
SIXTEENTH ANNUAL
BiTS
Burn-in & Test Strategies Workshop
March 15 - 18, 2015
Hilton Phoenix / Mesa Hotel
Mesa, Arizona
Archive – Session 8
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Session 8
Morten Jensen
Session Chair

BiTS Workshop 2015 Schedule

Solutions Day

Wednesday March 18 10:30 am

Looking For That Four Leaf Clover

"A Test-Cell-Solution for 81GHz Automotive Radar ICs"

Jason Mroczkowski, Peter Cockburn, & John Shelley - Xcerra Corporation

"Universal Device Interface DUT Solutions for ATE Test"

Bob Bartlett- Advantest Corporation

"Where No Tester Has Gone Before"

Roger Sinsheimer -Teradyne Inc.

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Universal Device Interface DUT Solutions for ATE

Bob Bartlett
Advantest Corporation

2015 BiTS Workshop
March 15 - 18, 2015

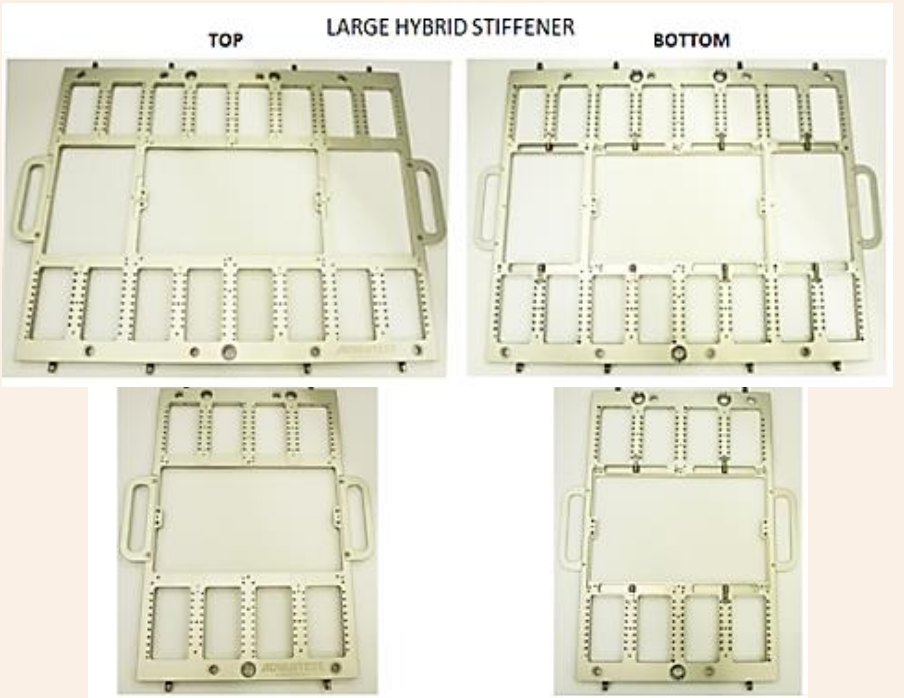
Agenda

- Universal Device Interface (UDI) introduction
- UDI concepts
- Use Cases
  - Tester Characterization
  - Interfacing to Reference Boards
  - Extending HSIO performance
  - RFPA
    - 18GHz extension module
    - Harmonic measurement module
- Summary

Universal Device Interface (UDI) Introduction

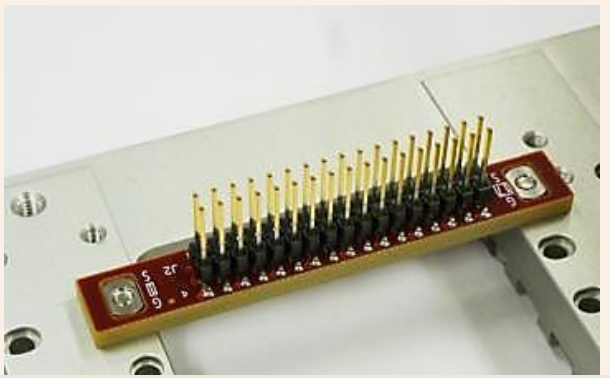
- UDI components are engineered to be shared across different applications
- Standardized interface to provide same tester look and feel to users
- We leverage development efforts through R&D across Advantest's installed base
- Extends the DUT interface in the Z axis with compatible docking and electrical interfaces
- Standard cable assemblies for fast interfacing
- Lower DUT fixture costs for RF applications

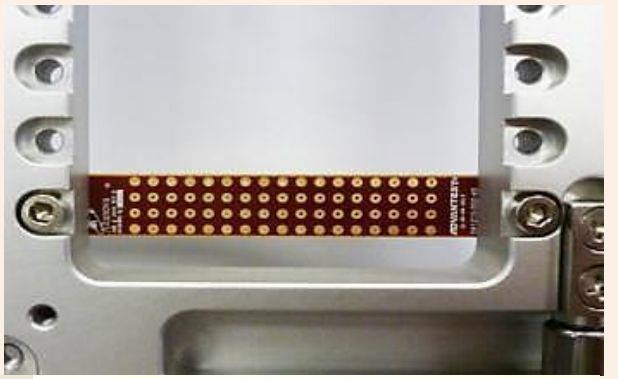
UDI concepts: Hybrid Stiffener

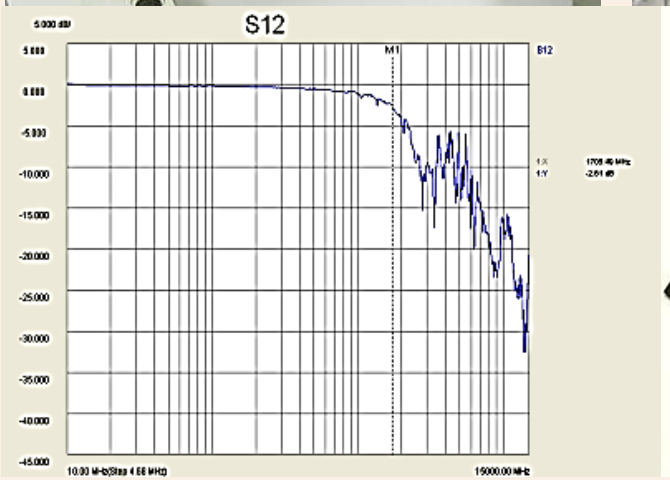


- The hybrid stiffener is fully compatible with standard V93K load boards
- The PCB mounting holes can be used for the assembly of evaluation boards
- Docking hardware, inlays and pickup points same as standard V93K stiffeners

