

# Indoor Rack Mount GaAs Solid State Power Amplifiers 2nd Generation, 3RU Rack Height



**300W C-Band Second Generation 3RU SSPA Chassis with 1RU N+1 Power Supply**

Teledyne Paradise Datacom's Indoor 3RU Solid State Power Amplifiers represent the latest in High Power Microwave Amplifier Technology. The SSPA chassis achieves the highest power density in the industry along with enhanced maintainability.

The power supply, fan trays and controller card connector plate are all removable for easy maintenance. At 25.25" deep, and only 3RU high, this chassis is perfect for SNG applications, or other configurations where rack space is at a premium.

The SSPA front panel features an easy-to-navigate display and menu structure. Dedicated LEDs are provided for alarm condition indication.

Teledyne Paradise Datacom rack mount power amplifiers have a wide range of monitor and control functionality, including:

- RS-232/RS-485 (4-wire) serial communication
- Ethernet port supporting UDP, SNMP and web browser-based control
- Form C contacts for output monitor ports and opto-isolated input ports
- Free Windows M&C software
- Variety of third party M&C drivers available

## FEATURES

- Extremely High Power Density:
  - to 300 W X-Band
  - to 200 W C-Band
  - to 125 W Ku-Band
- 1RU N+1 Power Supply
- Removable Fan Tray and M&C Card Assembly
- Remote Communication via RS232/485 or Ethernet
- RF Output Sample Port
- 20 dB RF Gain Adjustment
- True RF Output Power Measurement
- Built-in Maintenance Switch Controller

## OPTIONS

- Removable RF Module
- L-Band Input operation
- Reflected Power Monitor
- Input Sample Port
- Exhaust Duct Adapters
- Remote Control Panel
- System Configurations

# Indoor Rack Mount

## GaAs Solid State Power Amplifiers

### 2nd Generation, 3RU Rack Height

#### Specifications, C-Band SSPAs

PARAMETER	NOTES	LIMITS	UNITS
Frequency Range	Frequency selection "L" Frequency selection "H" Frequency selection "C" <sup>1</sup> Frequency selection "A" Frequency selection "B" <sup>1</sup> Frequency selection "D"	4.400 to 5.000 5.715 to 5.790 5.750 to 6.670 5.850 to 6.425 5.850 to 6.725 6.425 to 7.025	GHz GHz GHz GHz GHz GHz
Output Power Typical, P <sub>sat</sub> Guaranteed minimum, P <sub>1dB</sub>	HPAC3050ARXXXXP2 HPAC3075ARXXXXP2 HPAC3100ARXXXXP2 HPAC3140ARXXXXP2 HPAC3200ARXXXXP2 HPAC3250ARXXXXP2 HPAC3300ARXXXXP2	P <sub>sat</sub> / P <sub>1dB</sub> 47.0 (50) / 46.8 (48) 48.8 (76) / 48.5 (70) 50.0 (100) / 49.5 (89) 51.5 (150) / 51.0 (125) 53.0 (200) / 52.3 (170) 54.0 (250) / 53.0 (200) 54.7 (300) / 54.0 (250)	dBm (W) dBm (W) dBm (W) dBm (W) dBm (W) dBm (W) dBm (W)
Power Requirements Line Frequency Line Power (Voltage) (typical @ 220 VAC)	power factor  HPAC3050ARXXXXP2 HPAC3075ARXXXXP2 HPAC3100ARXXXXP2 HPAC3140ARXXXXP2 HPAC3200ARXXXXP2 HPAC3250ARXXXXP2 HPAC3300ARXXXXP2	.98 47 to 63  P <sub>sat</sub> 400 (90 to 265) 450 (90 to 265) 650 (90 to 265) 850 (90 to 265) 1000 (90 to 265) 1300 (180 to 265) <sup>2</sup> 1700 (180 to 265) <sup>2</sup>	Hz  W (VAC) W (VAC) W (VAC) W (VAC) W (VAC) W (VAC) W (VAC)
Receive Band Noise Power Density	without filter	-155	dBW / 4 kHz

**Note 1:** Output power decreases over the extended portion of the frequency range. Both P<sub>sat</sub> and P<sub>1dB</sub> de-rate by 1 dB from 5.85 to 5.75 GHz and from 6.425 to 6.725 GHz.

