

# ModuMAX GaN SSPA Systems

*Ku Band*



### Overview

General Dynamics’ SATCOM Technologies ModuMAX SSPAs are designed to meet the most critical link applications, using GaN-based amplifiers to offer output power up to 1800 watts in Ku-Band. Leveraging patented technology and field-proven architecture, the ModuMAX SSPAs are completely modular and utilize passive combining of eight truly hot-swappable, plug-in RF modules as well as power supplies and other hot-swappable electronic assemblies to maximize performance and minimize downtime. Designed for ease-of-use, with embedded secure web page and state-of-the-art technology, operators can keep in touch with performance indicators on a real-time basis via remote monitoring or email alerts. For over 15 years, ModuMAX systems have been the preferred choice of broadcasters, telecommunication services, and teleports worldwide that require 100 percent uptime.

### Features

- Embedded web page and automated email alerts
- Virtual factory real-time support
- Multiple redundancy configurations available
- 3-Year all-inclusive warranty
- Embedded web browser, with remote monitoring,
- Remote software upgrade, and factory monitoring and assistance capabilities

Plug-and-play hot-swappable design maximizes performance and minimizes downtime

Mean Time to Repair (MTTR) of less than 3 minutes for field-serviceable components

Automated prime power saving and link recovery software

Easy-to-use color touch screen for local control



# ModuMAX GaN SSPA Systems

## Easy to Operate and Maintain

- Front panel color touch screen offers quick and easy access for on-site operational control
- Full remote control of all features via the standard network and RS-232/-422/-485 interfaces
- Fast and easy servicing via eight hot-swappable RF modules accessible from the front panel
- No downtime during module replacement

## Parallel Architecture

- RF and power supply modules readily accessible on the front of the chassis for easy maintenance
- Solid state RF power amplifiers and power supply modules configured in parallel to share load making the ModuMAX SSPAs extremely reliable and fault-tolerant
- Passive RF combining architecture provides robust design with no single point of failure allowing the system to stay online during a module replacement
- RF modules combined in efficient, waveguide power combining enabling multi-level self-redundant configurations
- Front swappable modules eliminates cumbersome back of chassis cabling problems
- Hot-swappable major system components (power supply modules, fans, logic board, parallel I/O board, front panel touch screen) enables continuous uptime

## RF Plug-In Modules

- 8 identical and fully interchangeable RF plug-in modules
- GaN technology provides improved reliability and higher linear output power compared to GaAs technology
- Module status is indicated via the touch screen front panel as well as an LED on each module
- Software continuously monitors temperature, voltage and current performance and auto-corrects for changes associated with long-term component operation, enhancing long term performance while logging parameter changes
- Electrical interfaces for power and RF provided by blindmate connectors located at the back of the RF plug-in modules
  - Elimination of cables makes swapping modules easy and fast



## Modular Power Supply

- Powered by up to 8 identical 48-volt dc power supply modules that share the SSPA power load in an “N+1” configuration
- Built-in sufficient margin ensures that the loss of a single module will not affect operations and any module can be hot-swapped without interruption via front panel
- Distribution bus connected to the chassis via extremely safe, keyed, quick-connect, self securing connectors
- Automatic logging of operational parameters of the power supply modules such as temperature, current and voltage

## Auto-Recovery

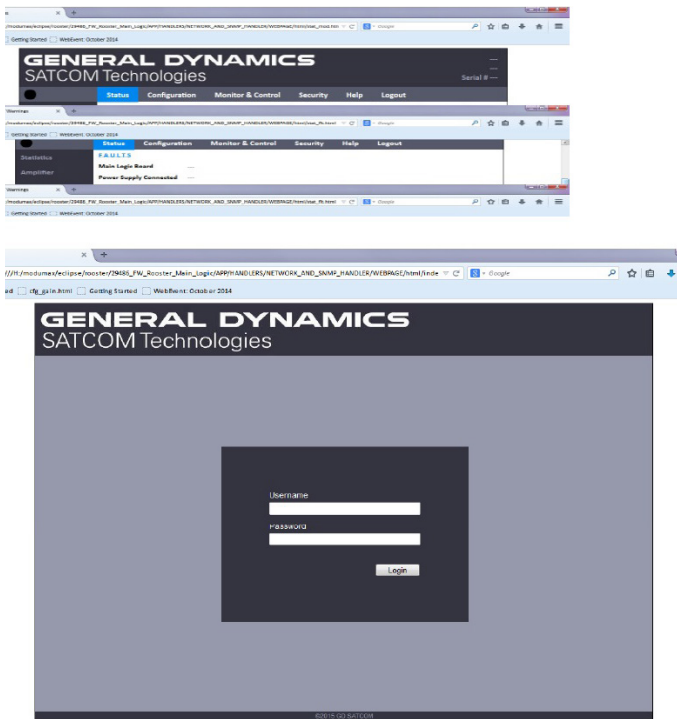
- Failure of an RF module causes a drop of only 1.2 dB in output power until the auto-recovery software selects and enables an in-chassis spare module, or increases the gain of the remaining on-line RF modules
  - Unlike conventional, switched redundant systems, there is no interruption of the uplink
  - Defective modules can be hot-swapped while the SSPA continues to operate

