IEEE SW Test Workshop
Semiconductor Wafer Test Workshop

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mmWave RFIC Probing Systems for Engineering and Production Test

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Agenda

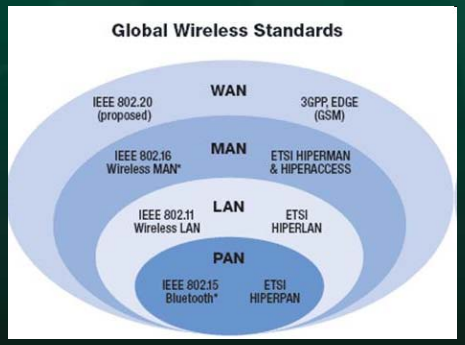
- Emerging Market, mmWave RFIC
- Roos Instruments Cassini ATE
- Cascade Unity-MW and Pyramid-MW Probes

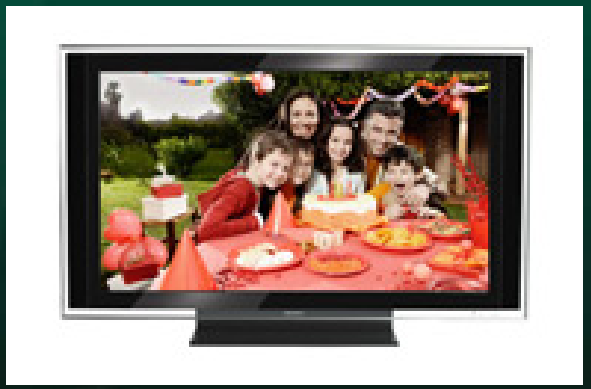
New Emerging Applications

67 - 81 GHz
Automotive
Radar

60 – 80 GHz
LAN/PAN
Wireless Network

60 – 80 GHz
Wireless-HD
Multimedia

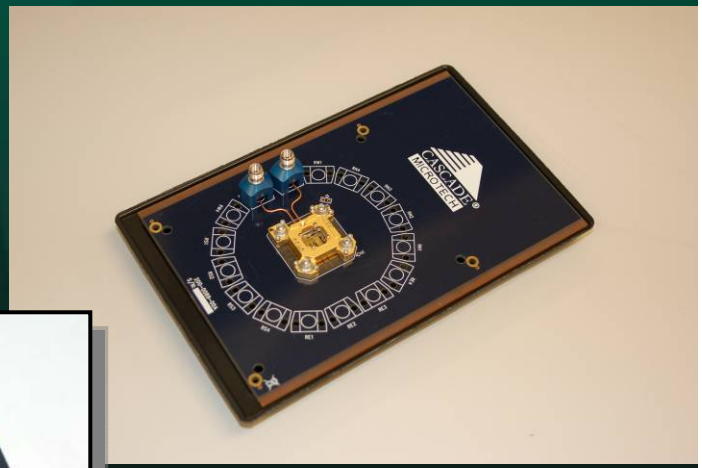


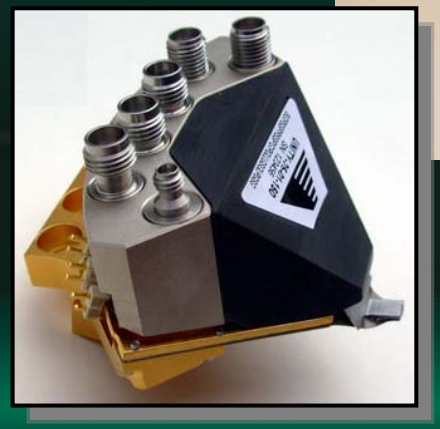


Cost Effective ATE for mmWave KGD Test

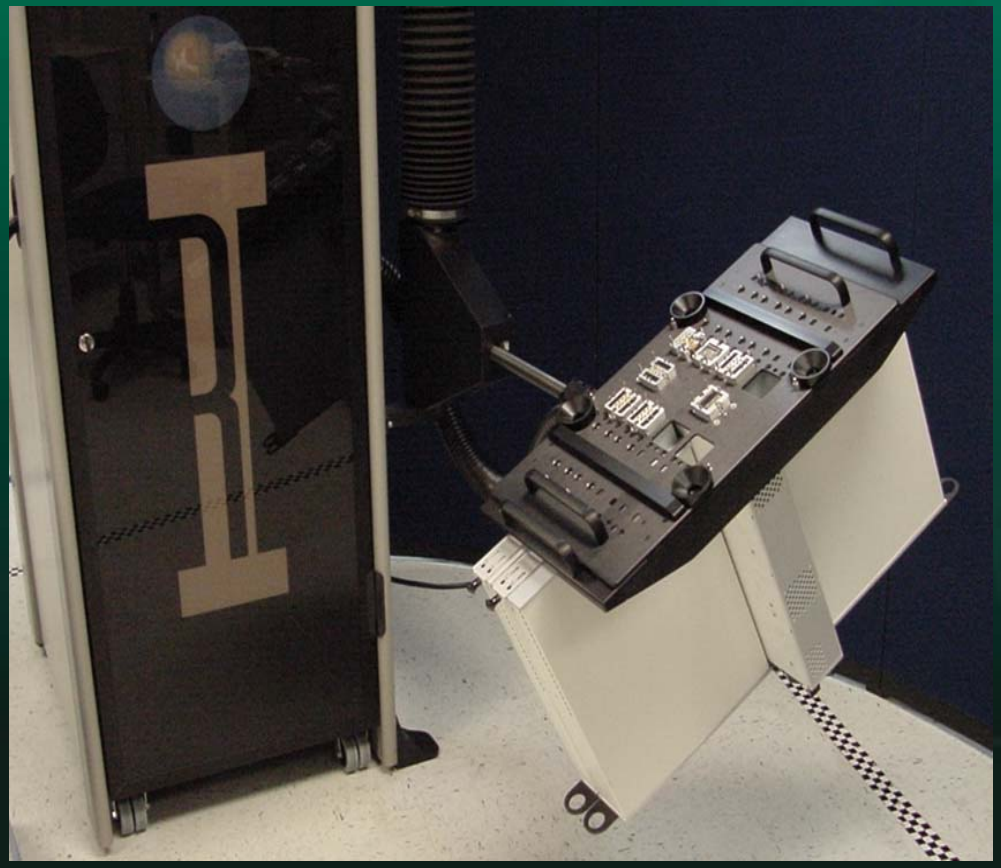
- **Roos Cassini**
  - Waveguide interface (for 60-81 GHz signals)
  - Built-in calibration capability

