
SEVENTEENTH ANNUAL
BiTS
Burn-in & Test Strategies Workshop
March 6 - 9, 2016
Hilton Phoenix / Mesa Hotel
Mesa, Arizona
Archive- Session 4
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BiTS 2016 Burn-in & Test Strategies Workshop

Session 4

Marc Mössinger

Session Chair

BiTS Workshop 2016 Schedule

Performance Day

Tuesday March 8 - 8:00 am

Frequently High

"High Speed BGA Sockets from a System Perspective"

Don Thompson - R&D Altanova

"A Solution of Test, Inspection and Evaluation for Blind Signal Waveform on a Board"

Tatsumi Watabe, Makoto Kawamura, Hiroyuki Yamakoshi - S.E.R. Corporation

"Device Packaging and How It Affects RF Performance"

Noureen Sajid, Jeff Sherry - Johnstech International

"Automotive Radar Test"

Jason Mroczkowski - Xcerra Corporation

BiTS 2016 Burn-in & Test Strategies Workshop

Automotive Radar Test

Jason Mroczkowski
Xcerra Corporation

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Agenda

ADAS Test Cell

ATE Challenges

Handler Challenges

Interface Challenges

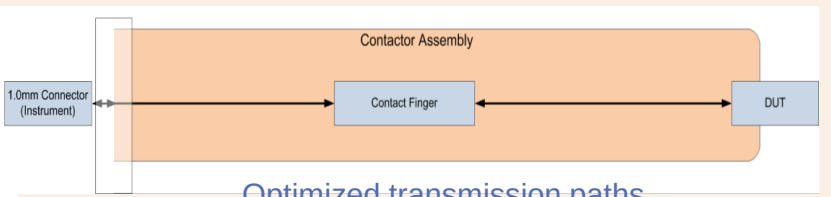
Next Steps

Conclusion

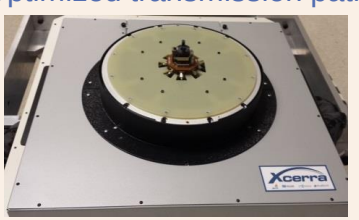
Radar Integrated Test Cell

- High volume production “at speed“ testing solution for ADAS (Advanced Driver Assistance Systems) Radar-enabled devices
- Automated, automotive-compliant, tri-temp testing and handling
- Commercial ATE with 76-81GHz Radar transmit and receive units
- Fully matched “at speed“ contactor and interfacing assembly
  - Lowest number of signal transitions provides better signal integrity
  - Packaged device and WLCSP compliant
- Optimized mechanical interfacing and integrated test cell communication

X-Series MX
General Purpose ATE



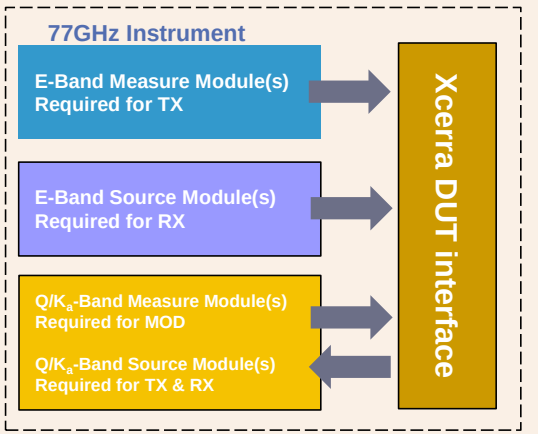
Optimized transmission paths



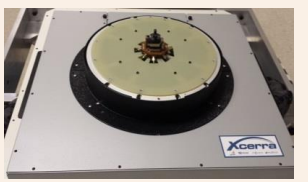
“Kestrel” Integrated 77GHz test and contactor assembly

MT 9510
Tri-Temp P&P Handler

ATE

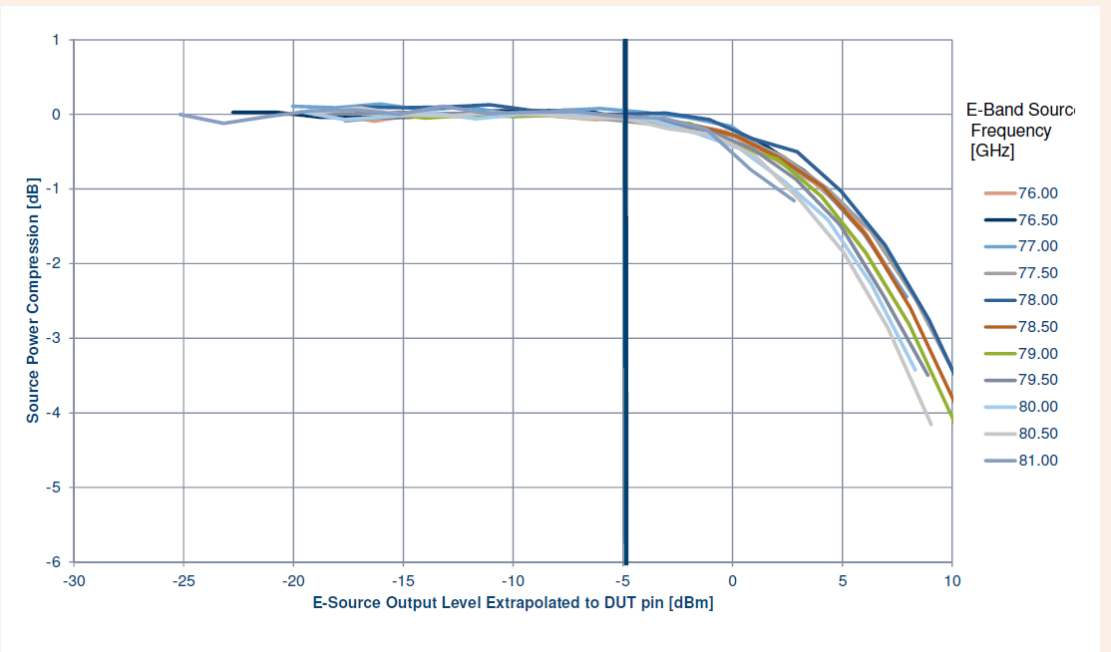


- ATE option for 76-81GHz
  - Channel to Channel Isolation
    - <-30dBm
  - Power
    - 1dB compression point -5dBm @ 80 GHz (assumes 10dB loss through contactor)
  - Level Accuracy
    - Within 1.5dB at DUT ball
- Demonstrated Tester Hardware:
  - 76-81GHz instrument with a mmWave socket
  - Using the calibration substrates on a tester
  - Correlated results on 3 independent testers
  - Customer Accepted Tester Instrument



