Anritsu Advancing beyond

A Paradigm Shift in Distributed Modular VNA Architecture That Makes Long Distance Measurement Simple and Easy

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CONFIDENTIAL

Background/Problem statement

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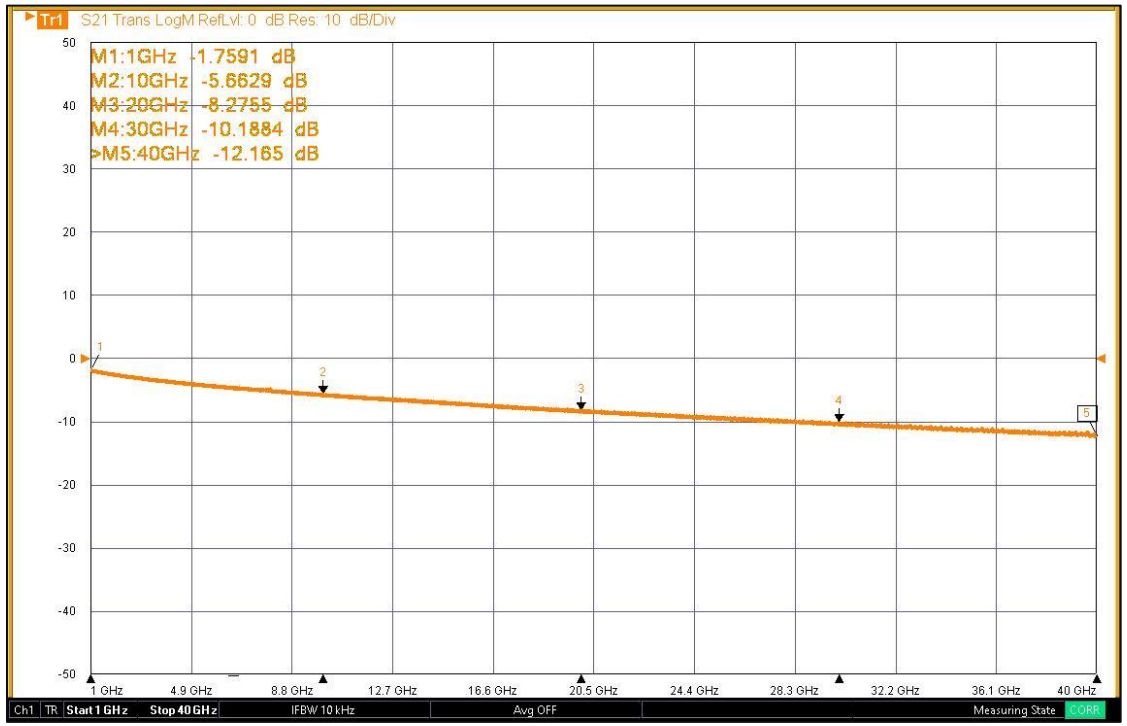
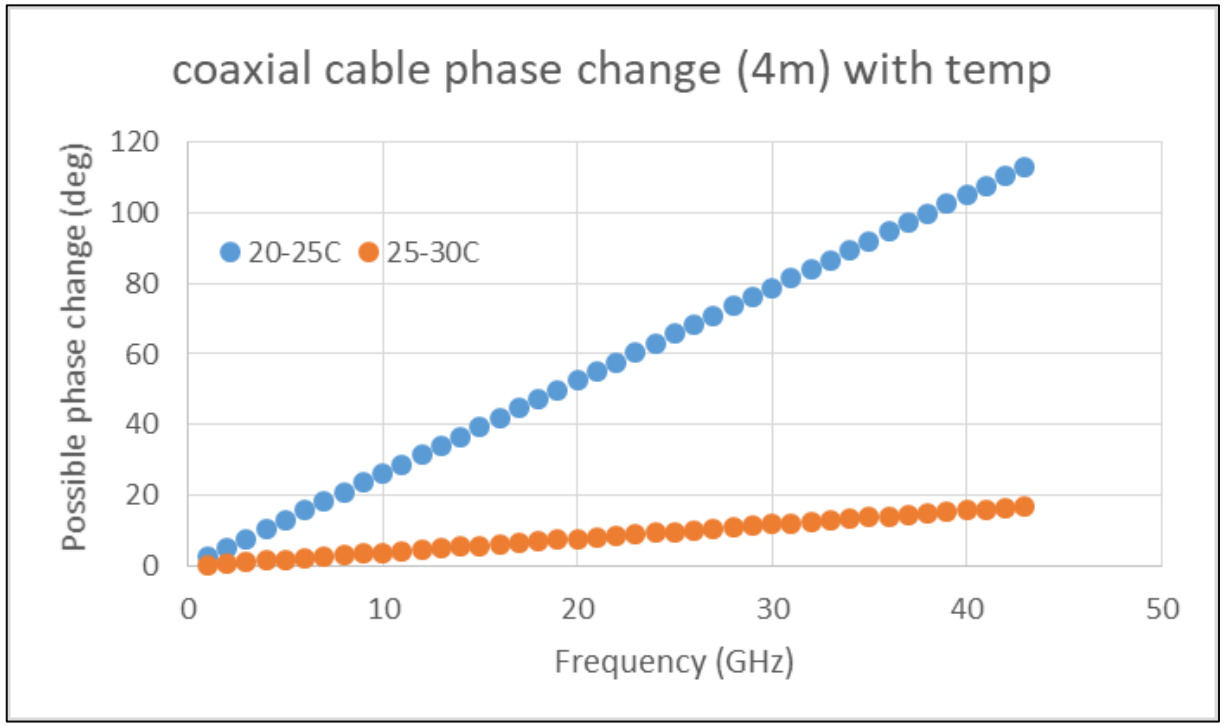
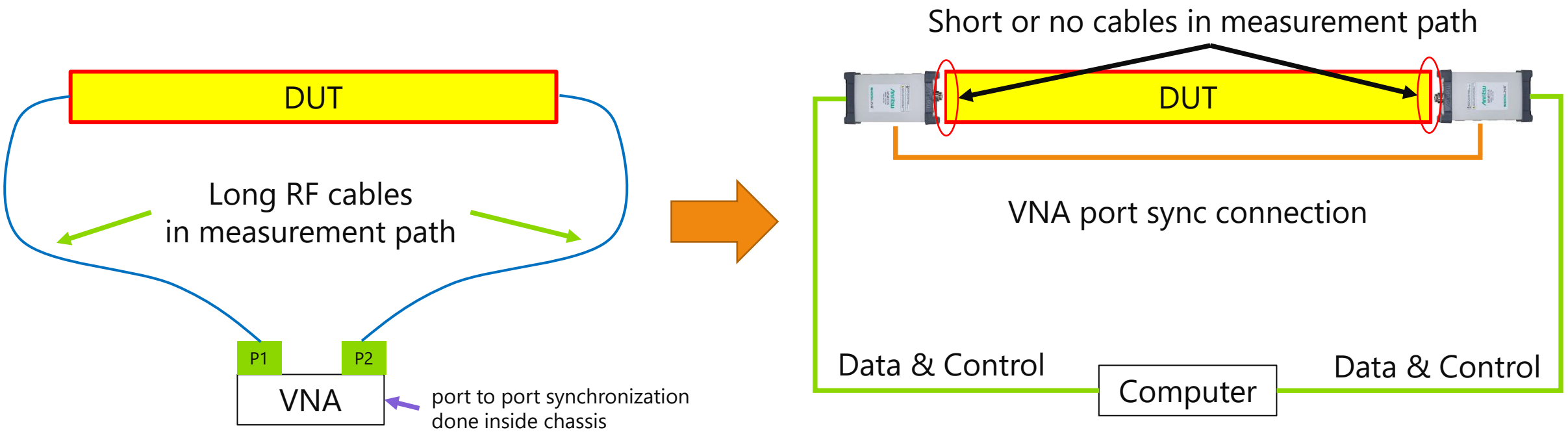
- **Cables introduce signal losses between DUT and VNA port**
  - Cable insertion loss (IL) reduces effective VNA measurement dynamic range
  - Higher frequencies and longer lengths = higher losses
    - Typical microwave cable might have ~1 dB loss per meter at 4 GHz
    - Loss grows to ~2-4 dB per meter at 40 GHz
- **Cable phase uncertainty**
  - Small deviations in cable electrical length cause deviations in phase measurement results
  - Length affected by changes in environmental temperature and cable movement





