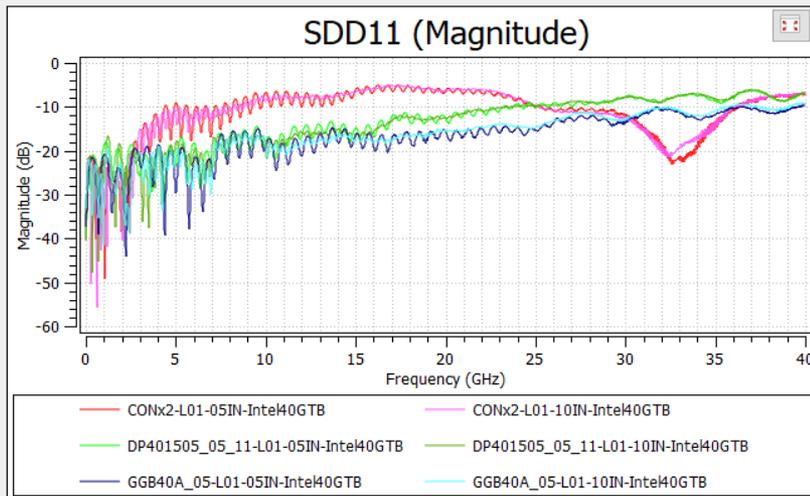


VNA measurement with D-Probe

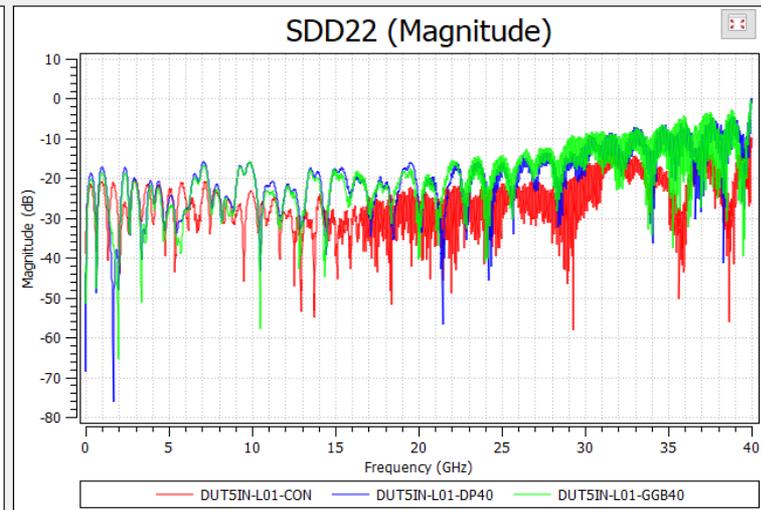
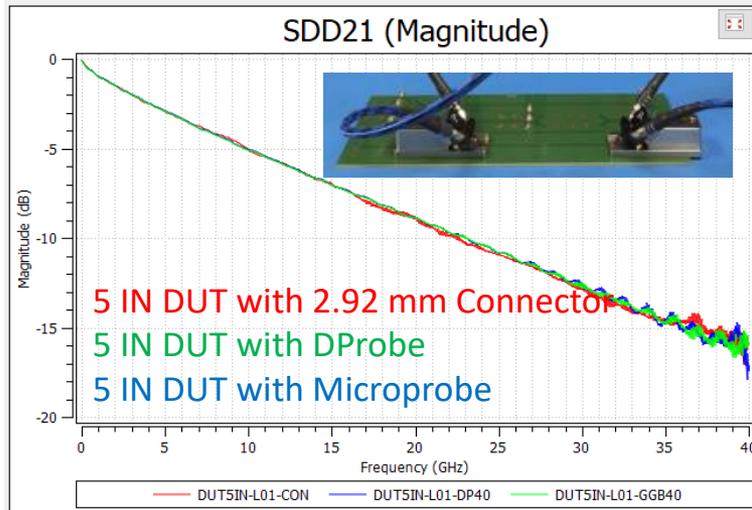
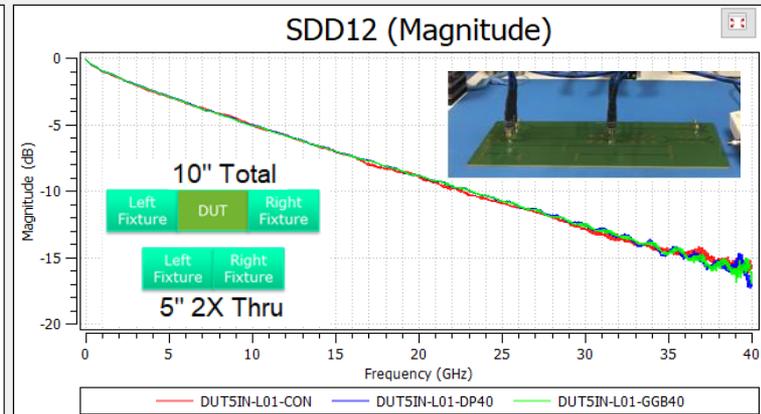
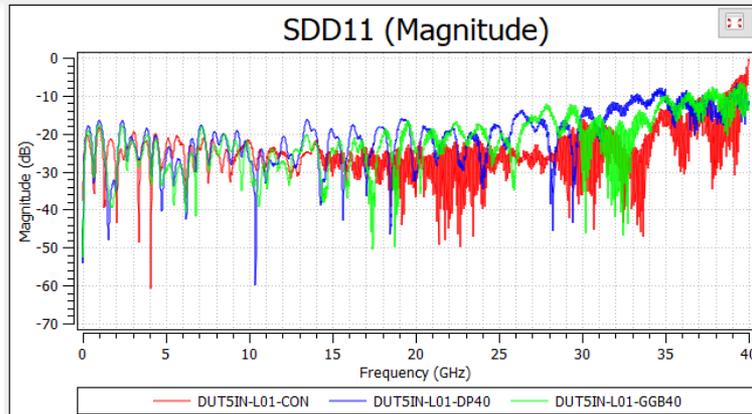