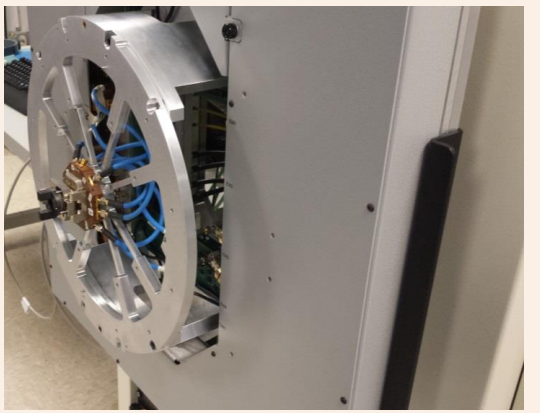
Kestrel E-Band Source

- P1dB @ DUT Pin



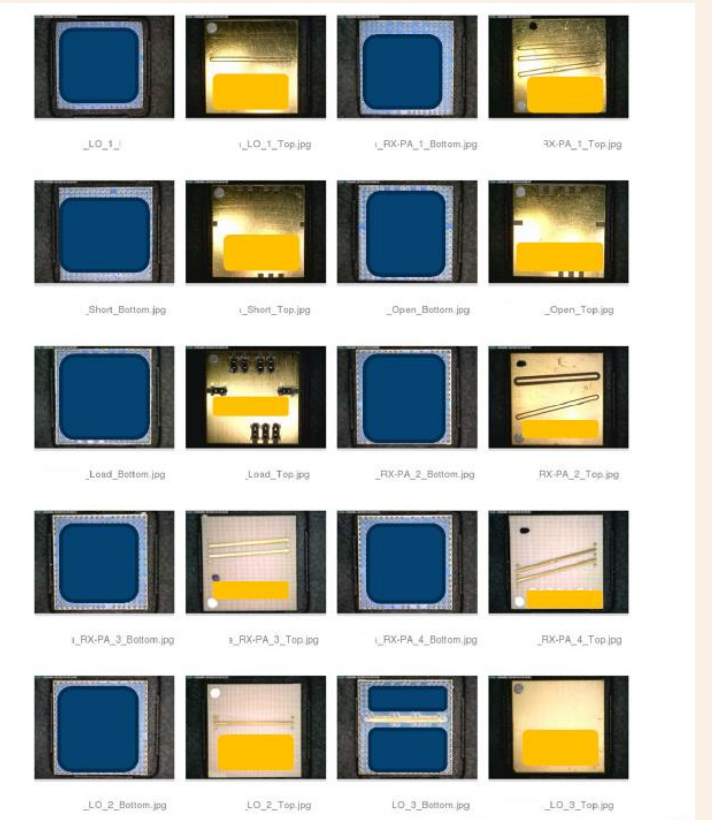
Tester Challenges

- Calibration
  - Need solution prior to having known good devices
  - Designing and manufacturing calibration substrates
- Correlation
  - Part Replacement
  - Tester to Tester

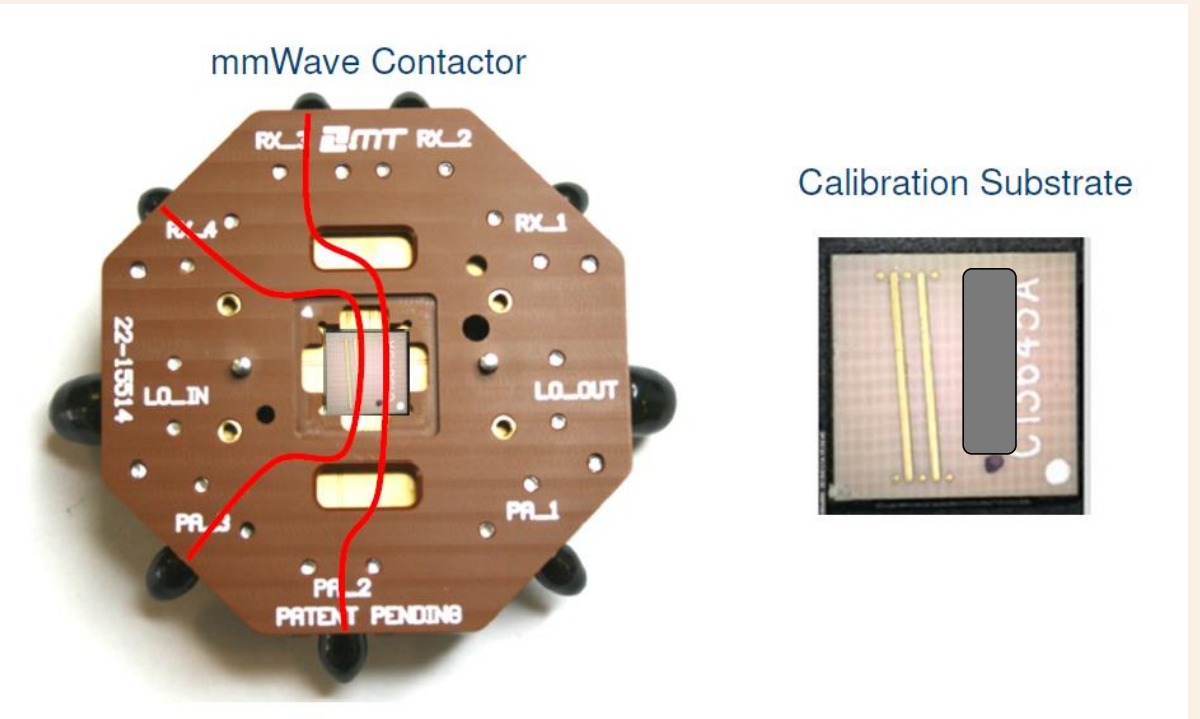


Kestrel Calibration Method

- In Development
  - Optimized Known Calibration and verification standards
  - OSLT (Open Short Load Through) Calibration substrates
  - Surrogate Devices with optimized transmission lines

