TELEDYNE
PARADISE DATACOM
A Teledyne Technologies Company

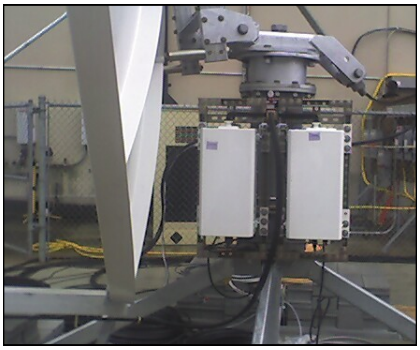
Compact Outdoor
Gallium Nitride (GaN)
Solid State Power Amplifiers

400W C-Band GaN
Compact Outdoor SSPA

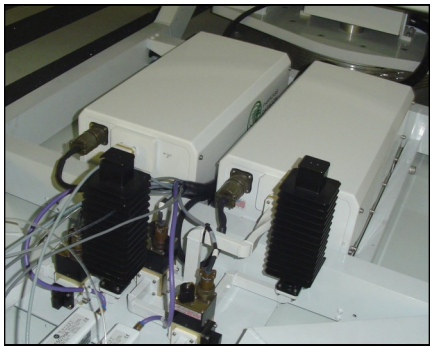
Description

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:

S-Band: 50W, 100W, 200W, 300W, 400W, 500W
C-Band: 300W, 400W, 500W
X-Band: 300W, 400W
Ku-Band: 100W, 150W, 200W, 250W, 300W
Ka-Band: 80W, 100W, 180W



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

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
- Fiber Optic Input
- 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, S-Band SSPAs

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]	A Series HPAS2050ACXXXXXG HPAS2100ACXXXXXG HPAS2200ACXXXXXG HPAS2300ACXXXXXG HPAS2400ACXXXXXG HPAS2500ACXXXXXG B Series HPAS2050BCXXXXXG HPAS2100BCXXXXXG HPAS2200BCXXXXXG HPAS2300BCXXXXXG HPAS2400BCXXXXXG HPAS2500BCXXXXXG	P_{sat} / P_{Linear} 47.5 (56) / 43.0 (20) 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) 47.5 (56) / 43.0 (20) 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) dBm (W) dBm (W) dBm (W) dBm (W) dBm (W) dBm (W) dBm (W)
Power Requirements Line Frequency Line Power (Voltage) (typical @ 220 VAC)	power factor HPAS2050ACXXXXXG HPAS2100ACXXXXXG HPAS2200ACXXXXXG HPAS2300ACXXXXXG HPAS2400ACXXXXXG HPAS2500ACXXXXXG	.98 47 to 63 400 / 300 (90-265) 500 / 400 (90-265) 800 / 700 (90-265) 1300 / 1000 (180-265) [2] 1600 / 1300 (180-265) [2] 1800 / 1500 (180-265) [2]	 Hz W (VAC) 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, C-Band SSPAs

PARAMETER	NOTES	LIMITS	UNITS
Frequency Range	Frequency selection "L" Frequency selection "H" Frequency selection "C" [3] Frequency selection "A" Frequency selection "B" [3] Frequency selection "E" Frequency selection "F"	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 6.725 6.725 to 7.025	GHz GHz GHz GHz GHz GHz GHz
Output Power Typical, P_{sat} Guaranteed minimum, P_{Linear} [1]	 HPAC2300ACXXXXXG HPAC2400ACXXXXXG HPAC2500ACXXXXXG	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 HPAC2300ACXXXXXG HPAC2400ACXXXXXG HPAC2500ACXXXXXG	.98 47 to 63 P_{sat} / P_{Linear} 1500 / 1300 (180-265) [2] 1800 / 1600 (180-265) [2] 2300 / 1700 (180-265) [2]	 Hz W (VAC) W (VAC) W (VAC)
Receive Band Noise Power Density	without filter	- 155	dBW / 4 KHz

Notes

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: Available with low line voltage option, 90 to 265 VAC. (Not available in S-Band units)
Note 3: 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.