**Note 2:** For 90 to 180 VAC operation, consult factory.

#### Specifications, X-Band SSPAs

PARAMETER	NOTES	LIMITS	UNITS
Frequency Range	Frequency selection "F" Frequency selection "D" <sup>1</sup> Frequency selection "A"	7.10 to 7.40 7.70 to 8.40 7.90 to 8.40	GHz GHz GHz
Output Power Typical, P <sub>sat</sub> Guaranteed minimum, P <sub>1dB</sub>	HPAX3060ARXXXXP2 HPAX3075ARXXXXP2 HPAX3100ARXXXXP2 HPAX3140ARXXXXP2 HPAX3200ARXXXXP2	P <sub>sat</sub> / P <sub>1dB</sub> 47.5 (60) / 47.3 (54) 48.8 (76) / 48.3 (68) 50.0 (100) / 49.5 (89) 51.4 (140) / 50.8 (120) 53.0 (200) / 51.8 (151)	dBm (W) dBm (W) dBm (W) dBm (W) dBm (W)
Power Requirements Line Frequency Line Power (Voltage) (typical @ 220 VAC)	power factor Line frequency  HPAX3060ARXXXXP2 HPAX3075ARXXXXP2 HPAX3100ARXXXXP2 HPAX3140ARXXXXP2 HPAX3200ARXXXXP2	.98 47 to 63  P <sub>sat</sub> 650 (90 to 265) 700 (90 to 265) 750 (90 to 265) 1225 (90 to 265) 1370 (180 to 265) <sup>2</sup>	Hz  W (VAC) W (VAC) W (VAC) W (VAC) W (VAC)
Receive Band Noise Power Density	without optional filter with optional filter	-85 -155	dBW / 4 kHz dBW / 4 kHz

**Note 1:** Output power decreases over the extended portion of the frequency range. Both P<sub>sat</sub> and P<sub>1dB</sub> de-rate by 1 dB linearly from 7.90 to 7.70 GHz.

**Note 2:** For 90 to 180 VAC operation, consult factory.

# Indoor Rack Mount

## GaAs Solid State Power Amplifiers

### 2nd Generation, 3RU Rack Height

#### Specifications, Ku-Band SSPAs

PARAMETER	NOTES	LIMITS	UNITS
Frequency Range	Frequency selection "F" Frequency selection "B" <sup>1</sup> Frequency selection "A" Frequency selection "C" Frequency selection "D"	12.75 to 13.25 13.75 to 14.50 14.00 to 14.50 14.50 to 14.70 15.10 to 15.40	GHz GHz GHz GHz GHz
Output Power Typical, P <sub>sat</sub> Guaranteed minimum, P <sub>1dB</sub>	HPAK3025ARXXXXP2 HPAK3035ARXXXXP2 HPAK3040ARXXXXP2 HPAK3050ARXXXXP2 HPAK3070ARXXXXP2 HPAK3100ARXXXXP2 HPAK3125ARXXXXP2	P <sub>sat</sub> / P <sub>1dB</sub> 44.0 (25) / 43.0 (20) 45.5 (35) / 44.5 (28) 46.0 (40) / 45.0 (31) 47.0 (50) / 46.0 (40) 48.5 (70) / 47.5 (56) 50.0 (100) / 49.0 (80) 51.0 (125) / 50.0 (100)	dBm (W) dBm (W) dBm (W) dBm (W) dBm (W) dBm (W) dBm (W)
Power Requirements Line Frequency Line Power (Voltage) (typical @ 220 VAC)	power factor Line frequency  HPAK3025ARXXXXP2 HPAK3035ARXXXXP2 HPAK3040ARXXXXP2 HPAK3050ARXXXXP2 HPAK3070ARXXXXP2 HPAK3100ARXXXXP2 HPAK3125ARXXXXP2	.98 47 to 63 P <sub>sat</sub> 320 (90 to 265) 350 (90 to 265) 500 (90 to 265) 500 (90 to 265) 650 (90 to 265) 1100 (90 to 265) 1200 (90 to 265)	Hz  W (VAC) W (VAC) W (VAC) W (VAC) W (VAC) W (VAC) W (VAC)
Receive Band Noise Power Density <sup>2</sup>		-155	dBW / 4 kHz

**Note 1:** Output power decreases over the extended portion of the frequency range. Both P<sub>sat</sub> and P<sub>1dB</sub> de-rate by 1 dB linearly from 14.00 to 13.75 GHz.

