

## Ku-Band Solid-State Power Amplifiers

These high power solid-state amplifiers offer output powers of 40 or 50 watts across the standard 14.0 to 14.5 GHz ("M") satellite uplink band. The 40 watt unit is also available for the extended 13.75 to 14.5 GHz ("O") band. Housed in a weatherproof enclosure, the amplifiers can be mounted in an antenna hub or outdoors in applications where it is desirable to reduce cable losses by mounting the SSPA close to the antenna. Built for reliable, trouble-free service, the amplifiers incorporate a microprocessor-based monitor and control system.

### Features

- 40/50 W saturated output power
- 53 dB minimum gain
- Direct-reading RF power meter
- Microprocessor-based monitor and control
- Serial interface (RS232/422/485) standard
- Output isolator for high load VSWR protection
- 20 dB range digital gain adjustment
- RF output sample port

### Applications

- Stand-alone SSPA
- 1:1 redundancy

### Options

- Parallel I/O with Form 'C' outputs and optoisolated inputs
- 1:1 redundancy
- Reflected power monitoring
- Block upconverter



### Functional Description

These rugged, reliable, solid-state power amplifiers deliver the power output of a TWTA yet achieve lower intermodulation distortion and longer lifetime than tube type amplifiers. The weatherproof enclosure, designed for outdoor structure or antenna king-post mounting, provides additional benefits. Extensive waveguide, coax, or fiber optic runs can be minimized, reducing associated losses. With the optional block upconverter (BUC), the SSPA can operate directly from L-Band IF input.

VertexRSI has incorporated a number of features into its in-house all GaAs FET SSPA module, including low loss power combining techniques, active bias regulation for stable Q-point vs. time and temperature, microprocessor-based current fault monitoring of each RF power FET, and low dropout dc regulation to minimize wasted power.

The amplifiers incorporate complete thermal management, optimized by thermal analysis CAD software to deliver lower device junction temperatures. The forced-air cooling system draws cool air in and across an external heatsink without disturbing the weatherproof integrity of the SSPA enclosure.

The SSPAs use a high efficiency switching power supply. The dc power, regulation, and bias circuitry are all optimized to minimize generation of waste heat.

### Remote Control

The standard unit contains one summary fault output and serial I/O to allow control and monitoring of the SSPA from a remote location. The 10-pin serial interface can be connected to RS-232 unbalanced, RS-422 balanced, or RS-485 multidrop interfaces. Baud rates are selectable from 300, 1200, 2400, 4800, 9600, 14400, 19200 or 28800 baud. Unit addresses can be set between 0 and 255. Features controlled and monitored remotely include:

