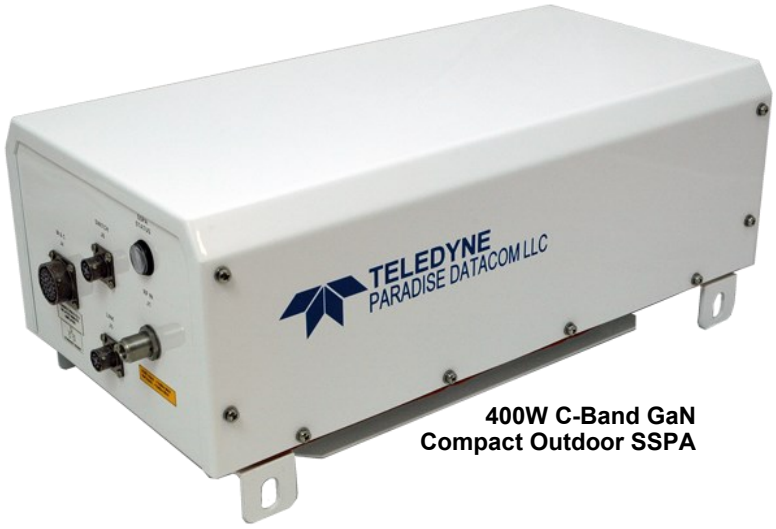
TELEDYNE
PARADISE DATACOM
A Teledyne Technologies Company

Compact Outdoor
Gallium Nitride (GaN)
Solid State Power Amplifiers

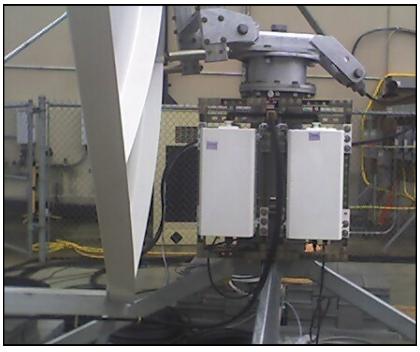


400W C-Band GaN
Compact Outdoor SSPA

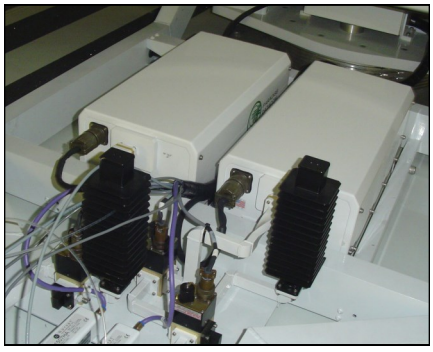
Description

The Teledyne Paradise Datacom Compact Outdoor Solid State Power Amplifier (SSPA) is built for extreme environmental conditions and high reliability operation. Along with the robust construction exists the highest power density in the industry. This allows solid state technology to be used in applications that have long been reserved for TWTAs. Weighing 44 lbs. (20 kg) and being only slightly larger than a shoe box, these SSPAs are available in output power levels of:

L-Band: 100W, 200W, 300W, 400W, 500W
S-Band: 100W, 200W, 300W, 400W, 500W
C-Band: 300W, 400W
X-Band: 300W, 400W
Ku-Band: 200W, 250W



Antenna-mount 1:1 system w/ mounting frame



SNG-mount 1:1 system w/ side-mount AC input

FEATURES

- Compact size and weight
- CE & MIL-461 Compliant
- Integrated forced-air cooling system
- 20 dB RF Gain Adjustment
- Extreme Environmental Testing
- RF Output Sample Port
- Maintenance Free Operation
- Universal, Power Factor Corrected Power Supply
- Built-in 1:1 Redundancy Control
- Built-in Maintenance Switch Controller
- True Output Power Detection
- Hot/Cold Standby operating modes for reduced power consumption

OPTIONS

- Hand Held Controller
- Antenna Mounting Kit
- Remote Control Panel
- L-Band Input
- FSK monitor & control via IFL
- Phase Combined Systems
- Low line voltage operation
- Optional side-mount AC input for SNG installations
- Receive Band Reject Filter
- Reflected Power Monitor
- -55 °C Operation

SPECIFICATIONS

- Compact Outdoor housing
  10.0 X 19.5 X 6.50 in
  254 X 495 X 165 mm
  44.0 lbs. / 20.0 kg
- White powder coat finish
- Operating temperature: -40 to +60 °C

