SW Test Workshop
Semiconductor Wafer Test Workshop

Automated Probe Card Exchange and Docking for RADAR Products Running at 40GHz and Beyond

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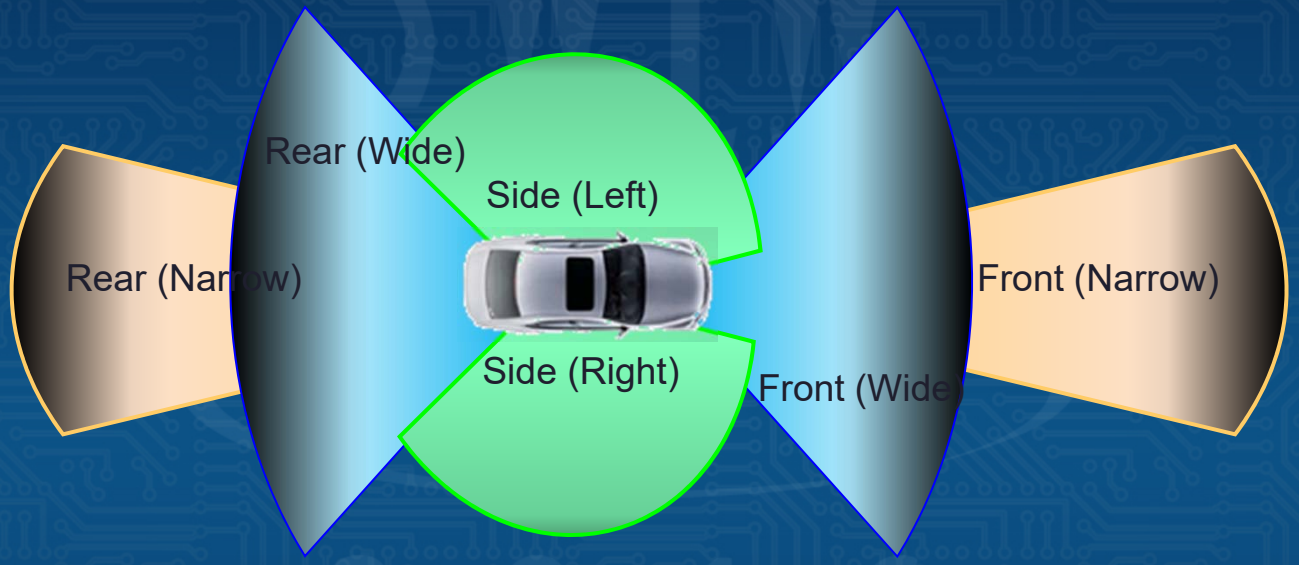
Overview

- Where is RADAR used
- How does NXP RADAR fit in to industry
- Components needed to test
- Is it ready for production
- Show me the data
- Summary of results
- Question and Answer

Where is the RADAR

- **Radar use Past/Present**
  - Radar was developed around the time of WWII. It has traditionally been used in a variety of military and commercial applications such as detecting aircraft, ships, guided missiles and weather formations
  - The modern uses of radar is expanding to be used in antimissile systems, flight control systems, aircraft anti-collision systems, and even geological observations
- **Where does NXP fit into the RADAR space?**
  - Answer: Automotive radar

