

HXI, LLC

Products and Capabilities

Facility

- Main facility located in Harvard, MA
- 16,000 square feet – 9,600 dedicated to production
- 70% Defense, Space, Aerospace Contracts
- ITAR controlled facility
- Facility Clearance level - Secret
- AS9100 Rev C
- Qual testing within 10 miles
- Wholly-owned subsidiary of Renaissance Electronics & Communications



Markets



Space



Defense



Wireless/Telcom



Medical

World Class Customers

Defense and Space



Commercial and Telecom



HXI Product Lines

- HXI Components to 110 GHz
 - Low Noise & Power Amplifiers
 - Mixers & Upconverters
 - Frequency Multipliers
 - Switches & Attenuators
 - Isolators & Circulators
- HXI Custom-Designed Products
 - Multi-Chip Modules
 - Integrated Assemblies
 - Radar Front Ends
 - Space-Qualified Assemblies
 - Auto Radar Test Assemblies at 76-81 GHz
 - 5G Test Assemblies at 20 GHz and Up

USA Sales Agent for Farran Technology

- Millimeter Wave & Sub-Millimeter Wave Components to 325 GHz
 - Fundamental, Harmonic & Subharmonic Mixers
 - Active & Passive Multipliers
 - Block Converters
 - FMCW Modules
 - Frequency Sources
 - LNAs & Power Amplifiers
- Test Instrumentation to 500 GHz
 - Cobalt FX VNA Systems
 - VNA Extenders & Calibration Kits
 - Signal Generator Extenders
 - Antenna Measurement Extenders
 - Noise Figure Analyzer Extenders
 - Noise Sources

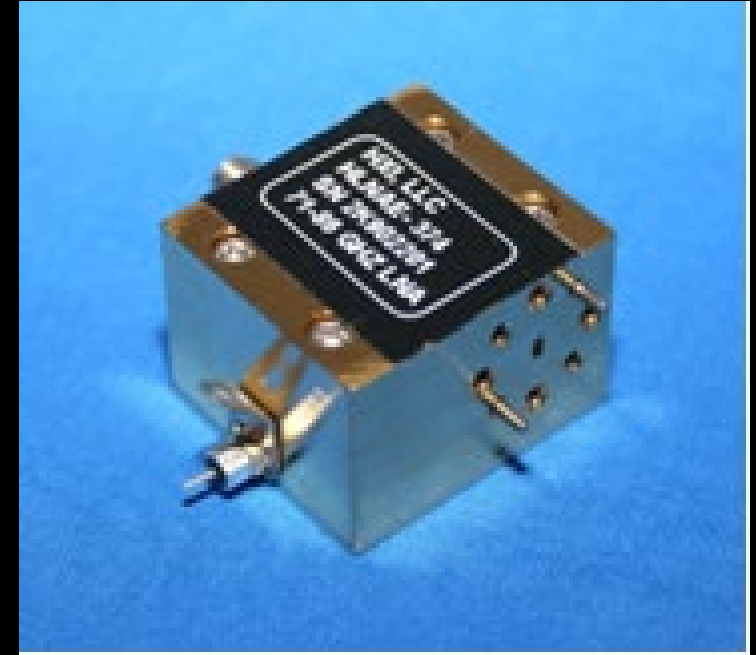
Our Differentiation

For the past 25 years, we have been an essential source to prime defense contractors and commercial entities with our devices and solutions to solve their issues with *power, bandwidth and miniaturization*.

Our customers keep coming back to us for our technical expertise, fast response and for schedule/affordability reasons.

Low Noise Amplifiers (HLNA Series)

- 18 GHz to 100 GHz Product Range
- Narrowband & Broadband Designs
- 2.9 mm, 2.4 mm, 1.85 mm & Waveguide Interfaces
- Internal Voltage Regulation & Sequencing
- Convenient RF Port Locations for System Insertion



LNA Model	Frequency Range	Noise Figure (Typical)	Gain (Typical)
HLNAKK-641	17-27 GHz	2.3 dB	21 dB
HLNAAK-642	26-34 GHz	2.7 dB	19 dB
HLNAQK-643	33-45 GHz	3.1 dB	17 dB
HLNAV-361	57-66 GHz	5.0 dB	28 dB
HLNAE-630	71-76 GHz	5.5 dB	18 dB
HLNAE-631	76-81 GHz	4.5 dB	18 dB
HLNAE-632	81-86 GHz	4.5 dB	17 dB

Partial Listing

Power Amplifiers (HHPA Series)

- 20 GHz to 96 GHz Product Range
- Narrowband & Broadband Frequency Coverage
- 2.9 mm, 2.4 mm, 1.85 mm & Waveguide Interfaces
- Internal Voltage Regulation & Sequencing
- Convenient RF Port Locations for System Insertion

Power Amplifier Model	Frequency Range	P _{1dB} (Typical)	Gain (Typical)
HMPAAK-133	17-31 GHz	+20 dBm	30 dB
HHPAA-301	32-36 GHz	+25 dBm	20 dB
HHPAB2.4-511	40-47 GHz	+23 dBm	15 dB
HHPAV-330	57-66 GHz	+14 dBm	25 dB
HHPAE-603	71-76 GHz	+20 dBm	35 dB
HHPAE-604	81-86 GHz	+20 dBm	33 dB
HHPAW-348	92-96 GHz	+15 dBm (P _{SAT})	18 dB



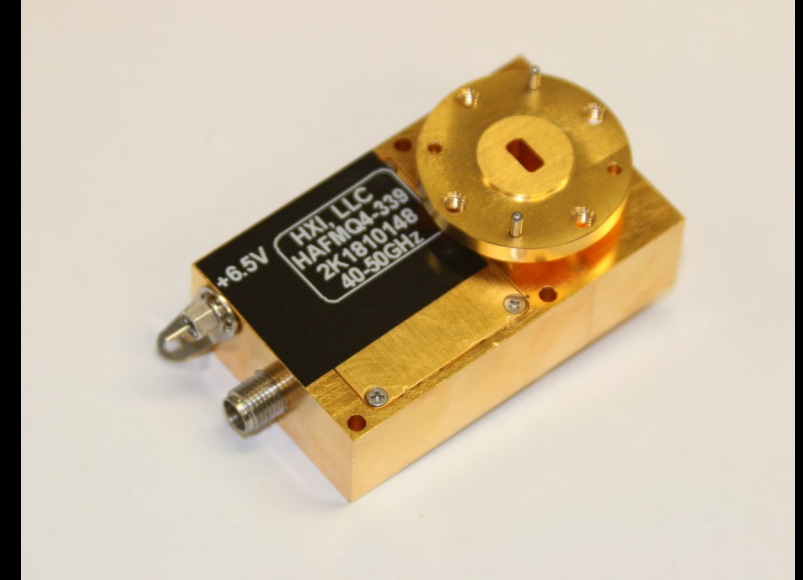
Partial Listing

Frequency Multipliers (HAFM Series)

