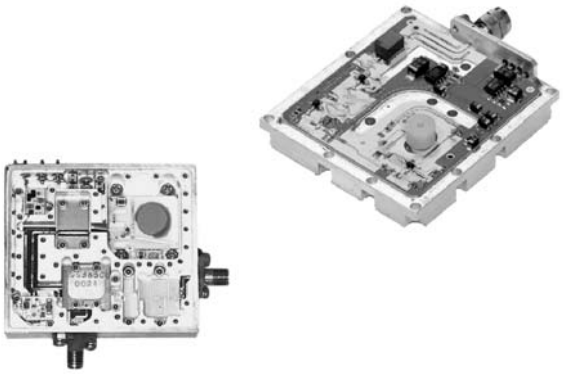
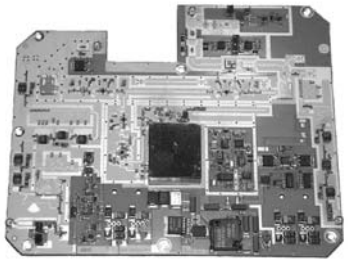
Microwave Integrated Circuits and Multifunction Assemblies (MIC and MFA)



MIC Microwave Integrated Circuit	a higher-order miniaturized device that utilizes micro-assembly techniques
MFA MultiFunction Assemblies	a higher-order device that utilizes combinations of assembly approaches



While renowned in the Industry for our catalog passive and active coaxial components, Narda has been providing higher-order assemblies to fulfill custom application needs in the military and commercial marketplaces for decades. Our heritage and more recent MIC assemblies have been, and continue to be utilized in the most demanding of military environments. In the commercial and wireless arenas, our MFA products have provided unique solutions in applications at lower frequencies (800-2500 MHz) through Ka Band.

Regardless of the requirement, the volume production of reliable and performance oriented MIC or MFA devices requires considerable resource and effort. The entire evolution of the product, from the initial dialog with the customer through its layout, assembly, and final test/inspection, demands a mature and carefully controlled process with the correct mix of facility and expertise. A superior final product is a direct result of the process, tools and talent available to the manufacturer in its production. At Narda, we have perfected this process, and those MIC or MFA assemblies manufactured in our state-of-the-art clean room, or elsewhere within our facility, continually live up to the standards of reliability and performance that exemplify the Narda name.

Since your ultimate goal in outsourcing the manufacture of integrated products is to properly balance *your* available resources, be assured that we have all the tools and expertise required to minimize your efforts, maximize your system performance, and add to the overall success of your organization. As illustrated by the tables, photographs, schematics, and narrative that follow, we have an extensive capability to package custom higher-order RF assemblies for your requirements. With 50 years in the RF and microwave business, and this, our 30th product catalog, we look forward to serving your MIC/MFA needs as they arise. Please contact your local Narda Sales professional for additional information.

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Electrical Engineering Design Equipment and Tools

Hardware/Test Equipment

- 40 GHz Vector Network Analyzers
- 65 GHz Vector Network Analyzer with Converter Group Delay Measurement Module
- 26 GHz Phase Noise Measurement System
- 12.6 GHz VCO/PLL Signal Test System
- PCS Band Passive Intermodulation Test System
- Cellular Band PIM Test System
- High Power Test Capability (200 to 600 W CW, 800 MHz to 18 GHz)
- High Power Pulser (peak power test system)
- Fiber Optic Pattern Generator (with 2.67 Gb/s modules)
- DCA Oscilloscope with Dual 50 GHz Electrical Channels
- Spectrum Analyzers to 50 GHz, Counters, Power Meters, Noise Figure Analyzers, Network Analyzers