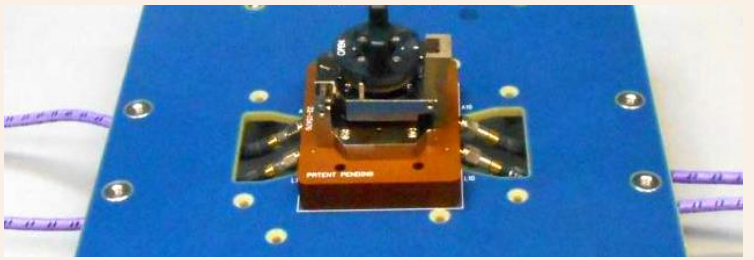


mmWave contactor with through Calibration substrate

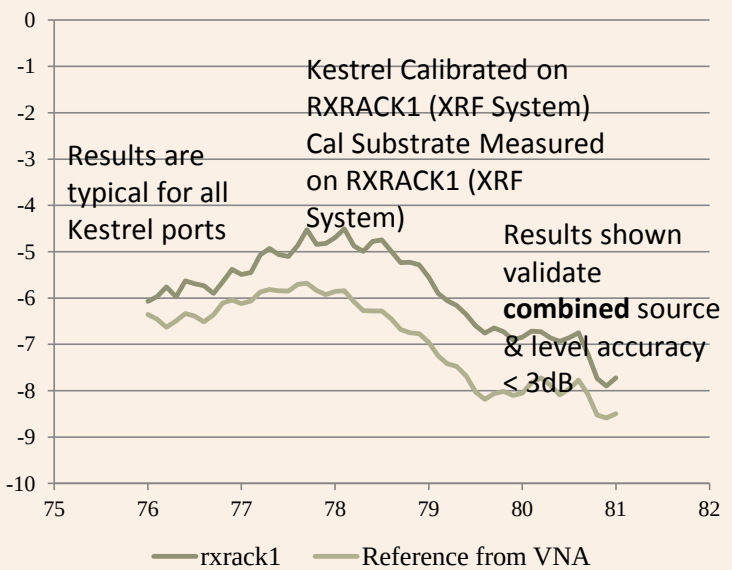


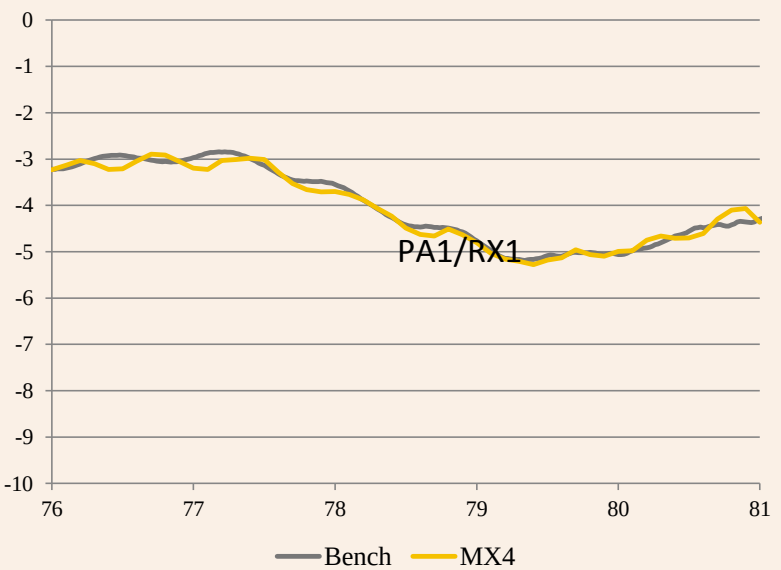
Kestrel Loopback Performance

March 2015



Jan 2016



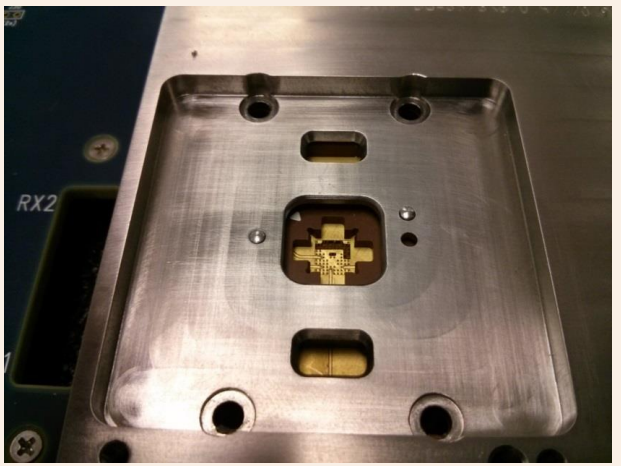


Handling Challenges

- Temperature testing
  - -40 degC
  - 25 degC
  - 100+ degC
- WLCSP Packaging
  - FCBGA – 1mm
  - WLCSP 0.25mm
- Z-axis compression
  - RF performance sensitive to test height