Compact Outdoor Gallium Nitride (GaN) Solid State Power Amplifiers

Specifications, X-Band SSPAs

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_{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

Specifications, Ku-Band SSPAs

PARAMETER	NOTES	LIMITS	UNITS
Frequency Range	Frequency selection "F" Frequency selection "B" Frequency selection "A" Frequency selection "C" Frequency selection "D"	12.75 to 13.25 13.75 to 14.50 14.00 to 14.50 14.50 to 14.70 15.10 to 15.40	GHz GHz GHz GHz GHz
Output Power Typical, P_{sat} Guaranteed minimum, P_{Linear} [1]	 HPAK2100ACXXXXXG HPAK2150ACXXXXXG HPAK2200ACXXXXXG HPAK2250ACXXXXXG HPAK2300ACXXXXXG	P_{sat} / P_{Linear} 50.0 (100) / 47.0 (50) 51.8 (150) / 48.8 (75) 53.0 (200) / 50.0 (100) 54.0 (250) / 51.0 (125) 54.8 (300) / 51.8 (150)	 dBm (W) dBm (W) dBm (W) dBm (W) dBm (W)
Power Requirements Line Frequency Line Power (Voltage) (typical @ 220 VAC)	power factor HPAK2100ACXXXXXG HPAK2150ACXXXXXG HPAK2200ACXXXXXG HPAK2250ACXXXXXG HPAK2300ACXXXXXG	.98 47 to 63 P_{sat} / P_{Linear} 900 / 750 (90-265) 1000 / 850 (90-265) 1200 / 920 (180-265) [2] 1500 / 1000 (180-265) [2] 1600 / 1250 (180-265) [2]	 Hz W (VAC) W (VAC) W (VAC) W (VAC) W (VAC)
Receive Band Noise Power Density [3]		- 155	dBW / 4 KHz

Specifications, Ka-Band SSPAs

PARAMETER	NOTES	LIMITS	UNITS
Frequency Range	Frequency selection "H" Frequency selection "C" Frequency selection "B" Frequency selection "A"	27.50 to 30.00 29.00 to 29.30 29.00 to 30.00 30.00 to 31.00	GHz GHz GHz GHz
Output Power Typical, P_{sat} Guaranteed minimum, P_{Linear} [1]	 HPAA2080ACXXXXXG HPAA2100ACXXXXXG HPAA2180ACXXXXXG	P_{sat} / P_{Linear} 49.0 (80) / 46.0 (40) 50.0 (100) / 47.0 (50) 52.5 (180) / 49.5 (90)	 dBm (W) dBm (W) dBm (W)
Power Requirements Line Frequency Line Power (Voltage) (typical @ 220 VAC)	power factor HPAA2080ACXXXXXG HPAA2100ACXXXXXG HPAA2180ACXXXXXG	.98 47 to 63 P_{sat} / P_{Linear} 825 / 575 (90-265) 1100 / 700 (90-265) 2000 / 1270 (90-265)	 Hz W (VAC) W (VAC) W (VAC)
Receive Band Noise Power Density		- 124	dBW/ 4 KHz

Notes

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: Available with low line voltage option, 90 to 265 VAC.
Note 3: All Ku-Band SSPAs are fitted with a receive band reject bulkhead filter, standard. An optional pressure window is available.

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) full band (S-Band) per 40 MHz per 10 MHz (S-Band) -40 °C to +60 °C at constant temperature 0.1 dB resolution	55-75 ± 1.0 ± 1.5 ± 0.75 ± 0.3 ± 0.3 ± 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)	At 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} (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	
Noise Figure	at maximum gain at maximum gain (S-Band)	10 8	dB 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) ± 0.75	dB dBm

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:

- 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)
- zBUC converter can accept FSK monitor and control signal via the IFL for complete amplifer 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
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 "D"	1350 - 1650 MHz	13.750 GHz	15.10 - 15.40 GHz
Ku	Sub-Band "F"	950 - 1450 MHz	11.800 GHz	12.75 - 13.25 GHz
Ka	Sub-Band "A"	1000 - 2000 MHz	29.000 GHz	30.00 - 31.00 GHz
Ka	Sub-Band "B"	1000 - 2000 MHz	28.0 GHz	29.00 - 30.00 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.)	Ka-band (typ.)	
	10 Hz	-30	-60	-58	-56	-50	dBc/Hz
	100 Hz	-60	-74	-70	-67	-65	dBc/Hz
	1 KHz	-70	-84	-80	-78	-76	dBc/Hz
	10 KHz	-80	-100	-94	-91	-85	dBc/Hz
	100 KHz	-90	-105	-97	-94	-105	dBc/Hz
	1 MHz	-90	-125	-122	-120	-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
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 (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)	$\pm 1 \cdot 10^{-8}$					

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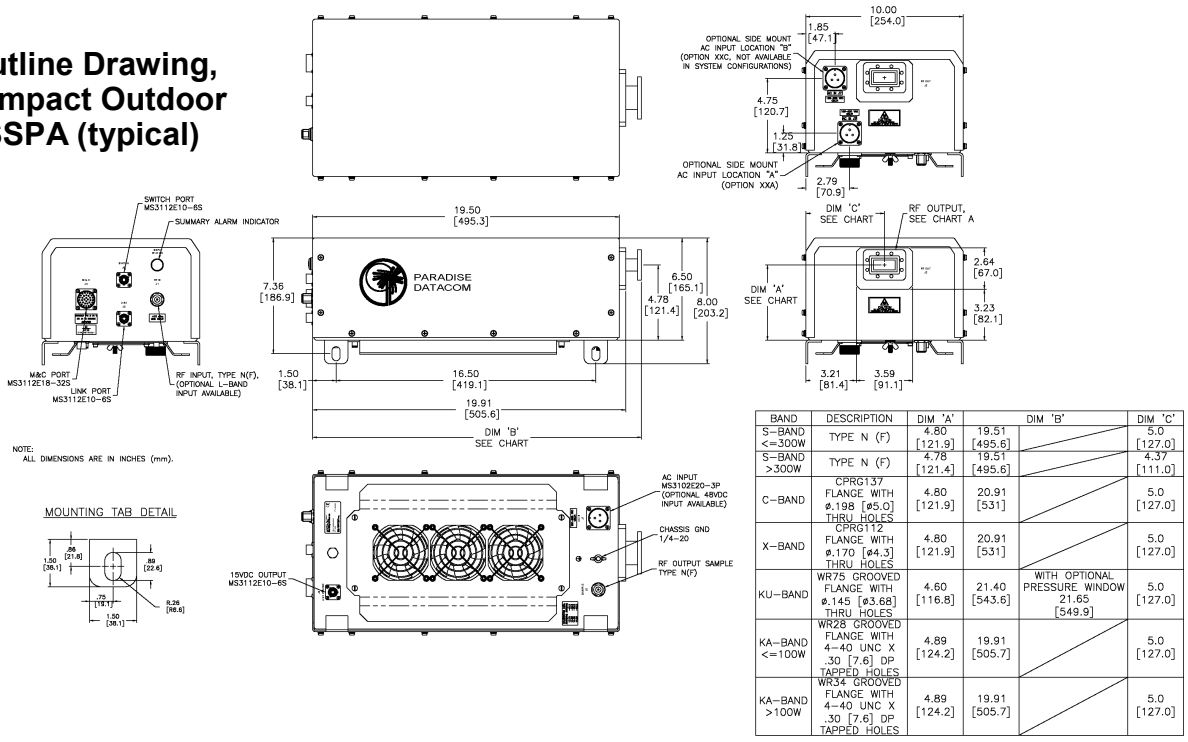
Outline Drawing, Compact Outdoor SSPA (typical)