- 18 GHz to 96 GHz Product Range
- Coaxial & Waveguide Interface Versions
- Internal Voltage Regulation and Sequencing

Multiplier Model	Mult Factor	Output Frequency Range	Output Power	Output Interface
HAFMA2-117	X2	32-40 GHz	+13 dBm	2.9 mm Female
HAFMV4-223	X4	57-66 GHz	+14 dBm	WR-15, UG-385/U
HAFME4-139	X4	71-76 GHz	+13 dBm	WR-12, UG-387/U

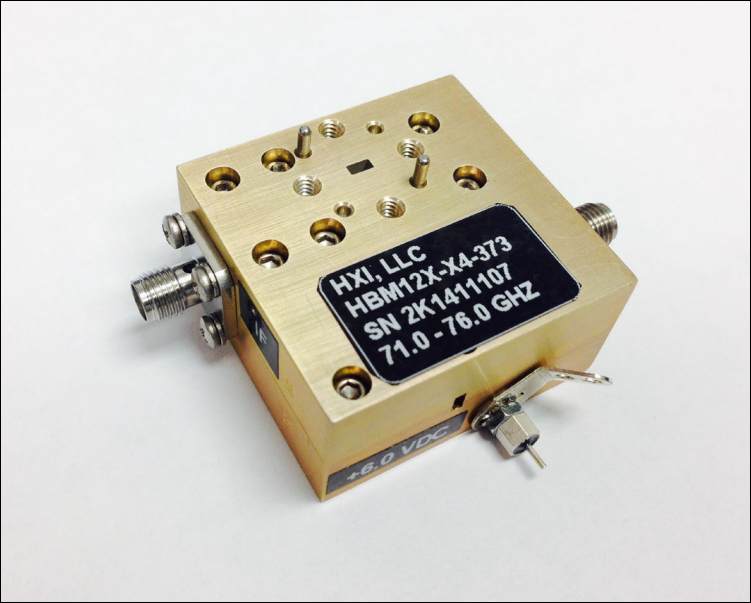
Partial Listing



Mixers & Upconverters (HBM & HBUC Series)

- 26 GHz to 110 GHz Product Range
- Low Conversion Loss
- High input P1dB
- E-Band Designs with Integral LO Multiplier

Mixer/Upconverter Model	RF Frequency Range	Conversion Loss	RF/LO Interfaces
HBM28XX-XXX HBUC28XX-XXX	33-37 GHz	6 dB Typical 7 dB Typical	WR-28, UG-599/U
HBM19XX-XXX HBUC19XX-XXX	47-53 GHz	6.5 dB Typical 7.5 dB Typical	WR-19, UG383/U-M
HBM15XX-XXX HBUC15XX-XXX	57-65 GHz	6.5 dB Typical 7.5 dB Typical	WR-15, UG-385/U
HBM12XX-XXX HBUC12XX-XXX	71-76 GHz 76-81 GHz 81-86 GHz	7.0 dB Typical	WR-12, UG-387/U
HBM12XX-X4-XXX HBUC12XX-X4-XXX	71-76 GHz	7.0 dB Typical	WR-12, UG-387/U 2.9 mm Female (LO)
HBM12XX-X6-XXX HBM12XX-X6-XXX	76-81 GHz 81-86 GHz	7.0 dB Typical	WR-12, UG-387/U 2.9 mm Female (LO)
HBM10XX-XXX	92-96 GHz	7.0 dB Typical	WR-10, UG-387/U-M



Partial Listing

Waveguide Isolators and Circulators

- 18 GHz to 110 GHz
- Compact designs
- Magnetically-Shielded Versions
- High Power Versions
- Low Cost Designs Available

Isolator Model *	Frequency Range	Insertion Loss/Isolation
HMI28-599-35.0-4.0	33 - 37 GHz	.4 dB / 20 dB
HMI15-385-61.5-9.0	57 - 66 GHz	1.2 dB / 12 dB
HMI12-387-73.5	71 - 76 GHz	1.0 dB / 16 dB
HMI10-387-79.04-4.0	77 – 81 GHz	.09 dB / 16 dB
HMI12-387-83.5-5.0	81 - 86 GHz	1.0 dB / 16 dB
HMI10-387-94.0-4.0	92 - 96 GHz	.8 dB / 18 dB

Partial Listing

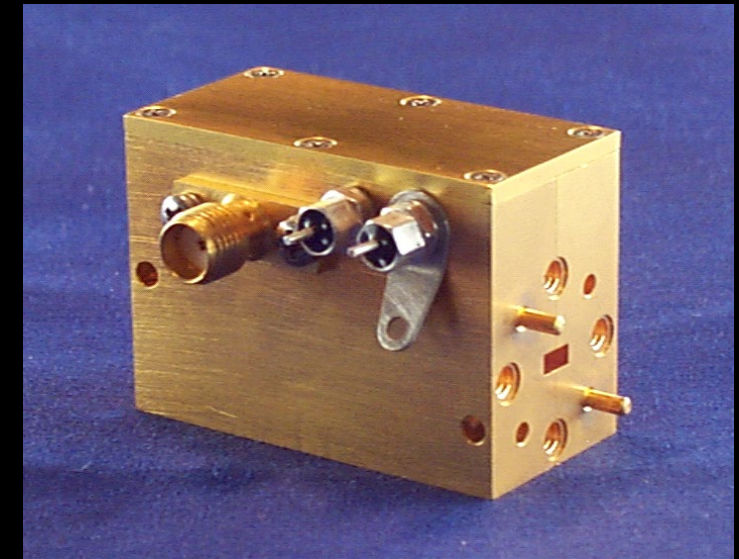


PIN Switches

- 18 GHz to 50+ GHz
- Full band versions available
- Fast switching times
- SPST & SPDT
- Coaxial and waveguide models

