1562

Part Number

P150-UHF-13

Amplifier Name

Revision 1.f Release Date July 9th 2007
Revision Notes

Technical Specifications Summary

Frequency Range:	470 - 860 MHz	Gain:	13dB
P1dB:	55 Watts CW	Efficiency:	45%
Class:	AB	Temperature Range:	0 to 70°C
Supply Voltage:	32.0V	Max VSWR:	1.5:1

Amplifier General Description

The **P150-UHF** is an integrated TV linear amplifier designed for the television integrator in mind. Providing a minimum of 150W pk linear power, the P150-UHF is the perfect amplifier for any broadband UHF transmitter. Featuring quadrature input and output combining, the amplifier is isolated from most external circuit problems. Gold metallized LDMOS technology gives 13 dB typical gain!

- No RF assembly or circuit tuning!
- 325 Watts of Pk Sync Output Power!
- Combined Video and Aural at full rated power!
- 13dB typical gain at Channel 69!
- Modular Construction for ease of Integration!

Amplifier Picture

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Electrical Specifications

Parameter	Min	Typ	Max	Units	Notes
Frequency	470		860	MHz	
P1dB	52	55		W, CW	
Linear Power Out	150	180		W	
IMD3	-40			dBc	For 2 tones, 1MHz spacing, 150 W PEP
Power Input		5.0	8.0	W, CW	
Gain	12	13		dB	
Vsupply	28	32	34	V, DC	
Drain Current		14		A, DC	
Input VSWR		1.2:1	1.5:1		
Insertion Phase Variation		±5		°	Unit to unit
Gain Variation		±1		dB	Unit to unit
F2 Second Harmonic		-20		dBc	
F3 Third Harmonic		-35		dBc	
Baseplate Operating Temperature	0		+70	°C	

Physical Dimensions 6.3" x 3.8" / 16cm x 10cm x 3cm

All specifications valid for 50 Ω output load, V_{sup} = +32VDC, I_{dq} = 2.0A

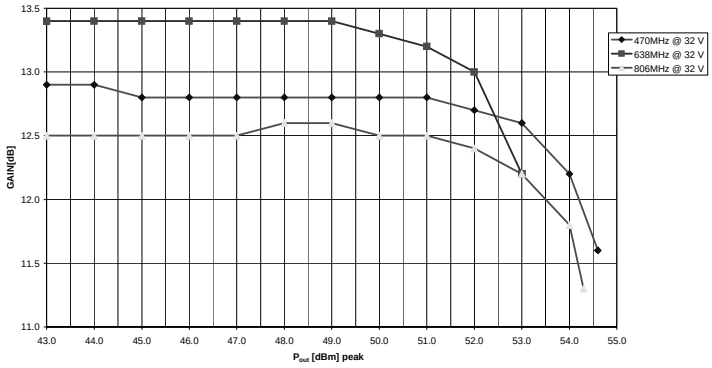
Absolute Maximum Ratings

Parameter	Value	Units	Notes
Maximum Operating Voltage	+34.0	VDC	
Stable Operating Voltage	28.0 to 32.0	VDC	
Maximum Bias Current, Qx	3.0	A	
Maximum Drain Current	14	A	
Load Mismatch Survival	3:1		
Storage Temperature	-40 to +105	°C	
Maximum Operating Baseplate Temp	+70	°C	

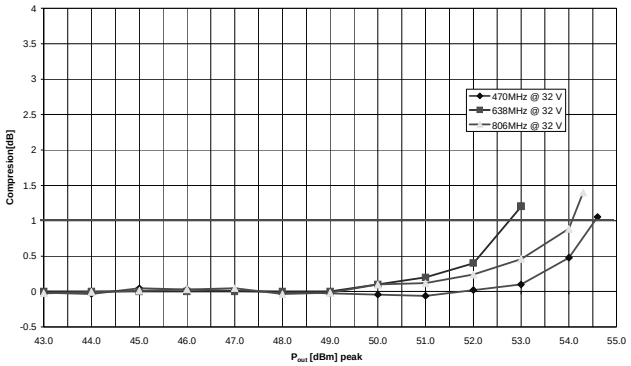
Features, Auxillary Functions

- Temperature Compensated Bias
- Temperature Controller - Analog Temperature Output
- High Temperature Alarm with Selectable Automatic PA Disable
- High Temperature Alarm Output
- Amplifier Disable
- Current Sense, Each Transistor
- Connectorized Power and I/O
- Flexible RF Locations