Major Software Packages

- **Design System** with multiple linear, nonlinear, convolution, system, and transient simulators. This schematic, entry-based package is the basis for Narda's high frequency component and module development. Narda has an exhaustive library of vendor and proprietary simulation data. The use of this data in conjunction with the software program optimizers and Monte Carlo analysis tools, results in excellent first-build success.
- **High Frequency Structure Simulator (HFSS)** with optimizer module. This software is a Maxwell equation solver for arbitrary, three-dimensional structures. When paired with a high performance PC, this system allows electromagnetic field solutions to circuits that do not conform to the standard elements of circuit simulators. This tool has a particular use in solving unusual coupling or filtering topologies, and for identifying structure leakage or moding.
- **Maxwell Simulator** with optimizer module. This software is used to solve and simulate the magnetic fields for applications such as electro-mechanical switch operation. With this tool, actuator coils can be designed for optimal magnetic switching strength for a given DC power requirement.
- **Design Tools** are used to create schematics and run transient simulations on those schematics. A key benefit is to allow the engineering staff to set up representative schematics with bill-of-material information, for prototype builds which can be phased seamlessly into the production documentation system.
- **Transient Simulator** is a convenient means of performing a quick simulation of a prototype analog circuit. It's ease of use, and substantial vendor component library has made it a very useful part of Narda's quick development capability.
- **Mechanical CAD Software** enables Narda's engineering staff to draft the mechanical sketches needed to fabricate prototype materials or packages. This information can then be transferred seamlessly to drafting tools used to generate the complete production print package.
- **Automated Test Equipment (ATE)** development package. The primary advantage of this software, besides its ease of use, is the incorporation of a wide range of software drivers needed to control microwave test equipment.
- **Component Synthesis Software, Design Calculators, System Budget Simulators, and Spreadsheet Calculations** are also used to provide Narda engineers with critical advantages in developing high performance components and systems in minimal time.

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Mechanical Design Capabilities

Personnel	• Staff of senior designers dedicated to RF and Electromechanical design from DC through 60 GHz. • Interconnect expertise, combined with specialized (internal /external) packaging techniques, enable superior RF performance, manufacturability, and reliability.
Available Tools	• Utilizing Three Dimensional Modeling capabilities, “soft” prototypes can be created during the design phase. As a physical aid in the design process (from initial evaluations to final design reviews), the use of soft prototyping facilitates the selection of tooling and fixturization required for production. • Advanced thermal and structural analysis tools are also utilized, where required. • Schematic/BOM capture and auto routing aid in the design of complex multi-layered PCB assemblies, utilized in Narda’s MIC and MFA production hardware
Advantages Gained	• Outstanding capability in design of High Frequency structures utilizing low cost SMT approaches, and the integration of SMT with traditional wire/ball bond interconnects and transitions.

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Quality Management Program

Quality System Heritage	• Approved Quality System in place since 1954 • MIL-Q-9858 Military Quality System Heritage • MIL-I-45208 Inspection System Heritage • MIL-STD-45662 Calibration System Heritage • US Government (DCMC) Quality Resident on Site
Quality System Status	• Registered to ISO-9001 in December 1996 • Registered by NQA (UKAS and ANSI-RAB) • NQA Surveillance Assessments Twice Yearly • System Transitioned to ISO 9000: 2000 in May '03 • QA System Approved by 100+ Customers
Design Conformance Capabilities	• Design Conformance Testing • Integrated Design Reviews • Product Reliability Testing • Specialized Testing including Environmental Testing • Test Procedures are Approved and Controlled
Integrated Quality Processes	• Review of all Bids and Proposals • Review of Orders • Preparation of Reliability Predictions and CDRLs • Investigations of Product Returns
Inspection Process	• In-Process Inspection – Documented QA Plans and Procedures – Workmanship Verified by IPC-A-610 Certified Solder Inspectors – Data Collected and Reported Electronically • Supplier Quality Assurance – Source Inspection – Supplier Surveys – Supplier Rating System • Final Inspection – Verifies Product Performs to Specifications – Samples of Product Receive ATP Testing – Workmanship Inspected IAW Contractual Requirements • Audit Inspection – Products Sampled and Tested by QA
Customer Satisfaction (Use of Metrics)	• Customer Ratings Reviewed and Evaluated • Warranty / Non-Warranty Returns are Analyzed • Evaluation of Employee Feedback and Responses

