



Teledyne Paradise Datacom's newly packaged High Power Outdoor (H) series of Solid State Power Amplifiers is packaged with the latest Gallium Nitride, GaN, based SSPA modules. Utilizing the latest in linearized GaN amplifier module technology, the High Power Outdoor enclosure can achieve the highest power densities in the industry. By utilizing an all GaN semiconductor design along with proprietary linearization techniques, the High Power Outdoor amplifier simultaneously provides excellent linear output power along with industry leading efficiency.

The key advantages of GaN technology include:

- Higher Linear Output Power Levels
- Higher Reliability
- Greater Efficiency

A robust thermal platform and mechanical design make the High Power Outdoor package one of the most reliable outdoor high power amplifiers, HPA. Teledyne Paradise Datacom outdoor amplifiers are designed and tested to many of the MIL-STD-810 environmental conditions.

All Teledyne Paradise Datacom SSPAs have a full complement of local and remote control capability. The remote control capabilities include: RS485/RS232 serial control, Ethernet including SNMP, UDP, and internal web browsing. Discrete hardware control, Form C contact alarms and opto isolated inputs are also included.

## FEATURES

- Extremely High Power Density:
  - to 1.0 kW L-Band
  - to 1.0 kW S-Band
  - to 1.0 kW C-Band
  - to 800 W X-Band
  - to 600 W Ku-Band
- RF Output Sample Port
- Remote Communication via RS232/485 or Ethernet
- 20 dB Gain Adjustment
- Built-in 1:1 Redundancy Control with 'Cold' Standby capability
- Built-in Maintenance Switch Controller
- CE Mark/MIL-STD-461 compliant

## OPTIONS

- Hand Held Controller
- RF Input Sample Port
- L-Band Input Operation
- Reflected Power Monitor
- Phase Combined Systems
- Antenna Mounting Kit

## SPECIFICATIONS

- Dimensions & Weight:
  - 16.5 x 27.5 x 9.335 in.
  - 419 x 699 x 238 mm
  - 95.0 lbs. / 43.2 kg

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## L-Band Output Power Levels

PARAMETER	NOTES	LIMITS	UNITS
Frequency Range	Frequency selection "A"	1.750 to 1.850	GHz
Output Power Typical, $P_{sat}$ Guaranteed minimum, $P_{Linear}^1$	HPAL2600AHXXXXXG HPAL2800AHXXXXXG HPAL210KAHXXXXXG	$P_{sat} / P_{Linear}$ 58.0 (600) / 55.0 (300) 59.0 (800) / 56.0 (400) 60.0 (1000) / 57.0 (500)	dBm (W) dBm (W) dBm (W)
Power Requirements Line Frequency Line Power (Voltage) (typical @ 220 VAC)	Power Factor corrected Autoranging  HPAL2600_HXXXXXG HPAL2800_HXXXXXG HPAL210K_HXXXXXG	> 0.9 47–63 $P_{sat} / P_{Linear}$ 2200 / 1700 (90-265) 2500 / 2000 (90-265) 4000 / 3500 (180-265)	Hz  W (VAC) W (VAC) W (VAC)
Receive Band Noise Power Density	without optional filter with optional filter	- 95 - 155	dBW / 4 KHz dBW / 4 KHz

## S-Band Output Power Levels

PARAMETER	NOTES	LIMITS	UNITS
Frequency Range	Frequency selection "G" Frequency selection "A" Frequency selection "B"	1.750 to 2.120 2.020 to 2.120 2.200 to 2.300	GHz GHz GHz
Output Power Typical, $P_{sat}$ Guaranteed minimum, $P_{Linear}^1$	HPAS2600AHXXXXXG HPAS2800AHXXXXXG HPAS210KAHXXXXXG	$P_{sat} / P_{Linear}$ 58.0 (600) / 55.0 (300) 59.0 (800) / 56.0 (400) 60.0 (1000) / 57.0 (500)	dBm (W) dBm (W) dBm (W)
Power Requirements Line Frequency Line Power (Voltage) (typical @ 220 VAC)	Power Factor corrected Autoranging  HPAS2600_HXXXXXG HPAS2800_HXXXXXG HPAS210K_HXXXXXG	> 0.9 47–63 $P_{sat} / P_{Linear}$ 2200 / 1700 (90-265) 2500 / 2000 (90-265) 4000 / 3500 (180-265)	Hz  W (VAC) W (VAC) W (VAC)
Receive Band Noise Power Density	without optional filter with optional filter	- 95 - 155	dBW / 4 KHz dBW / 4 KHz