NXP RADAR



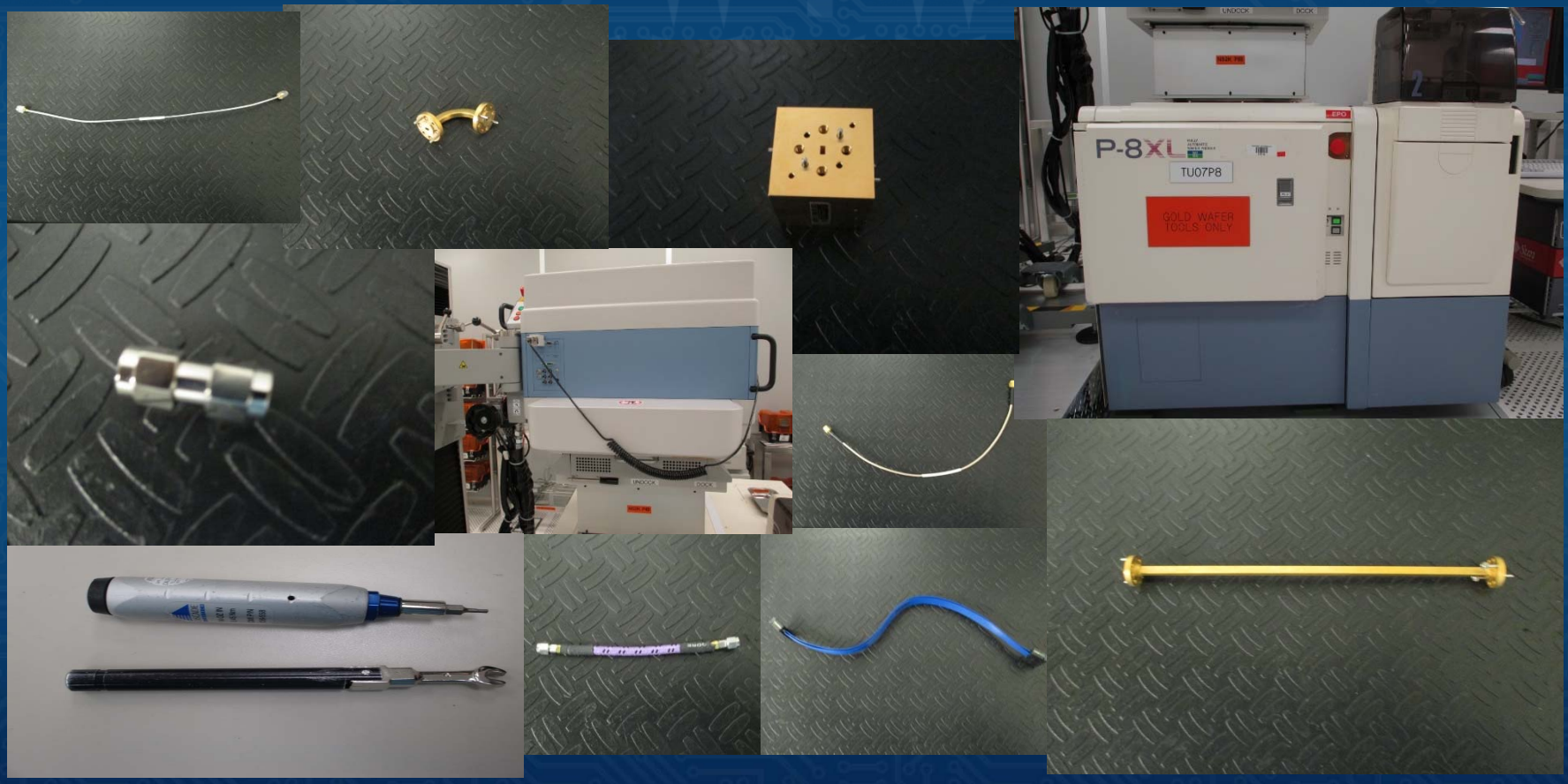
NXP Chip-Sets designed to sense objects around your vehicle

NXP RADAR

- **NXP produces a 77GHz radar transceiver chipsets which can support the following:**
- **Long-, mid- and short range functionality**
- **High performance and integration capabilities**
- **Multiple safety applications such as:**
  - Adaptive Cruise Control (ACC)
  - Blind Spot Detection (BSD)
  - Emergency Braking
  - Forward Collison Warning (FCW)
  - Headway Alert