VNA measurement with 2.92 mm

# Microstrip L01 10" & 5" - SS DProbe, GSSG Microprobe

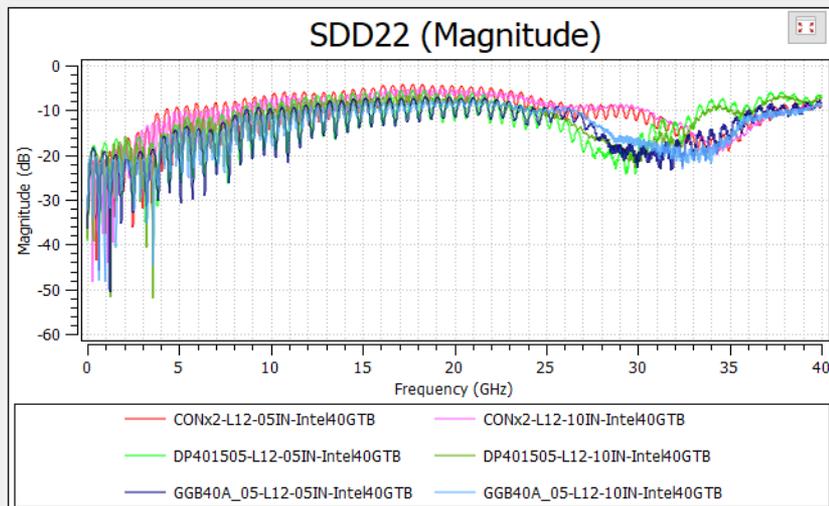
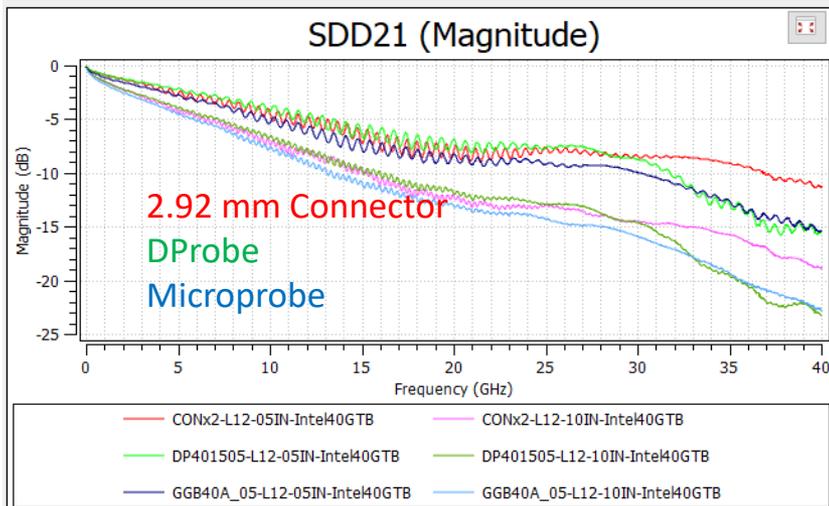
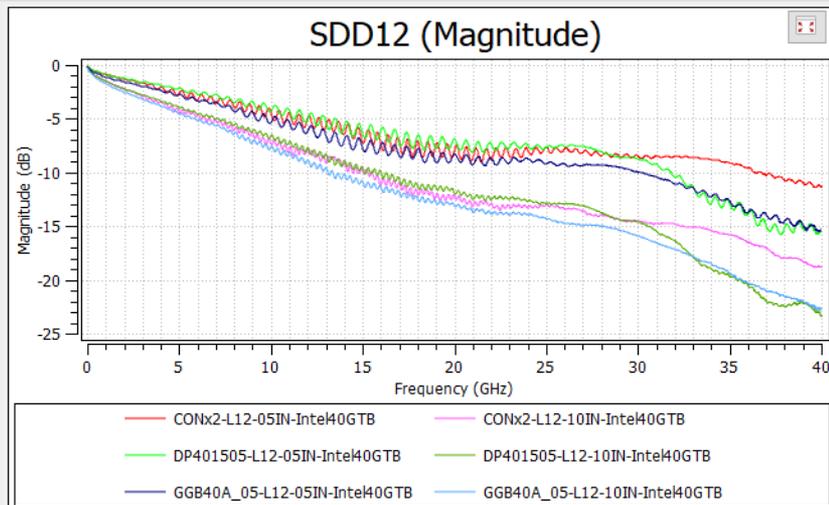
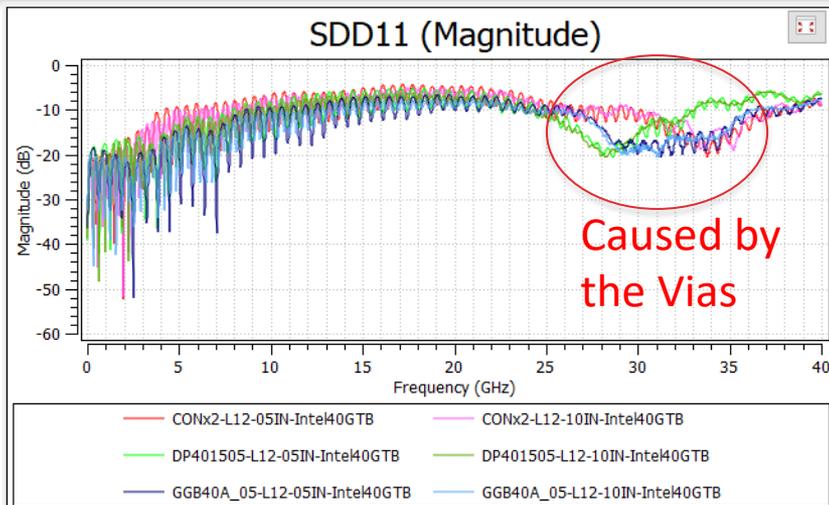


# Microstrip 5" DUT (10" Total with 5" as 2X Thru)

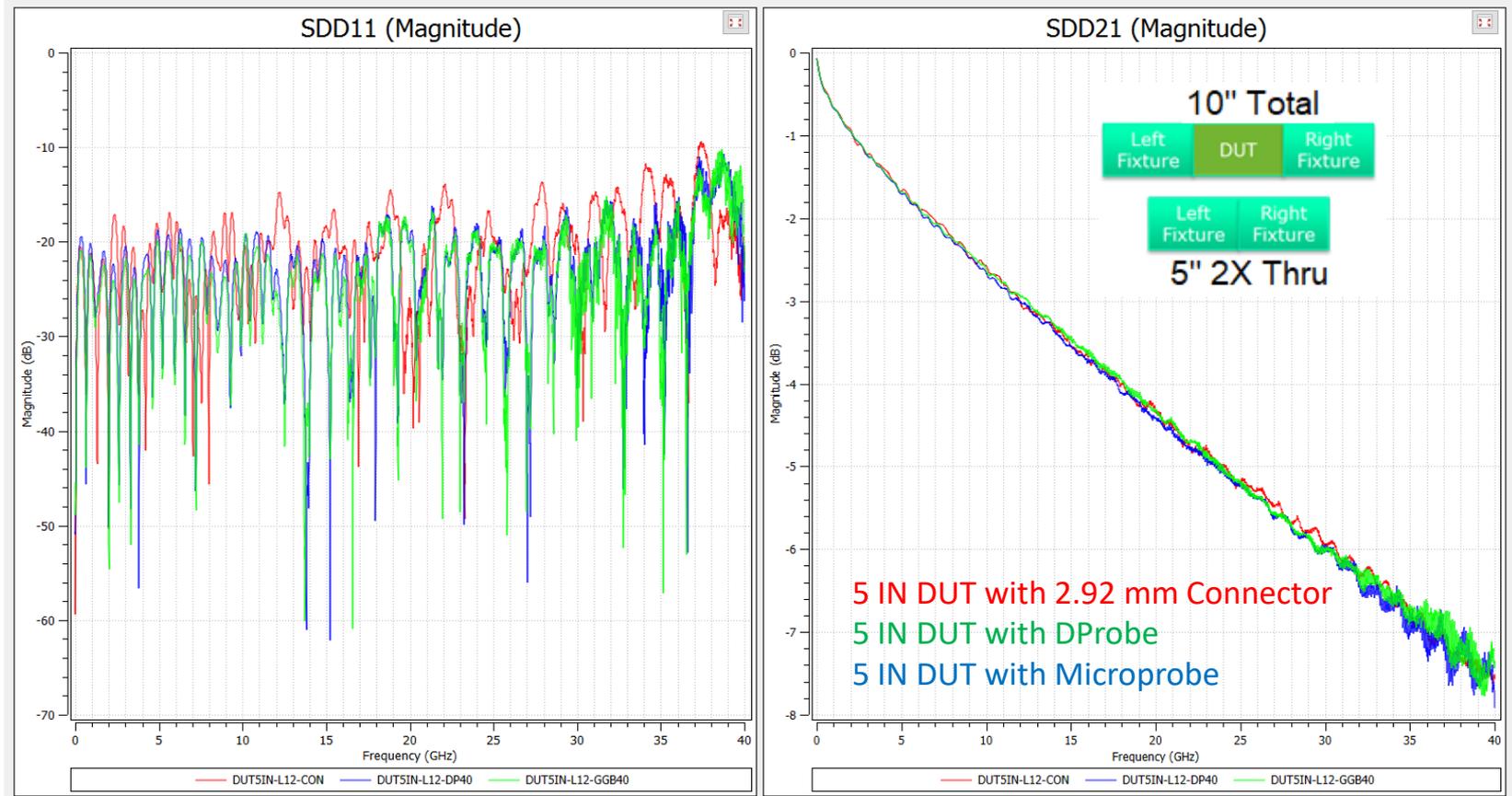


Connector, DProbe, and microprobe DUT results are very close up to 40 GHz by using the 5" trace as the 2X Thru.