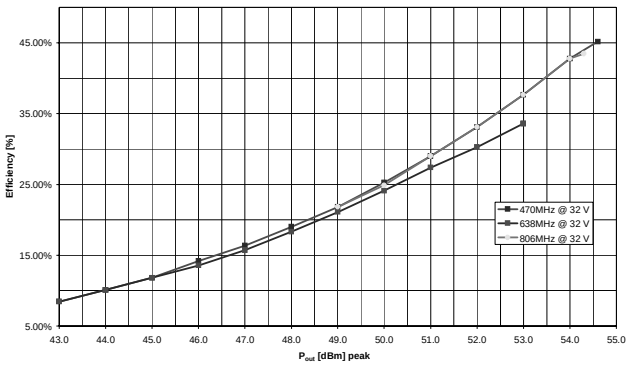
Power Gain of P150-UHF-H @ 32V



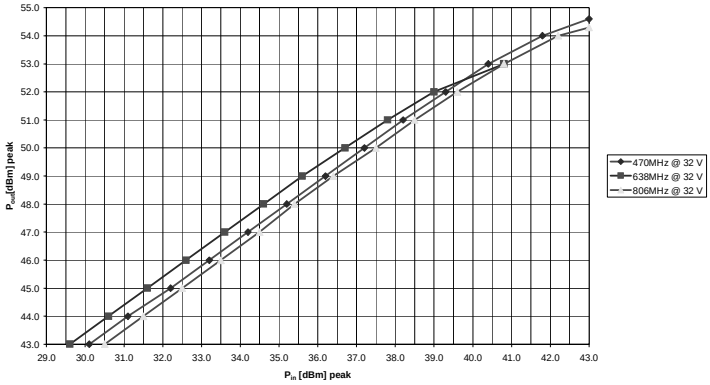
Compresion point of P150-UHF-H @ 32V



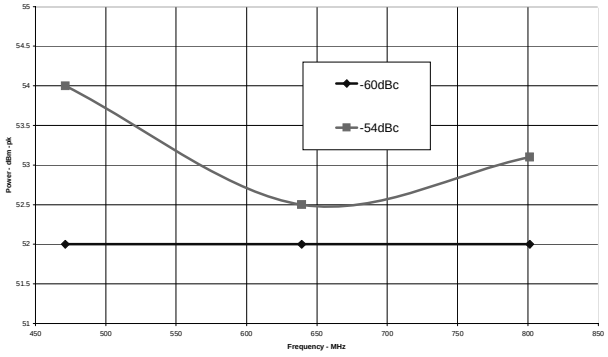
Efficiency of P150-UHF-H @ 32V



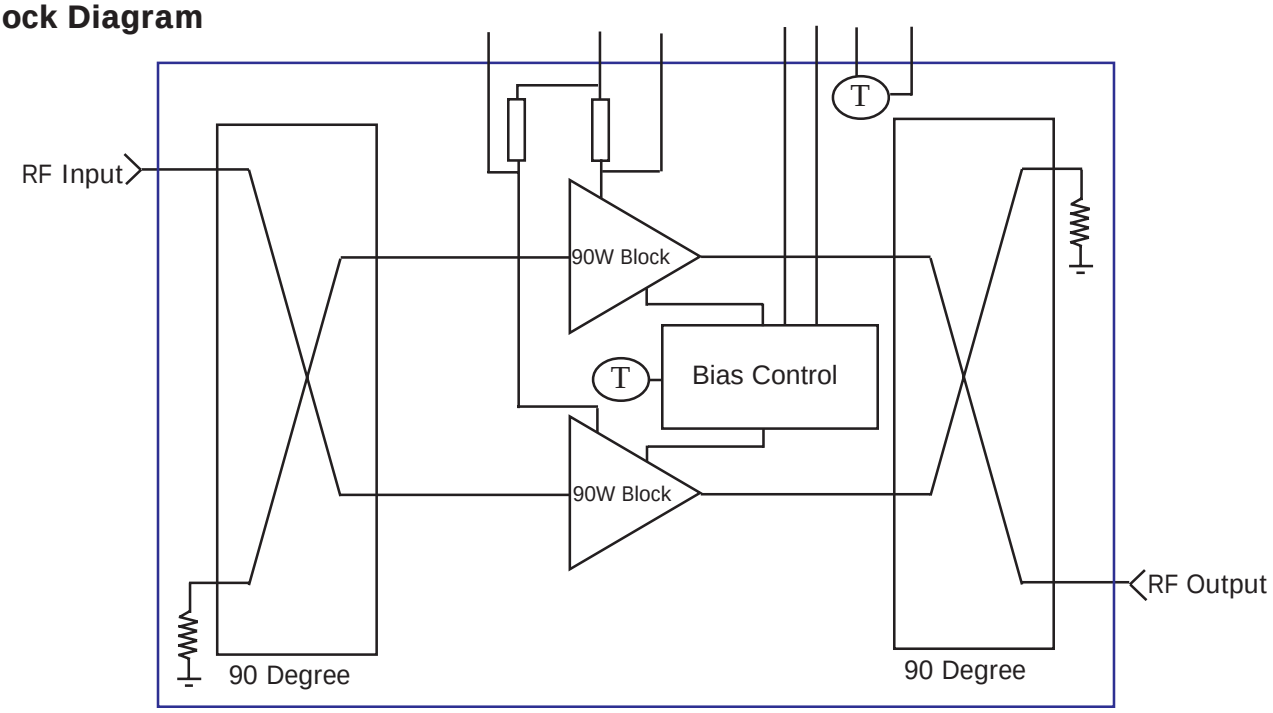
Pout vs Pin P150-UHF-H @ 32V



Full Field Red IMD Distortion vs. Frequency



Block Diagram



Theory of Operation

RF Input signals are presented at 'RF Input' within parameters as specified by the data sheet. RF Input signal is routed into the input quadrature where it is evenly split. Half of the signal is routed into one transistor, the second half is phase shifted by 90 degrees and fed into the second transistor. The transistors amplify the two signals where they are fed into the output quadrature. The first signal which was not