



Capabilities, Capacities and
Developments: 2019



Introduction

- Established in 1992, and Incorporated as "OPHIR RF" in 1997.
- Privately Owned Small Business
- Currently staffed with 45-50 Employees
- All Design, Manufacturing, Sales and Support are done at Ophir RF's state of the art design facility in Los Angeles, California
- Known throughout the industry as a rock-solid, reliable designer and manufacturer of High Power RF Systems.
- Capabilities Include: Broadband & Band Specific, from 10kHz to 40 GHz, with power rating in excess of 23 KW
- Communications, EMC, Test & Measurement, Scientific Applications Radar and Electronic Warfare, TWT (Tube) Replaced with Solid State



*Ophir RF Facility Located
approximately 10 minutes
from Los Angeles
International Airport (LAX)*



Accolades and Achievements



- International Space Station (ISS) – Externally Mounted Communication Link.
- Supplied All Base Station Amplifiers for Shanghai Metropolitan Train Services.
- Supplied thousands of RF Amplifier Modules to the TMC Design Corporation WBJ, IED Jamming Program for US Army.
- On Approved Vendor List for multiple IED Jamming Programs throughout the US Military with Lockheed Martin Corporation, Exelis Corporation, and others.
- Awarded Contract to Design and Manufacture Solid State RFPA for the Raytheon AN/TPQ-37 RADAR.
- Standard Five Year Warranty on all Solid State Amplifier Systems.
- Awarded Contract to Design and Manufacture Solid State RFPA's for the Thales Smart S MK 2 RADAR.
- Awarded IDIQ contract by United States Navy to produce High Power RF Modules for the AN/ALQ 231 Jamming Pods.
- Awarded Contract to manufacture the RF Amplifiers for the Coast Guards' RF Distribution System (Deepwater Program). Currently in use onboard all new Coast Guard Cutters.
- Awarded Long Term Contract to manufacturer High power RF Amplifiers for the AN/RT-1828 SatCom Transceiver used worldwide by NATO forces.
- Established Service Center in Stuttgart, Germany in 2016
- Established Service Center in Beijing, China in 2018
- 2007 ISO-9001:2008 Certification.
- 2019 ISO-9001:2015 Recertification



Ophir RF Partners



Raytheon



ERICSSON

NOKIA

THALES



BAE SYSTEMS



Military	Wireless Telecom	Linear Accelerator Laboratories
United States Army	Motorola	Fermi National Labs
United States Navy	Ericsson	Stanford Linear Accelerator (SLAC)
United States Air Force	Nokia	Oak Ridge National Laboratories
United States Marine Corps	Glenaire	Jefferson National Laboratories
United States Coast Guard	General Electric	European Spallation Source
Sweden FOI (Totalförsvarets forskningsinstitut)	Qorvo	<i>Lund, Sweden</i>
France Ministere De La Defense	Sumitomo Electric Devices	<i>Bilbao, Spain</i>
Canada Royal Navy	Ampleon	CERN (Conseil Européen pour la Recherche Nucléaire)
Prime Defense Contractors	EMC Laboratories	Others
IAI (Israeli Aerospace Industry)	Element	Volvo
Thales	Intertek	QualComm
Saab	RISE	Nasa
Lockheed Martin	NTS	Royal Canadian Mounted Police (RCMP)
Harris	Toyota	Federal Bureau of Investigations
Northrop Grumman	EMP Tronic	Cobham
Raytheon	EMC Services	ViaSat

