



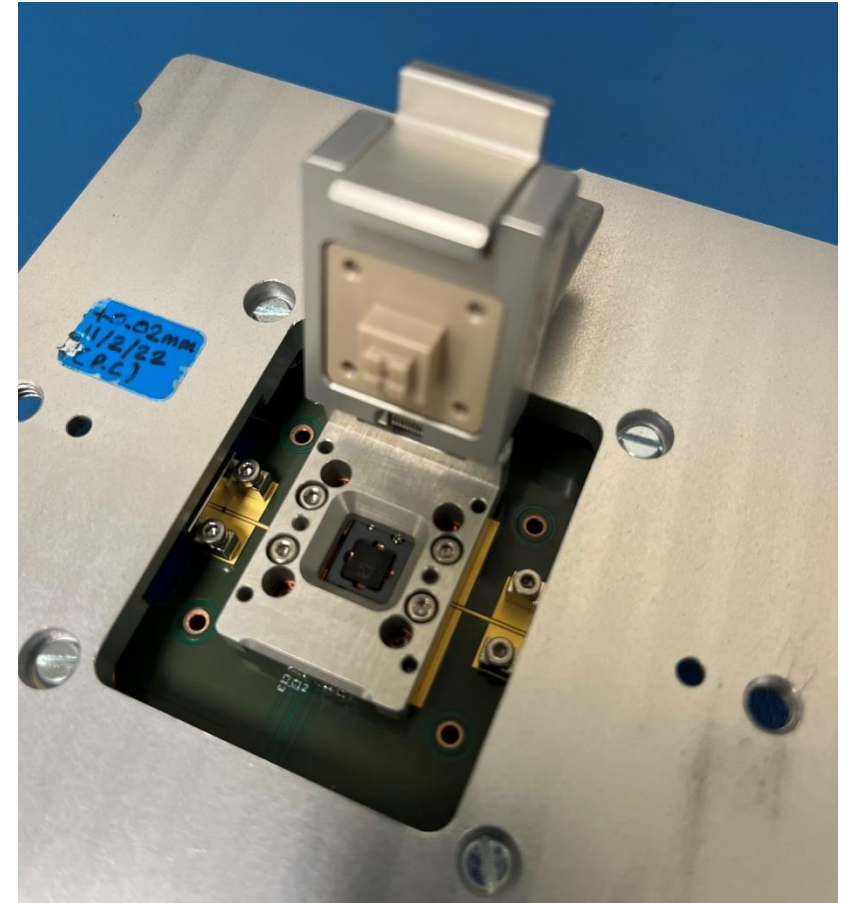
High Volume, Cost-Effective Production Testing of MMICs in the UK

