EMPOWER
RF SYSTEMS, INC.

# Solid State Broadband High Power Amplifier

## 2162 – BBS2E4AUT

## 20 – 1000 MHz / 1000 Watts

The BBS2E4AUT (SKU 2162) is suitable for multi-octave bandwidth high power CW, modulated, and pulse applications. This amplifier utilizes high power LDMOS devices that provide wide frequency response, high gain, high peak power capability, and low distortions. Exceptional performance, long-term reliability and high efficiency are achieved by employing advanced broadband RF matching networks and combining techniques, EMI/RFI filters, and all qualified components. The amplifier is constructed within one single 5RU drawer including the forced air-cooling. The system comes standard to operate from 180-260VAC single phase or can be ordered optionally with a three phase AC supply.

The amplifier includes a built in control and monitoring system, with protection functions which preserve high availability. Remote management and diagnostics are via an embedded web server allowing network managed site status and control simply by connecting the unit's Ethernet port to a LAN. Using a web browser and the unit's IP address (IPV4) allows ease of access with the benefit of multi-level security. The control system core runs an embedded OS (Linux), has a built-in non-volatile memory for event recording, and factory setup recovery features. The extended memory option allows storage of control parameters and event logs.

Empower RF's ISO9001 Quality Assurance Program assures consistent performance and the highest reliability.

- Solid-state linear design
- Suitable for CW, AM, FM and pulse (Consult factory for other modulation types)
- Compact Modular design
- 50 ohm input/output impedance
- Built-in Control, Monitoring and Protection functions
- High reliability and ruggedness

### ELECTRICAL SPECIFICATIONS over temperature conditions (-10 to +50ºC)

| Parameter | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Operating Frequency | BW | 20 | | 1000 | MHz |
| Power Output CW *(Note 1)* | $P_{SAT}$ | 1000 | | | Watt |
| Power Output @ 1dB Gain Compression *(Note 2)* | $P_{1dB}$ | 500 | | | Watt |
| Power Gain @ 1dB Gain Compression | $G_{1dB}$ | 63 | | | dB |
| Input Power for Rated $P_{SAT}$ | $P_{IN}$ | | 0 | | dBm |
| Input Power Range | $P_{IN}$ | -3.0 | | +3.0 | dBm |
| Gain Flatness / Leveled (ALC) | ΔG | | | ±3.5/±1.0 | dB |
| Gain Adjustment Range | VVA | 20 | | | dB |
| Input Return Loss | $S_{11}$ | | | -10 | dB |
| Noise Figure @ maximum gain<br>20-300MHz/300-1000MHz | NF | | | 20/15 | dB |
| Third Order Intercept Point<br>2-Tone @ 54dBm/Tone, 1MHz Spacing | IM3 | | -20 | | dBc |
| Harmonics @ $P_{OUT}$ = 1000W *(Note 3)*<br>(without Harmonic Suppression Filters) | $2^{ND}$ | | | -20 | dBc |
| | $3^{RD}$ | | | -10 | |
| Spurious Signals | Spur | | | -60 | dBc |
| Operating Voltage – (1-phase) | $V_{AC}$ | 180 | 220 | 260 | Volt |
| Operating Voltage – (3-phase) | $V_{AC}$ | | 208 | | Volt |
| Power Consumption @ 1000W CW | $P_D$ | | | 6000 | Watt |

*Notes:* *1. CW measurement performed in MGC Mode (Manual Gain Control)*

*2 .P1dB measurement performed with CCDF Method, IS-95, 1MHz BW*

*3. 20-50MHz second harmonic specs is -15dBc max.*

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## MECHANICAL SPECIFICATIONS

| Parameter | Value | Units |
|---|---|---|
| Dimensions W x H x D | 17.5 x 8.75 x 22 | Inch |
| Weight (Without Harmonic Suppression Filters) | 95 | Pound |
| RF Connectors Input/Output | Input: Type-N, Female<br>Output: Type-7/16-DIN, Female (optional Type-SC, Female) | - |
| RF Sample | Type-SMA, Female | - |
| Blanking Input | Type-BNC, Female | - |
| Cooling | Built-in forced-air cooling system | - |

## ENVIRONMENTAL CHARACTERISTICS (Qualification Data available for review)

| Parameter | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Operating Ambient Temperature | $T_A$ | -10 | | +50 | °C |
| Non-operating Temperature | $T_{STG}$ | -40 | | +85 | °C |
| Relative Humidity (non-condensing) | RH | | | 95 | % |
| Shock / Vibration - MIL-STD-810F<br>Shock Method 516.5, Vibration Method 514.5 | SH / VI | | | | |