# Stripline L12 10" & 5" : SS DProbe, GSSG Microprobe

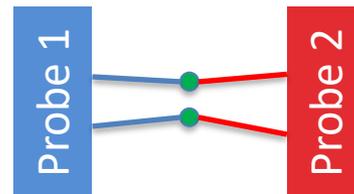
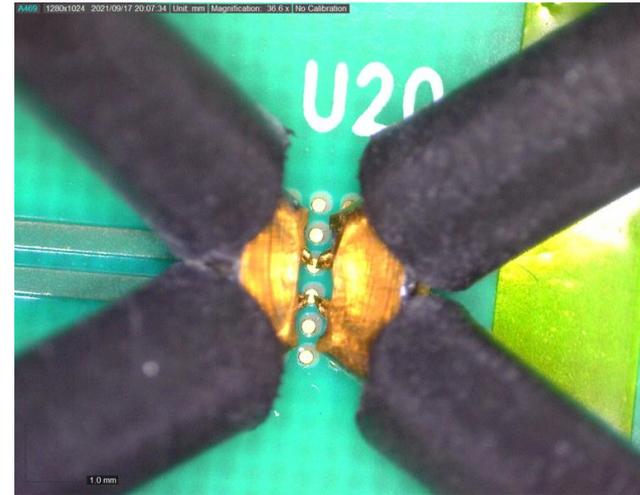
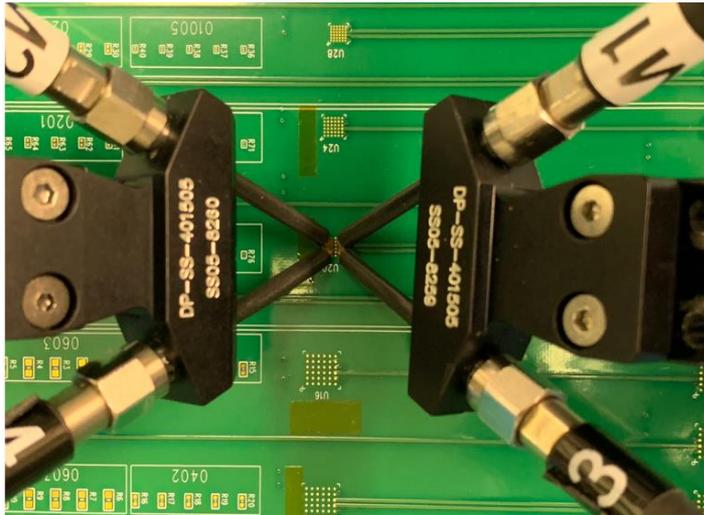


# Stripline L12 5" DUT (2X Thru)



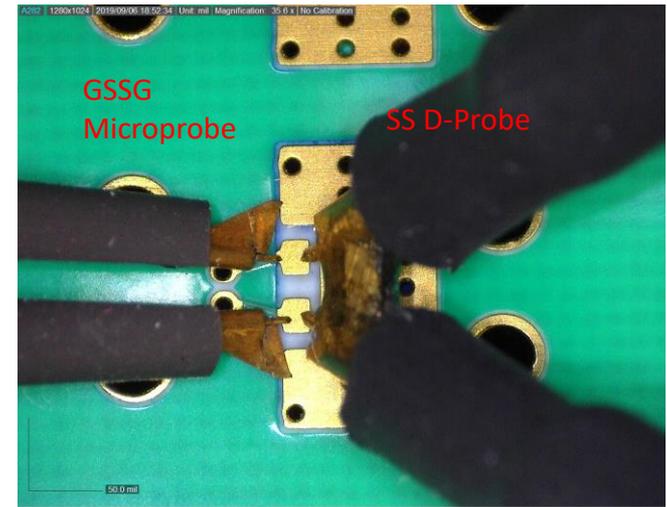
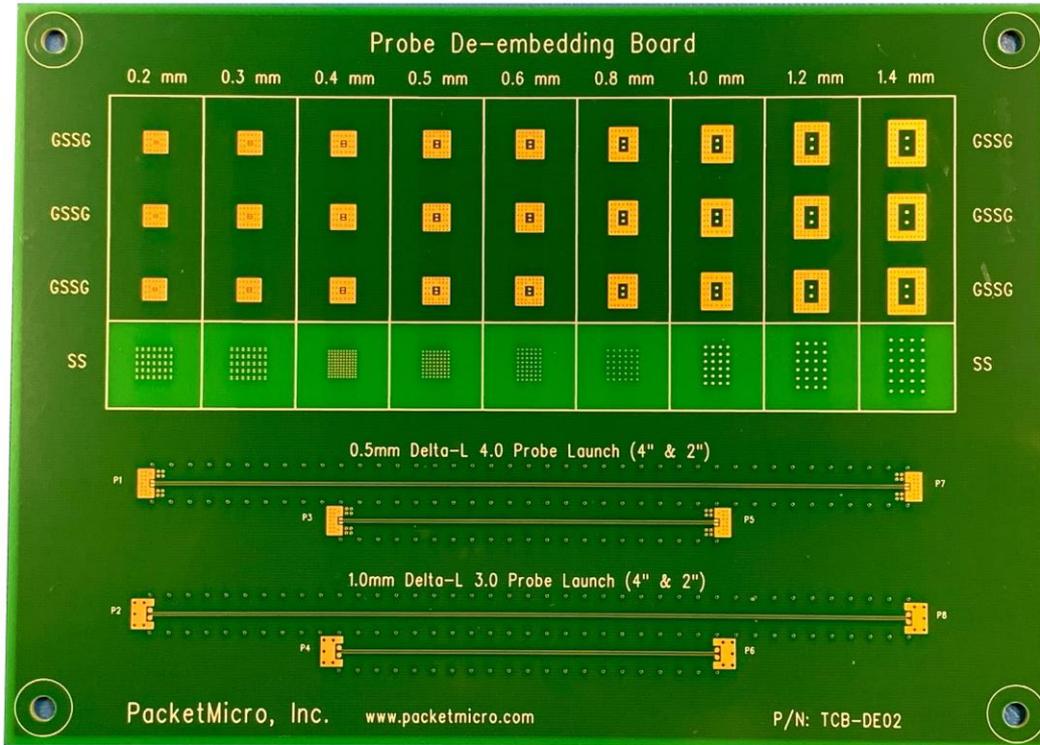
Connector, DProbe, and microprobe DUT results are very close up to 40 GHz by using 2X Thru approach.

# Extract Probe S4P by using 2X Thru



- Create floating test pads on the same PCB, which match IC footprint, such as 0.5 mm / 0.8 mm/ 1.0 mm BGA pads
- Extract probe S4P by treating the total 2-probe measurements as a 2X Thru

# TCB-DE02 D-Probe De-embedding Board



- You can use TCB-DE02 board to de-embed D-Probes if there are no floating BGA pads on your board.

