TELEDYNE
PARADISE DATACOM
Everywhereyoulook™

Indoor Rack Mount
GaAs Solid State Power Amplifiers
5RU Rack Height

500W X-Band 5RU SSPA Chassis

Teledyne Paradise Datacom's Indoor, Rack Mount (R) series SSPAs represent the latest in High Power Microwave Amplifier Technology. The 5RU SSPA chassis achieves the highest power density in the industry along with enhanced maintainability.

Local control is available with a front panel color touchscreen display, with a menu structure full of useful functions. Five fault condition indicators reflect some of the SSPA major faults states. The amplifier icon on the mimic panel turns green when the amplifier is in Online mode (1:1 Mode). Local/Remote and Mute/Unmute indicators show the current control mode and mute state of the amplifier.

Serial and parallel (contact closure) control is also available from the rear panel. Our free Universal M&C software allows monitor and control of the SSPA from a remote computer.

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.

Prime power to the amplifier is provided by a separate, external power supply in an N+1 redundant configuration. A failure of one power supply module will not take the amplifier off the air.

FEATURES

- Extremely High Power Density:
  - to 600 W C-Band
  - to 500 W X-Band
  - to 250 W Ku-Band
- Removable Fan Tray and Monitor & Control Card Assembly
- Remote Communication via RS232/485 or Ethernet
- RF Output Sample Port
- 20 dB Gain Adjustment
- 1RU N+1 Power Supply
- Color Touchscreen Display
- True RF Output Power Measurement
- Built-in Maintenance Switch Controller

OPTIONS

- Remote Control Panel
- L-Band Input operation
- Reflected Power Monitor
- Input Sample Port
- Exhaust Duct Adapters
- Redundant Systems
- Phase Combined Systems

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Specifications, C-Band SSPAs

PARAMETER	NOTES	LIMITS	UNITS
Frequency Range	Frequency selection "G" Frequency selection "A" Frequency selection "B" [1] Frequency selection "D"	5.750 to 6.475 5.850 to 6.425 5.850 to 6.725 6.425 to 7.025	GHz GHz GHz GHz
Output Power Typical, P_{sat} Guaranteed minimum, P_{1dB}	 HPAC5400ARXXXXP HPAC5500ARXXXXP HPAC5600ARXXXXP	P_{sat} / P_{1dB} 56.0 (400) / 55.0 (316) 57.0 (500) / 56.0 (400) 57.8 (600) / 57.0 (500)	 dBm (W) dBm (W) dBm (W)
Power Requirements Line Frequency Line Power (Voltage) (typical @ 220 VAC)	power factor HPAC5400ARXXXXP HPAC5500ARXXXXP HPAC5600ARXXXXP	.98 47 to 63 2400 (180 to 265) [2] 2800 (180 to 265) [2] 3700 (180 to 265) [2]	 Hz W (VAC) W (VAC) W (VAC)

Note 1: De-rate output power by 1 dB linearly from 6.425 to 6.725 GHz.
Note 2: For 90 to 180 VAC operation, consult factory.

Specifications, X-Band SSPAs

PARAMETER	NOTES	LIMITS	UNITS
Frequency Range	Frequency selection "D" [1] Frequency selection "A"	7.70 to 8.40 7.90 to 8.40	GHz GHz
Output Power Typical, P_{sat} Guaranteed minimum, P_{1dB}	 HPAX5250ARXXXXP HPAX5350ARXXXXP HPAX5500ARXXXXP	P_{sat} / P_{1dB} 54.0 (250) / 53.3 (214) 55.5 (354) / 54.5 (282) 57.0 (500) / 56.0 (400)	 dBm (W) dBm (W) dBm (W)
Power Requirements Line Frequency Line Power (Voltage) (typical @ 220 VAC)	power factor HPAX5250ARXXXXP HPAX5350ARXXXXP HPAX5500ARXXXXP	.98 47 to 63 2450 (180 to 265) [2] 3000 (180 to 265) [2] 3500 (180 to 265) [2]	 Hz W (VAC) W (VAC) W (VAC)

Note 1: De-rate output power by 1 dB linearly from 7.90 to 7.70 GHz.
Note 2: For 90 to 180 VAC operation, consult factory.