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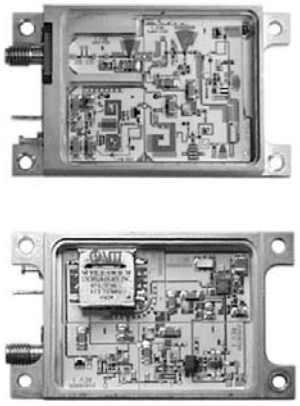
MIC and MFA Product Capabilities

The following sections provide examples of our MIC and MFA manufacturing capabilities. With few exceptions, the products within this listing are for illustrative purposes only. The applicable products will not be, nor are they intended to be, for small quantity "off-the-shelf" catalog requirements. For assistance in the development of an MIC or MFA product to suit your application, please contact your local Narda Sales professional.

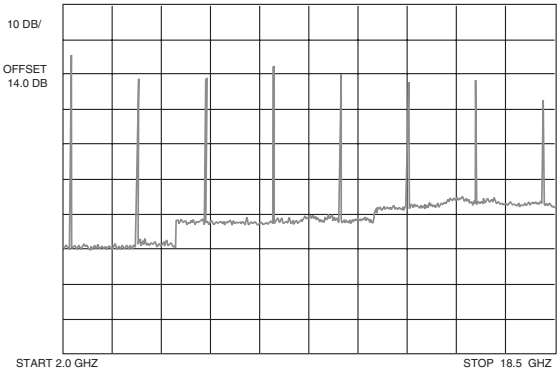
MIC Assemblies:



2-18 GHz

Comb Generator Assembly

- **Phase-Locked VCO Fundamental Frequency @ 2 GHz**
- **Maximum Spurious Signal Level -60 dBC**
- **Exceptionally Low Phase Noise**
- **Shaped Power Spectrum**
- **P0 @ Fundamental Typically +5 dBM**
- **-54° to +95°C Operation**
- **Ruggedized for Military Application**



Sample Output Spectrum

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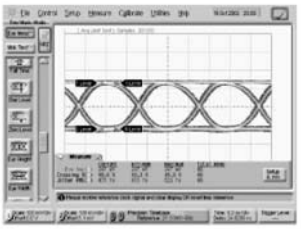
MIC and MFA

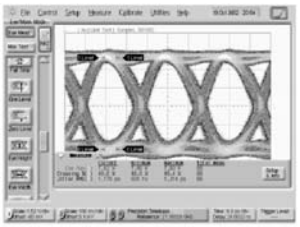
High Performance

Lithium Niobate Modulator Driver MIC Assembly

- Ultra-Broadband RF Amplifier 30 kHz - 43 GHz
- Supports Input Data Rates of up to 44 GBPS
- 7.8 Volt Typical Output Amplitude
- Exemplifies Narda High Frequency Packaging Capabilities
- Applications for 40 GBPS (OC-768) Fiber Optic Data Networks



Input Signal



Output Signal

Local Oscillator Assembly

- Rugged Construction
- Surface Mount Design
- Superior Phase Noise Performance
- Maintains Lock Under Severe Shock
- Ease of Manufacture, Minimal “Hands-On”

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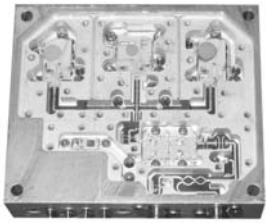
Heritage MIC Assemblies:

Switched Local Oscillator



Up Converter

- Military Airborne Requirement
- Integrates Passive and Active Technology Platforms
- Hermetic, Laser-Sealed Package
- Ruggedized for Harsh Military Environment

High Power Coupler/Amplifier Detector

- Military Airborne Requirement
- Integrates Passive, Active and Analog Platforms
- Hermetic, Laser-Sealed RF Cavities
- High Power Input
- Provides Selectable High Speed Switching of Detected Output