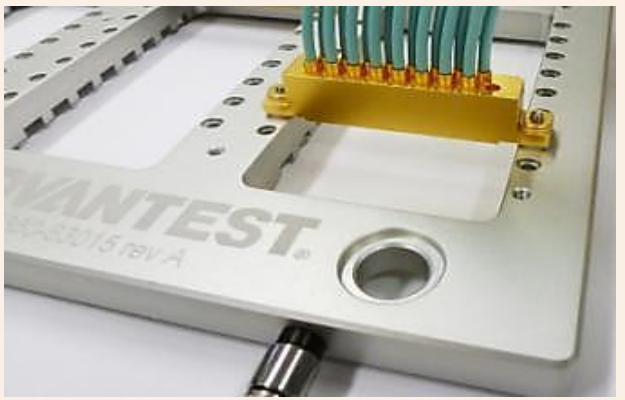
UDI concepts: Standard Channel Anti-Pogo

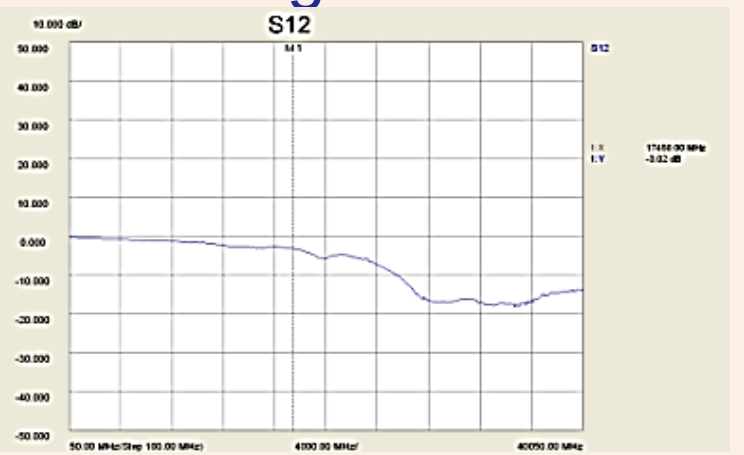






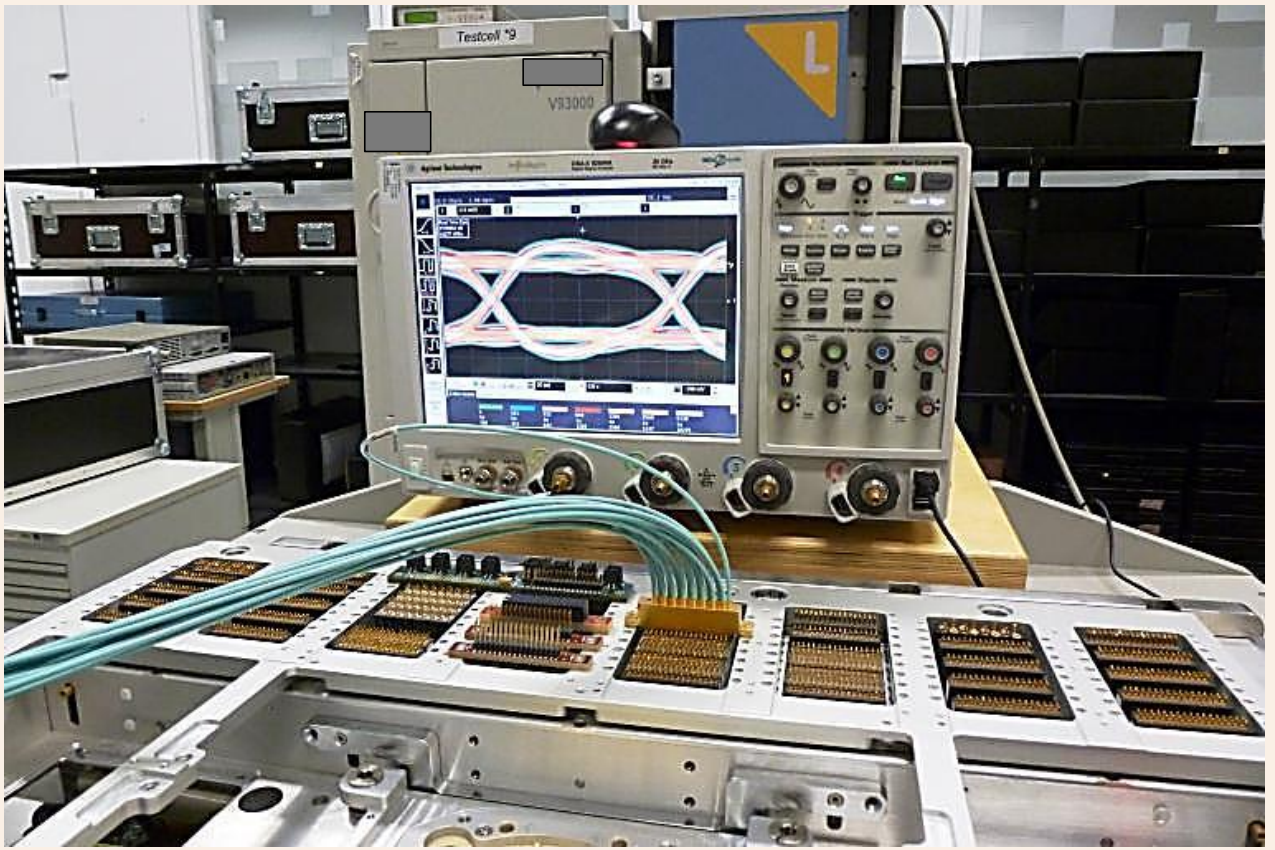
UDI concepts: High Speed Anti-Pogo



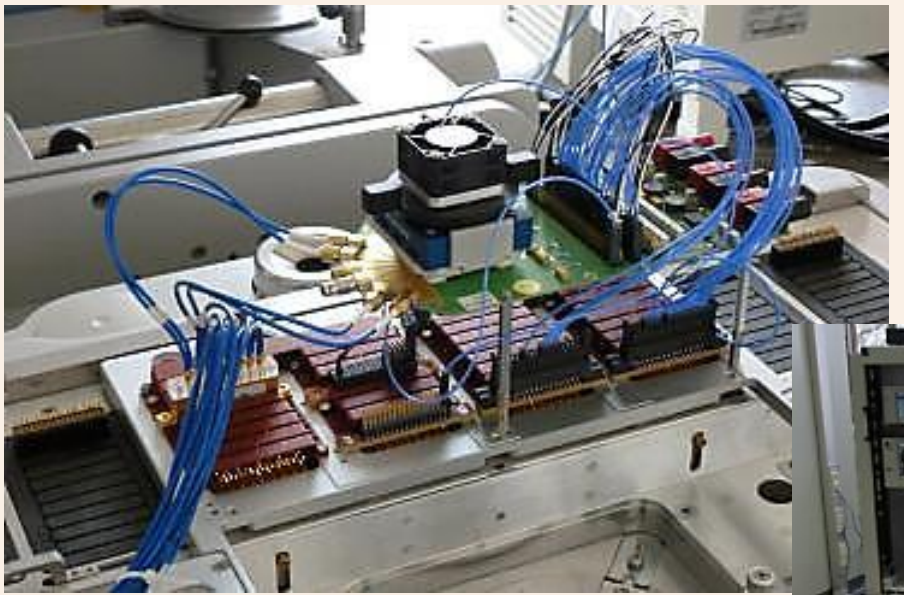


- Requires the hybrid stiffener
- Can be connected to any pogo channel location
- For high performance ATE channels
  - PS9G, PS-SL
- Assembly length and connector type can be customized
  - SMA, SMP, custom

