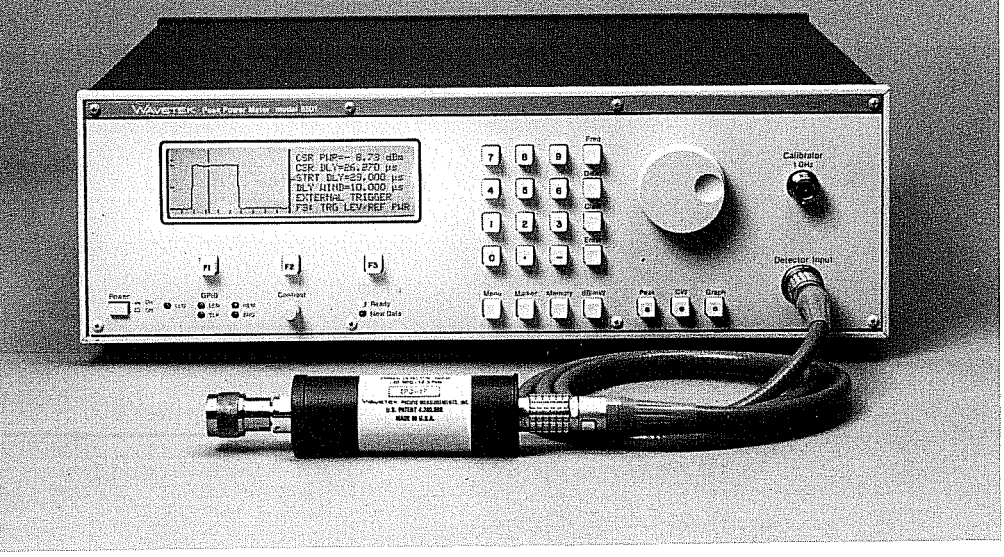
MICROWAVE PEAK POWER METERS

8500 SERIES



Microwave Peak Power Meter

- **High Instrumentation Accuracy ±3% (±0.13dB)**
- **30 MHz to 40 GHz Frequency Range**
- **Graph Mode for Plot of Pulse Profile**
- **Full GPIB Control**
- **Complete Family of Low VSWR Sensors**

The 8500 Series of Peak Power Meters is designed for making highly accurate power measurements on pulsed RF signals independent of pulse width or rep rate of the pulses. Single channel and dual channel versions are available. The pulse profile can be displayed on the LCD screen along with the main measurement parameters. Pulses as narrow as 15 ns can be displayed and measured.

A family of diode power sensors complements the power meter. To minimize mismatch errors, each of the sensors has a low VSWR. In addition, each sensor includes a built-in PROM which has been programmed with frequency response information for that particular power sensor. Both fast risetime (high speed) and slow risetime (low speed) sensors are available.

Rackmount (5¼ inches high) and bench top units are available. The power sensor inputs and calibrator output can be on the front or rear of the instrument.

Precise Amplitude Measurements
A unique power sweep calibration system is used to provide the ±3% linearity specification over the power range from +20 dBm to −20 dBm. With this system any power sensor can be used with any power meter without degradation in accuracy. The calibration system also serves as a test for the measurement system to prevent damaged diodes in the sensors generating erroneous power readings. Calibration of the sensors to the power meter can be done at any time by the user. The operation is microprocessor controlled and takes less than 45 seconds. This same calibration system transfers NBS traceability to the 8500 Series peak power meter and sensors.

Corrections to power readings over the full frequency range of the sensors is executed by reading Cal Factor information from a PROM built into the power sensor. The measurement frequency can be entered manually, or automatically via the GPIB, or by applying an external analog voltage corresponding the frequency of the signal.

Offsets can be entered into the 8500 Series Peak Power Meters to compensate for losses in directional couplers and attenuators used to sample the RF power. This allows the display of true power being delivered at the measurement point.

Precise Timing Measurements
In many applications, the 8500 Series peak power meter can be used to replace crystal detectors and oscilloscopes for timing measurements. Using built-in markers, the user can precisely measure the pulse width and risetime either manually or over the GPIB. The time base is crystal controlled providing high accuracy and reliability over a wide range of time base (delay) speeds.

A delay line has been incorporated to permit viewing the leading edge of the pulse without the need for an external trigger.

Measurement Convenience Using Stored Setups
Nine store/recall memories are available to store the complete operating state of the instrument. A tenth memory retains the power down status which is then available automatically as an option when next using the instrument.

Powerful GPIB Capability
Full GPIB control makes the 8500 Series ideal for systems applications. Many internal high level functions such as risetime and pulse width are available over the bus and return results instead of just data to the controller.

