SW Test Workshop
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Blindmate RF Connector for E-Band Production Test

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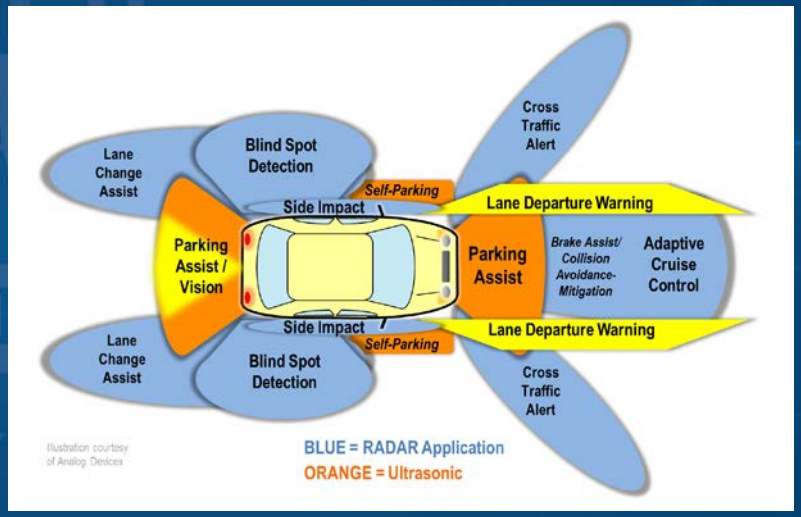
Overview

- **Introduction**
- **Production E-Band test (60-90 GHz)**
  - Current Connector Options and Limitations
- **Summary of Connectors for production test**
- **Performance comparison with non-Blindmate connectors**
- **Summary**

E-Band Market Drivers

- **There are several primary market drivers that are requiring more test in the E-band**
  - Automotive Radar



  - 802.11ad

  - Cell Phone Short/Back Haul

Market Growth Coming

- **The largest of these is projected to be Automotive Radar**
  - An anticipated CAGR of ~33% through 2018

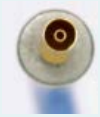
What does this mean for Probe Cards?

- **The market will require:**
  - Hard dock probe cards instead of cabled (soft dock)
    - Prefer blind-mate connectors to standard coax connectors
  - Large number of RF connectors
    - Each automotive die can have 5+ RF high speed channels
    - x4 would then require more than 20 RF connectors per probe card

What should a full production connector look like?

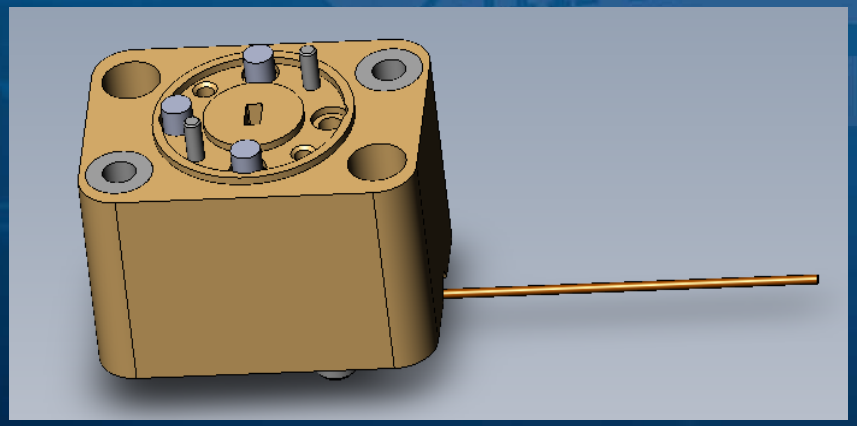
- **Simple to connect**
  - Requires no manual ‘threading’
- **Minimize need for recalibration**
  - No flexing of coax
- **No need for the test engineer to install the probe card**
- **High performance (better than -10 dB RL)**
  - Air dielectric is preferred