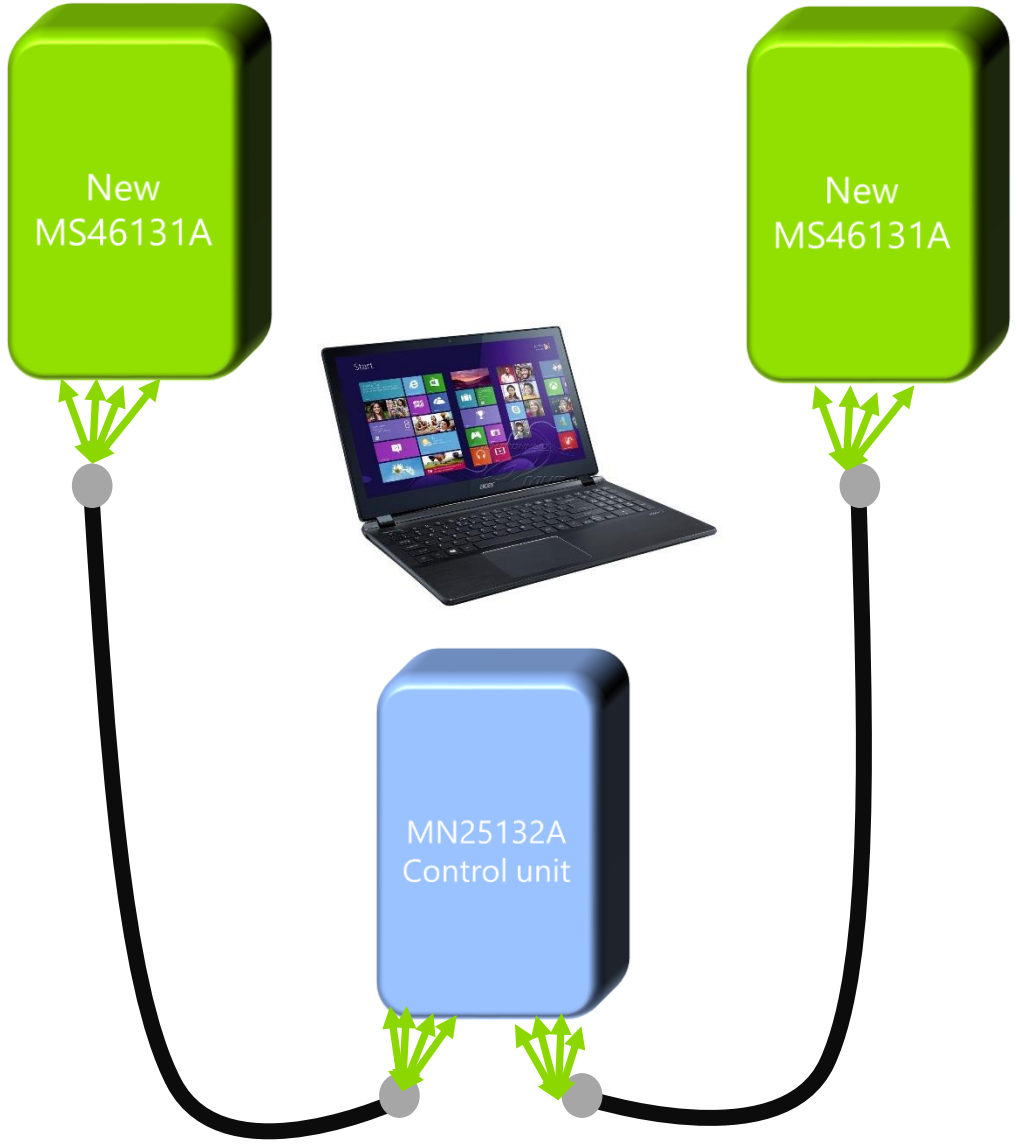
Solution to the problems

- **Address cable IL and phase issues by eliminating the test port cables altogether**
- **Requires:**
  - Portable VNA ports for easy placement at DUT eliminating long test port cables
  - Independent source and measure circuitry in each port module
  - Long distance port to port synchronization to enable vector s-parameter measurement (Phaselync™).



Anritsu Distributed VNA – The Answer

- 2-port VNA uses two ShockLine MS46131A 1-port VNAs as port modules
- 8/20/43.5 GHz models
- Supports fully reversing 2-port S-parameter measurements



