TELEDYNE
PARADISE DATACOM
A Teledyne Technologies Company

High Power Outdoor
Solid State Power Amplifiers

DESCRIPTION

Teledyne Paradise Datacom's High Power Outdoor (W) series SSPAs represent the latest in High Power Microwave Amplifier Technology. The SSPA package achieves the highest power density in the industry along with enhanced maintainability.

All subassemblies are accessible and replaceable in the field. Local, front panel, control is available with a user friendly interface. A full compliment of serial and parallel (contact closure) control is also available via circular connectors.

A state of the art thermal platform provides efficient cooling for the amplifier module and power supplies. This ensures the highest possible MTBFs for microwave power amplifiers.

Along with high reliability comes the ultimate in amplifier maintainability. Amplifier modules and power supplies are easily accessed and removed, making this one of the easiest amplifier assemblies to maintain in the field.

FEATURES

- Extremely High Power Density:
  - 600W S-Band
  - 500W X-Band
  - 600W C-Band
  - 250W Ku Band
- Field Replaceable Subassemblies
- RF Output Sample Port (-40dBc)
- Ethernet Port
- RF Gain Adjustment (20 dB)
- Built-in 1:1 Redundancy Control

OPTIONS

- RF input sample port (-10 dBc)
- 48 VDC operation
- L-Band Input operation
- Reflected Power Monitor
- Phase Combined Systems
- Fiber Optic Input
- Antenna Mounting Kit
- Receive Band Reject Filter for S-Band units up to 400W in sub-band A

SPECIFICATIONS

- Housing:
  21.0 X 27.95 X 13.5 in.
  533 X 710 X 343 mm
  125.0 lbs. / 57 kg;
- White powder coat finish
- Operating temperature: -40 to +60 °C
- Relative Humidity: 100% condensing
- Integrated Forced-Air Cooling

S-Band Output Power Levels

PARAMETER	NOTES	LIMITS	UNITS
Frequency Range	Band A Band B	2.020 to 2.120 2.200 to 2.300	GHz GHz
Output Power @ Saturation / P_{1dB} Typical / Guaranteed Minimum	Band A HPAS2400AWXXXXX (2.020 - 2.090 GHz) HPAS2400AWXXXXX (2.095 - 2.120 GHz) HPAS2500AWXXXXX (2.020 - 2.090 GHz) HPAS2500AWXXXXX (2.095 - 2.120 GHz) HPAS2600AWXXXXX (2.020 - 2.090 GHz) HPAS2600AWXXXXX (2.095 - 2.120 GHz) Band B HPAS2400BWXXXXX (2.200 - 2.300 GHz) HPAS2500BWXXXXX (2.200 - 2.300 GHz) HPAS2600BWXXXXX (2.200 - 2.300 GHz)	P_{sat}/P_{1dB} 56.5 / 56.0 (447/400) 56.0 / 55.5 (400/355) 57.2 / 57.0 (525/500) 56.7 / 56.5 (468/447) 58.0 / 57.5 (631/560) 57.5 / 57.0 (560/500) 56.5 / 56.0 (447/400) 57.2 / 57.0 (525/500) 58.0 / 57.5 (631/560)	 dBm (W) dBm (W) dBm (W) dBm (W) dBm (W) dBm (W) dBm (W) dBm (W) dBm (W)
Prime Input Power Line Voltage Line Frequency Line Power	Power factor corrected HPAS2400A/BWXXXXX (180 - 265 VAC) HPAS2500AWXXXXX (180 - 265 VAC) HPAS2600AWXXXXX (180 - 265 VAC)	 47– 63 1800 3500 3800	 Hz W W W

C-Band Output Power Levels

PARAMETER	NOTES	LIMITS	UNITS
Frequency Range	(see options for extended band)	5.850 to 6.425	GHz
Output Power @: Saturation/P_{1dB} (Typical/Guaranteed minimum)	 HPAC2400AW HPAC2500AW HPAC2600AW	Psat / P1dB 56.0/55.0 (400/316) 57.0/56.0 (500/400) 57.8/57.0 (600/500)	 dBm (W) dBm (W) dBm (W)
Power Requirements Line Voltage Line Frequency Line Power	Power Factor corrected Autoranging HPAC2400AW (180 to 265 VAC) HPAC2500AW (180 to 265 VAC) HPAC2600AW (180 to 265 VAC)	> 0.9 47 - 63 2400 2800 3700	 Hz W W W

X-Band Output Power Levels

PARAMETER	NOTES	LIMITS	UNITS
Frequency Range	(see options for extended band)	7.90 to 8.40	GHz
Output Power @: Saturation/P_{1dB} (Typical/Guaranteed minimum)	 HPAX2350AW HPAX2500AW	Psat / P1dB 55.5/54.5 (354/282) 57.0/55.7 (500/370)	 dBm (W) dBm (W)
Power Requirements Line Voltage Line Frequency Line Power	Power Factor corrected Autoranging HPAX2350AW (180 to 265 VAC) HPAX2500AW (180 to 265 VAC)	> 0.94 47 - 63 2700 4000	 Hz W W