Current Types of Connectors for above 40 GHz

Connector	BW	Type of Connector	Example	Limitations
1.85 mm	67 GHz	Thread-on		Soft Dock
1 mm	110 GHz	Thread-on		Soft Dock
SMPM	65 GHz	Blindmate		Not enough BW
SMPS	100 GHz	Blindmate		Low number of cycles (<500)
SSB	65 GHz	Blindmate		Not enough BW

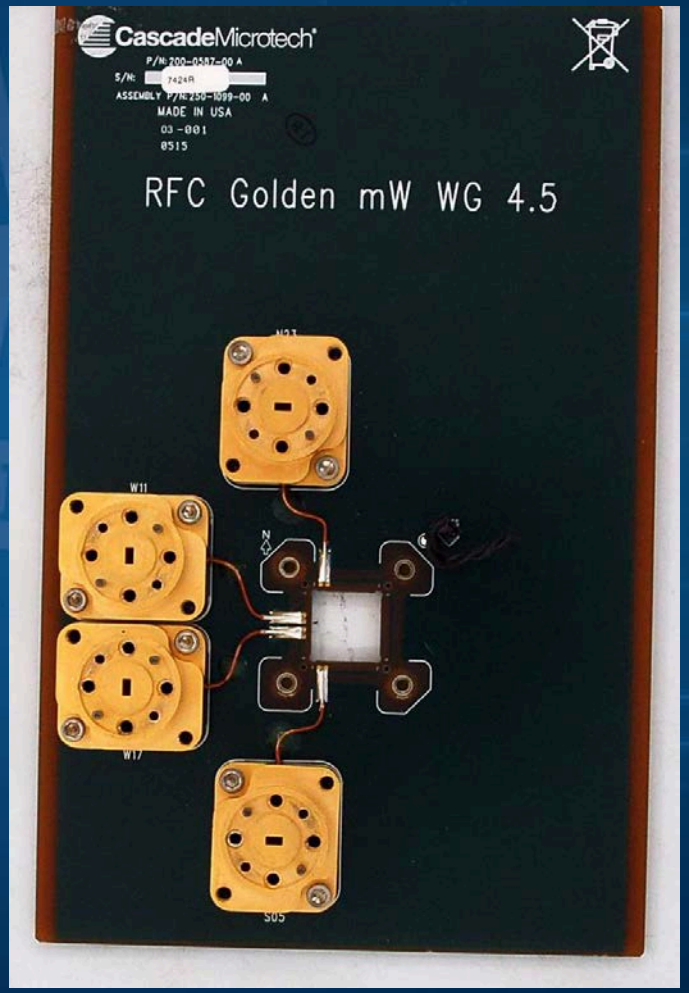
Direct-dock Waveguide Connector

- **In order to meet the requirements for a full production connector, Cascade Microtech is developing a Blind-mate Waveguide connector**



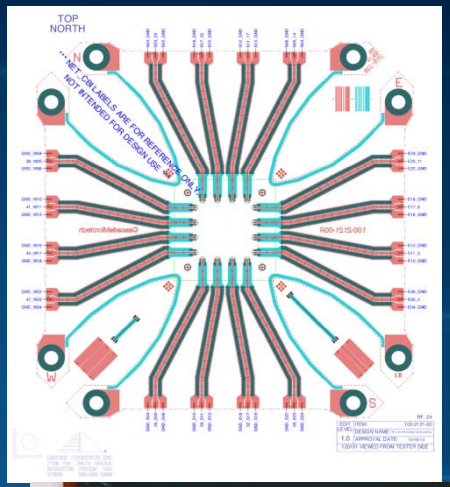
Evaluation Probe card

- **Cascade Microtech fabricated an evaluation probe card to test RF performance when using a Pyramid Probe®**
  - The evaluation Probe card had 4 waveguide connectors
  - 4.5” probe card
  - Used the smallest Pyramid Probe (RFC)



