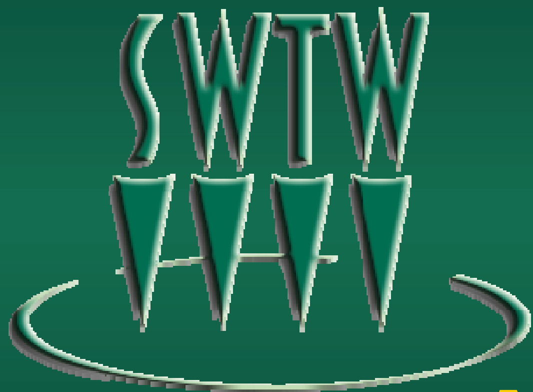

IEEE SW Test Workshop
Semiconductor Wafer Test Workshop

June 12 to 15, 2011
San Diego, CA

An Advanced Cantilever Probe Card with 6GHz Bandwidth for RFIC Wafer Testing

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MPI

Overview

- Background
- RF Cantilever Probe Card Solution
- RF Simulation and Modeling
- Experiment, Validation & Customer Verification
- Summary

Background

Radio Frequency

5GHz

3GHz

1GHz

High Speed

1Gbps 3Gbps 5Gbps 7Gbps 9Gbps 10Gbps

WiMAX FORUM

WiFi CERTIFIED

Bluetooth

lte

GSM GLOBAL SYSTEM FOR MOBILE COMMUNICATIONS