HARRIS



NORTHROP GRUMMAN

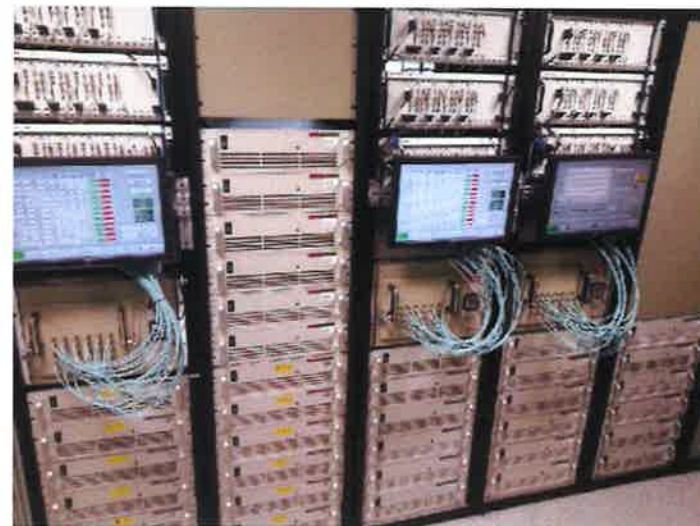


Fermilab



Applications

- Test and Measurement
 - Semi Conductor Testing
 - This can be companies making
 - Integrated Circuits
 - Pin Diodes
 - RF Semi Conductors
 - LDMOS
 - GaN
 - GaAs
 - Ophir RF Customers include:
 - NXP
 - Freescale
 - Cree Semiconductor
 - RFMD/Triquint/ Qorvo
 - Nokia
 - Ericsson



Applications

- Communications
 - Mobile Phone Communications
 - Success Story
 - Glenaire Corporation
 - Shanghai Metro System; Base Station Repeater Amplifiers
 - Military Communications
 - Success Story
 - ViaSat Corporation
 - AN/RT-1830 SatCom Transceiver
 - Exelis Corporation
 - Coast Guard RFDS
 - First Responder Communications
 - Success Story
 - Motorola Solutions
 - UHF Trunked Radio for mobile digital communications for Police and Fire



Applications

- Electronic Warfare
 - This market can be broken into three categories:
 - Jamming
 - AN/ALQ 231
 - RADAR
 - AN/TPQ 37
 - SMART S MK II
 - Threat Simulation.
 - C4SIR (*Command, Control, Communications, Intelligence, Surveillance, and Reconnaissance*).



Applications

- EMC
 - The EMC market has shown significant increase in the last 5 years.
 - This market has traditionally accounted for about 10% of Ophir RF Annual Sales
 - Last three years this market has more than doubled into about 20% of Ophir RF Annual Sales.
 - Customers in this market are looking for highly linear class A amplifiers.
 - Ophir RF Products in this category are almost entirely class A.
 - These are the 52xx series of RF amplifiers



Product Ranges

❖ 0.01-250 MHz

- ❖ 25 Watts
- ❖ 75 Watts
- ❖ 100 Watts
- ❖ 250 Watts
- ❖ 600 Watts
- ❖ 1000 Watts
- ❖ 2500 Watts
- ❖ 5000 Watts





Product Ranges

❖ 1.5-30 MHz

- ❖ 100 Watts
- ❖ 500 Watts
- ❖ 1000 Watts
- ❖ 2000 Watts
- ❖ 5000 Watts
- ❖ 12,000 Watts
- ❖ 20,000 Watts





Product Ranges

❖ 1.0-1000 MHz

- ❖ 4 Watts
- ❖ 25 Watts
- ❖ 70 Watts
- ❖ 200 Watts
- ❖ 300 Watts
- ❖ 500 Watts
- ❖ 1000 Watts
- ❖ 2500 Watts





Product Ranges

– 700-6000 MHz

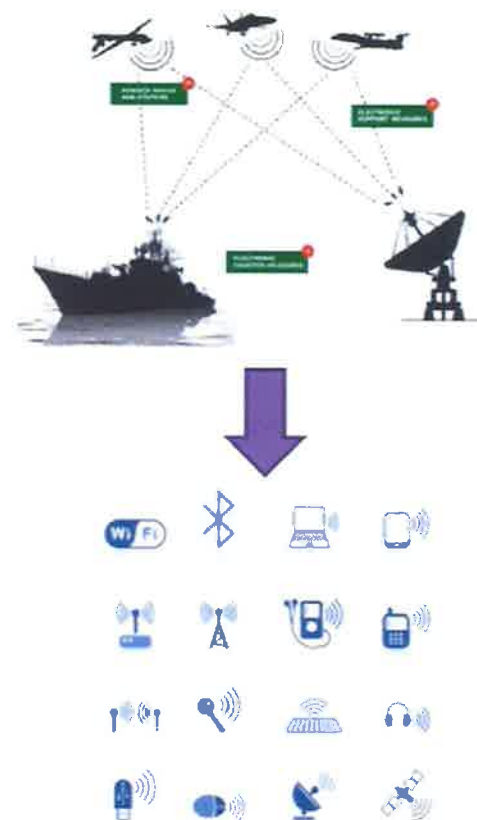
- 9 Watts
- 15 Watts
- 25 Watts
- 50 Watts
- 100 Watts
- 200 Watts
- 350 Watts

Need More Power?
Just Ask!