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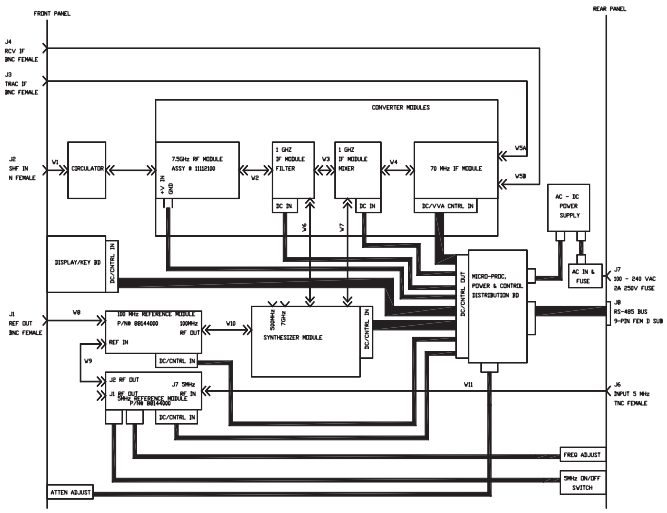
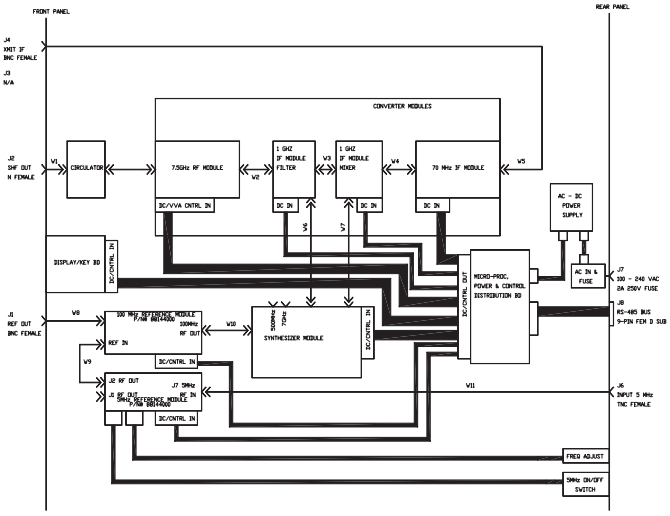
Multifunction Assemblies (MFAs):

Satellite Terminal Converter

- **Double Conversion Architecture**
- **Provides Wide-Band Frequency Translation with Low Phase Noise**
- **PLDRO with Low Noise, VCO Based PLL Synthesizer Offset Loops**
- **Stable, Low Noise LO Signals – Replaces YIG Based LOs**
- **SMT Construction**



Down Converter



Up Converter

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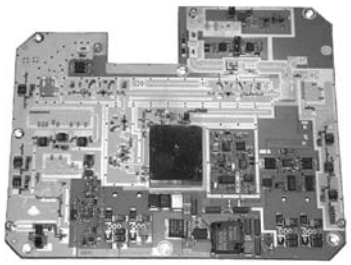
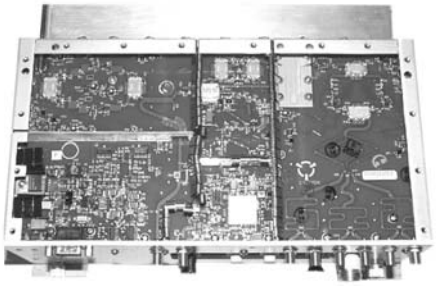


26.4 GHz Single Board Transceiver

- Designed for Customer Premise Equipment, LMDS Application
- Surface Mount Configuration for Ease of Manufacure
- Demonstrates Packaging Expertise for High Frequency, Higher Order Assemblies
- Minimal Hands on Alignment Required, Ideal for Volume Manufacturing
- Heart of Performance is Based on Narda PLDRO Development IP