Hardcopy pulse profiles are easily made using a digital plotter connected to the GPIB interface. No other controller is required. The plot is fully annotated including time, data and part identification.

Family of Power Sensors
Two types of power sensor with a variety of connectors are available for the 8500 Series. The high speed sensors have a minimum pulse width capability of <15 ns. Frequency range is 750 MHz to 40 GHz depending on the connector.

The low speed sensor has a minimum pulse width of <750 ns. Frequency range is 30 MHz to 26.5 GHz.

The power sensors are connected to the meter using a rugged, double shielded cable terminated in high quality, locking connectors. Various cable lengths are available.

8500 SERIES

Frequency Range: 30 MHz to 40 GHz depending on detectors (see PEAK POWER SENSOR specifications).

Power Range
Pulse: −20 dBm to +20 dBm.
CW: −40 dBm to +20 dBm.
(See sensor specifications.)

Accuracy: Uncertainty of microwave power measurements depends on seveal factors, the

most important of which is the effective mismatch of both the power sensor and the RF source. Excluding mismatch effects, the measurement uncertainties of the instrument are:

Calibrator Power Uncertainty (at 0 dBm): ±1.5%.

Linearity After Automatic Calibration: ±3% (at stable temp.).

Temperature Coefficient of Linearity at Ambient ±5°C, CW and Peak, Typical:
>−10 dBm, negligible, 0° to 50°C.
<−10 dBm, ±0.5%/°C, 15° to 50°C.
±1%/°C, 0° to 15°C.
Instrument indicates if ±5°C calibration range is exceeded.

Uncertainty Due to Zeroing and Noise:
CW (Avg.=500): <±10 nW, 15° to 50°C,
<±20 nW, 0° to 15°C.
Peak (Avg.=100): <±3.5μW, 15° to 50°C,
<±5.0μW, 0° to 15°C.
Single Pulse: <±15μW, typical 15° to 50°C,
<±30μW, typical 0° to 15°C.

Time Base Range: 1.2 ns/div to 20 ms/div (12 ns to 200 ms time window), using either the Data Entry Keyboard or the Control Knob.
Resolution: 0.1 ns.
Accuracy: 0.01% of time window, ±1 ns.

Trigger Delay Range: 0 to 200 ms using either the Data Entry Keyboard or the Control Knob.
Resolution: 0.1 ns.
Accuracy: 0.01% of delay, ±1 ns.

Triggering Modes
Internal: −10 dBm to +16 dBm.
External (BNC): TTL levels, Maximum PRF 1 MHz.

Markers: Up to 4 markers/channel plus a Reference Power Level cursor. Markers can be positioned at any point on the pulse waveform. Typically they would be positioned to make risetime and pulse width measurements. The markers and cursor can be positioned either at user selected delays or automatically at specified percentage of amplitude for pulse parameter measurements.

Graph Display Mode: Plots the outline of the detected pulse on the LCD display. Also provides readout of amplitude and timing information.

Fast Measurement Mode: Available under GPIB control to provide fast data acquisition and output. For an averaging number = 1, typically between 70 and 120 measurements/second. Also can be used to provide fast data acquisition and throughput via rear panel analog output for using an 8500 with a network analyzer to make swept frequency response tests.

Calibrator
Frequency: 1 GHz ±5%.
Power Uncertainty at 1 mW: ±1.5%.
Return Loss at 1 mW: >25 dB.
Self Calibration Time: <1 minute.
Connector: Type N.

Output Channels
8501: Single Channel.
8502: Dual Channel.

Auxiliary Outputs/Inputs (BNC).
Monitor: Provides a voltage proportional to the detected RF envelope. Risetime is typically 20 ns, output impedance is nominally 50Ω.
Analog Output: Provides a voltage proportional to detected power. Scale Factor is 100 mV/dB, ±0.5%, offset is <±10 mV.
Trigger Input: TTL.
RF Blanking: TTL open collector low during zeroing. Used to control power source.
Voltage Proportional to Freq (V/GHz): Allows direct entry of frequency from RF power sources equipped with a V∝F output.

GPIB Interface: In accordance with IEEE STD 488-1978.
GPIB Indicators: REM, TLK, LSN, SRQ, LLO.
Remote Operation: Complete setup and measurement capabilities accessible via GPIB (IEEE-488). Reporting of errors, malfunctions, operational status and self-test diagnostics available through serial poll capability.
Direct Plot Output: Outputs hardcopy pulse profile including time, date and part identification to a GPIB plotter.
GPIB Address: Selectable from front panel.
GPIB Interface Functions: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, TE0, LE0.