A small video on how Antenna measurements are done today

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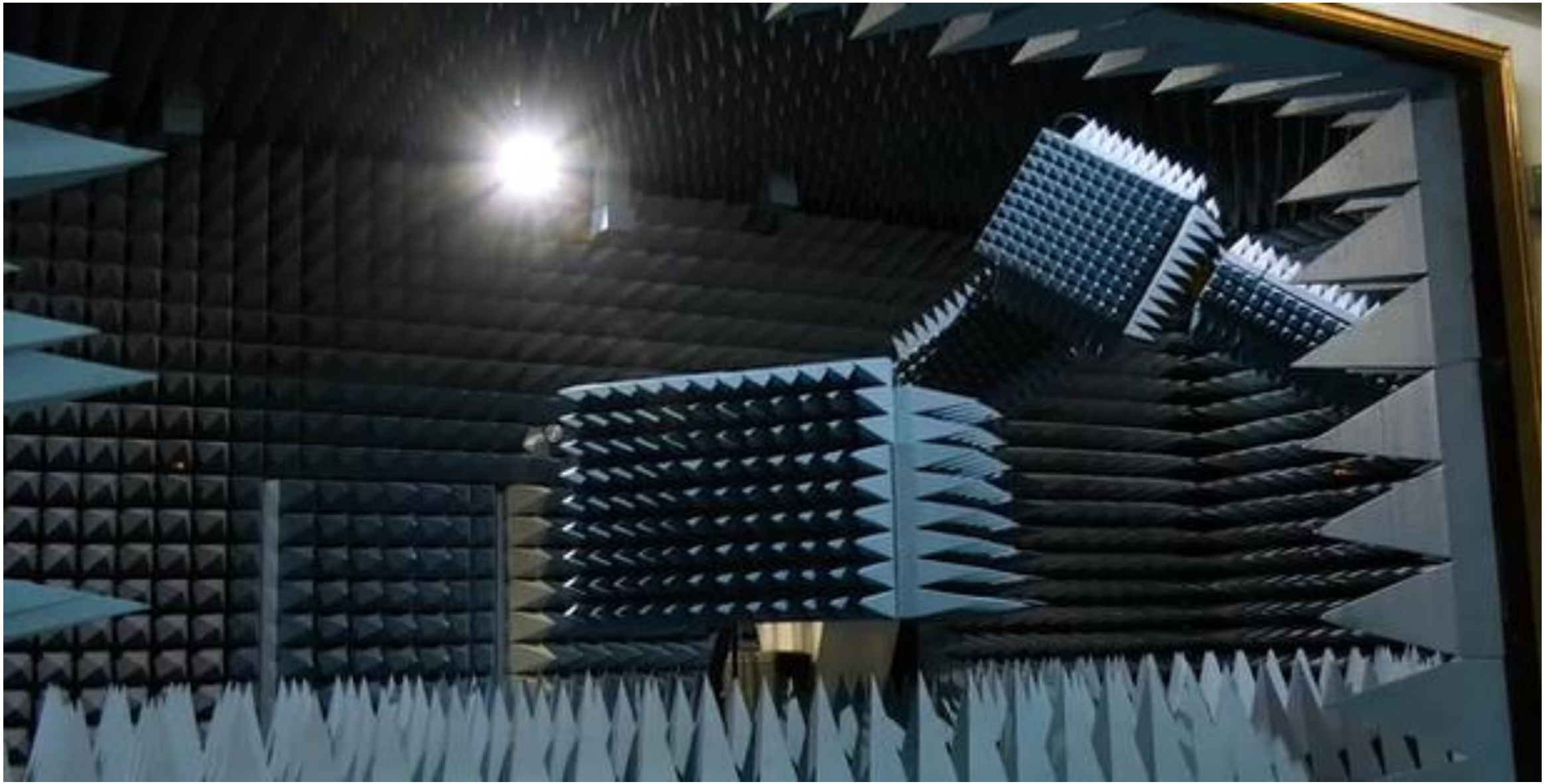
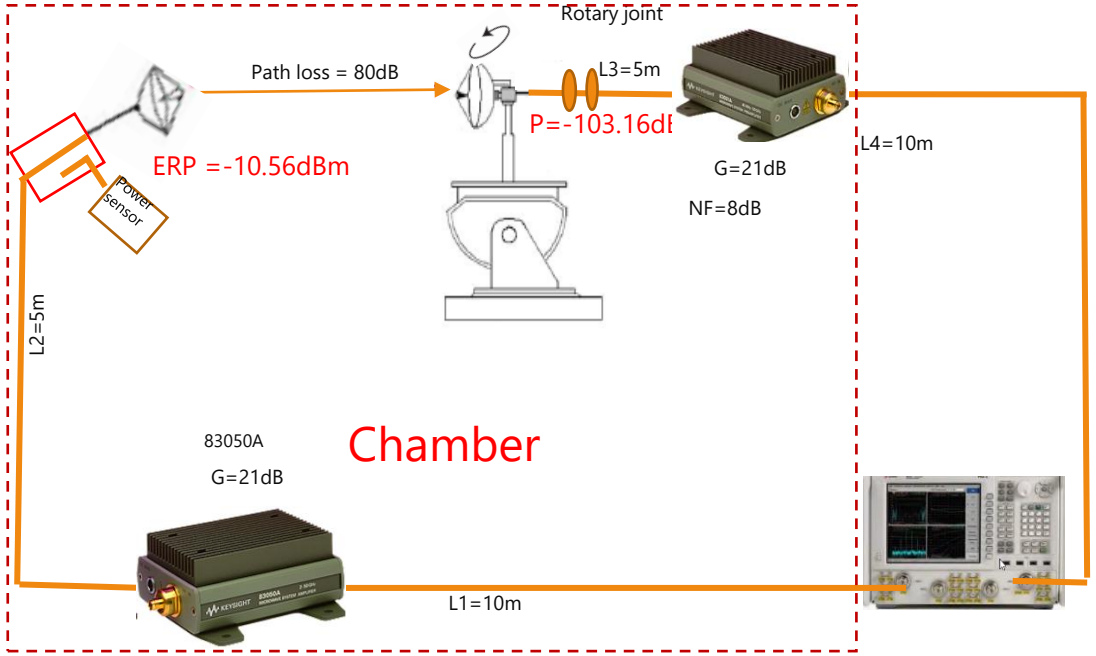
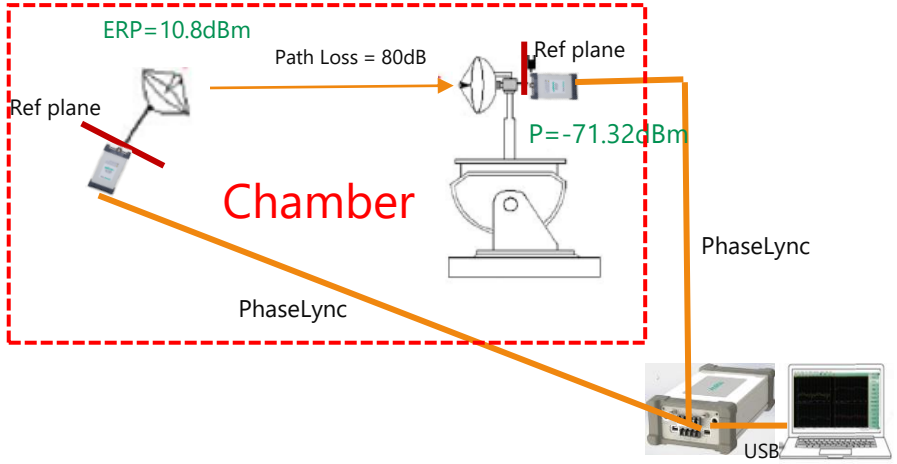
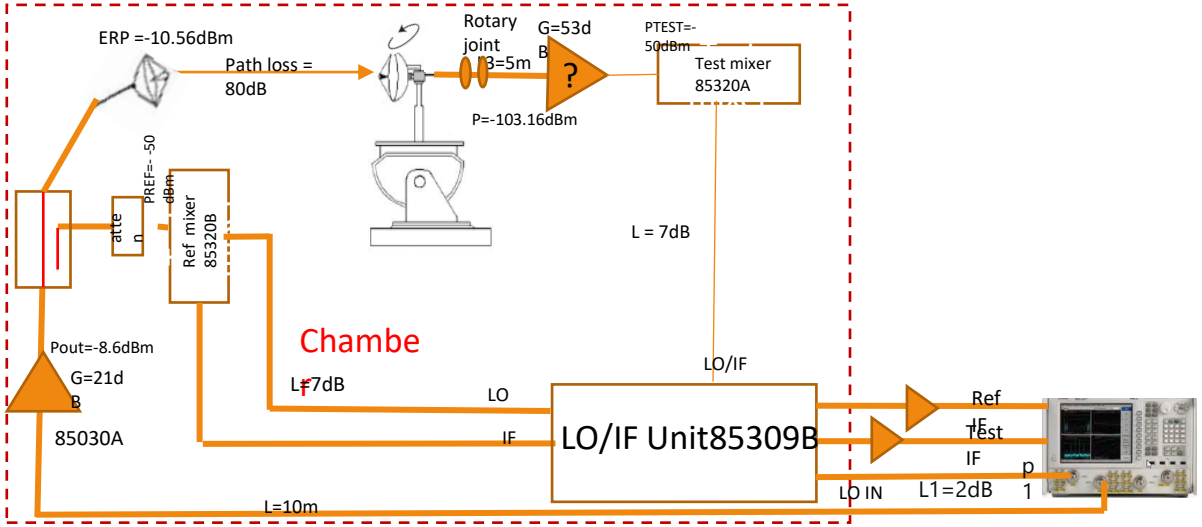
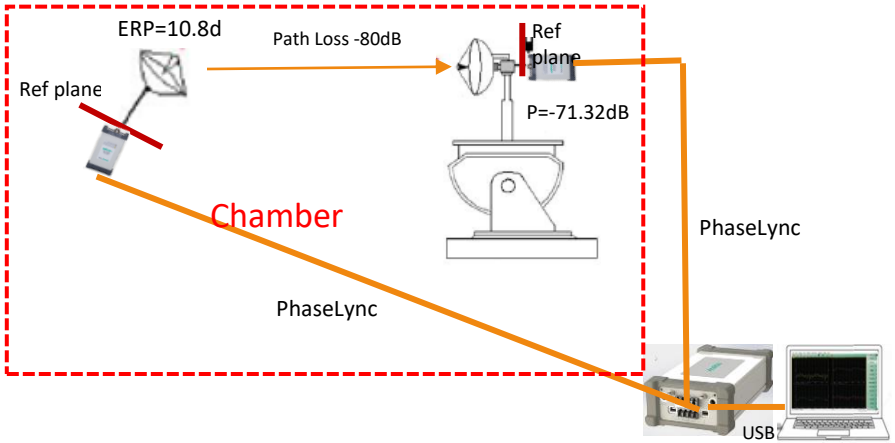