Handling Results

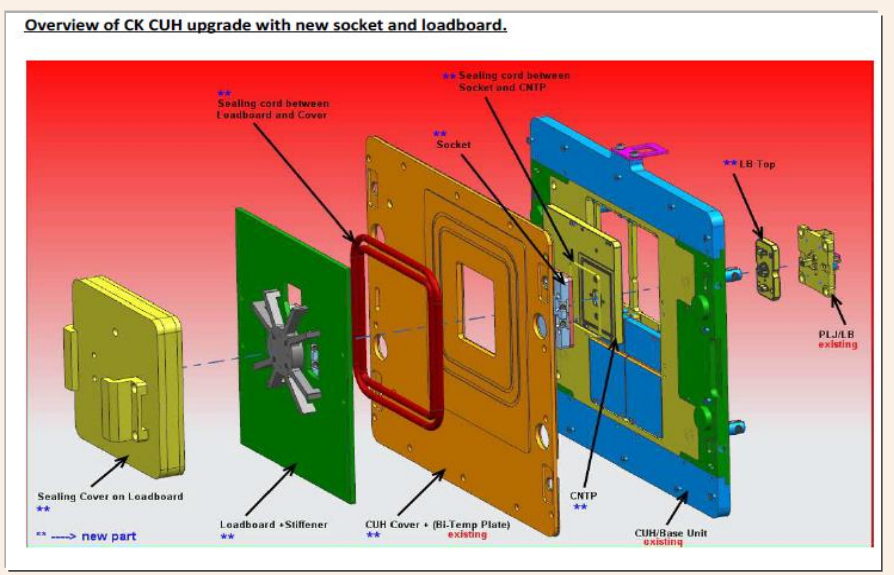
- Initial results
  - Variations at temp extremes
    - 3dBm lower at 100 than 25
    - Output power at 25degC as low as -40degC



	TX1 Output Power (dBm)	
Freq (GHz)	Handler Test	Hand Test
76.0	8.2	15.2
76.3	9.6	14.5
76.5	8.8	14.6
76.8	9.0	14.7
77.0	9.5	14.6

Tri-Temp Change Kit Design

- Leverage the design of Contactor, Board and Handler to achieve best temperature performance
  - Adjustable centering plate
  - Optimized sealing method



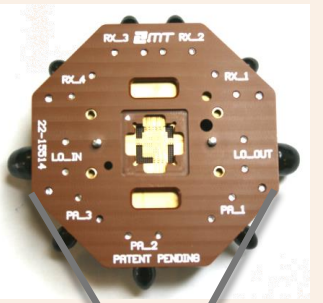
Handling Challenges Resolved

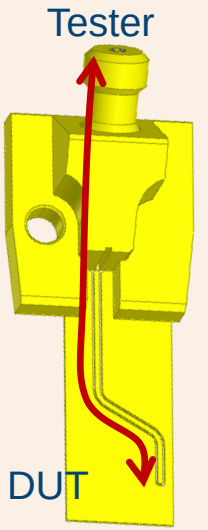
- Final Results
  - <0.5dB variation across temperature extremes

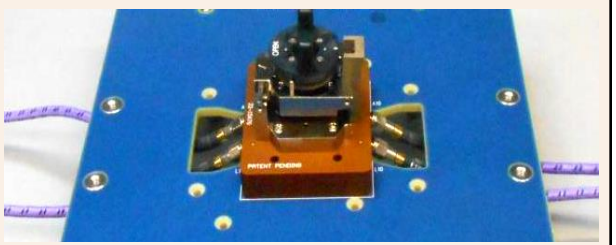
	TX1 Output Power (dBm)	
Freq (GHz)	Handler Test	Hand Test
76.0	15.3	15.6
76.5	15.6	15.6
77.0	15.8	15.8

mmWave Contactor

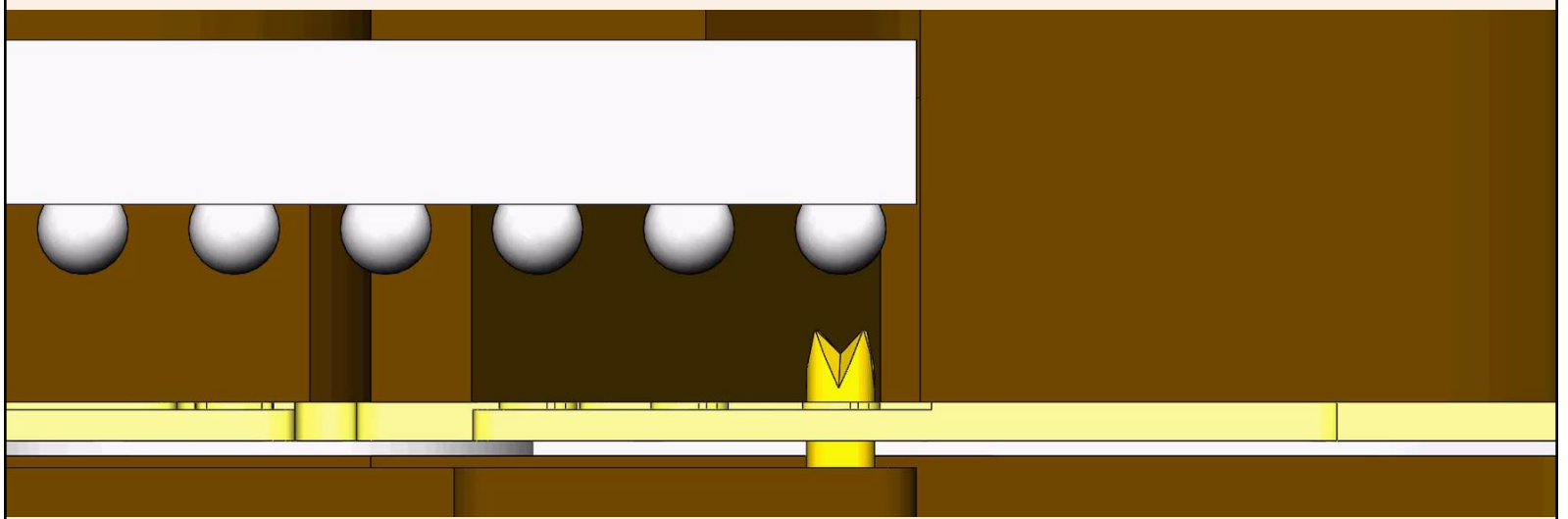
- Optimized For mmWave Test (30GHz to 90+GHz)
  - Designed for Automotive Radar, WiGig, and 5G
  - Hybrid pogo pin construction for low speed and power connections
- Minimum Number of Transitions
  - Shortest possible, impedance controlled path for >80GHz TX/RX
  - Signal path includes 1mm connector and 50ohm coplanar waveguide trace
- Load board/Contactor Assembly
  - 3years development and in production at multiple customer sites
  - Highly reliable Fully Assembled Interface







