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"Microwave and Millimeter Wave Multi-Chip Module Manufacturing"

HXI, LLC / Monzite Corporation

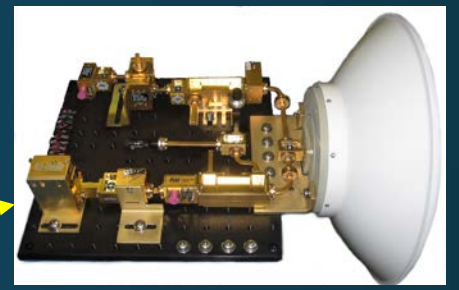
Presented at iMAPS New England
May 2, 2017

HXI Company Info

- Company formed as Harmonix in 1992 and grew with financial assistance from SoftBank and Omron
- Main facility located in Harvard, MA (Shared with parent company – Renaissance Electronics & Communications)
- Employee backgrounds include Alpha Industries (Skyworks), Arcom Wireless, Millitech, Endwave & others
- Services military, commercial and space customers
- ITAR controlled facility and able to facilitate classified programs
- AS9100C & ISO9001:2008

HXI Products

- Millimeter Wave Components

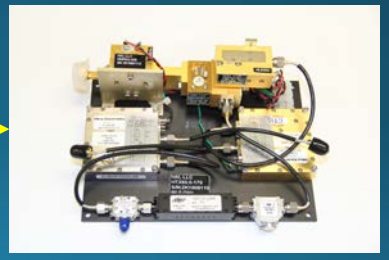


- Radar Front Ends, X-Band to W-Band
  Ka-Band Transceivers for UAV Tracking & Landing

- Point-to-Point MMW Radios (GigaLink)

- Test Instrumentation (Farran products)

- Custom Test Components and Subsystems for Auto
  Radar, WiGig, 5G and other MMW Applications