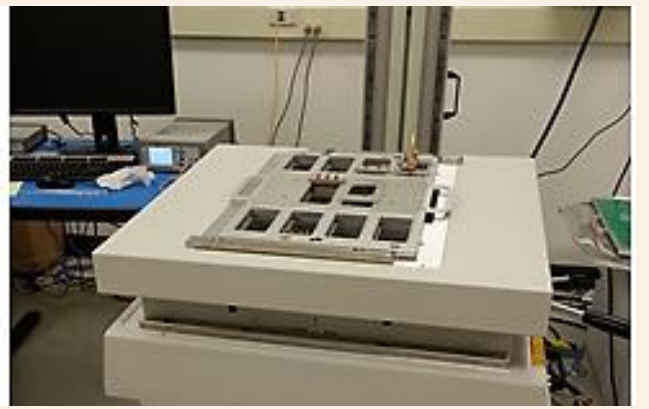
Measurement of V93000 HSIO Channels

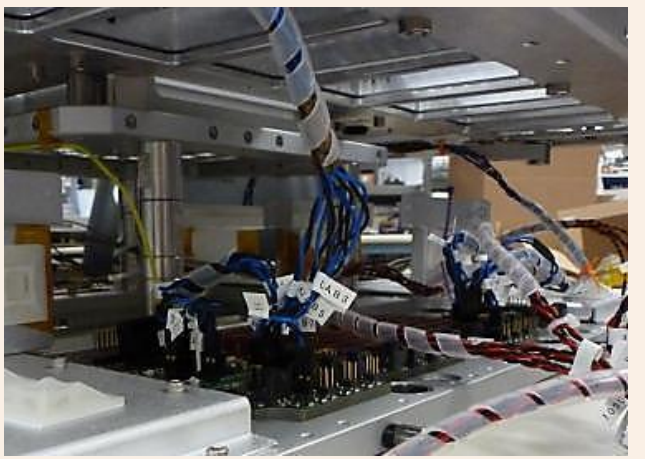


Fast Interconnect to PCB's & Reference Boards

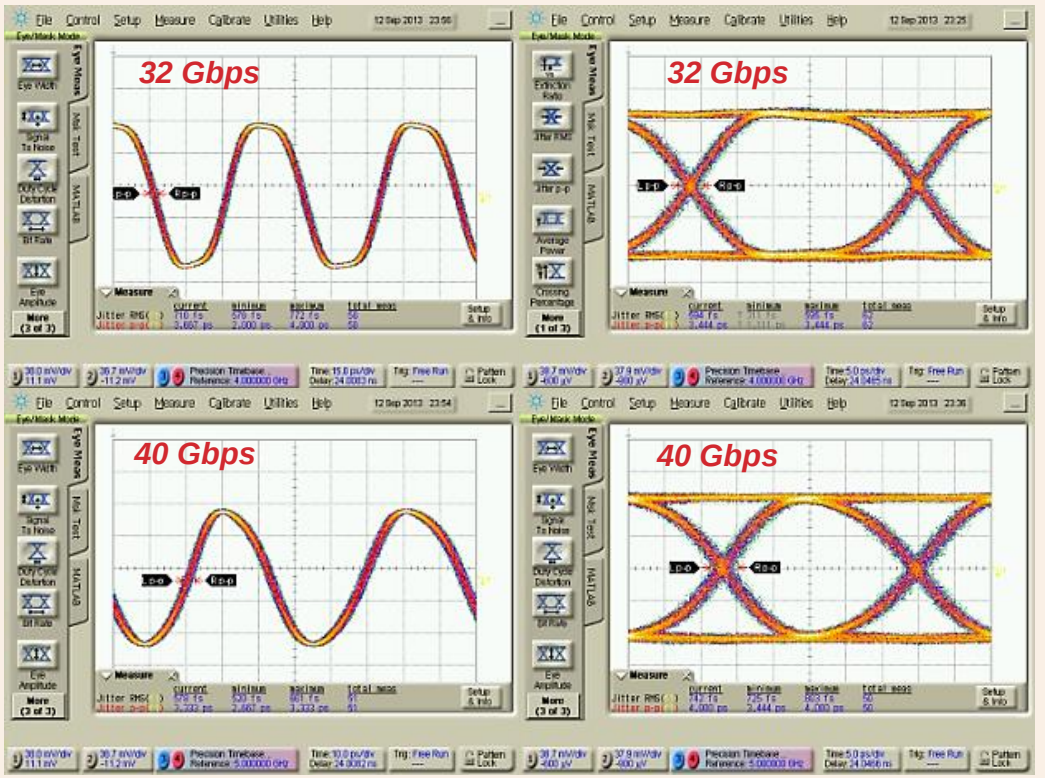


Development of Active Test Fixtures





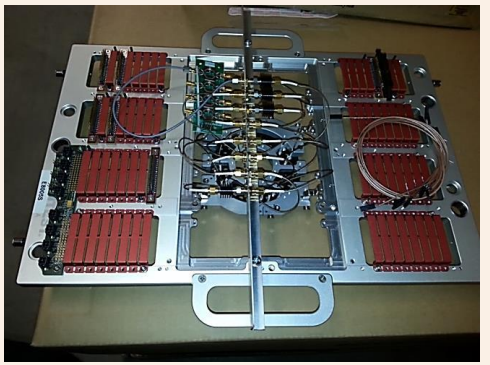
Extending HSIO Signal Performance



- Extends standard PS-SL performance beyond 16Gbps
- Performance to 51Gbps
- Typical signal performance
  - 700 fs rms jitter
  - <10 ps transition times (20%-80%)