# De-embedding with Measured Probe S4P Files

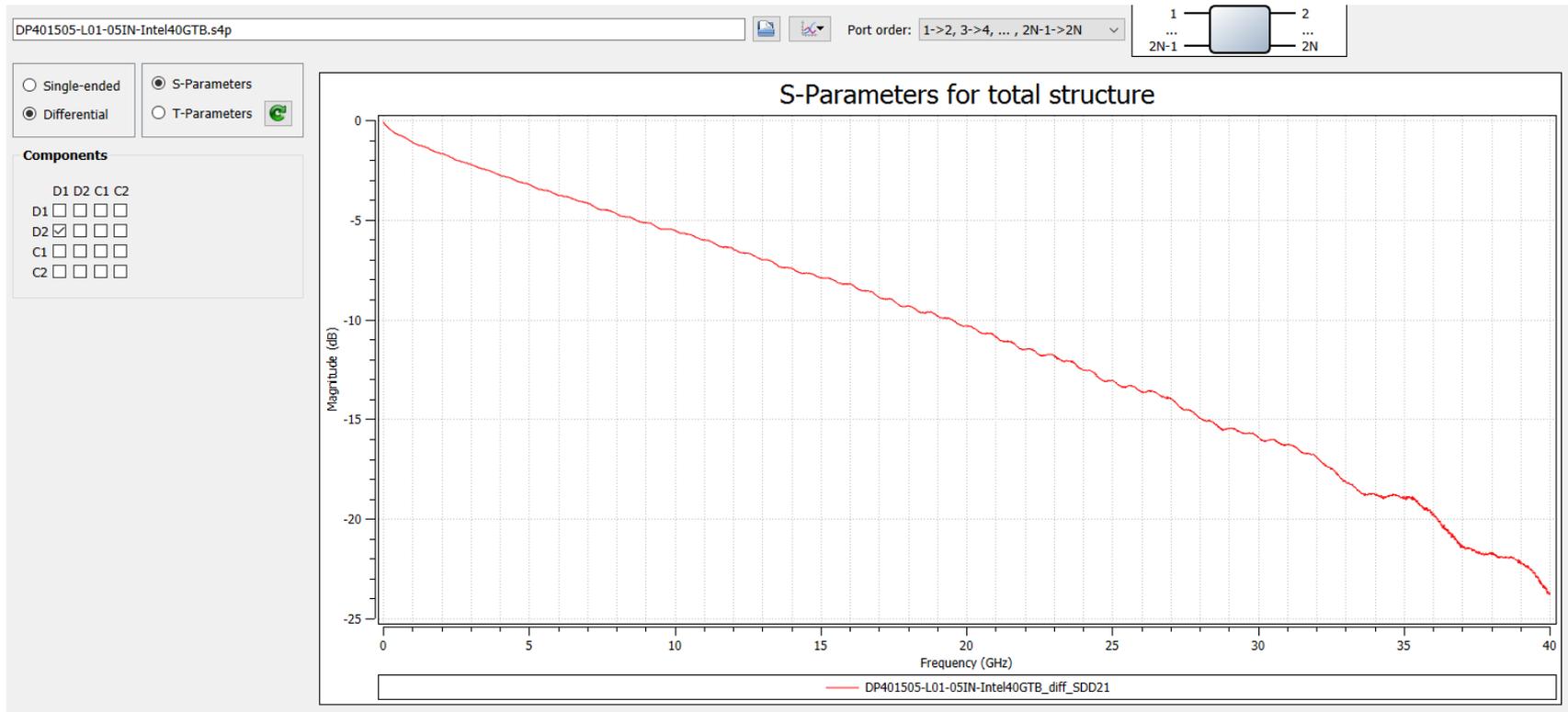


## When 2X Thru is not available:

- Remove probe and probe contact effects by de-embedding with probe S4P files
- Perform probe-tip calibration for GSSG microprobe (This approach cannot be used for SS only DProbe)

# Extract Microstrip L01 5" Trace with AITT-SFD

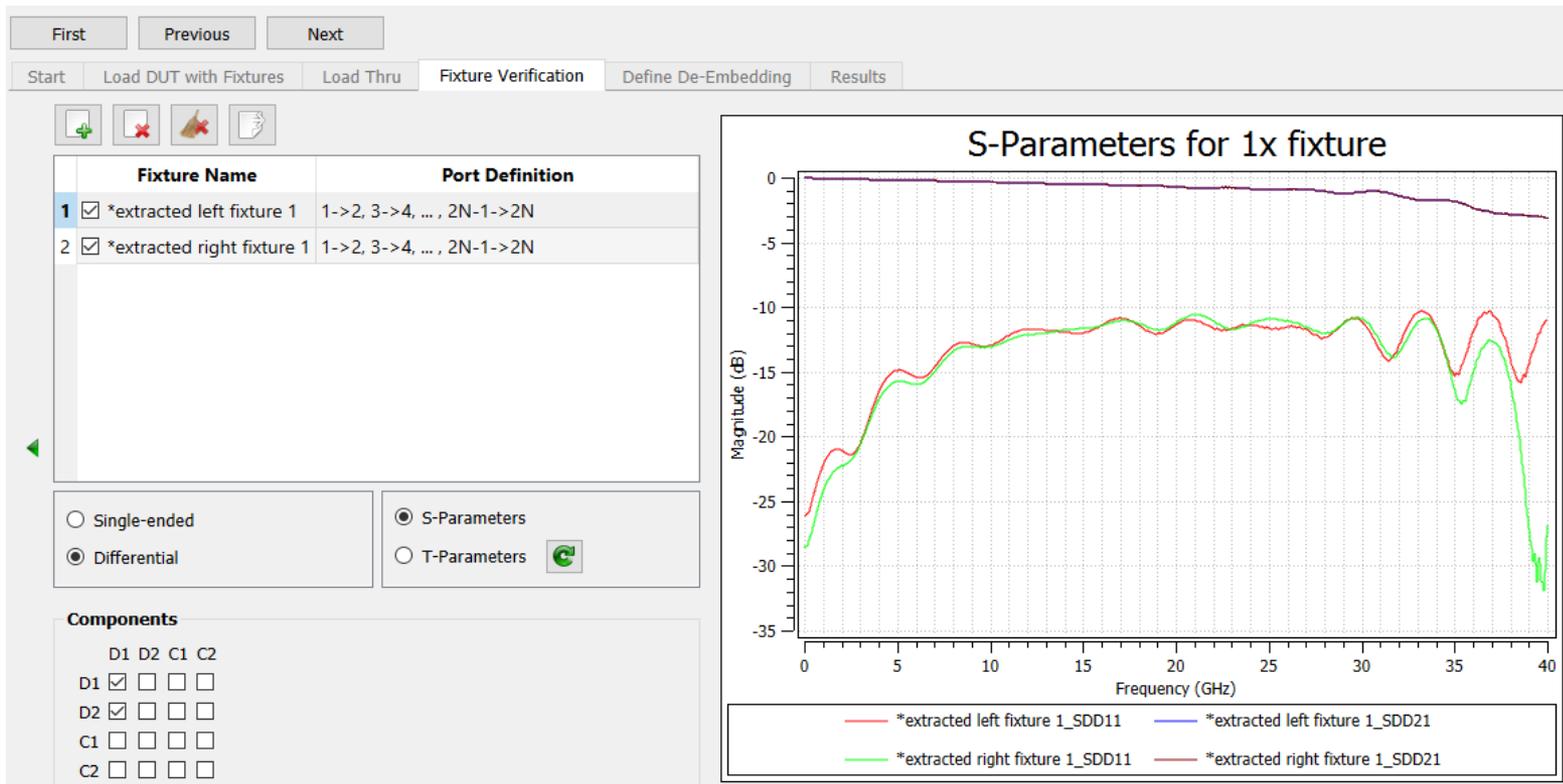
## Step 1: Load DUT with fixtures (DP40 - 5 IN Trace - DP40)





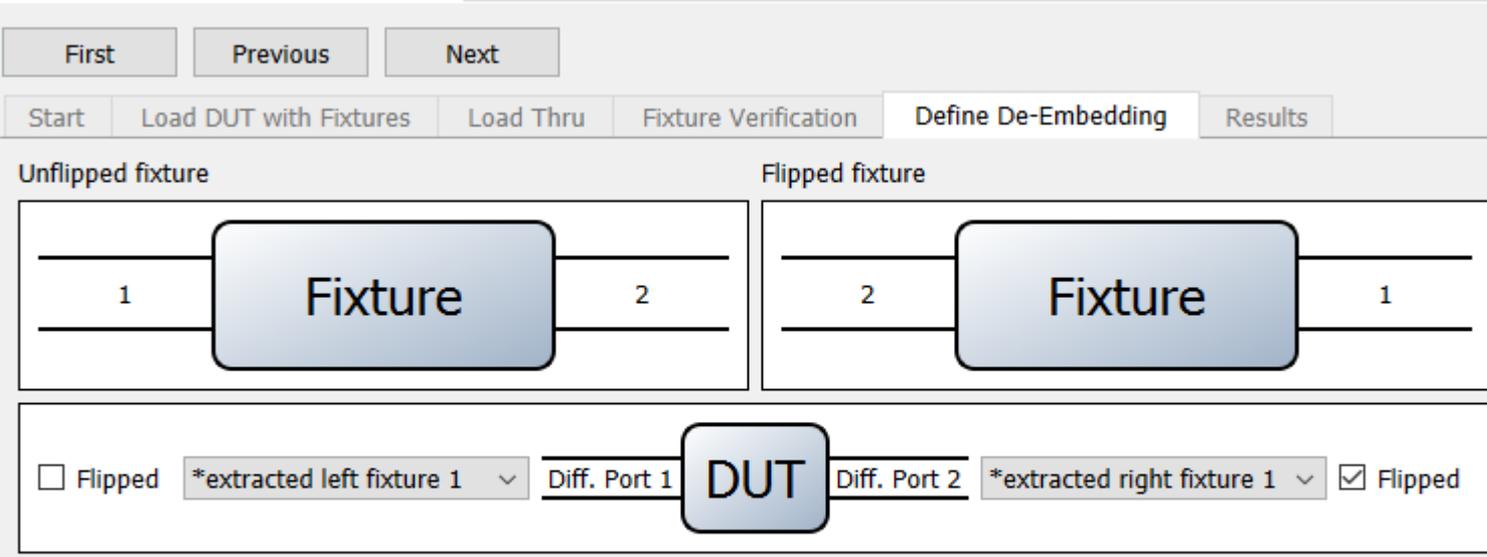
# Extract Stripline 5" Trace with AITT-SFD