Specifications, Ku-Band SSPAs

PARAMETER	NOTES	LIMITS	UNITS
Frequency Range	Frequency selection "F" Frequency selection "B" [1] Frequency selection "A"	12.75 to 13.25 13.75 to 14.50 14.00 to 14.50	GHz GHz GHz
Output Power Typical, P_{sat} Guaranteed minimum, P_{1dB}	 HPAK5200ARXXXXP HPAK5250ARXXXXP	P_{sat} / P_{1dB} 53.0 (200) / 51.7 (150) 54.0 (250) / 52.7 (190)	 dBm (W) dBm (W)
Power Requirements Line Frequency Line Power (Voltage) (typical @ 220 VAC)	power factor HPAK5200ARXXXXP HPAK5250ARXXXXP	.98 47 to 63 2200 (180 to 265) [2] 2400 (180 to 265) [2]	 Hz W (VAC) W (VAC)

Note 1: De-rate output power by 1 dB linearly from 14.00 to 13.75 GHz.
Note 2: For 90 to 180 VAC operation, consult factory.

Common Electrical Specifications

PARAMETER	NOTES	LIMITS	UNITS
Gain Gain Flatness Gain Slope Gain Variation vs. Temperature Gain Stability Gain Adjustment	range full band full band (Extended C-Band) per 40 MHz 0 °C to +50 °C at constant temperature 0.1 dB resolution	55-75 ± 1.0 ± 1.5 ± 0.3 ± 1.0 ± 0.25 20	dB dB dB dB/40 MHz dB dB / 24 hours dB
Intermodulation Distortion (Two-tone, 5 MHz spacing)	At P_{1dB} (P_{sat} - 3 dB)	-25	dBc
AM/PM Conversion	@ rated P_{1dB}	≤ 1.0	°/dB
Spurious Harmonics (SSPA only)	@ rated P_{1dB} @ rated P_{1dB}	-65 -50	dBc dBc
Input/Output VSWR	 Extended C-Band Output VSWR: Ku-Band with bulkhead filter	1.30:1 1.50:1 1.40:1	
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
Transmit 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	P_{sat} to (P_{sat} - 20) ± 0.5	dB dBm

Specifications are subject to change without notice.

1RU N+1 Redundant Power Supply

The combination of a separate, fully redundant power supply is an excellent means of obtaining the ultimate in system reliability. The power supply is an N+1 redundant configuration, meaning that there is one more power supply module available than required to operate the SSPA. A failure of one power supply module will not take the amplifier off the air.

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® 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 extenally 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).

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 "F"	950 - 1450 MHz	11.800 GHz	12.75 - 13.25 GHz

Electrical Specifications for 5RU RM 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
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)			$\pm 1 \cdot 10^{-8}$		
	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)			$\pm 1 \cdot 10^{-8}$		

Mechanical Specifications

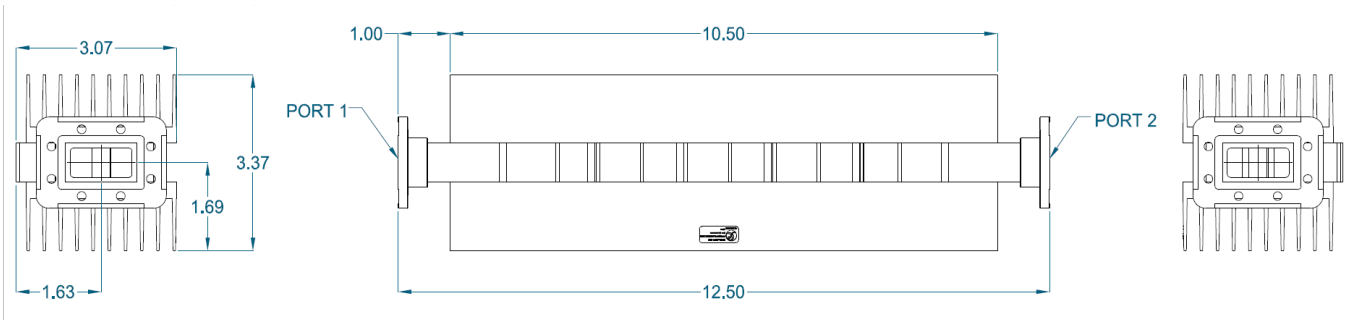
PARAMETER	NOTES	LIMITS	UNITS
Size (SSPA)	width X height X depth	19.0 x 8.75 x 30.25 483 x 222 x 768	inches mm
Size (Power Supply)	width X height X depth	19.0 x 1.75 x 15.97 483 x 45 x 406	inches mm
Weight (SSPA)	With integrated zBUC converter	150 (68) +1.7 (+0.8)	lbs. (kg) lbs. (kg)
Weight (Power Supply)	with four (4) power supply modules	29 (13.2)	lbs. (kg)
Finish		Paint	Gray; powder coat
Connectors	RF Input RF Output (C-Band) RF Output (X-Band) RF Output (Ku-Band) RF Output Sample	Type N WR137 Waveguide WR112 Waveguide WR75 Waveguide Type N	Female CPR137G Flange (PDR-70) CPR112G Flange (PDR-84) Grooved flange (PBR-120) Female