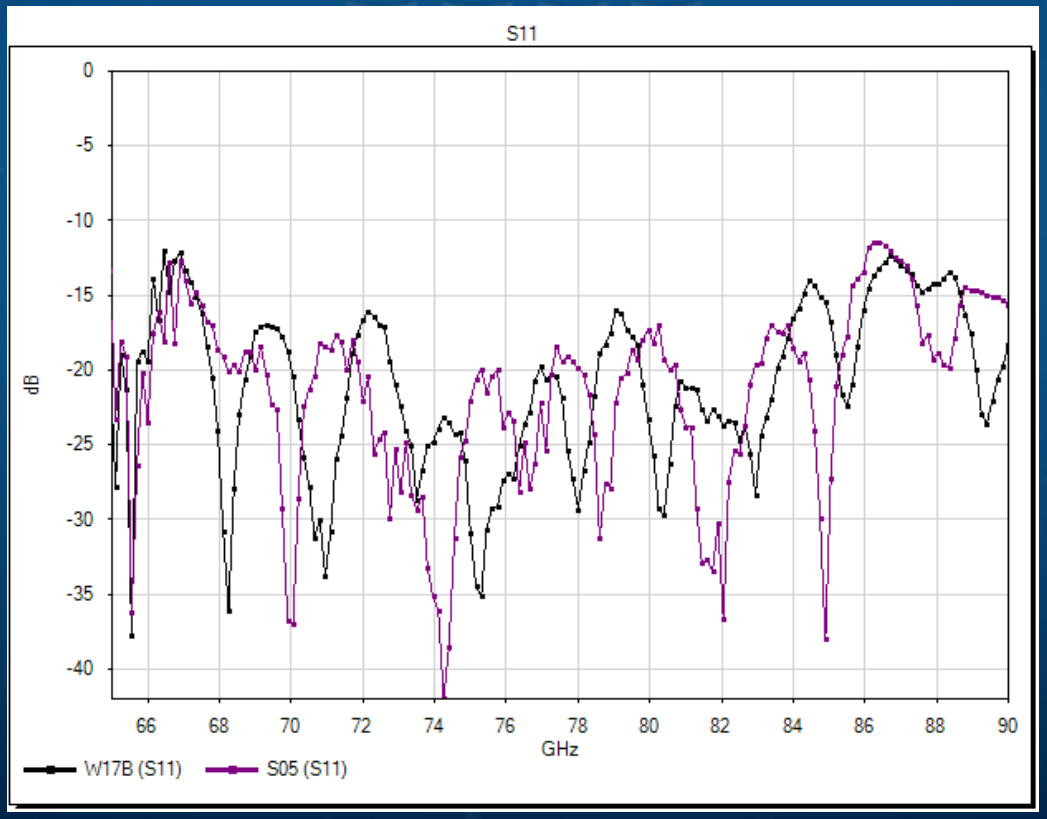
Test Setup

- **A Golden Pyramid Probe**
  - Designed for 80 GHz performance
- **PCB using Blindmate Waveguide**
  - Semi-rigid 0.031” coax between the waveguide and the Pyramid Probe
- **Cascade Microtech Summit 12k Probe Station**
- **Keysight E8361C with frequency extenders**
  - Using Coax to waveguide adapters (WR12)