Test Radio Switch Panel

- Multilayer PCB Design
- Surface Mount Construction
- Dual Frequency Conversion
- Custom Aftermarket Wireless Solution



Receiver Multicoupler

- Aftermarket / OEM Custom Front End Solution
- High Rejection Duplexed Filtering
- Low Noise Amplifier
- Configurable Output Arrangement
- Built-in Alarm / VSWR Monitoring Capability

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Additional MIC Capabilities (Heritage Products)

J-Band, Drop-In Local Oscillators

This unit is one of a family of high-powered, stable, local oscillators for a radar warning receiver application. Each oscillator is a DRO and is integrated with a buffer amplifier. The package is designed for integration into motherboard assemblies.

H-Band, Modulated LO and BIT Oscillator

This unit is used as a local oscillator in a radar warning receiver and doubles as a BIT oscillator for the system. The assembly integrates a DRO with an isolator, coupler detector, and PIN modulator. The modulator provides a 70 dB on/off ratio.

F-G Band Dual LOs

Each unit in this series contains two oscillators offset by about 150 MHz and is used in a dual down conversion EW processor. The assembly contains the two oscillators, two isolators, and detectors for BIT. This family of units covers the 3 to 6 GHz frequency range.

J-Band Dual Output Dual LO

This unit serves as a local oscillator for a radar warning receiver and provides two distinct frequencies in J-Band. Each DRO oscillator is amplified and split to provide two outputs at each frequency. The unit is packaged in a drop-in case with removable connectors. Frequency stability of 15 MHz is offered with minimum output power of +18 dBm over the -54 to +95°C operating temperature.

J-Band Switched Local Oscillator

This unit is a switched local oscillator for radar warning receivers. It contains three stable J-Band sources, a high isolation PIN switch, buffer amplifiers, and appropriate control electronics. The unit is required to select a frequency with an accuracy of 1 MHz of its final value within 1 microsecond. (Fig. 1)

J-Band High Power Monitor and Control Assembly

This unit is used in an ECM system to monitor TWT power in J-Band and can handle CW power levels in excess of 50 watts. It contains a broadband directional coupler, broadband power divider, low-pass filter, single pole two-throw switch, a detector and baseband signal processing. Its size is 2¼" x 2¼" x 1". (Fig. 2)

E-G Band IF Switching Network

This unit is used in an EW receiver IF for routing receive signals to various processing assemblies. It has a broadband microstrip unit which integrates four power dividers, four terminated switches, two directional couplers, and hybrid control electronics into a 2" x 2" x .22" package with removable connectors for motherboard insertion.

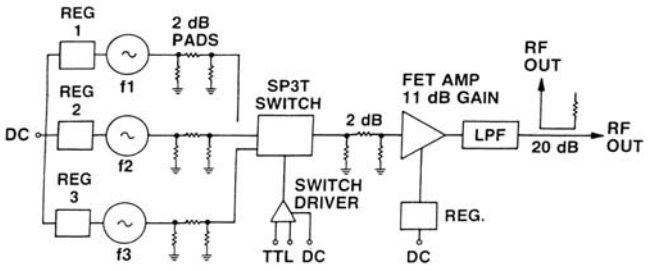

Figure 1
J-Band Switched Local Oscillaror

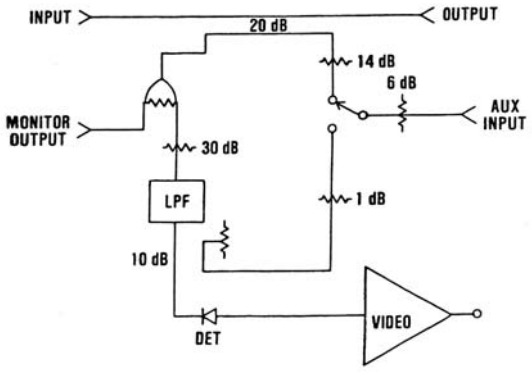

Figure 2
J-Band Coupler/Detecor Amplifier

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C-F Band Gain Control Assembly