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Overview

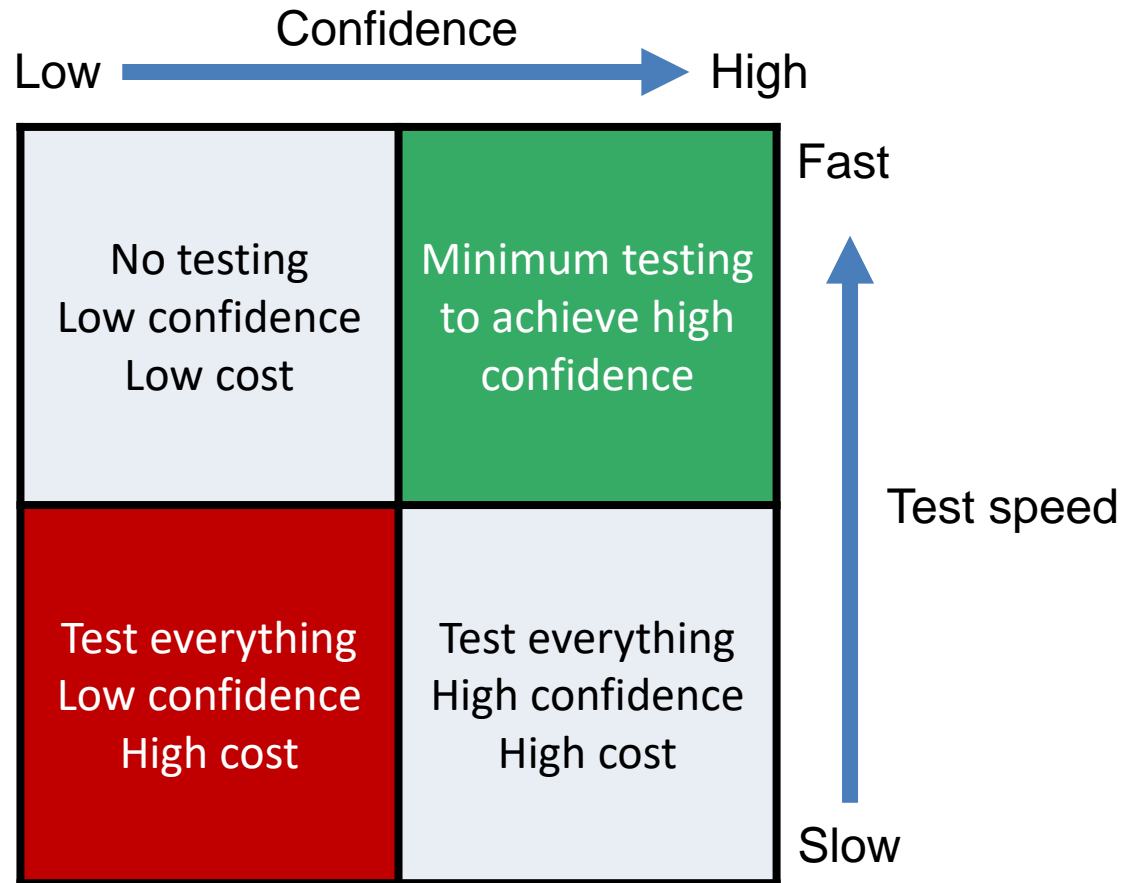


- Challenges of RF testing packaged ICs
- Production test cost reduction
- Test socket design
- Load-board design
- Production test correlation
- Test parameters & test procedure optimisation
- Automation
- Production test in action
- Summary





Challenges of Production Testing Packaged ICs at RF & Microwave Frequencies



Objective: Ensure quality of products shipped to customer

Technical Challenges:

- Achieving correlation between evaluation board performance and test socket performance
- Achieving repeatability between measurements
- Reducing impact of test socket and PCB



Where to Production Test?

“Why not just outsource production test?”

Several factors to consider:

- Labour costs - higher in UK / Europe compared to Asia
- Supply chain resilience
- Flexibility
- Speed at which issues can be resolved
- Reputation

In-house testing is well suited to a broad product mix

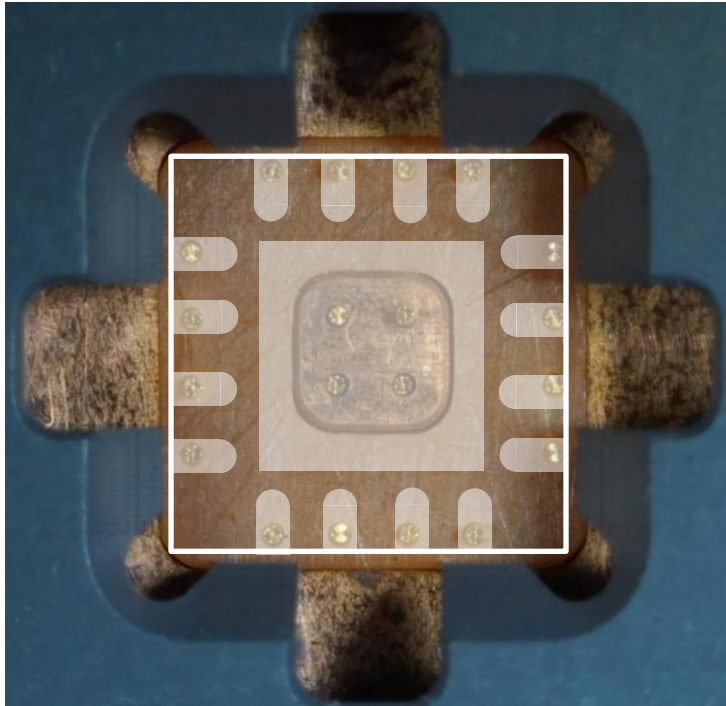
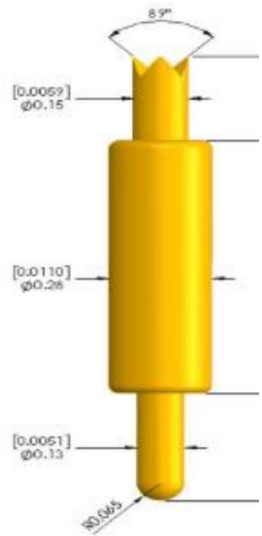
Production Test Cost Reduction