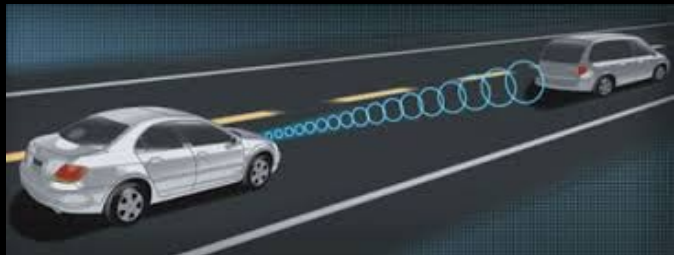


Switch Model	Frequency Range	Insertion Loss/ Isolation	Power Handling
HSWM4201/2.9-320 SPST	18.0-26.5 GHz	1.0 dB / 35 dB	100 mW
HSW2801 SPST	26.5-40.0 GHz	1.2 dB / 30 dB	100 mW
HSWM22801/2.9-239 SPDT	26.5-40.0 GHz	1.6 dB / 23 dB	100 mW
HSWM22801/2.9-309 SPDT	26.5-40.0 GHz	1.8 dB / 30 dB	10W
HSWM22801-324	26.5-40.0 GHz	2.0 dB / 38 dB	10W

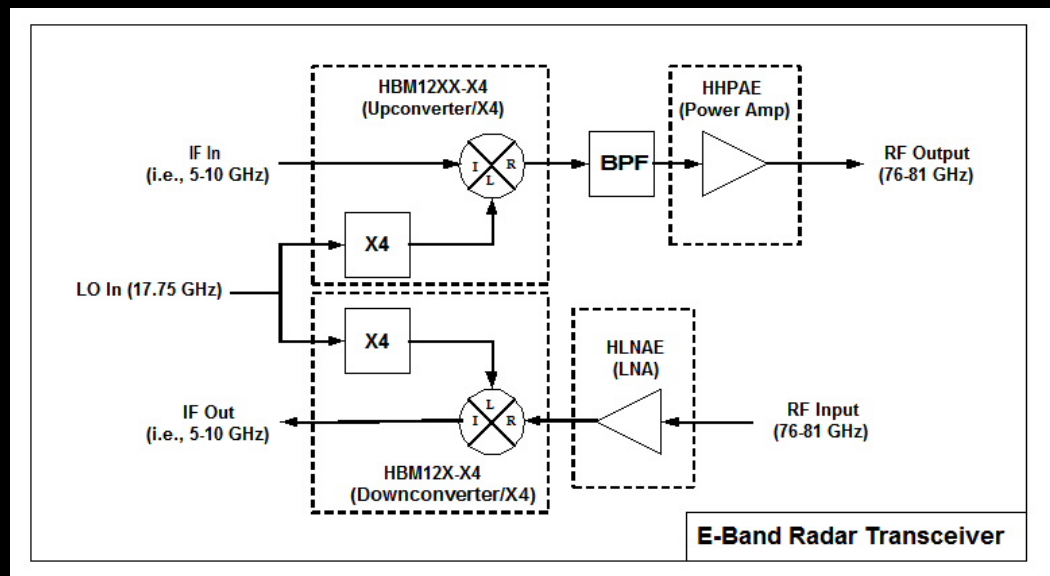
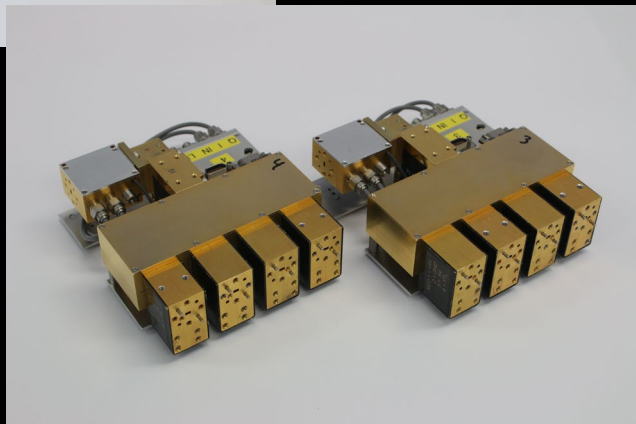
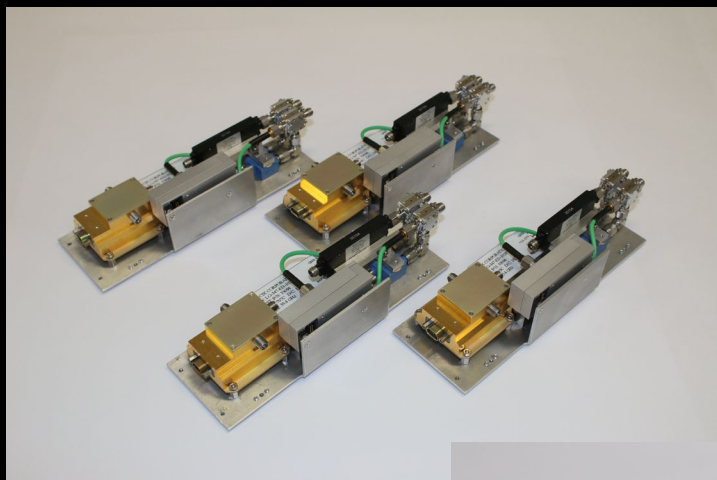


Partial Listing

Auto Radar Test Solutions



- Up/Down Converters, including Subharmonic
- Low Noise and Power Amps
- Isolators, Switches, Power Splitters & more