#### FAULTS

- List faults
- Reset faults

#### OPERATE

- Operate/Mute
- Gain
- Antenna/Dummy Load

#### 1:1 (with Option 4)

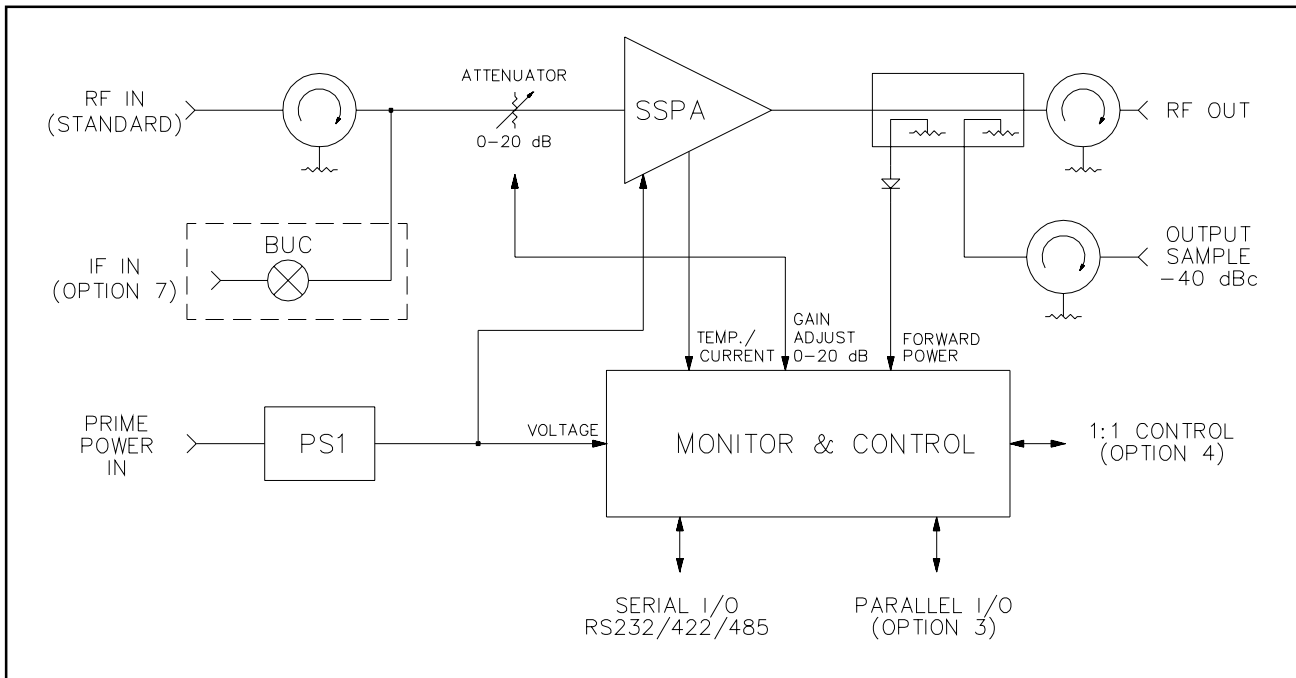
- Auto/Manual Mode
- On-Line/Standby
- Status

#### SERVICE

- Metering
  - Power Output
  - Temperature
  - Current
  - Voltage
- $\mu$ P Test

#### SETUP

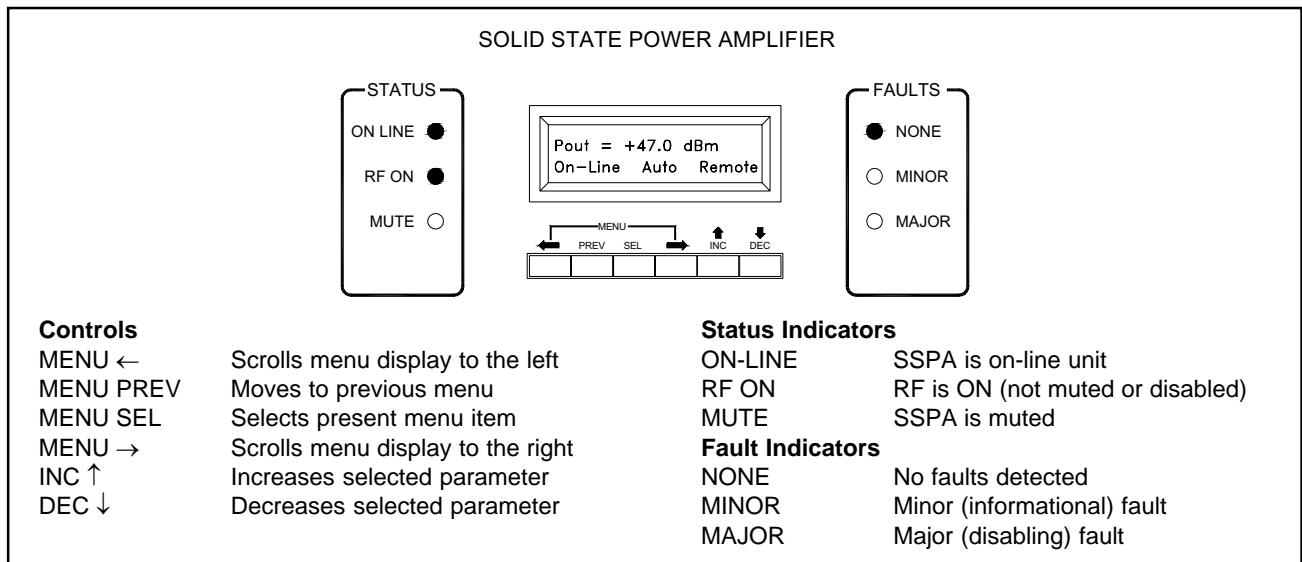
- Faults
- Power Cal
- Serial I/O
- Power-up State
- Password