- Reducing test time per IC
 - Auto-handlers
 - Parameters to test
 - Measurement test equipment settings
- Increasing automation
- Maximise uptime
 - Preventative maintenance
 - Reduce changeover times between products
 - Common hardware platform



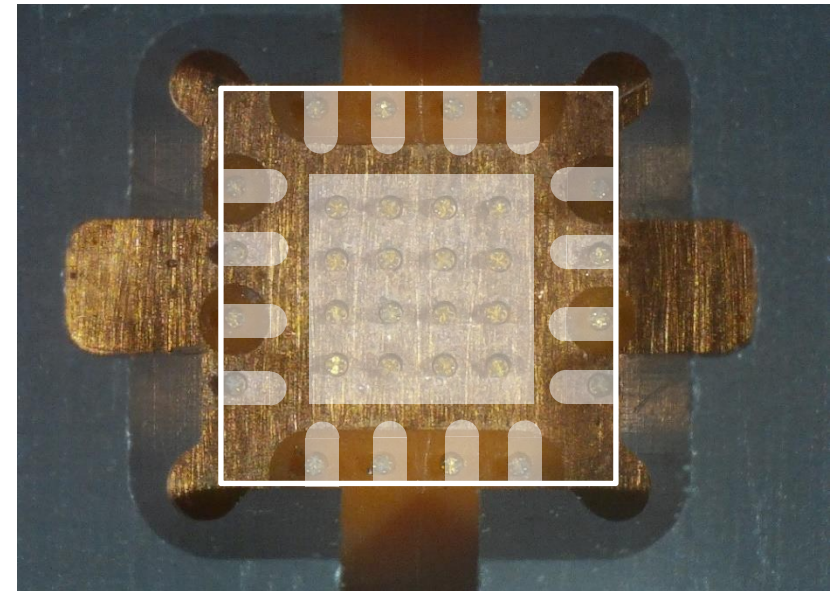
Test Socket Design

Initial design



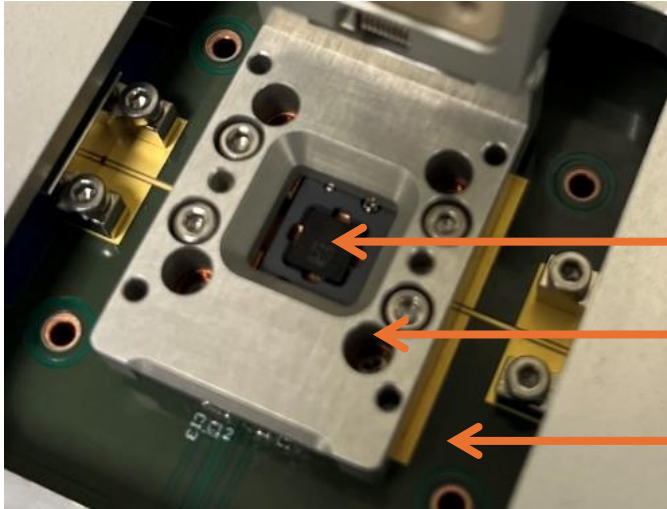