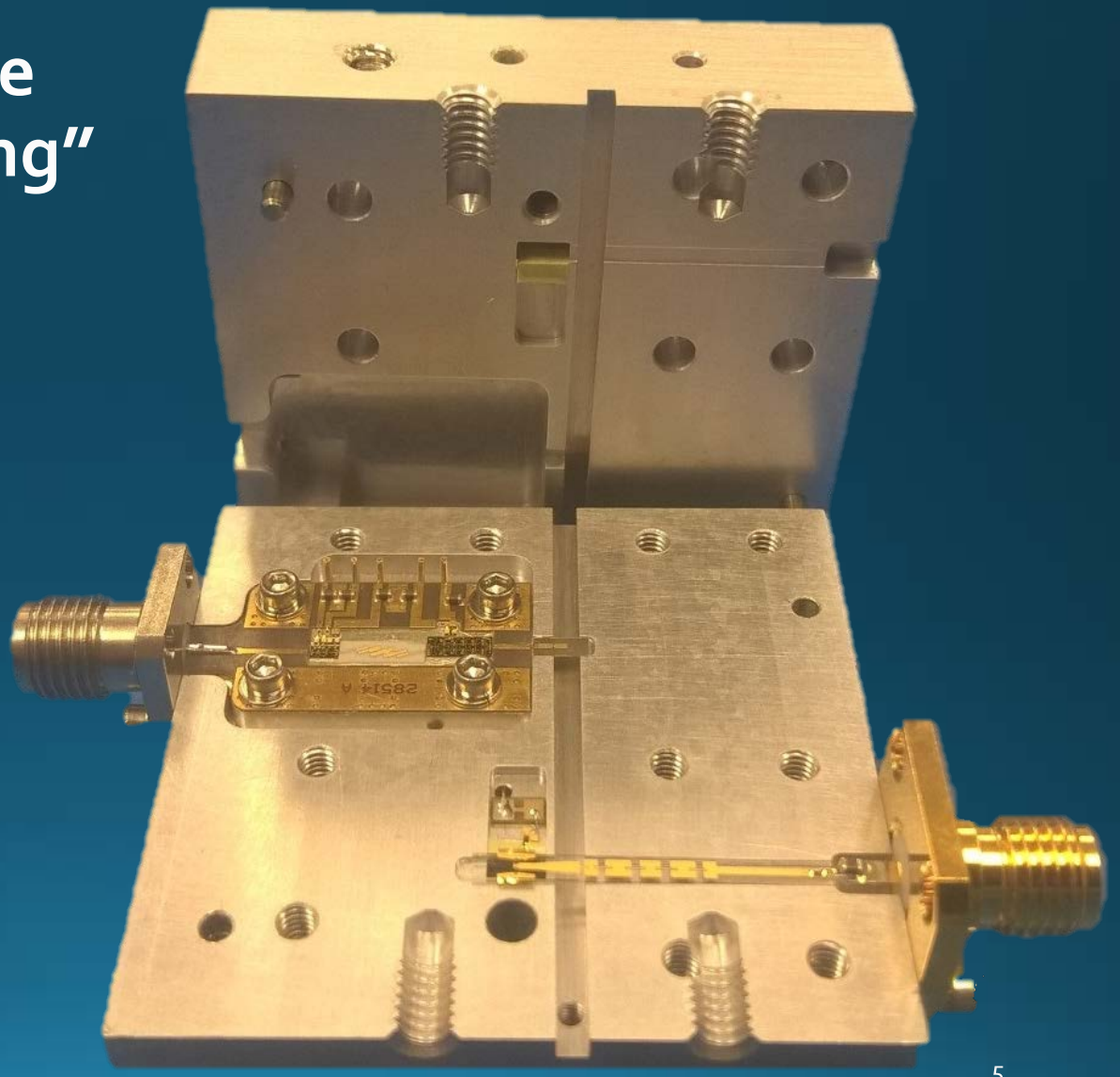
Monzite Company

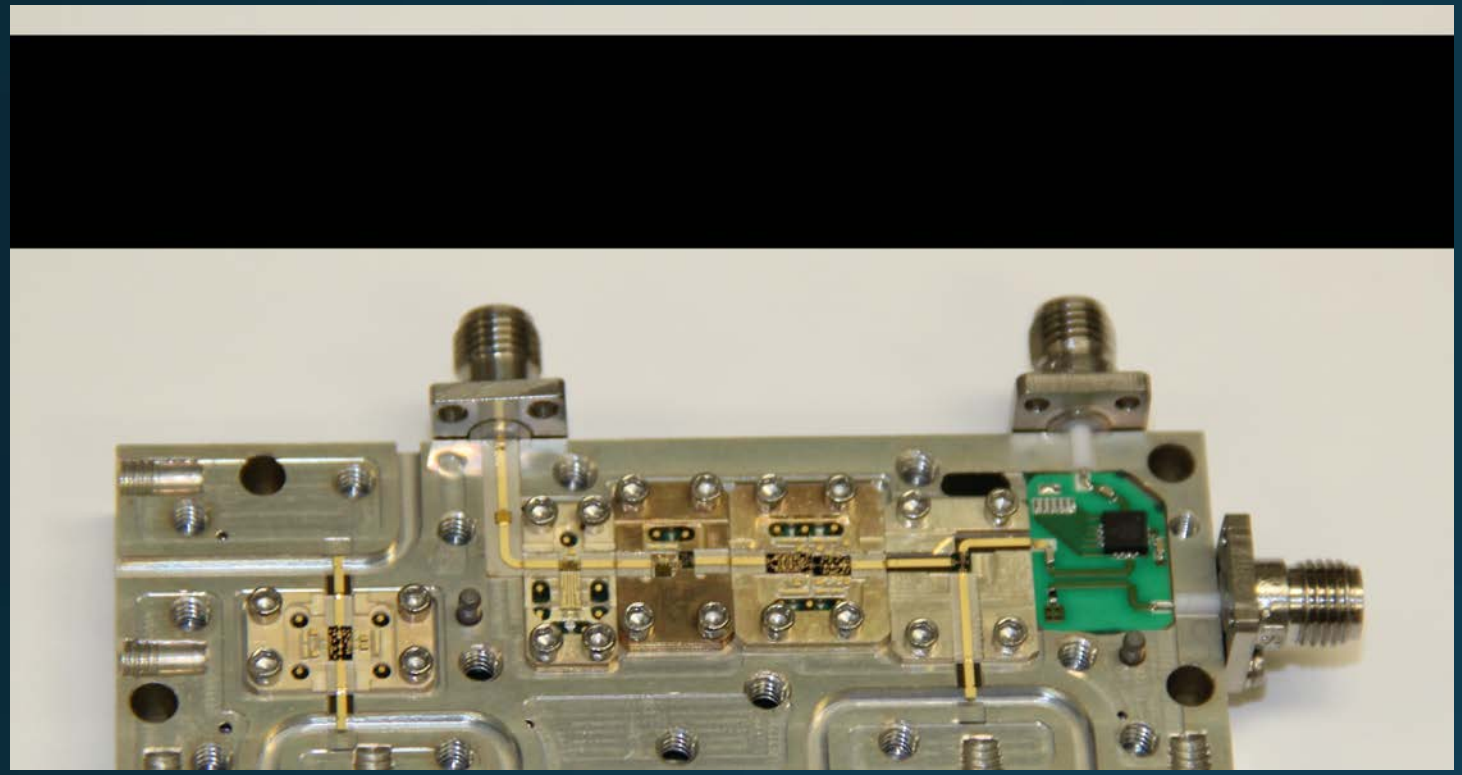
- Company formed as Monzite in 2013 merged with Impellimax
- Manufacturing facility located in Nashua, NH Monzite EMS Electronic Manufacturing Services and Impellimax brand electronic components
- Employee backgrounds include Alpha Industries (Skyworks), Micronetics Inc., Arcom Wireless, AD Micro-Assembly.
- Services Aerospace and Defense and Industrial
- ITAR controlled facility ISO 9001:2008

ITAR International Traffic in Arms Regulations Compliant
CERTIFIED ISO 9001:2008 NO. 19.4683
J-STD-001 CERTIFIED
IPC-A-610 CERTIFIED

Overview
"Microwave and Millimeter Wave Multi-Chip Module Manufacturing"