Compact Outdoor Gallium Nitride (GaN) Solid State Power Amplifiers

Specifications, L-Band SSPAs

PARAMETER	NOTES	LIMITS	UNITS
Frequency Range	Frequency selection "A" Frequency selection "C"	1.750 to 1.850 1.760 to 1.900	GHz GHz
Output Power Typical, P_{sat} Guaranteed minimum, P_{Linear} [1]	 HPAL2100ACXXXXXG HPAL2200ACXXXXXG HPAL2300ACXXXXXG HPAL2400ACXXXXXG HPAL2500ACXXXXXG	P_{sat} / P_{Linear} 50.0 (100) / 47.0 (50) 53.0 (200) / 50.0 (100) 54.8 (300) / 51.8 (150) 56.0 (400) / 53.0 (200) 57.0 (500) / 54.0 (250)	 dBm (W) dBm (W) dBm (W) dBm (W) dBm (W)
Power Requirements Line Frequency Line Power (Voltage) (typical @ 220 VAC)	power factor HPAL2100ACXXXXXG HPAL2200ACXXXXXG HPAL2300ACXXXXXG HPAL2400ACXXXXXG HPAL2500ACXXXXXG	.98 47 to 63 500 / 400 (90-265) 800 / 700 (90-265) 1300 / 1000 (90-265) 1600 / 1300 (90-265) 1800 / 1500 (90-265)	 Hz W (VAC) W (VAC) 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

Specifications, S-Band SSPAs

PARAMETER	NOTES	LIMITS	UNITS
Frequency Range	Frequency selection "G" Frequency selection "A" Frequency selection "B"	1.750 to 2.120 [2] 2.020 to 2.120 2.200 to 2.300	GHz GHz GHz
Output Power Typical, P_{sat} Guaranteed minimum, P_{Linear} [1]	 HPAS2100ACXXXXXG HPAS2200ACXXXXXG HPAS2300ACXXXXXG HPAS2400ACXXXXXG HPAS2500ACXXXXXG	P_{sat} / P_{Linear} 50.0 (100) / 47.0 (50) 53.0 (200) / 50.0 (100) 54.8 (300) / 51.8 (150) 56.0 (400) / 53.0 (200) 57.0 (500) / 54.0 (250)	 dBm (W) dBm (W) dBm (W) dBm (W) dBm (W)
Power Requirements Line Frequency Line Power (Voltage) (typical @ 220 VAC)	power factor HPAS2100ACXXXXXG HPAS2200ACXXXXXG HPAS2300ACXXXXXG HPAS2400ACXXXXXG HPAS2500ACXXXXXG	.98 47 to 63 500 / 400 (90-265) 800 / 700 (90-265) 1300 / 1000 (90-265) 1600 / 1300 (90-265) 1800 / 1500 (90-265)	 Hz W (VAC) W (VAC) 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

Notes

Note 1: P_{linear} is the linear power as defined by MIL-STD-188-164 for two tones separated by 5 MHz or $\leq$ -30 dBc spectral regrowth on a single OQPSK signal at 1.0x symbol rate.

Note 2: Not available at 500W.

Continuous operation at saturated power can negatively impact the life of the amplifier and will not be covered by warranty. Normal operating output should be limited to P_{linear} (3dB backed off from the full rated power, P_{sat}).

Specifications, C-Band SSPAs

PARAMETER	NOTES	LIMITS	UNITS
Frequency Range	Frequency selection "A" Frequency selection "B" [3] Frequency selection "C" [4]	5.850 to 6.425 5.850 to 6.725 5.750 to 6.670	GHz GHz GHz
Output Power Typical, P_{sat} Guaranteed minimum, P_{Linear} [1]	 HPAC2300ACXXXXXG HPAC2400ACXXXXXG	P_{sat} / P_{Linear} 54.8 (300) / 51.8 (150) 56.0 (400) / 53.0 (200)	 dBm (W) dBm (W)
Power Requirements Line Frequency Line Power (Voltage) (typical @ 220 VAC)	power factor HPAC2300ACXXXXXG HPAC2400ACXXXXXG	.98 47 to 63 P_{sat} / P_{Linear} 1500 / 1300 (180-265) [2] 1800 / 1600 (180-265) [2]	 Hz W (VAC) W (VAC)
Receive Band Noise Power Density	without filter	- 155	dBW / 4 KHz

Note 1: P_{linear} is the linear power as defined by MIL-STD-188-164 for two tones separated by 5 MHz or ≤ -30 dBc spectral regrowth on a single OQPSK signal at 1.0x symbol rate.
Note 2: Available with low line voltage option, 90 to 265 VAC.
Note 3: De-rate output power by 1.0 dB linearly from 6.425 to 6.725 GHz.
Note 4: De-rate output power by 1.0 dB linearly from 5.850 to 5.750 GHz and by 1.0 dB linearly from 6.425 to 6.670 GHz.

