



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 1.0 kW L-Band
 - to 1.0 kW S-Band
 - to 1.0 kW 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 Redundancy Control with 'Cold' Standby capability
- Built-in Maintenance Switch Controller
- CE Mark/MIL-STD-461 compliant

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

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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 HPAL210KAHXXXXXG | P_{sat} / P_{Linear} 58.0 (600) / 55.0 (300) 59.0 (800) / 56.0 (400) 60.0 (1000) / 57.0 (500) | dBm (W) dBm (W) dBm (W) |
| Power Requirements Line Frequency Line Power (Voltage) (typical @ 220 VAC) | Power Factor corrected Autoranging HPAL2600_HXXXXXG HPAL2800_HXXXXXG HPAL210K_HXXXXXG | > 0.9 47–63 P_{sat} / P_{Linear} 2200 / 1700 (90-265) 2500 / 2000 (90-265) 4000 / 3500 (180-265) | Hz 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 |

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 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 HPAS210KAHXXXXXG | P_{sat} / P_{Linear} 58.0 (600) / 55.0 (300) 59.0 (800) / 56.0 (400) 60.0 (1000) / 57.0 (500) | dBm (W) dBm (W) dBm (W) |
| Power Requirements Line Frequency Line Power (Voltage) (typical @ 220 VAC) | Power Factor corrected Autoranging HPAS2600_HXXXXXG HPAS2800_HXXXXXG HPAS210K_HXXXXXG | > 0.9 47–63 P_{sat} / P_{Linear} 2200 / 1700 (90-265) 2500 / 2000 (90-265) 4000 / 3500 (180-265) | Hz 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 |

C-Band Output Power Levels

| PARAMETER | NOTES | LIMITS | UNITS |
|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| Frequency Range | Frequency selection "L" Frequency selection "H" Frequency selection "C" ² Frequency selection "A" Frequency selection "B" ² 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 | HPAC2650AHXXXXXG HPAC2800AHXXXXXG HPAC210KAHXXXXXG | P_{sat} / P_{Linear} 58.1 (650) / 55.1 (325) 59.0 (800) / 56.0 (400) 60.0 (1000) / 57.0 (500) | dBm (W) dBm (W) dBm (W) |
| Power Requirements Line Frequency Line Power (Voltage) (typical @ 220 VAC) | Power Factor corrected Autoranging HPAC2650_HXXXXXG HPAC2800_HXXXXXG HPAC210K_HXXXXXG | > 0.9 47 - 63 P_{sat} / P_{Linear} 3300 / 2800 (90-265) 4000 / 3500 (180-265) 4500 / 3700 (180-265) | Hz W (VAC) W (VAC) W (VAC) |
| Receive Band Noise Power Density | without filter | - 155 | dBW / 4 KHz |

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: 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 for frequency selection "C" and from 6.425 to 6.725 GHz for frequency selection "B".

X-Band Output Power Levels

| PARAMETER | NOTES | LIMITS | UNITS |
|-------------------------------------------------------------------------------------|---------------------------------------|-------------------------------------------------------------------------|--------------------|
| Frequency Range | Frequency selection "F" | 7.10 to 7.40 | GHz |
| | Frequency selection "D" | 7.70 to 8.40 | GHz |
| | Frequency selection "A" | 7.90 to 8.40 | GHz |
| Output Power Typical, P_{sat} Guaranteed minimum, P_{Linear}^1 | HPAX2650AHXXXXXG | P_{sat} / P_{Linear} 58.1 (650) / 55.1 (325) | dBm (W) |
| | HPAX2800AHXXXXXG | 59.0 (800) / 56.0 (400) | dBm (W) |
| Power Requirements Line Frequency Line Power (Voltage) (typical @ 220 VAC) | Power Factor corrected Autoranging | > 0.94 47 - 63 | Hz |
| | HPAX2650_HXXXXXG HPAX2800_HXXXXXG | P_{sat} / P_{Linear} 3300 / 2800 (90-265) 4000 / 3500 (180-265) | W (VAC) W (VAC) |
| Receive Band Noise Power Density | without optional filter | - 85 | dBW / 4 KHz |
| | with optional filter | - 155 | dBW / 4 KHz |