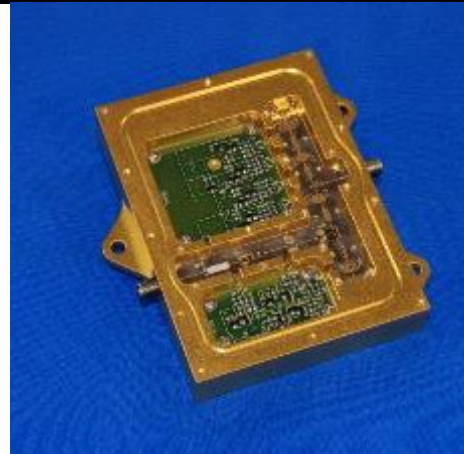
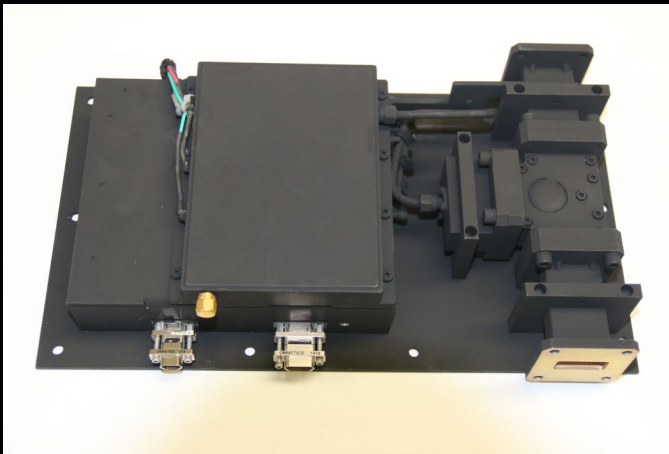
Example of Test Set for Auto Radar MMICs or Sensors

Components for 5G Development & Testing

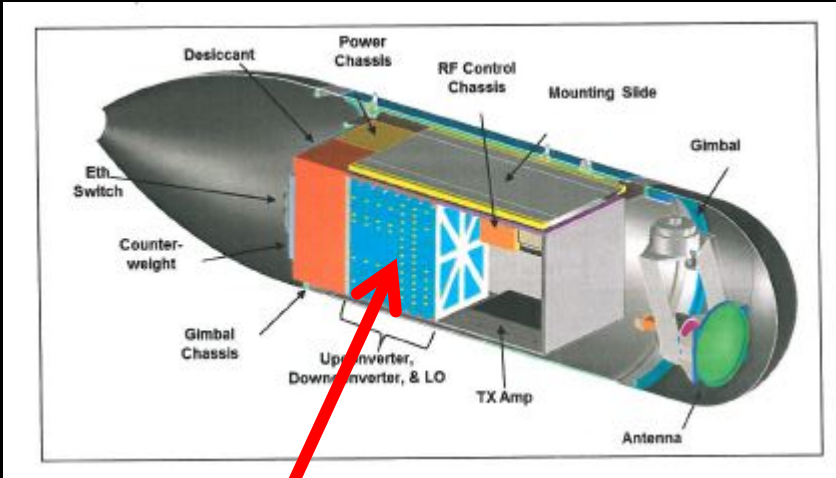
- Coaxial & Waveguide LNAs
- Coaxial & Waveguide Power Amplifiers
- Active Frequency Multipliers
- PIN Diode Switches (Up to 10W)
- Broadband Digital Attenuator
- Isolators & Circulators

Radar Front End Capability

- Provided integrated subsystems for military customers, think tanks and commercial ventures
- Transmitters, receivers, transceivers, block upconverters and test sets from a few GHz to 100+ GHz, are all within our capability and experience.