Specifications, X-Band SSPAs

PARAMETER	NOTES	LIMITS	UNITS
Frequency Range	Frequency selection "A"	7.90 to 8.40	GHz
Output Power Typical, P_{sat} Guaranteed minimum, P_{Linear} [1]	 HPAX2300ACXXXXXG HPAX2400ACXXXXXG	P_{sat} / P_{Linear} 54.8 (300) / 51.8 (150) 56.0 (400) / 53.0 (200)	 dBm (W) dBm (W)
Power Requirements Line Frequency Line Power (Voltage) (typical @ 220 VAC)	power factor HPAX2300ACXXXXXG HPAX2400ACXXXXXG	.98 47 to 63 P_{sat} / P_{Linear} 1500 / 1300 (180-265) [2] 2000 / 1700 (180-265) [2]	 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_{linear} is the linear power as defined by MIL-STD-188-164 for two tones separated by 5 MHz or ≤ -30 dBc spectral regrowth on a single OQPSK signal at 1.0x symbol rate.
Note 2: Available with low line voltage option, 90 to 265 VAC.

Specifications, Ku-Band SSPAs

PARAMETER	NOTES	LIMITS	UNITS
Frequency Range	Frequency selection "A" Frequency selection "B" [3]	14.00 to 14.50 13.75 to 14.50	GHz GHz
Output Power Typical, P_{sat} Guaranteed minimum, P_{Linear} [1]	 HPAK2200ACXXXXXG HPAK2250ACXXXXXG	P_{sat} / P_{Linear} 53.0 (200) / 50.0 (100) 54.0 (250) / 51.0 (125)	 dBm (W) dBm (W)
Power Requirements Line Frequency Line Power (Voltage) (typical @ 220 VAC)	power factor HPAK2200ACXXXXXG HPAK2250ACXXXXXG	.98 47 to 63 P_{sat} / P_{Linear} 1200 / 920 (180-265) [2] 1500 / 1000 (180-265) [2]	 Hz W (VAC) W (VAC)
Receive Band Noise Power Density [4]		- 155	dBW / 4 KHz

Note 1: P_{linear} is the linear power as defined by MIL-STD-188-164 for two tones separated by 5 MHz or ≤ -30 dBc spectral regrowth on a single OQPSK signal at 1.0x symbol rate.
Note 2: Available with low line voltage option, 90 to 265 VAC.
Note 3: De-rate output power by 1.0 dB linearly from 14.00 to 13.75 GHz.
Note 4: All Ku-Band SSPAs are fitted with a receive band reject bulkhead filter, standard. An optional pressure window is available.

Continuous operation at saturated power can negatively impact the life of the amplifier and will not be covered by warranty. Normal operating output should be limited to P_{linear} (3dB backed off from the full rated power, P_{sat}).

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
	full band (L-/S-Band)	± 0.75	dB
Gain Slope	per 40 MHz	± 0.3	dB/40 MHz
	per 10 MHz (L-/S-Band)	± 0.3	dB/10 MHz
Gain Variation vs. Temperature	-30 °C to +50 °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)	@ 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		1.30:1	
	Extended C-Band	1.50:1	
	Output VSWR: Ku-Band with bulkhead filter	1.40:1	
Group Delay	Linear	0.01	ns/MHz
(per 40 MHz segment)	Parabolic	0.003	ns/MHz^2
	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	P_{sat} to (P_{sat} - 20)	dB
	Accuracy, Psat to (Psat - 10 dB)	± 0.75	dB
	Accuracy, (Psat - 10 dB) to (Psat - 20 dB)	± 1.0	dB
	L-/S-Band units, Accuracy (full band)	± 1.0	dB

Specifications are subject to change without notice.

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:

- Autosensing zBUC includes an internal reference but will switch to an external reference if applied;
- Internal high stability (10 MHz) reference; will lock to externally supplied (10 or 50 MHz) reference;
- 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