phase shifted is now shifted 90 degrees to be coherent with the second signal. The combined power is presented at RF Output. Any mismatch is dissipated Component Description

i Input quadrature. The input quadrature is made from a specific type of coupled wireline which gives a 90 degree phase shift.

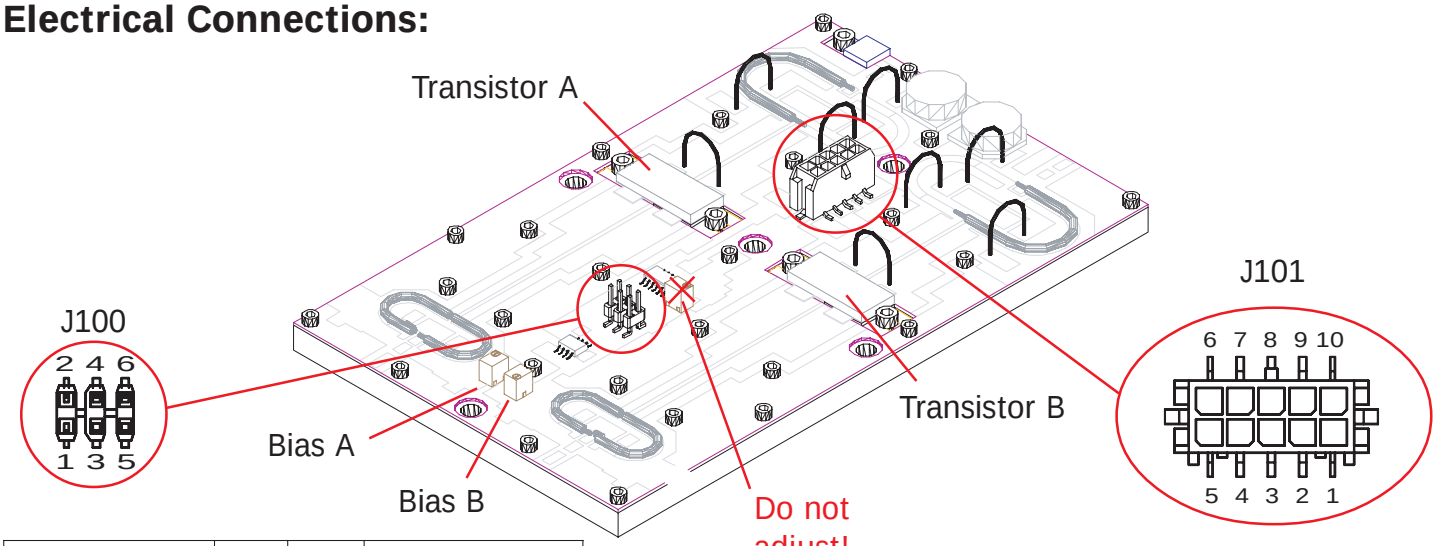
ii Transistors. The transistors are gold MOSFET type and are exceptionally rugged. These transistors are mounted to a highly thermally conductive ceramic substrate which is in turn mounted to a copper tungsten heat sink that is bolted to the aluminum heat spreader. In practice, these devices have 16 + dB of gain, and feature stable operating voltage +26V to +32 V DC. These devices are biased to Class AB operation which balances linear operation with efficiency.