Rotary joint
Path loss = 80dB
L3=5m
P=-103.16dB
ERP =-10.56dBm
Power Sensor
G=21dB
NF=8dB
L4=10m
L2=5m
83050A
G=21dB
Chamber
L1=10m

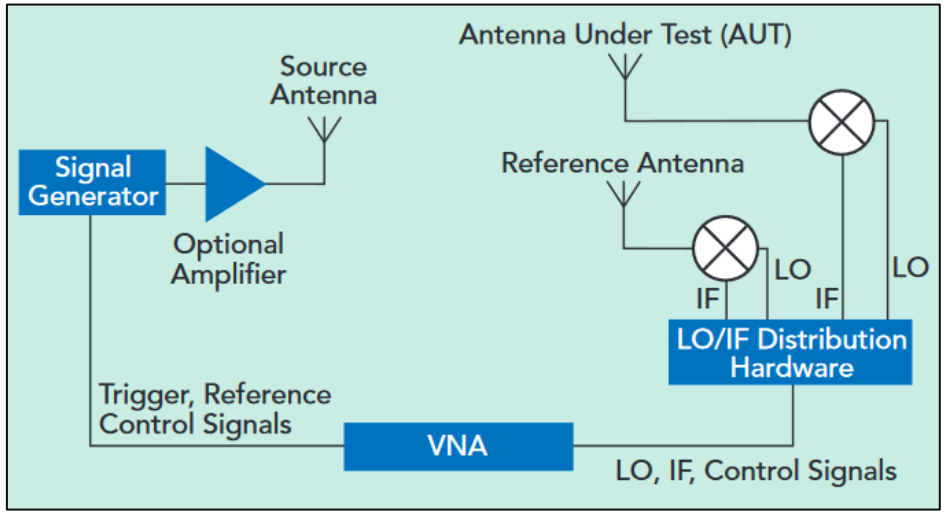

ERP=10.8dBm
Path Loss = 80dB
Ref plane
Ref plane
P=-71.32dBm
Chamber
PhaseLync
PhaseLync
USB


ERP =-10.56dBm
Path loss = 80dB
Rotary joint
G=53dB
L3=5m
PTEST=-50dBm
Test mixer 85320A
P=-103.16dBm
PREF=--50 dBm
atte n
Ref mixer 85320B
L = 7dB
Chambe
Pout=-8.6dBm
G=21dB
85030A
L=7dB
LO
IF
LO/IF
LO/IF Unit85309B
Ref IF
Test IF
LO IN
L1=2dB
L=10m

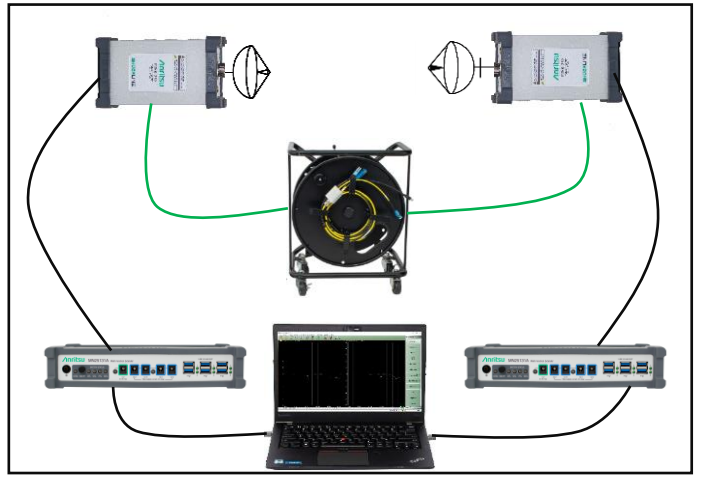

ERP=10.8d
Path Loss -80dB
Ref plane
Ref plane
P=-71.32dB
Chamber
PhaseLync
PhaseLync
USB

OTA Chamber Setup and Measurements

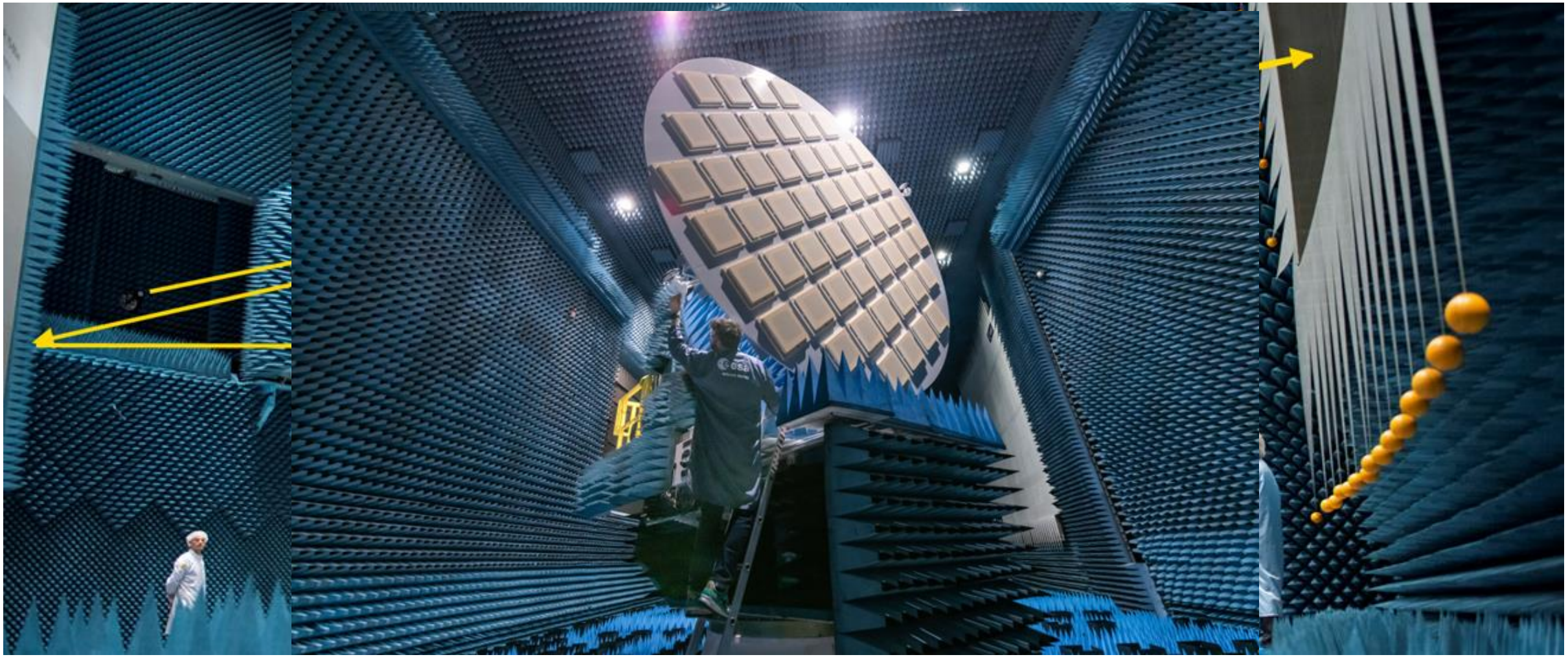
- **Typical microwave OTA antenna test setup requires:**
  - High performance VNA for dynamic range and complex hardware control
  - Signal generator for remote sourcing at test source antennas
    - Eliminates long cable from VNA source port with very high insertion loss
    - Requires complex triggering, reference, and measurement control
  - Mixers for reference and antenna under test (AUT)
    - **Down converts measurement signals to lower frequencies, lowering losses**
    - **Requires additional LO and IF distribution hardware for mixer control**
    - **High end VNA must supply LO, IF, and control signals for mixers**
    - **Mixers limit measurement bandwidth**
- **ME7868A simplifies equivalent OTA antenna test setup**
  - VNA ports connect near or directly to test antennas
    - **Full wideband measurement sweeps**
    - **No down conversion required**
    - **Eliminates cable insertion loss, full VNA SDR applies to measurement**
    - **Improves phase stability over temperature and movement**
  - Improves overall measurement uncertainty
    - Less hardware required
    - Calibration and de-embedding simplified
- **Much more cost-efficient solution**