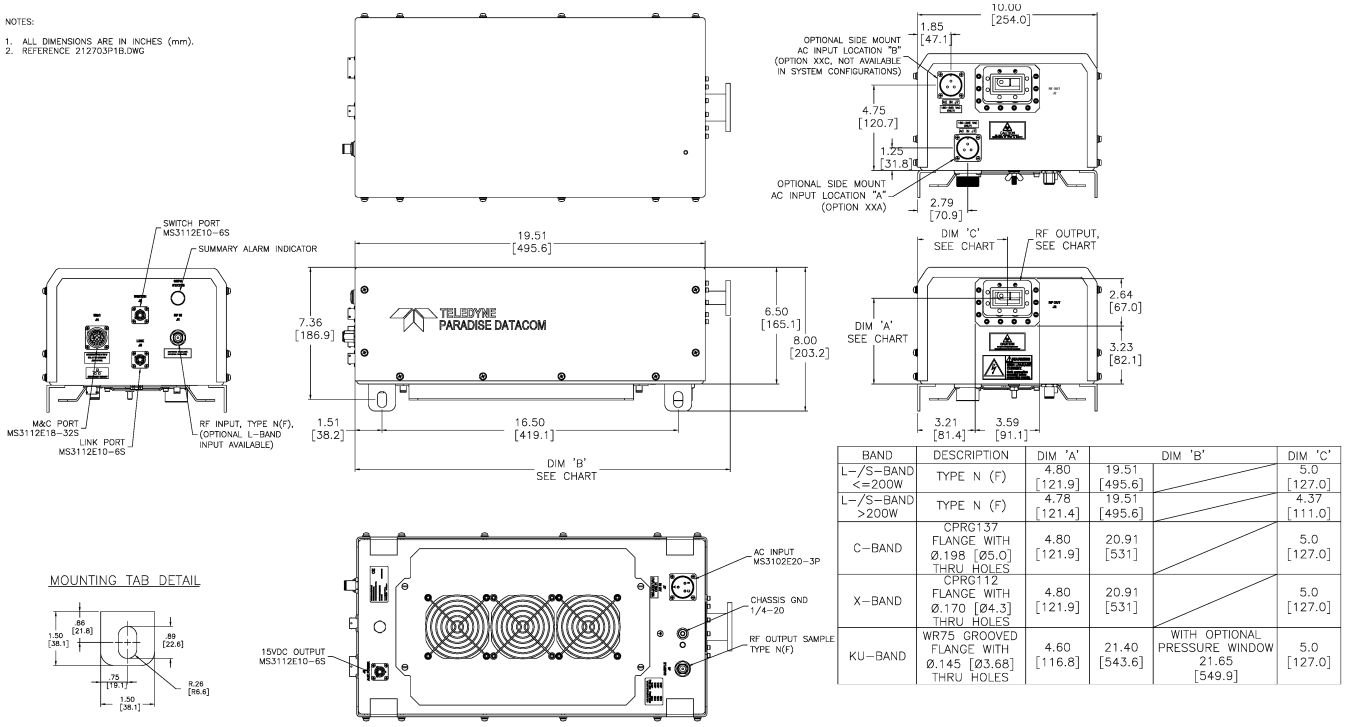
Band	Frequency Plan	IF Input	LO Frequency	RF Output
C	Sub-Band "A"	950 - 1525 MHz	4.900 GHz	5.850 - 6.425 GHz
C	Sub-Band "B"	950 - 1825 MHz	4.900 GHz	5.850 - 6.725 GHz
C	Sub-Band "C"	950 - 1870 MHz	4.800 GHz	5.750 - 6.670 GHz
X	Sub-Band "A"	950 - 1450 MHz	6.950 GHz	7.900 - 8.400 GHz
Ku	Sub-Band "A"	950 - 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

Electrical Specifications for Compact Outdoor SSPA with ZBUC converter

PARAMETER	NOTES	LIMITS				UNITS
Gain	Nominal setting	75				dB
Gain Flatness	full band	± 2.0				dB
Gain Slope	per 40 MHz	± 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	Absolute max.	C-band (typ.)	X-band (typ.)	Ku-band (typ.)	
	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			-50		dBc
	(Extended C-Band)			-40		dBc
	Close to Carrier Spurious (≤ 20 MHz)			-50		dBc
	Local Oscillator			-30		dBm
Transmit Band Noise Output Power Density	Tx Band at Maximum gain			-65		dBW/4kHz
Input VSWR	L-Band			1.5 : 1 (13.9)		(dB)
Internal Reference Option	Reference Accuracy (initial)			$\pm 1 \cdot 10^{-8}$		
	Aging per day (after 30 days)			$\pm 1 \cdot 10^{-9}$		
	Aging per year (after 30 days)			$\pm 6 \cdot 10^{-8}$		
	Reference Stability over Temp. (-40 to +40 °C, ambient)			$\pm 1 \cdot 10^{-8}$		

Compact Outdoor Gallium Nitride (GaN) Solid State Power Amplifiers

Outline Drawing, Compact Outdoor SSPA (typical)