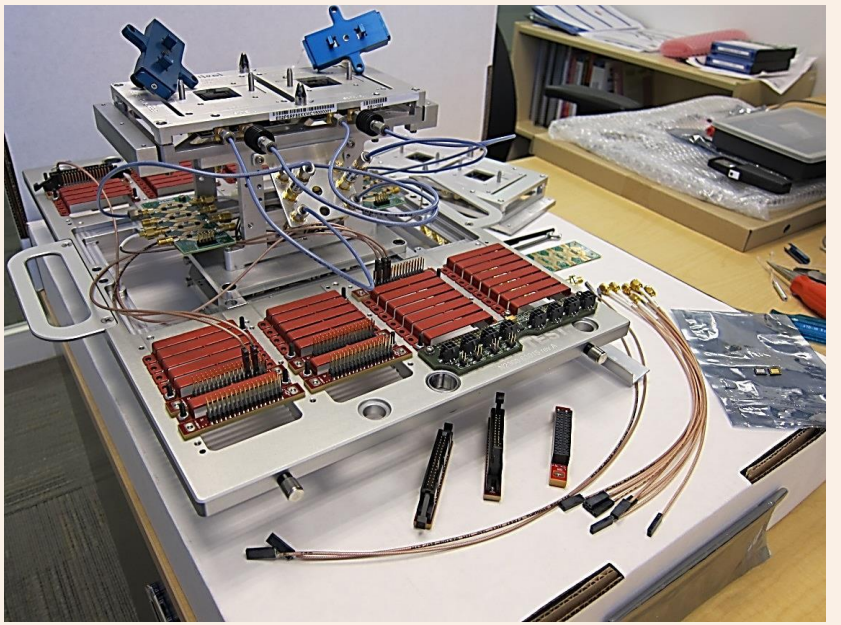
UDI Board for RFPA Fixtures

- UDI Stiffener used with PA evaluation boards in an engineering environment for fast bring-up of manufacturers reference boards
- UDI production solution for HVM shortens TTM and lowers fixture costs



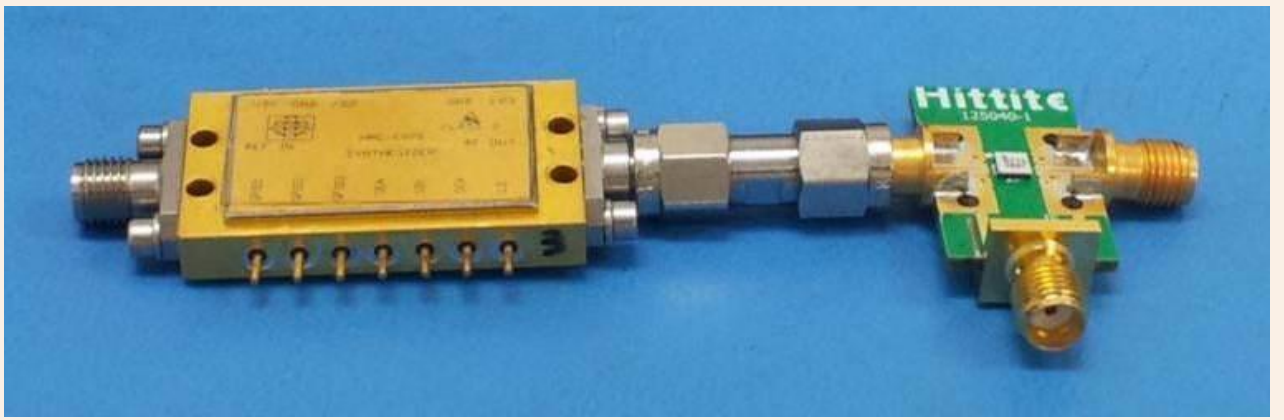
UDI in Engineering

UDI in Production



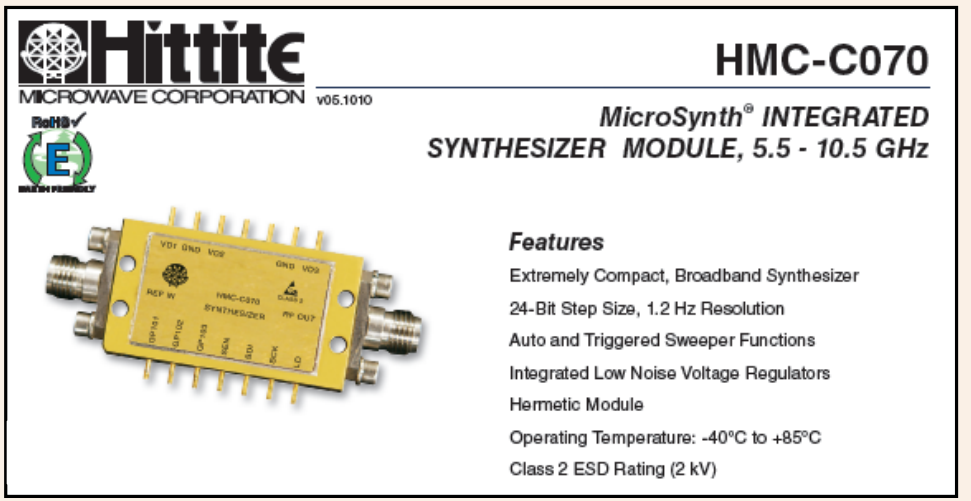
18GHz Solution: Overview

- A compact external synthesizer is used as an LO to bring signals up to 18GHz down to a frequency range that is measureable by the native V93000 PSRF tester
- With FE24 card and PSRF 8GHz measurement solution this 18GHz module extends measurements to 18GHz
  - We can measure CW or modulated signals to 18GHz
  - Our prototype was validated with connectorized components



18GHz Solution: Synthesizer

- Foundation of this solution is Hittite HMC-C070 synthesizer
- Typical output power of +21dBm
- Capable of driving two mixers with a 2-way power splitter (6dB loss).
- Connects to 10MHz BNC on test head
- Controlled by SPI commands from standard SmarTest UTM