Ku-Band Output Power Levels

PARAMETER	NOTES	LIMITS	UNITS
Frequency Range	(see options for extended band)	14.00 to 14.50	GHz
Output Power Saturation/P1dB (Typical/Guaranteed minimum)	 HPAK2200AW HPAK2250AW	Psat / P1dB 53.0/52.0 (200/158) 54.0/53.0 (250/200)	 dBm (W) dBm (W)
Power Requirements Line Voltage Line Frequency Line Power	 Power Factor corrected Autoranging HPAK2200AW (180 to 265 VAC) HPAK2250AW (180 to 265 VAC)	 > 0.94 47 - 63 2500 2800	 Hz W W

Common Specifications; HPA_2000XW Series

Electrical Specifications

PARAMETER	NOTES	LIMITS	UNITS
Gain Gain Flatness Gain Slope Gain Variation vs. Temperature Gain Adjustment	range full band Extended C-Band units per 40 MHz (C-,X-,Ku-bands) per 10 MHz (S-band) -40°C to +60°C 0.1 dB resolution	55-75 ±1.0 ±1.5 ±0.3 ±0.2 ±1.5 20	dB dB dB dB/40 MHz dB/10 MHz dB dB
Intermodulation Distortion	3dB back off relative to P_{1dB}	-25	dBc
AM/PM Conversion	(@ rated P_{1dB}) (@P_{1dB}-3dB)	3.5 1.0	°/dB °/dB
Spurious Harmonics	(@ rated P_{1dB}) (@ rated $P_{1dB-3dB}$) (C-,X-,Ku-bands) (@ rated $P_{1dB-3dB}$) (S-band)	-60 -50 -30	dBc dBc dBc
Input/Output VSWR	Standard Band units Extended Band units	1.30:1 1.50:1	
Noise Figure	at maximum gain	10	dB
Group Delay (per 40 MHz segment)	Linear Parabolic Ripple	0.01 0.003 1.0	ns/MHz ns/MHz^2 ns p-p
Noise Output	TX Band (S-,C-, X- or Ku-Band) RX Band (C- or Ku-Band) RX Band (X-Band) RX Band (S-Band)	-75 -150 -100 See options	dBW/4 KHz dBW/4 KHz dBW/4 KHz
Residual AM Noise	0 - 10 KHz 10 KHz - 500 KHz 500 KHz - 1 MHz	-45 -20 (1.25 + log F) -80	dBc dBc dBc
Phase Noise	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

Mechanical Specifications

Size	width X height X depth	21.0 X 27.95 X 13.5 533 X 710 X 343	inches mm
Weight		125 (57)	lbs.(kg)
Finish		powder coat	white