HDMI HIGH-DEFINITION MULTIMEDIA INTERFACE 1.3

USB 3.0

PCI EXPRESS

PCI EXPRESS 2.0

USB

LVDS SCORPIONS

SERIAL ATA

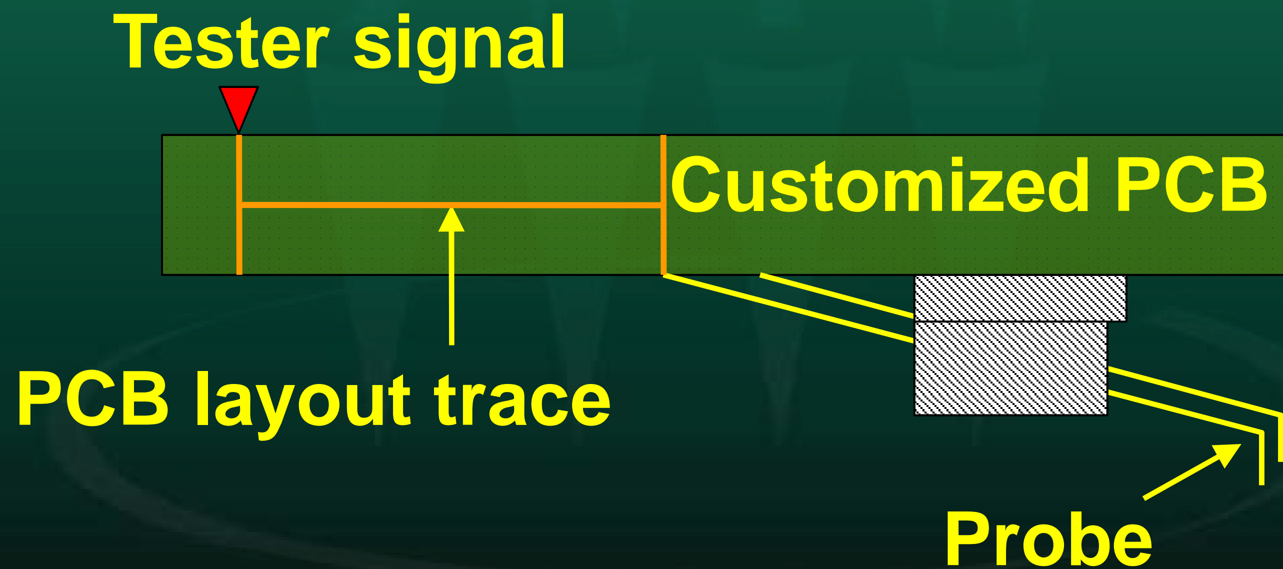
SERIAL ATA 3Gb/s

SERIAL ATA 6Gb/s

PCI EXPRES Gen3

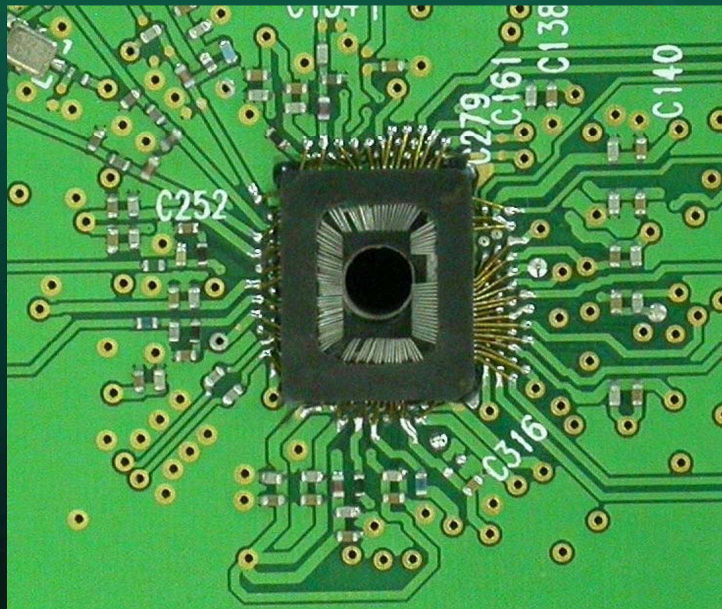
Background

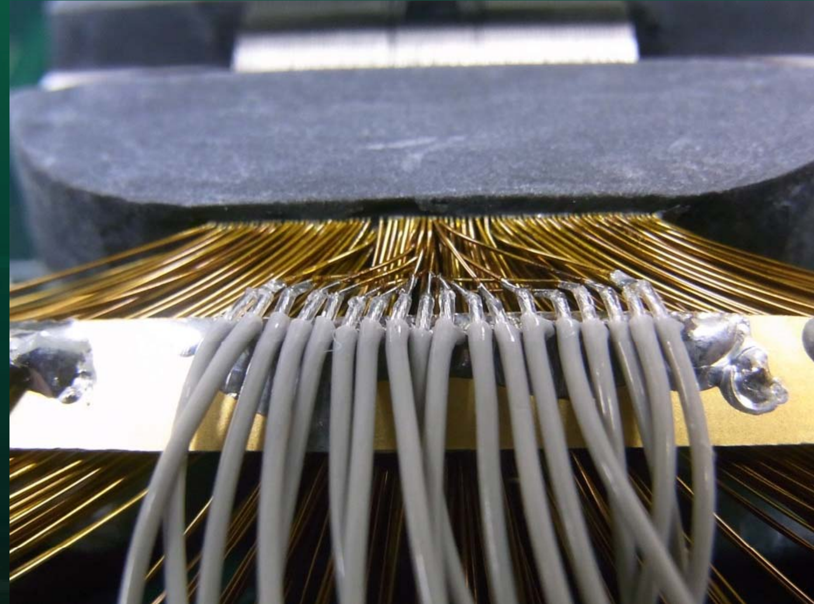
- Cantilever probe card structure



RF/HF Solution

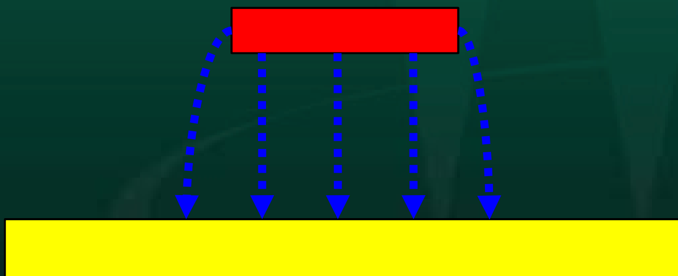
- **Traditional RF Solution**

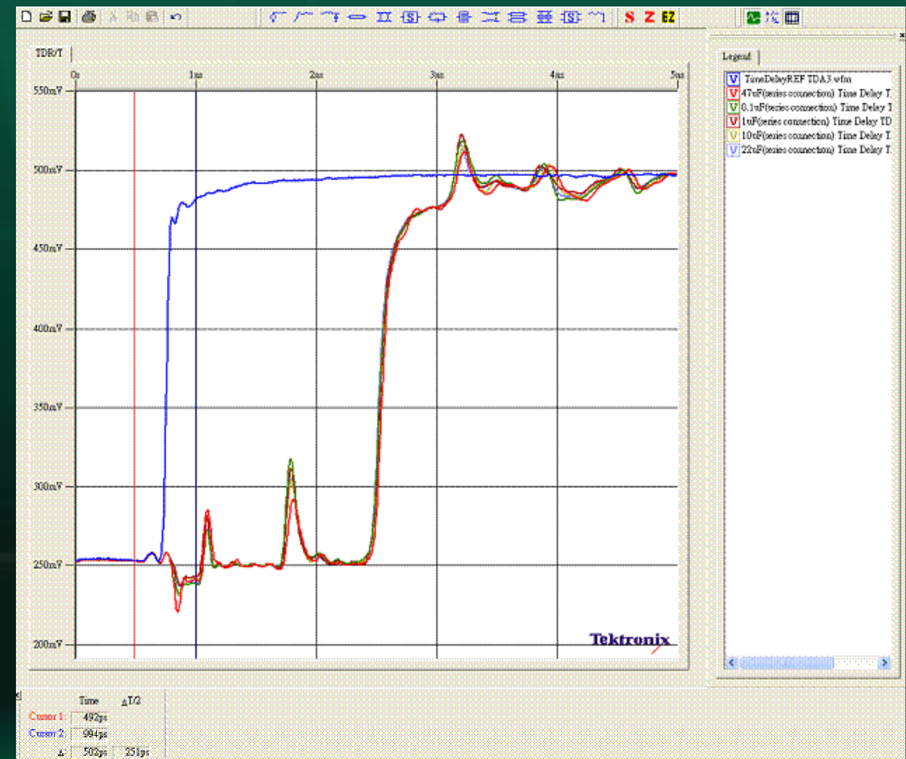




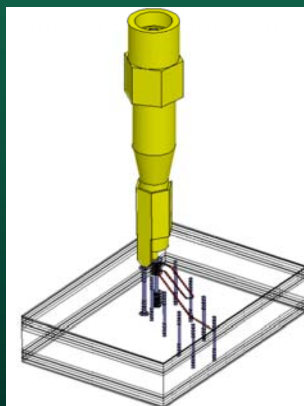
RF/HF Solution

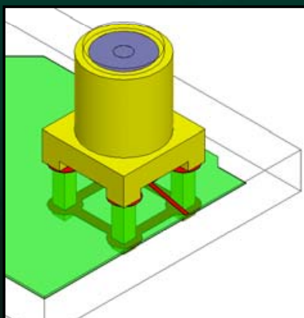
- Transmission Line Theorem
- Impedance Control