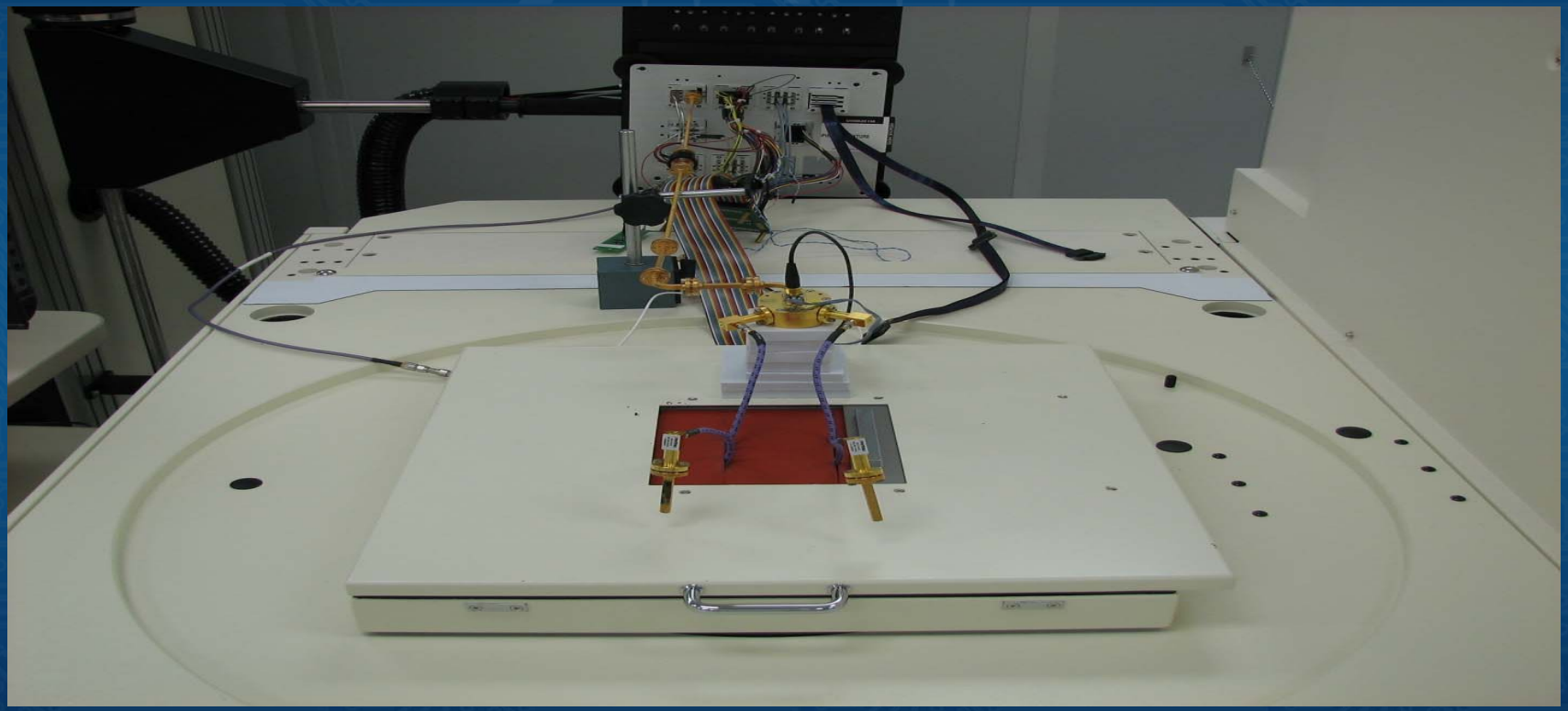
Parts to test

- **Parts required to test product**



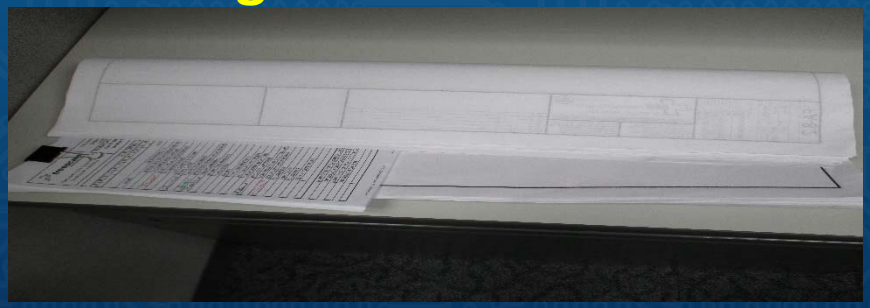
Assembled Parts

- **Parts fit together**



Production Worthy?

