



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 S-Band
  - to 800 W X-Band
  - to 800 W C-Band
  - to 500 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

## 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

## 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)
Prime Input Power Line Frequency Line Power (Voltage) (typical @ 220 VAC)	Power factor corrected  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

**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 .

## 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 "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, $P_{sat}$ Guaranteed minimum, $P_{Linear}^1$	HPAC2650AHXXXXXG HPAC2800AHXXXXXG	$P_{sat} / P_{Linear}$ 58.1 (650) / 55.1 (325) 59.0 (800) / 56.0 (400)	dBm (W) dBm (W)
Power Requirements Line Frequency Line Power (Voltage) (typical @ 220 VAC)	Power Factor corrected Autoranging  HPAC2650_HXXXXXG HPAC2800_HXXXXXG	> 0.9 47 - 63 $P_{sat} / P_{Linear}$ 3300 / 2800 (90-265) 4000 / 3500 (180-265)	Hz  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 and from 6.425 to 6.725 GHz.

## X-Band Output Power Levels

PARAMETER	NOTES	LIMITS	UNITS
Frequency Range	Frequency selection "F" Frequency selection "D" 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>Linear</sub> <sup>1</sup>	HPAX2650AHXXXXXG HPAX2800AHXXXXXG	$P_{sat} / P_{Linear}$ 58.1 (650) / 55.1 (325) 59.0 (800) / 56.0 (400)	dBm (W) dBm (W)
Power Requirements Line Frequency Line Power (Voltage) (typical @ 220 VAC)	Power Factor corrected Autoranging  HPAX2650_HXXXXXG HPAX2800_HXXXXXG	> 0.94 47 - 63  $P_{sat} / P_{Linear}$ 3300 / 2800 (90-265) 4000 / 3500 (180-265)	Hz  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:** P<sub>Linear</sub> = 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 .

## Ku-Band Output Power Levels

PARAMETER	NOTES	LIMITS	UNITS
Frequency Range	Frequency selection "F" Frequency selection "B" Frequency selection "A" Frequency selection "C" Frequency selection "G" Frequency selection "D"	12.75 to 13.25 13.75 to 14.50 14.00 to 14.50 14.50 to 14.70 14.75 to 15.25 15.10 to 15.40	GHz GHz GHz GHz GHz GHz
Output Power Typical, P <sub>sat</sub> Guaranteed minimum, P <sub>Linear</sub> <sup>1</sup>	HPAK2300AHXXXXXG HPAK2400AHXXXXXG HPAK2500AHXXXXXG	$P_{sat} / P_{Linear}$ 54.8 (300) / 51.8 (150) 56.0 (400) / 53.0 (200) 57.0 (500) / 54.0 (250)	dBm (W) dBm (W) dBm (W)
Power Requirements Line Frequency Line Power (Voltage) (typical @ 220 VAC)	Power Factor corrected Auto ranging  HPAK2300_HXXXXXG HPAK2400_HXXXXXG HPAK2500_HXXXXXG	> 0.94 47 - 63  $P_{sat} / P_{Linear}$ 2000 / 1500 (90-265) 2500 / 1700 (90-265) 3000 / 2000 (90-265)	Hz  W (VAC) W (VAC) W (VAC)
Receive Band Noise Power Density <sup>2</sup>	with optional filter	- 155	dBW / 4 KHz

**Note 1:** P<sub>Linear</sub> = 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 (S-Band)	± 0.75	dB
Gain Slope	per 40 MHz (C-,X-,Ku-bands)	± 0.3	dB/40 MHz
	per 10 MHz (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 $P_{Linear}$ (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 (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

## Mechanical & Environmental Specifications

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		powder coat	white
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. 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 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.