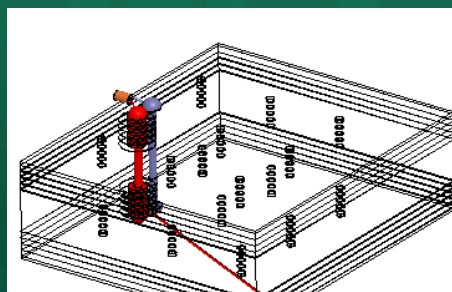


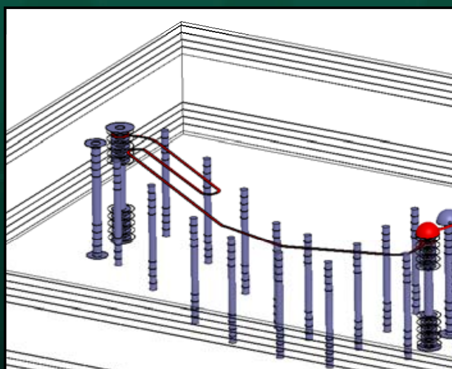


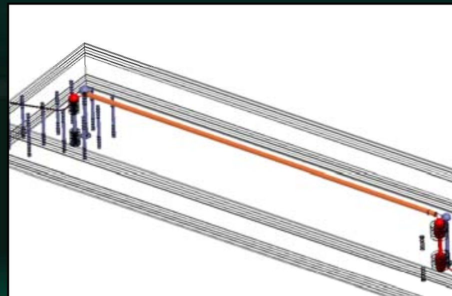
RF Simulation and Modeling

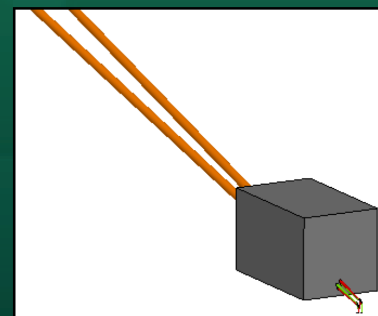


