SELECTION, CHARACTERIZATION AND DE-EMBEDDING OF DIFFERENTIAL PROBES FOR ACCURATE MEASUREMENTS OF HIGH-SPEED PCB SIGNAL STRUCTURES

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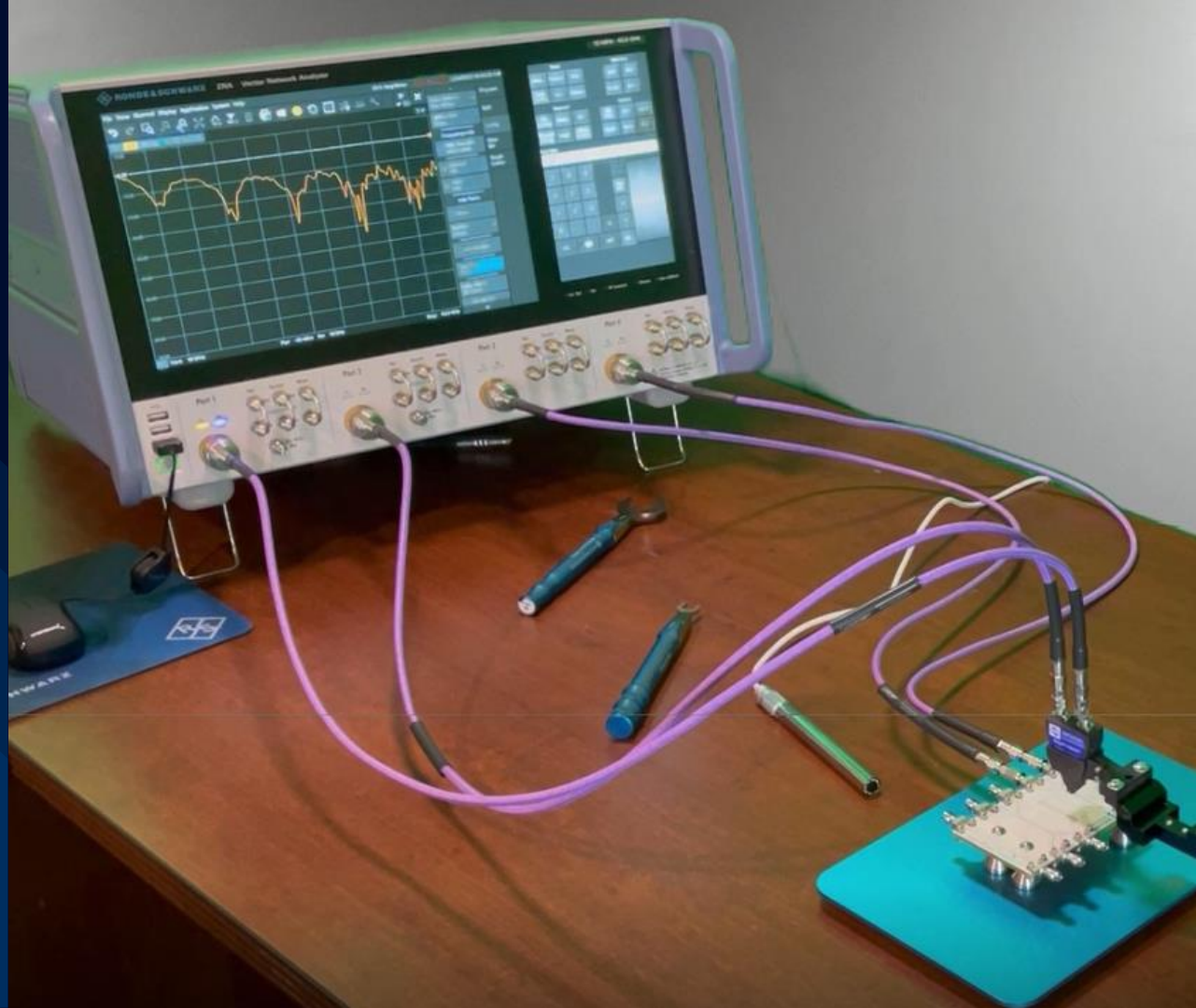
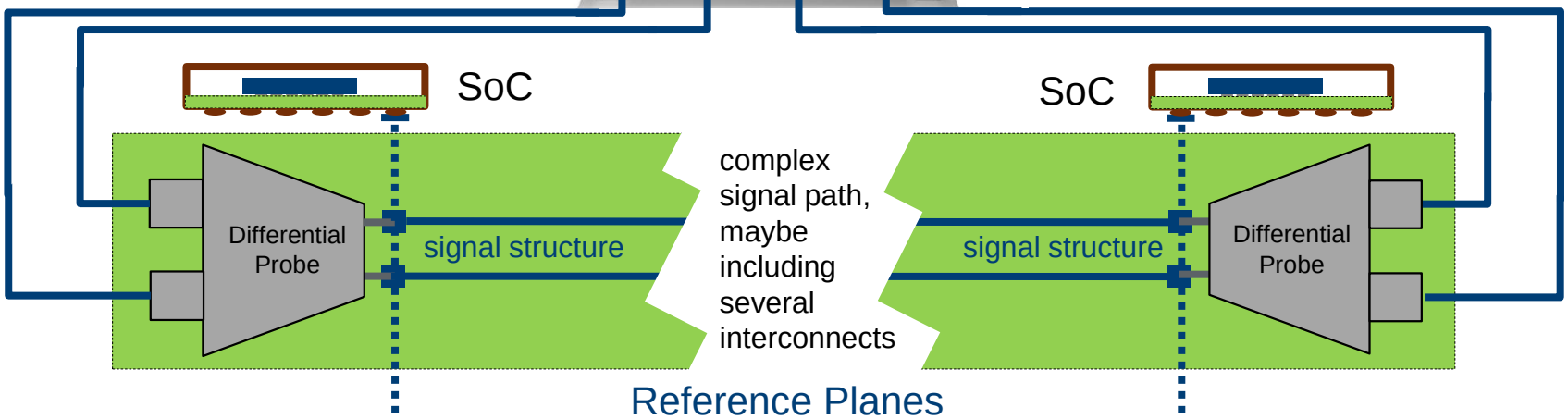
MEASURING SIGNAL TRACES WITH DIFFERENTIAL PROBES:

INTRODUCTION



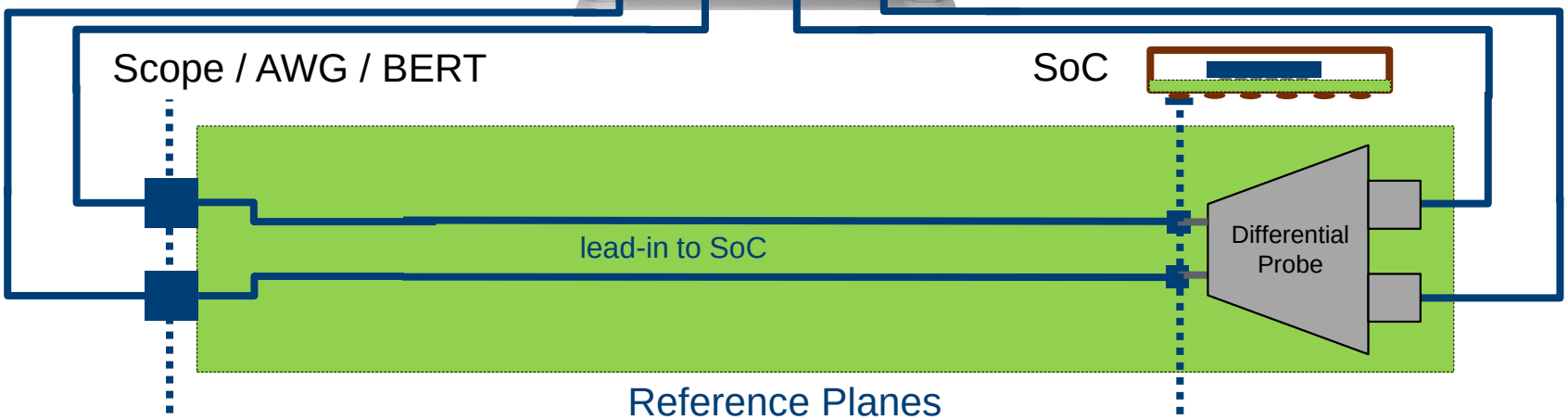
MEASUREMENT OF CHANNEL BETWEEN TWO SOCS: CONNECTION WITH 2 DIFFERENTIAL PROBES

R&S ZNA



MEASUREMENT OF LEAD-IN TO AN SOC ON A TEST BOARD: CONNECTION WITH 1 DIFFERENTIAL PROBE

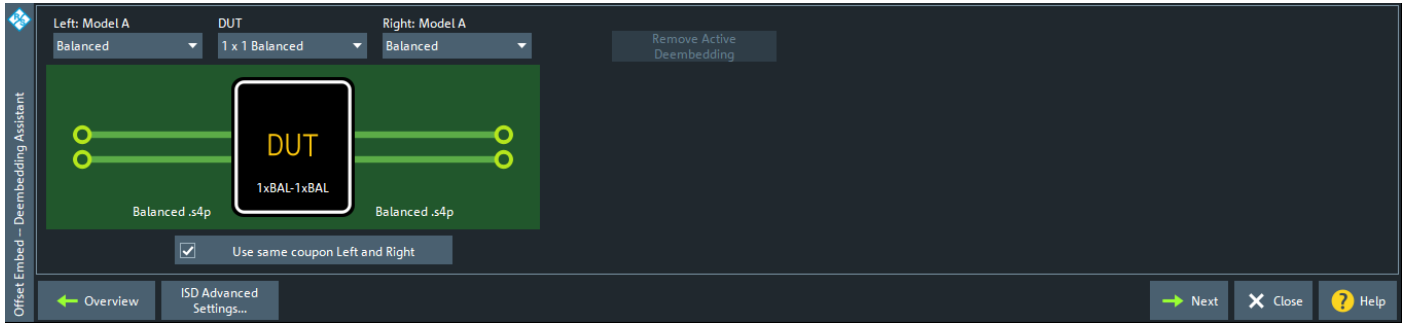
R&S ZNA



R&S DE-EMBEDDING ASSISTANT: ZNA, ZNB / ZNBT AND ZND WORKFLOW WITH IMPEDANCE CORRECTION

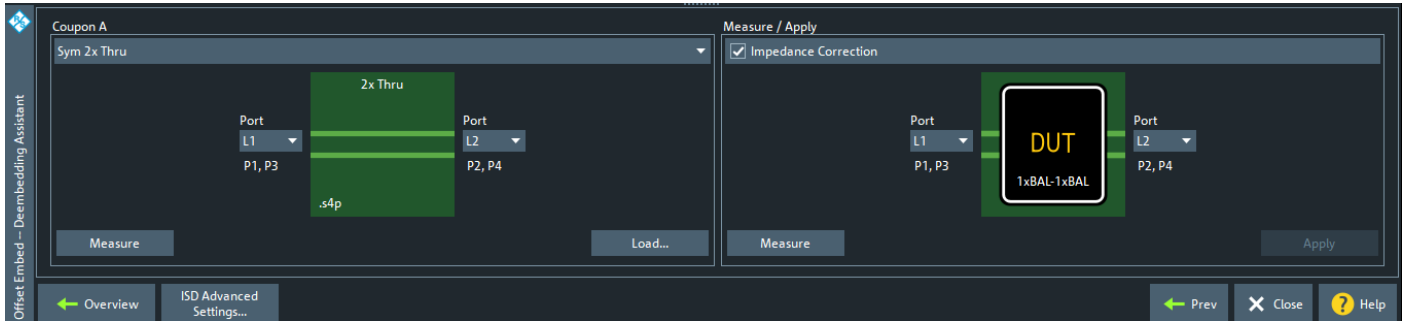
R&S De-embedding Assistant with Impedance Correction: Example ZNx-K220 / ISD