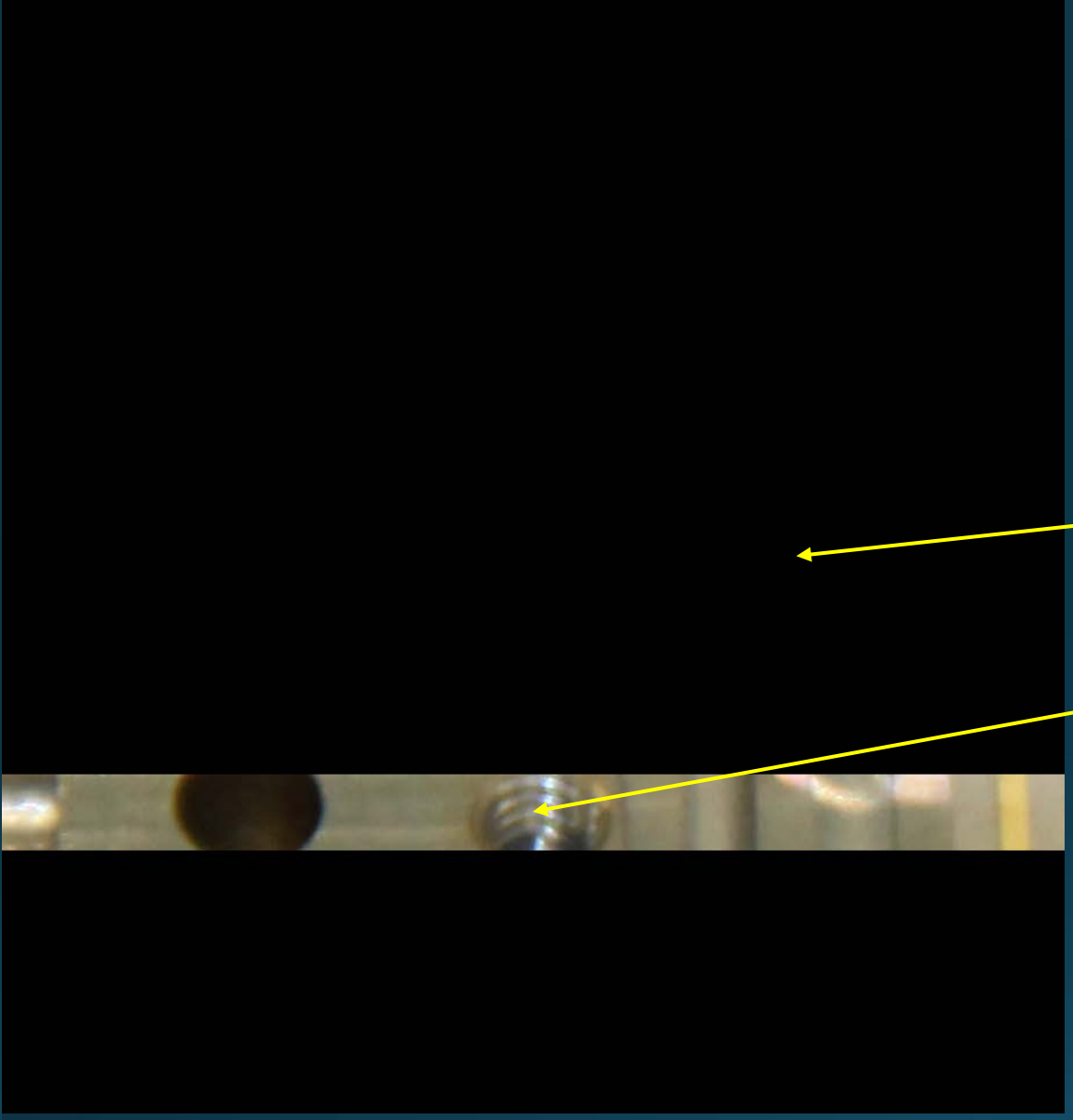
- Multi-Chip module manufacturing for Microwave and Millimeter Wave Applications (30 GHz-100 GHz)
- Low to medium quantity build profile
- Design and manufacturing process geared to customization and optimized for a specific specification





Carrier-Based Millimeter Wave Transmitter

- Operating RF Frequency Range: 70 to 78 GHz
- Carrier-Based Subassemblies
- Quartz & Duroid 5880 transmission lines
- GaAs MMICs
- Glass/metal feedthrus to carry DC bias from opposite side
- FR4-Based IF circuit