Works to ~1 GHz

Revised design



Works to ~30GHz

Load Board Design



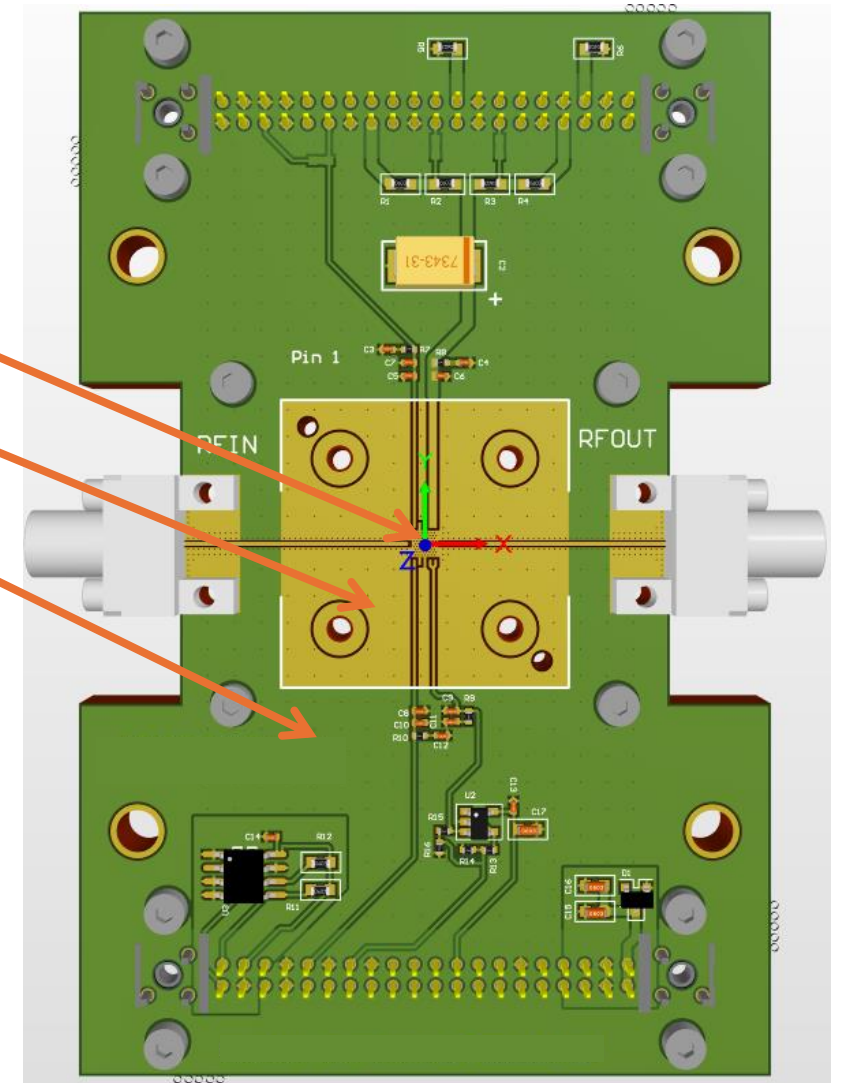
IC under test

Test socket

Load board

Factors to consider:

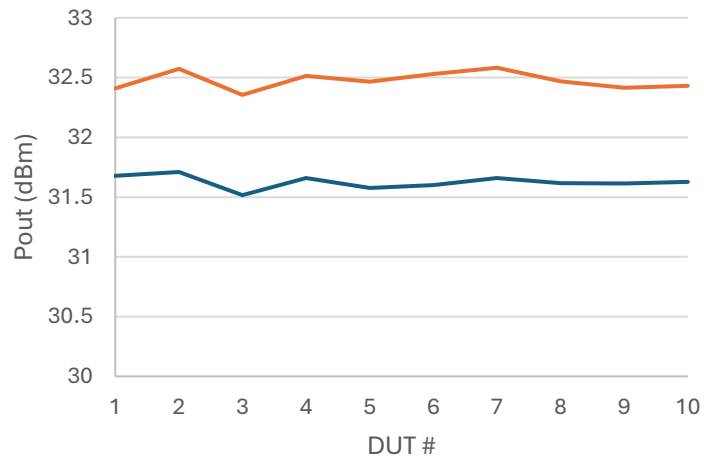
- Test socket footprint versus SMT component positions
- PCB stackup
- Connectors
- Ease of use
- Commonality with other production test boards