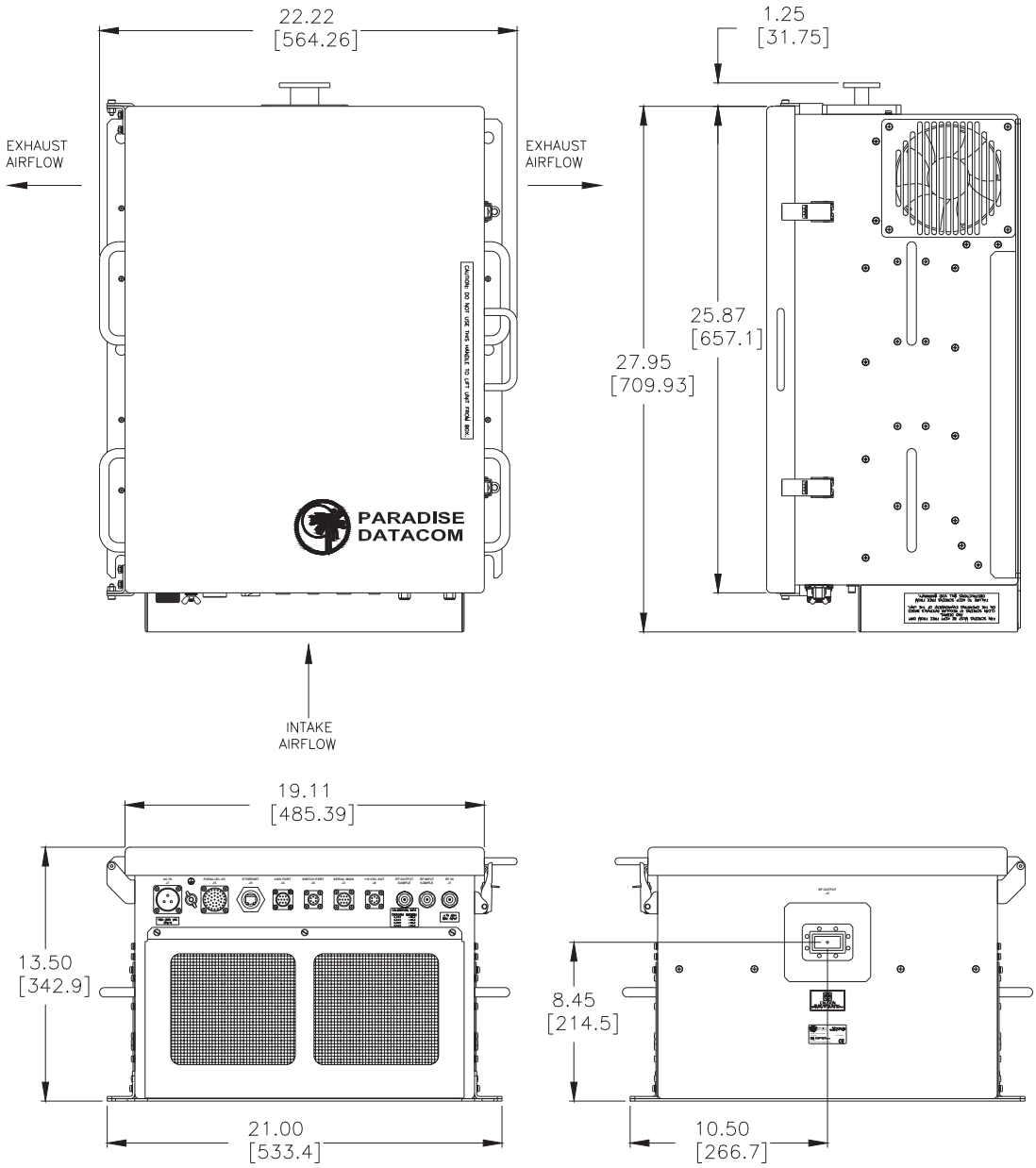
Specifications are subject to change.

High Power Outdoor
Solid State Power Amplifiers

Options

Extended C-Band 5.850 to 6.725 GHz 5.750 to 6.670 GHz 6.425 to 7.025 GHz	 De-rate power by 1.0dB linearly from 6.425 to 6.725 GHz De-rate power by 1.0dB linearly from 6.425 to 6.725 GHz Available in power levels up to 500W	Model: HPAC2XXXBWXXXXX HPAC2XXXCWXXXXX HPAC2XXXE/FWXXXXX
Extended X-Band 7.70 to 8.40 GHz	 De-rate power by 1.0dB linearly from 7.90 to 7.70 GHz	Model: HPAX2XXXDWXXXXX
Extended Ku-Band 13.75 to 14.5 GHz	 De-rate power by 1.0dB linearly from 14.0 to 13.75 GHz	Model: HPAK2XXXBWXXXXX
Reflected Power Monitor	See the part number configuration to determine Model numbers for this option.	

Receive Band Reject Filter (S-Band only) Filter integrated into 400W SSPA chassis 500W and 600W SSPAs require external filter.	Insertion Loss Rx Reject	- 0.5 -60	dB dB
Receive Band Noise Power Density	Without optional filter With optional filter	-95 -155	dBw/4 KHz dBw/4 KHz



L-Band Operation

Teledyne Paradise Datacom offers C-, X-, and Ku-Band amplifiers with an integrated L-Band Block Up Converter. The L-Band units utilize Paradise Datacom's proprietary ZBUC™ technology. The addition of a ZBUC converter to a High Power Outdoor SSPA typically increases the gain by 2-4 dB. The advantages of ZBUC™ technology include:

- A ZBUC converter can detect and switch to an extenally supplied reference.
- Optional internal high stability (10MHz) reference.
- A ZBUC converter can lock to an externally supplied reference of 5, 10, 20, 25, or 50 MHz without modification.
- A ZBUC converter can accept a wide range of external reference power (-10 to +5 dBm)
- A ZBUC converter can accept FSK monitor and control signal via the IFL for complete amplifer 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
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 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	-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 @ 25 °C			$\pm 1 \cdot 10^{-8}$		
	Reference Stability over Temperature (-40 to +40 °C)			$\pm 1 \cdot 10^{-9}$		