## C-Band Output Power Levels

PARAMETER	NOTES	LIMITS	UNITS
Frequency Range	Frequency selection "L" Frequency selection "H" Frequency selection "C" <sup>2</sup> Frequency selection "A" Frequency selection "B" <sup>2</sup> Frequency selection "E" Frequency selection "F"	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 6.725 6.725 to 7.025	GHz GHz GHz GHz GHz GHz GHz
Output Power Typical, $P_{sat}$ Guaranteed minimum, $P_{Linear}^1$	HPAC2650AHXXXXXG HPAC2800AHXXXXXG HPAC210KAHXXXXXG	$P_{sat} / P_{Linear}$ 58.1 (650) / 55.1 (325) 59.0 (800) / 56.0 (400) 60.0 (1000) / 57.0 (500)	dBm (W) dBm (W) dBm (W)
Power Requirements Line Frequency Line Power (Voltage) (typical @ 220 VAC)	Power Factor corrected Autoranging  HPAC2650_HXXXXXG HPAC2800_HXXXXXG HPAC210K_HXXXXXG	> 0.9 47 - 63 $P_{sat} / P_{Linear}$ 3300 / 2800 (90-265) 4000 / 3500 (180-265) 4500 / 3700 (180-265)	Hz  W (VAC) W (VAC) W (VAC)
Receive Band Noise Power Density	without filter	- 155	dBW / 4 KHz

**Note 1:**  $P_{Linear}$  = maximum output power at which third order intermodulation products < -25 dBc (for two tones separated by 5 MHz) or spectral regrowth on a single QPSK at 1.5 x symbol rate or OQPSK at 1.0 x symbol rate is < -30 dBc.

**Note 2:** Output power decreases over the extended portion of the frequency range. Both  $P_{sat}$  and  $P_{Linear}$  de-rate by 1 dB from 5.85 to 5.75 GHz for frequency selection "C" and from 6.425 to 6.725 GHz for frequency selection "B".

## X-Band Output Power Levels

PARAMETER	NOTES	LIMITS	UNITS
Frequency Range	Frequency selection "F"	7.10 to 7.40	GHz
	Frequency selection "D"	7.70 to 8.40	GHz
	Frequency selection "A"	7.90 to 8.40	GHz
Output Power Typical, $P_{sat}$ Guaranteed minimum, $P_{Linear}^1$	HPAX2650AHXXXXXG	$P_{sat} / P_{Linear}$ 58.1 (650) / 55.1 (325)	dBm (W)
	HPAX2800AHXXXXXG	59.0 (800) / 56.0 (400)	dBm (W)
Power Requirements Line Frequency Line Power (Voltage) (typical @ 220 VAC)	Power Factor corrected Autoranging	> 0.94 47 - 63	Hz
	HPAX2650_HXXXXXG HPAX2800_HXXXXXG	$P_{sat} / P_{Linear}$ 3300 / 2800 (90-265) 4000 / 3500 (180-265)	W (VAC) W (VAC)
Receive Band Noise Power Density	without optional filter	- 85	dBW / 4 KHz
	with optional filter	- 155	

## Ku-Band Output Power Levels

PARAMETER	NOTES	LIMITS	UNITS
Frequency Range	Frequency selection "F"	12.75 to 13.25	GHz
	Frequency selection "B"	13.75 to 14.50	GHz
	Frequency selection "A"	14.00 to 14.50	GHz
	Frequency selection "C"	14.50 to 14.70	GHz
	Frequency selection "G"	14.75 to 15.25	GHz
	Frequency selection "D"	15.10 to 15.40	GHz
Output Power Typical, $P_{sat}$ Guaranteed minimum, $P_{Linear}^1$	HPAK2400AHXXXXXG	$P_{sat} / P_{Linear}$ 56.0 (400) / 53.0 (200)	dBm (W)
	HPAK2500AHXXXXXG	57.0 (500) / 54.0 (250)	dBm (W)
	HPAK2600AHXXXXXG	57.8 (600) / 54.8 (300)	dBm (W)
Power Requirements Line Frequency Line Power (Voltage) (typical @ 220 VAC)	Power Factor corrected Auto ranging	> 0.94 47 - 63	Hz
	HPAK2400_HXXXXXG HPAK2500_HXXXXXG HPAK2600_HXXXXXG	$P_{sat} / P_{Linear}$ 2500 / 1700 (90-265) 3000 / 2000 (90-265) 3200 / 2500 (90-265)	W (VAC) W (VAC) W (VAC)
	Receive Band Noise Power Density <sup>2</sup>	with filter	- 155

**Note 1:**  $P_{Linear}$  = maximum output power at which third order intermodulation products < -25 dBc (for two tones separated by 5 MHz) or spectral regrowth on a single QPSK at 1.5 x symbol rate or OQPSK at 1.0 x symbol rate is < -30 dBc .