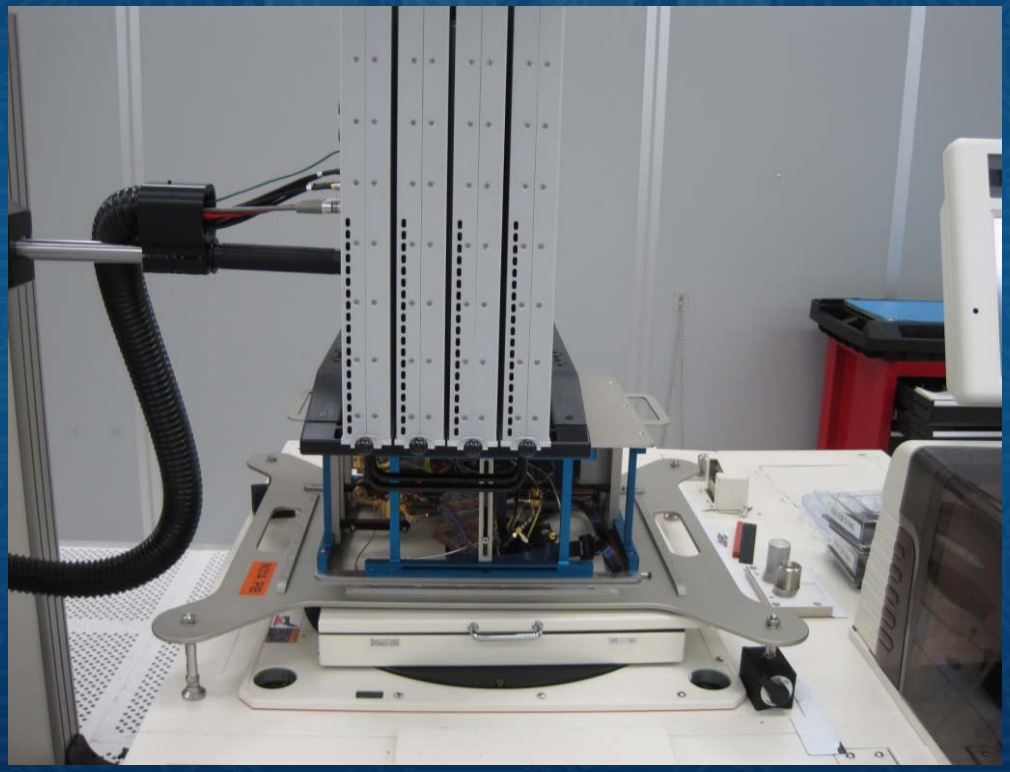
- **Is the previous picture able to be ran by production associates?**
- **Answer: NO!**
  - It takes an engineer/technician hours to set this up. There are too many parts/pieces which have to be correct. Production does not have time to spend hours setting up a device.
- **The part has to be assembled properly with the correct components for each different device. This would be equivalent to a blueprint for testing the wafer.**



- **We Need a BETTER solution**

Production Worthy 2nd Attempt

- Recruited some friends at NXP for our 2nd attempt at making the setup production worthy.



Production Worthy 2nd Attempt

- The wires are now encased in a cage. The test head can be docked from the top. It was a big leap forward for the engineers setting up the tool.

- But did this solve our issue?
- Not quite…..

- The problem was to change the probe card, the cage had to be removed and all the wires detached from the probe card. It is still not ready to be ran by production associates. This process still too time consuming.

Production Worthy 3rd Attempt

- How to make a production worthy 3rd attempt?
- Recruit some friends!
- Enlisted the help of our friends at inTest Corporation and Cascade MicroTech

Proof of Concept (POC)