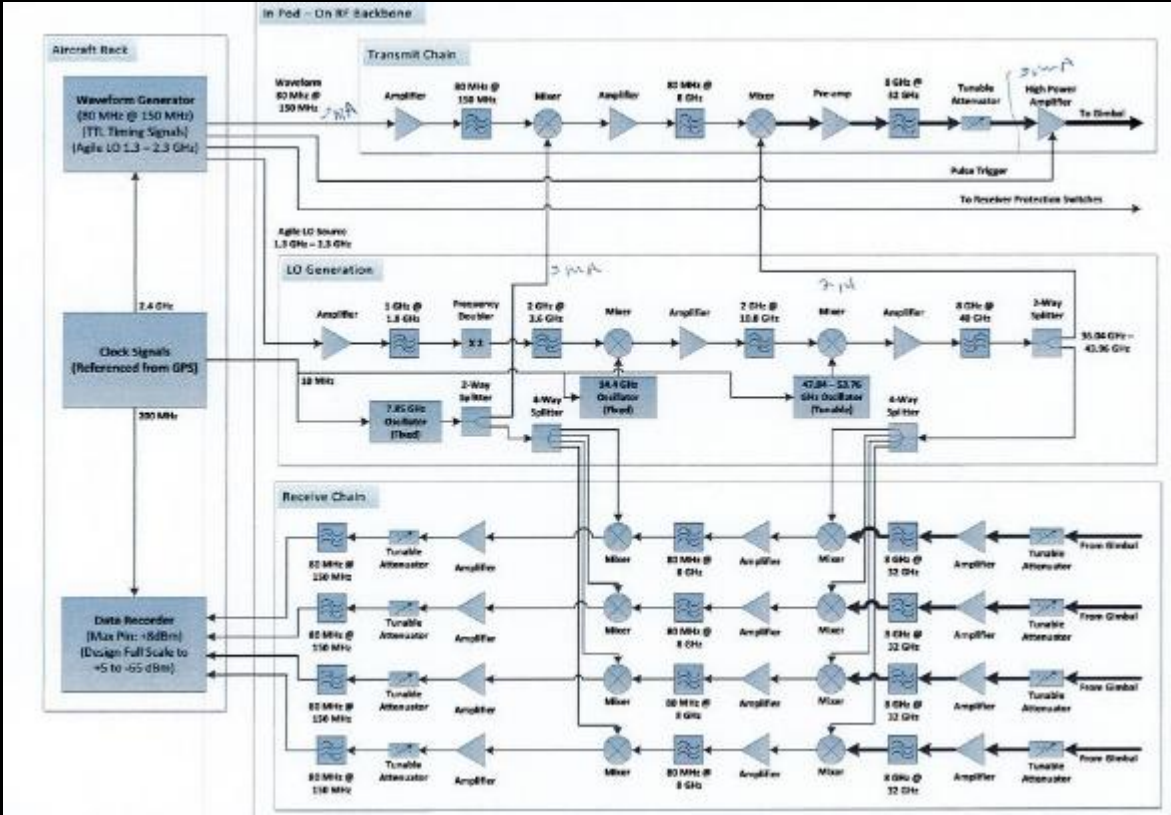
Multi-Band Radar



POD Mounted Airborne Application

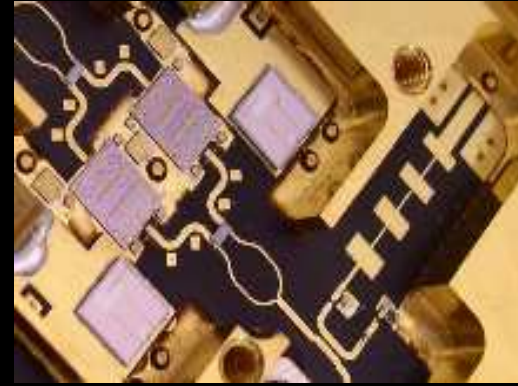


8 Different Electronics Trays



System Block Diagram

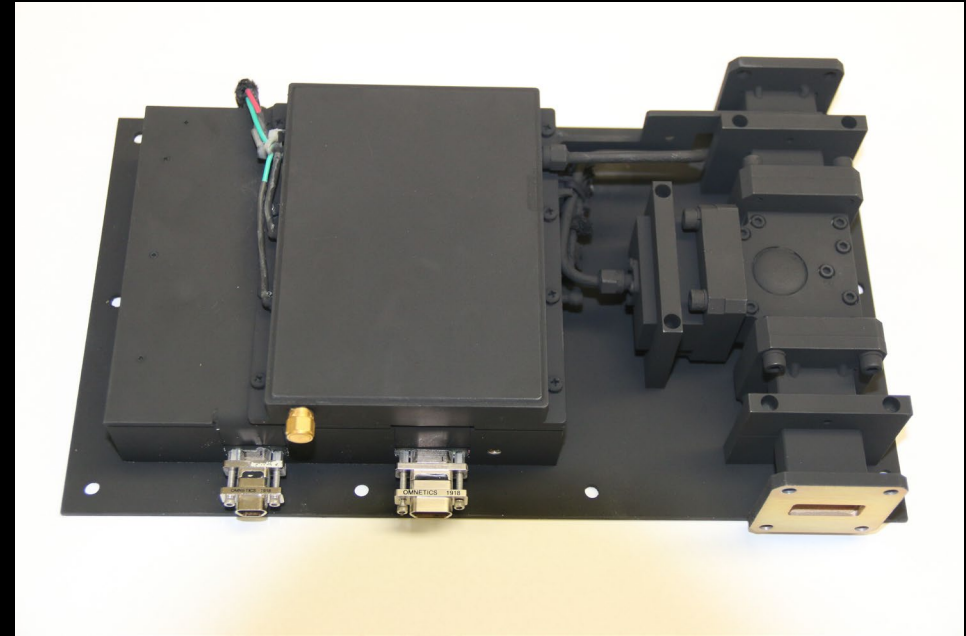
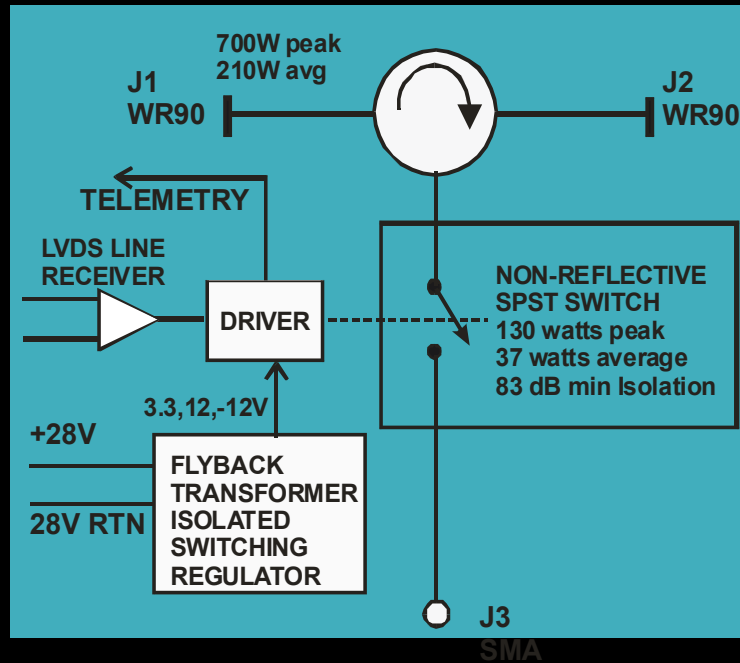
Ka-Band Landing System Transceivers



- Sole source for flight and ground-based transceivers to support automatic landing of the Shadow 200 UAV
- Highly integrated ground-based unit features 17 individual MMW and IF circuit functions, including 3.5W Ka-Band power amplifier and SP4T switch matrix
- Customized quality system put in place for customer
- Highly interactive engineering development with customer
- Typical current ~ 300 mA
- Voltages: +15, +7, +5, -5, -2 and -15V



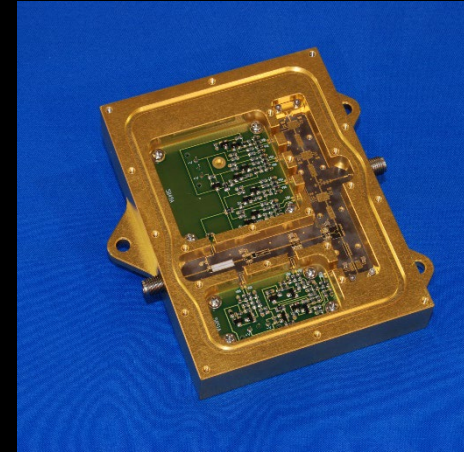
X-Band Integrated Front End – Space Environment



Integrated Front End (IFE)

94 GHz Pulsed Radar Front End

- Developed for helicopter landing radar with imaging capability. (Blackhawk test vehicle)
- Common LO distribution/upconversion packaging using MMIC/microstrip technologies.
- Waveguide downconvert mixer used for its high compression point and input power handling capabilities, with noise figure within one dB of using a MMIC LNA. (30 dB power handling advantage)
- Separate transmit power amplifier so future power improvements would not affect main transceiver packaging.
- Phase 1 (breadboard) and Phase 2 (pre-production) units flew in demonstrations for the U.S. Army and advanced the program to the next phase.