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

## Electrical Specifications

PARAMETER	NOTES	LIMITS	UNITS
Gain	range	55-75	dB
Gain Flatness	full band	± 1.0	dB
	Extended C-Band units	± 1.5	dB
	full band (L-, S-Band)	± 0.75	dB
Gain Slope	per 40 MHz (C-, X-, Ku-bands)	± 0.3	dB/40 MHz
	per 10 MHz (L-, S-Band)	± 0.2	dB/10 MHz
Gain Variation vs. Temperature	-40°C to +60°C	± 1.5	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)	At $P_{Linear}$ ( $P_{sat} - 3$ dB)	-25	dBc
AM/PM Conversion	@ rated $P_{Linear}$	≤ 1.0	°/dB
Spurious	@ rated $P_{Linear}$	-65	dBc
Harmonics (SSPA only)	@ rated $P_{Linear}$	-50	dBc
	@ rated $P_{Linear}$ (L-, S-Band)	-30	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	10	dB
	at maximum gain (L-, S-Band)	8	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
TX 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	$P_{sat}$ to ( $P_{sat} - 20$ ) ± 0.75	dB dBm

## Environmental Specifications

Operating Temperature	Ambient	-40 to +60	°C
Relative Humidity	Condensing	100	%
Cooling System	Integrated	Forced air	
Ingress Protection Rating	With connectors properly sealed	IP54	
Altitude	No temperature de-rating up to 10,000 ft. (3,000 m) De-rate maximum temperature by 2 °C per 1,000 ft (300 m) beyond 10,000 ft.		
Shock	50 g p-p, 11 msec pulses		
Vibration	3g rms 30 min. 5-2000 Hz		

## 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. Adding a zBUC® converter typically increases the gain by 2-4 dB. Advantages 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 10 or 50 MHz.
- zBUC converter can accept a wide range of external reference power (-10 to +5 dBm)
- zBUC converter can accept FSK monitor and control signal via the IFL for complete amplifier remote control.