**Note 2:** All Ku-Band SSPAs are fitted with a receive band reject bulkhead filter, standard. An optional pressure window is available.

### Common Electrical Specifications

PARAMETER	NOTES	LIMITS	UNITS
Gain	range	55-75	dB
Gain Flatness	full band	± 1.0	dB
	full band (Extended C-Band)	± 1.5	dB
Gain Slope	per 40 MHz	± 0.3	dB/40 MHz
Gain Variation vs. Temperature	0 °C to +50 °C	± 1.0	dB
Gain Stability	at constant temperature	± 0.25	dB/24 hours
Gain Adjustment	0.1 dB resolution	20	dB
Intermodulation Distortion (Two-tone, 5 MHz spacing)	3 dB back off relative to P <sub>1dB</sub>	-25	dBc
AM/PM Conversion	@ rated P <sub>1dB</sub>	3.5	°/dB
	@ rated P <sub>1dB</sub> - 3 dB	1.0	°/dB
Spurious	@ rated P <sub>1dB</sub>	-65	dBc
Harmonics (SSPA only)	@ rated P <sub>1dB</sub> - 3 dB	-50	dBc
Input/Output VSWR	Extended C-Band	1.30:1	
	Output VSWR: Ku-Band with bulkhead filter	1.50:1 1.40:1	
Noise Figure	at maximum gain	12	dB
Group Delay (per 40 MHz segment)	Linear	0.01	ns/MHz
	Parabolic	0.003	ns/MHz <sup>2</sup>
	Ripple	1.0	ns p-p
Transmit Band Noise Output Power Density	TX Band	-75	dBW/4 KHz
Residual AM Noise, typical	Offset frequency from carrier		
	1 Hz	-110	dBc/Hz
	10 Hz	-120	dBc/Hz
	100 Hz	-130	dBc/Hz
	1 KHz	-135	dBc/Hz
	10 KHz	-140	dBc/Hz
	100 KHz	-140	dBc/Hz
	1 MHz	-140	dBc/Hz
Residual Phase Noise, typical (SSPA only)	Offset frequency from carrier		
	10 Hz	-90	dBc/Hz
	100 Hz	-100	dBc/Hz
	1 KHz	-110	dBc/Hz
	10 KHz	-120	dBc/Hz
	100 KHz	-125	dBc/Hz
	1 MHz	-130	dBc/Hz
True RF Power Detector	Range Accuracy	P <sub>sat</sub> to (P <sub>sat</sub> - 20) ± 0.5	dB dBm

### 1RU N+1 Redundant Power Supply

The combination of a separate, fully redundant power supply is an excellent means of obtaining the ultimate in system reliability. The power supply is an N+1 redundant configuration, meaning that there is one more power supply module available than required to operate the SSPA. A failure of one power supply module will not take the amplifier off the air.



### L-Band Operation

Teledyne Paradise Datacom amplifiers are available with an integrated L-Band Block Up Converter. L-Band units utilize Teledyne Paradise Datacom's proprietary zBUC technology. The addition of a zBUC<sup>®</sup> converter to the SSPA typically increases the gain by 2-4 dB. The advantages of zBUC technology include:

- zBUC converter can detect and switch to an externally supplied reference.
- Optional internal high stability (10MHz) reference.
- zBUC converter can lock to an externally supplied reference of 5, 10, 20, 25, or 50 MHz without modification.
- zBUC converter can accept a wide range of external reference power (-10 to +5 dBm).