**Step 3: Extract Left fixture (DPSS401505-05) and right fixture (DPSS401505-11)**



# Extract Stripline 5" Trace with AITT-SFD

## Step 4: Set up de-embedding configuration



First Previous Next

Start Load DUT with Fixtures Load Thru Fixture Verification Define De-Embedding Results

Unflipped fixture Flipped fixture

1 Fixture 2 2 Fixture 1

Flipped \*extracted left fixture 1 Diff. Port 1 DUT Diff. Port 2 \*extracted right fixture 1  Flipped

**Define De-Embedding**

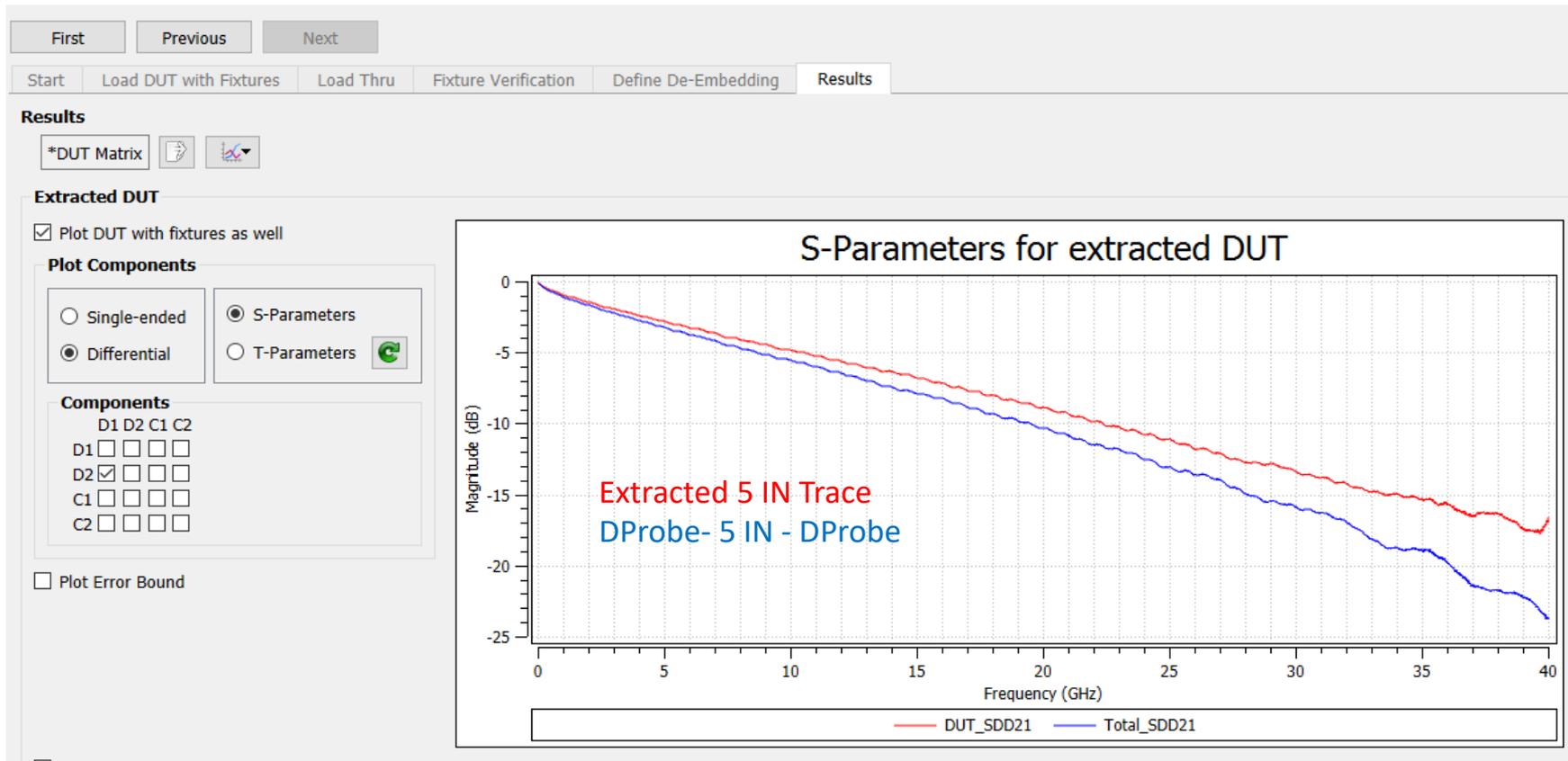
Modal de-embedding with mode conversions neglected

Fixture autocorrection

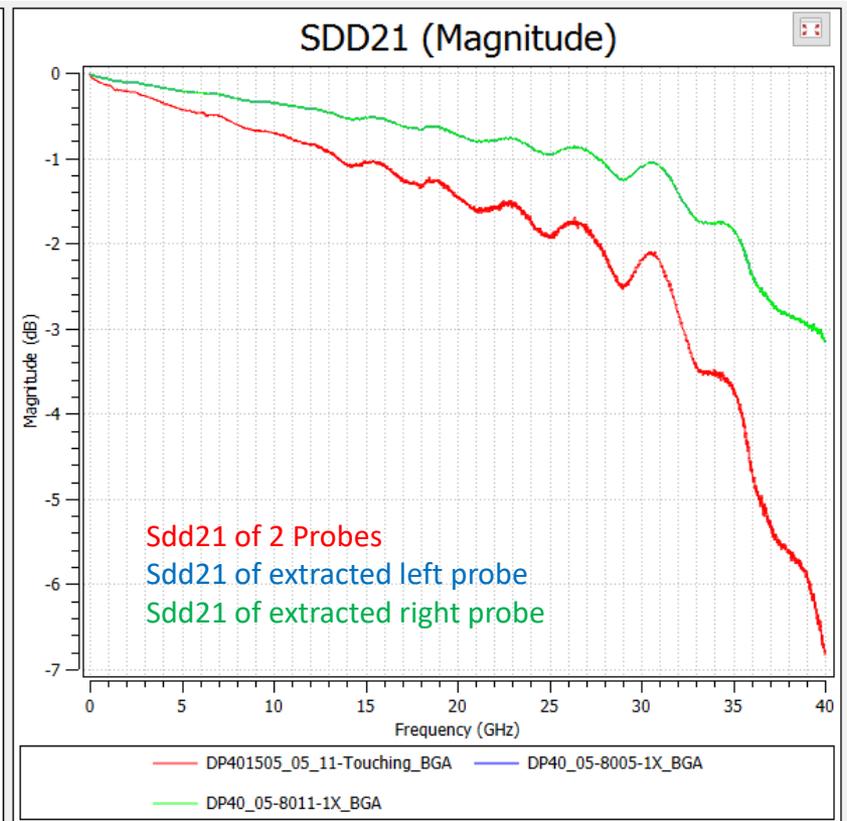
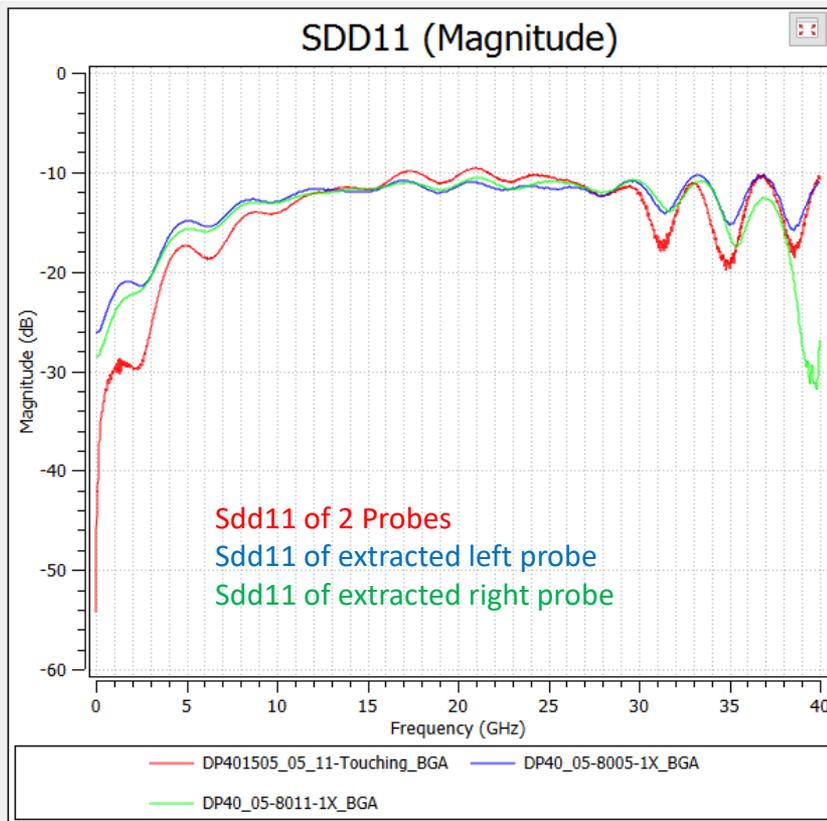
Make sure to check this box for signal-signal only D-Probe!