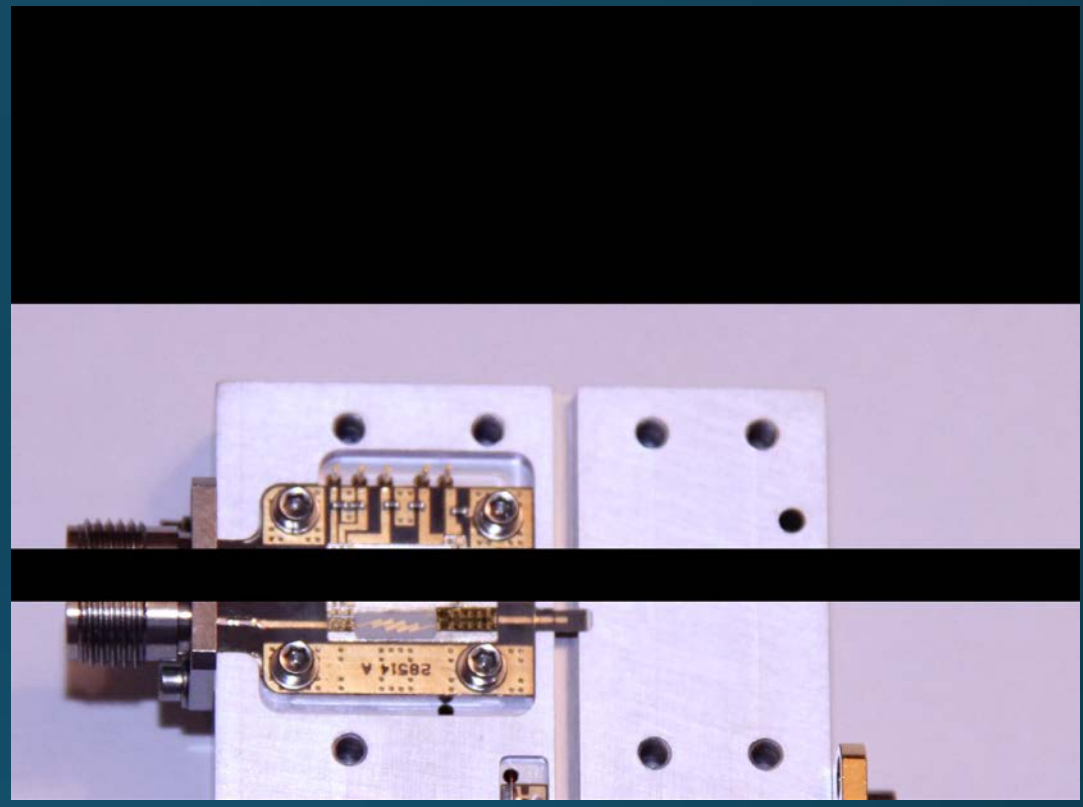


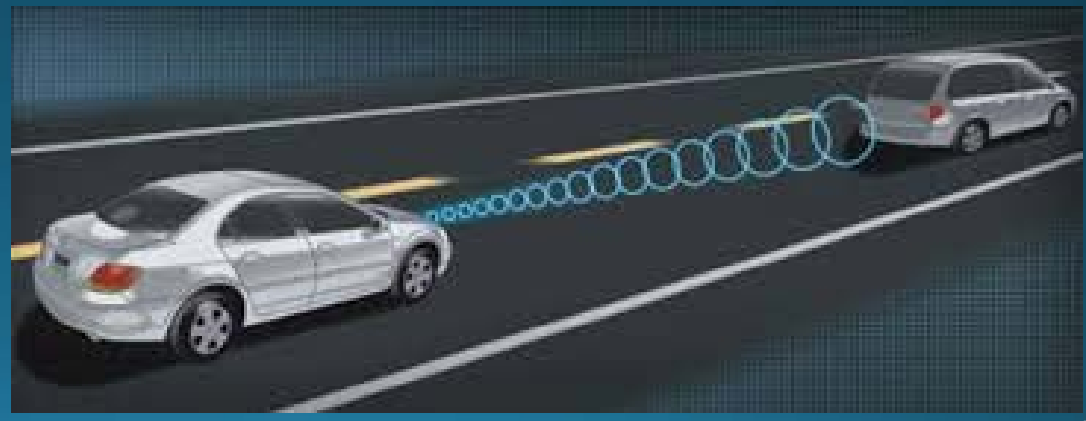
Carrier-Based Construction

- Replacable carrier subassemblies
- Quartz Waveguide Launch & Transmission Lines
- GaAs MMICs
- Glass/metal feedthrus to carry DC bias from opposite side