Typical large OTA Chamber Setup

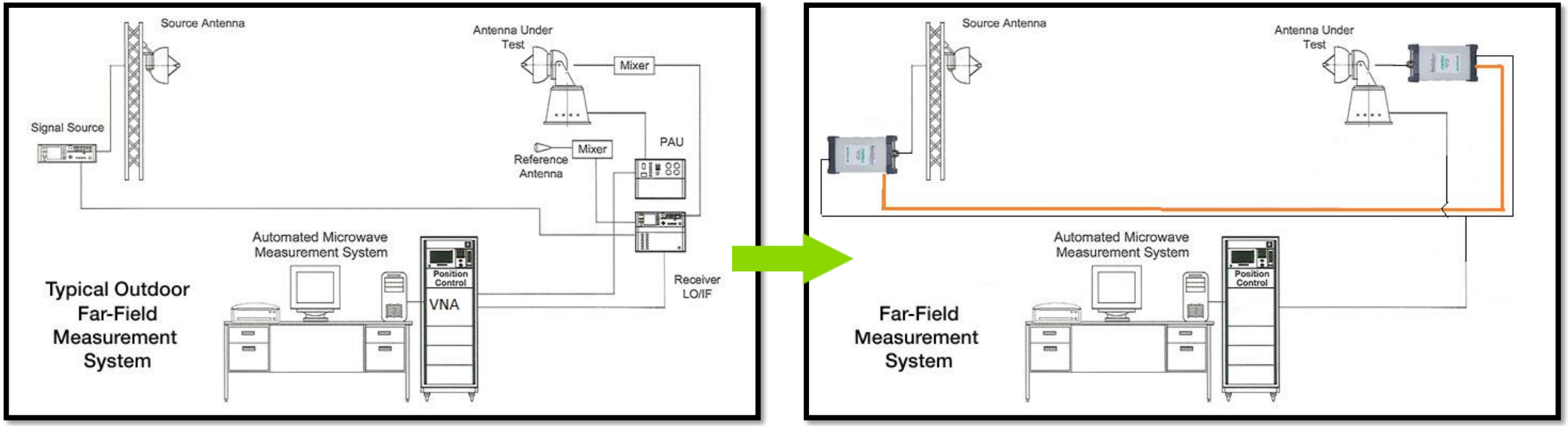


Large Chambers – Large Antenna – Large Payloads



Use cases and applications

- **Outdoor antenna ranges use similar hardware to large OTA Antenna chambers**
  - High performance VNA for dynamic range and complex hardware control
  - Signal generator for remote sourcing at test source antenna
  - Mixers and support hardware for reference and antenna under test (AUT) signal paths
  - Hardware must work over longer distances (50+ meters)
- **ME7868A PhaseLync technology advantages in long distance setups**
  - ***Ports can be setup 100 meters apart, simplifying outdoor range setups***
  - ***Eliminate Long RF cable runs to either transmit or antenna under test***
  - ***Improved amplitude and phase stability***
  - No coupling into RF cables
  - Flexible Configurability

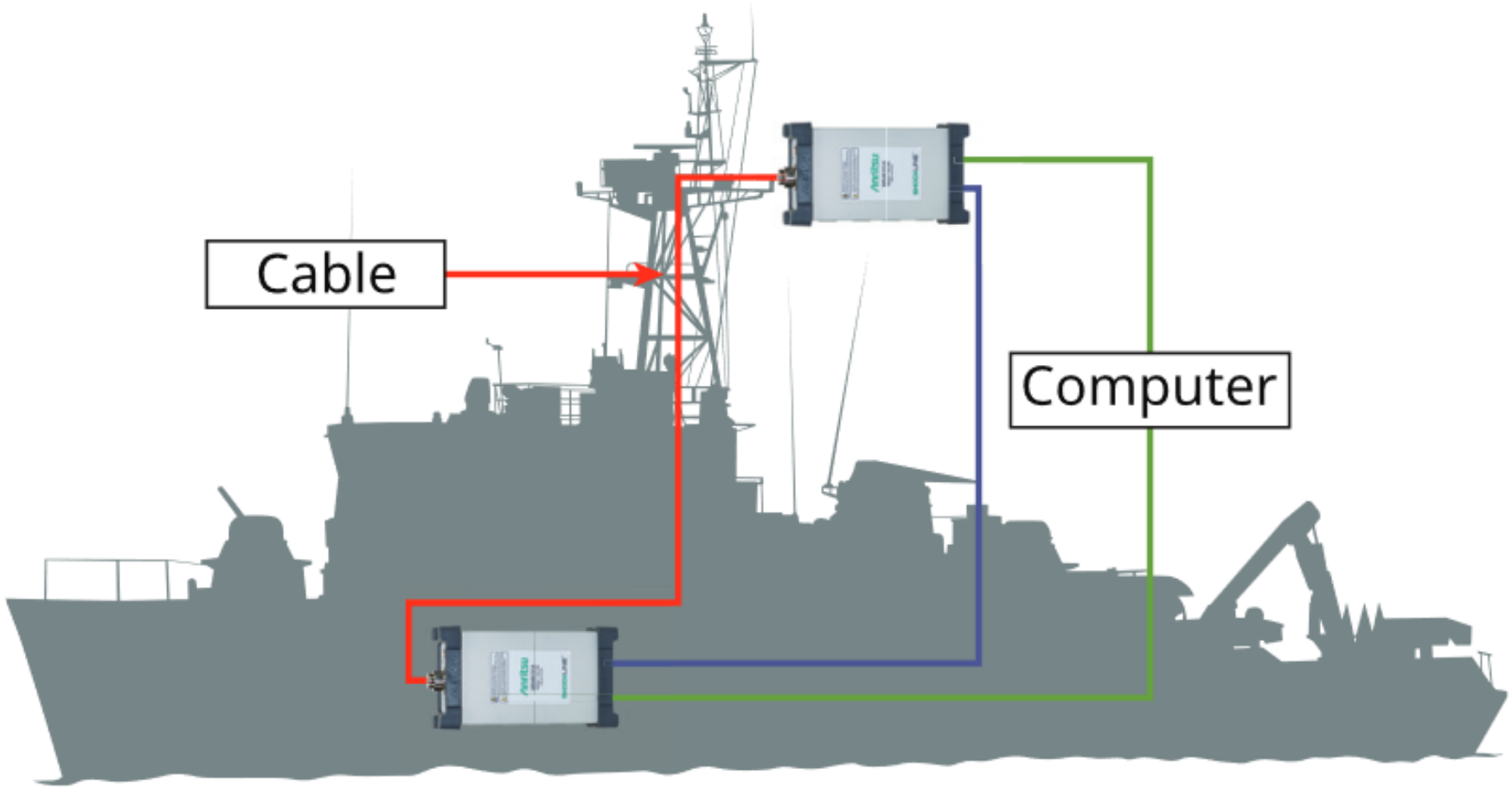


Aircraft cable testing

Long cables needs to be tested

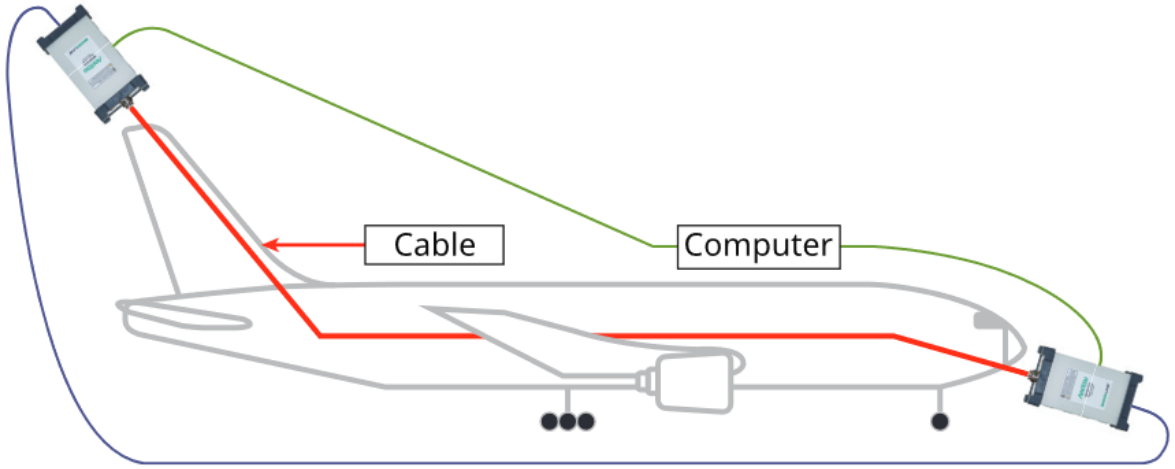
- *Insertion loss*
- *VSWR*
- *Time domain*