mmWave Contactor Animation

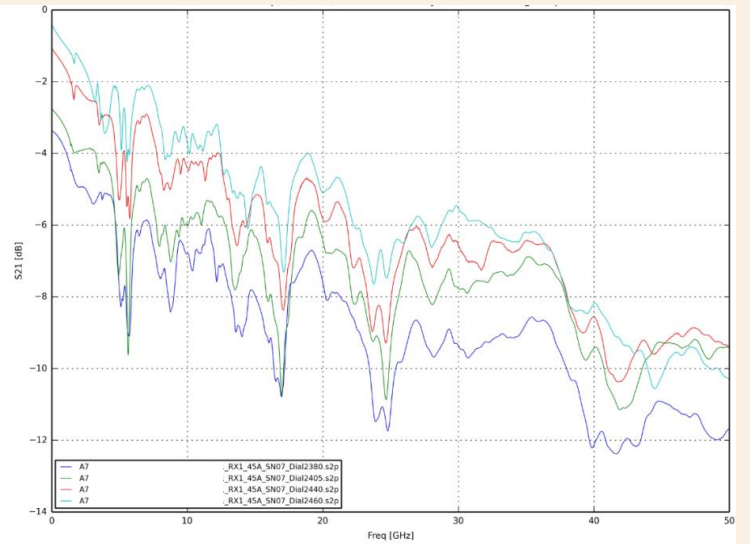


Interface Challenges

- Return Loss
  - < -10dB @ 81 GHz
- Impedance
  - 50 Ohm impedance match
- Insertion Loss
  - < 10dB @ 81 GHz
- Repeatibility and mechanical reliability

Interface Initial Results

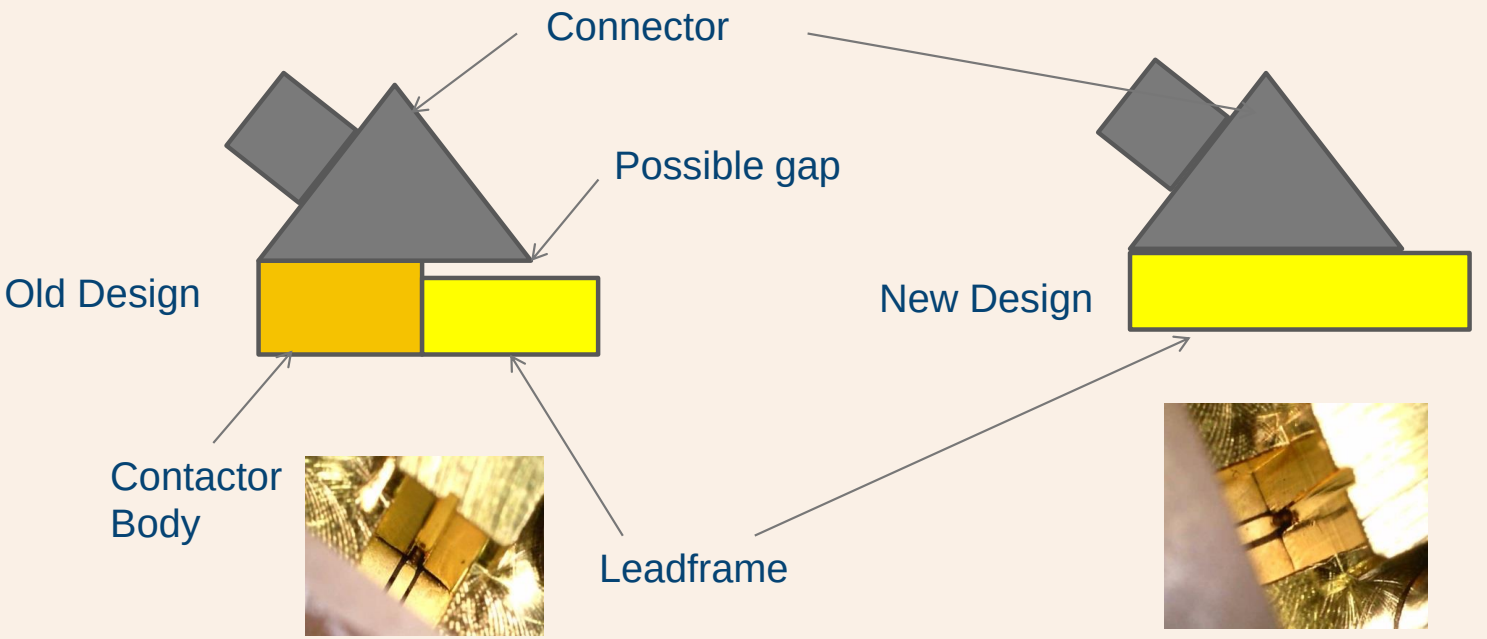
- Initial Results
  - Variability across RX and TX
  - Variability with Deflection of Leadframe



- Initial Customer Feedback
  - CH1: Range is 3 – 4dB (Probe insertion loss < Socket)
  - CH2: Range is 2 – 2.8 dBm (Probe Insertion Loss < socket)
  - CH3: Range is 2.3 – 3 dBm (Probe insertion loss < socket).