- **Cascade Probes**
  - Engineering Test
  - High Volume Production Probing



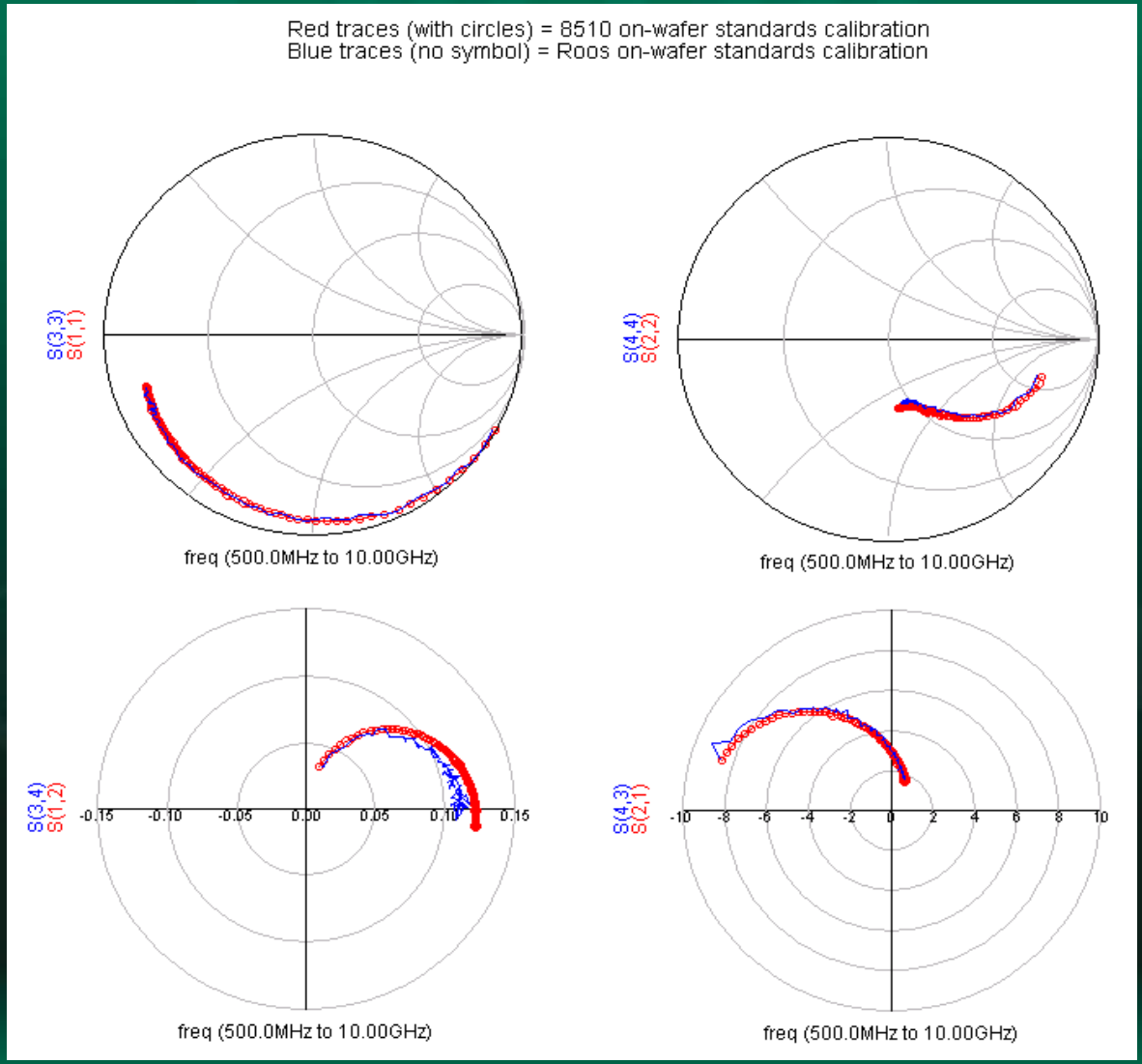


CASSINI Modular ATE

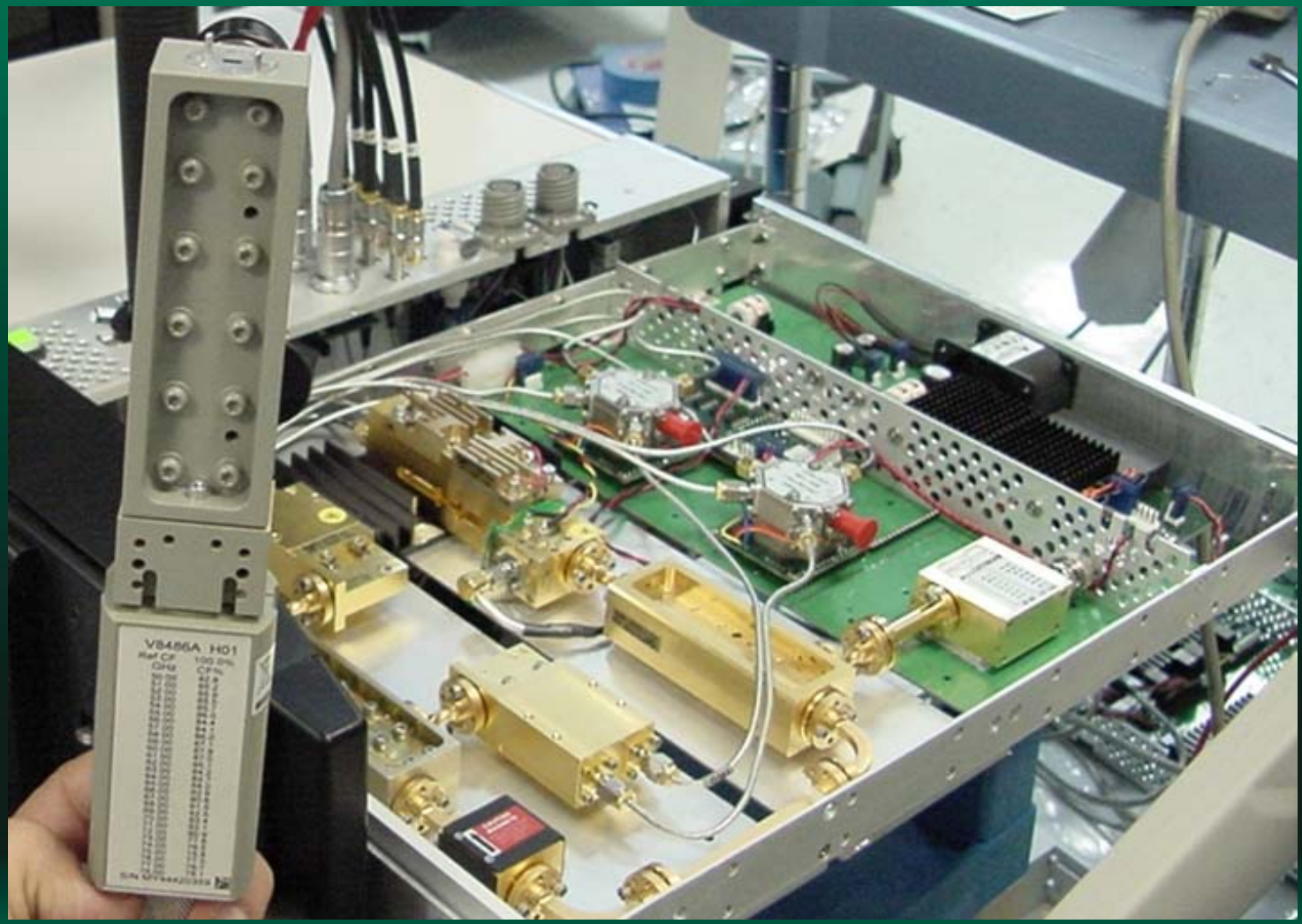