# Extract Stripline 5" Trace with AITT-SFD

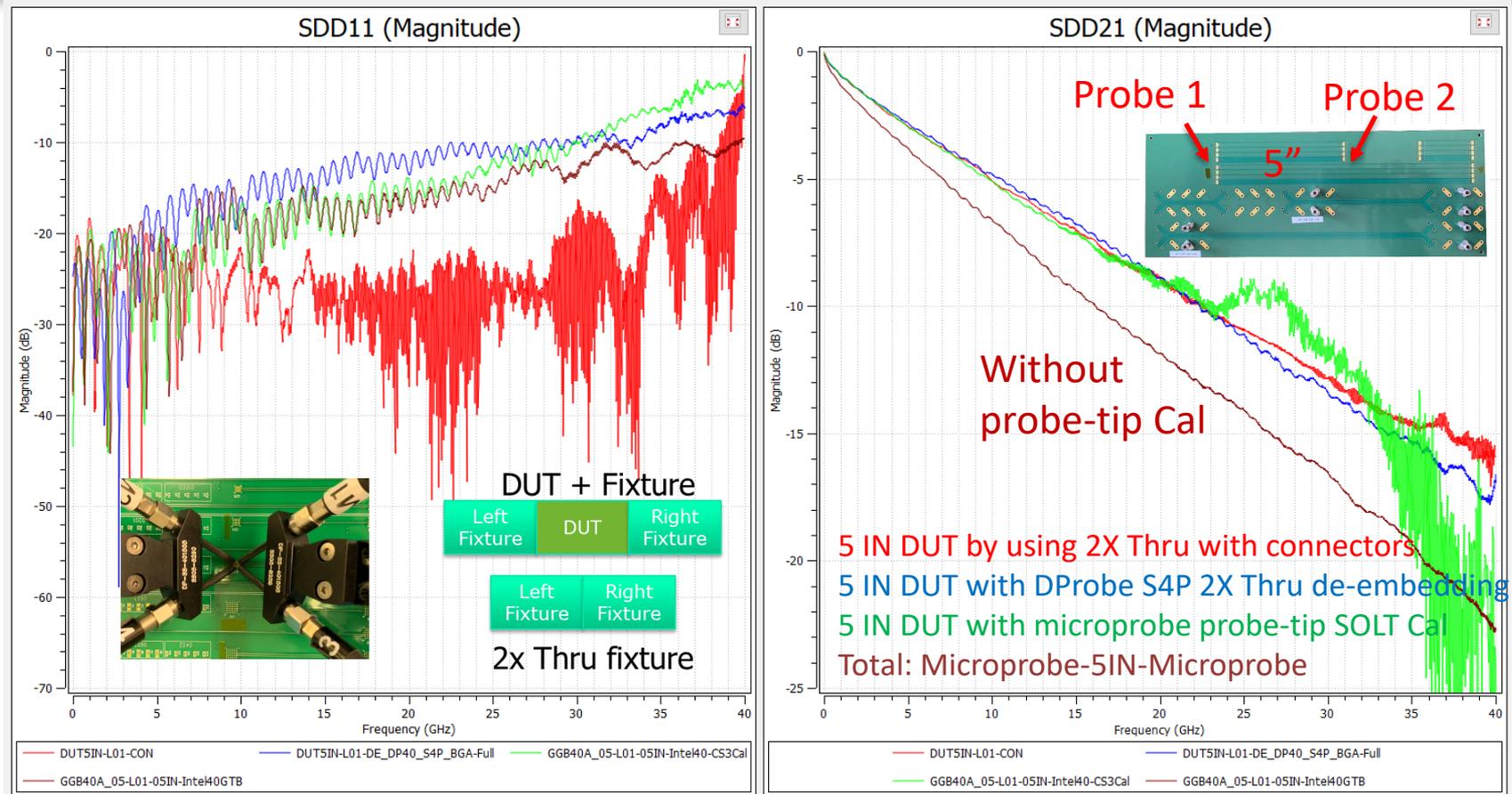
## Step 5: Extract 5 IN Trace



# Extract DProbe S4P from 2X Thru

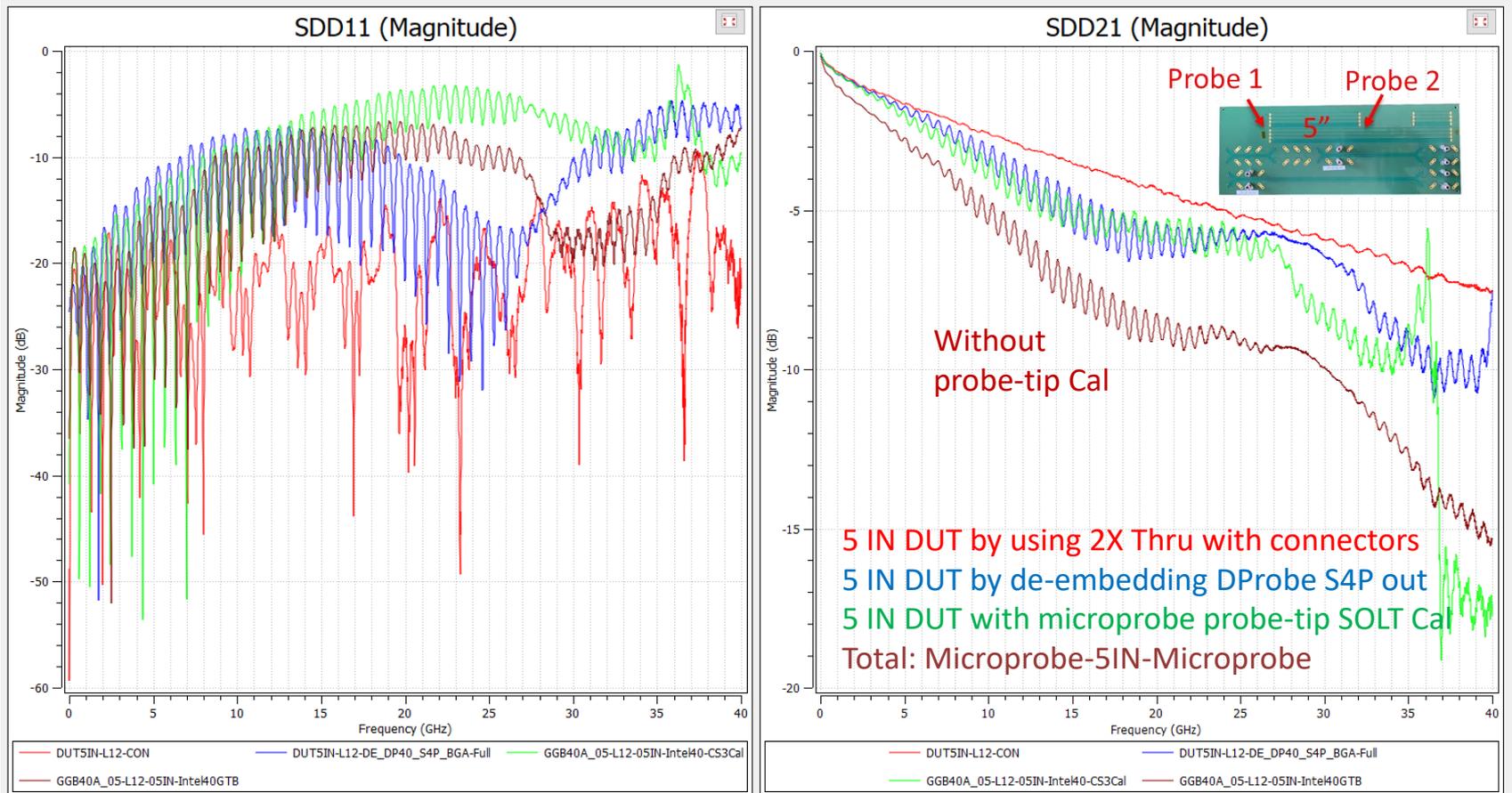


# L01 5" DUT: D-Probe (2X Thru) vs. Microprobe (SOLT)



- DUT results of Connectors (using 5" as the 2X Thru), DProbes (using 2 probes as the 2X Thru), and microprobes (with SOLT) are similar up to 25 GHz.
- 2 D-Probes act like the left and right test fixtures in the 2X Thru de-embedding approach.