## Cooling System

- Integral forced-air cooling system with fault-tolerant redundancy minimizes RF plug-in module temperature rise, maintaining RF power capability and increasing operational lifetime
- Built-in margin tolerates the loss of one cooling fan
- Monitoring of fan rotational speed and failure via the control panel display and via the M&C interfaces
- Easily remove and replace fans in the air-cooling system without taking the SSPA off-line
- In the event of a fan failure, the SSPA will continue to operate until a replacement is installed
- Separate air cooling system rear panel air intake and exhausts that can be ducted outdoors or into the room

## User Interface—Leading Edge Software

The ModuMAX GaN SSPA is equipped with a color touchscreen for local control along with a leading-edge TCP/IP embedded web page software package. The software can be configured for remote monitoring and firmware upgrades, while allowing virtual factory access to monitor the amplifier system’s key performance parameters such as temperature, current, and voltage measurements to individual component levels. The software is on a SNMP v3 secure protocol base capable of issuing email alerts.



## Sizing Your ModuMAX

Correct power sizing of the ModuMAX is critical for operational performance, ease-of-maintenance, and future expansion of additional carrier service. In addition to link budget power, inter-facility loss, and rain fade margin, the amplifier can be enhanced to leverage configurable power, fault recovery, as well as foreseeable additional service requirements. In addition, the ModuMAX can be phase combined with another ModuMAX to achieve higher power for additional multi-carrier operation.

## Sparing

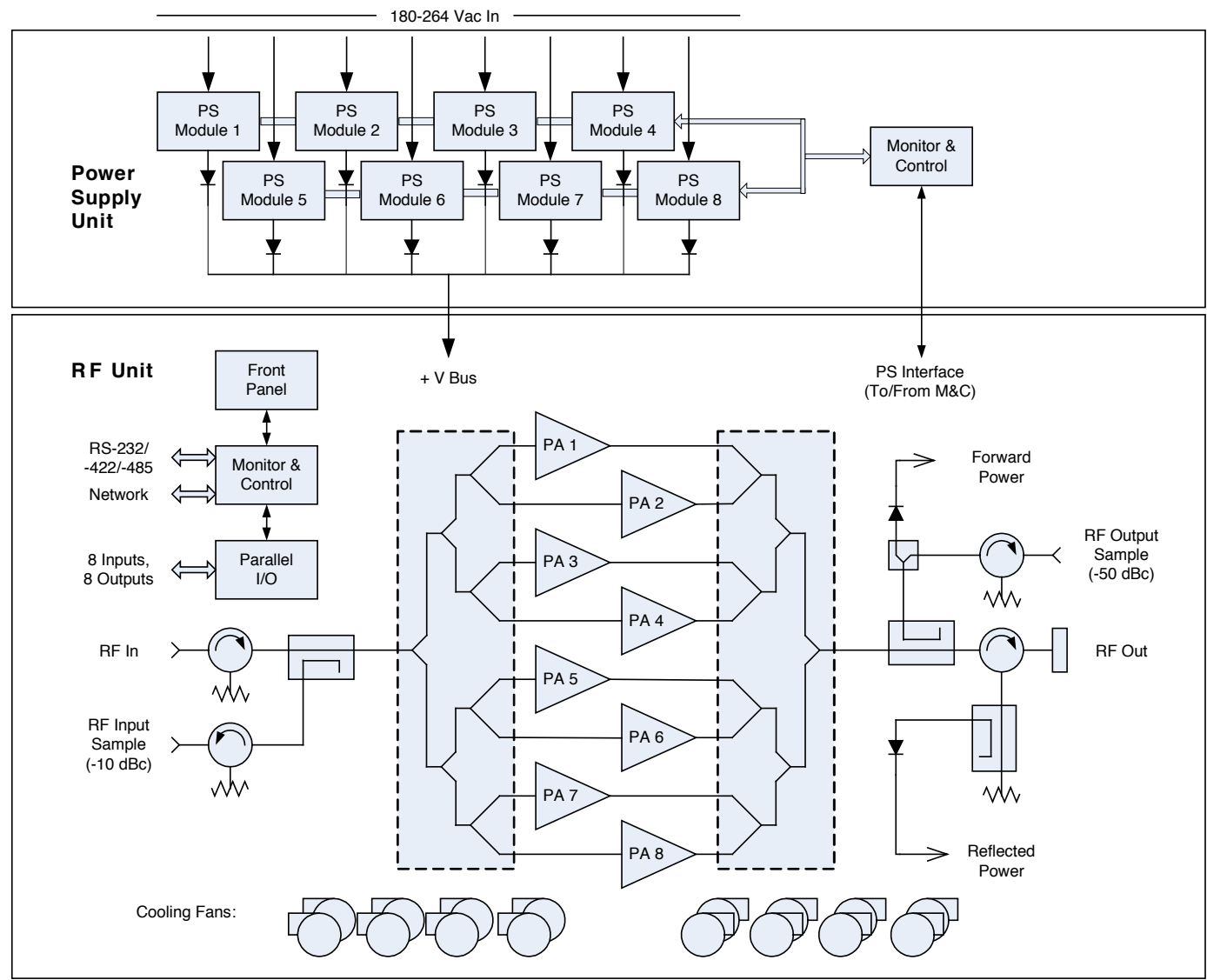
Sparing costs are minimized by utilizing a prudent spares kit capable of covering numerous systems. Spare RF modules are affordable, since replacement is restricted to the module level. Spare modules can go from shelf to on-line in minutes.