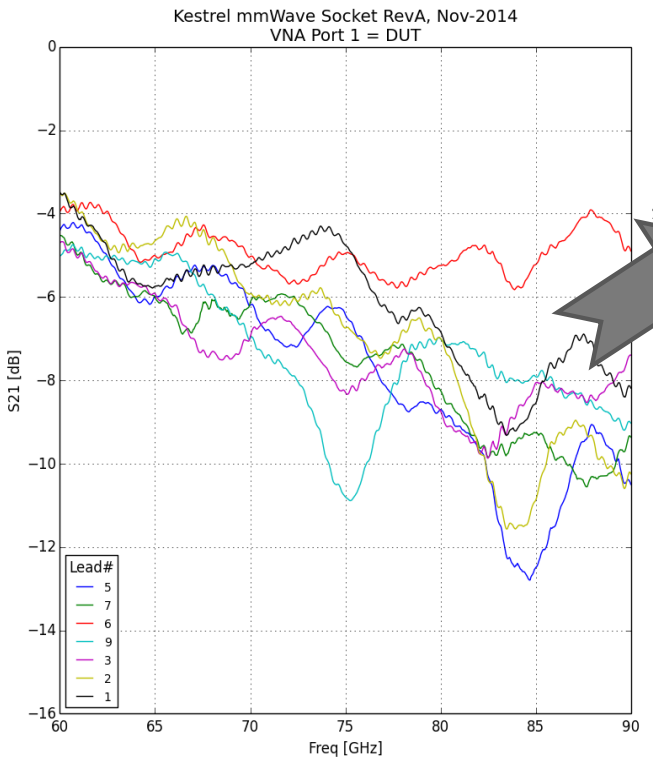
Connector Interface Improvements

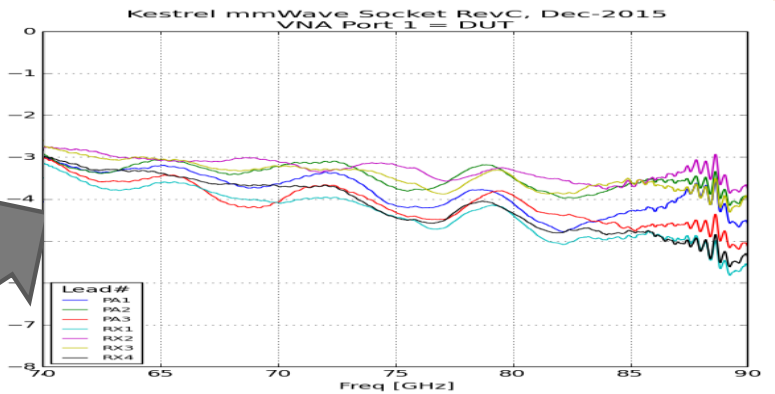
- Old design
  - potential gap due to body and leadframe design