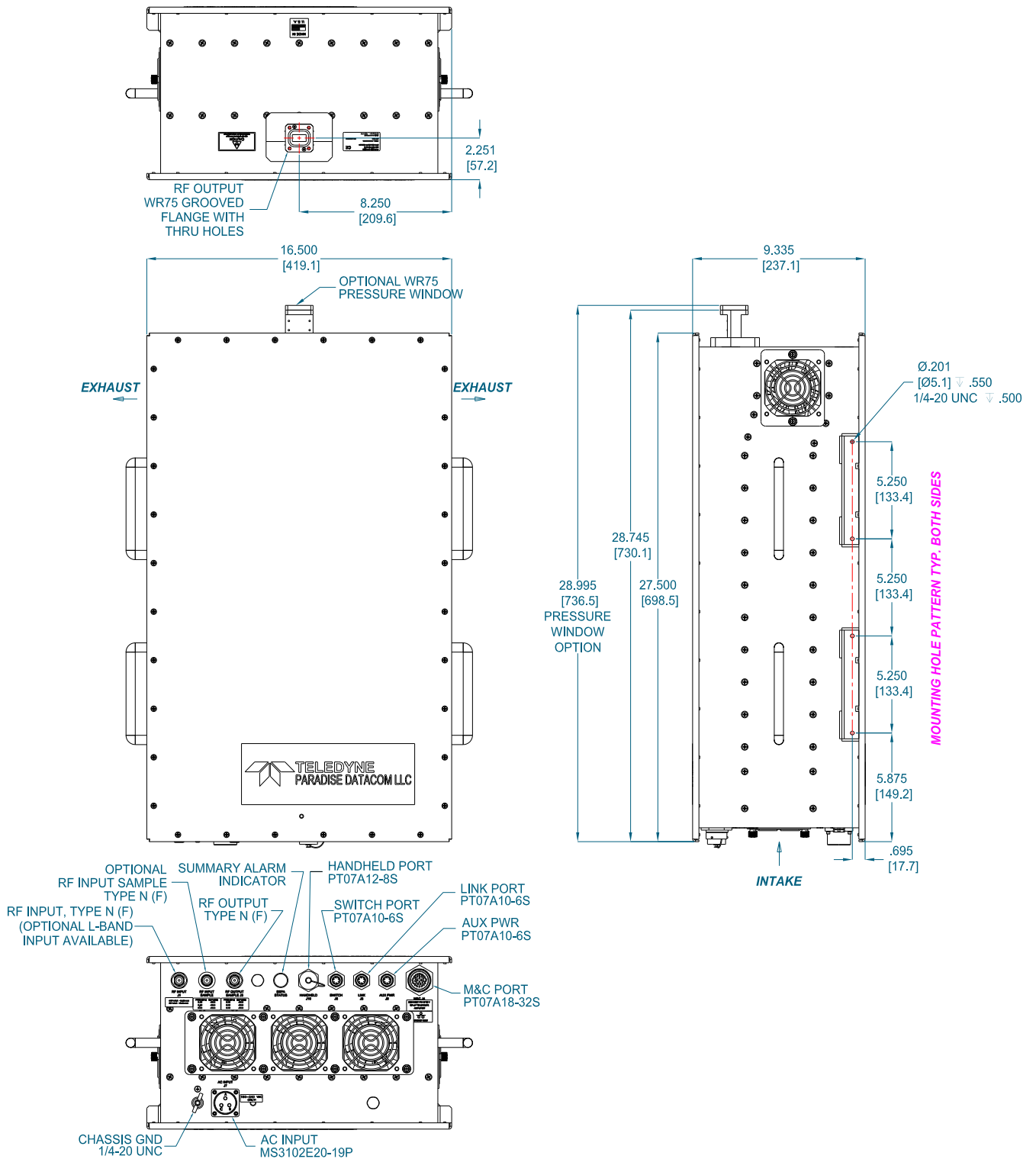
## Available Frequency Plans

Band	Frequency Plan	IF Input	LO Frequency	RF Output
C	Sub-Band "A"	950 - 1525 MHz	4.900 GHz	5.850 - 6.425 GHz
C	Sub-Band "B"	950 - 1825 MHz	4.900 GHz	5.850 - 6.725 GHz
C	Sub-Band "C"	950 - 1870 MHz	4.800 GHz	5.750 - 6.670 GHz
C	Sub-Band "E"	950 - 1250 MHz	5.475 GHz	6.425 - 6.725 GHz
C	Sub-Band "F"	950 - 1250 MHz	5.775 GHz	6.725 - 7.025 GHz
C	Sub-Band "L"	950 - 1550 MHz	3.450 GHz	4.400 - 5.000 GHz
X	Sub-Band "A"	950 - 1450 MHz	6.950 GHz	7.900 - 8.400 GHz
Ku	Sub-Band "A"	950 - 1450 MHz	13.050 GHz	14.00 - 14.50 GHz
Ku	Sub-Band "B"	950 - 1700 MHz	12.800 GHz	13.75 - 14.50 GHz
Ku	Sub-Band "D"	1350 - 1650 MHz	13.750 GHz	15.10 - 15.40 GHz
Ku	Sub-Band "F"	950 - 1450 MHz	11.800 GHz	12.75 - 13.25 GHz

## Electrical Specifications for High Power Outdoor SSPA with ZBUC 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		20				dB
	Typical C-Band Adj. Range	60 - 80				dB
	Typical Ku-Band Adj. Range	57 - 77				dB
Gain Stability	-40 to +60 °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	-58	-56	dBc/Hz
	100 Hz	-60	-74	-70	-67	dBc/Hz
	1 KHz	-70	-84	-80	-78	dBc/Hz
	10 KHz	-80	-100	-94	-91	dBc/Hz
	100 KHz	-90	-105	-97	-94	dBc/Hz
	1 MHz	-90	-125	-122	-120	dBc/Hz
Spurious	In-Band Signal Related (C-/Ku-Band) (Extended C-Band)	-50				dBc
	Close to Carrier Spurious (≤ 20 MHz)	-40				dBc
	Local Oscillator	-50				dBc
		-30				dBm
Noise Figure	At Maximum gain	20				dB
Transmit Band Noise Output Power Density	Tx Band at Maximum gain	-65				dBW/4kHz
Input VSWR	L-Band	1.5 : 1				
Internal Reference Option	Reference Accuracy (initial)	± 1 • 10 <sup>-8</sup>				
	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 (-40 to +40 °C, ambient)	± 1 • 10 <sup>-8</sup>				