Hittite MICROWAVE CORPORATION v05.1010

HMC-C070

MicroSynth® INTEGRATED SYNTHESIZER MODULE, 5.5 - 10.5 GHz

Features

Extremely Compact, Broadband Synthesizer

24-Bit Step Size, 1.2 Hz Resolution

Auto and Triggered Sweeper Functions

Integrated Low Noise Voltage Regulators

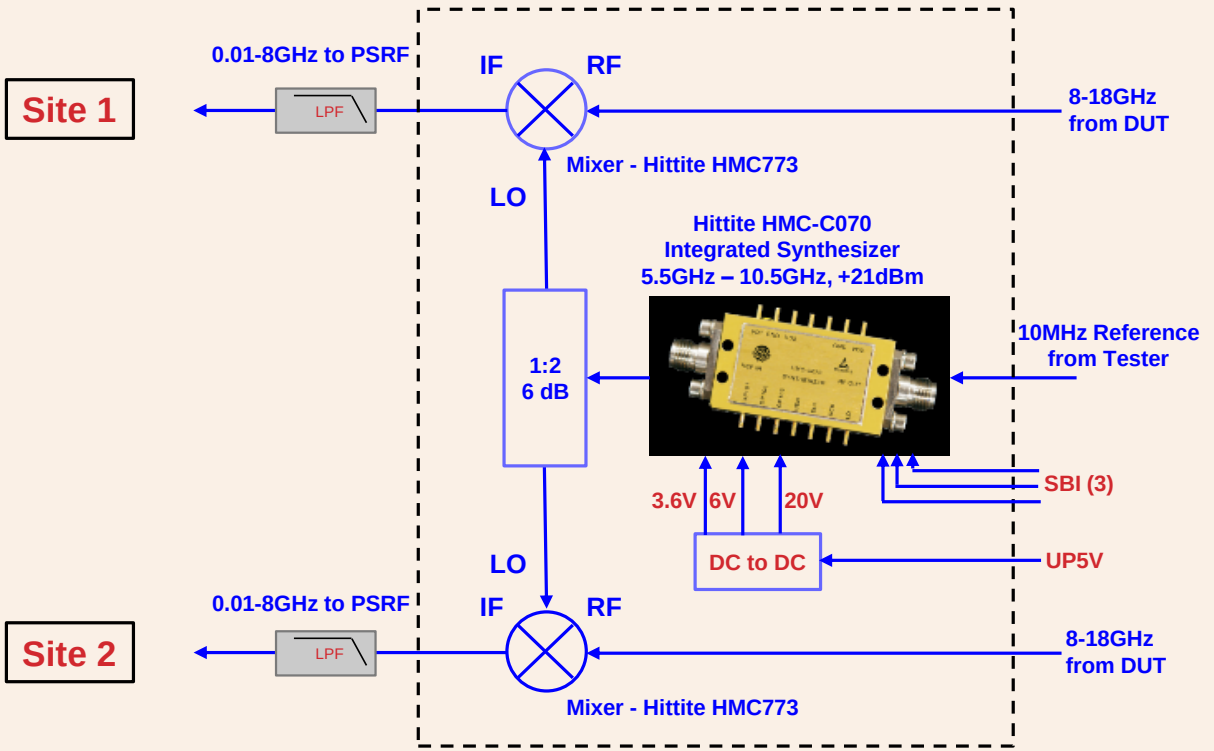
Hermetic Module

Operating Temperature: -40°C to +85°C

Class 2 ESD Rating (2 kV)

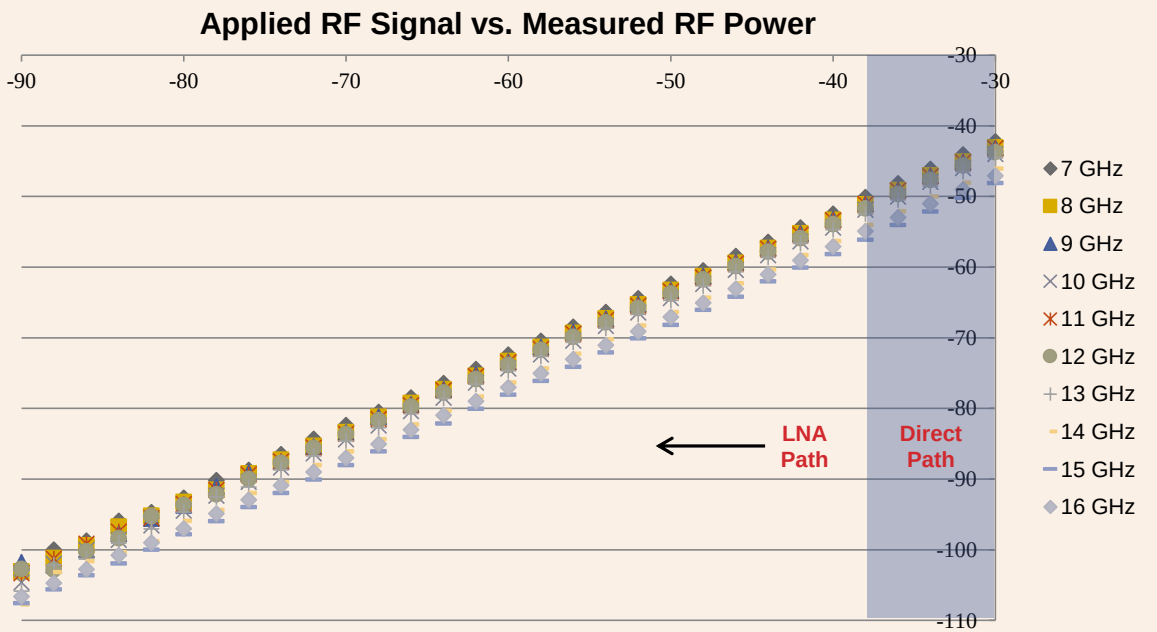
18GHz Solution: Block Diagram

- The 18 GHz solution is an external module (load board solution)
- To reduce cost, one synthesizer is shared between two sites