E-Band Integrated Mixer/LO Multiplier Modules

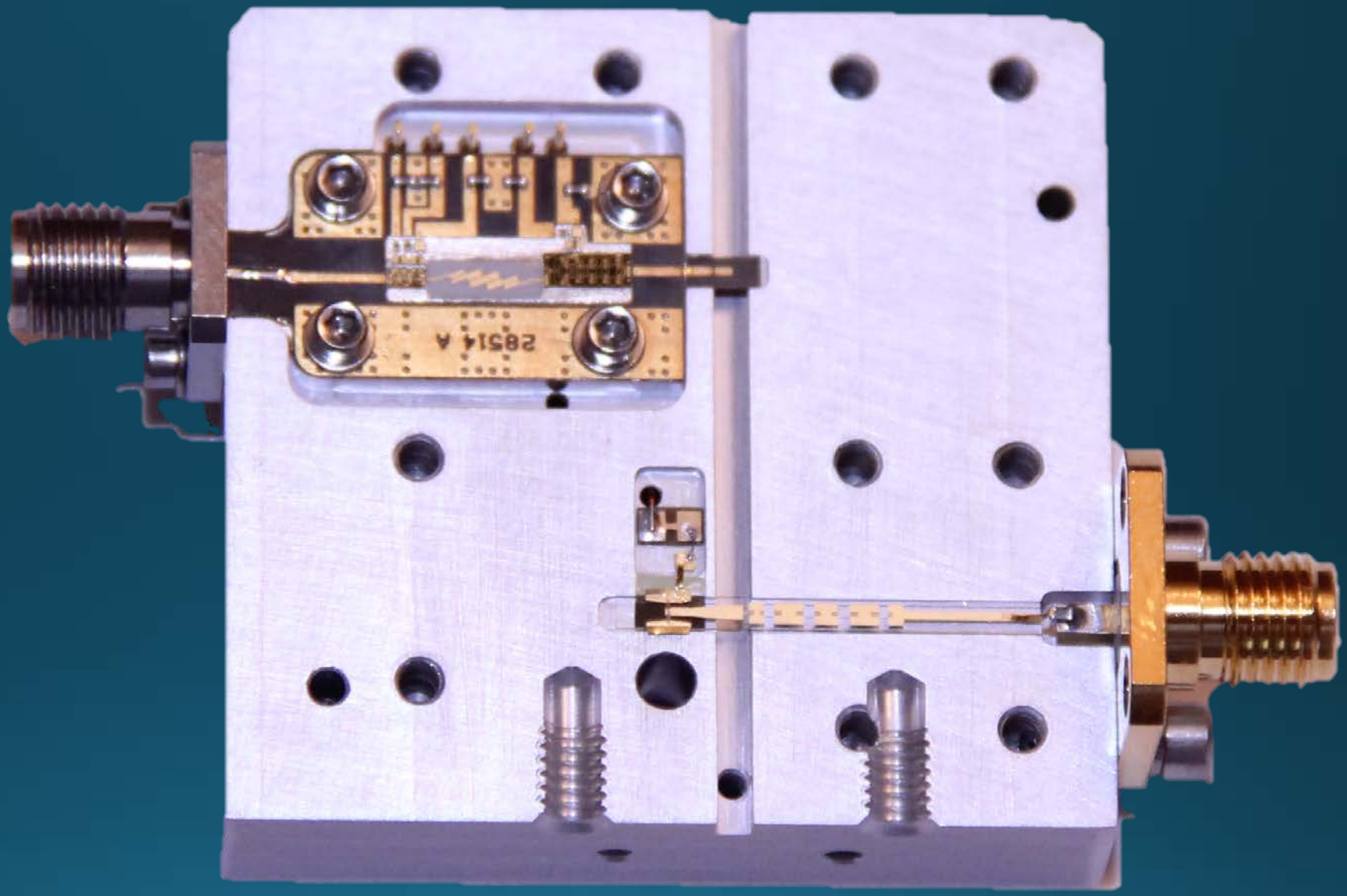
- Used in HXI 71-76/81-86 GHz radios
- Used in test equipment configurations for production testing of automotive radar MMIC transceivers and complete radar modules
- Carrier-based multiplier circuit using GaAs MMICs & alumina BPF
- High performance mixer using beam lead diodes and quartz substrate in a suspended stripline medium
- Glass/metal feedthrus to bring DC bias from backside regulator/sequencer