iii Output Quadrature. The output quadrature is a hybrid stripline construction which is designed to handle in excess of 500W average. The addition of this component isolates the transistors from external circuit problems and allows operation even when one device is disabled.

iv Bias Control circuitry - the bias control circuity uses a variable voltage regulator which is tied to a hermetically sealed thermistor to regulate quiescent current. The bias control circuitry controls the quiescent current by regulating the DC voltage applied at the gates and keeping it constant over the temperature range. By applying ground, the bias control circuitry shuts down the amplifier.

v Temperature controller - This integrated circuit is attached to the amplifier and outputs the temperature of the baseplate in a scaled voltage. Using on-board alarm circuitry, the alarm will go active at 70c and clear itself at approximately 65C.

Electrical Connections:



I/O Standard 0.100" pitch DIP /IDC header: SAMTEC type IDSD, HCSD 3M type 89106-0101 AMP 102393-1, 102398-1 BERG 71602-306 -or- Solder directly to Pin in I/O connector	**J100-1**	ALARM_OUT	TTL Hi when baseplate exceeds 70C
	J100-2	ALARM_IN	Jumper to J100-1 for automatic shutdown at 70C, automatically re-enables at 60C
	J100-3	GROUND	
	J100-4	BIAS_SUP	Optional - Remove R108 to power control circuitry at this pin. With R108 installed, Vsup is present here.
	J100-5	TEMP	Baseplate Temperature
	J100-6	DISABLE	TTL Hi to Disable amplifier
Power 3.0mm Micro Connector: MOLEX 43025-1000 MOLEX Pin 43030-0001, 43030-0007 AMP 1-794617-0 AMP Pin 794610, 794606 -or- Solder directly to pad adjacent to connector	**J101-1**	CURRENT_B	Current Sense, Transistor B
	J101-2,3,8,9	GROUND	System Ground
	J101-4,5,6,7	Vsup	+28 to +32 VDC
	J101-10	CURRENT_A	Current Sense, Transistor A

Connections:
Connect amplifier to +Vsup and Ground using either 3.0mm modular 10-position plug (J101) or soldering directly to pads adjacent to connector. If using Single connection, 14 gauge wire to each side is recommended, 12 gauge ground wire. 20 gauge wire is recommended for use in modular connector, and all power connections must be used! In all cases, use of teflon insulated wire is highly recommended.
I/O connector (J100) must have +Vsup (+24V minimum) DC applied to J100-4 to supply power to bias and control circuitry. All other connections are optional.
Connect coaxial cable to input and output RF connections (semi rigid or flexible) using best RF practices. Ensure output cable is of sufficient power handling rating. Pads are provided for ground on co-axial connections.

Amplifier Startup

+Vsup should be applied to amplifier with no drive and with no bias applied. The system must allow drain voltage to reach +28V minimum before applying bias and drive or damage will result to the amplifier and void warranty. This typically takes between 2 - 10 seconds and should be verified by the system integrator. This can be accomplished in several ways:
1) Apply power to amp at J101, and remove power from J100-4. After proper voltage has been reached, apply voltage to J100-4 as described above. Amplifier is ready for use.
2) Apply power to amp at J101, and J100-4. Place a TTL Hi (+5V) to J100-6 DISABLE. After proper voltage has been reached, remove TTL Hi from J100-6 DISABLE. Amplifier is ready for use.