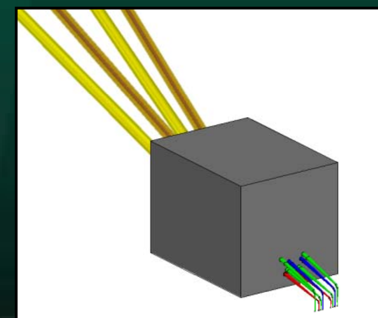




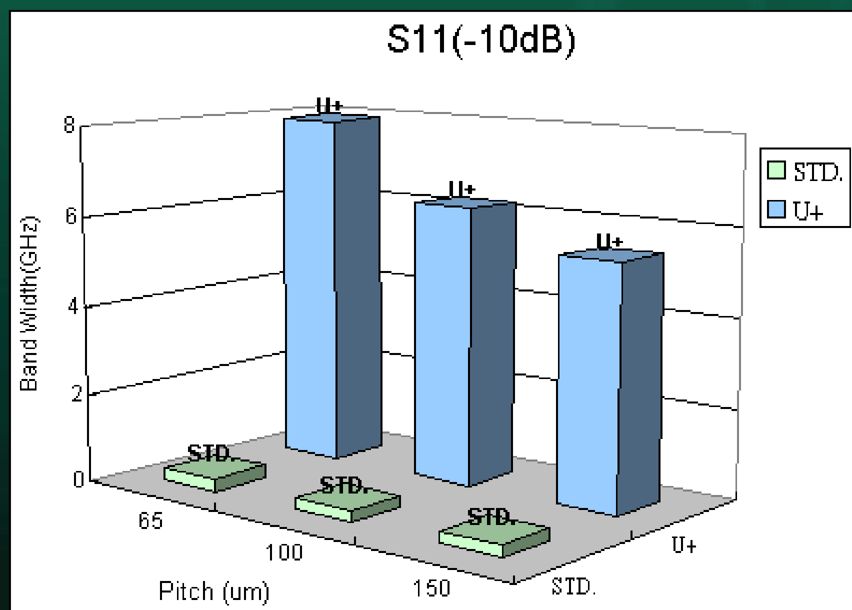


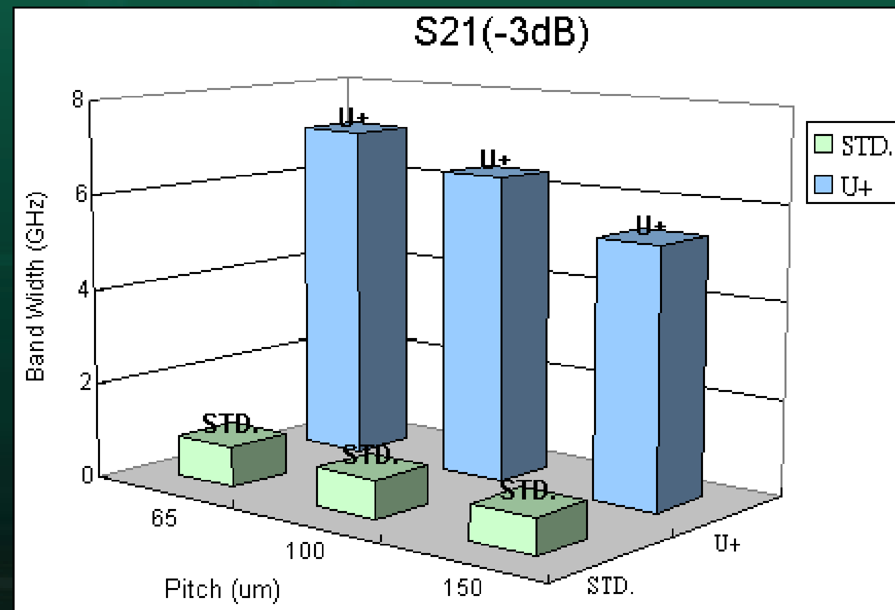




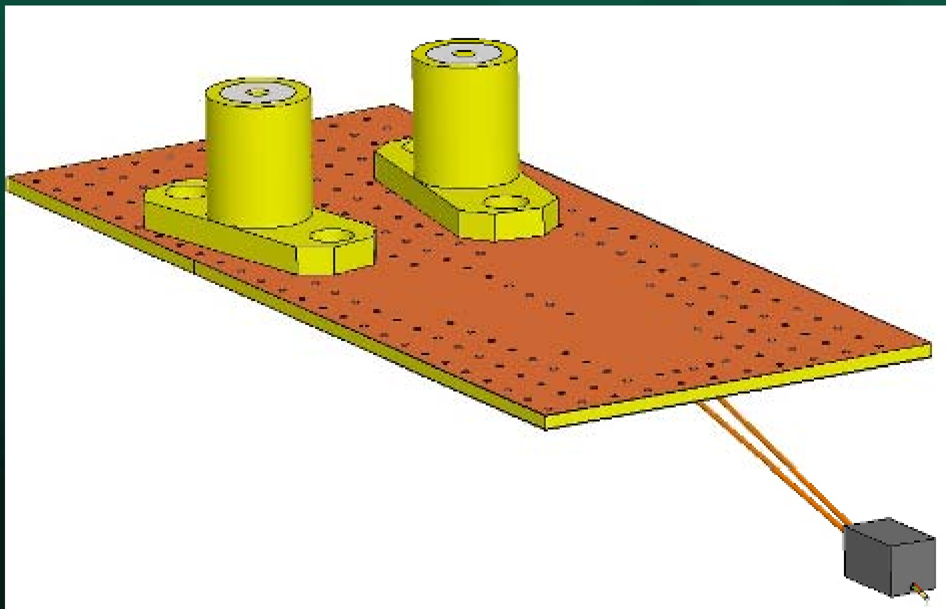


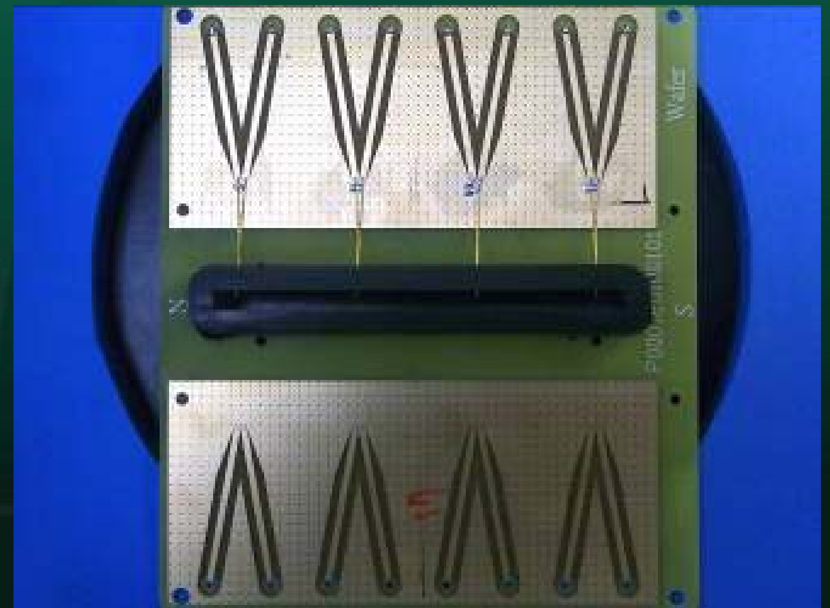