## Operator Interface

Microprocessor-based monitor and control simplifies amplifier operation and allows incorporation of powerful user-friendly features, such as direct-reading RF power metering with display in dBm, dBW, or watts. Operation is menu-driven, with simple, logical

menus arranged in order of most frequent use. Four menu softkeys are used to scroll through menus and make selections, while two keys are used to increment or decrement parameters. Information is presented on an alphanumeric 2-line by 20-character backlit liquid-crystal display.



## Fault Monitoring and Metering

The internal microprocessor continually monitors operation of the SSPA and reports any faults on the front panel display. Monitored parameters include microprocessor status, overtemperature shutdown, heatsink temperature, device currents, power supply voltages, RF output level, 1:1 status (with Option 4), maintenance switch position (with System Option A), and reflected power (with System Option B). Nominal

values and tolerances are all adjustable from the front panel via the setup menu. Password protection can be activated to prevent inadvertent or unauthorized access. Faults are reported as either major (disabling) or minor (informational). Major faults will cause automatic switchover in a 1:1 redundant system, but minor faults will not.

The following parameters can be displayed via the operate and service menus:

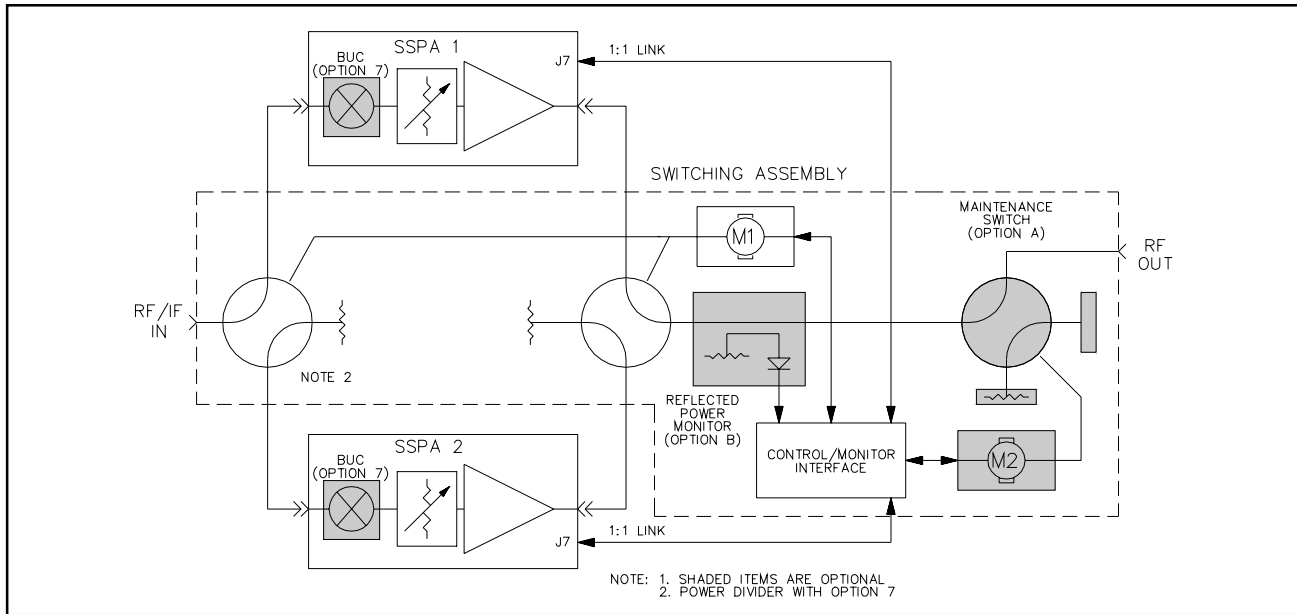
Parameter	Features/Notes	Measurement Range	Resolution
Gain Adjust		0 to 20 dB	0.1 dB
Power Output	Can be offset $\pm 6$ dB in 0.1 dB steps for calibration/loss compensation.	40W: +16.0 to +48.0 dBm 50W: +17.0 to +49.0 dBm	0.1 dB (top 20 dB)
Temperature	Heatsink	-40.0 to +85.0 °C	0.5 °C
Current	Each stage Total current	0 to 10.00 A 0 to 99.99 A	40 mA 40 mA
Voltage		0 to 12.50 V	50 mV
Reflected Power	Available on 1:1 systems only (with System Option 3).	40W: +16.0 to +48.0 dBm 50W: +17.0 to +49.0 dBm	0.1 dB (top 20 dB)