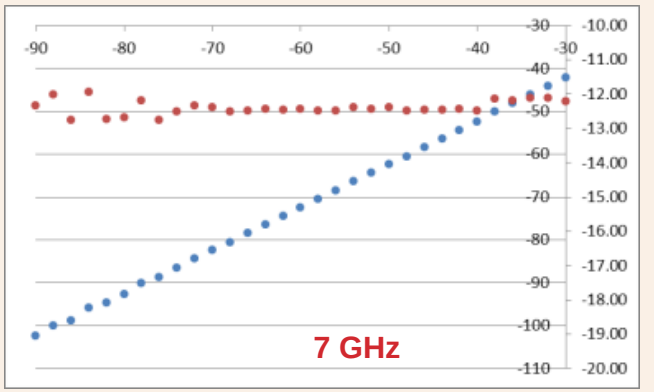
18GHz Solution: Performance

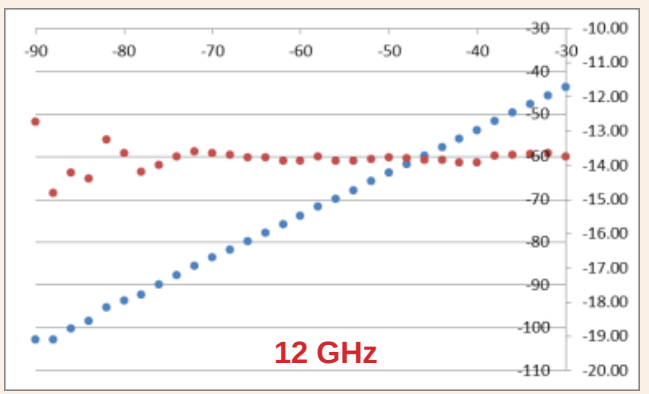
- Synth set to 10.5GHz, RF signal power (from Agilent E8257D sig gen) varied with freq. and power (top axis)
- Very linear over power range -30dBm to -90dBm
- Measurable to -90dBm with very good linearity

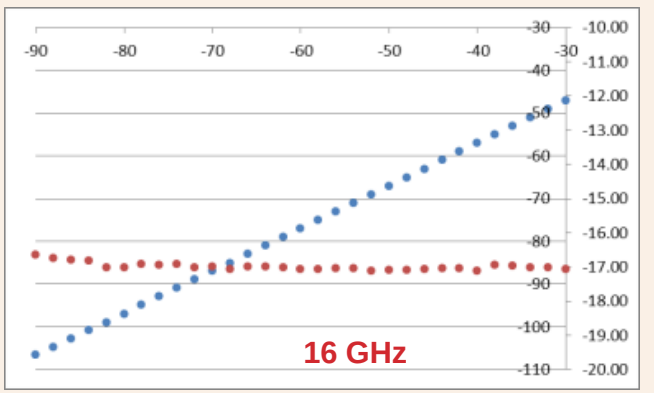


18GHz Solution: Performance

- Transfer Curves
- Top Axis: Applied Power (dBm)
- Blue: Measured Power (dBm)
- Red: Conversion Loss (dB)







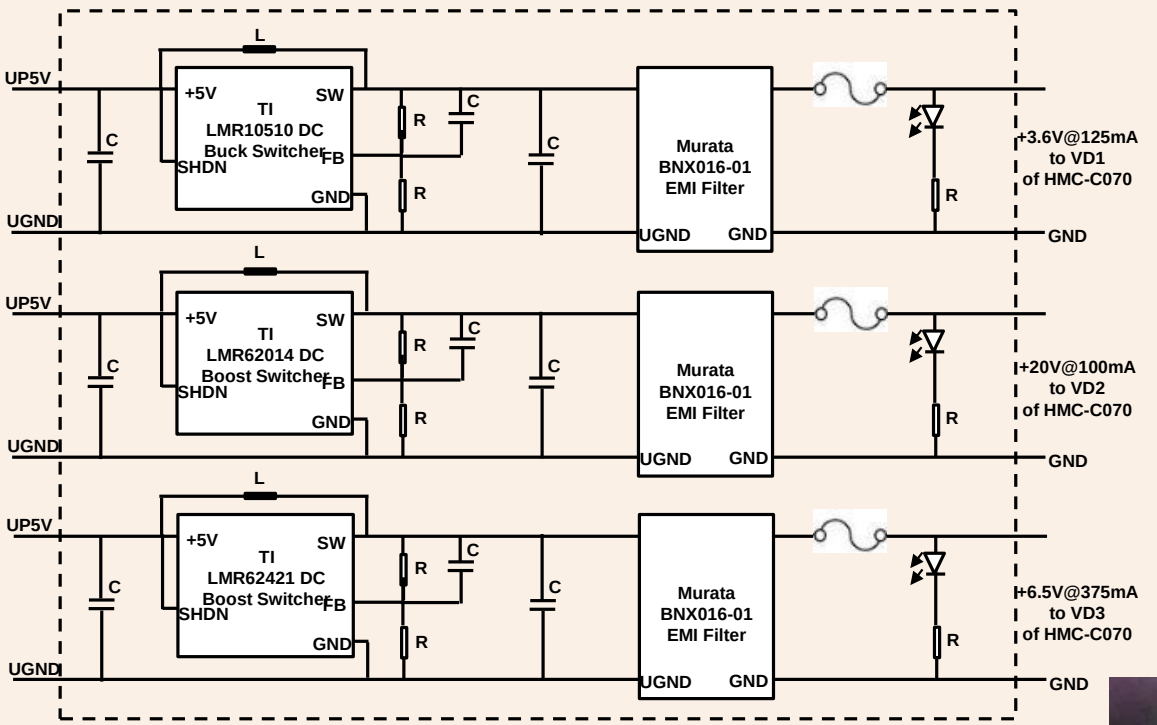
18GHz Solution: Calibration

- Advantest will build these as hermetically sealed modules with factory calibration on an EEPROM with no further calibration needed
  - Reduce burden of calibration for the end user
  - Has slightly reduced accuracy compared to user-based calibration
  - Eliminates need to have power meters and rack equipment on test floor
- Performance results indicate that calibration will be relatively easy to implement due to linearity of conversion loss
- The power supply and RF module are built to attach as a UDI anti-pogo assembly on one standard tester utility block