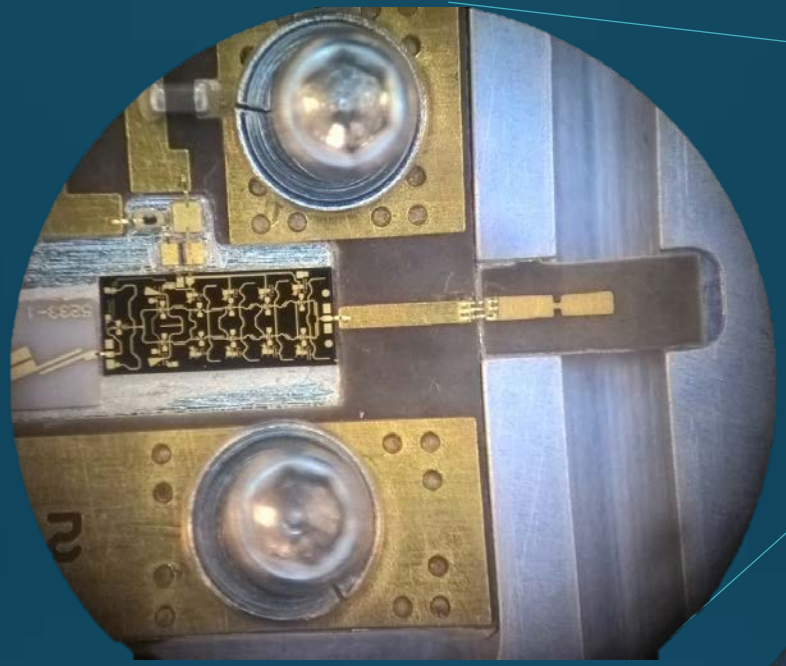
Mixed Media

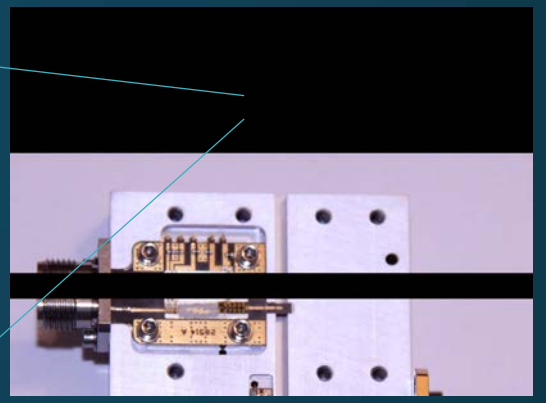
- Combined Alumina, Quartz, 5880 Duroid, Carrier integration
- Discrete Beam Lead Diodes, MMIC, SMT components
- Micro-Strip, Suspended Stripline, Coaxial, Stripline
- Solder, epoxy paste, epoxy film