### 1:1 Option (Option 4)

This option adds 1:1 redundancy switchover logic to the SSPA. With this option, no external redundancy controller is required. The complete 1:1 redundant SSPA system consists of two SSPAs, an external switching assembly, and interface cables to link each SSPA to the switching assembly. If a fault occurs in one of the units, it is switched off-line. Full remote control of the system is available via the serial I/O interface (or parallel I/O with Option 3).

A maintenance switch at the system output is offered as an option. This allows operation of the system into the antenna or into a dummy load. This switch is controlled and its position is monitored via the serial I/O interface.

A reflected power monitor is also available as an option. Reflected power is measured at the system's output and can be monitored via the serial I/O interface.



### Parallel I/O Option (Option 3)

This option adds Form 'C' status outputs, contact-closure-to-ground control inputs, and an analog voltage output that is proportional to forward power.

#### Form 'C' Status Outputs

- Major/Minor Faults *with 1:1 Option*
- Mute/Unmute/RF Inhibit
- Faults:
  - Auto/Manual
  - On-Line/Standby
  - Antenna/Dummy
- Summary, Power Out, Reflected Power, Voltage, Current and Temperature
- Remote, Local, Maintenance Mode

#### Control Inputs

- Major/Minor Faults *with 1:1 Option*
- Mute/Unmute/RF Inhibit
- Fault Reset
- Auto/Manual Select
- Standby/On-Line
- Antenna/Dummy Load

#### Analog Output

- Proportional to forward power, 0 to 5 Vdc nominal, 0.1 V/dB (5 V = +50 dBm)
- Balanced, 2-wire. Can be run over long distances.
- Drives loads to 600 ohms min.

### BUC Option (Option 7)

This option adds a VertexRSI BUC-14000 series block upconverter to the SSPA, which allows the unit to work from L-Band inputs. The input frequency is

950 to 1450 MHz (band "M") or 950 to 1700 MHz (band "O"). A 10 MHz externally applied reference is required.