LO/Upconverter

Specifications:

Frequency Range: 92.5 to 95.5 GHz

LO Input Frequency Range: 13.75 to 14.25 GHz

IF Output: 10 GHz +/- 300 MHz

Noise Figure: 7.5 dB at mixer input

Transmit power: +24 dBm at HPA output *

RF Interface: WR-10, UG-387/U-M

LO/IF Interfaces: SMA Female

W-Band Helicopter Landing System Transceiver

- Delivered several W-Band prototypes and pre-production units for helicopter landing systems.
- Subsystem also includes 250 mW power amplifier and high-power handling (>10W) Tx and Rx switches
- Highly interactive engineering development with customer



Prototype



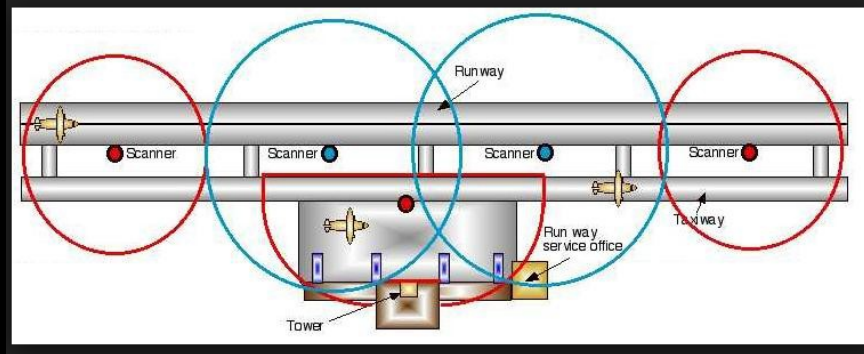
Production

94 GHz FOD Runway Radar

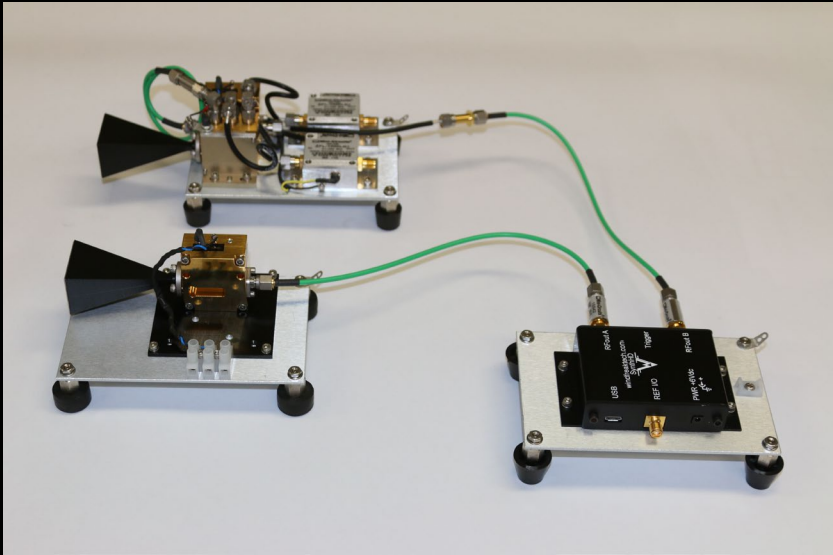
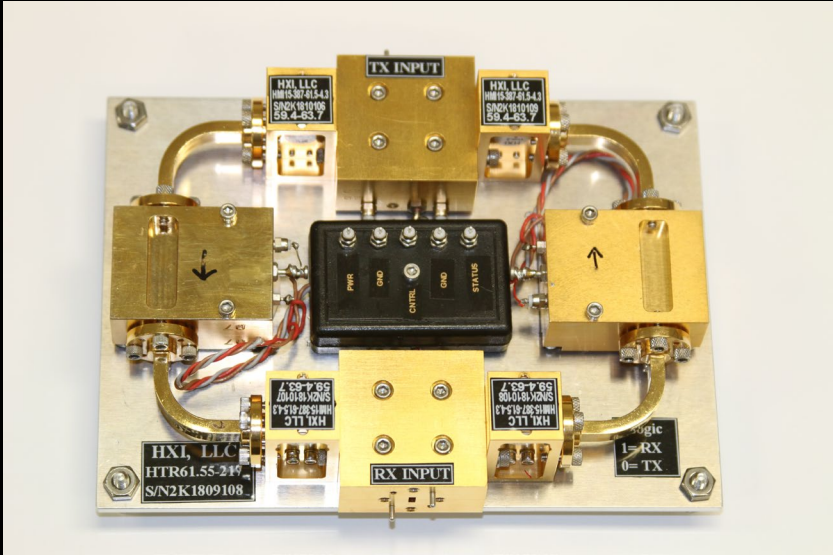
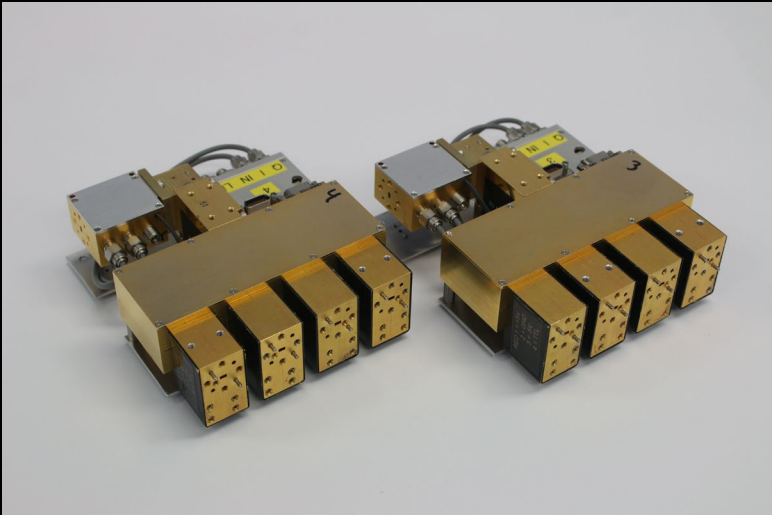
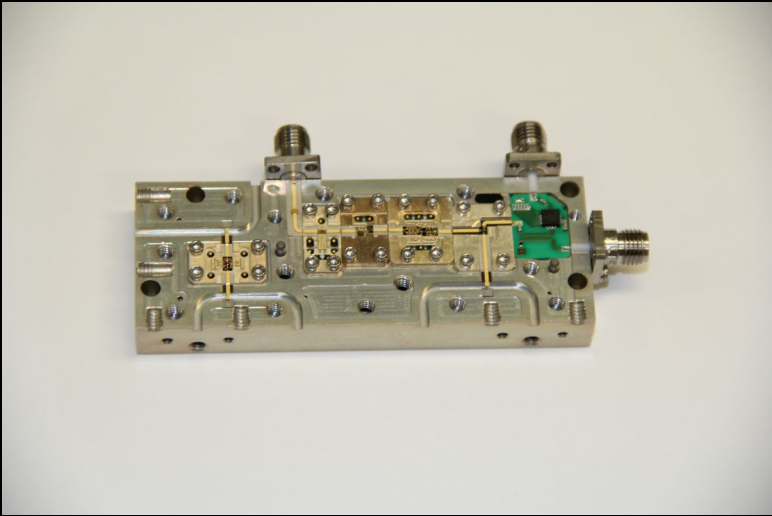