- New design
  - Interfaces connector directly to ground plane in leadframe

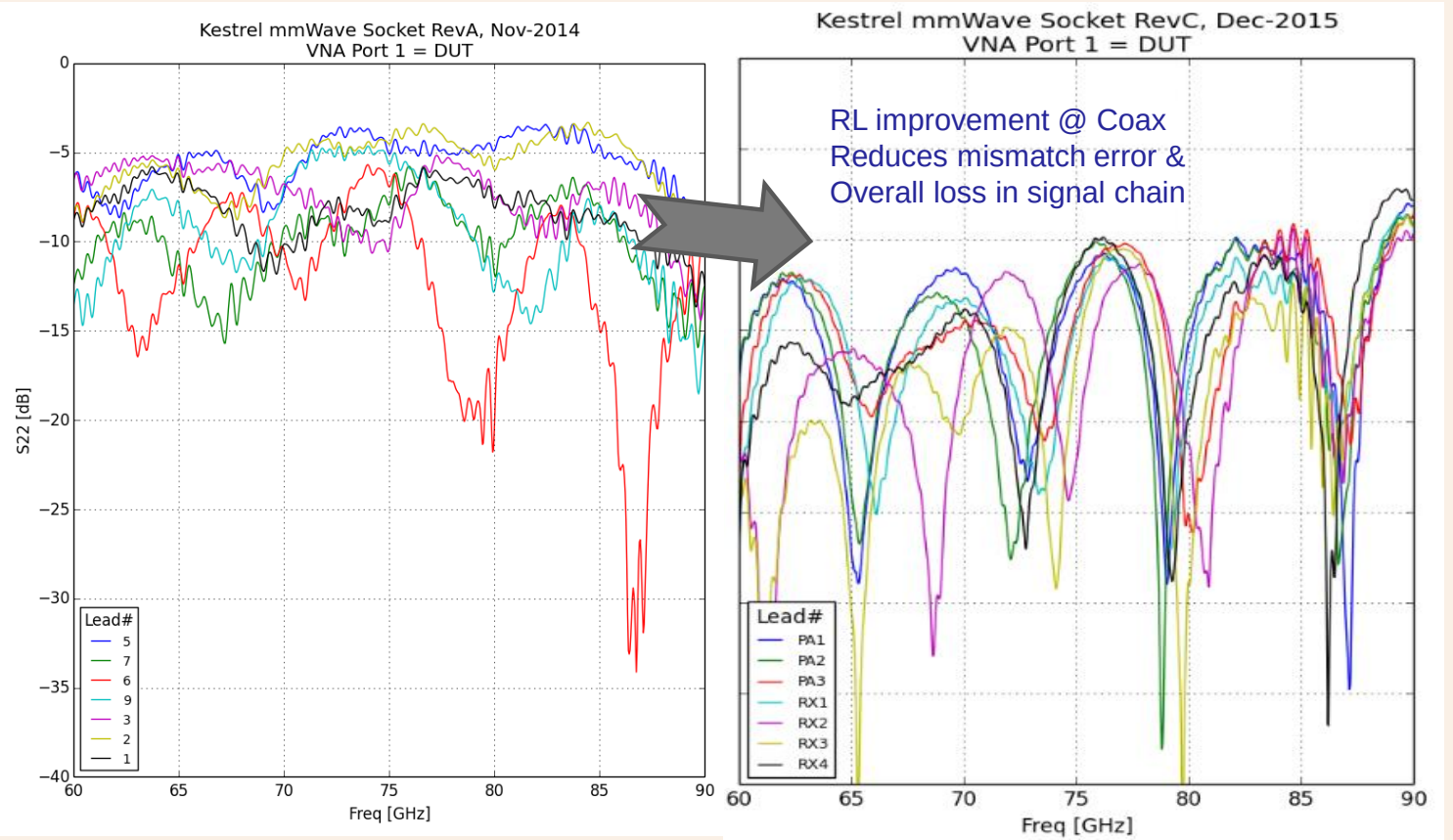
Contactor Improvements: Connector





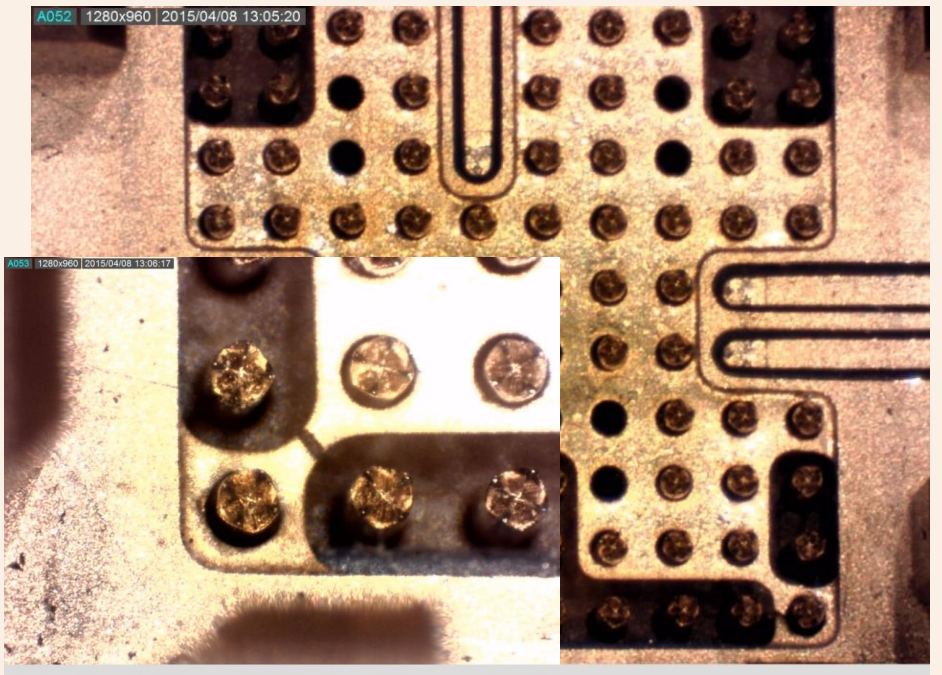
Consistency and Loss Improvement

Contactor Improvement -- Match @ Coax



DUT Interface Challanges

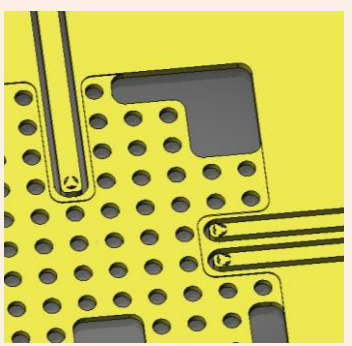
- Cracked Leadframe
  - Stress concentration points in corners of DUT area



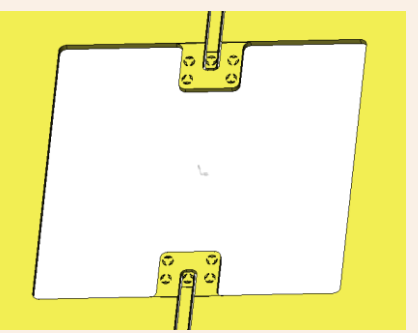
Leadframe Improvements

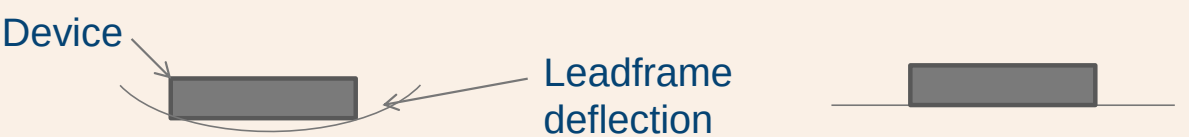
- Leadframe ground
  - Concave deflection of leadframe eliminated by removing DUT area ground plane