Step 1:
select tolology
- DUT
- lead-in
- lead-out



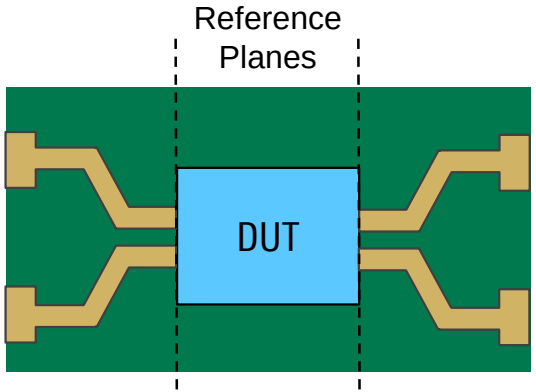
Step 2:
measurements
- coupon(s)
- total structure

Step 3:
apply



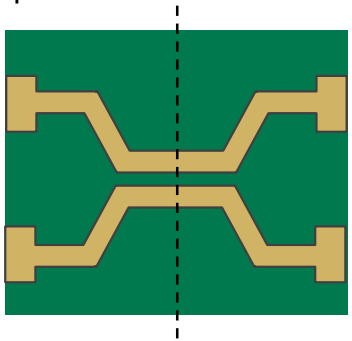
ACCURATE TEST FIXTURE MODELLING AND DE-EMBEDDING: HOW IT WORKS – IMPEDANCE CORRECTED DE-EMBEDDING

Total Structure
Fixture – DUT – Fixture



with

2x-Thru Coupon
Replica of Lead-in / Lead-out



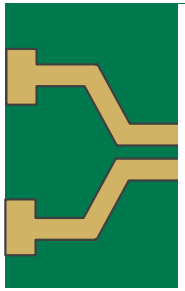
Traditional 2x-Thru de-embedding:
fixture models were only derived from 2x-Thru Coupon (replicas)

But:
replicas typically have different impedance profiles than actual lead-ins / lead-outs!

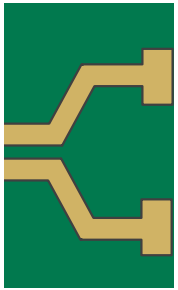
Therefore:
use modern de-embedding with impedance correction