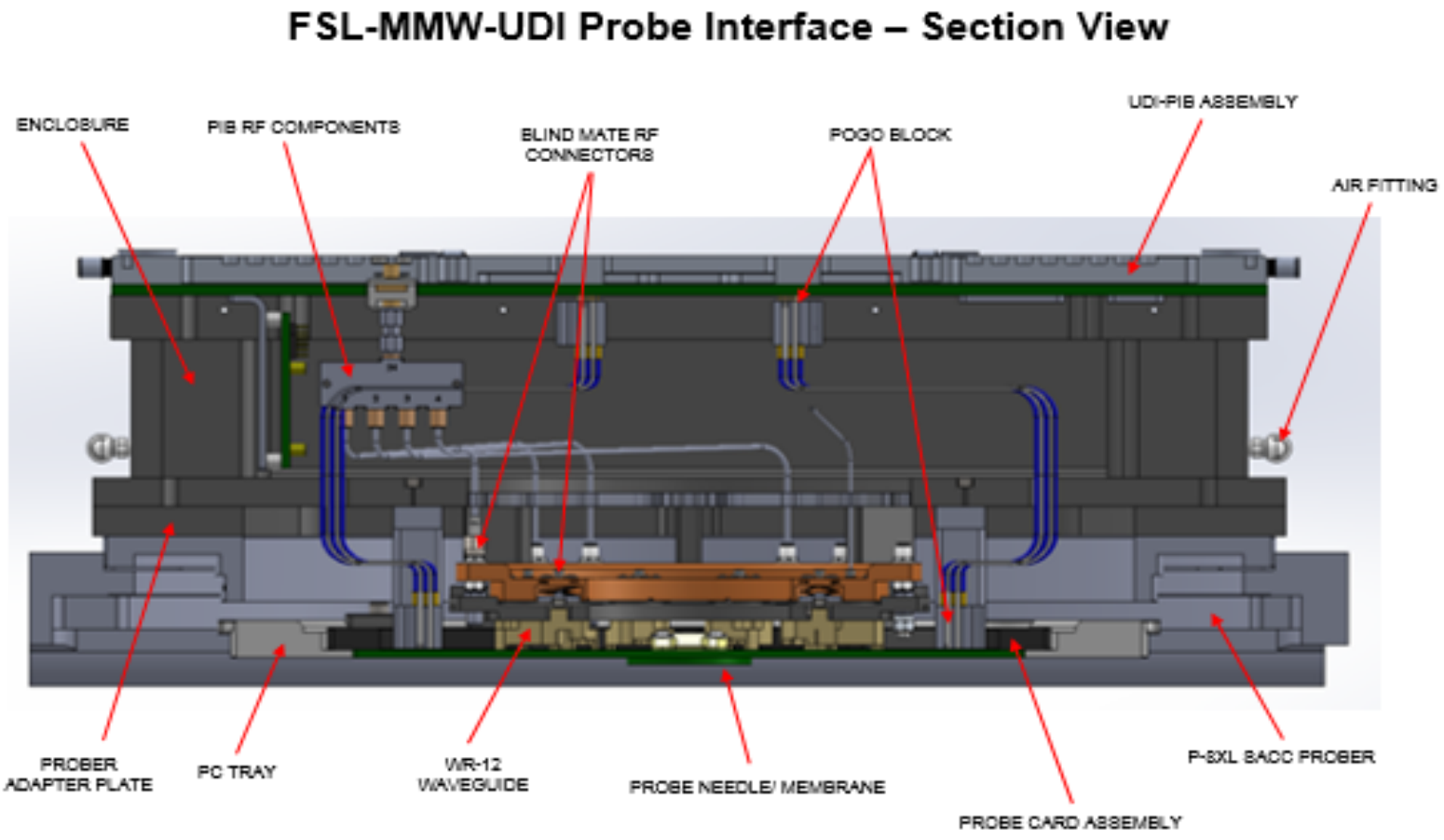
- **Stakes are now higher so decided to build a POC before starting the production version**

Test Name	Test	Lower	Upper	Min	Max	Mean	Sdev	Runs
MMW_Loopback_76	5000	-25	5	-22.627	-22.534	-22.568	0.0198	20
MMW_Loopback_38	5001	-25	5	-14.341	-14.267	-14.292	0.0170	20
MMW_Loopback_77	6000	-25	5	-23.576	-23.481	-23.517	0.0229	20
MMW_Loopback_38p5	6001	-25	5	-12.845	-12.760	-12.797	0.0206	20
MMW_Loopback_78	7000	-25	5	-20.271	-20.156	-20.219	0.0236	20
MMW_Loopback_39	7001	-25	5	-15.686	-15.639	-15.655	0.0104	20
MMW_Loopback_79	8000	-25	5	-24.290	-24.191	-24.241	0.0253	20
MMW_Loopback_39p5	8001	-25	5	-14.468	-14.411	-14.449	0.0138	20
MMW_Loopback_80	9000	-25	5	-24.819	-24.705	-24.764	0.0335	20
MMW_Loopback_40	9001	-25	5	-16.295	-16.237	-16.270	0.0136	20

Test Name	Test	Lower	Upper	Min	Max	Mean	Sdev	Runs
MMW_Loopback_76	5000	-25	5	-19.902	-19.827	-19.854	0.0164	20
MMW_Loopback_38	5001	-25	5	-14.396	-14.341	-14.358	0.0119	20
MMW_Loopback_77	6000	-25	5	-20.330	-20.275	-20.306	0.0180	20
MMW_Loopback_38p5	6001	-25	5	-13.363	-13.301	-13.346	0.0172	20
MMW_Loopback_78	7000	-25	5	-17.229	-17.159	-17.203	0.0193	20
MMW_Loopback_39	7001	-25	5	-15.162	-15.121	-15.148	0.0114	20
MMW_Loopback_79	8000	-25	5	-22.229	-22.115	-22.166	0.0311	20
MMW_Loopback_39p5	8001	-25	5	-17.159	-17.120	-17.146	0.0124	20
MMW_Loopback_80	9000	-25	5	-23.414	-23.328	-23.371	0.0211	20
MMW_Loopback_40	9001	-25	5	-15.546	-15.521	-15.538	0.0063	20