RF Simulation and Modeling



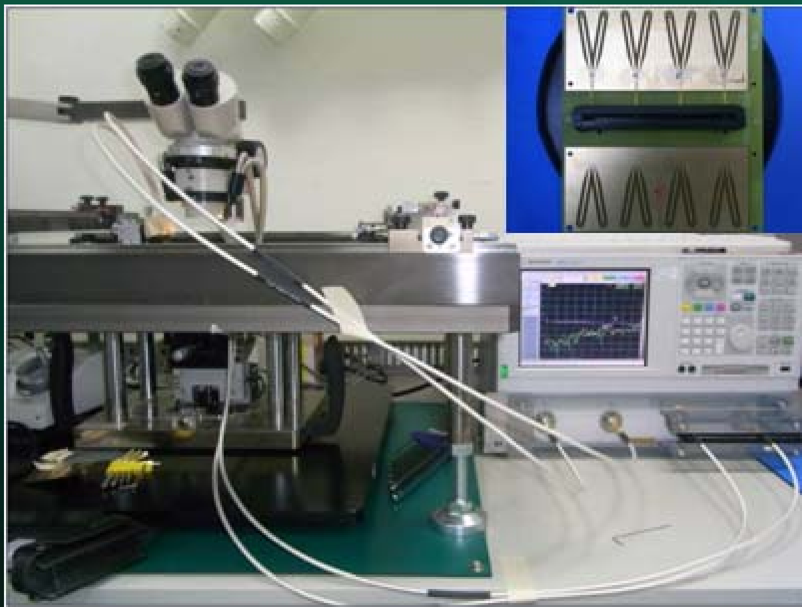


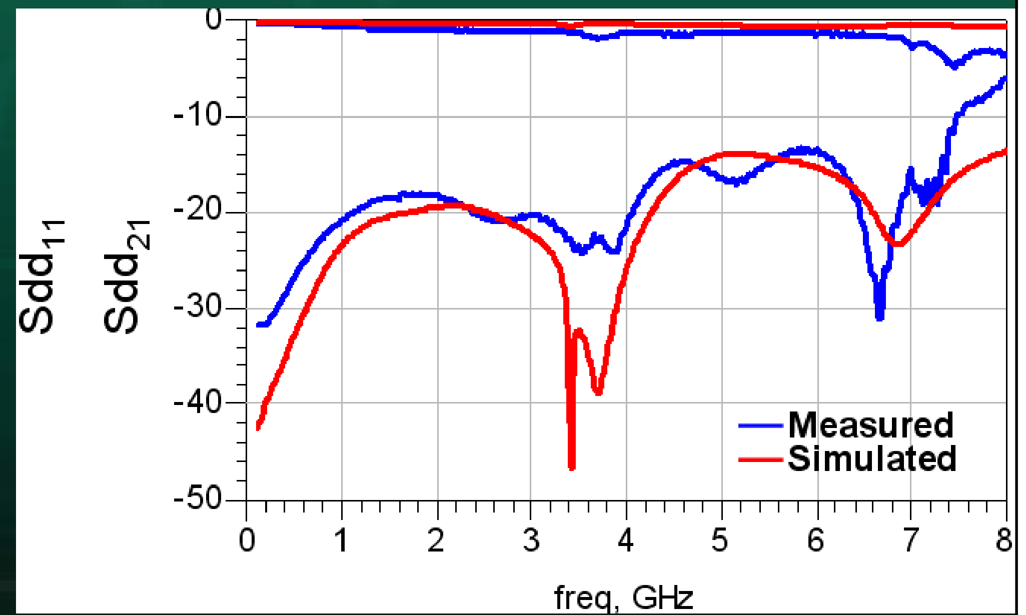
Experiment





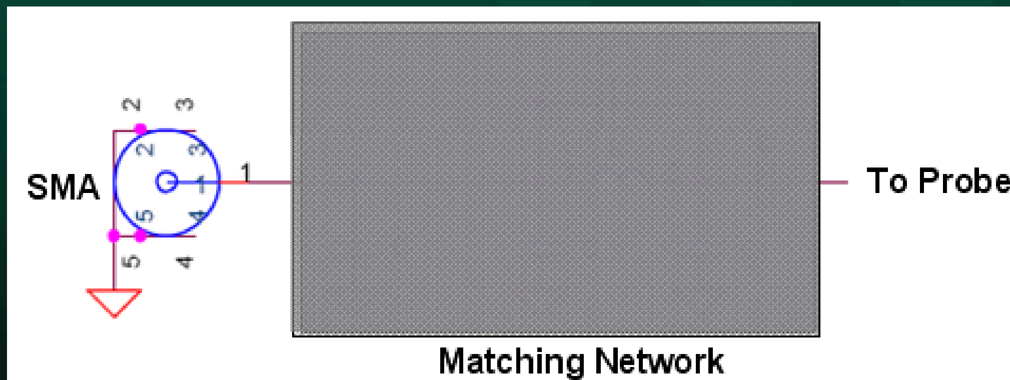
Experiment