Environmental Specifications

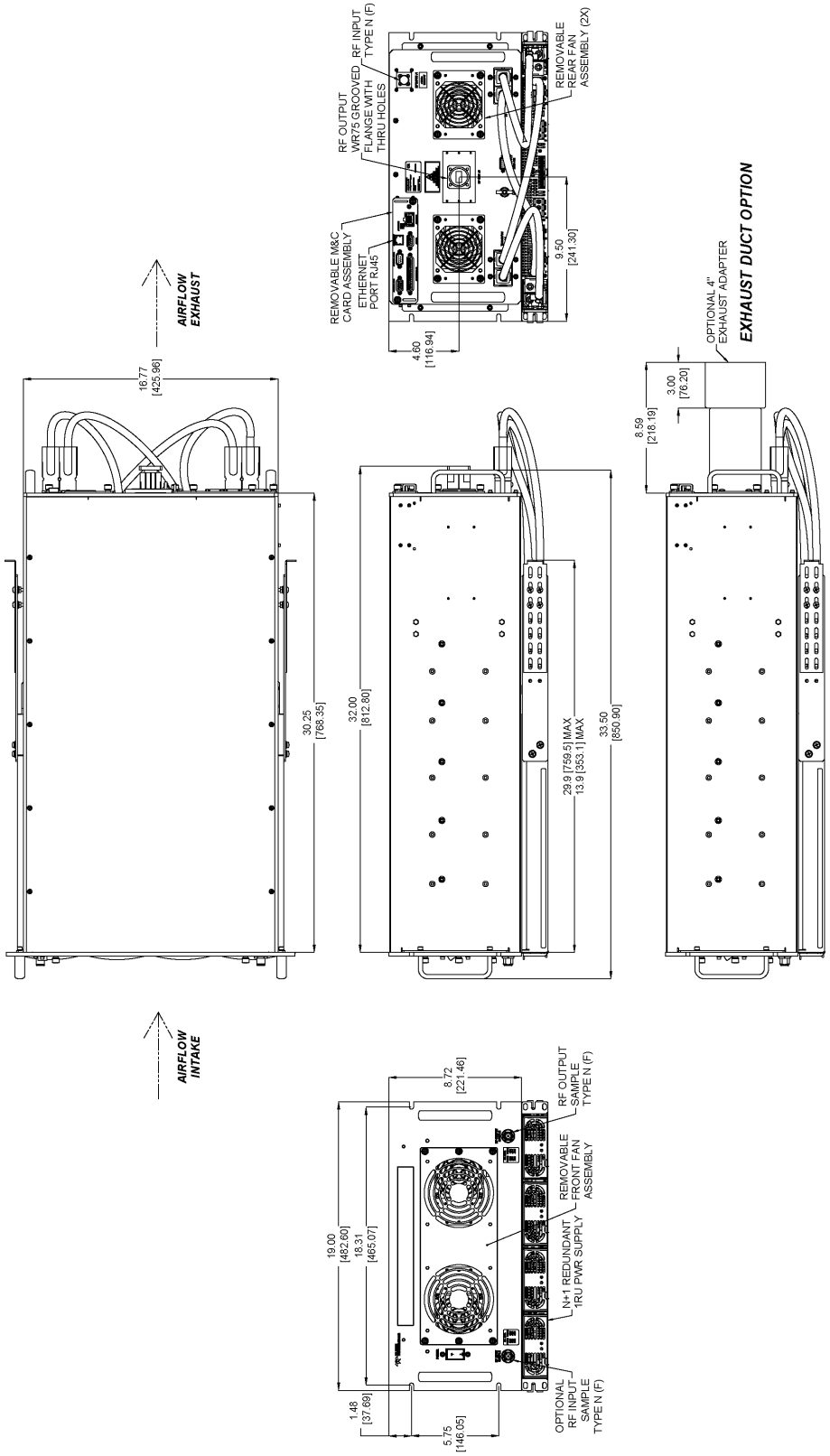
PARAMETER	NOTES	LIMITS	UNITS
Operating Temperature	Ambient	0 to +50	°C
Relative Humidity	Non-condensing	95	%
Cooling System	Forced Convection Air Cooling	Front Panel - Intake Rear Panel - Exhaust	
Audible Noise	Measured 1m from unit, at P_{sat}	61	dBA
Altitude	No temperature de-rating up to 10,000 ft, (3000 m) De-rate maximum temperature by 2 °C per 1,000 ft (300 m) beyond 10,000 ft.		