- Configurable tester
- Full range of resources
- Super RF

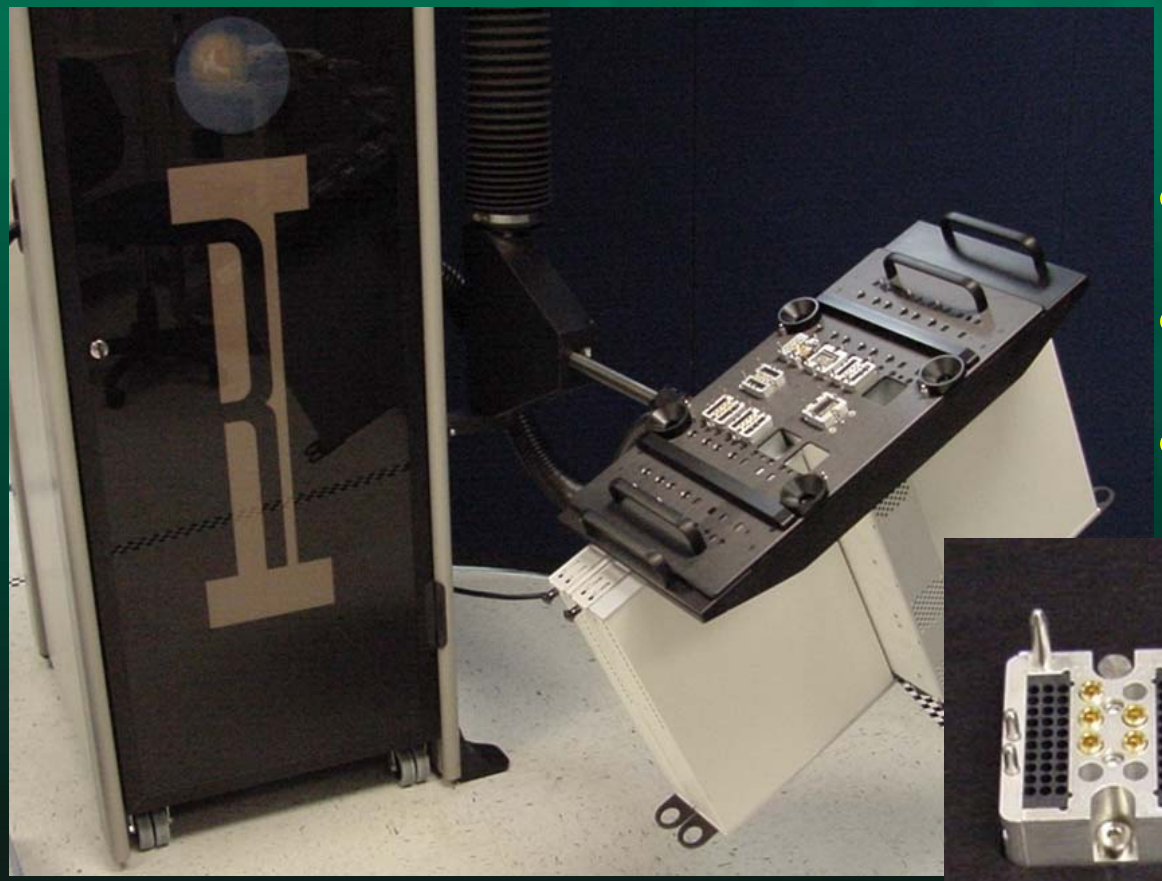
Proven On Wafer Accuracy



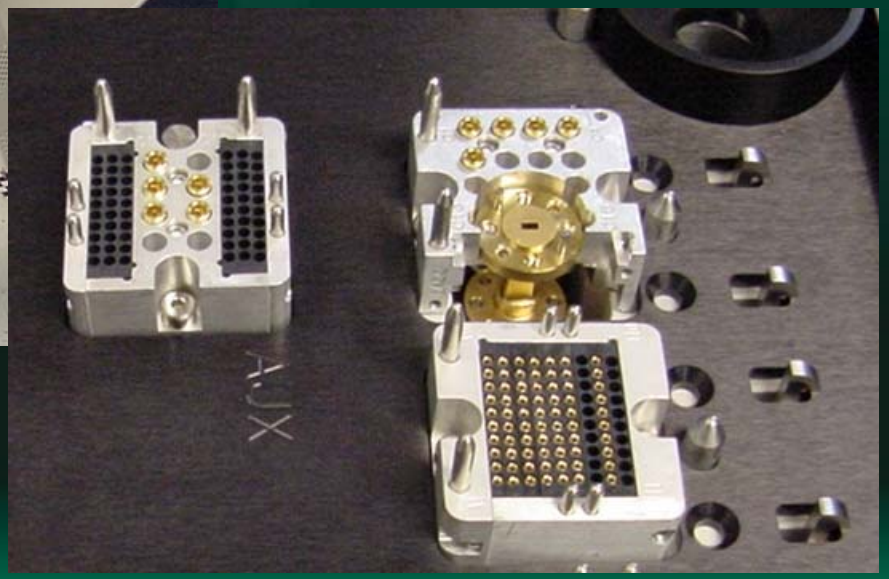