## PROTECTIONS

| Parameter | Specifications | Unit |
|---|---|---|
| Input Overdrive | +10 dBm | Max |
| VSWR Protection | At 3:1 – PA backs-off output power to a safe operating level – no system shutdown, “On Air” time is maximized | - |
| Thermal – Graceful Degradation | Ambient 50ºC | Min |
| Default Data Recovery | Factory Default Calibration Recovery | |

## COMMUNICATION INTERFACES

| Function | Utility | Connector |
|---|---|---|
| Ethernet | Network Management of Device / Web Interface | RJ45 |
| USB | Mass Storage / Expansion Bus | USB 1.x/2.0 compatible |
| RS-232 (Standard) RS-422 (optional) | Serial Management of Device / Local Operator Access | D-Sub 9-position Male |

## SYSTEM I/O INTERFACE – 14-Position

| Pin # | Description | Specifications |
|---|---|---|
| 1 | FWD Test Point | Forward detected power (analog voltage: 0-5 Volt) |
| 2 | REV Test Point | Reverse detected power (analog voltage: 0-5 Volt) |
| 3 | Summary Fault | Summary Fault: Active TTL Logic Low (≤0.7V)<br>(*Internally Pulled-High*) |
| 4 | VVA control | Gain control/Monitor: Analog Voltage Range 0-5V<br>Gain Control: 0V= Max. Attenuator, 5V= Min. Attenuator |
| 5 | Shutdown | Amplifier Disable: TTL Logic Low (≤0.7V)<br>(*Internally Pulled-High*) |
| 6 | Aux P/S Test Point | +12.0$V_{DC}$ ±2V (resettable 0.5amp fuse) |
| 7 | P/S System Test Point | +44.0$V_{DC}$ ±4.8V (resettable 0.5amp fuse) |
| 8 | GND | Ground |
| 9 | Open drain control | Site management utility (reserved) |
| 10 | Open drain control | Site management utility (reserved) |
| 11 | Open drain control | Site management utility (reserved) |
| 12 | Digital I/O (configurable) | Site management utility (reserved) |
| 13 | Digital I/O (configurable) | Site management utility (reserved) |
| 14 | GND | Ground |

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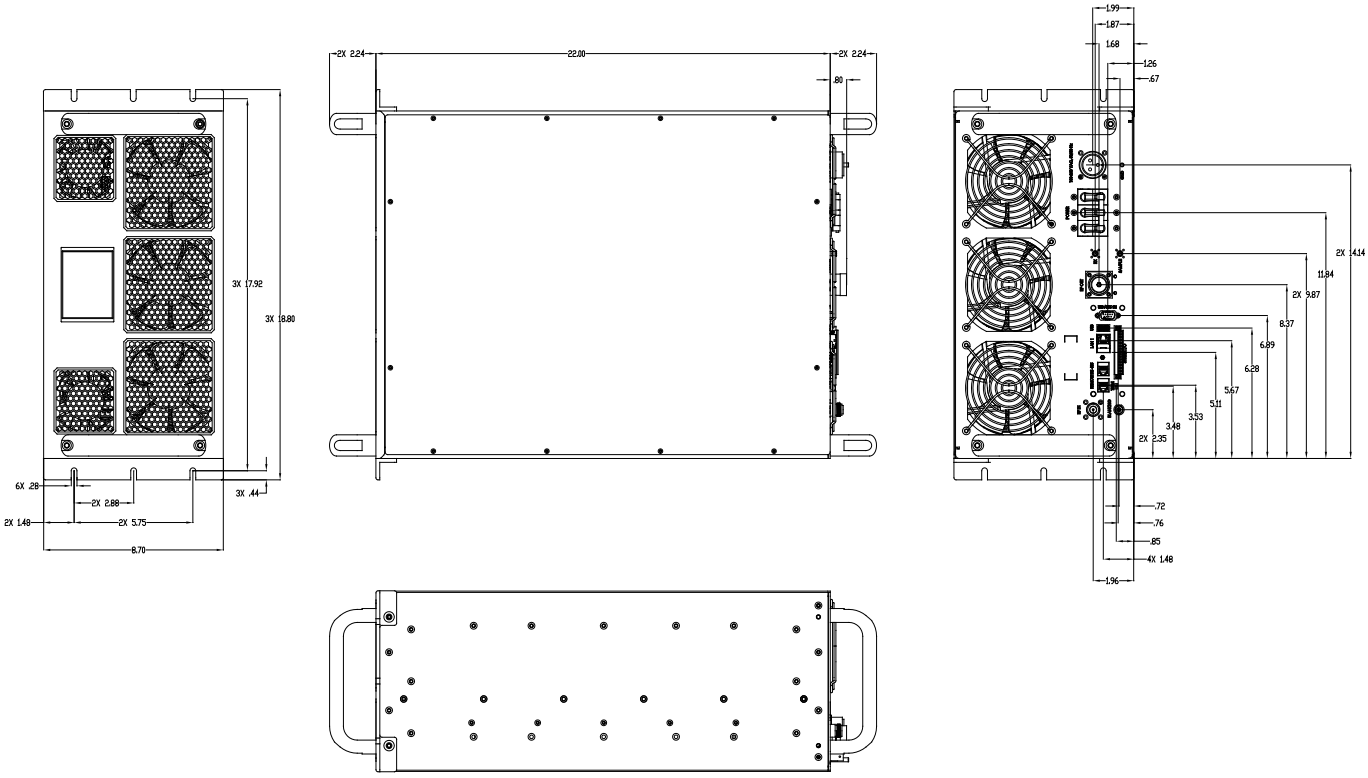
## OUTLINE DRAWING