# Stripline L12 5" Trace (1X Probe S4P De-embedding)



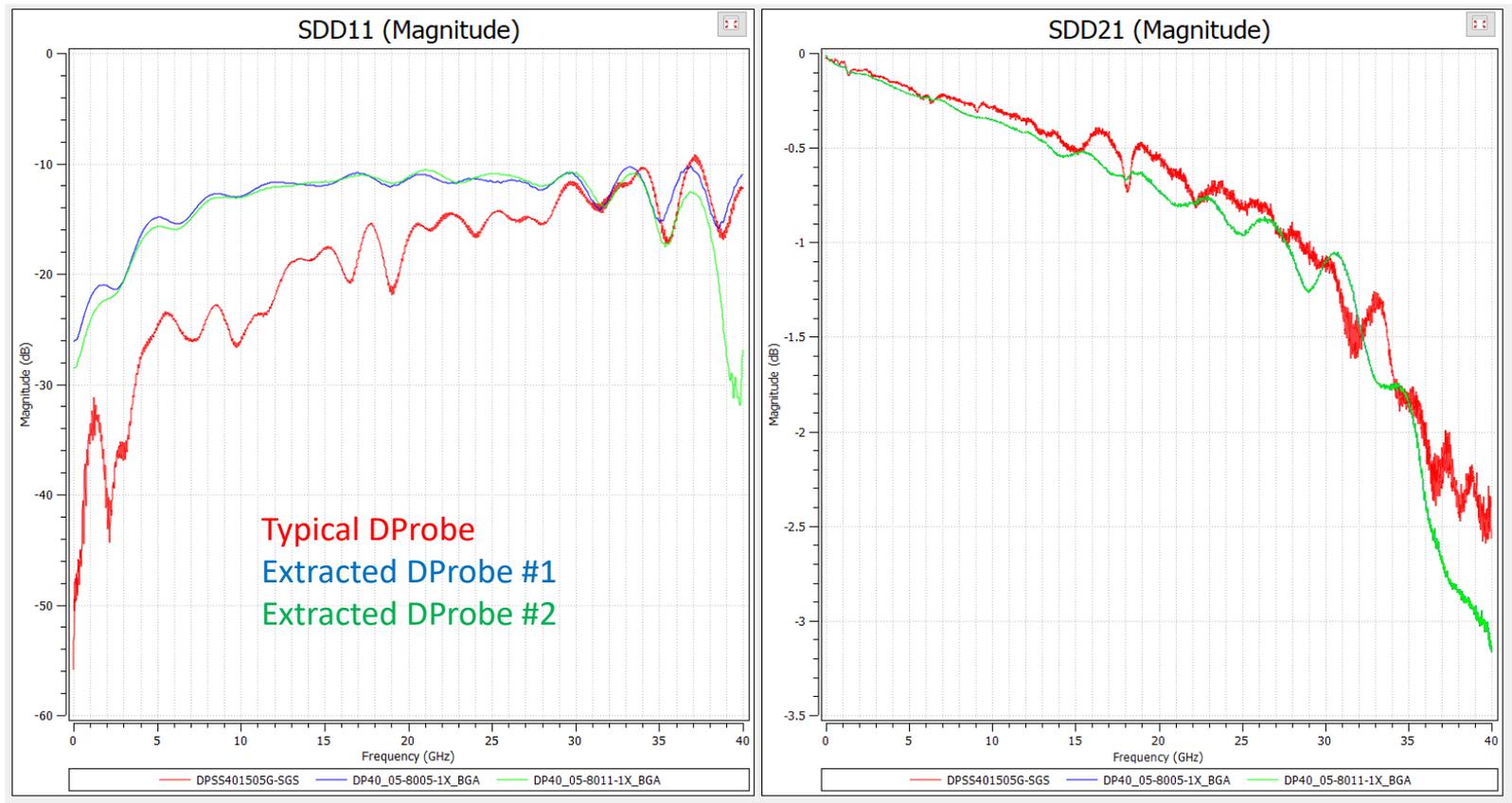
De-embedded DUT with D-Probe and microprobe probe-tip calibration result are similar up to 25 GHz.

# De-embedding with Typical D-Probe S4P File

## **When to use the typical DProbe S4P provided by PacketMicro**

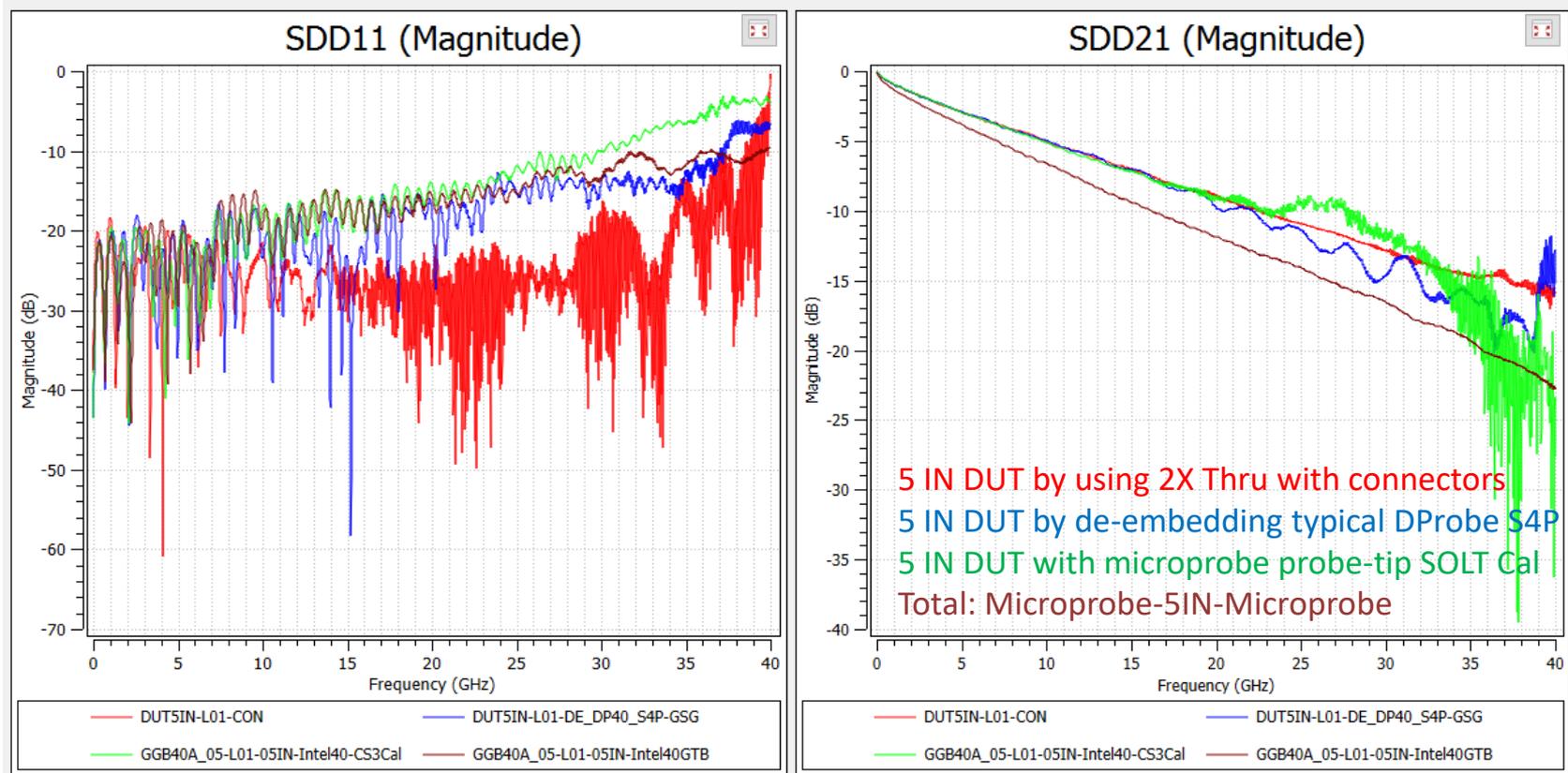
- 2X Thru fixture on PCB is not available
- Floating test pads on PCB to extract the probe S4P is not available