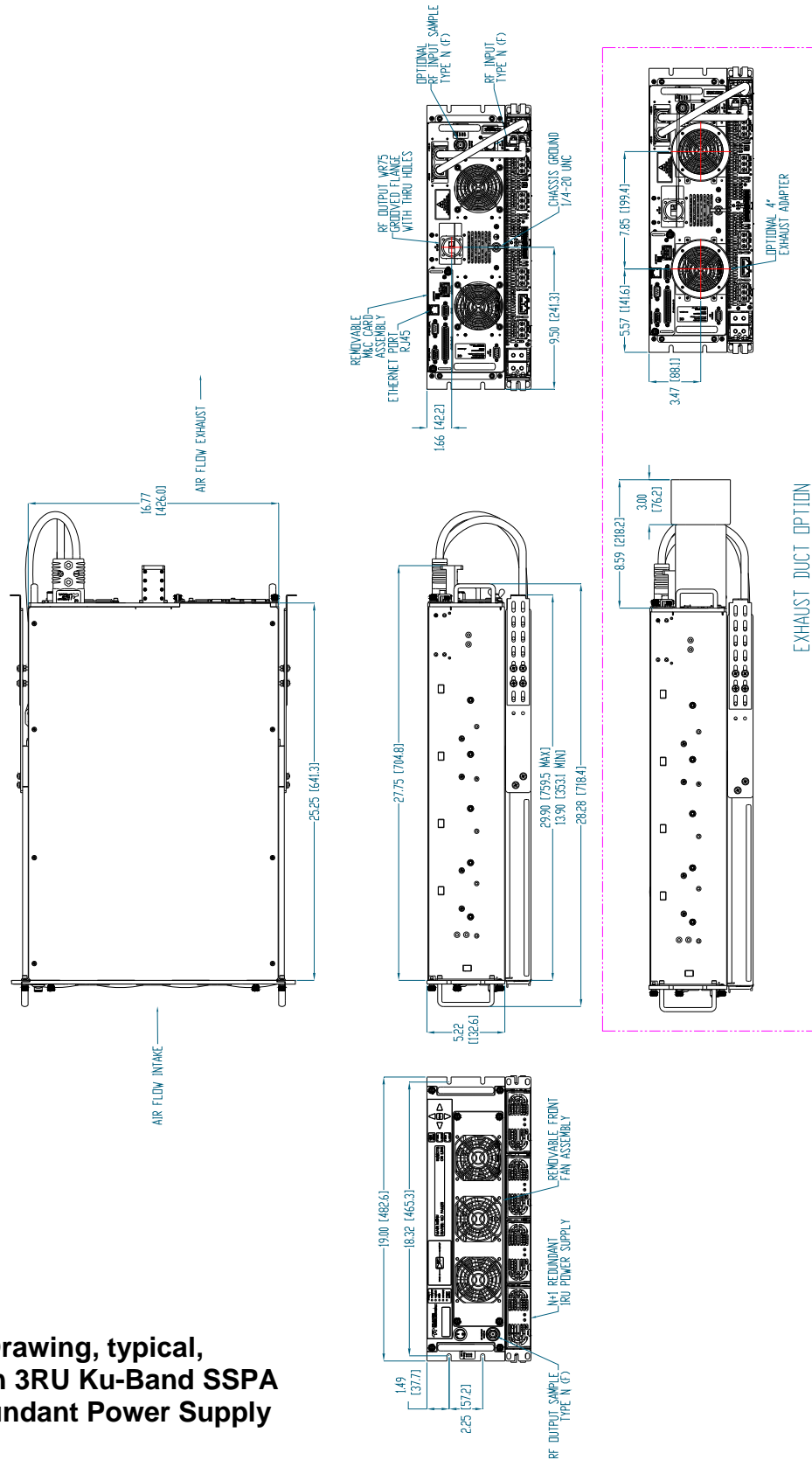
### Available Frequency Plans

Band	Frequency Band	IF Input	LO Frequency	RF Output	Gain Change
C	Standard C-Band	950 - 1525 MHz	4.900 GHz	5.850 - 6.425 GHz	0-4 dB
C	Extended C-Band	950 - 1825 MHz	4.900 GHz	5.850 - 6.725 GHz	0-4 dB
C	Palapa Band	950 - 1250 MHz	5.475 GHz	6.425 - 6.725 GHz	0-4 dB
C	Insat Band	950 - 1250 MHz	5.775 GHz	6.725 - 7.025 GHz	0-4 dB
C	Extended C-Band 2	950 - 1675 MHz	4.800 GHz	5.750 - 6.475 GHz	0-4 dB
C	Low C-Band	840 - 1000 MHz	4.250 GHz	5.090 - 5.250 GHz	0-4 dB
X	Standard X-Band	950 - 1450 MHz	6.950 GHz	7.900 - 8.400 GHz	0-2 dB
Ku	Standard Ku-Band	950 - 1450 MHz	13.050 GHz	14.00 - 14.50 GHz	0-2 dB
Ku	Extended Ku-Band	950 - 1700 MHz	12.800 GHz	13.75 - 14.50 GHz	0-2 dB

### Electrical Specifications for 3RU RM GaN SSPA with zBUC<sup>®</sup> converter

PARAMETER	NOTES	LIMITS				UNITS	
Gain	Nominal setting	75				dB	
Gain Flatness	full band (C-,X-,Ku-bands)	± 2.0				dB	
Gain Slope	per 40 MHz (C-,X-,Ku-bands)	± 0.5				dB/40 MHz	
Gain Adjusted Range	Range	20				dB	
	Typical C-Band Adj. Range	60 - 80				dB	
	Typical Ku-Band Adj. Range	57 - 77				dB	
Gain Stability	0 to +50 °C	± 1.5				dB	
Phase Noise	Offset frequency from carrier	<u>Absolute max.</u>	<u>C-band (typ.)</u>	<u>X-band (typ.)</u>	<u>Ku-band (typ.)</u>		
	10 Hz	-30	-60	-60	-50	dBc/Hz	
	100 Hz	-60	-80	-75	-65	dBc/Hz	
	1 KHz	-70	-80	-75	-72	dBc/Hz	
	10 KHz	-80	-85	-100	-90	dBc/Hz	
	100 KHz	-90	-120	-110	-110	dBc/Hz	