77 GHz Instrumentation



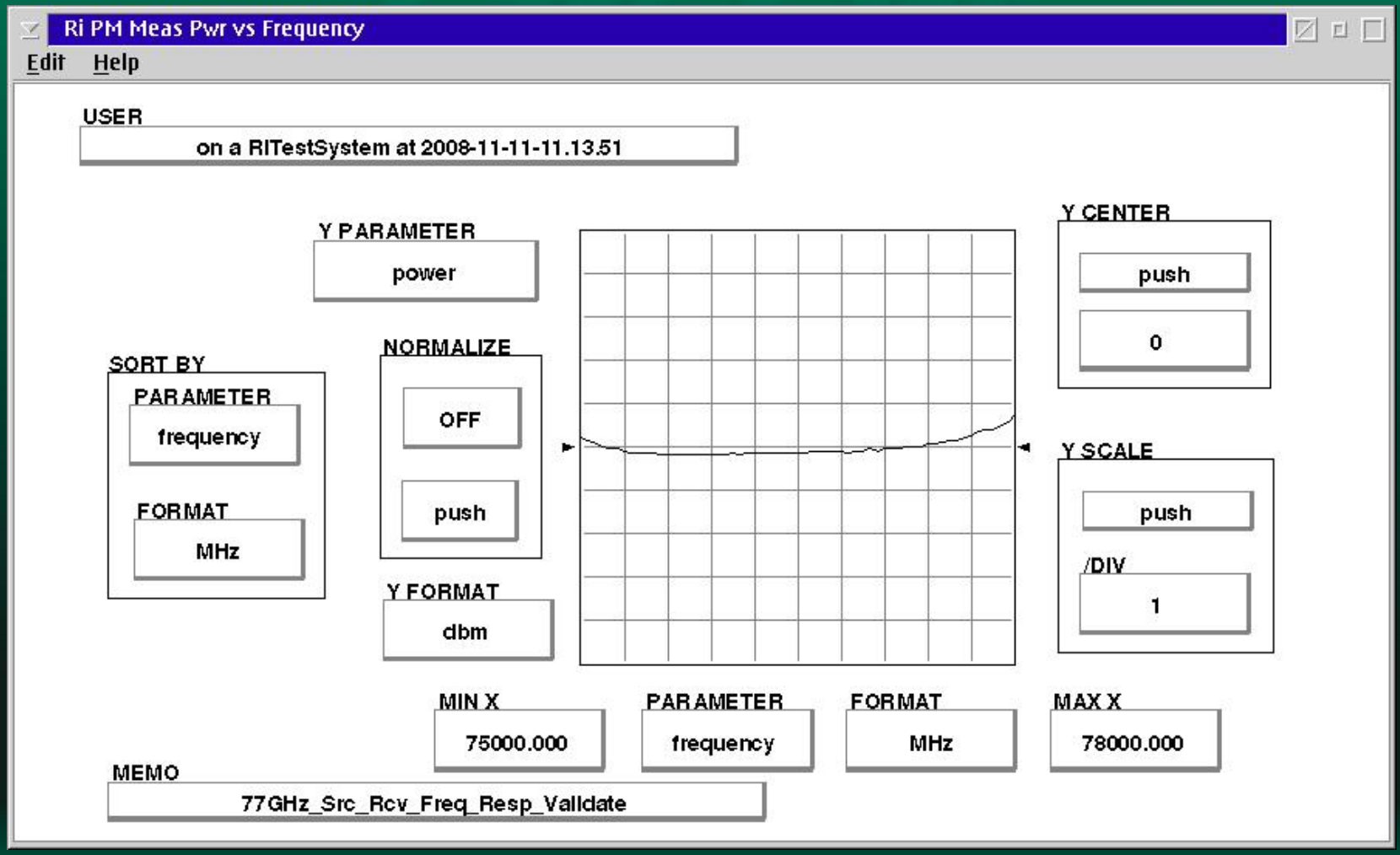
Blind Mate to the DIB



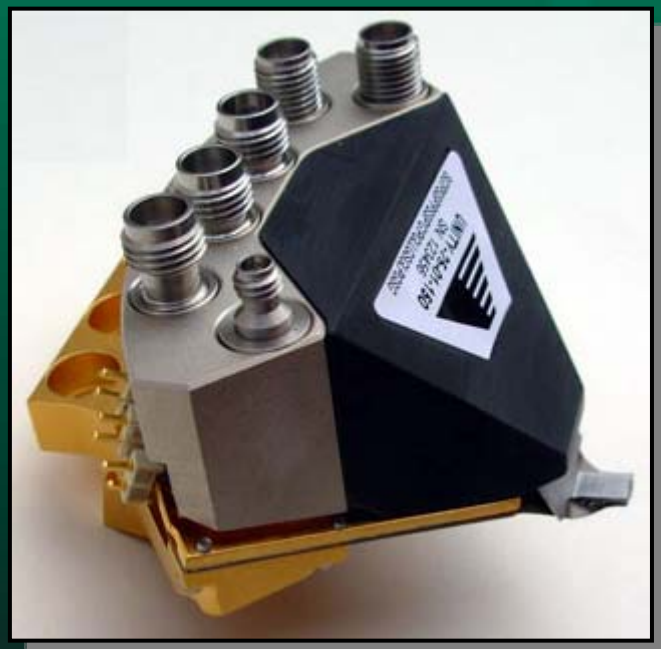
- DC – 100GHz
- Repeatable
- Many Options