BAND	DESCRIPTION	DIM 'A'	DIM 'B'		DIM 'C'
S-BAND <=300W	TYPE N (F)	4.80 [121.9]	19.51 [495.6]		5.0 [127.0]
S-BAND >300W	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]
KA-BAND <=100W	WR28 GROOVED FLANGE WITH 4-40 UNC X .30 [7.6] DP TAPPED HOLES	4.89 [124.2]	19.91 [505.7]		5.0 [127.0]
KA-BAND >100W	WR34 GROOVED FLANGE WITH 4-40 UNC X .30 [7.6] DP TAPPED HOLES	4.89 [124.2]	19.91 [505.7]		5.0 [127.0]

Mechanical & Environmental 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 Base Unit (Ka-Band, <180W) Base Unit (Ka-Band, 180W) With Internal zBUC	44 (20.0) ± 3% 50 (22.7) ± 3% 53 (24.1) ± 3% +1.7 (+0.8)	lbs.(kg) lbs.(kg) lbs.(kg) lbs.(kg)
Finish		Paint	White; powder coat
Connectors	RF/L-Band Input RF Input (Ka-Band) RF Output (S-Band) RF Output (C-Band) RF Output (X-Band) RF Output (Ku-Band) RF Output (Ka-Band, to 100W) RF Output (Ka-Band, 180W) RF Output Sample RF Output Sample (Ka-Band) Line Power Monitor and Control Link Port Redundancy Switch Auxiliary +15VDC LNB Power (500 mA)	Type N 2.92 mm Type N WR137 Waveguide WR112 Waveguide WR75 Waveguide WR28 Waveguide WR34 Waveguide Type N 2.92 mm 3-pin MS-type 32-pin MS-type 6-pin MS type 6-pin MS-type 6-pin MS-type	Female Female Female CPR137G flange (PDR-70) CPR112G flange (PDR-84) Grooved flange Grooved flange Grooved flange Female Female Plug Socket Socket Socket Socket
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 Accessories

Remote Control Panel (RCP2-1000-CO)

The RCP2-1000-CO is a Remote Control Panel for the Compact Outdoor SSPA. It requires 1RU of cabinet space and provides a similar local interface as exists on Teledyne Paradise Datacom Indoor Rack Mount amplifiers. Reference specification sheet **209728**.

The controller communicates with the outdoor amplifier via a RS485 link. The controller then provides a wide range of interface capability including Ethernet communications. The following communication links are available at the Remote Control Panel:

- RS232 or Addressable RS485 Serial Data
- Discrete (Parallel) Interface - Form C contact outputs & Opto Isolated Inputs
- Ethernet Interface - A full compliment of Ethernet Communications including UDP, SNMP, and an internal web browser.
- Local (Manual) interface via front panel LCD display

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.

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Part Number Configuration Matrix

HPA	C	2	4	0	0	A	C	M	X	X	X	X	G

Band	
S-Band	S
C-Band	C
X-Band	X
Ku-Band	K
Ka-Band	A

Generation	
Second	2

Power Level (Watts)	
S-Band	050, 100, 200, 300, 400, 500
C-Band	300, 400, 500
X-Band	300, 400
Ku-Band	100, 150, 200, 250, 300
Ka-Band	080, 100, 180

Frequency Sub Band	
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
E[1]	6.425 to 6.725 GHz
F[1]	6.725 to 7.025 GHz
H	5.715 to 5.790 GHz
L[1]	4.400 to 5.000 GHz
X-Band	
A[1]	7.90 to 8.40 GHz
D	7.70 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
C	14.50 to 14.70 GHz
D[1]	15.10 to 15.40 GHz
F[1]	12.75 to 13.25 GHz
G	14.75 to 15.25 GHz
Ka-Band	
A[1]	30.00 to 31.00 GHz
B[1]	29.00 to 30.00 GHz
C	29.00 to 29.30 GHz
H	27.50 to 30.00 GHz

[1] Available with optional BUC

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] 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	Internal Reference BUC
P	External Reference BUC
X	No BUC

Package	
C	Standalone amplifier