Ground Design A

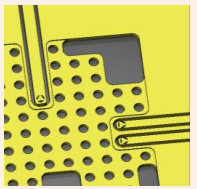


Ground Design B

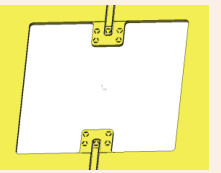




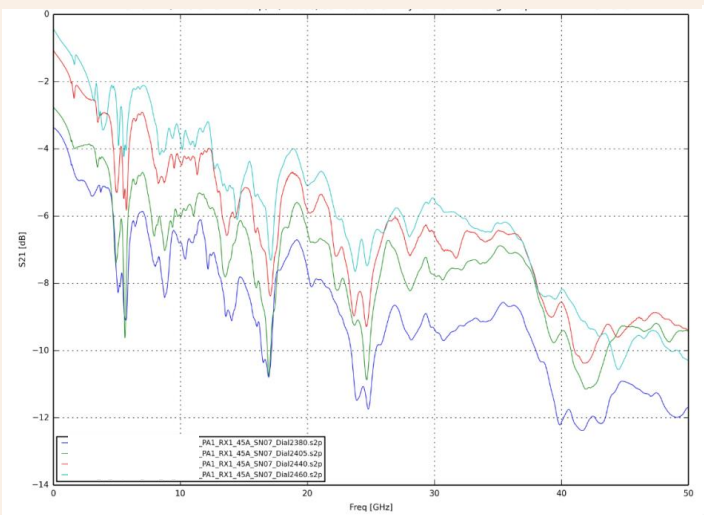
Ground Contact: Low Frequency

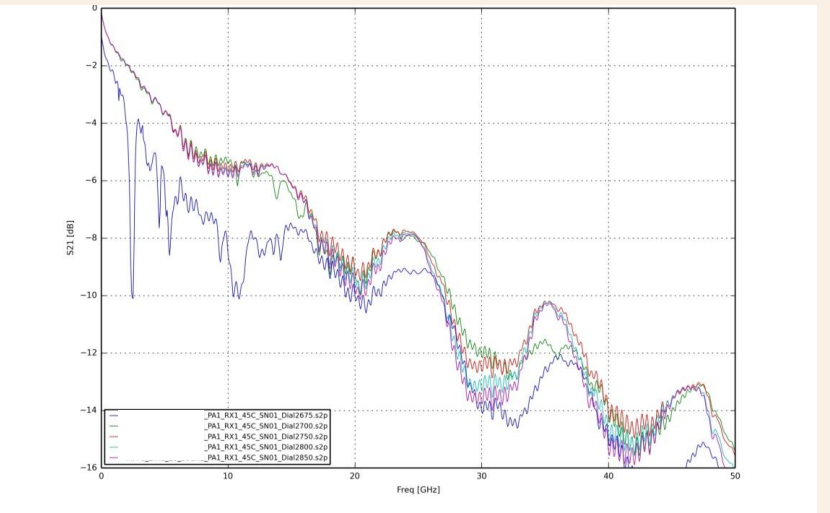


Ground Design A

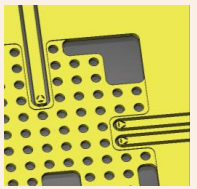


Ground Design B

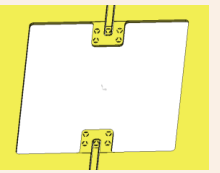




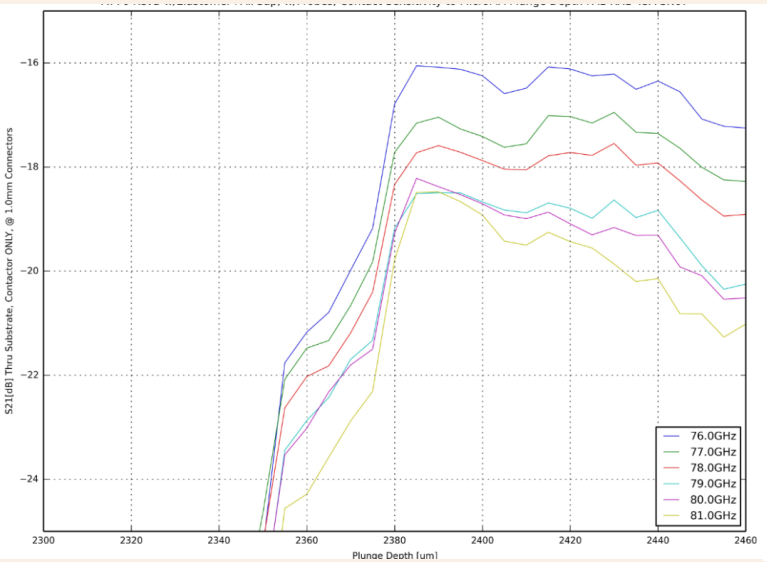
Ground Contact: High Frequency

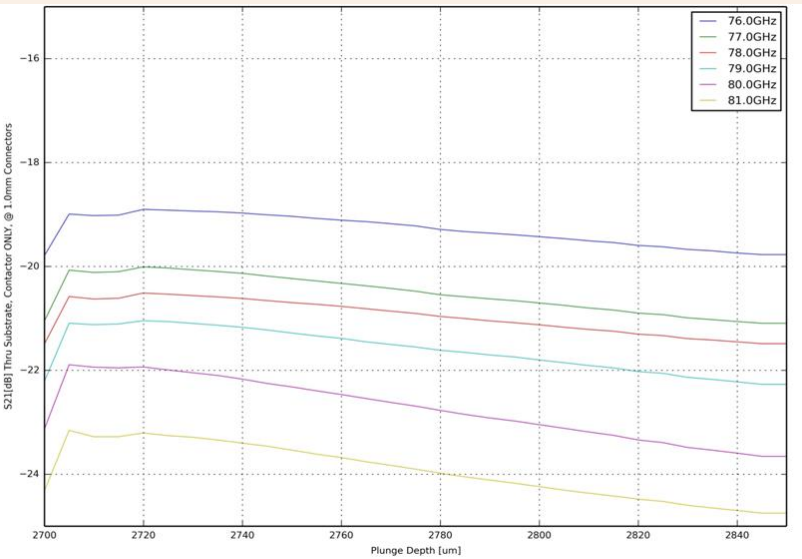


Ground Design A



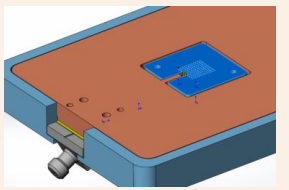
Ground Design B

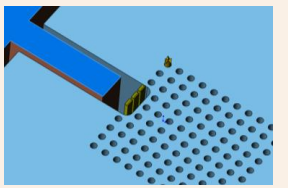




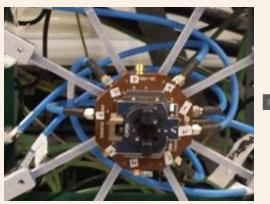
mmWave Roadmap

- Solution for multisite and WLCSP
  - Internal Array compatible, Prober Compatible, 0.15mm pitch compatible





- Blindmate solution for ADAS, WiGig, 5G Backhaul
  - Improved RF repeatability by further reducing number of interfaces
  - Ease of assembly/Dissasembly



Summary

- ADAS Test Cell Solution
  - Requires significant interaction between Hardware groups
- Tester Learning
  - Calibration and Verification of Test is Critical
- Handler Learning
  - Thin packages and RF performance make stackup tolerances critical
- Interface Learning
  - Grounding key to getting repeatible results
    - Everything is critical at 80GHz!