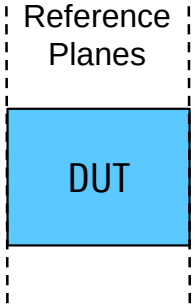
Tool

Fixture 1 Model:
Lead-in traces



Fixture 2 Model:
Lead-out traces

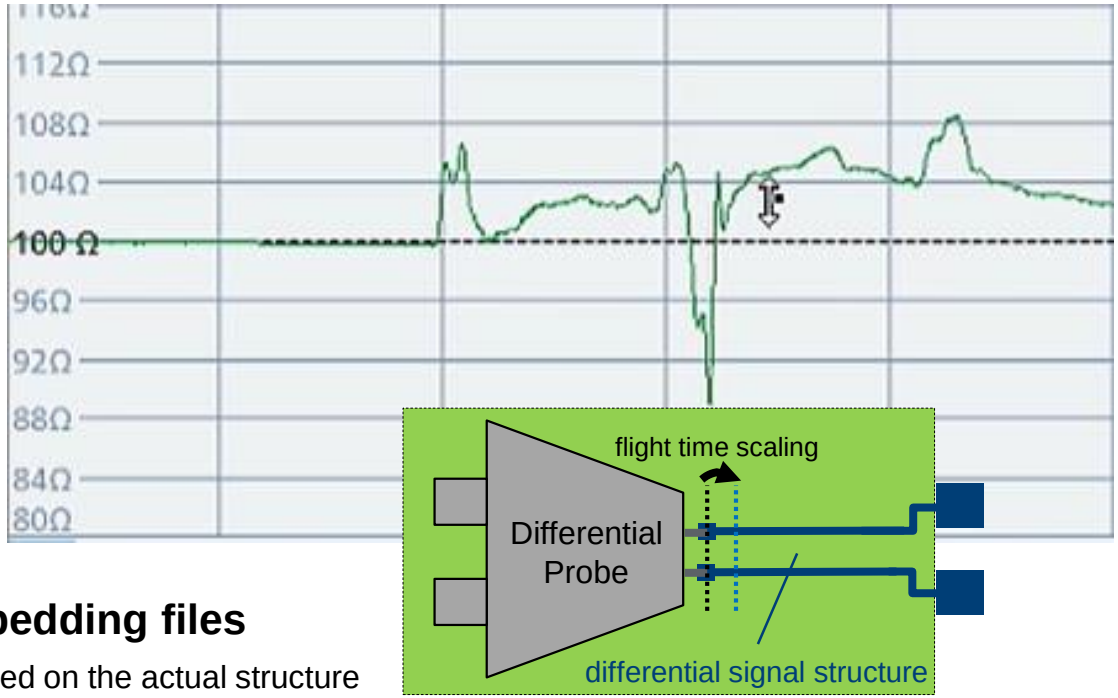




ACCURATELY MODELLING AND DE-EMBEDDING OF DIFFERENTIAL PROBES: HOW FAR TO DE-EMBED?

How far do we need to de-embed?

- discontinuity at the probe tips is **not** part of the differential signal structure
- de-embedding has to be done past this discontinuity and slightly into the differential signal structure
- impedance corrected de-embedding to correctly model the probe and contact point discontinuity as it is on the board.



Limitation of factory made de-embedding files

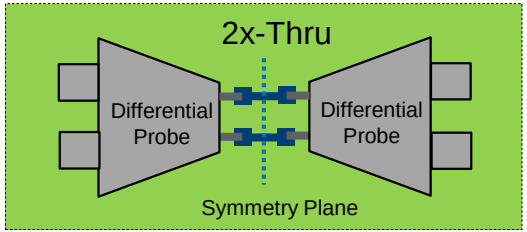
- recommendation to characterize and de-embed on the actual structure

ACCURATELY MODELLING AND DE-EMBEDDING OF DIFFERENTIAL PROBES: CONCLUSION

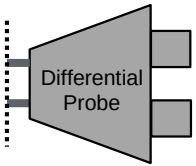
Workflow of Impedance Corrected De-embedding:

- calibration up to the coaxial interface of the VNA setup
- characterization and de-embedding of the probe:
  - total structure
  - de-embedding structures:
    - 2x-Thru or
    - 1x-Open & 1x-Short or
      1x-Short only
      with flight time scaling
      (move past discontinuity
      of probe contact point)
  - impedance correction required to correctly model probe contact discontinuity at actual signal structure (between probe tips and pads)

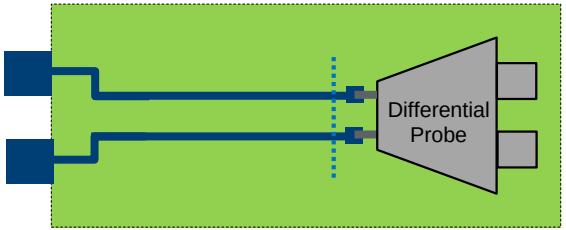
Reference Structure
(Coupon)