- **Data from the loop back connections**

Universal Hard Dock

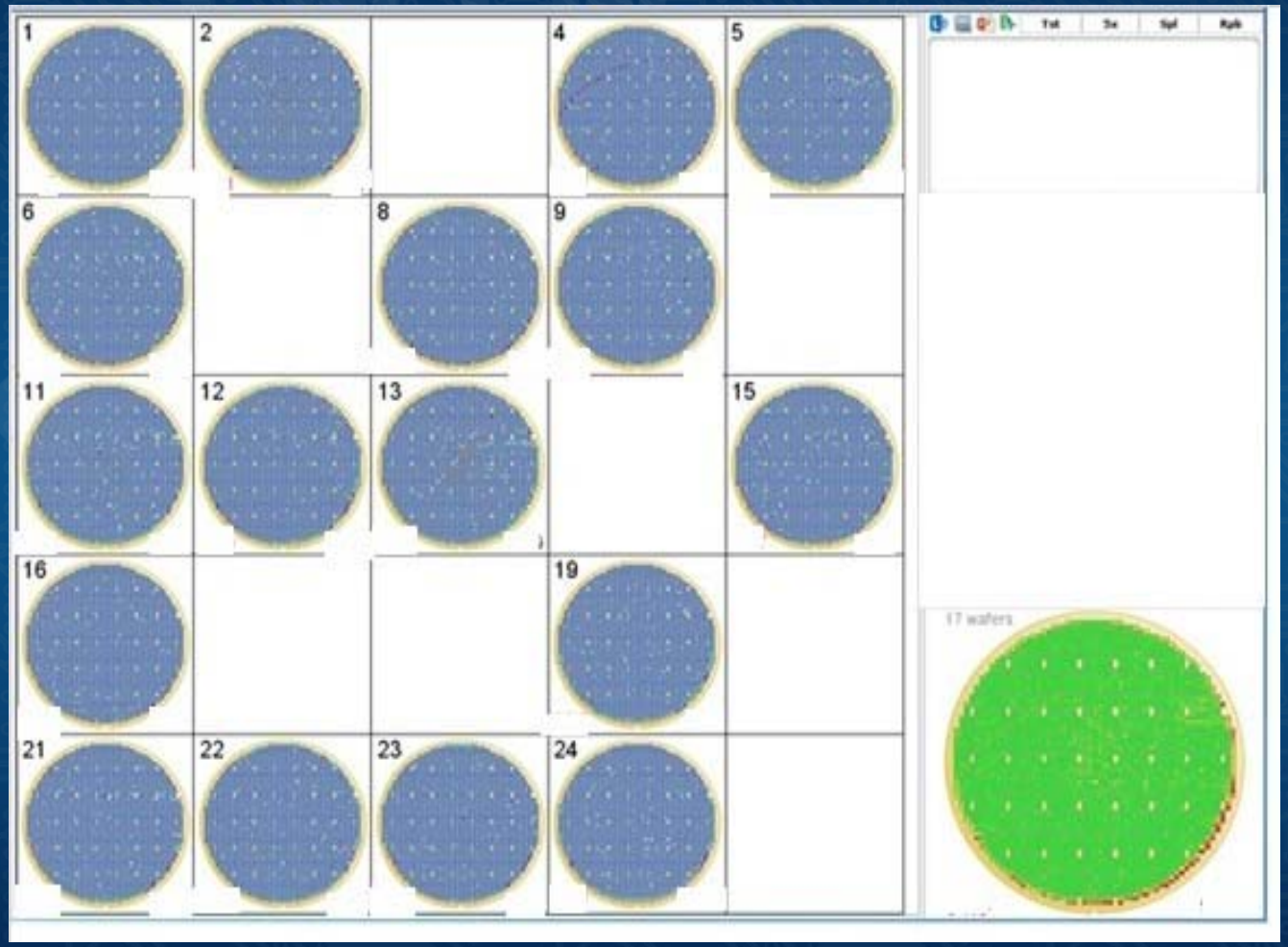


Universal Hard Dock Components

- **The Universal Hard Dock incorporated the following items:**
  - Blind mate connections for the 77GHz and below signals
  - Pogo block for the DC and logic connections
  - PIB RF components
  - Air fitting to allow for testing at temperature other than room
  - WR-12 waveguides for connecting the probe card to the enclosure
  - UDI PIB assembly for docking the test head