	1 MHz	-90	-125	-122	-120	dBc/Hz	
Spurious	In-Band Signal Related (C-/Ku-Band)					-50	dBc
	(Extended C-Band)					-40	dBc
	Close to Carrier Spurious (≤ 20 MHz)					-50	dBc
	Local Oscillator					-30	dBm
Noise Figure	At 75 dB gain setting					20	dB
Input VSWR	L-Band					1.5 : 1	
Internal Reference Option	Aging per day (after 30 days)					± 1 • 10 <sup>-9</sup>	
	Aging per year (after 30 days)					± 6 • 10 <sup>-8</sup>	
	Reference Stability over Temperature (-20 to +85 °C)					± 3 • 10 <sup>-8</sup>	

# Indoor Rack Mount GaAs Solid State Power Amplifiers 2nd Generation, 3RU Rack Height



**Outline Drawing, typical,  
 2nd Generation 3RU Ku-Band SSPA  
 with N+1 Redundant Power Supply**

### Mechanical Specifications

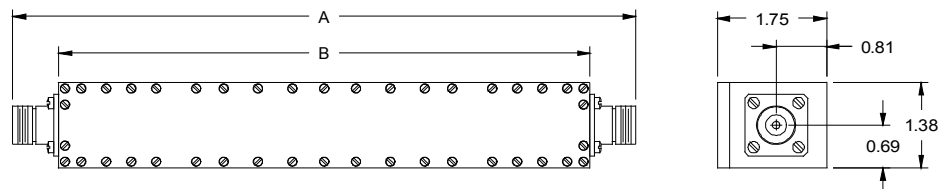
PARAMETER	NOTES	LIMITS	UNITS
Size (SSPA)	width X height X depth	19.0 x 5.22 x 24.13 483 x 133 x 613	inches mm
Size (Power Supply)	width X height X depth	19.0 x 1.75 x 15.97 483 x 45 x 406	inches mm
Weight (SSPA)	Typical ( $\pm 3\%$ ) With integrated zBUC converter	75 (34) +1.7 (+0.8)	lbs. (kg) lbs. (kg)
Weight (Power Supply)	with four (4) power supply modules	29 (13.2)	lbs.(kg)
Finish		Paint	Gray; powder coat
Connectors	RF Input RF Output (C-Band) RF Output (X-Band) RF Output (Ku-Band) RF Output Sample	Type N WR137 Waveguide WR112 Waveguide WR75 Waveguide Type N	Female CPR137G Flange (PDR-70) CPR112G Flange (PDR-84) Grooved flange (PBR-120) Female