Large Vehicles



Example Cable Testing on Ships with ME7868A

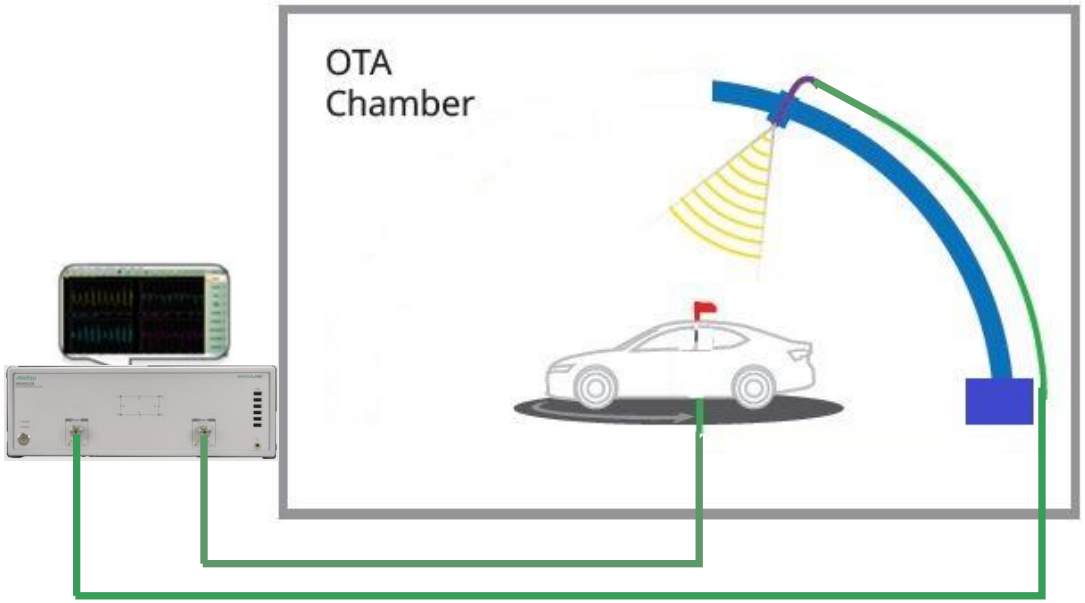
Shielding effectiveness/Cables of Aircraft frames



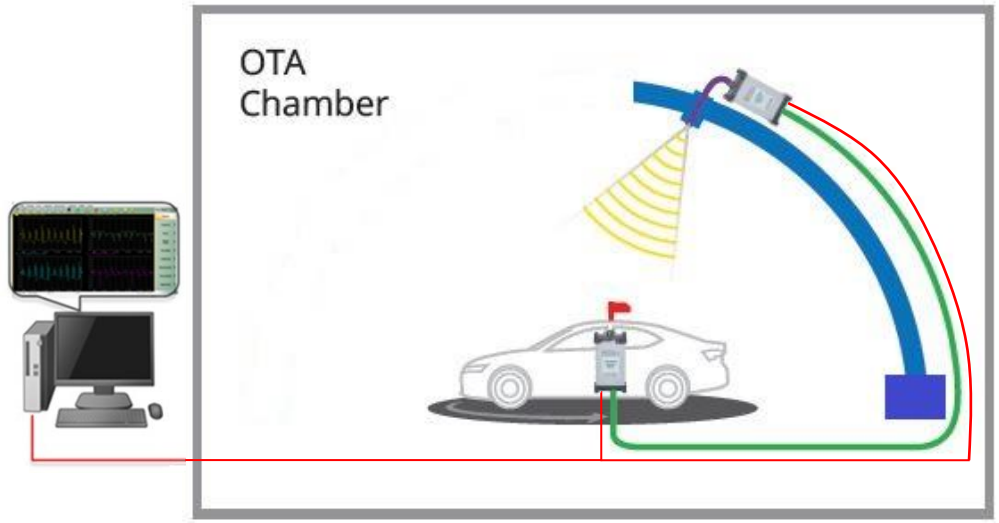
Example ME7868A Setup for Cable Testing in Aircraft

Use cases and applications

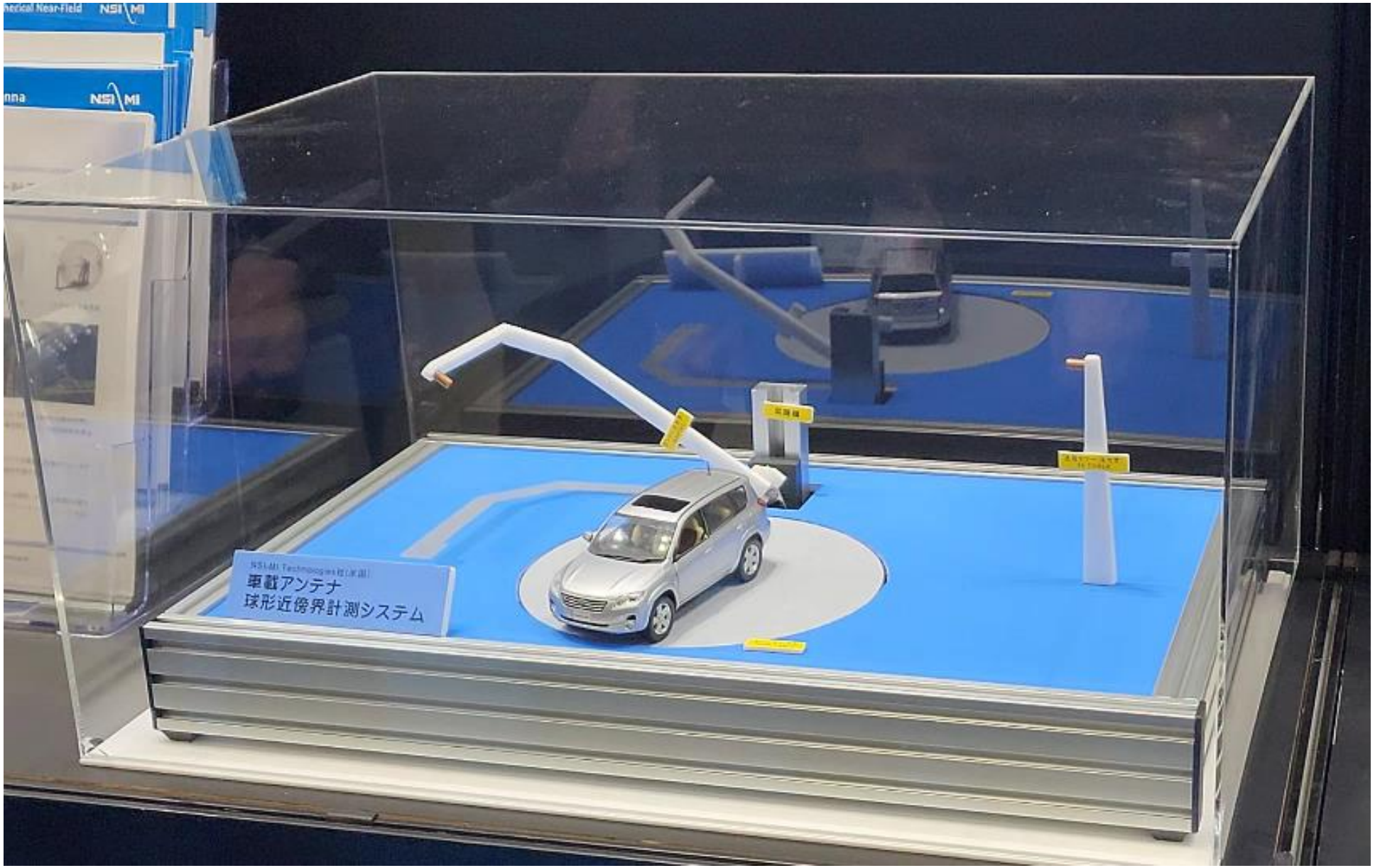
- **Automotive antenna testing**
  - Auto rotates turntable, test antenna on arched positioner enabling 3D pattern scans
  - Tests include antenna gain, directivity, beamwidth, efficiency