700-6000 MHz Product Line

- Ophir RF has been delivering the 0.7-6.0 GHz product line since 2007.
- These products were originally developed as IED (Improvised Explosive Device) Jammers.
- Since international conformity testing standards were updated to cover radiated immunity testing at 6GHz for all commercial electronic products, this line of amplifiers has seen a lot of use in Interference testing labs throughout the world (EMC).
- In addition most semiconductor labs are using Ophir RF amplifiers in this band to test their own RF power devices.
- The 0.7-6GHz band is particularly useful for testing RF power devices as the amplifier covers the GSM, UMTS, TDMA, EDGE, i-DEN, PCS, ZigBee, WLAN, Wi-Fi, EV-DO, WCDMA, LTE, 80211.b and Bluetooth frequency bands.





Product Ranges

❖ 6.0-18.0 GHz

❖ 10 Watts

❖ 25 Watts

❖ 50 Watts

❖ 100 Watts

Need More Power?
Just Ask!



Product Ranges

❖ 18.0-40.0 GHz

❖ 3 Watts

❖ 5 Watts

❖ 10 Watts

❖ 20 Watts

Need More Power?

Just Ask!



Engineering Capabilities

- High Power, Multi Channel Switched Filter Bank
 - Part of Ophir RF Model XRF669-001
 - 225-520 MHz, 400 Watt Power Handling Capability
 - 50dBc Out of band Rejection
 - 2 Filters, 4 Channels
 - 225-400 MHz
 - 400-520 MHz



Engineering Capabilities

Product	Market	Customer
XRF717	Military	-----

The Ophir RF Model XRF717 is designed as a GaN replacement for the unstable Bi-Polar technology used in the SMART S Mark II RADAR System.

- This Solid State RF Amplifiers uses Ophir RF Proprietary GaN Devices in all stages of RF Amplification, and generates over 1,500Watts peak power in S Band RADAR.
- In Addition, this RF System has integrated receive side with fast TR switching and excellent Transmit/Receive Isolation.
- Over 500 units in service worldwide



Engineering Capabilities

Product	Market	Customer
XRF747	Military	----

The Ophir RF Model XRF747 is designed as a solid state replacement for the aging tube technology used in the AN/TPQ-37 FIREFINDER RADAR System.

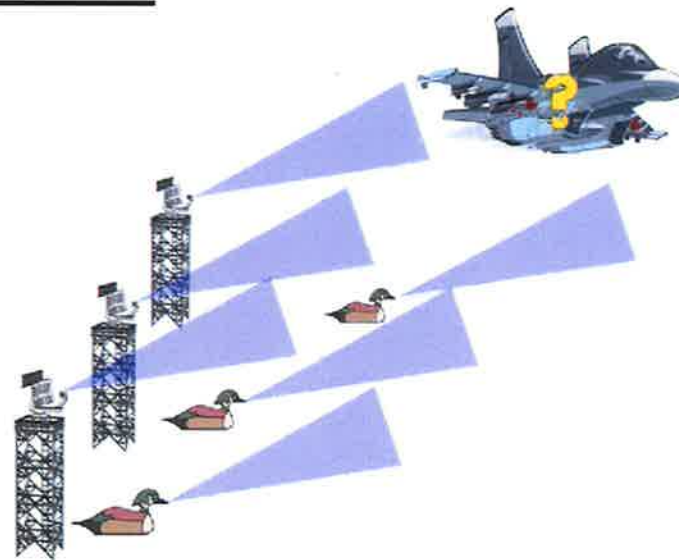
- This Solid State RF Amplifiers uses latest Generation GaN Devices in all stages of RF Amplification, and generates over 13K Watts peak power in S Band RADAR



Engineering Capabilities

Product	Market	Customer
XRF629	Military	----

The Ophir RF Model XRF629 is used as an amplifier in a Radar Decoy system currently sold through FMS to many US Allied countries. This amplifier generates a powerful S band signal that is closely tailored to mimic an air search radar





Engineering Capabilities

Product	Market	Customer
XRF917	Military	----

The Ophir RF Model XRF917 is used as an amplifier to amplify the 10MHz reference signal on many different radar platforms on multiple ship classes.



Engineering Capabilities

Product	Market	Customer
XRF638	Military	----

The Ophir RF Model XRF638 is designed as a Solid State RF Amplifier used in an Israeli C4SIR Airborne System.

- This Solid State RF Amplifiers uses GaN Devices in all stages of RF Amplification, and generates over 500 Watts C Band.
- This RF Amplifier is housed in a fully airborne qualified 1 1/2 ATR Chassis to 40,000 feet.