### Environmental Specifications

PARAMETER	NOTES	LIMITS	UNITS
Operating Temperature	Ambient	0 to +50	$^{\circ}\text{C}$
Storage Temperature		-20 to +75	$^{\circ}\text{C}$
Operating Relative Humidity	Non-condensing	95	%
Cooling System	Forced Convection Air Cooling	Front Panel - Intake Rear Panel - Exhaust	
Audible Noise	Measured 1m from unit, at $P_{\text{sat}}$	71	dBA
Altitude		No temperature de-rating up to 10,000 ft. (3000 m) De-rate maximum temperature by $2^{\circ}\text{C}$ per 1,000 ft (300 m) beyond 10,000 ft.	

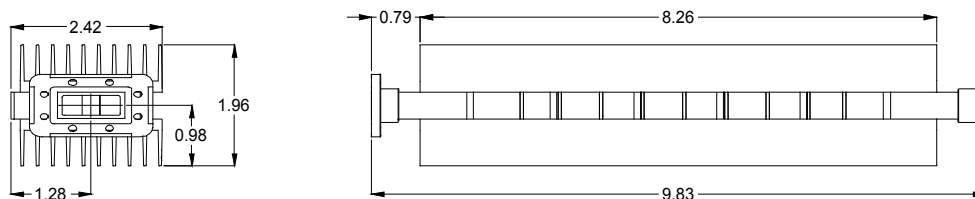
### Receive Band Filter Options

S-Band



- 2.020-2.120 GHz (Band A) : Filter L205250-S3-TX Dimensions: A=9.972 , B=8.500
- 2.200-2.300 GHz (Band B) : Filter L205250-S4-TX Dimensions: A=12.222 , B=10.750
- 1.750-2.120 GHz (Band G) : Filter L205250-S11-TX Dimensions: A=4.730 , B=3.250

X-Band



## Redundant and Phase Combined Systems

Teledyne Paradise Datacom's 3RU Rack Mount SSPAs can be configured in a variety of redundant and phase combined configurations.

- 1:1 Redundant System with Internal Redundancy Control
- 1:1 Redundant System with RCP2-1100 Redundant System Controller
- 1:1 Fixed Phase Combined System with FPRC-1100 Phase Combined System Controller
- 1:2 Redundant System with Internal Redundancy Control
- 1:2 Redundant System with RCP2-1200 Redundant System Controller
- 1:2 Fixed Phase Combined System with FPRC-1200 Phase Combined System Controller

## System Output Power Capacity

Due to residual losses inherent in redundant system configurations (waveguide bends; switch and coupler losses), reduce the typical output power specification of a single amplifier by approximately 0.2 dB for 1:1 and by 0.4 dB for 1:2 systems.

In phase combined systems, these same losses result in slightly less than the ideal addition of 3 dB to the output power of a single HPA unit. For 1:1 phase combined systems, the typical additive output power is approximately 2.70 dB above the output power of a single HPA. For 1:2 phase combined systems, the typical additive output power is approximately 2.50 dB above the output power of a single HPA.

Actual system losses will vary based on the system options.

## System Controllers

The RCP2/FPRC-1100/1200 system controller provides an extremely user friendly interface for complete monitor and control of the amplifier system.