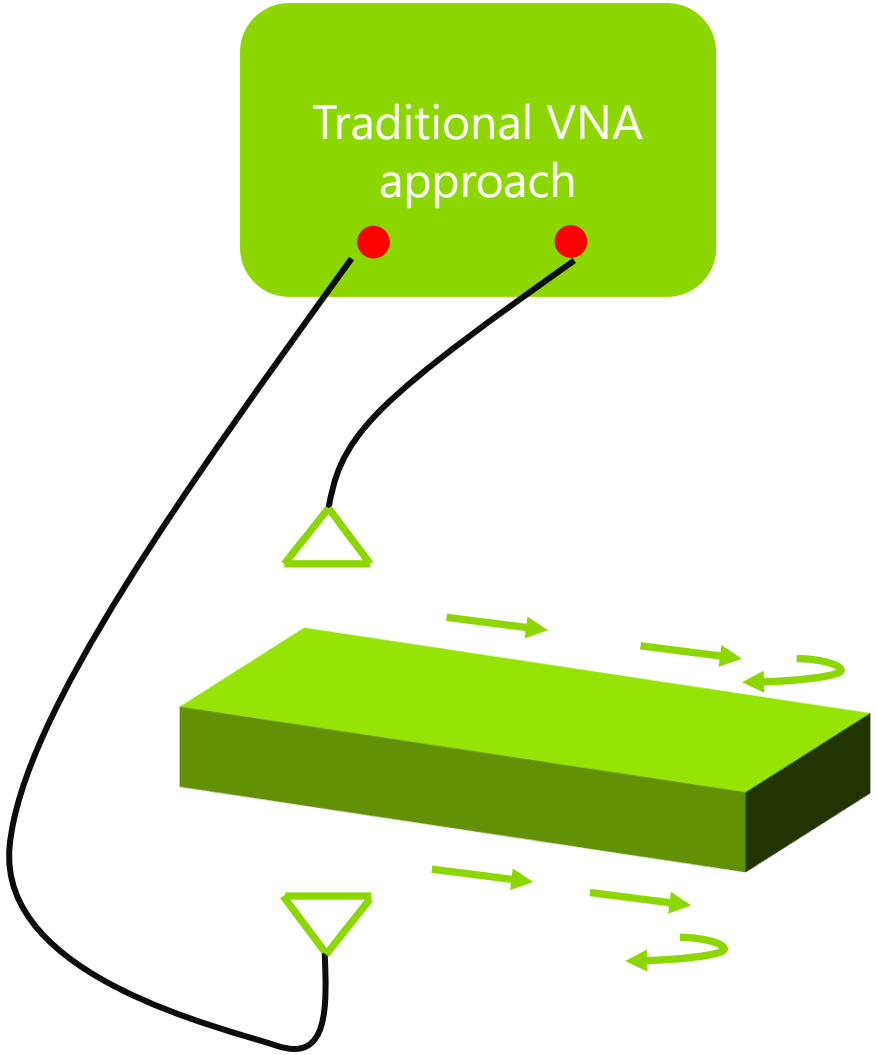
Standard VNA setup
- Long port cables required (>~25 meters)
- Reduced measurement dynamic range due to cable insertion loss
- Cables add phase measurement uncertainty



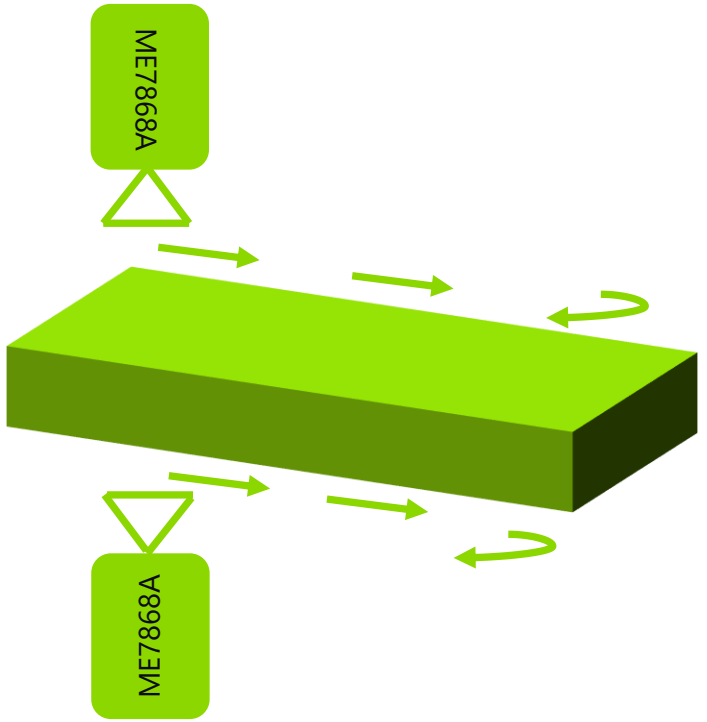
ME7868A setup
- Ports directly interface to DUT and test antennas
- Full VNA dynamic range applied to measurement
- Less measurement uncertainty with no long cabling


車載アンテナ
球形近傍界計測システム

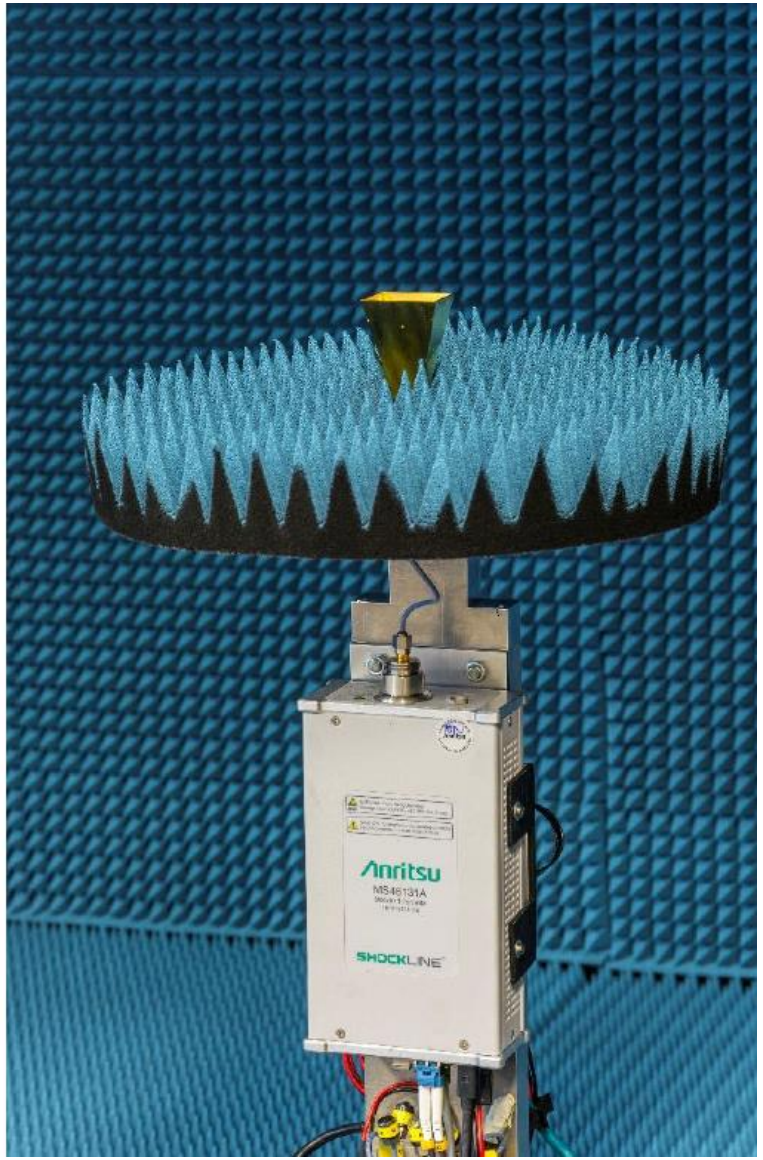
Long, lossy and phase instability leading to erroneous results