Interface Specifications; HPA_2000XW Series

PARAMETER	NOTES	LIMITS	UNITS
Monitor & Control (J5) Connector: MS3112E20-41S Mate: MS3116F20-41P	Parallel Port Outputs Form C Relays Contact conditions on fault (Closed, Open, Common) Mute Status RF Switch Position	Power Supply Fault Auxiliary Fault Mute Status Block Up Converter Fault Temperature Fault Current Fault Low RF Alarm	Pins A, B, C Pins D, E, F Pins G, H, J Pins K, L, M Pins N, P, R Pins V, W, X Pins a, Y, Z
	Parallel Port Inputs	Mute Input Local Remote Auxiliary Fault Input Standby Select Latched Fault Reset Auto/Manual Switching +5V pull-up Ground	Pin b Pin c Pin d Pin e Pin f Pin g Pins h, I, j, k, m Pin n
Main Serial Port (J3) Connector: MS3112E12-10P Mate: MS3116F12-10S	RS232 / RS485 Summary Alarm	RS232 Out, RS485 TX- RS232 In, RS485 RX- RS485 RX+ RS485 TX+ Service Request 1 Service Request 2 Service Request Common Termination Ground	Pin A Pin B Pin C Pin D Pin E Pin F Pin G Pin H Pin J
Link Port (J4) Connector: MS3112E12-10S Mate: MS3116F12-10P	1:1 Redundant System Control Link	RS485+ RS485- Link Out Link In Ground	A, B C, D E, F G, H Pin J
Switch Port (J6) Connector: MS3112E10-6S Mate: MS3116F10-6P	Redundant Switch Control	+28 VDC RF Switch 1, pos 1 RF Switch 1, pos 2 RF Switch 2, pos 1 RF Switch 2, pos 2	A, B C E D F
RF Connectors	RF Input (J1), Input & Output Sample RF Output (J2) HPAS2XXXXW HPAC2XXXXW HPAX2XXXXW HPAK2XXXXW	Type N Type N WR137 Waveguide WR112 Waveguide WR75 Waveguide	Female Female CPR137G flange (PDR-70) CPR112G flange (PDR-84) Grooved flange (PBR-120)
AC Input (J7) Connector: MS3102E20-3P Mate: MS3106E20-3S	Line Power	Line Neutral Ground	A C B
Optional 48 VDC Input MS3102E20A37P	DC Input Power	+48 VDC Return	A,B C,D
+15 VDC Output (J8) Connector: MS3112E10-6S Mate: MS3116F10-6P	Auxiliary Power	External Fault In Reserved +15VDC LNA Ground +15VDC External Ground	A B C D E F
Ethernet Port (J9) Connector: RJ45 (F)	Remote M&C, UDP, SNMP	TX+ TX- RX+ RX- Ground	1 2 3 6 4,5,7,8

Environmental Specifications

Operating Temperature	Ambient	-40 to +60	°C
Relative Humidity	Condensing	100	%
Cooling System	Integrated	Forced air	

High Power Outdoor
Solid State Power Amplifiers

Part Number Configuration

HPA [ ] 2 [ ][ ][ ][ ] W [ ][ ][ ][ ][ ]

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

Power Level (in Watts)

S-Band
400, 500 or 600

C-Band
400, 500 or 600

X-Band
350 or 500

Ku-Band
200 or 250

Frequency Sub Band

S-Band
A - 2.020 - 2.120 GHz
B - 2.200 - 2.300 GHz

C-Band
A[1] - 5.85 - 6.425 GHz
B[1] - 5.85 - 6.725 GHz
C - 5.75 - 6.670 GHz
E[1,2] - 6.425 - 6.725 GHz (Palapa)
F[1,2] - 6.725 - 7.025 GHz (Insat)
G[1] - 5.750 - 6.475 GHz
H[1] - 5.715 - 5.790 GHz
J[1] - 5.740 - 6.650 GHz
V[1,3] - 5.85 - 6.725 GHz

X-Band
A[1] - 7.90 - 8.40 GHz
B - 7.50 - 8.50 GHz
D - 7.70 - 8.40 GHz
E - 7.75 - 8.50 GHz

Ku-Band
A[1] - 14.00 - 14.50 GHz
B[1] - 13.75 - 14.50 GHz

[1] Available with optional BUC.
[2] Available in 400W or 500W power levels.
[3] With 1.3:1 VSWR.

Configuration Modifier
XXX = Standard
SXX = Input Sample
XVX = Reflected Power Monitor
XXR* = Receive Band Reject Filter

* S-Band only

System Configuration
X = Standalone

See the following specification sheets for the appropriate configuration:

- Outdoor Packaged Redundant SSPA Systems (203581)
- Outdoor Packaged Phase Combined SSPA Systems (203582)

Block Up Converter
B = BUC (Custom)
M = Internal Reference ZBUC (FSK)
P = External Reference ZBUC (FSK)
X = None

An optional uni-strut mounting kit is available.

Example - A standalone 500W Extended C-Band High Power Outdoor SSPA with block up converter using an external reference is part number: **HPAC2500BWPXXXX**.

Specifications listed in this document are subject to change without notice.
X-Band products may be subject to ITAR restrictions and should not be exported from the U.S. without obtaining proper licensing from the appropriate government agencies.