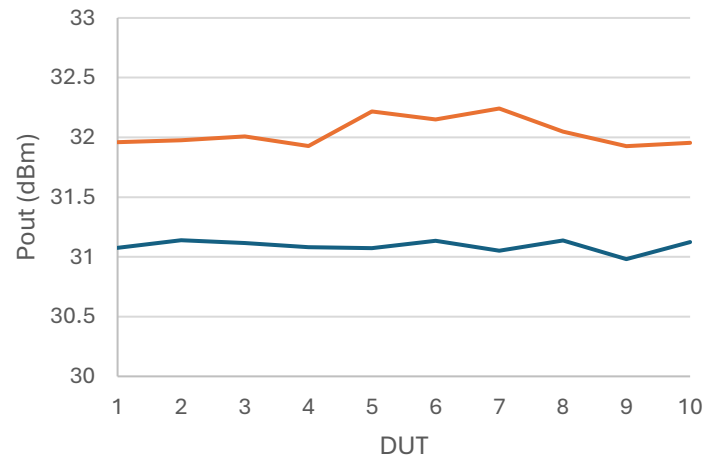


Production Test Correlation

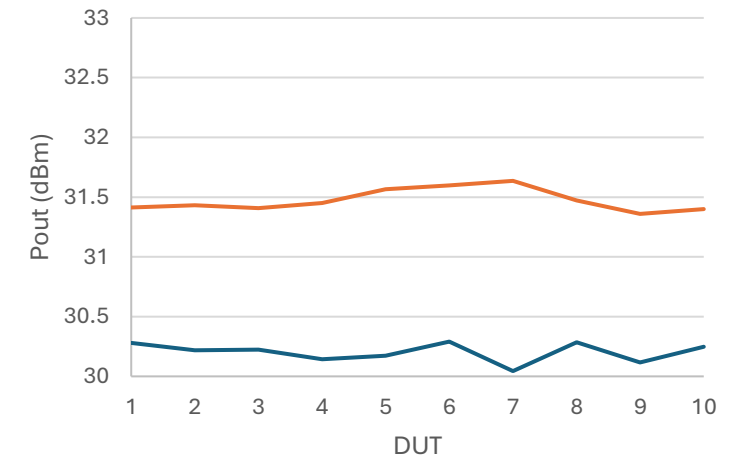
Pout at 1dB Compression @
low-band



Pout at 1dB Compression @
mid-band



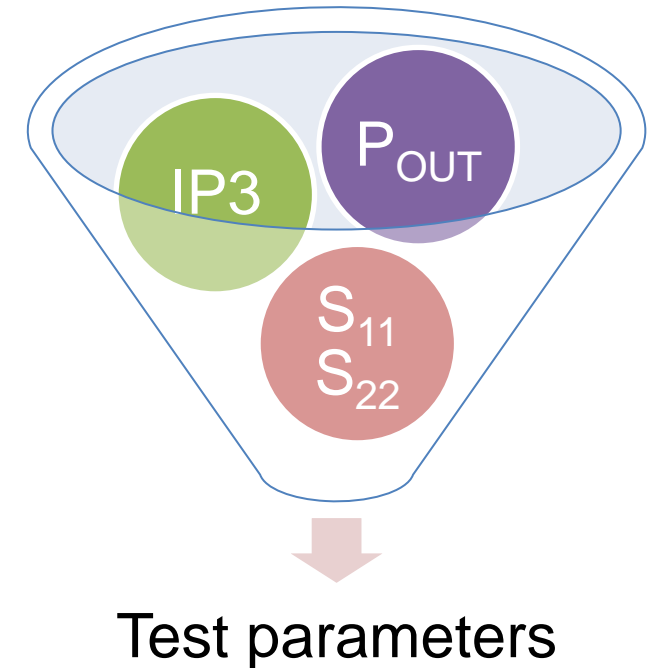
Pout at 1dB Compression @
high-band



Performance of the device soldered onto the evaluation board
Performance in the test socket using production test board

Possible Parameters to Test

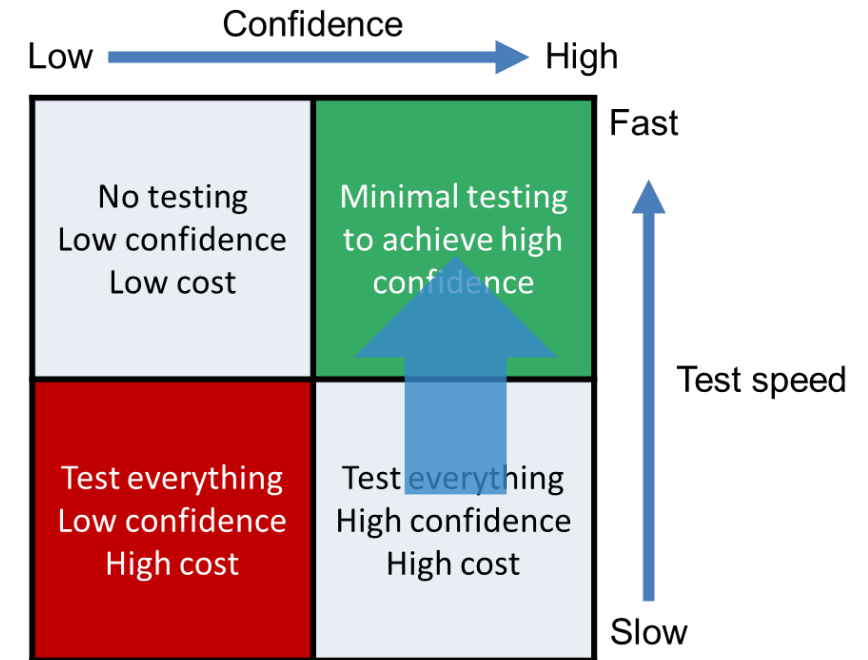
- DC parameters – quiescent, standby mode
- S-Parameters
- Large-signal performance – CW or pulsed
- Two-tone performance (IP3)
- Modulated signal performance
- Considerations:
 - Time to conduct each measurement
 - Test equipment required
 - Test routines / automation that are required to be developed
 - Test in each mode/configuration?