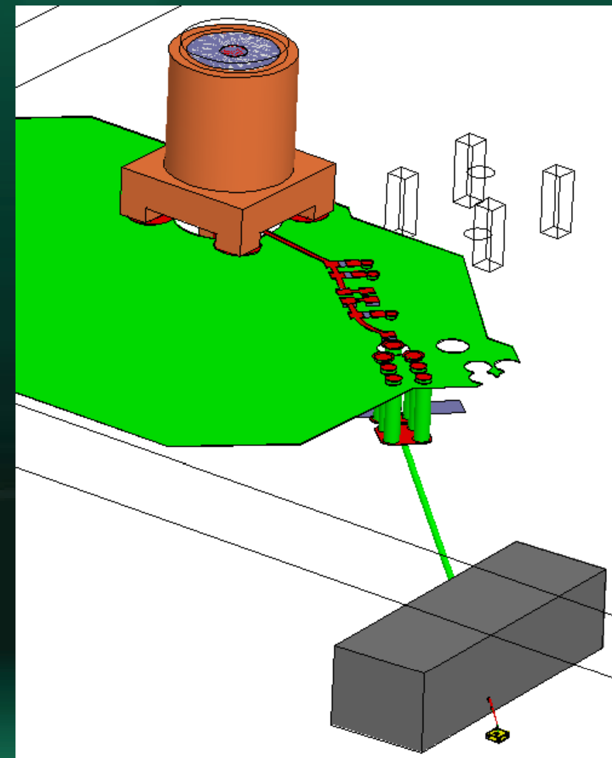




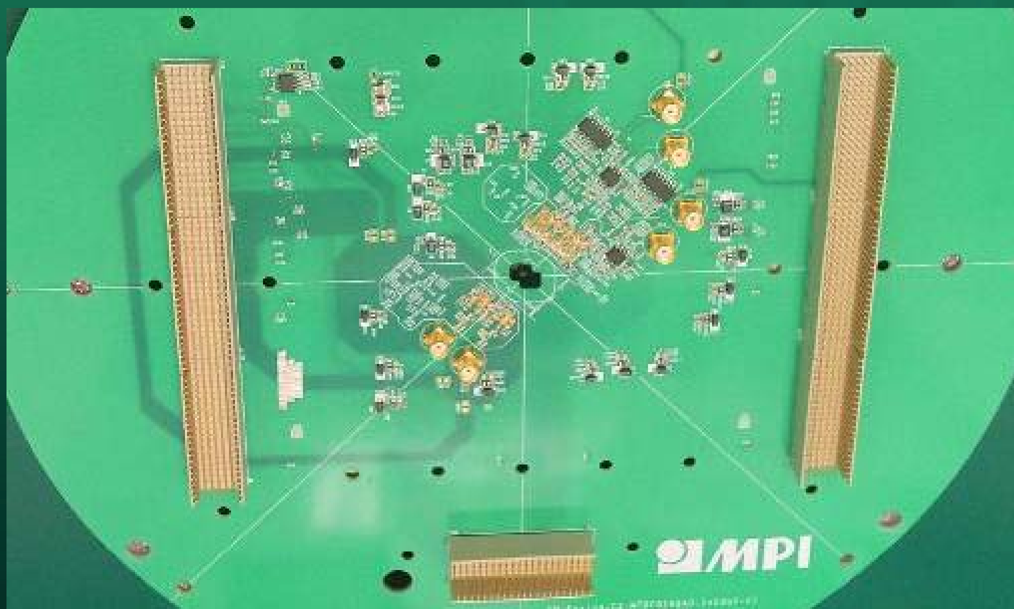
Customer Verification

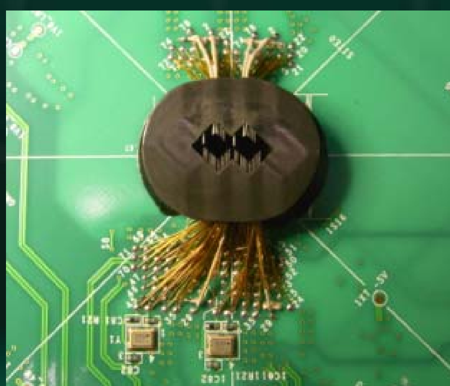
- Application: RFIC
- Frequency : RF Out 2.3-3.8GHz