Engineering Capabilities

Product	Market	Customer
4039	Military	----

The Ophir RF Model 4039 is designed as a Solid State RF Amplifier used by the US and Allied Militaries as part of the AN/RT 1828 UHF SatCom Transceiver System.

- This Solid State RF Amplifiers uses latest Generation LDMOS Devices in all stages of RF Amplification, and generates over 250 Watts in the SatCom DAMA Bands.
- There are presently over 750 of these units in operation worldwide



Engineering Capabilities

Product	Market	Customer
XRF771 XRF773	Military	----

The Ophir RF Models XRF771 and XRF773 are high power broadband amplifier modules used in the AN ALQ-231 Intrepid Tiger (II) Airborne Jamming Pod. This jamming Pod is used by the Marine Air Ground Task Force (MAGTF) on AV-8B Harrier and EA-18 Growler platforms. Platform has been theatre proven since 2007.



Engineering Capabilities

Product	Market	Customer
XRF669-001	Military	----
XRF670-001		
XRF671		

As part of the United States Coast Guard's Deepwater program, the Exelis (Harris Corp) RF Distribution System, channels all VHF and UHF Communications to the various antennas on board USCG Cutters. This RFDS is powered by Ophir RF Amplifiers which include:

- Four Channel UHF Low Band Amplifier with integrated High Power Switched Filter bank
- Four Channel VHF High Band Amplifier with Integrated High Power Switched Filter Bank
- Two Channel VHF Low Band and UHF High Band Amplifier with integrated High Power Switched Filter banks





Engineering Capabilities

Product	Market	Customer
XRF818	EMC	

The Ophir RF Model XRF818 is designed as a Solid State RF Amplifier which is used by Boeing Corporation as a driver for a HIRF (High Intensity RF Field) System.

- *This RF Amplifier System is liquid cooled and generates over 5000 Watts peak power in the 80-1000 MHz band.*





THANK YOU FOR YOUR TIME!

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All Ophir RF Amplifiers are proudly
designed and manufactured in the
United States of America.

*Photo Taken Summer 2014; 40 Km West of Bishop,
California at an elevation of 3800 Meters*

Ophir RF has 4000 Amplifier Designs...



Training: Amplifier Module or Amplifier System?



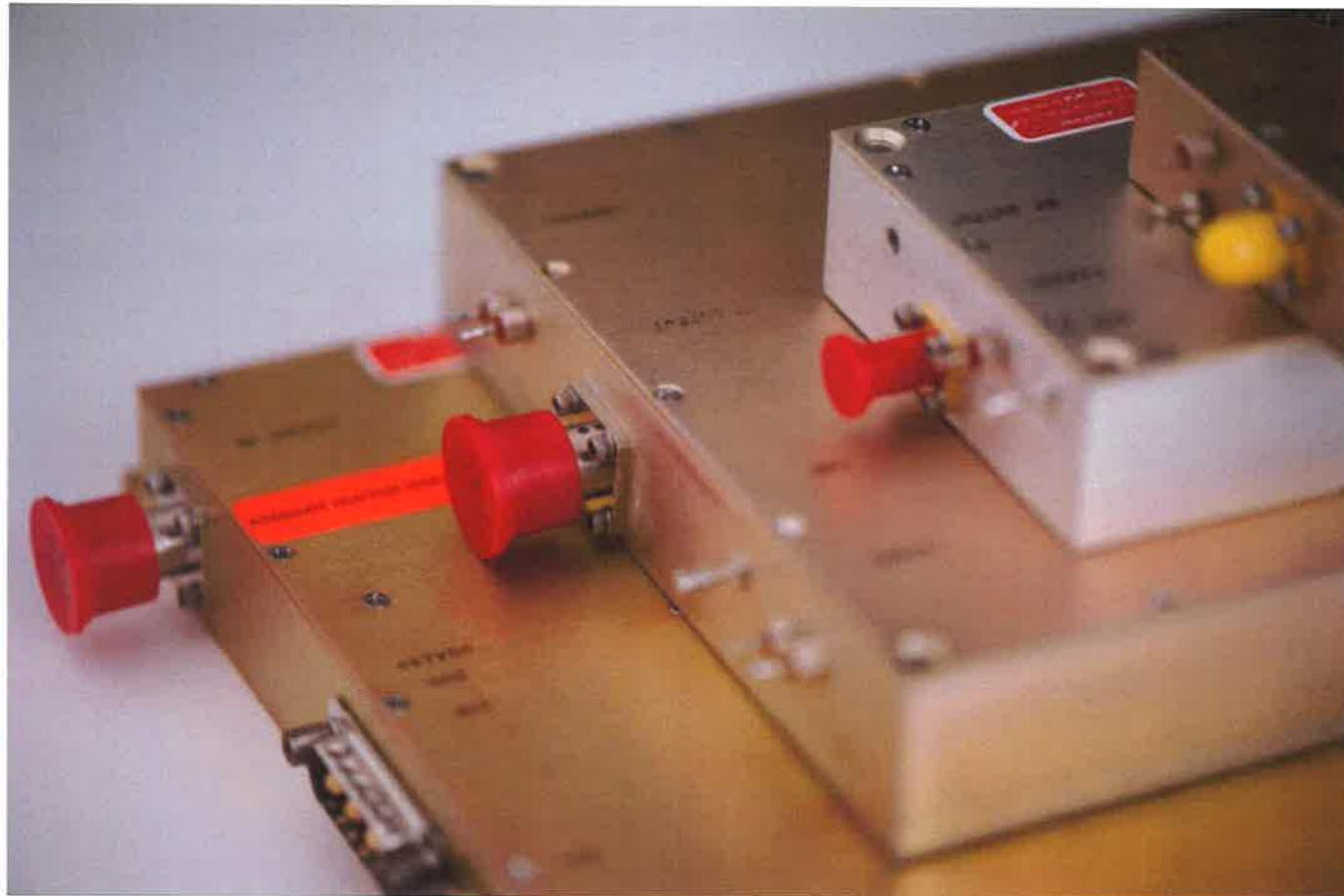
This is the most common question that Ophir RF asks the outside sales teams when a new requirement is sent to the factory.