## Global EMC and Safety Compatibility

ModuMAX SSPA systems are certified to applicable EU EMI/EMC and safety standards.

Block Diagram

■ The block diagram below highlights the modularity and passive combining architecture which makes the ModuMAX the SSPA of choice. All active components within the design are hot-swappable without removal of power.



Stand-Alone SSPA Specifications

Parameter	Notes	Min.	Nom./Typ. <sup>(1)</sup>	Max.	Units
Frequency Range	Ku-Band, Extended	13.75		14.50	GHz
Gain, at Maximum Setting		60			dB
Gain vs. Temperature	0 to 50 °C		±0.5	±0.75	dB
Gain Adjust Range	Digital, 0.1 dB steps	20			dB
Gain Flatness	Per 40 MHz			±1.0 ±0.3	dB dB
Saturated Power Output			+60.3 (1080)		dBm (W)
Linear Output Power			+57.3 (540)		dBm (W)
Two-Tone Intermodulation	At rated linear power		-30	-25	dBc
Residual Noise, Ku-Band	13.75–14.5 GHz			-70	dBW/4 kHz
Group Delay	Linear Parabolic Ripple			0.03 0.003 1.0	ns/MHz ns/MHz² ns p-p
AM/PM Conversion	At rated linear power		1.0		°/dB
Second Harmonic	At rated linear power			-50	dBc
Spurious	At rated linear power			-70	dBc
VSWR	Input, Output		1.2:1	1.3:1	
Sample Ports	Input/Output		-10/-50		dBc
Power Requirements (single or 3-phase)	Voltage Frequency Power factor	180 47	0.98	264 63	Vac Hz
Power Requirement	At rated linear power		7.4	11	kVA
Cooling System			Forced air		
Operating Temperature °C	Ambient/inlet air	0		+50	°C
Storage Temperature	Non-operating	-45		+85	°C
Relative Humidity	Non-condensing			95	%
Altitude Derating	10,000 ft (3000 m) max.		Derate 2 °C per 1000 ft (300 m)		
Size <sup>(2)</sup>	RF Unit (16 U panel ht.)		19.0 W x 27.97 H x 31.64 D 483 W x 711 H x 804 D		inches mm
	Power Supply (4 U ht.)		19.0 W x 6.97 H x 29.12 D 483 W x 177 H x 740 D		inches mm
Weight <sup>(2)</sup>	RF Unit Power Supply		387 (176) 96 (44)		lb (kg) lb (kg)