94 GHz Foreign Obstacle Detection (FOD) Runway Radar

- HXI has completed a design working with a foreign government technology development organization for a 94 GHz FOD radar to be used at airport runways.
- Dual aperture design with 4 x 1 aspect ratio antennas for accurate azimuth determination.
- DDS-based design with upconversion to 94 GHz and 2nd conversion for accurate IQ output.



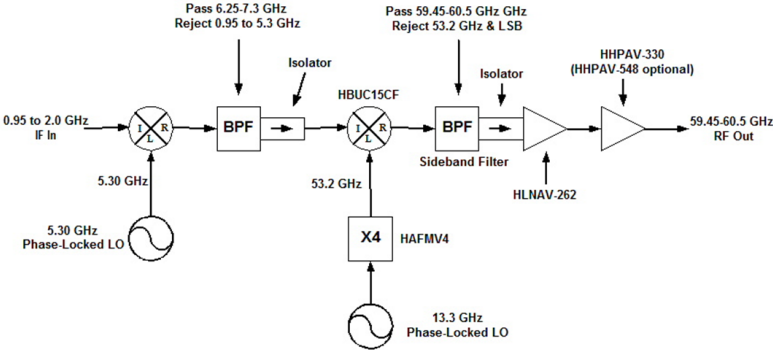
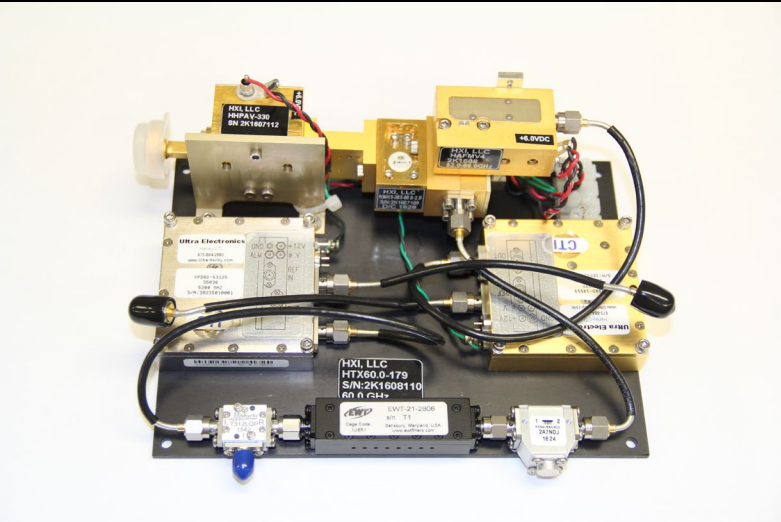
Other Custom Solutions



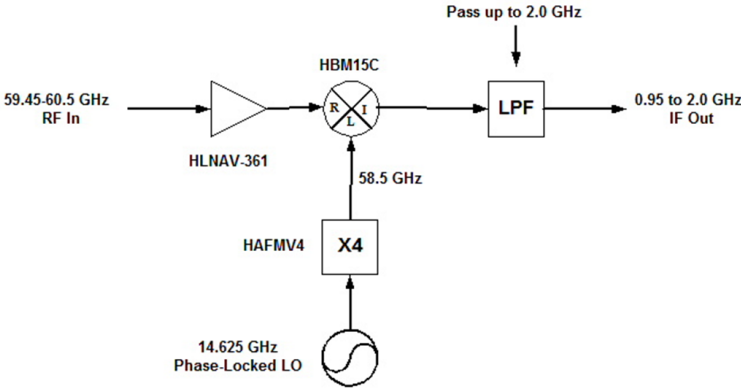
60 GHz Transmitter/Receiver Pair

Multiple Uses

- Propoagation Studies
- Material Characterization



60 GHz Transmitter



60 GHz Receiver

Custom-Configured Low Latency Radio Links

- Many radio link applications require performance or characteristics that off-the-shelf radio links just cannot provide
- HXI can modify existing radio designs or design new radio links at MW or MMW frequencies for specialized applications
- Transmit power, antennas and packaging can all be customized
- HXI has relationships with many GaAs and GaN foundries, allowing us to tailor performance and cost for individual customers. E-Band MMIC LNAs with 2 dB noise figure and MMIC power amplifiers exceeding 1/4 watt can be implemented.
- Support services include installation/alignment training, range calculations and site installation recommendations

We Don't Build Our Radio...We Don't Build Their Radio

HXI Builds YOUR Radio!



Customizable Features/Services:

- ✓ Range Optimization
- ✓ Ridiculously Low Latency (<2 nS)
- ✓ Analog Versions
- ✓ Antennas & Mounting
- ✓ Alignment Tools
- ✓ Niche Applications
- ✓ Installation/Alignment Training on our Outdoor Range
- ✓ Range Calculations & Site Installation Recommendations
- ✓ Consulting Services For Single Link & Multiple Hop Installations

We Also Offer:

- ✓ E-Band Interference Testing Tool
- ✓ Bench-Top Link Test & Qualification Equipment

Yes, we have standard radios in E-Band and at 60 GHz, but aren't there times when the standard just won't do? When you need a radio for a unique purpose, choose HXI to configure your link.





