TELEDYNE
PARADISE DATACOM
A Teledyne Technologies Company

High Power Outdoor
GaN Solid State Power Amplifiers

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 800 W L-Band
  - to 800 W S-Band
  - to 800 W 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 Redundant Control
- Built-in Maintenance Switch Controller
- CE Mark/MIL-STD-461 compliant
- Hot/Cold Standby operating modes for reduced power consumption

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

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	P_{sat} / P_{Linear} 58.0 (600) / 55.0 (300) 59.0 (800) / 56.0 (400)	 dBm (W) dBm (W)
Power Requirements Line Frequency Line Power (Voltage) (typical @ 220 VAC)	Power Factor corrected Autoranging HPAL2600_HXXXXXG HPAL2800_HXXXXXG	> 0.9 47– 63 P_{sat} / P_{Linear} 2200 / 1700 (90-265) 2500 / 2000 (90-265)	 Hz 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 [3] 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	P_{sat} / P_{Linear} 58.0 (600) / 55.0 (300) 59.0 (800) / 56.0 (400)	 dBm (W) dBm (W)
Power Requirements Line Frequency Line Power (Voltage) (typical @ 220 VAC)	Power Factor corrected Autoranging HPAS2600_HXXXXXG HPAS2800_HXXXXXG	> 0.9 47– 63 P_{sat} / P_{Linear} 2200 / 1700 (90-265) 2500 / 2000 (90-265)	 Hz 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 "A" Frequency selection "B" [2] Frequency selection "C" [3]	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]	HPAC2800AHXXXXXG	P_{sat} / P_{Linear} 59.0 (800) / 56.0 (400)	dBm (W)
Power Requirements Line Frequency Line Power (Voltage) (typical @ 220 VAC)	Power Factor corrected Autoranging HPAC2800_HXXXXXG	> 0.9 47 - 63 P_{sat} / P_{Linear} 4000 / 3500 (180-265)	 Hz 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: De-rate output power by 1.0 dB linearly from 6.425 to 6.725 GHz.
Note 3: 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.

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}).

X-Band Output Power Levels

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

Ku-Band Output Power Levels

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]	 HPAK2400AHXXXXXG HPAK2500AHXXXXXG HPAK2600AHXXXXXG	P_{sat} / P_{Linear} 56.0 (400) / 53.0 (200) 57.0 (500) / 54.0 (250) 57.8 (600) / 54.8 (300)	 dBm (W) dBm (W) dBm (W)
Power Requirements Line Frequency Line Power (Voltage) (typical @ 220 VAC)	Power Factor corrected Autoranging HPAK2400_HXXXXXG HPAK2500_HXXXXXG HPAK2600_HXXXXXG	> 0.94 47 - 63 P_{sat} / P_{Linear} 2500 / 1700 (90-265) 3000 / 2000 (90-265) 3200 / 2500 (90-265)	 Hz W (VAC) W (VAC) W (VAC)
Receive Band Noise Power Density [2]	with 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: All Ku-Band SSPAs are fitted with a receive band reject bulkhead filter, standard. An optional pressure window is available.
Note 3: De-rate output power by 1.0 dB linearly from 14.00 to 13.75 GHz.

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}).

Electrical Specifications

PARAMETER	NOTES	LIMITS	UNITS
Gain Gain Flatness Gain Slope Gain Variation vs. Temperature Gain Stability Gain Adjustment	range full band Extended C-Band units full band (L-, S-Band) per 40 MHz (C-,X-,Ku-bands) per 10 MHz (L-, S-Band) -30 °C to +50 °C at constant temperature 0.1 dB resolution	55-75 ± 1.0 ± 1.5 ± 0.75 ± 0.3 ± 0.2 ± 1.5 ± 0.25 20	dB dB dB dB dB/40 MHz dB/10 MHz dB dB/24 hours 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 Harmonics (SSPA only)	@ rated P_{Linear} @ rated P_{Linear} @ rated P_{Linear} (L-, S-Band)	-65 -50 -30	dBc dBc dBc
Input/Output VSWR	 Extended C-Band Output VSWR: Ku-Band with bulkhead filter	1.30:1 1.50:1 1.40:1	
Group Delay (per 40 MHz segment)	Linear Parabolic Ripple	0.01 0.003 1.0	ns/MHz ns/MHz^2 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 10 Hz 100 Hz 1 KHz 10 KHz 100 KHz 1 MHz	 -110 -120 -130 -135 -140 -140 -140	 dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz
Residual Phase Noise, typical (SSPA only)	Offset frequency from carrier 10 Hz 100 Hz 1 KHz 10 KHz 100 KHz 1 MHz	 -90 -100 -110 -120 -125 -130	 dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz
True RF Power Detector	Range Accuracy, Psat to (Psat - 10 dB) Accuracy, (Psat - 10 dB) to (Psat - 20 dB) L-/S-Band units, Accuracy (full band)	P_{sat} to (P_{sat} - 20) ± 0.75 ± 1.0 ± 1.0	dB dB dB dB

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:

- 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.