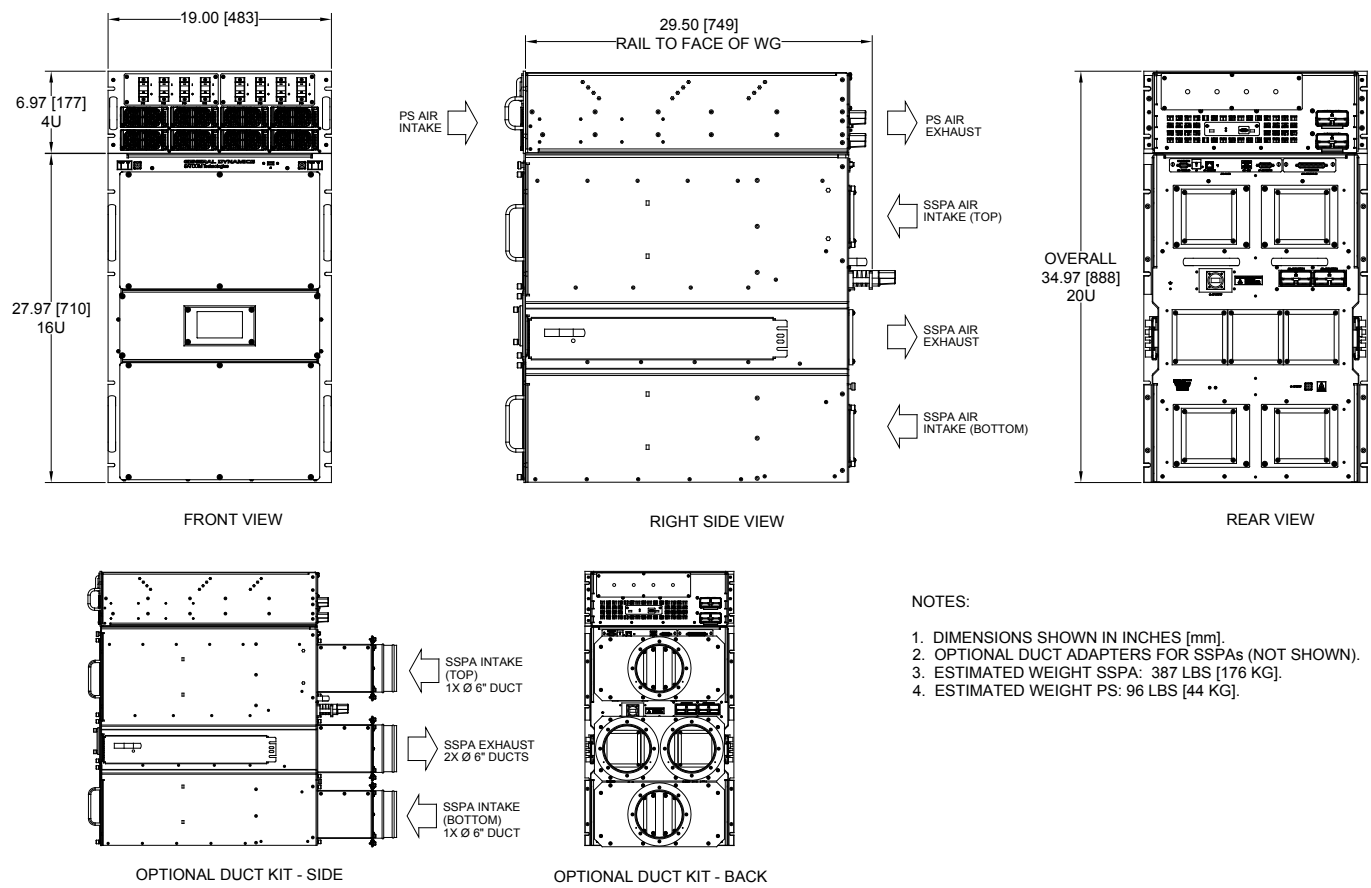
<sup>(1)</sup> When there is only one entry on a line, the Nom./Typ. column is a nominal value; otherwise it is a typical value. Typical values are intended to illustrate typical performance, but are not guaranteed.

<sup>(2)</sup> Size and weight are given for a single ModuMAX SSPA.