X-Band Receive Band Filter Option

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



Outline Drawing, Typical Ku-Band SSPA Chassis



Redundant and Phase Combined Systems

Teledyne Paradise Datacom's 5RU Rack Mount SSPAs can be configured in a variety of redundant and phase combined configurations.

- 1:1 Redundant System with Internal Redundancy Control
- 1:1 Redundant System with RCP2-1100 Redundant System Controller
- 1:1 Fixed Phase Combined System with FPRC-1100 Phase Combined System Controller
- 1:2 Redundant System with Internal Redundancy Control
- 1:2 Redundant System with RCP2-1200 Redundant System Controller
- 1:2 Fixed Phase Combined System with FPRC-1200 Phase Combined System Controller

System Output Power Capacity

Due to residual losses inherent in redundant system configurations (waveguide bends; switch and coupler losses), reduce the typical output power specification of a single amplifier by approximately 0.2 dB for 1:1 and by 0.4 dB for 1:2 systems.

In phase combined systems, these same losses result in slightly less than the ideal addition of 3 dB to the output power of a single HPA unit. For 1:1 phase combined systems, the typical additive output power is approximately 2.70 dB above the output power of a single HPA. For 1:2 phase combined systems, the typical additive output power is approximately 2.50 dB above the output power of a single HPA.

Actual system losses will vary based on the system options.

System Controllers

The 1RU system controller provides an extremely user friendly interface for complete monitor and control of the amplifier system.

Redundant System Controller Configured for 1:1 Redundant Mode

The front panel touchscreen display shows the on-line amplifiers and the switch positions. Fault indicators are provided for easy identification of system status. All system monitor and control is available locally at the front panel, as well as remotely by the RS232, RS485, or Ethernet interface ports. Audible alarms and a full compliment of parallel I/O signal are available at the rear panel of the controller.

Indoor Rack Mount
GaAs Solid State Power Amplifiers
5RU Rack Height

Part Number Configuration Matrix

Power Level (Watts)	
C-Band	**400, 500, 600**
X-Band	**250, 350, 500**
Ku-Band	**200, 250**

Rack Height	
5RU	**5**

Band	
C-Band	**C**
X-Band	**X**
Ku-Band	**K**

System Configuration	
R	Standalone amplifier

See the following datasheets for system options:

- Indoor Rack Mount Redundant SSPA Systems (203583)
- Indoor Rack Mount Phase Combined SSPA Systems (203584)

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

MODEL: **HPA** C 5 6 0 0 A R M X X X P

Frequency Sub Band			
C-Band		X-Band	
A[1]	5.850 to 6.425 GHz	**A**[1]	7.90 to 8.40 GHz
B[1]	5.850 to 6.725 GHz	**D**	7.70 to 8.40 GHz
C[1]	5.750 to 6.670 GHz	**F**	7.10 to 7.40 GHz
E[1]	6.425 to 6.725 GHz	Ku-Band	
F[1]	6.725 to 7.025 GHz	**A**[1]	14.00 to 14.50 GHz
H	5.715 to 5.790 GHz	**B**[1]	13.75 to 14.50 GHz
L[1]	4.400 to 5.000 GHz	**F**[1]	12.75 to 13.25 GHz
		G	14.75 to 15.25 GHz

[1] Available with optional BUC

Configuration Modifier 3	
P	Standard (N+1 Power Supply)
L	N+1 P.S. + Rear Exhaust Adapters

Configuration Modifier 2	
X	Standard
R[1]	Rx Band Reject Filter
V	Reflected Power Monitor
C[1]	R + V (see above)

[1] X-Band units only

Standalone Unit	
X	Standalone amplifier

Configuration Modifier 1	
X	Standard
S	Input Sample Port

Example - A standalone 600W GaAs C-Band 5RU Rack Mount SSPA with standard N+1 external power supply and an optional internal reference block up converter is part number: **HPAC5600ARMXXXP**.