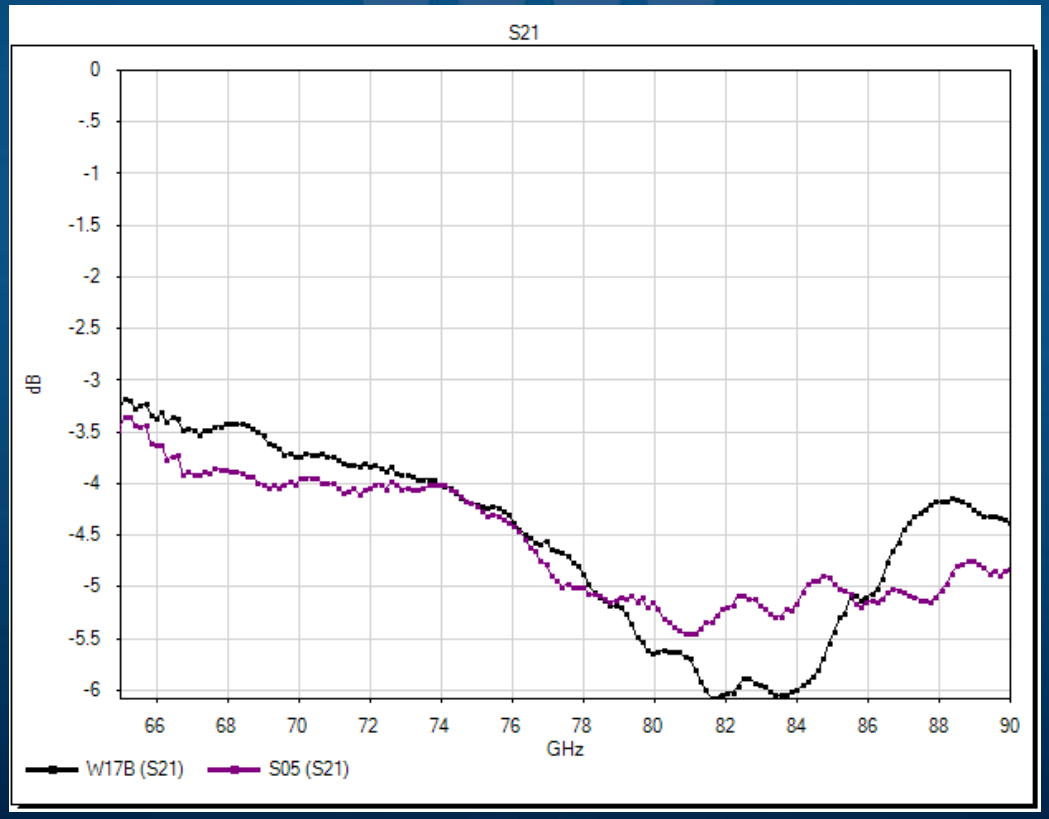
RF Data – Return Loss

- **Better than -10 dB from 65 GHz to 90 GHz**
  - Better than -15 dB from 68 to 84 GHz