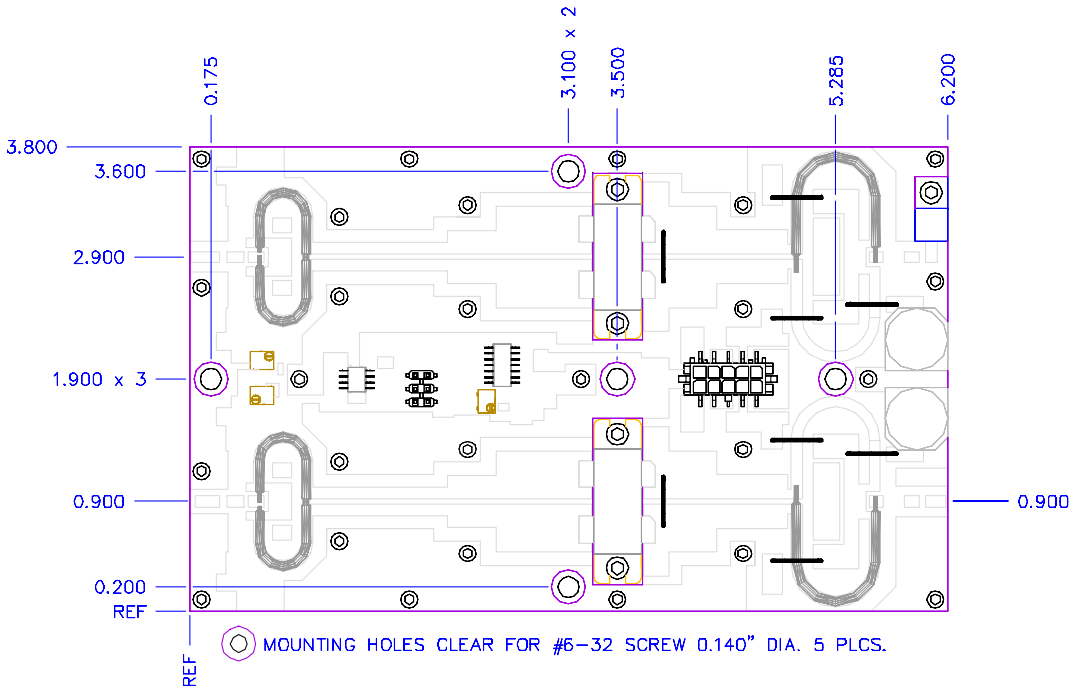
Bias Current:
Bias current is controlled via temperature compensated bias system that uses a hermetically sealed glass thermistor as reference. If excessive air is directed above the amplifier such that the thermistor is cooled below the temperature of the baseplate, this circuitry may not perform properly. Bias has been pre-set at the factory to 1.0A each side at +32.0V DC. This bias point has been selected to offer the optimum balance between IMD performance, efficiency, and gain. If the bias point is changed, take great care to set the same bias point on each transistor, and not to exceed the bias listed on page 1.

Fault Condition - Bad VSWR
Current sense J101-1, J101-10 should be monitored for excessive current. The voltage difference between J100-10 (transistor A) to J100-4,5,6,7 and J100-1 (transistor B) to J100-4,5,6,7 is scaled 1A per 0.010 V. If either transistor experiences currents in excess of normal operation, a fault condition exists, and the amplifier should be disabled through J100-6 DISABLE. If current on either transistor drops to below 0.5A indicated, a fault condition exists, and the amplifier should be disabled through J100-6 DISABLE.

Temperature Sense and Temperature Fault
An on board temperature controller reports temperature on pin J100-5 TEMP. This is scaled to +395mV + (Temperature °C X +6.20mV/°C) and has an output impedance of 1.5kohm typical. An output alarm, J100-1 ALARM OUT, is TTL Low when the temperature exceeds approximately 70°C, and the alarm is cleared when the baseplate temperature drops below approximately 60°C. For automatic operation, jumper J100-1 ALARM OUT to J100-2 ALARM IN and the amplifier will automatically disable by removing bias when the temperature exceeds 70°C, and automatically re-enable when the temperature drops below 60°C.

Amplifier Shutdown
To prevent damage to amplifier and surrounding systems, bias and drive should be removed prior to powering down PA. This can be accomplished by removing voltage from J100-4, or by applying TTL Hi (+5V) to J100-6 DISABLE. Power can safely be removed from PA.