This unit is used in an ECM transmitter to monitor and control the power output. It contains two directional couplers, a broadband power divider, a single-pole two-throw switch, and a single-pole three-throw switch. The construction is of stripline form. (Fig. 3)

E-G Band Threshold Detector Circuit

This broadband unit operates across the IF of a radar warning receiver. It contains a 4-bit attenuator, a temperature compensated GaAs FET amplifier, a detector circuit, and support hybrid electronics. It is housed in a drop-in package with removable connectors which is 1" x 1.5" x .22" in size.

J-Band Switching Network

This unit is used in a techniques generator for combining and switching various RF signals. It combines three broadband power dividers with a SPDT high-speed PIN switch. The package size is 2.5" x 2.5" x .7".

J-Band Gain Control Assembly

This unit is used to control transmitter gain in a ECM system. It combines a broadband, voltage-variable attenuator with a directional detector and hybrid control electronics. The unit is 2" x 2" x .5".

C-Band Switching Network

This unit is used in a techniques generator for combining and switching various RF signals. It integrates two directional couplers, two SPDT PIN switches, and an isolator into a compact assembly of 2.5" x 3" x .5".

J-Band Monitor and Control Assembly

This unit is employed in an ECM transmitter to monitor and adjust the output power level. It is a microstrip assembly containing a bandpass filter, two directional couplers, 5-bit attenuator, and a single-pole two-throw terminated switch. The unit is housed in a drop-in package with removable connectors with dimensions of 2" x 2" x .22". The attenuator provides a 45 dB dynamic range with 25 nanoseconds switching speed. (Fig. 4)

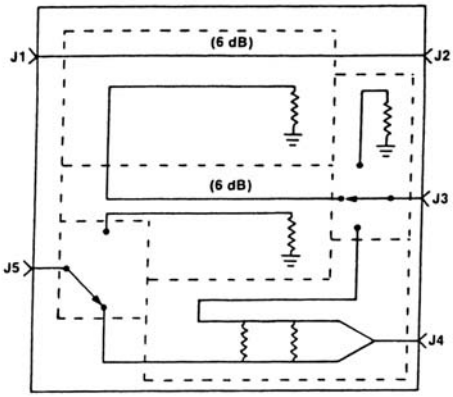

Figure 3
C-F Band Gain Control Assembly

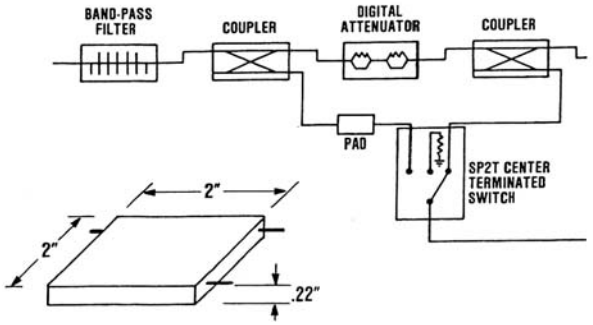

Figure 4
J-Band Monitor and Control Assembly

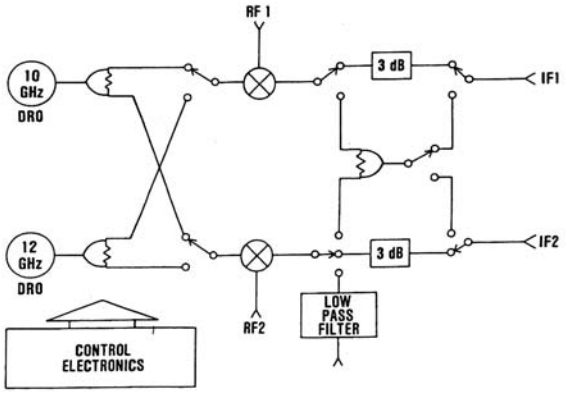

Figure 5
J-Band Dual Down Converter