Test Procedure Optimisation

- Key question – what is important to customers?
 - Some customers may have more stringent requirements than others
- Start with testing a more extensive set of parameters to ensure device is behaving as expected
- Once sufficient data has been gathered, look for patterns in the test data
- Reduce test time to speed up test throughput
 - Which parameters take longest to test?
 - Can we reduce the number of frequencies tested?
 - Can we eliminate a test parameter?

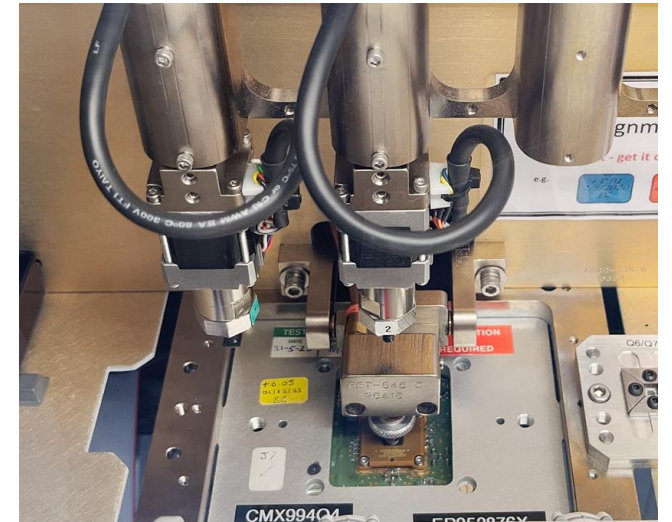




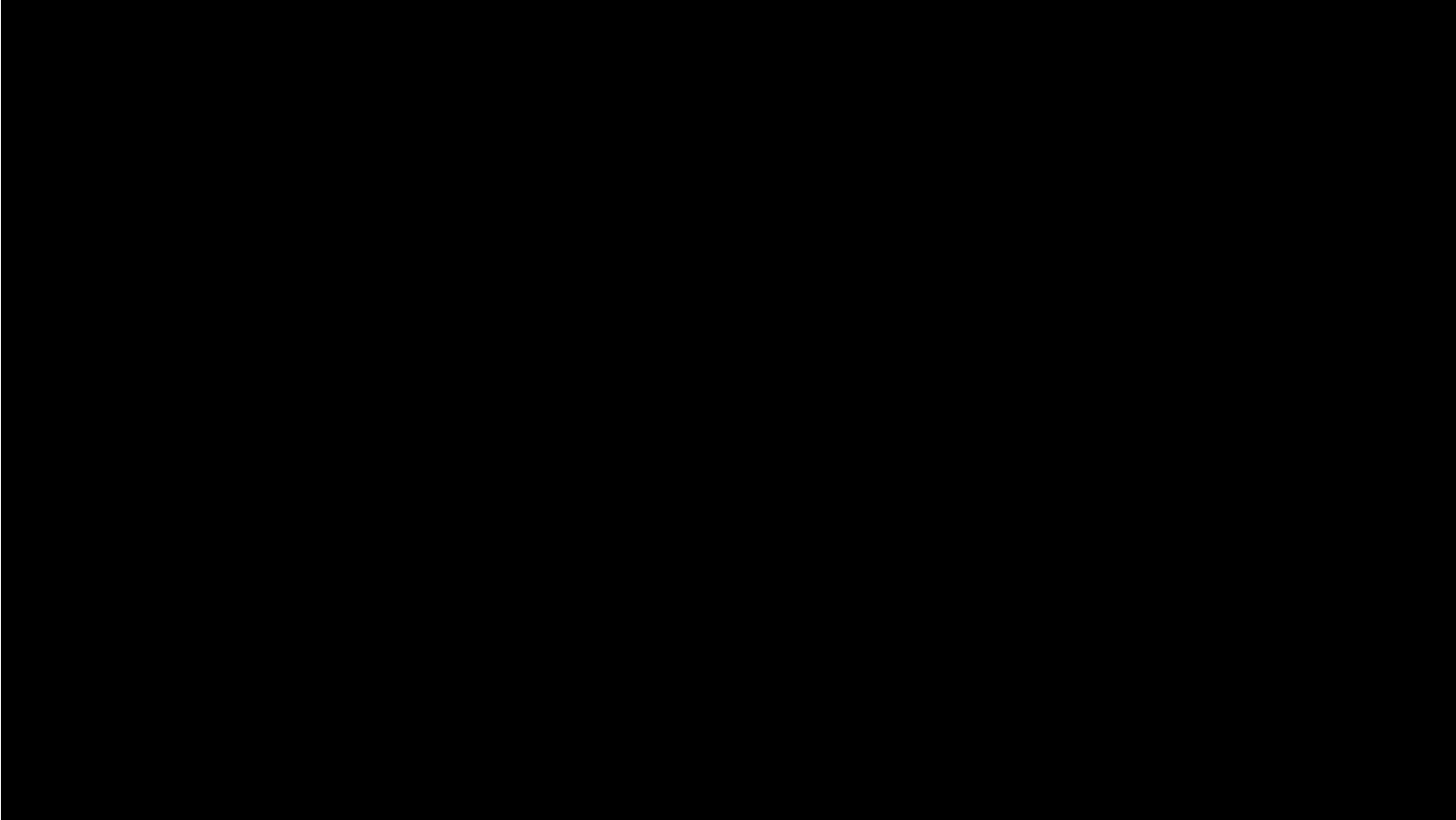
Production Test Automation