BAND	DESCRIPTION	DIM 'A'	DIM 'B'		DIM 'C'
L-/S-BAND <=200W	TYPE N (F)	4.80 [121.9]	19.51 [495.6]		5.0 [127.0]
L-/S-BAND >200W	TYPE N (F)	4.78 [121.4]	19.51 [495.6]		4.37 [111.0]
C-BAND	CPRG137 FLANGE WITH Ø.198 [Ø5.0] THRU HOLES	4.80 [121.9]	20.91 [531]		5.0 [127.0]
X-BAND	CPRG112 FLANGE WITH Ø.170 [Ø4.3] THRU HOLES	4.80 [121.9]	20.91 [531]		5.0 [127.0]
KU-BAND	WR75 GROOVED FLANGE WITH Ø.145 [Ø3.68] THRU HOLES	4.60 [116.8]	21.40 [543.6]	WITH OPTIONAL PRESSURE WINDOW 21.65 [549.9]	5.0 [127.0]

Mechanical Specifications

PARAMETER	NOTES	LIMITS	UNITS
Size	width X length X height	10.0 X 19.5 X 6.5 254 X 495 X 165	inches mm
Weight	Base Unit With Internal zBUC	44 (20.0) ± 3% +1.7 (+0.8)	lbs.(kg) lbs.(kg)
Finish		Paint	White; powder coat
Connectors	RF/L-Band Input RF Output (L-/S-Band) RF Output (C-Band) RF Output (X-Band) RF Output (Ku-Band) RF Output Sample Line Power Monitor and Control Link Port Redundancy Switch Auxiliary +15VDC LNB Power (500 mA)	Type N Type N WR137 Waveguide WR112 Waveguide WR75 Waveguide Type N 3-pin MS-type 32-pin MS-type 6-pin MS type 6-pin MS-type 6-pin MS-type	Female Female CPR137G flange (PDR-70) CPR112G flange (PDR-84) Grooved flange Female Plug Socket Socket Socket Socket

Environmental Specifications

PARAMETER	NOTES	LIMITS	UNITS
Operating Temperature	Ambient	-40 to +60	°C
Relative Humidity	Condensing	100	%
Cooling System	Integrated, Forced air	103	CFM
Ingress Protection Rating	With connectors properly sealed	IP 54	
Audible Noise	Measured 1m from unit, at P_{sat}	74.0	dBA
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		

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 or H-Series High Power Outdoor SSPAs. 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.

Compact Outdoor Gallium Nitride (GaN) Solid State Power Amplifiers

Part Number Configuration Matrix

HPA	C	2	4	0	0	A	C	M	X	X	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	100, 200, 300, 400, 500
S-Band	100, 200, 300, 400, 500
C-Band	300, 400
X-Band	300, 400
Ku-Band	200, 250

Frequency Sub Band (GHz)			
L-Band		C-Band	
A	1.75 to 1.85	A[1]	5.850 to 6.425
C	1.76 to 1.90	B[1]	5.850 to 6.725
S-Band		C[1]	5.750 to 6.670
A	2.02 to 2.12	X-Band	
B	2.20 to 2.30	A[1]	7.90 to 8.40
G[2]	1.75 to 2.12	Ku-Band	
		A[1]	14.00 to 14.50
		B[1]	13.75 to 14.50

[1] Available with optional BUC
[2] Not available at 500W

GaN Device Designator	
G	GaN Device

Configuration Modifier 3	
X	None (Standard)
A	Side-Mount AC Input, Location 'A'
C[1]	Side-Mount AC Input, Location 'B'

[1] Standalone units only

Configuration Modifier 2	
X	Standard
M	MS-Connector Covers
R[1]	Receive Band Reject Filter
S[1]	M + R (see above)
W[2]	Waveguide Pressure Window
Y[2]	M + W (see above)

[1] L-Band, S-Band and X-Band only
[2] Ku-Band standalone units only

Configuration Modifier 1	
X	Standard
K[1]	110 VAC Input Power

[1] Available on all C-Band units, all X-Band units, Ku-Band units > 150W

System Configuration	
X	Standalone amplifier

Block Up Converter	
M	Autosensing BUC
X	No BUC

Package	
C	Standalone amplifier

COMMENTS:

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Data Security: Teledyne Paradise Datacom amplifiers and controllers do not inherently provide encryption to transmitted data, and have limited security measures to protect it. If the unit will be accessible over the Internet, exercise appropriate data security protocols. Teledyne Paradise Datacom strongly recommends placing the equipment behind a protective Firewall or setting up a VPN link with dual authentication for remote access.

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