Accurate Power at 77Ghz

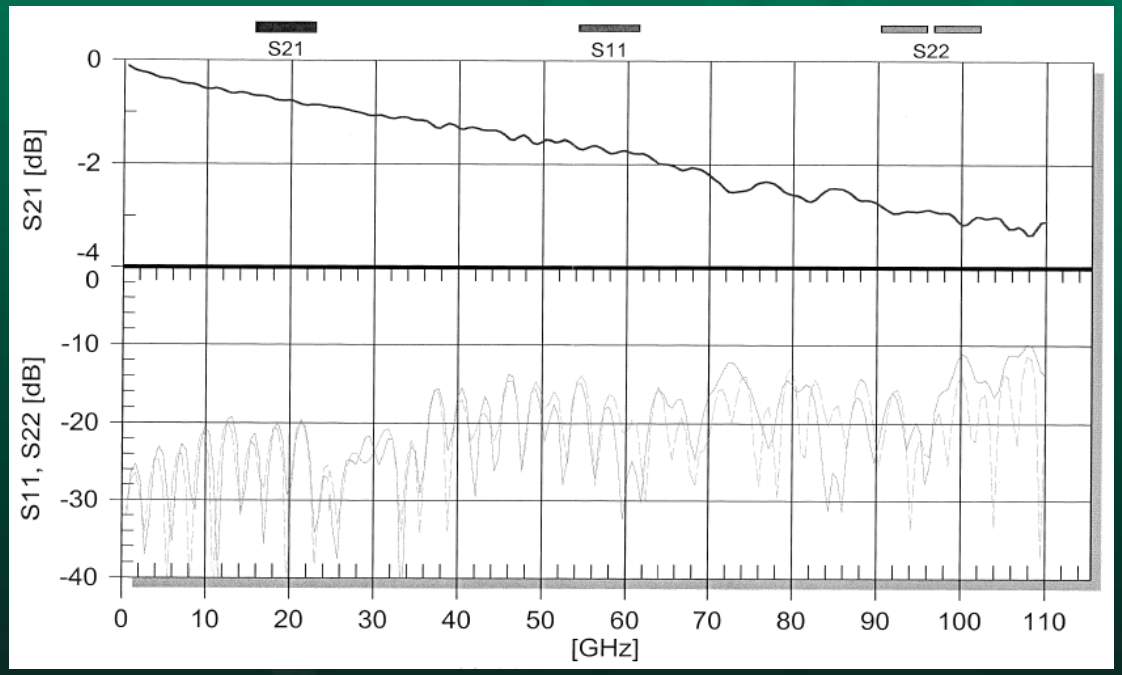


Unity-MW Product Features

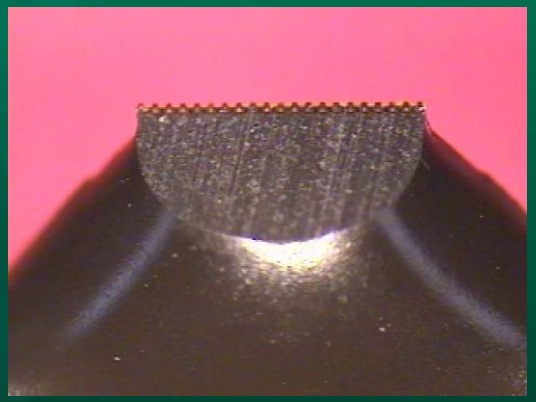


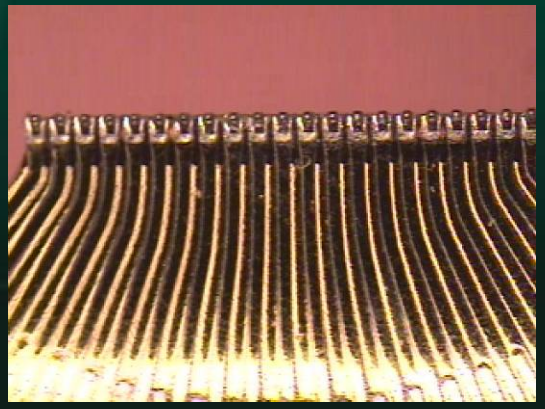
- **Based on Infinity Probe® Technology**
  - Photo-lithographically defined tips.
  - Minimal skate.
  - Small pad probing (40x40 um).
  - Permanent alignment.
- **Flexible Signal Configuration**
  - Up to 25 colinear contacts at uniform pitch.
  - Up to 4 low loss mmW RF signals, to **110 GHz**.
  - “Quadrant” compatible.
- **Full Environmental Testing**