Miscellaneous:
Placing noisy analog or digital systems, such as additional control circuitry, directly over the top of transistors or RF path can cause improper operation. Care should be taken to locate these components where they will not cause interference.



Tips for Mechanical Mounting:

1 All holes are clear for #6 Screw. Stainless Steel mounting hardware is recommended, grade 18-8 or better. A lock washer of same material should also be used.

2 Ensure mounting surface is flat to better than 0.003" / "

3 Use a thin layer of thermal compound on the backside of the PA - no more than 0.001" - 0.002" thickness!

4 Torque all screws to 10-12 in-lbs

Considerations for Mechanical Mounting:

- Considerations for proper thermal design include
- Total power dissipated = Total DC Power Consumed x (1-Efficiency)
- Ambient Airflow
- Thermal Resistance of Heat Sink

For this PA, typical DC efficiency is 35%. At 400W Pk power output, 200W Average, +32.0V DC operation, 544 total watts are consumed, which leaves 344W dissipated power. If we assume an input air temperature of +25°C, and a maximum desired baseplate temperature of 55°C, this leaves a temperature differential between baseplate and ambient air of 30°C. The desired thermal resistance for heatsink mounting surface to air is therefore 30°C/344W = 0.09°C/W.

Since the baseplate is aluminum, it is important to find a heat sink that it sized at the same outline as the PA which can give this thermal resistance. For example, a 230mm x 127mm heat sink with serrated fins, 70mm in length, (40 fins across 127mm dimension) with an air velocity of 4 m / s achieves this value.

Ordering Information:

Order Code	Description	DRFT Reference
P150-UH-13	P150-UHF-13	1562
PAB150-UHF-13	PAB150-UHF-13	TBD
Options		
-A11	SMA Female Connectors In / Out	0201
-A12	Heat Sink Option	0202
-A13	Heat Sink Option with DC Fan, pre wired	0203
-A14	Ruggedized for vibration	0204
-A15	Wire harness, 1' length, 10 wires for pallet amplifier only (NON-FM)	0205
-A16	Wire harness, customer specified length for pallet amplifier only	0206
-T2	Extended Burn In	0271
-T3	Extended Data Collection	0272

Standard Pallet Options:

SMA Female Connectors, Input and Output. Stainless Body, Gold Center pin, 4-hole SMA bolted to pallet amplifier edge through bottom two holes located at amplifiers RF IN and RF OUT locations. All stainless steel hardware.

Enclosure- all aluminum machined enclosure available for most pallet amplifiers. Alodyned aluminum, alloy 6061-T6. SMA Female input and output RF connectors. Supply voltage and ground through solder / feedthrough connections. Module must be bolted to appropriate heatsink.

Heat Sink - aluminum extruded heat sink, black anodized. Pallet amplifier or module will be bolted to heatsink. Customer will be required to provide adequate airflow.

Heat sink with fan - aluminum extruded heat sink as above, with included fan bolted to push air through the heat sink. Depending on heat requirements, a second fan may also be provided on the output of the unit.

Ruggedized - all screws have threadlocking compound applied, and all flying components are staked and attached to base. Designed to withstand MIL-STD-810E 514.4 Category 8.

Power Connector - a 10 pin molex connector is used on all standard pallet amplifiers to supply +Vsup and Ground connections, as well as hi-side current shunts for current monitoring. Delta RF offers the mating connector with 1' wires - Red (Vsup), Black (Ground), Yellow (Current monitor). All wires are 18 gauge teflon insulated wires. Customer may optionally specify wire length and wire color.

Testing Options:

Standard - includes power test and brief burn - in under laboratory conditions. Printed test report gives graph of Gain and Input Return Loss at rated P1dB and Voltage Conditions. Report shows pass/fail critera. All amplifiers include this test.

Extended burn in - 8-hour burn in at P1dB with standard test run at completion. Unit is monitored during test and any discrepancy reported. Standard test data is included.

Extended data collection - Standard data is run and included. Detailed data is taken point by point giving the customer 25 - 70 frequency points, depending on the amplifier model. For each frequency point, data is generated to include gain, input power, input return loss, current, second harmonic, third harmonic, efficiency, audio distortion.

Other tests available - Vibration, Temp cycling, Shock. Please inquire.