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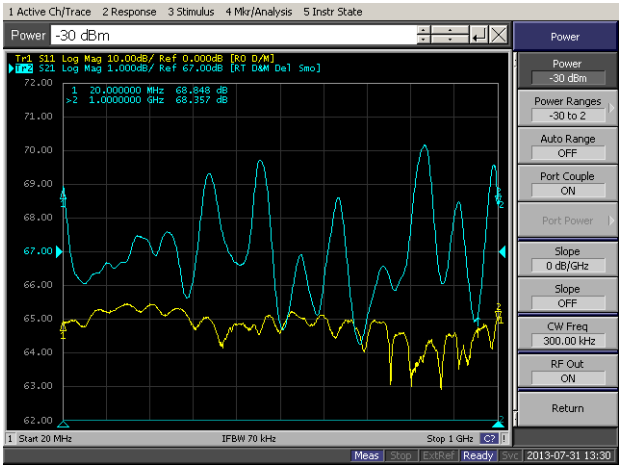
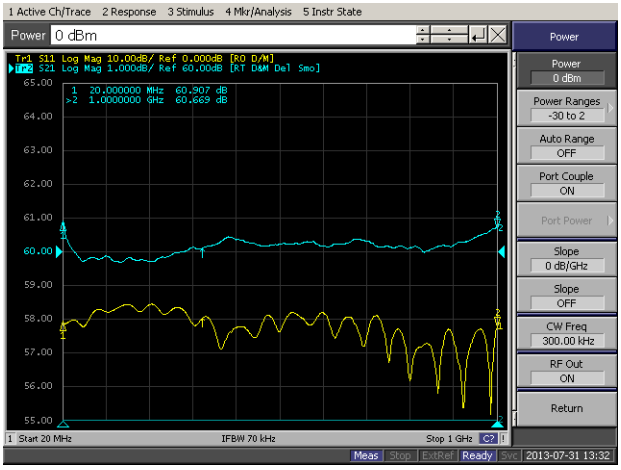
### TYPICAL PERFORMANCE

**Plot 1 – Small Signal Gain and Flatness**
Top Curve: Small Signal Gain @ $P_{IN}$ = -30dBm
Reference: 67dB, 1dB/div.
Bottom Curve: Input Return Loss
Reference: 0dB, 10dB/div.




**Plot 2 – Output Power @ 1000W Leveled**
Top Curve: Mode ALC @ 60dBm, $P_{IN}$ = 0dBm
Reference: 60dB, 1dB/div.
Bottom Curve: Input Return Loss
Reference: 0dB, 10dB/div.




**Plot 3 – Gain Adjustment Range**
Top Curve: Maximum Gain @ $P_{IN}$ = -30dBm
Middle Curve: Minimum Gain @ $P_{IN}$ = -30dBm
Reference: 40dB, 10dB/div.
Bottom Curve: Input Return Loss @ Minimum Gain
Reference: 0dB, 10dB/div.