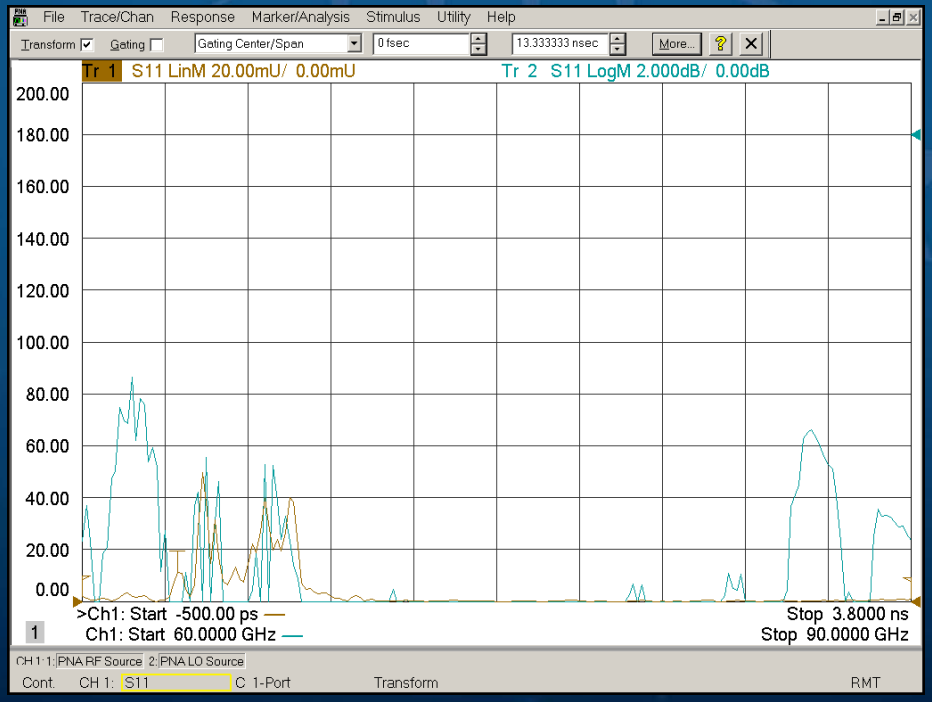
RF Data – Insertion Loss

- **Better than -6 dB insertion loss from 65 GHz to 90 GHz**



TDR Measurement

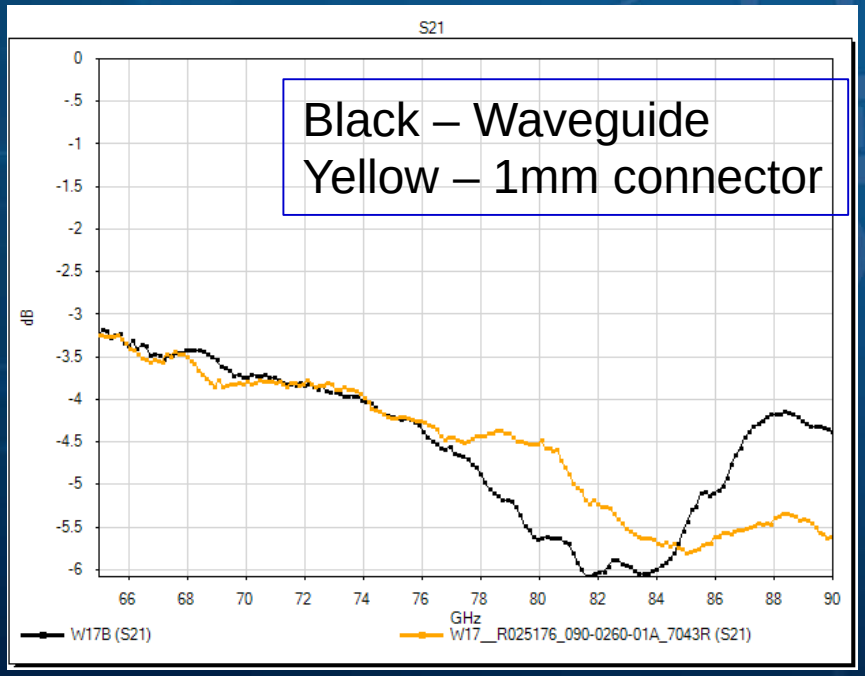
- The TDR data shows that the impedance discontinuity is less than 60 milli-rho at the waveguide to coax transition