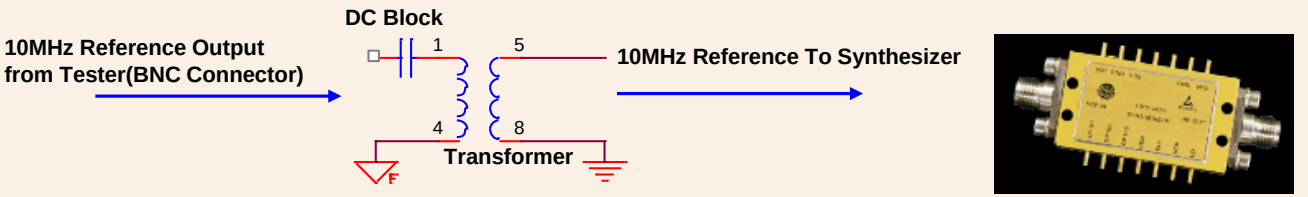
18GHz Solution: DC Supply Overview

- The V93000 5V Utility supply is used to generate three (3) separate voltages to power the synthesizer used with the 18GHz measurement module
  - To keep tester costs down, we want to avoid using DPS resources
- Required power
  - Synthesizer pin VD1, 3.6V@125mA
  - Synthesizer pin VD2, 20V@25mA
  - Synthesizer pin VD3, 6.5V@375mA
- This is accomplished with 3 circuits
  - All connected to the V93000 UP5V supplies
    - UP5V powers up when DUT board is docked
  - All on same power supply UDI module

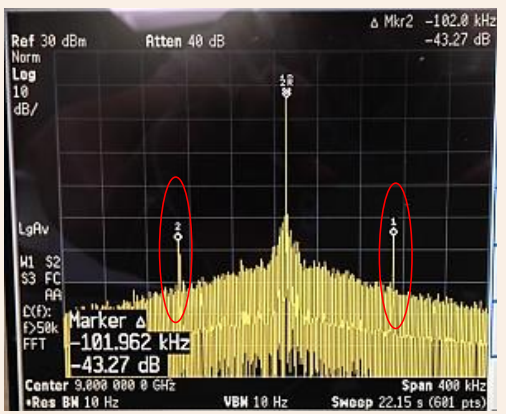
18GHz Solution: DC Supply Block Diagram



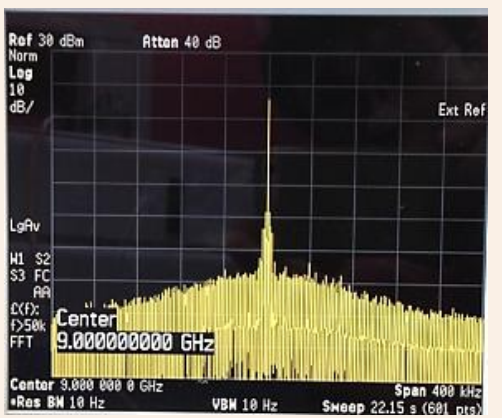
Isolation of 10MHz Reference



Synthesizer output at 9GHz



Without DC block/transformer



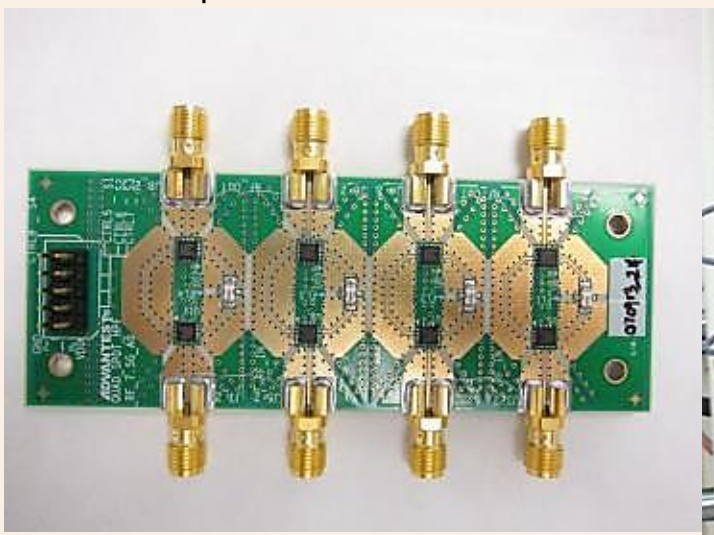
With DC block/transformer

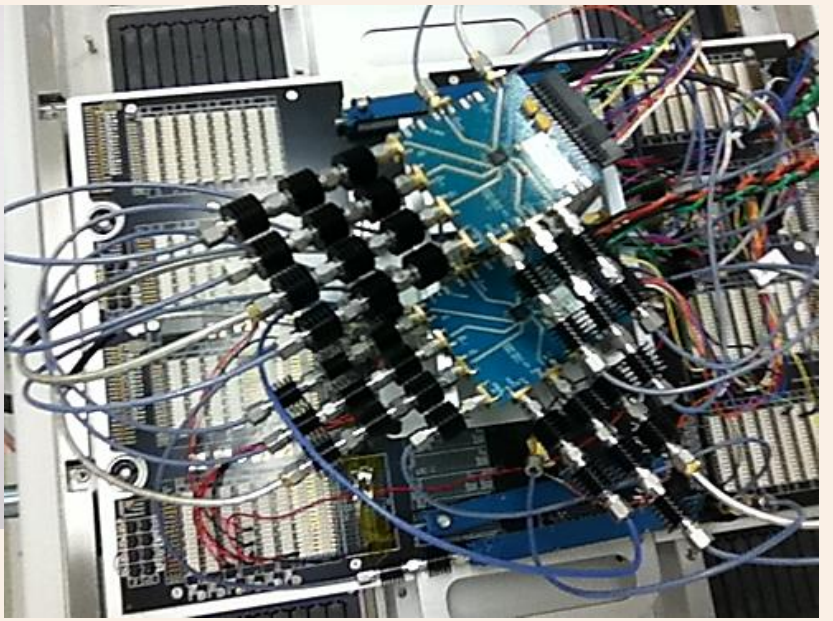
18GHz Solution: DC Supply Learnings

- HMC-C070 contains LT1764 LDOs on 3.6V and 6.5V inputs
  - Hittite did this allow the user to apply a simple 12V to both inputs
  - Problem is that this would lead to additional heat dissipation
  - HMC-C070 already generates a lot of heat
  - Approach we took was to have regulation and conversion on the separate DC supply board and supply exactly the required voltages to the HMC-C070
- Grounding
  - Multiple signal and power grounds: UGND, RF-GND, D-GND, PS-GND, 10MHz REFOUT BNC shield (tester chassis GND)
  - RF-GND, D-GND and PS-GND's are connected at HMC-C070
  - 10MHz REFOUT is isolated from the rest with DC block transformer
- We can produce a UDI power supply and 18GHz extension module for less than $3k