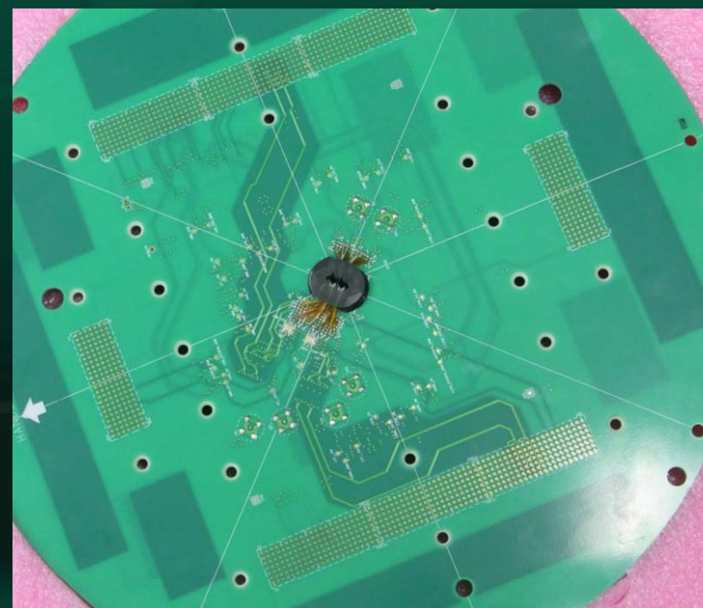




Customer Verification

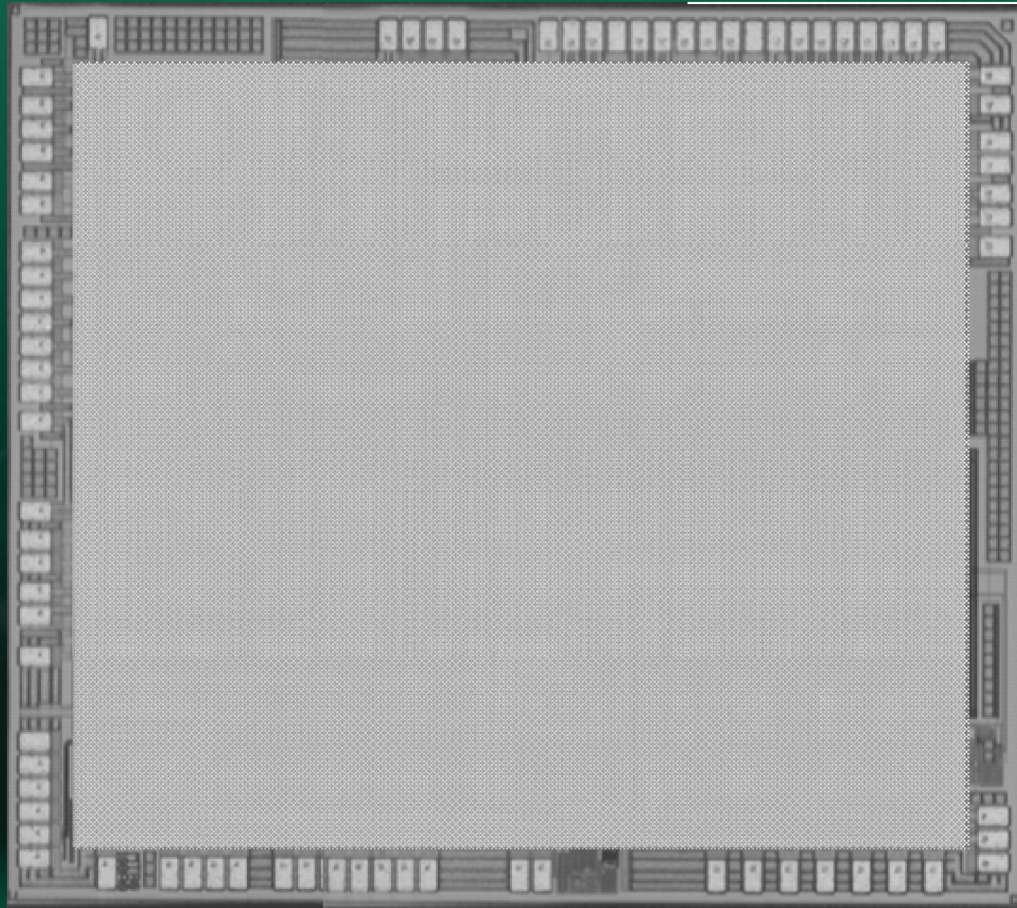






Customer Verification

- **DUT information – Probe Mark**

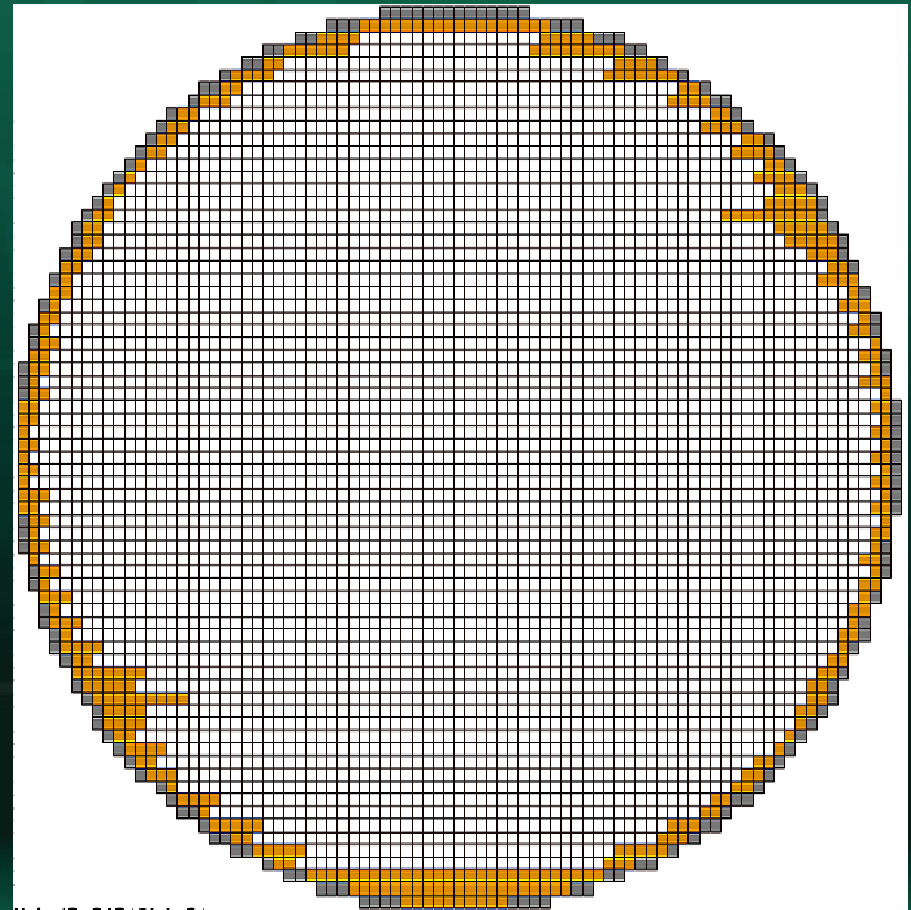


Customer Verification

- **DUT information – Wafer Map**

Electroglas SECS Wafer Map Summary

Date/Time Printed: 2011-05-20 16:56:19
Date/Time Probed: 2011-05-06 16:57:53
Wafer ID: G6B150-01C4
Flat Location: 0
X Die Size= 2400, Y Die Size= 2800
Die Size Units: 10^-6*m
Coordinate Quadrant= 2
Reference Die X,Y= 31,3
X Coordinates: Minimum= 1, Maximum= 83
Y Coordinates: Minimum= 1, Maximum= 71
Total Die in Map: 4659

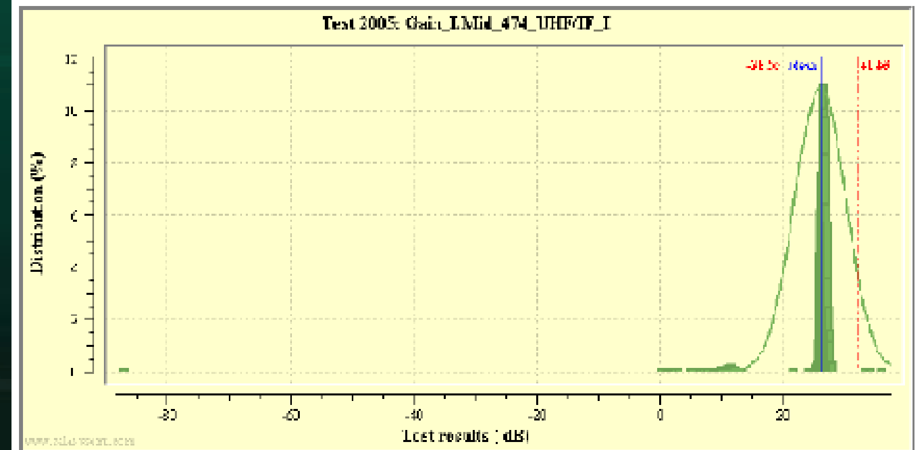


Customer Verification

- **DUT information – Test Data**

Test	Name	Cp
2704	Pout_1.7_634_UHF/IF_I	1.35
2504	Pout_Peak_634_UHF/IF_I	1.39
1028	IIL_INFO_PWM/INFO_PWM	1.40
1023	IIL_DATA_OUT/DATA_OUT	1.40
2706	Pout_3.8_634_UHF/IF_I	1.46
2702	Freq_Peak_634_UHF/IF_I	1.47
2959	Ps858_I_PN_UHF/IF_I	1.58
2941	Ps802_I_PN_UHF/IF_I	1.60
2005	Gain_LMid_474_UHF/IF_I	1.61

Test	2005
Name	Gain_LMid_474_UHF/IF_I
Test type	Parametric
Low L.	20.2 dB
High L.	60.0 dB
Mean / Min / Max	25.9586 dB / –86.9897 dB / 36.1069 dB from summary
Mean / Min / Max	25.9586 dB / –86.9897 dB / 36.1069 dB from 4100 samples
Sigma / Range	4.12527 dB / 123.097 dB
Cp / Cpk	1.61 / 0.47
Samples	4100



Summary

- The impedance compensated cantilever probe (U+) has been successful developed and validated the superior RF performance of the probe card. (Patent pending)

Application & Specification

- $S11_{-10dB}$ Bandwidth: > 6GHz
- Fine pitch: < 35 um
- RF Application of U+ ➔
  DTV, GPS, Mobile Phone, WIFI.

Follow-On Work

- **Ongoing work ~ higher frequency device testing probe card for differential RF application devices.**

Acknowledgements

- Great thanks to Innofidei :
  Jamie, John.
- MPI Probe Card Center Engineering Team

Q & A

Thank you very much .