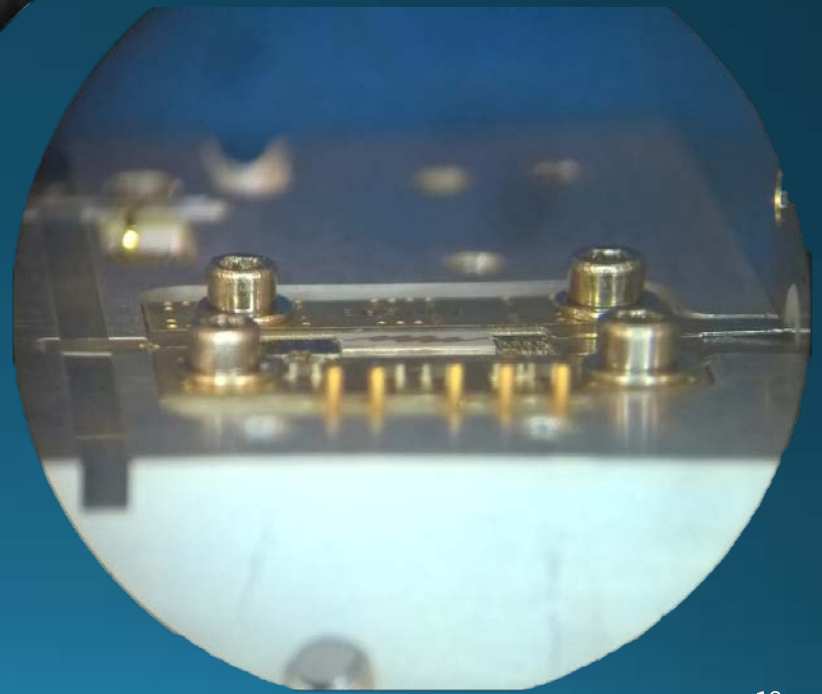


Bonding to Mixed Media

- Duroid, GaAs, Alumina
- Keeping Bond Looping low
- Z Axis control

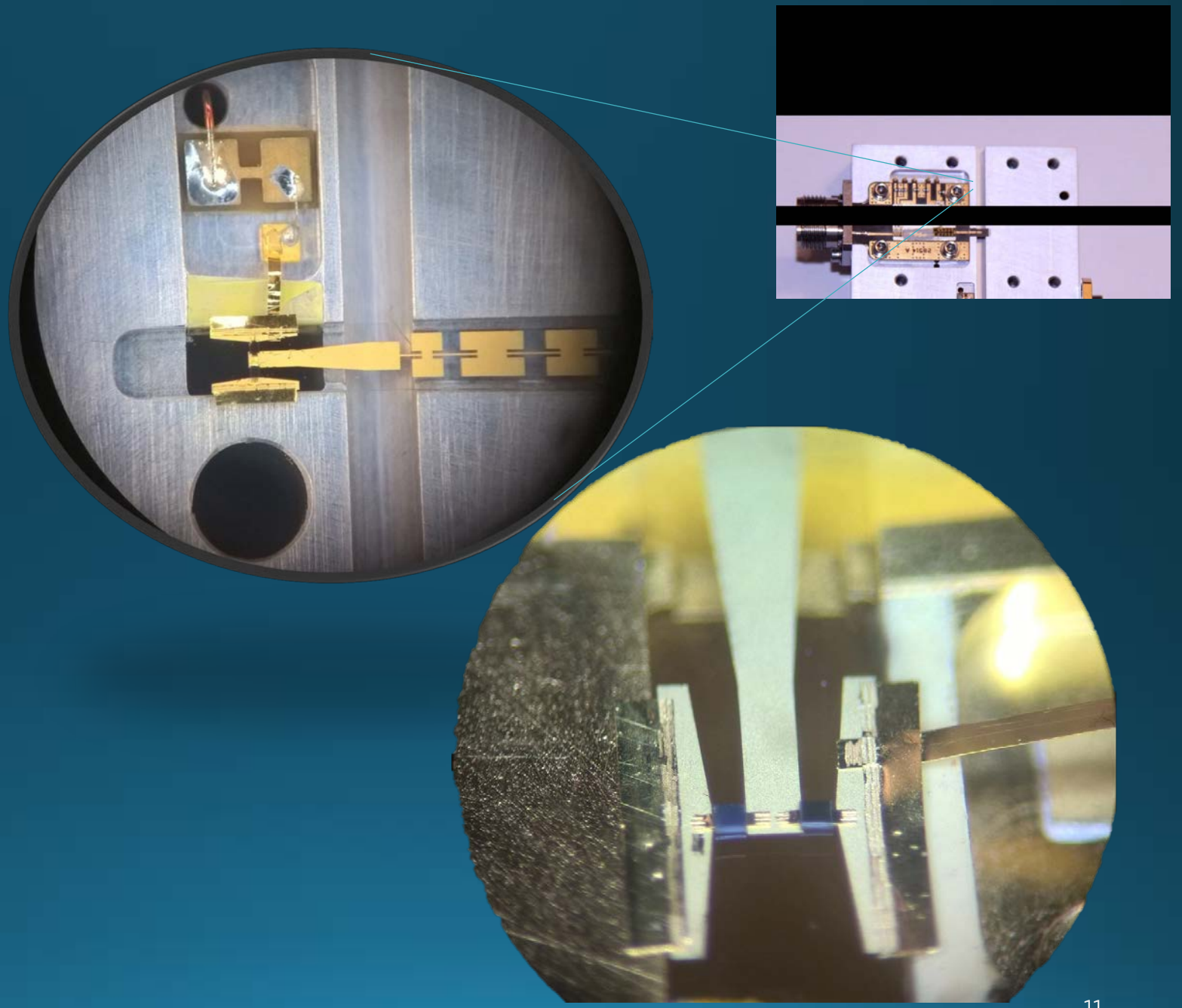






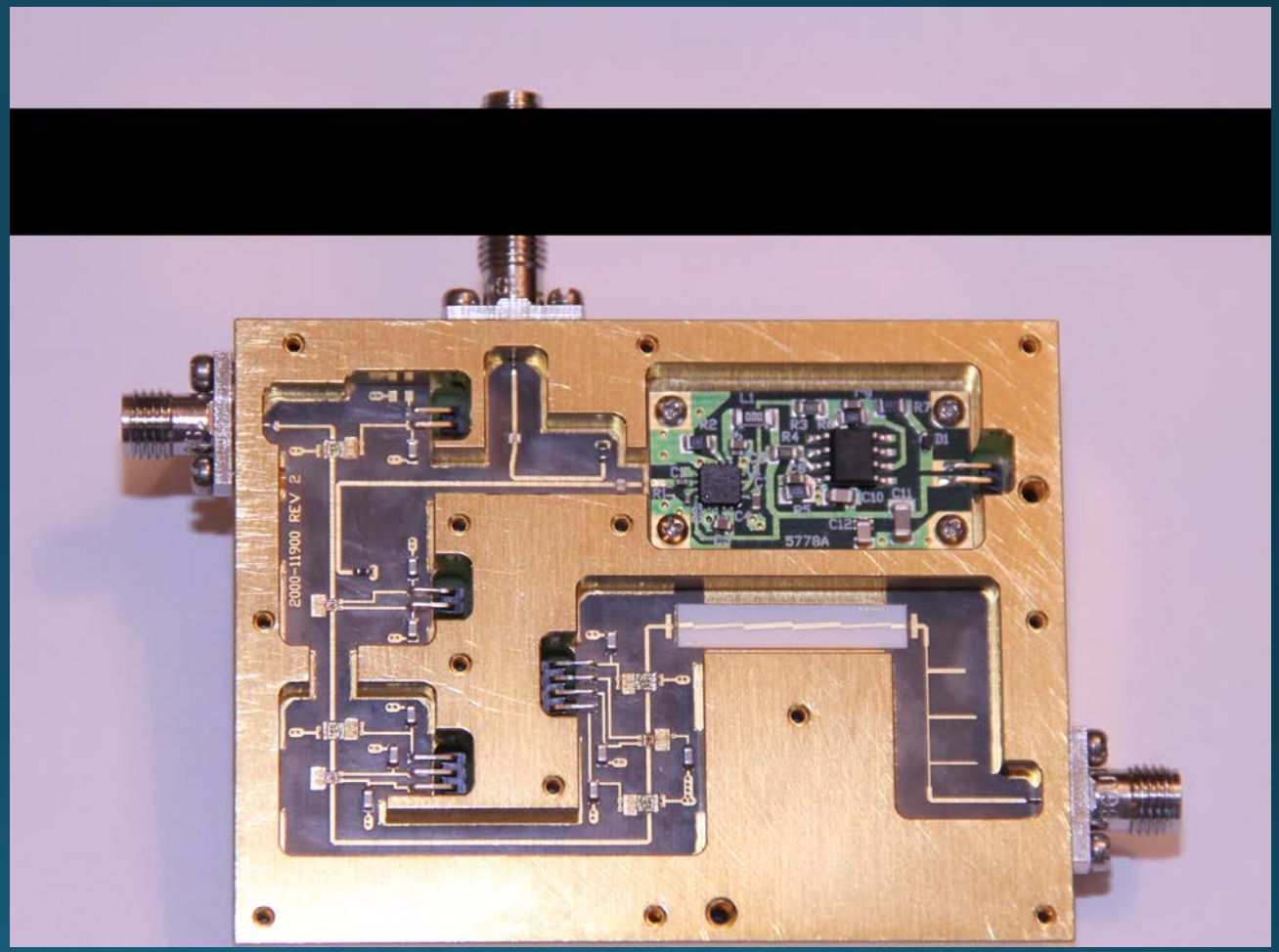
Bonding on Suspended Media

- Quartz suspended strip-line
- Discrete Beam Lead Diodes,
- Thermo-Compression bond on Au Ribbon and Beam Lead Diode