Millimeter Wave Products

A Wholly-Owned Subsidiary of Renaissance Electronics & Communications, LLC

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Technology Roadmap

- Converters: Up and down (Ka-band) for Satcom applications
- Miniature and broadband Active and passive components for 5G applications (sub 6 to MMWave)
- Amplifiers – Millimeter wave from Ka band to E-band
- Surface Mount circulators and isolators reaching 50 GHz

Engineering

RF and Microwave Circuit Simulation

- ANSOFT HFSS
- Microwave Office
- Eagleware
- Internally Developed Software

Multipactor Analysis

- ESA/ESTEC
- Internally Developed Software

3D Design and Modeling

- Solidworks
- Autodesk Inventor

Mechanical and Thermal Stress Analysis

- Autodesk Algor

Access to Clean Room Assembly

- Access to Class 100,000 Clean Room
- 10 Assembly Stations
- J-STD 001 and IPC Certified Assemblers and Instructors
- FOD, FOE and ESD Awareness Programs

Access to Environmental Lab

- Thermal Shock and Temperature Cycle
- Temperature-Altitude
- Thermal Vacuum
- Particle Impact Noise Detection
- Mechanical Shock and Vibration
- Corona
- Multipaction
- Humidity
- Gross Leak
- EMI
- DPA

Capability to meet the following specs:

- Screening: MIL-PRF-38534 Table C-III Passive Element Evaluation
- Specs:
 - MIL-STD-202 Environmental Test Methods (i.e., Vibration, Shock, etc.)
 - MIL-STD-810 Environmental Test Methods (i.e., Temperature Test, Vibration, Shock, etc.)
 - MIL-STD-461 Electromagnetic Interference
 - MIL-STD-883 Environmental Test Methods for Microcircuits, i.e. Barometric Pressure, Vibration, etc.
 - MIL-I-45208 Inspection System Requirements (cancelled) (using AS9100C)
 - MIL-STD-31000 Technical Data Package
 - MIL-Q-9858 Quality Program Requirements (cancelled) (using AS9100C)
 - ISO 17025 Calibration Standard
 - ESCC 3202 European Space Components Coordination (Ferrite Microwave Components)
 - MIL-R-10509 Resistor Fixed Film (high stability)

Space Grade Capability

- MIL-PRF-55342 is the military performance specification for surface mount and wire bondable, fixed film chip resistors.
- MIL-PRF-32159 is the military performance specification for surface mount and wire bondable zero ohm resistors.
- MIL-PRF-55342 resistors and MIL-PRF-55342 zero ohm resistors are used in mission critical avionics, satellite, space, biomedical, and military applications.
- MIL-PRF-55342 includes two screening levels: established reliability failure rate level maintained on the basis of life testing, and space level T which includes 100% power conditioning and a full Group B.
- Product levels M, P, R, S, U & V are established reliability (ER) failure rate products. ER products are subject to Group A, B, & C testing. Group A is performed on a manufacturing lot basis. Group B is performed on an inspection lot basis for ER levels M, P, R, & S and on a production lot basis for ER levels U & V. Group C is performed on an inspection lot basis for all ER levels.
- Product level T is a space level resistor that includes power conditioning (burn-in) on a 100% basis as part of Group A to identify and screen any infant mortality defects from the manufacturing lot. Group B is performed on a production lot basis and Group C is performed on an inspection lot basis for product level T.

Testing

Group A Inspection

- Precap Visual Inspection
- 100% Thermal Shock
- 100% Power Conditioning (T level only)
- 100% D.C. Resistance
- 100% Visual (T level only)
- Visual Inspection
- Solderability
- Resistance to Solvents (marked parts)

Group B Inspection

- Resistance Temperature Characteristic
- Short Time Overload
- Mounting Integrity

Group C Inspection

- Life Test
- Thermal Shock
- Low Temp Operation
- Resistance to Soldering Heat
- Moisture Resistance
- High Temp Exposure

Our Quality Policy

“At Renaissance Electronics & HXI, we are customer centric. This is at the core of our belief. Our primary goal is to ensure we meet or exceed the needs of our customers by providing high quality, reliability products/services on time and at a competitive price, while maintaining total conformance to all appropriate customer and regulatory requirements.”

President and CEO

Our Objectives in Alignment with our Policy

We achieve this by:

Having an engaged organization with strong leadership, effective tools and a culture of continuous improvement.

Taking ownership for our business processes/systems via the identification of risk and improvement opportunities.

Providing exceptional service to our customers.

Effective Quality Management System



Management System

📁 [Quality Manual](#)

📁 [Procedures](#)

📁 [Work Instructions](#)

📁 [Forms/Checklists](#)

📁 [External Documents](#)

📁 [Records Table](#)

📁 [Templates](#)

Quality Policy

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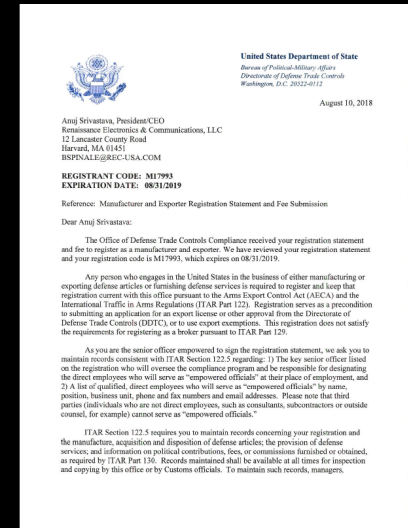
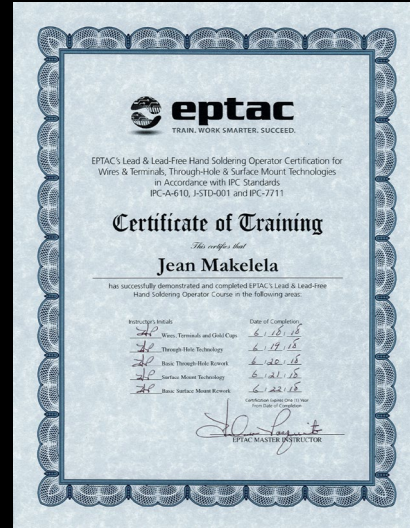
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- Providing exceptional service to our customers.

(See [Dashboard](#) for specific targets)

Industry Accreditations

- AS9100A & ISO 9001:2015
- J-STD-001 Class 3 Workmanship/Soldering
- IPC-A-610 Acceptability Standards
- ITAR Registered



Thank you!!