Unity-MW RF Performance



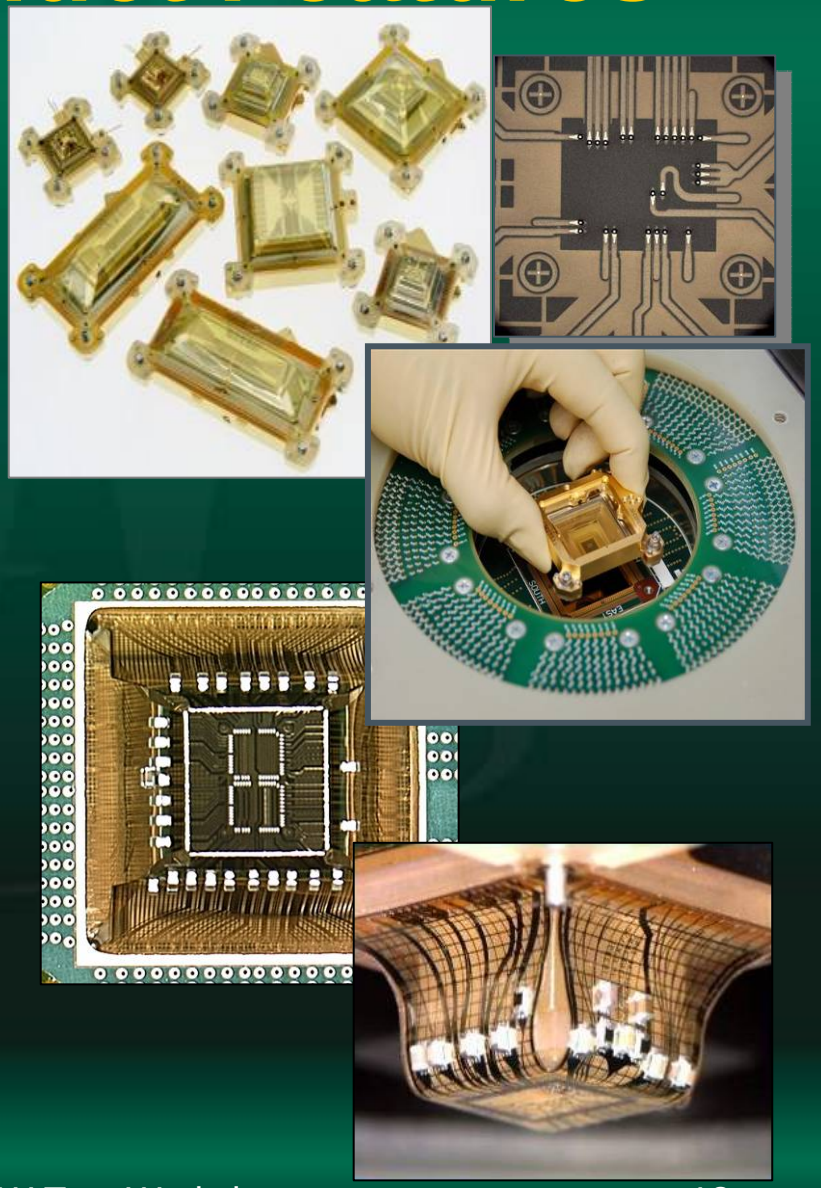
RF Probe Transmission Characteristics



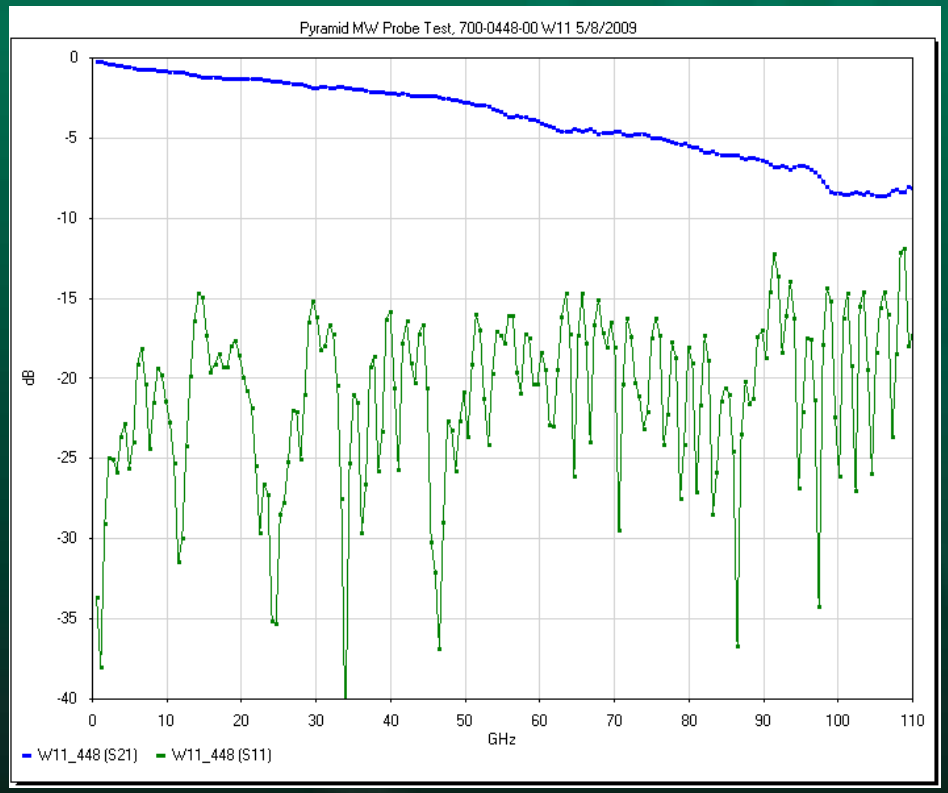


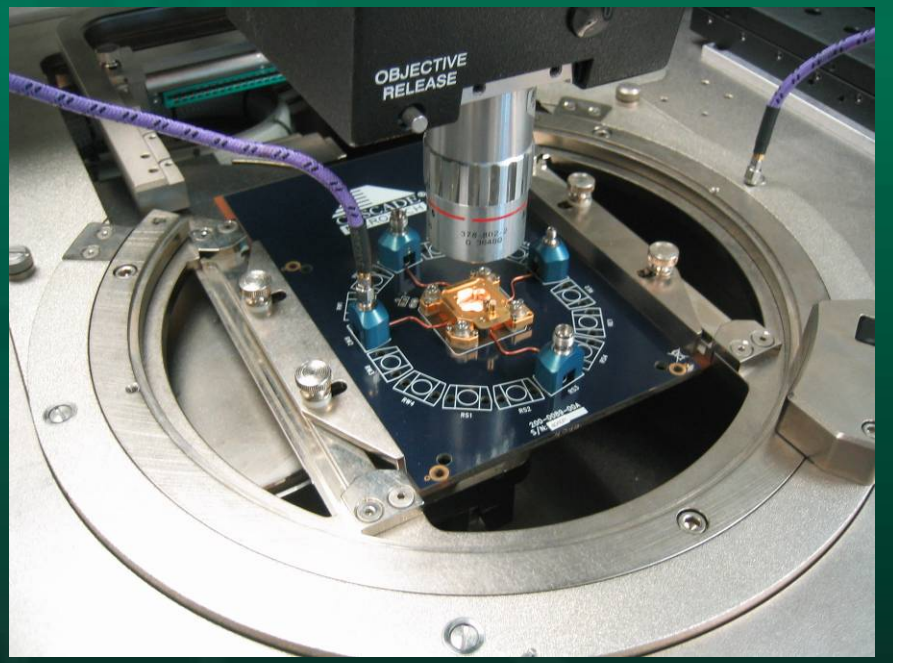
Pyramid-MW Product Features

- **Industry-Leading Electrical Performance**
  - Exact layout to match customer's die.
  - Stable power supply lines.
  - Decoupling caps near die.
  - Low and stable contact resistance.
- **Extended RF Bandwidth**
  - Controlled impedance to the probe tips.
  - >10 dB return loss thru 110 GHz.