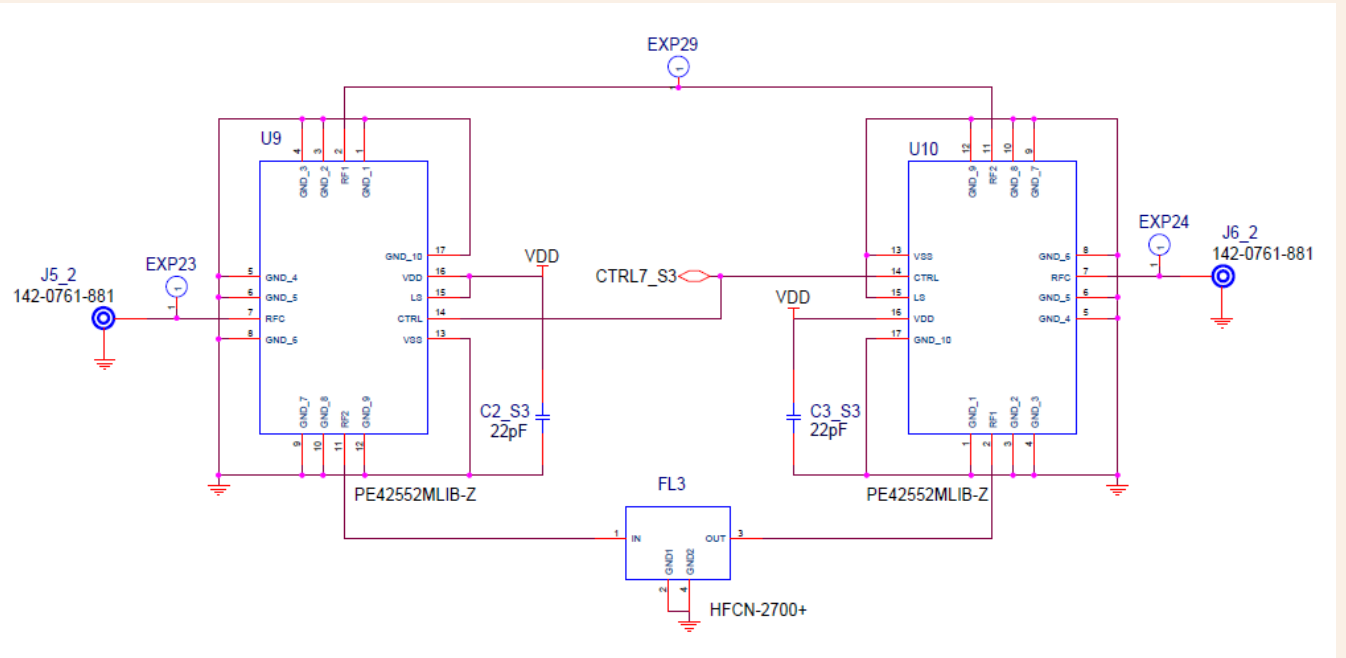
RF Harmonic Measurement (HM) Module

- RFPA Harmonic Filtering
- Built for dual site LTE/CDMA high and low band
- RFPA Applications Target
  - LTE, CDMA, 802.11ac
  - Up to 18GHz

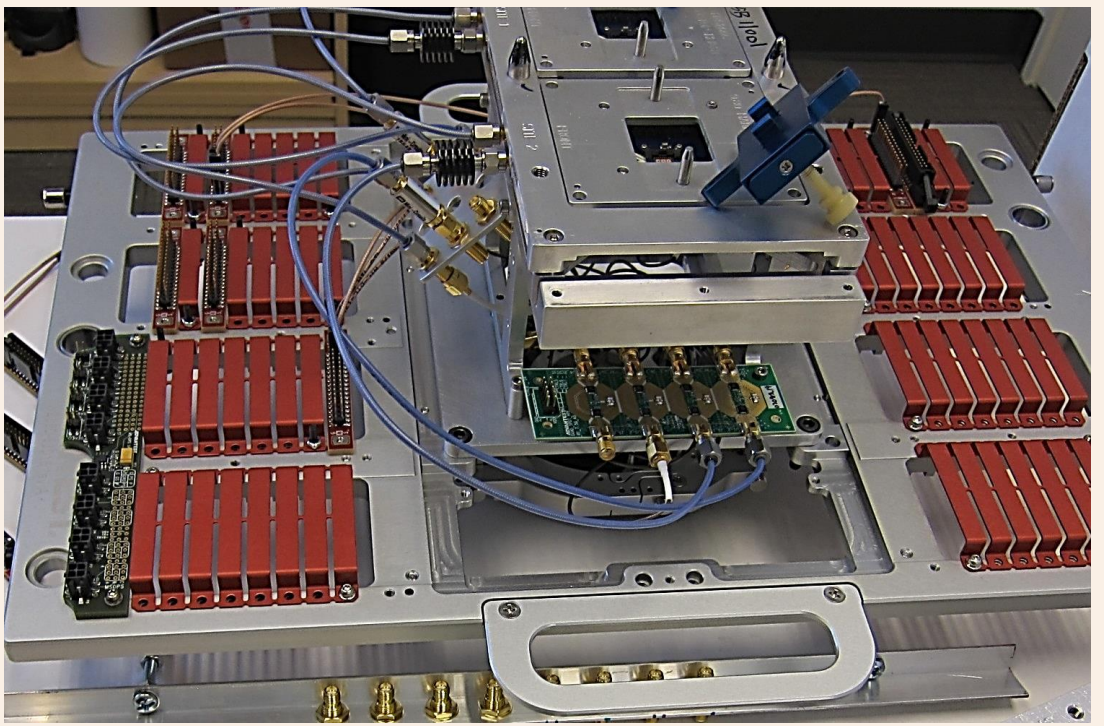




RFPA HM Low Band



LTE RFPA UDI and HM Module



Summary

- UDI
  - Lowers cost of DUT fixtures
  - Extends performance of standard ATE instruments
  - UDI allows rapid prototyping and fast bring up for HSIO, RF and complex MX reference boards
  - Compatible with our standard docking and electrical interfaces
- 18GHz RF Solution
  - Available in 2015 as a packaged UDI module solution
    - We also do a DUT board based connectorized version
  - Key learnings from building the DC supply for the 18GHz solution
    - Base for RF module, EEPROM calibration support, ground management, UDI base
  - Results indicate that calibration will be relatively easy to implement due to linearity of conversion loss
- Harmonic Measurement (HM) module
  - One board eliminates four (4) wideband directional couplers
  - HM has same performance at <10% of the cost of traditional couplers
  - Working on UDI anti-pogo version for 4 sites
  - Evaluating higher frequency versions for additional applications
    - Higher power, modulated signals, fast signal switching