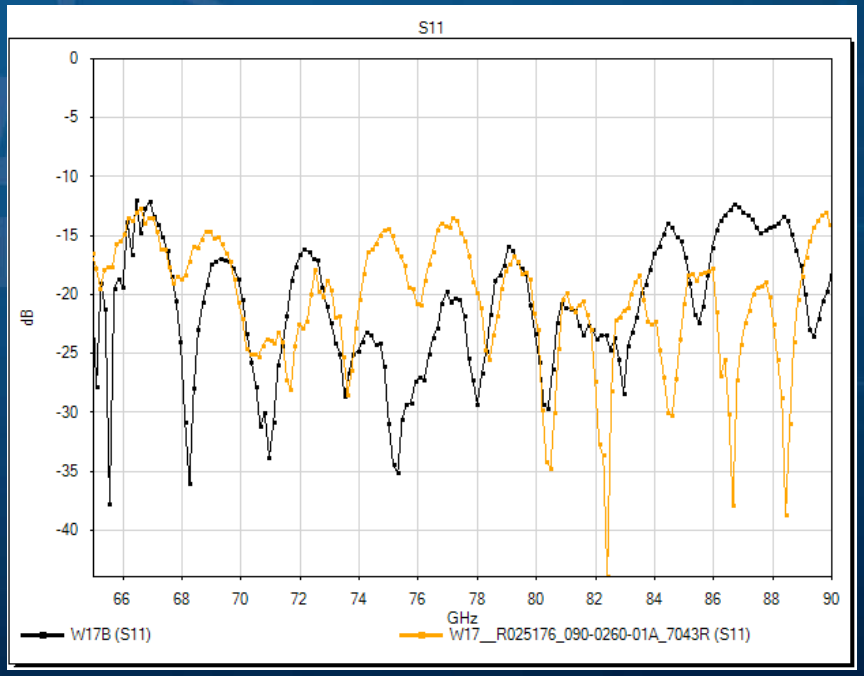
Comparison with 1mm

- **Comparing with a typical probe card using 1 mm connectors, the performance is similar over the frequency range**
  - 22 mm of waveguide and ~40 mm for coax
  - 1 mm connector (~13 mm long) and ~40 mm of coax

Insertion Loss



Return Loss

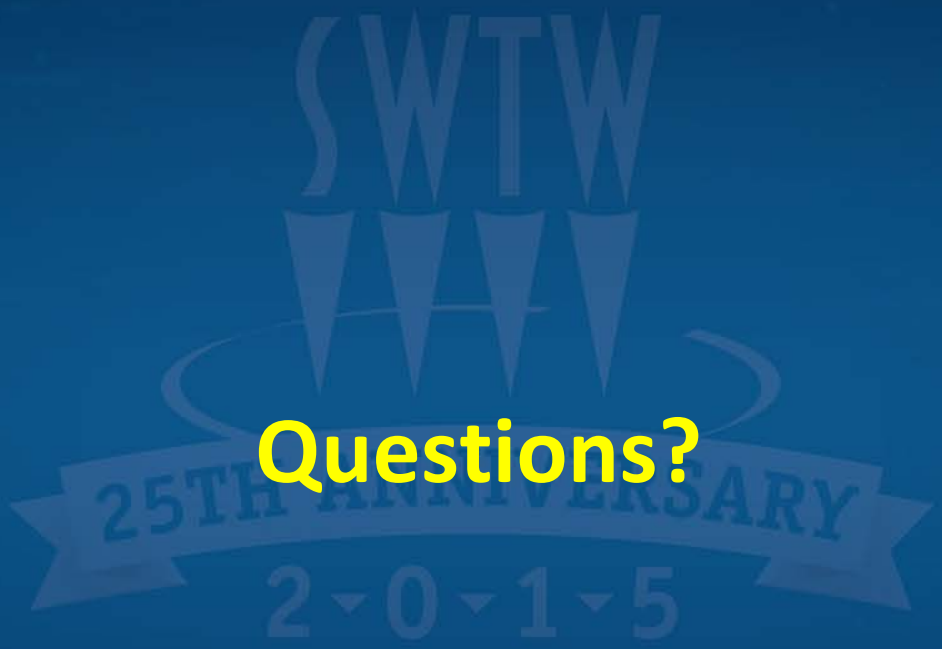


Next Steps

- **Continuing work to evaluate the number of cycles**
  - Our expectation is that mechanical wear should have a minimal effect
- **Evaluation of the repeatability of RF performance with dock/undocking cycles**

Summary

- **We have characterized a direct dock waveguide connector that could be used with ATE systems**
  - It meets the performance requirements for 65-90 GHz
- **The hard dock waveguide connector will work well for full production test**



Questions?