Aim: Increase number of simultaneous test systems per operator

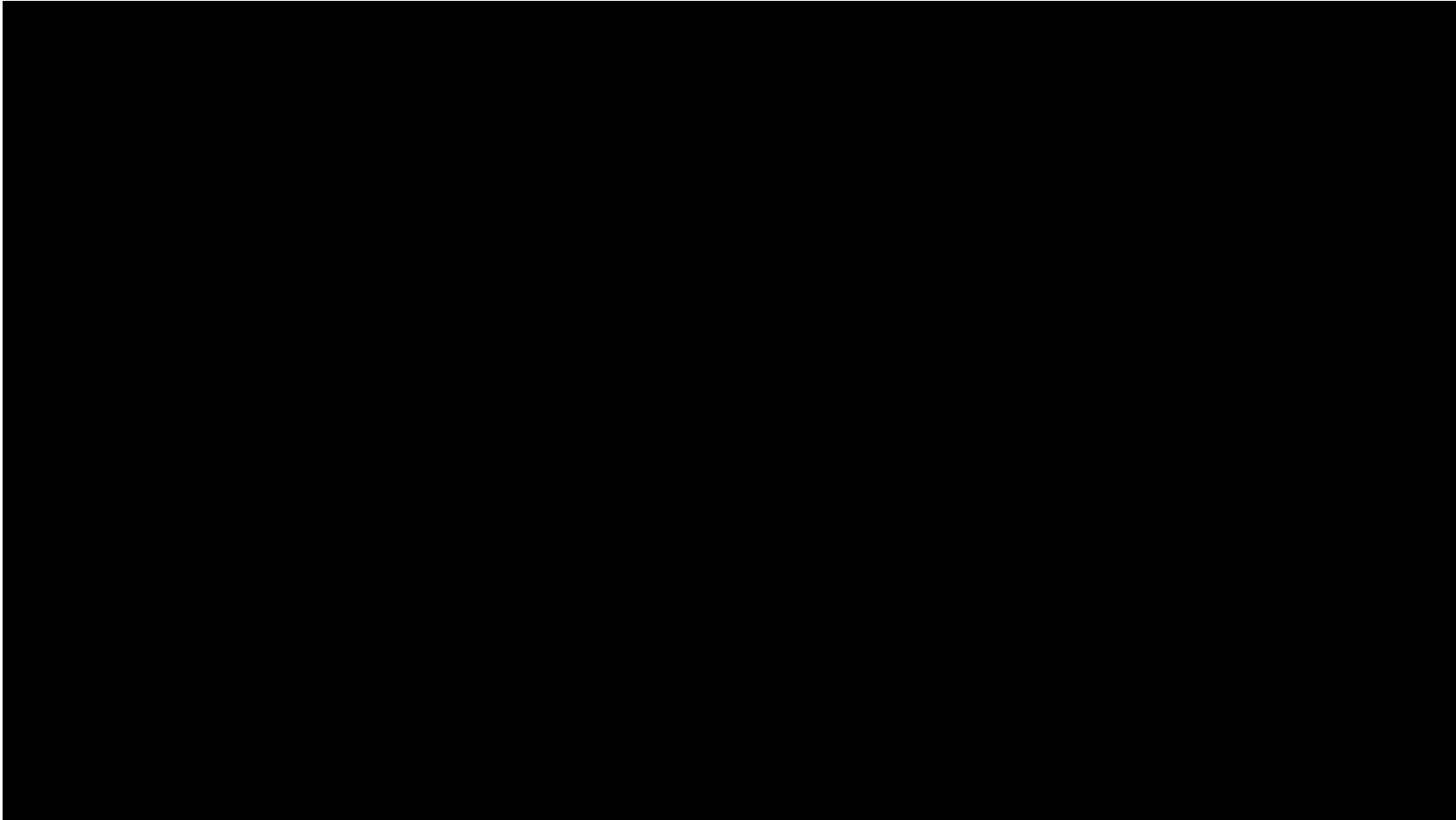
- Packaged part handler
- Tray handler
- Automated data storage, analysis and reporting
- Measurement system reliability and error reporting
 - If the system crashes, is data stored and progress saved?
 - Are error messages easy to understand and fix by the operator?
 - Does the system advise on when maintenance is required?



Auto Handler

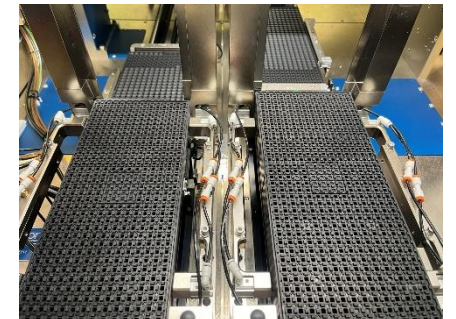
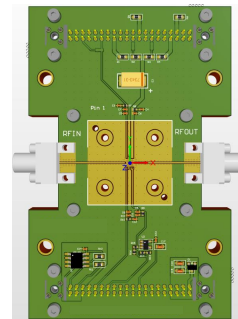
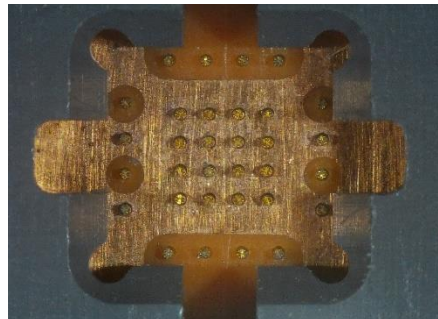
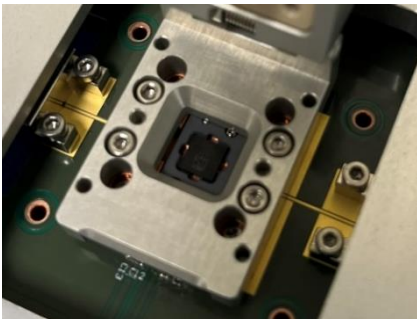


Tested Devices



Summary

- Test sockets and production test boards have greater impact on production test performance at RF/microwave frequencies and require careful consideration
- Automation is key to keeping production test costs low
- Production test often a compromise between confidence and time/cost
- Careful consideration of which parameters to test can achieve low test costs and high product confidence
- Close collaboration between design team and production test team can highlight potential issues early and accelerate move to production



Thanks for your attention!



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