OPTIONS

01: Rack Mount.
03: Rear Panel Connections (Sensor(s) and Calibrator). Deletes front panel connections.)
04: Internal MATE Interface. (Contact your Wavetek representative for information.)

GENERAL

Stored Setups: Saves settings at power down and nine additional stored settings in non-volatile memory.
Self-Test: Self-Test is optionally performed at any time. A diagnostic code indicates the cause and location of any errors.
Reset Control: (Rear Panel) Returns instrument to preset default condition.

Design and Construction: To the intent of MIL-T-28800C, Type III, Class 5, Style E, Color R.

Power Requirements: 100, 120, 220 or 240 Vac ±10%, 48 to 480 Hz. Approx. 100 VA.

Environmental Characteristics
Temperature:
Operating: 0° to 50°C (32° to 122°F).
Non-operating: −40° to +65°C (−40° to +149°F).
Humidity: Operating (without precipitation:
95% ± 5% to 30°C.
75% ± 5% to 40°C.
45% ± 5% to 50°C.

Physical Characteristics
Dimensions: 42.57 cm (16.76 in.) wide, 14.83 cm (5.84 in.) high with feet, 13.25 cm (5.22 in.) without feet, 35.56 cm (14 in.) deep.
Weight:
Model 8501: 12 kg (26 lb.) net.
Model 8502: 13 kg (28 lb.) net.

PEAK POWER SENSORS

Frequency Ranges
High Speed: (High Speed detectors can be used down to 500 MHz.)
16936, 16937: 750 MHz to 18.5 GHz.
17266: 750 MHz to 26.5 GHz.
17071: 750 MHz to 40 GHz.
Low Speed:
16934, 16935: 30 MHz to 18.5 GHz.
17267: 30 MHz to 26.5 GHz.

Risetime
High Speed: <15 ns, typically 10 ns.
Low Speed: <750 ns, typically 500 ns.

Power Range
Measurement: −20 to +20 dBm (Pulse), −40 to +20 dBm (CW).
Absolute Maximum: (Damage Limit). +23 dBm (200 mW).

Return Loss (SWR)

	Type N, APC-7	Type K
Below 2 GHz	>25 dB (1.12)	>25 dB (1.12)
2 to 12.4 GHz	>20 dB (1.22)	>20 dB (1.22)
12.4 to 18 GHz	>16 dB (1.37)	>16 dB (1.37)
18 to 26.5 GHz		>14 dB (1.50)
26.5 to 40 GHz		>10 dB (1.92)

Calibration Factor Uncertainty

	Sum of Uncertainties (%)[1]	Probable Uncertainty (%)[2]
Below 10 GHz	2.6%	1.2%
10 to 18 GHz	6.4%	3.7%
18 to 26.5 GHz	10%	6.5%
26.5 to 40 GHz	20%	10%

Measurement Uncertainty: (Using Root of the Sum of the Squares.) The total Measurement Uncertainty will consist of the Calibration Factory Uncertainty (see preceding table) plus the Calibrator Uncertainty at 1 GHz (=1.5%) plus the Mismatch Uncertainty of the calibrator and sensor at 1 GHz (=0.6%) plus the linearity if not near 1 mW (=3%) plus the uncertainty due to noise if operating at low signal levels plus the Mismatch Uncertainty of the sensor and source under test.
Typical Example:
Frequency =6 GHz, Source Return Loss =10 dB.
Calibration Factor uncertainty at 6 GHz: 2.6%.
Calibrator uncertainty at 1 GHz: 1.5%.
Mismatch uncertainty of Calibrator and Sensor at 1 GHz: 0.6%.
Linearity (if not near 1 mW): 3.0%.
Noise (see preceding section on Accuracy): ±2.5μW.
Mismatch of Sensor and Source: 3.2%.
Total Measurement Uncertainty = 10.9% ±3.5μW.
RSS value = 5.34% ±3.5μW.

GENERAL

Connectors
16936, 16934: Type N.
16937, 16935: Type APC-7.
17266, 17071, 17267: Type K (SMA compatible).

Sensor Cables: Detachable from the sensor heads. Standard length is 5 feet. Special lengths available.

Dimensions: 2.7 cm (1.44 in.) diameter, 14.6 cm, (5.75 in.) length.

Weight: 0.3 kg (0.7 lb.).

[1] *Includes uncertainty of reference standard and transfer uncertainty. Directly traceable to NBS.*
[2] *Square root of the sum of the individual uncertainties squared. (RSS)*

FACTORY/FOB
Sunnyvale, CA