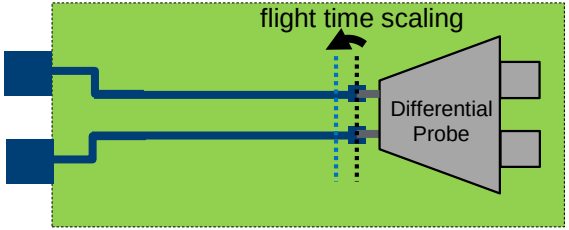


1x-Open &
1x-Short
or
1x-Short



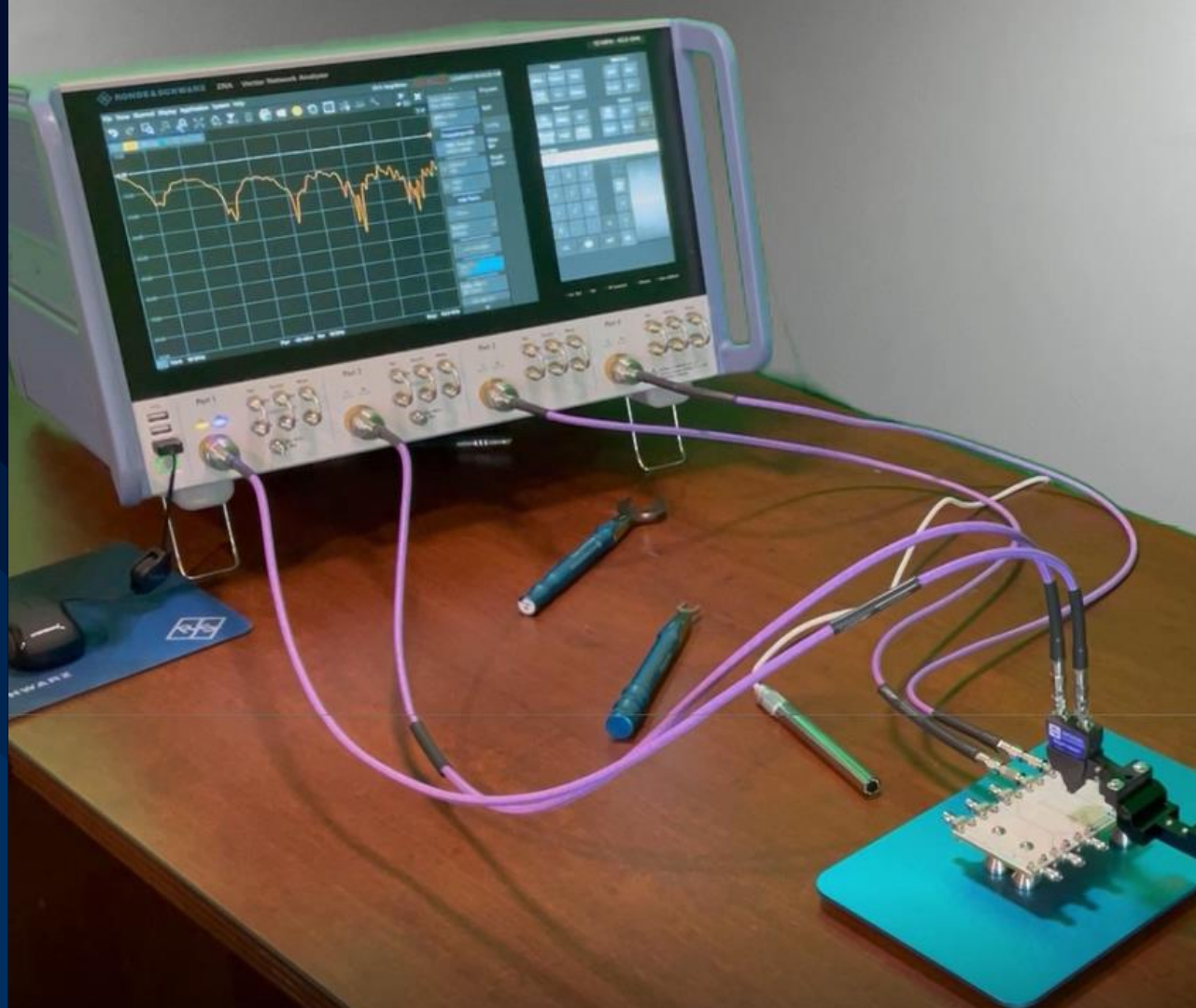
Total Structure
Fixture – DUT – Fixture





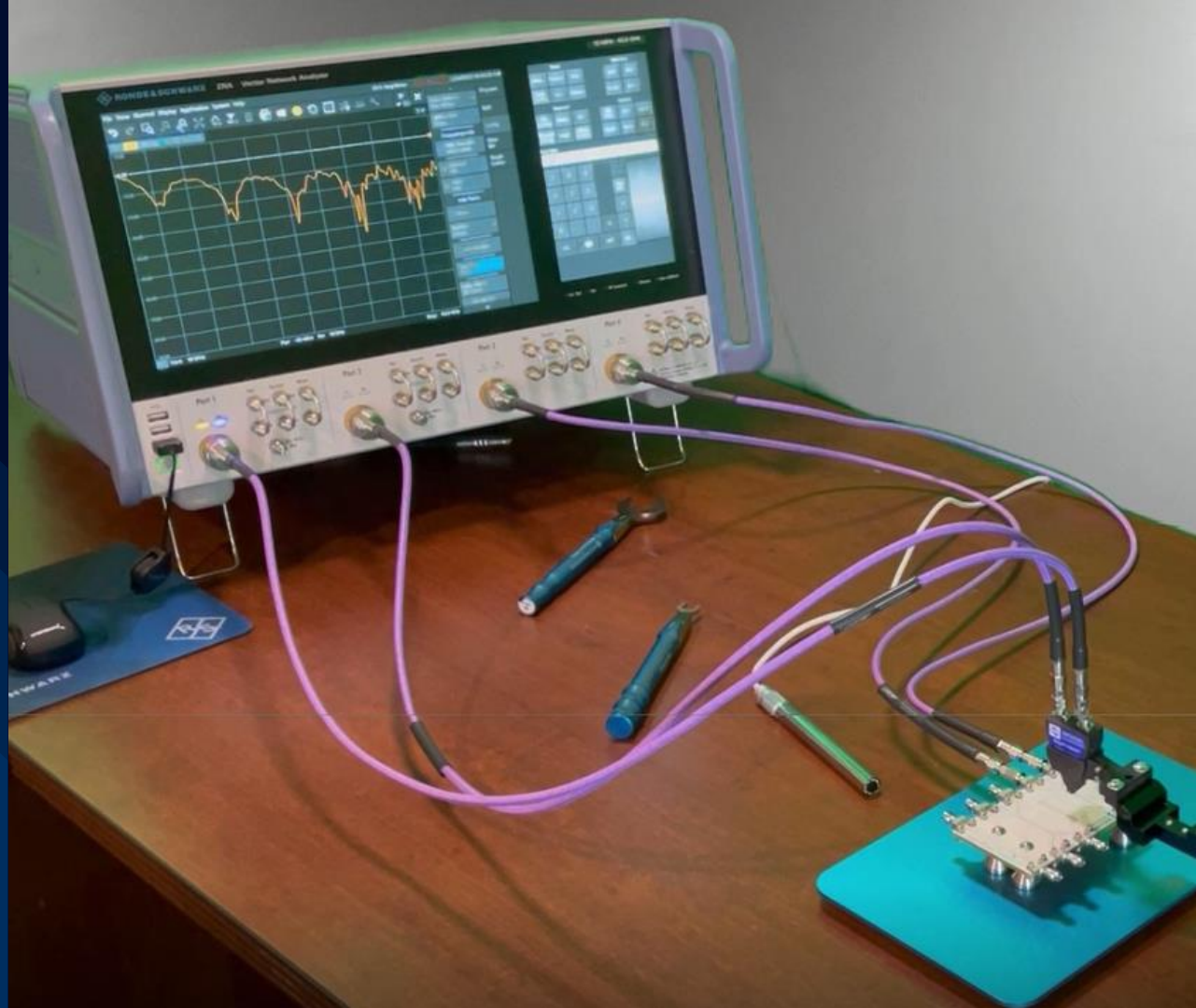
MEASURING SIGNAL TRACES WITH DIFFERENTIAL PROBES:

PROBE SOLUTIONS



MEASURING SIGNAL TRACES WITH DIFFERENTIAL PROBES:

PRACTICAL MEASUREMENTS



Find out more

www.rohde-schwarz.com

Application Note:
Accurate Test Fixture Characterization and De-embedding

https://www.rohde-schwarz.com/applications/accurate-test-fixture-characterization-and-de-embedding-application-note_56280-1271617.html

Thank you!

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