## Outline Drawing, Ku-Band High Power Outdoor SSPA (typical)



## Mechanical Specifications

PARAMETER	NOTES	LIMITS	UNITS
Size	width X length X height	16.5 X 27.5 X 9.335 419 X 699 X 238	inches mm
Weight		95 (43.2)	lbs. (kg)
Finish		white powder coat	
Connectors	(J1) RF Input (J2) RF Output — L-, S-Band (J2) RF Output — C-Band (J2) RF Output — X-Band (J2) RF Output — Ku-Band (J3) RF Output Sample (J4) Monitor and Control (M&C) (J5) Link (J6) Switch (J7) AC Input (J8) Auxiliary Power (J10) Handheld Controller (see below) Optional RF Input Sample	Type N 7/16 DIN CPRG-137 CPRG-112 WR-75 (grooved) Type N MS3112E18-32S MS3112E10-6S MS3112E10-6S MS3102E20-19P MS3112E10-6S MS3112E12-8S Type N	Female Female    Female Socket Socket Socket Pin Socket Socket Female

## Optional Accessory

### Universal Handheld Controller (RCH-1000)

The Universal Handheld Controller (RCH-1000) is a versatile device used to interface with a variety of Teledyne Paradise Datacom amplifiers, including Compact Outdoor SSPA, or H-Series High Power Outdoor SSPA. Reference specification sheet **211667**.

The device is housed in a ruggedized enclosure that is environmentally sealed to IP65 levels. This allows the Universal Handheld Controller (RCH-1000) to be used in most outdoor environments. The rugged construction of the device enclosure provides protection from impact and vibration.



This device allows the operator to adjust the attenuation of the connected unit, and control the mute/unmute selection, as well as monitor the status, conditions and settings of the connected unit via a serial RS-485 connection. Fault conditions and other events are tracked in the controller's internal log.

## Part Number Configuration Matrix

HPA **C 2 8 0 0 A H M X S X X G**

Band	
L-Band	L
S-Band	S
C-Band	C
X-Band	X
Ku-Band	K

Generation	
Second	2

Power Level (Watts)	
L-Band	600, 800, 1000 (10K)
S-Band	600, 800, 1000 (10K)
C-Band	650, 800, 1000 (10K)
X-Band	650, 800
Ku-Band	400, 500, 600

Frequency Sub Band	
L-Band	
A	1.75 to 1.85 GHz
S-Band	
A	2.02 to 2.12 GHz
B	2.20 to 2.30 GHz
G	1.75 to 2.12 GHz
C-Band	
A <sup>1</sup>	5.850 to 6.425 GHz
B <sup>1</sup>	5.850 to 6.725 GHz
C <sup>1</sup>	5.750 to 6.670 GHz
E <sup>1</sup>	6.425 to 6.725 GHz
F <sup>1</sup>	6.725 to 7.025 GHz
H	5.715 to 5.790 GHz
L <sup>1</sup>	4.400 to 5.000 GHz
X-Band	
A <sup>1</sup>	7.90 to 8.40 GHz
D	7.70 to 8.40 GHz
F	7.10 to 7.40 GHz
Ku-Band	
A <sup>1</sup>	14.00 to 14.50 GHz
B <sup>1</sup>	13.75 to 14.50 GHz
C	14.50 to 14.70 GHz
D <sup>1</sup>	15.10 to 15.40 GHz
F <sup>1</sup>	12.75 to 13.25 GHz
G	14.75 to 15.25 GHz

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

An optional mounting kit is available.

GaN Device Designator	
G	GaN Device

Configuration Modifier 3	
X	None (Standard)

Configuration Modifier 2	
X	Standard
R <sup>1</sup>	Receive Band Reject Filter
V	Reflected Power Monitor
W <sup>2</sup>	Waveguide Pressure Window
Y <sup>1</sup>	R + V (see above)
Z <sup>2</sup>	V + W (see above)

<sup>1</sup> S-Band and X-Band only  
<sup>2</sup> Ku-Band standalone units only

Configuration Modifier 1	
X	Standard
S	Input Sample Port

System Configuration	
X	Standalone amplifier

Block Up Converter	
M	Internal Reference BUC
P	External Reference BUC
X	No BUC

Package	
H	Standalone amplifier

**Example** - A standalone 800W GaN C-Band High Power Outdoor SSPA an optional input sample port and optional internal reference block up converter is part number: **HPAC2800AHMXSXXG**.

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