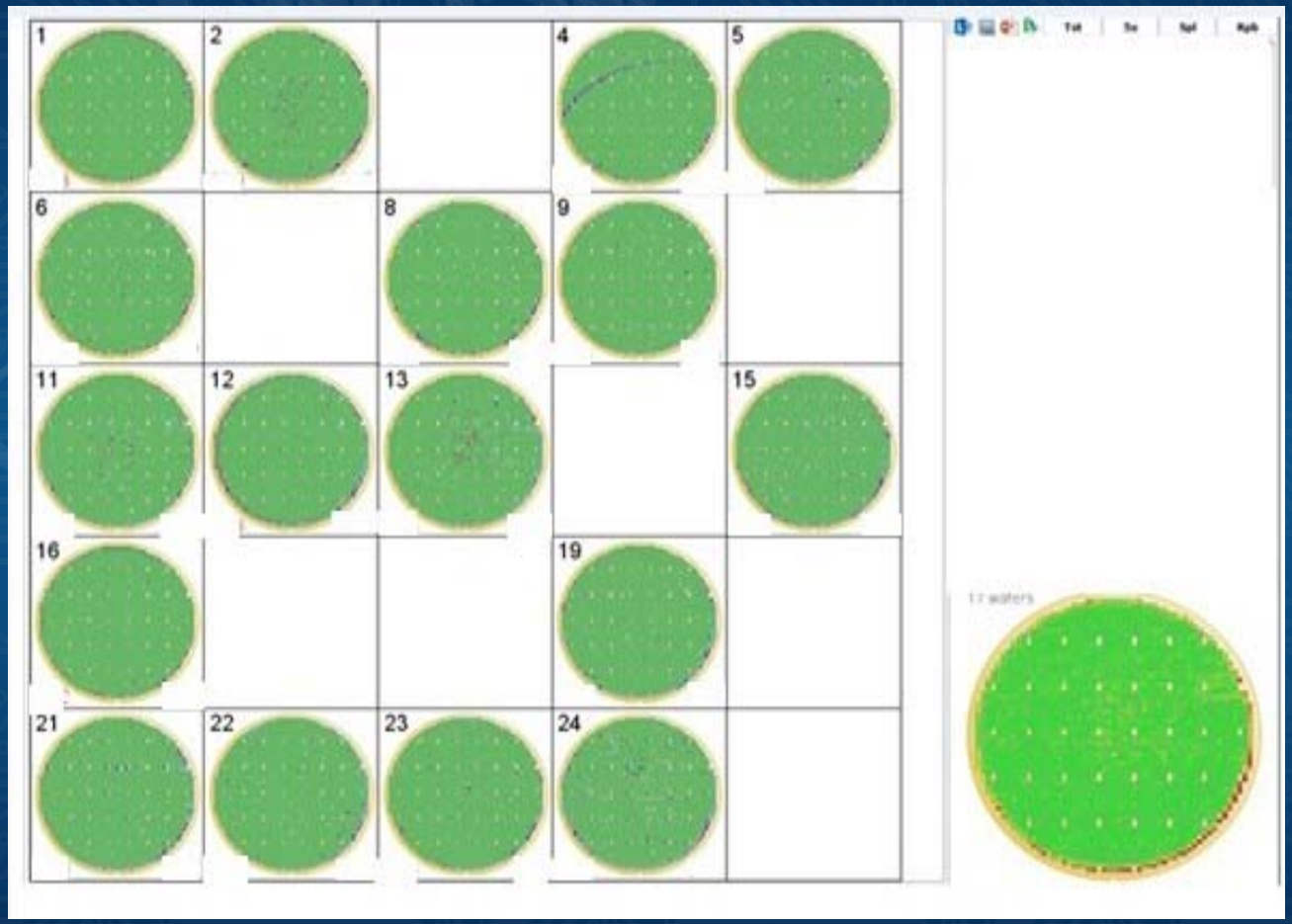
Universal Hard Dock Production Data -40C

- Test done at -40C
- Wafer splits 2,6,8,11,13, 15,19,22,23
- Wafer splits 1,4,5,9,12,16, 21,24