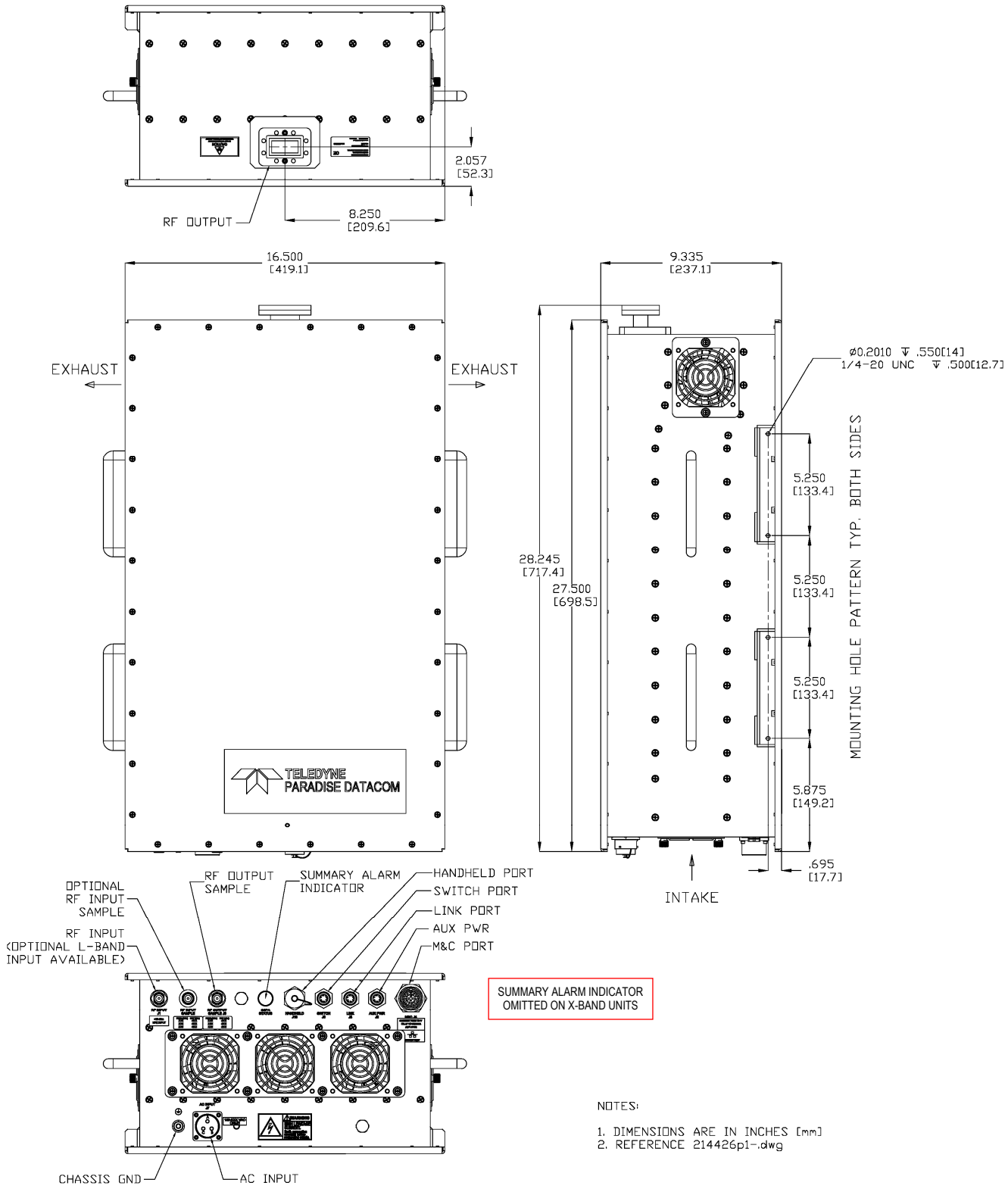
Available Frequency Plans

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 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	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 (C-/Ku-Band)	-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				
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 Temperature (-40 to +40 °C, ambient)	$\pm 1 \cdot 10^{-8}$				

Outline Drawing, C-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 PT07A18-32S-027 PT07A10-6S-027 PT07A10-6S-027 AIT2-20-19PS-472 PT07A10-6S-027 PT07A12-8S-027 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.

High Power Outdoor
GaN Solid State Power Amplifiers

Part Number Configuration Matrix

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

An optional mounting kit is available.

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
S-Band	600, 800
C-Band	800
X-Band	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[1]	5.850 to 6.425 GHz
B[1]	5.850 to 6.725 GHz
C[1]	5.750 to 6.670 GHz
X-Band	
A[1]	7.90 to 8.40 GHz
F	7.10 to 7.40 GHz
Ku-Band	
A[1]	14.00 to 14.50 GHz
B[1]	13.75 to 14.50 GHz

[1] Available with optional BUC

GaN Device Designator	
G	GaN Device

Configuration Modifier 3	
X	None (Standard)

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

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

Configuration Modifier 1	
X	Standard
S	Input Sample Port

System Configuration	
X	Standalone amplifier

Block Up Converter	
M	Autosensing BUC
X	No BUC

Package	
H	Standalone amplifier

COMMENTS:

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