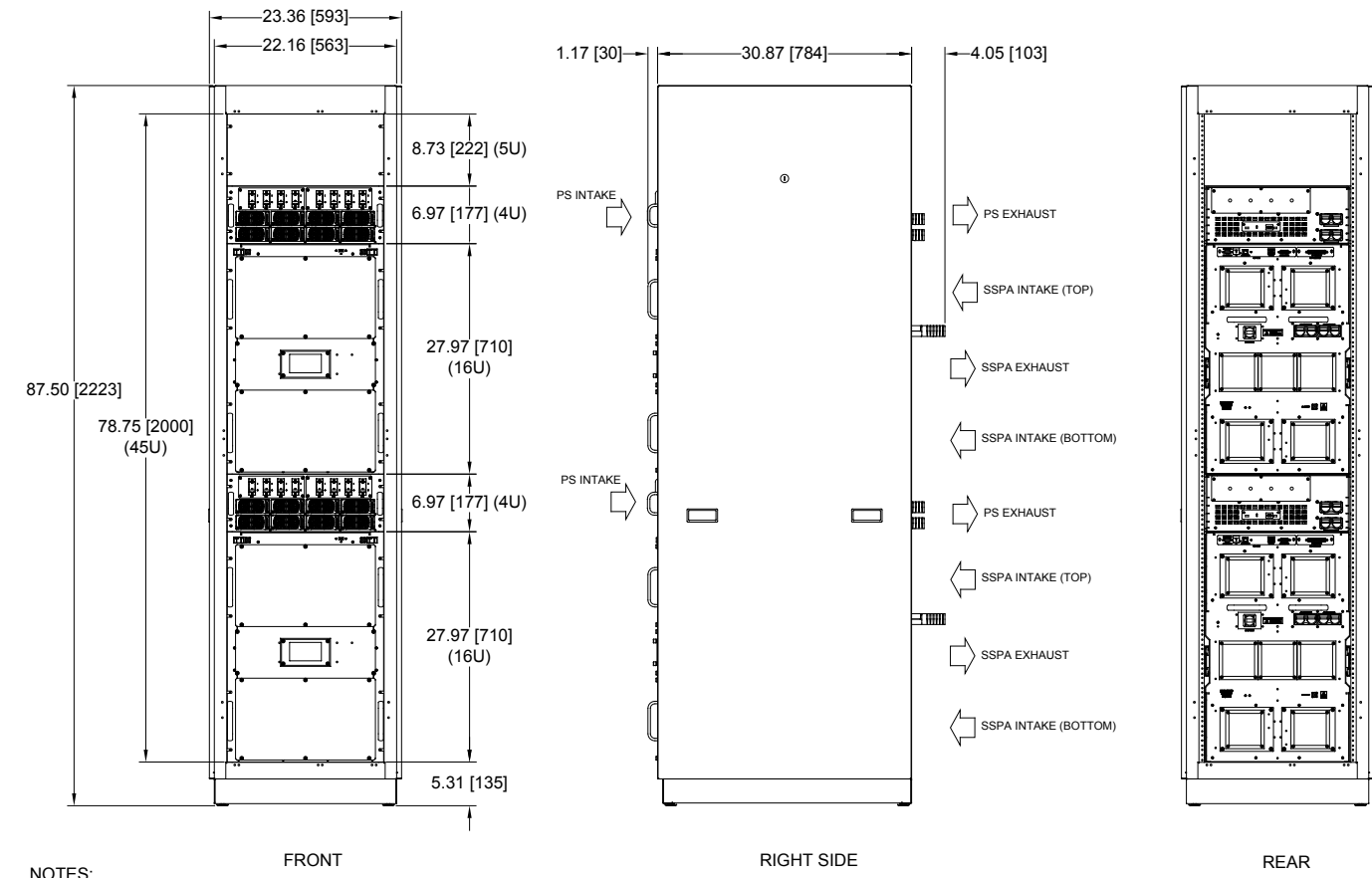
Electrical Connections

RF Input	N-Type (f)	50 ohms
RF Output	WR75	
RF Monitor Ports (Input, Output)	N-Type (f)	50 ohms
Network	RJ-45	J6
Parallel I/O	D 37 Male	J5
System	D 15 Male	J7
Serial I/O	D 9 Female	J12

Outline Drawing, Single-Thread SSPA



Outline Drawing, Dual SSPAs in one Rack Cabinet



NOTES:

1. DIMENSIONS SHOWN IN INCHES [mm].
2. OPTIONAL DUCT ADAPTERS FOR SSPAs (NOT SHOWN).