**PKM14S040N-XXX, PKM14S050N-XXX,  
and PKO14S040N-XXX**

## SPECIFICATIONS

Parameter	Notes	Min	Nom/Typt	Max	Units
Frequency Range, Standard	Band "M" (40 & 50 W)	14.0		14.5	GHz
	Band "O" (40 W only)	13.75		14.5	GHz
Input Frequency Range with Option 7, Block Upconverter	Band "M" (40 & 50 W)	950		1450	MHz
	Band "O" (40 W only)	950		1700	MHz
Gain, at Maximum Gain Setting	Standard	53	56		dB
	with Option 7	70	72		dB
Gain Adjust Range		20			dB
Gain Flatness	Full band, Standard			±1.0	dB
	Full band, with Option 7			±2.0	dB
	Per 40 MHz, Standard			±0.3	dB
	Per 40 MHz, with Option 7			±0.5	dB
Gain Stability vs Temperature	Standard		±1.0	±1.5	dB
	with Option 7		±2.0	±2.5	dB
Saturated Power Output	40 W (See Note 1)		+46 (40)		dBm (W)
	50 W		+47 (50)		dBm (W)
Power Output, at 1 dB Compression	40 W (See Note 1)	+45 (32)			dBm (W)
	50 W	+46 (40)			dBm (W)
Two-tone Intermodulation	At 3 dB total backoff from 1 dB compression point		-30	-25	dBc
Group Delay	Linear			0.03	ns/MHz
	Parabolic			0.003	ns/MHz <sup>2</sup>
	Ripple			1.0	ns p-p
AM/PM Conversion	At 3 dB backoff		1.0	2.0	°/dB
Noise Figure at Maximum Gain	Standard		8		dB
	With Option 7		20		dB
VSWR	Input, Standard		1.20	1.25	:1
	Input, with Option 7		1.35	1.50	:1
	Output		1.20	1.30	:1
Output Sample Port			-40		dBc
Connectors	Input		Type N Female		
	Output		WR75G Waveguide		
	Sample Port		Type N Female		
	Serial I/O		10-pin MS, mate supplied		
	Parallel I/O (Option 3)		41-pin MS, mate supplied		
	Power		3-pin MS, mate supplied		
Power Requirements	Voltage		90-135 or 180-270		Vac
	Frequency	47		63	Hz
	Power, 40 W		500	550	W
	Power, 50 W		530	570	W
Cooling System			Forced air		
Operating Temperature Range	Ambient air temperature	-40		+50	°C

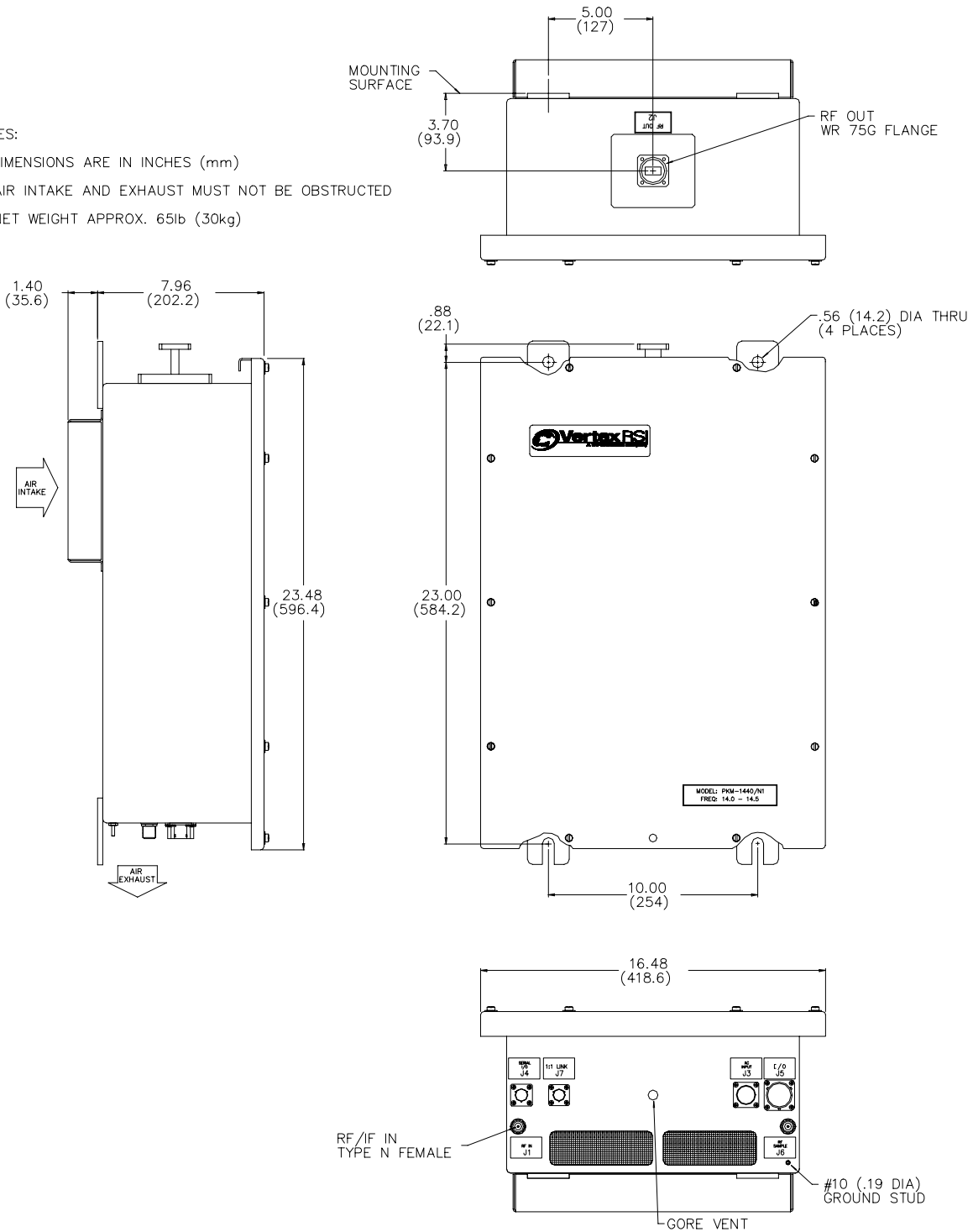
† When there is only one value on a line, this column is a nominal value. Otherwise it is a typical value. Typical values are intended to illustrate typical performance, but are not guaranteed.