**RCP2-1100 Redundant System Controller**

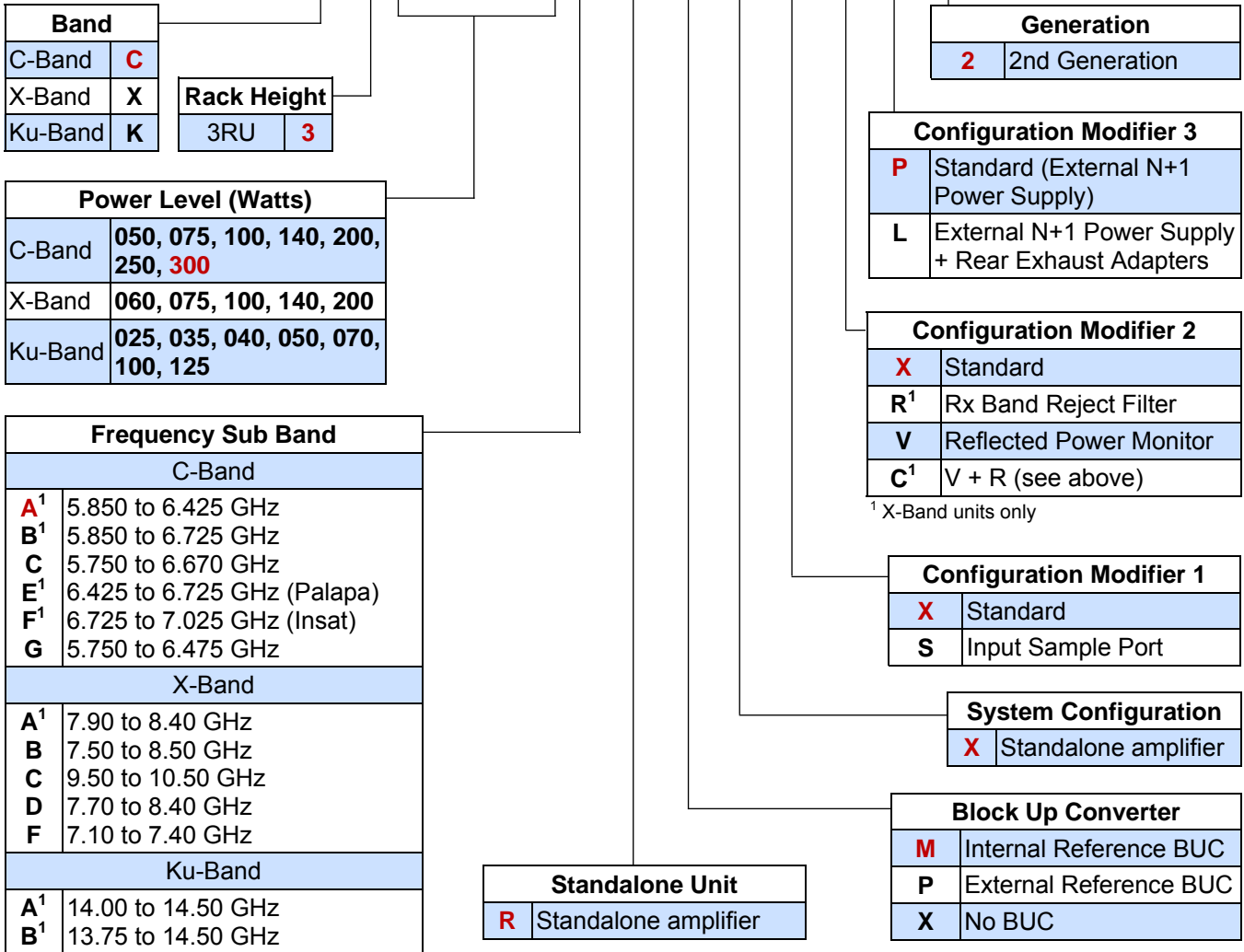
The front panel mimic display shows the on-line amplifiers and the switch positions. Fault lights are provided for easy identification of system status. All system monitor and control is available locally at the front panel LCD display, as well as remotely by the RS232, RS485, or Ethernet interface ports. Audible alarms and a full compliment of parallel I/O signal are available at the rear panel of the controller.



# Indoor Rack Mount GaAs Solid State Power Amplifiers 2nd Generation, 3RU Rack Height

## Part Number Configuration Matrix

**MODEL: HPA** C 3 3 0 0 A R M X X X P 2



<sup>1</sup> Available with optional BUC

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