# D-Probe S4P (Typical vs. Extracted)



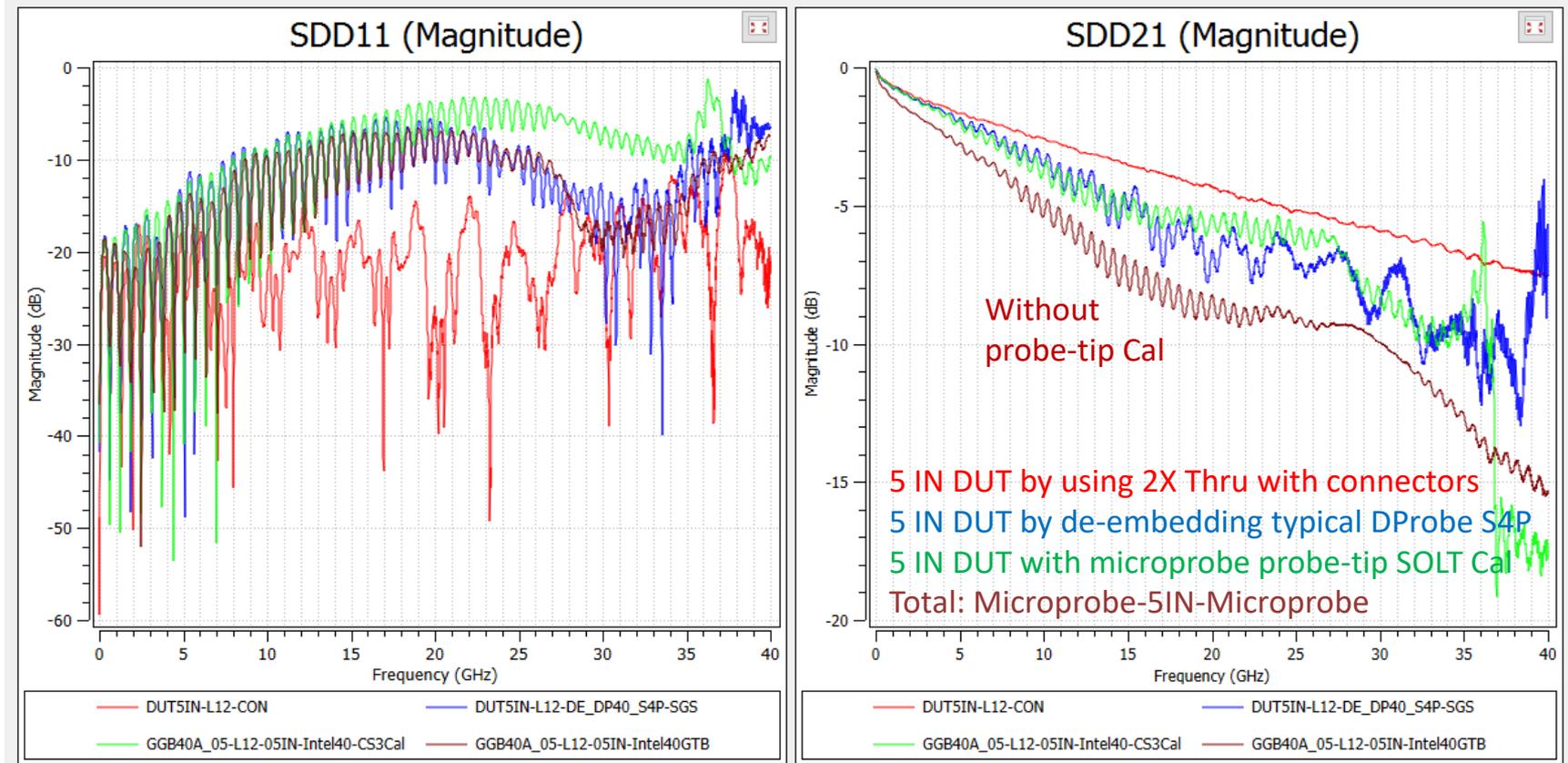
- Special test fixture is designed to make DProbe S4P measurement with ground contact (SGS)

# Microstrip L01 5" Trace (Typical DP40 S4P De-embedding)



De-embedded DUT with D-Probe and microprobe probe-tip calibration result are similar up to 20 GHz.

# Stripline L12 5" Trace (Typical P40 S4P De-embedding)

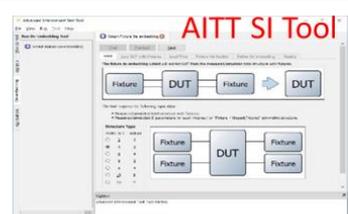


De-embedded DUT with D-Probe and microprobe probe-tip calibration result are similar up to 15 GHz.

# Summary

- **Use 2X Thru approach on PCB whenever it is possible.**
- **Use 2 probe landing on floating test pads as the 2X Thru when 2X Thru on PCB is not available.**
- **Use typical probe S4P file from PacketMicro for de-embedding as a last resort.**

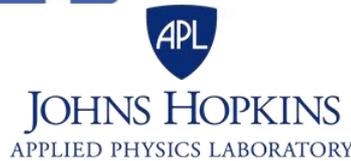
# PacketMicro Product Offering

 <p>D-Probe S-Probe R-Probe</p>	 <p>R-Probe for PDN testing</p>	 <p>Delta-L 4.0 Solution</p>	 <p>TCS70 Cal Substrate</p>	 <p>S-Probe</p>
 <p>Precision Positioners TP250 TP150</p>	 <p>VPS10 2-Sided Probe Station</p>	 <p>F80 FP40</p>	 <p>Flex Positioners FP160MS FP160</p>	
 <p>USB Type-C Fixtures</p>	 <p>HPS24 Probe Station</p>	 <p>AITT SI Tool</p>	 <p>Slim Phase Stable Cable Up to 67 GHz Junkosha MWX161</p>	 <p>Flex Probe Station Vertical &amp; Horizontal Probing in Minutes</p>

**PacketMicro offers one-stop shopping for your needs in PCB probing and SI analysis.**

- Rugged 40/30 GHz probes
- Probe Positioners
- DIY Probe Stations
- Junkosha phase-stable cables
- CSS AITT Signal-Integrity Tool
- Dino-Lite Microscopes

# PacketMicro Customers (of 200+ in 30+ Countries)



# Thank You

## We help make your probing tasks easy!

- Benchtop DIY Probe Stations
- Rugged 40 GHz Differential Probes
- Rugged 30 GHz Single-ended Probes
- Laboratory Rental
- Engineering Services
- Signal Integrity Consulting

### Contact:

support@packetmicro.com

Office: 408-675-3900

2312 Walsh Avenue, Suite A, Santa Clara, CA 95051, USA