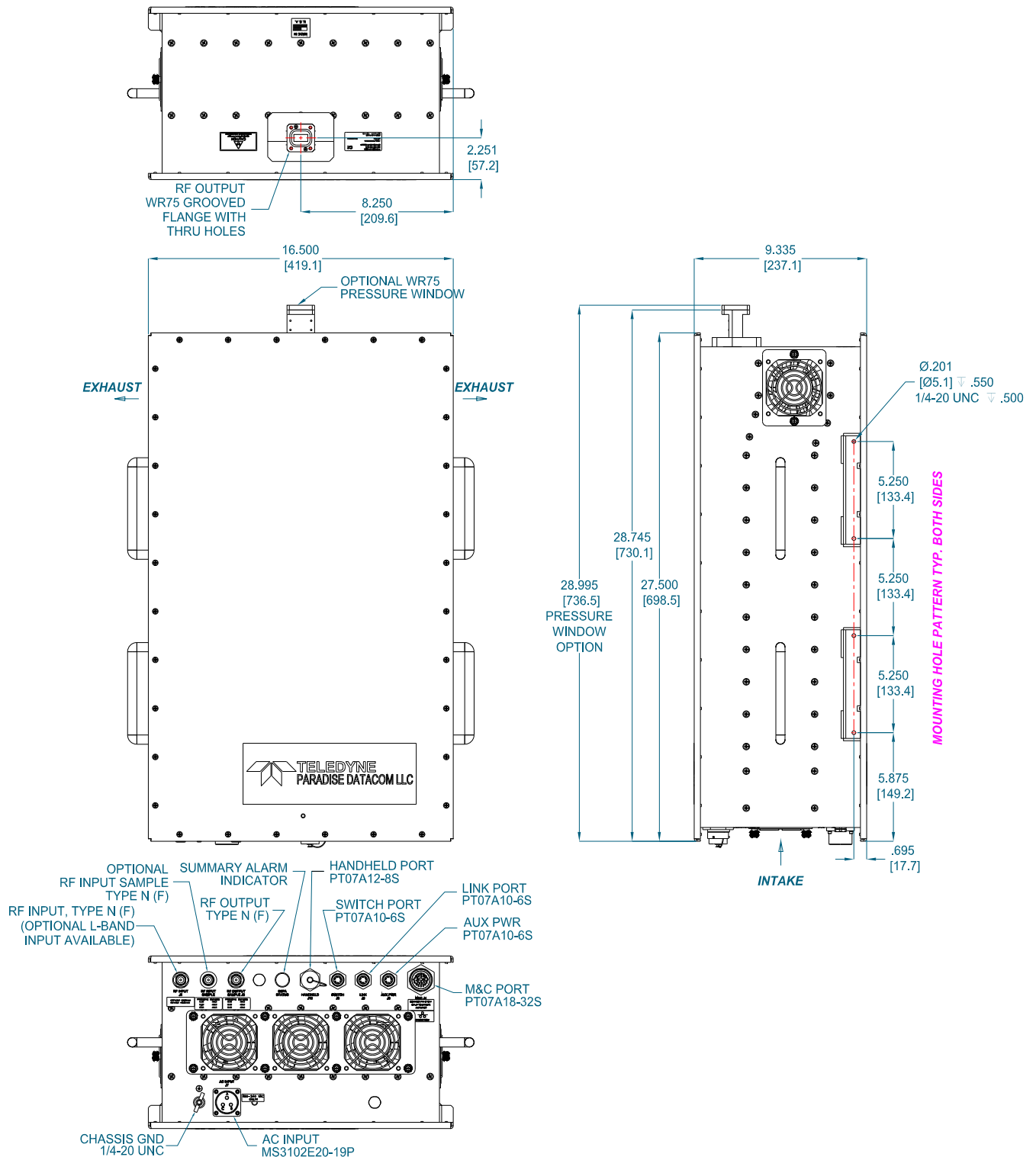
### Available Frequency Plans

Band	Frequency 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 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	
Gain Stability	Typical C-Band Adj. Range	60 - 80				dB	
	Typical Ku-Band Adj. Range	57 - 77				dB	
	-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	-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	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)



## 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, Mini Compact Outdoor SSPA, or H-Series High Power Outdoor SSPA. Reference specification sheet **211667**.

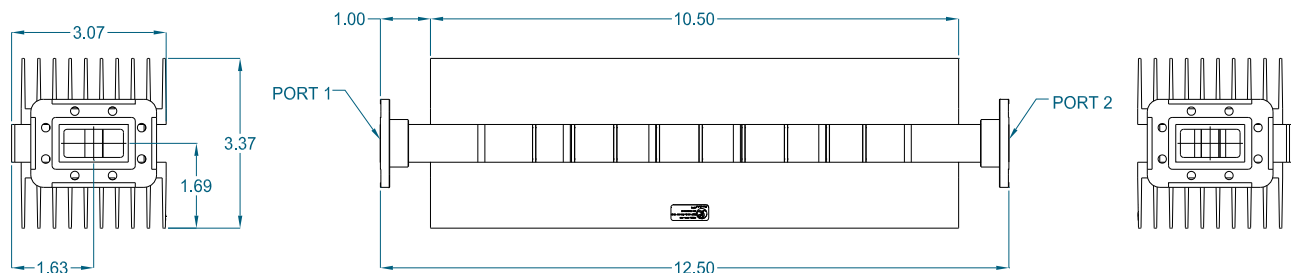
The device is housed in a ruggedized enclosure that is environmentally sealed to IP65 levels. This allows the Universal Handheld Controller (RCH-1000) to be used in most outdoor environments. The rugged construction of the device enclosure provides protection from impact and vibration.



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.

## Receive Band Filter Options

X-Band GaN amplifiers may be ordered with an external receive band reject filter. The filter used for frequency band 7.90 - 8.40 GHz is model L205250-X6-TX.



Consult the factory for S-Band Receive Band Reject Filters.



## Part Number Configuration Matrix

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

Band	
S-Band	<b>S</b>
C-Band	<b>C</b>
X-Band	<b>X</b>
Ku-Band	<b>K</b>

Generation	
Second	<b>2</b>

Power Level (Watts)	
S-Band	<b>600, 800, 1000 (10K)</b>
C-Band	<b>650, 800</b>
X-Band	<b>650, 800</b>
Ku-Band	<b>300, 400, 500</b>

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

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

GaN Device Designator	
<b>G</b>	GaN Device

Configuration Modifier 3	
<b>X</b>	None (Standard)

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

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

Configuration Modifier 1	
<b>X</b>	Standard
<b>S</b>	Input Sample Port

System Configuration	
<b>X</b>	Standalone amplifier

Block Up Converter	
<b>M</b>	Internal Reference BUC
<b>P</b>	External Reference BUC
<b>X</b>	No BUC

Package	
<b>H</b>	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**.

An optional mounting kit is available.

### Use and Disclosure of Data

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