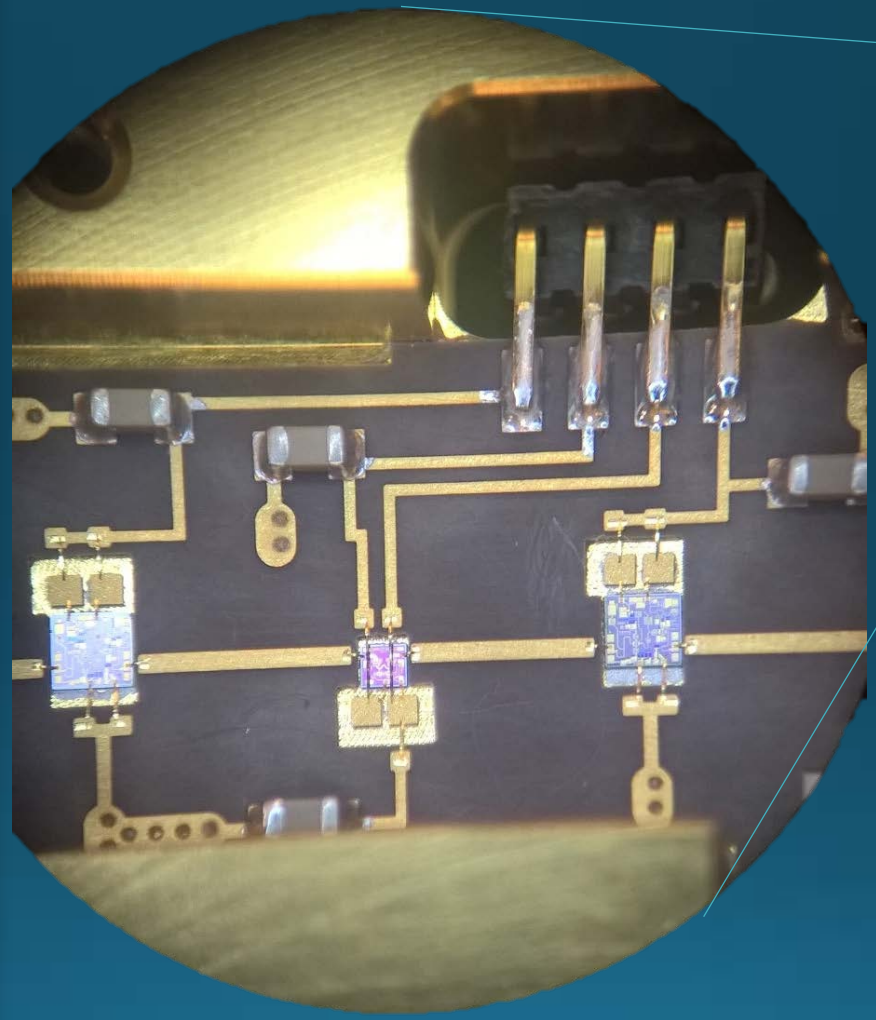
C-Band AGC Amplifier Module

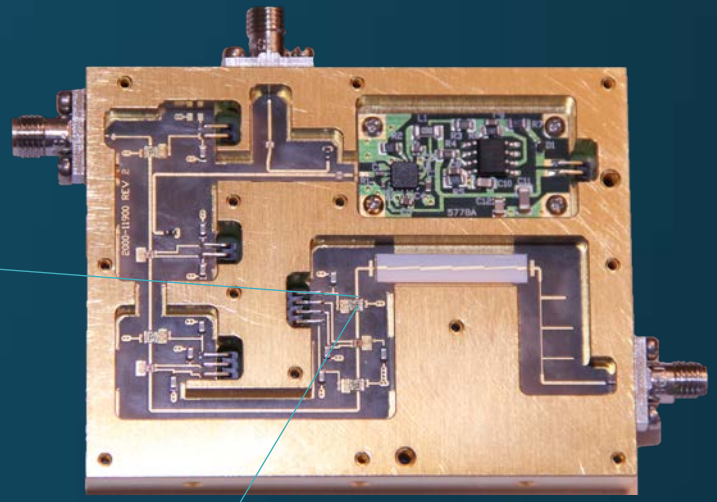
- 4 to 9 GHz
- 70 dB Total Gain
- 50 dB Attenuation Range
- Duroid 5880
  Base material
- GaAs MMICs (bare die)
- Alumina BPF



Mixed SMT with Hybrid Chip & Wire

- Soldered Bypass Capacitors
- Epoxy MMIC's single layer capacitors
- 2 mil Au ribbon bonds
- Soldered SIP bias lines





Thank you!!