Ku-Band Output Power Levels

| PARAMETER | NOTES | LIMITS | UNITS |
|-------------------------------------------------------------------------------------|----------------------------------------------------------|------------------------------------------------------------------------------------------------|-------------------------------|
| Frequency Range | Frequency selection "F" | 12.75 to 13.25 | GHz |
| | Frequency selection "B" | 13.75 to 14.50 | GHz |
| | Frequency selection "A" | 14.00 to 14.50 | GHz |
| | Frequency selection "C" | 14.50 to 14.70 | GHz |
| | Frequency selection "G" | 14.75 to 15.25 | GHz |
| | Frequency selection "D" | 15.10 to 15.40 | GHz |
| Output Power Typical, P_{sat} Guaranteed minimum, P_{Linear}^1 | HPAK2400AHXXXXXG | P_{sat} / P_{Linear} 56.0 (400) / 53.0 (200) | dBm (W) |
| | HPAK2500AHXXXXXG | 57.0 (500) / 54.0 (250) | dBm (W) |
| | HPAK2600AHXXXXXG | 57.8 (600) / 54.8 (300) | dBm (W) |
| Power Requirements Line Frequency Line Power (Voltage) (typical @ 220 VAC) | Power Factor corrected Auto ranging | > 0.94 47 - 63 | Hz |
| | HPAK2400_HXXXXXG HPAK2500_HXXXXXG HPAK2600_HXXXXXG | P_{sat} / P_{Linear} 2500 / 1700 (90-265) 3000 / 2000 (90-265) 3200 / 2500 (90-265) | W (VAC) W (VAC) W (VAC) |
| | Receive Band Noise Power Density ² | with filter | - 155 |

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: All Ku-Band SSPAs are fitted with a receive band reject bulkhead filter, standard. An optional pressure window is available.

Electrical Specifications

| PARAMETER | NOTES | LIMITS | UNITS |
|---------------------------------------------------------|-------------------------------------------|-------------------------------------------|---------------------|
| Gain | range | 55-75 | dB |
| Gain Flatness | full band | ± 1.0 | dB |
| | Extended C-Band units | ± 1.5 | dB |
| | full band (L-, S-Band) | ± 0.75 | dB |
| Gain Slope | per 40 MHz (C-, X-, Ku-bands) | ± 0.3 | dB/40 MHz |
| | per 10 MHz (L-, S-Band) | ± 0.2 | dB/10 MHz |
| Gain Variation vs. Temperature | -40°C to +60°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) | At 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 | Extended C-Band | 1.30:1 | |
| | Output VSWR: Ku-Band with bulkhead filter | 1.50:1 1.40:1 | |
| Noise Figure | at maximum gain | 10 | dB |
| | at maximum gain (L-, S-Band) | 8 | dB |
| Group Delay (per 40 MHz segment) | Linear | 0.01 | ns/MHz |
| | Parabolic | 0.003 | ns/MHz ² |
| | Ripple | 1.0 | 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 | -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 Accuracy | P_{sat} to ($P_{sat} - 20$) ± 0.75 | dB dBm |

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:

- zBUC converter can detect and switch to an externally 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 amplifier remote control.