Pyramid-MW RF Performance

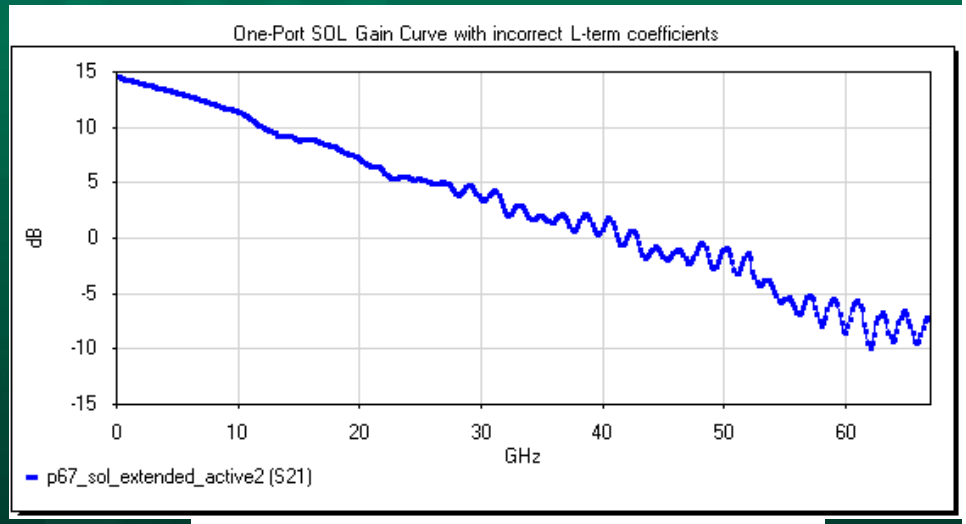


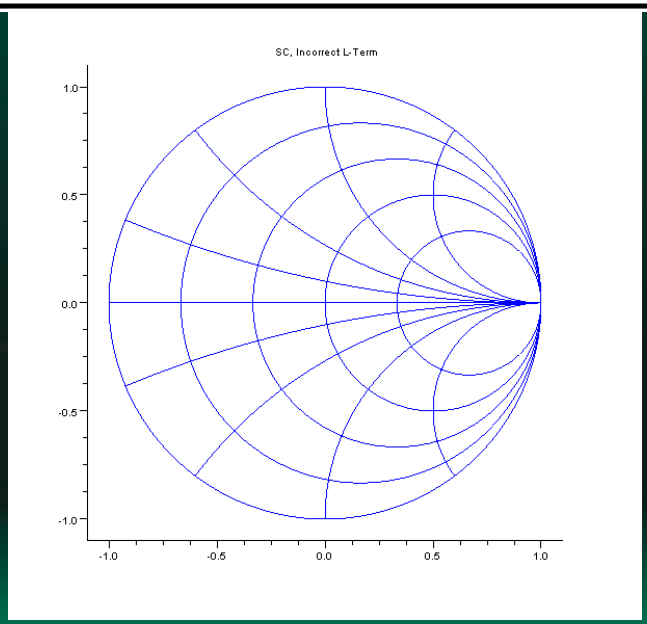


RF Probe Transmission Characteristics

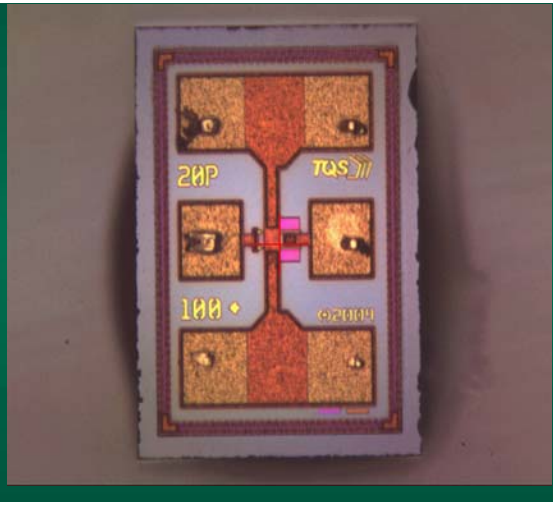
RF Calibration

- **Unity-MW:**
  - Re-position to align with wafer standards.
  - SOLT, LRRM, etc.
- **Pyramid-MW**
  - Cable Calibration, Port Extend with S-O-L measurements.
  - On Cassini: One-port S-O-L measurements.
- **Finalizing parasitic characterization for most-accurate calibration.**
  - SOL Terms will be delivered with each probe for integration into the Cassini system.

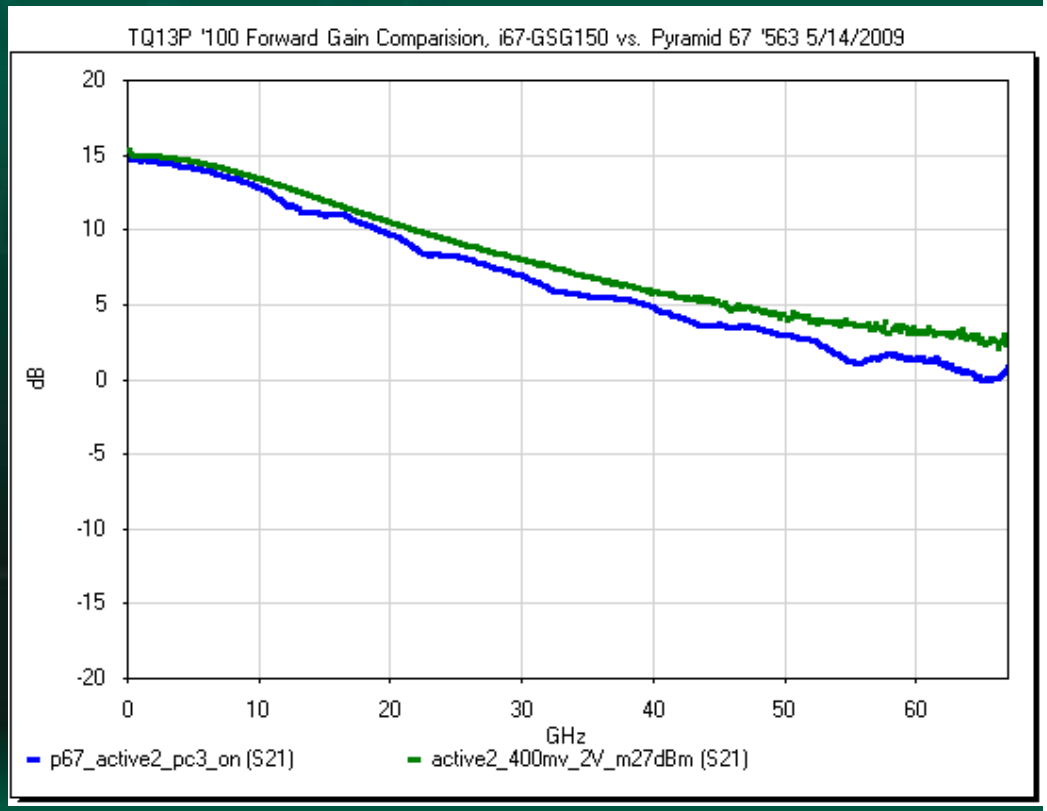




Measurements



- **After calibration, its time to probe something real!**
- **TriQuint test cells.**
  - 0.13um PHEMT process.
  - Gain bandwidth > 80 GHz.
- **Comparison:**
  - Two setups (Engineering vs. Production Probe)
  - Differences noted in DC bias, dynamic range of each system.
  - Results correlate relatively well.



Thank You!

- **Special thanks to:**
  - Ken Mays, TriQuint Semiconductor.
  - Prof. R. Campbell, Portland State University.
  - The Roos and Cascade teams.