Amplifier system or Amplifier module?

An Amplifier system is a (Typically) 19" rack mountable amplifier that includes heatsink, power supplies, cooling, control modules, all contained within a uniform housing.

An Amplifier module is just that, a module. Typically an amplifier module does not include external control circuitry. In addition an amplifier module does not include external power supplies or a means of cooling.

Amplifier Modules



Amplifier Module Salient Characteristics



- Input Output impedance: 50 Ohms
- DC Input: Various
 - Common Input Voltages
 - +48 VDC
 - +28 VDC
 - +13 VDC
 - Less Common Voltages
 - +36 VDC
 - +32 VDC
 - +24 VDC
 - +12 VDC
- RF Input is typically +10 dBm over 1dB compression
- RF input signal Format: CW/AM/FM/PM/Pulse
 - Always check with factory when customer has a non-standard signal format.
- Spurious Signals: <-60 dBc
- Input/Output Connectors:
 - SMA Connectors are normal
 - Higher power units may use N connector or other connector configuration.

Amplifier Module Features

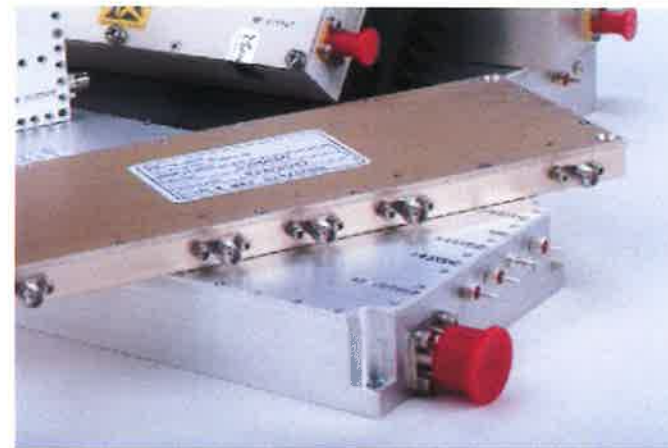
- Cooling
 - Heatsink
 - Customer still must supply cooling fans
 - The “530” part number changes to “590”
 - Example: 5303012A
 - No Heatsink, no Fans
 - Example: 5903012A
 - With Heatsink, no Fans
 - Heatsink & Fans
 - As seen in picture to the right.
 - The “530” part number changes to “580”
 - Example: 5303012A
 - No Heatsink, no Fans
 - Example: 5803012A
 - With Heatsink, With Fans



Amplifier Module Custom Options



- Blanking
 - Allows rapid shutdown of devices gates.
 - Feature commonly used in many military applications, where a silent mode, or listening mode may occur.
- Shutdown
 - Fairly standard feature available on many amplifier modules.
 - Typically an open collector circuit is used for shutdown.
 - Some instance a TTL shutdown signal can be used.
- Forward/Reflected Power sample ports or pins
 - This is a non-standard feature on most amplifier modules.
 - A surface mount directional coupler may implemented into the module design.
 - This feature is not available in all modules.
- MIL-STD-810F compliance for harsh environmental conditions
- MIL-STD-461G compliance for demanding Input environments.
- Other custom features may be available.