Note 1: Between 14.0-14.5 GHz. 1 dB lower between 13.75-14.0 GHz for Band "O" amplifiers.

## Outline Drawing, SSPA

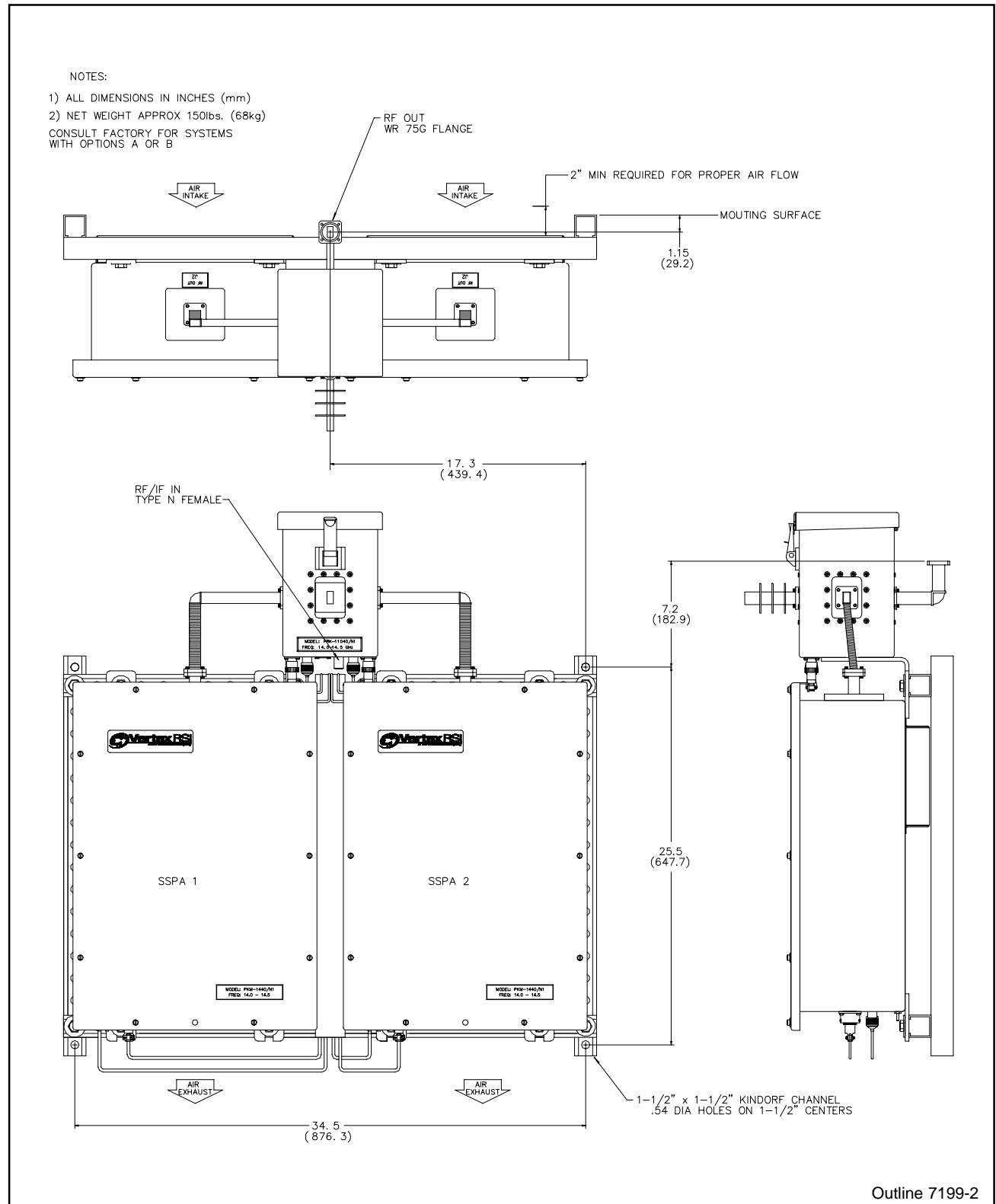
**NOTES:**

- 1) DIMENSIONS ARE IN INCHES (mm)
- 2) AIR INTAKE AND EXHAUST MUST NOT BE OBSTRUCTED
- 3) NET WEIGHT APPROX. 65lb (30kg)



Outline 6832-6

# Outline Drawing, 1:1 System



## Connector Interface

Ref. Des.	Function	Connector Type	Mating Connector	Comment
J1	RF/IF Input	Type N Female	Type N Male	
J2	RF Output	WR75G Waveguide	WR75 Flange	
J3	AC In	3-pin MS, Male	3-pin MS, Female	Supplied
J4	Serial I/O	10-pin MS, Female	10-pin MS, Male	Supplied
J5	Parallel I/O	41-pin MS, Female	41-pin MS, Male	Option 3
J6	Output RF Sample	Type N Female	Type N Male	
J7	1:1 Link	6-pin MS, Female	6-pin MS, Male	Option 4

## Part Number/Ordering Information

**SSPAs:**

**PK**  **14S**  **N-XXX**

14.00-14.50 GHz = M      40 watts = 040  
 13.75-14.50 GHz = O\*    50 watts = 050  
 (\*40 W only)

**Options:**

**Parallel I/O** ..... 3  
 Form 'C' status outputs (100 Vdc/0.5 A contacts) and contact closure to ground (5 V/5 mA) control inputs.

**1:1 Redundancy** ..... 4  
 Redundant capability (required for units in 1:1 systems)

**Block Upconverter** ..... 7  
 L-Band IF Input, 20 dB additional gain

---

**Redundant Systems:**  
 (Consists of 1:1 switching assembly, two SSPAs, and interconnecting cables.)

**PRK1**   **N-XXXX**

14.00-14.50 GHz = M      40 watts = 040  
 13.75-14.50 GHz = O\*    50 watts = 050  
 (\*40 W only)

**Options:**

**Parallel I/O** ..... 3  
 Form 'C' status outputs (100 Vdc/0.5 A contacts) and contact closure to ground (5 V/5 mA) control inputs.

**Block Upconverter** ..... 7  
 L-Band IF Input, 20 dB additional gain

**Maintenance Switch** ..... A  
 Allows selection of antenna or dummy load at system output

**Reflected Power Monitor** ..... B  
 Measures reflected power at system output

---

**Related Accessories:**

- **RCP-1000** SSPA Remote Control Panel  
 1U-high rack-mounted panel duplicates all menus and functions available at SSPA front panel. Can be located up to 1.3 km (4000 ft) away and interconnects with inexpensive cable.
- **MAXCON™** Monitor and Control Software. Microsoft® Windows® application.



12872 Rev. – 3/21/02  
 Specifications are subject to change at VertexRSI's discretion.