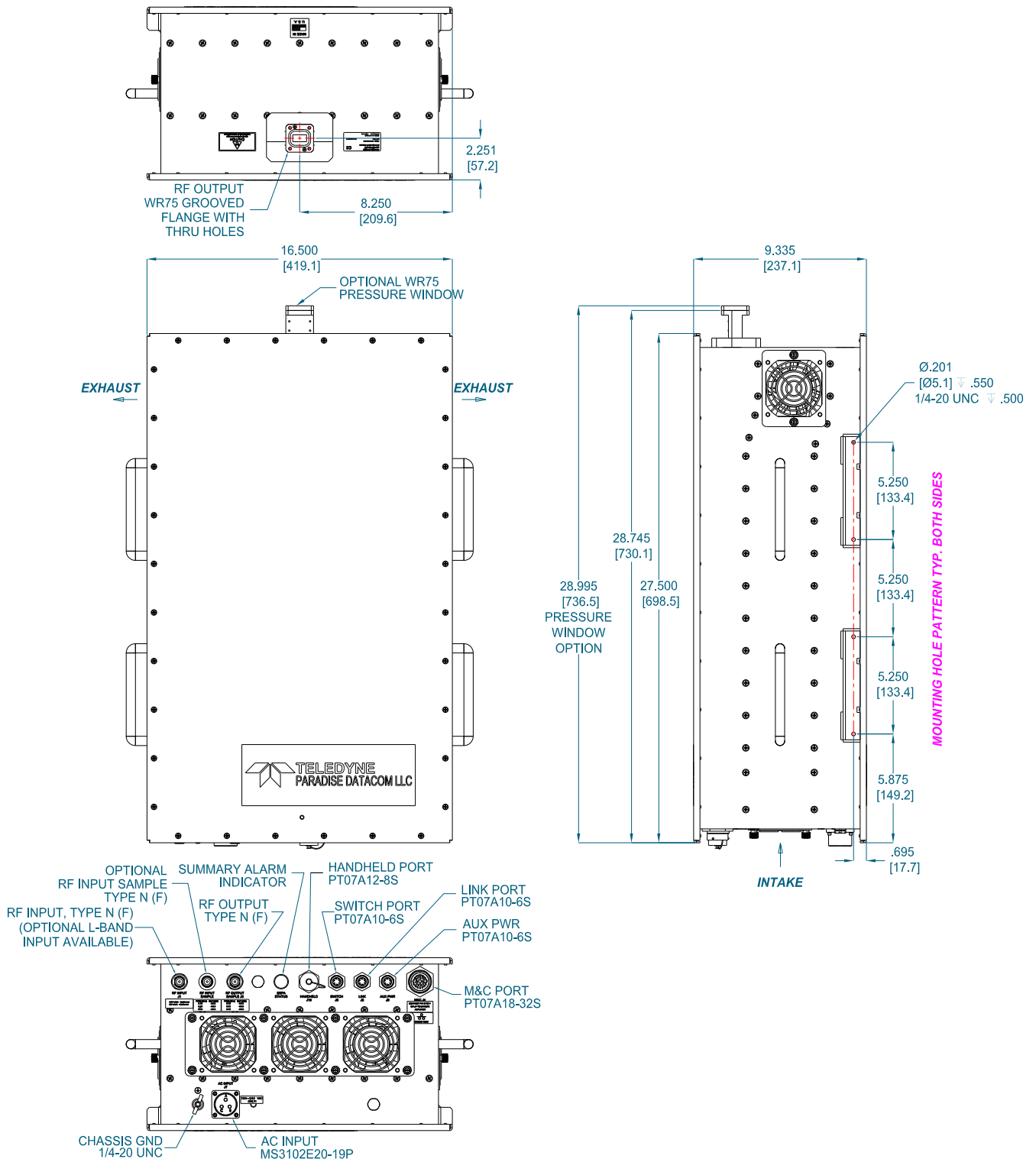
Available Frequency Plans

| 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 |
| 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 |

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 | <u>Absolute max.</u> | <u>C-band (typ.)</u> | <u>X-band (typ.)</u> | <u>Ku-band (typ.)</u> | |
| | 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) (Extended C-Band) | -50 | | | | dBc |
| | Close to Carrier Spurious (≤ 20 MHz) | -40 | | | | dBc |
| | Local Oscillator | -50 | | | | dBc |
| | | -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) | ± 1 • 10 ⁻⁸ | | | | |
| | Aging per day (after 30 days) | ± 1 • 10 ⁻⁹ | | | | |
| | Aging per year (after 30 days) | ± 6 • 10 ⁻⁸ | | | | |
| | Reference Stability over Temperature (-40 to +40 °C, ambient) | ± 1 • 10 ⁻⁸ | | | | |

Outline Drawing, Ku-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 MS3112E18-32S MS3112E10-6S MS3112E10-6S MS3102E20-19P MS3112E10-6S MS3112E12-8S 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.

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, 1000 (10K) |
| S-Band | 600, 800, 1000 (10K) |
| C-Band | 650, 800, 1000 (10K) |
| X-Band | 650, 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 |
| 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 |

| 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 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 | Internal Reference BUC |
| P | External Reference BUC |
| X | No BUC |

| Package | |
|---------|----------------------|
| H | Standalone amplifier |

Example - A standalone 800W GaN C-Band High Power Outdoor SSPA an optional input sample port and optional internal reference block up converter is part number: **HPAC2800AHMXSXXG**.

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Specifications are subject to change without notice.

¹ Available with optional BUC