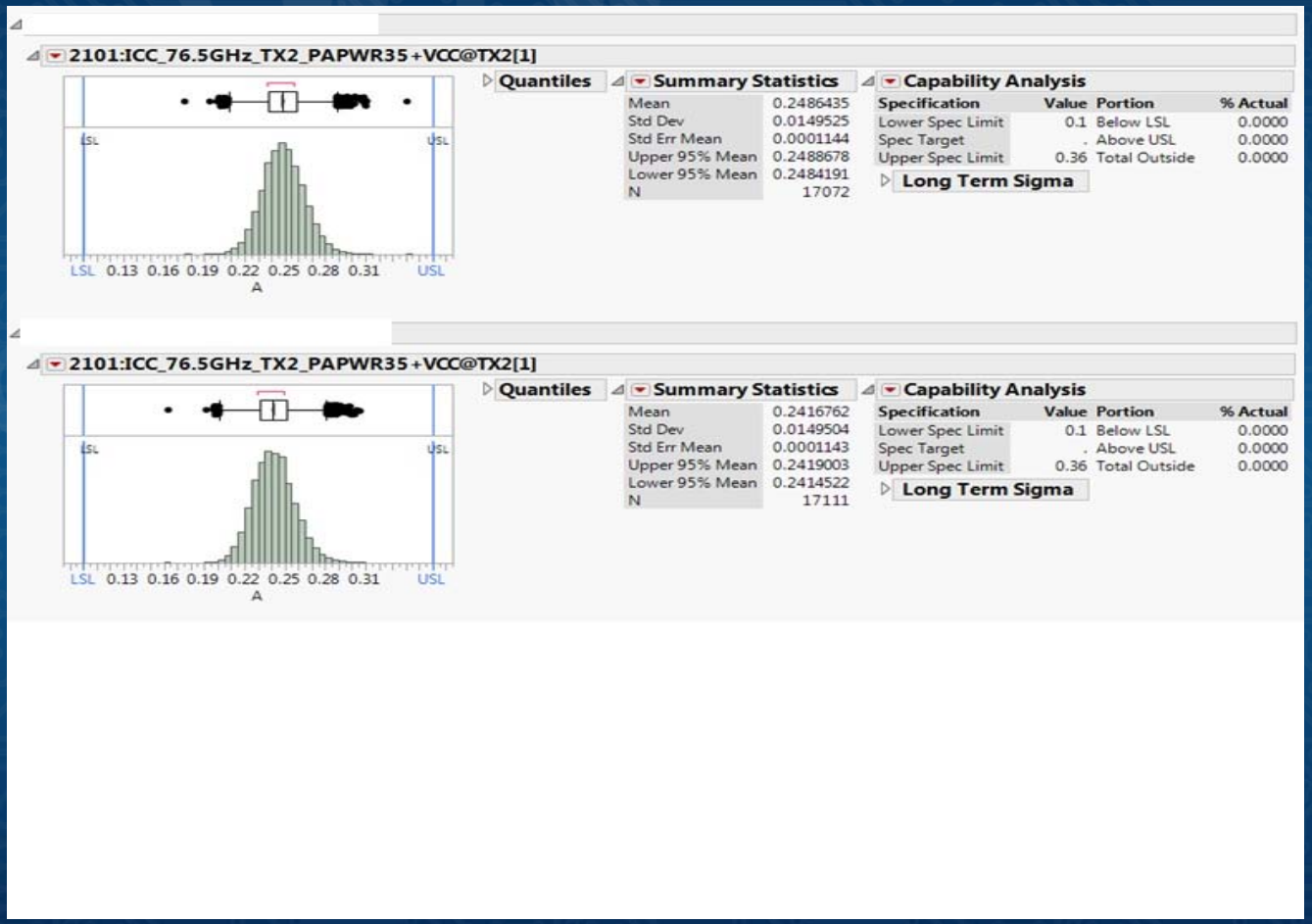
Universal Hard Dock Production Data 125C

- Test done at 125C
- Wafer splits 2,6,8,11,13, 15,19,22,23
- Wafer splits 1,4,5,9,12,16, 21,24



Universal Hard Dock Production Data

- ICC test between systems



Summary

- Time savings of 2x for changeover between products
- Eliminate possible damage to cables, waveguides, and other RF components due to handling
- Critical parameters Pout & Icc Cpk >> 1.67
- Yields are comparable between setups
- The Universal Hard Dock allows manufacturing the ability to change the products running without engineering involvement saving time and engineering resources

Thanks for the Support !

- **Thank you to the following individuals and their teams for the time and effort in completing this project**
  - Jeff Finder and team at NXP
  - Roy Green and team at inTest
  - Jeff Arasmith and team at Cascade MicroTech

Question and Answer