Amplifier Systems



Amplifier Systems Salient Characteristics



- Input/Output Impedance: 50 Ohms
- AC Input: Typically 100-240 VAC, Single Phase (1 Φ).
- AC Input Frequency: Typically 47-63 Hz
- Noise Figure: 10 dB nominally
- Harmonics: -20 dBc @ P_{1dB} Compression
- Spurious: <-60 dBc Normally
- VSWR: 2:1
- Cooling: Air Cooled
- Operating Temperature: 0° to +50°
- Humidity: 95% Non-Condensing
- Altitude: Up to 3000 meters
- Shock & Vibration: Normal Truck Transport
- Circuit protections
 - Thermal Overload
 - Over Current
 - Over Voltage



Amplifier System Features

- Amplifier Systems come in two varieties.
- Variety I
 - Standard Option
 - RF Input/Output Connectors
 - When ordering, please specify “F” for Front Panel RF Connectors, or “R” for Rear Panel RF Connectors.
 - AC Input
 - Normally 100-240 VAC, Single Phase, 47-63 Hz
 - Other Input Voltages available.
 - Higher power units may use 180-240 VAC, Single Phase, 47-63 Hz
 - Other voltages, and three phase (3 Φ) power is available.
 - Standard, Forced Air Cooled, 19” Rack Mountable Chassis
 - Thermal Protection
 - Over/Under Voltage Protection
 - The Standard Option does not offer VSWR protection.



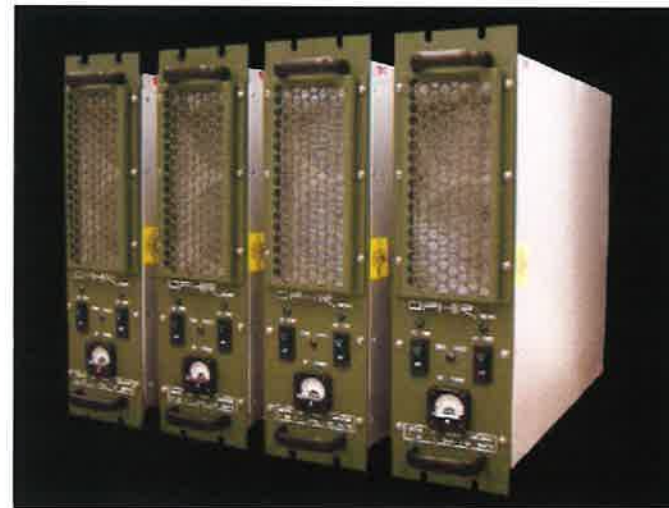
Amplifier System Features

- Amplifier Systems come in two varieties.
- Variety II
 - E Option
 - All Features of the “Standard” option
 - Forward Power Monitoring (dBm or Watts).
 - Reflected Power Monitoring (dBm or Watts).
 - Gain Control (20 dB dynamic range of adjustment).
 - Fault Status
 - Full Protection Of any VSWR Condition, Open or Short, into any Phase.
 - Remote Control Access via the Ethernet, RS-232, or IEEE-488 Communications ports.
 - Integrated Automatic Leveling Control to allow end-user to maintain output even with variances in temperature, or input RF level.
 - Standby/Enable Control
 - Front Panel Display for easy viewing of System Status Locally.
 - Keypad buttons for full local control.

Amplifier System Custom Features



- Switched Filter Bank
- Input Power Requirements
- Ruggedized Version
- Cabinet Requirements
- Outdoor Version
- Sample Ports
- Racking Options
- OEM Options
- Airborne Packaging
- Consult Factory!



Questions to ask your Customer!

- Operating Frequency?
 - Start Frequency
 - Stop Frequency
- Output Power?
 - PSAT
 - P1dB (If needed)
- Module or System?
- How Many?
- When are they needed?
- Is this a budgetary quote?
- Will these be re-exported?