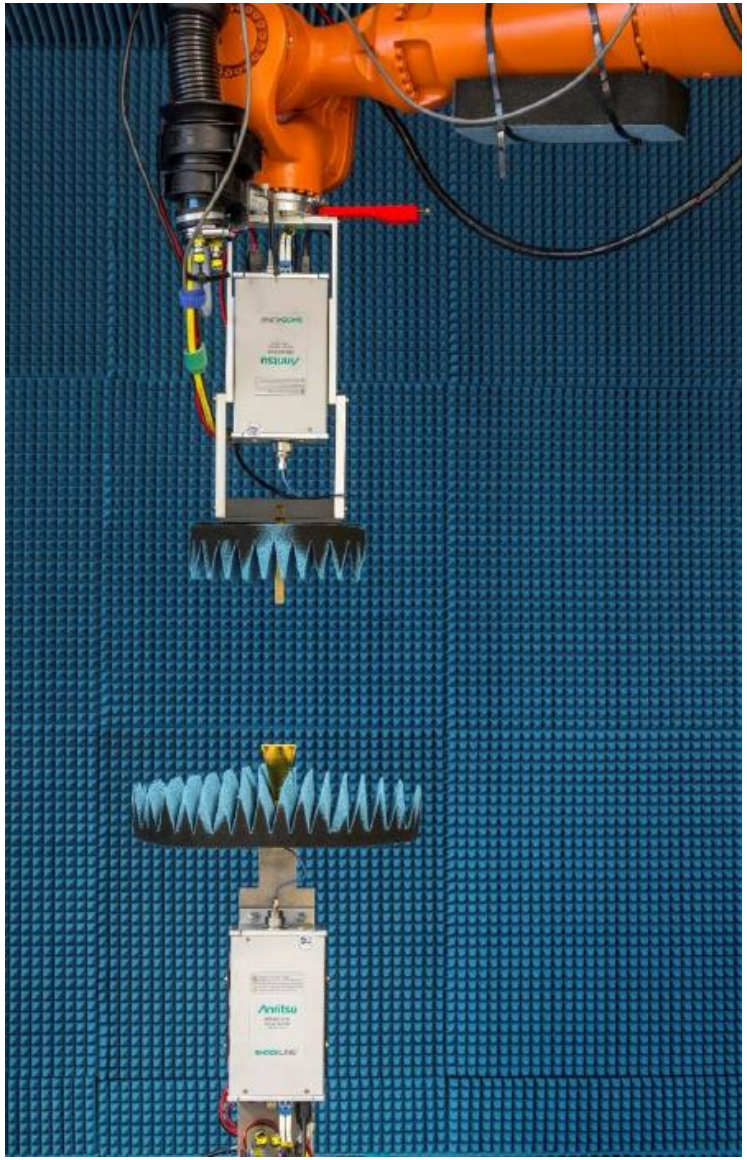


Anritsu Modular distributed VNA – no long cables, direct connection with material under test

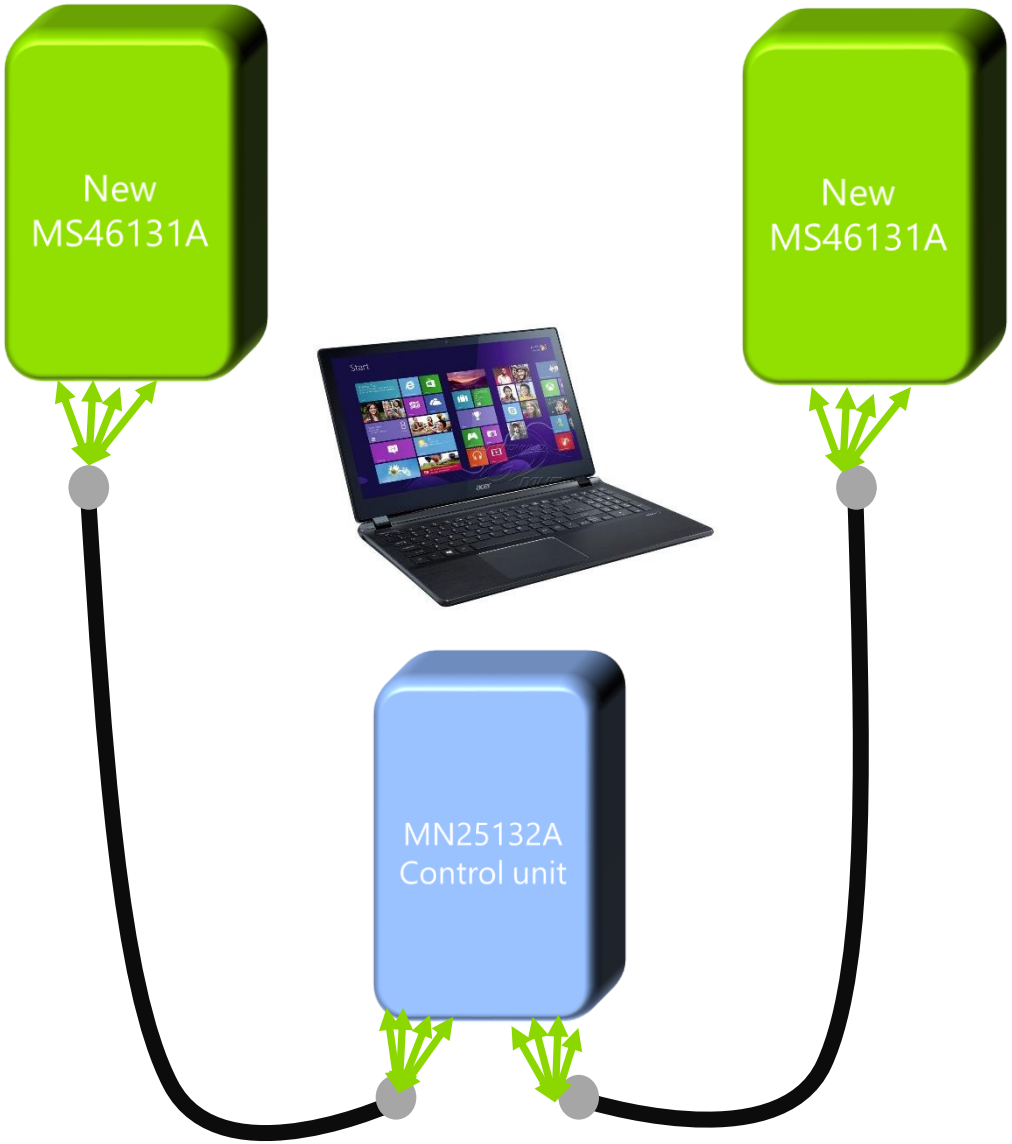


Near filed, Far Field





ME7869A

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