Power Meter Specifications

Meter

Frequency Range

100 kHz to 110 GHz, power sensor dependent

Power Range

-70 dBm to +44 dBm (100 pW to 25 W), power sensor dependent

Power Sensors

Compatible with all Agilent 8480 series power sensors and Agilent E-series power sensors.

Single Sensor Dynamic Range

90 dB maximum (Agilent E-series power sensors)
50 dB maximum (Agilent 8480 series power sensors)

Display Units

Absolute: Watts or dBm
Relative: Percent or dB

Display Resolution

Selectable resolution of:

1.0, 0.1, 0.01 and 0.001 dB in logarithmic mode, or
1, 2, 3 and 4 significant digits in linear mode

Default Resolution

0.01 dB in logarithmic mode
3 digits in linear mode

Accuracy

Instrumentation

Absolute: ±0.02 dB (Logarithmic) or ±0.5% (Linear). (Refer to the power sensor linearity specification in your power sensor manual to assess overall system accuracy.)
Relative: ±0.04 dB (Logarithmic) or ±1.0% (Linear). (Refer to the power sensor linearity specification in your power sensor manual to assess overall system accuracy.)

Zero Set (digital settability of zero): Power sensor dependent (refer to Table 5-1). For Agilent E-series power sensors, this specification applies when zeroing is performed with the sensor input disconnected from the POWER REF.

Table 5-1: Zero Set Specifications

Power Sensor	Zero Set
Agilent 8481A	±50 nW
Agilent 8481B	±50 µW
Agilent 8481D	±20 pW
Agilent 8481H	±5 µW
Agilent 8482A	±50 nW
Agilent 8482B	±50 µW
Agilent 8482H	±5 µW
Agilent 8483A	±50 nW
Agilent 8485A	±50 nW
Agilent 8485D	±20 pW
Agilent R8486A	±50 nW
Agilent R8486D	±30 pW
Agilent Q8486A	±50 nW
Agilent Q8486D	±30 pW
Agilent V8486A	±200 nW
Agilent W8486A	±200 nW
Agilent 8487A	±50 nW
Agilent 8487D	±20 pW
Agilent E4412A	±50 pW
Agilent E4413A	±50 pW

Power Reference

Power Output

1.00 mW (0.0 dBm). Factory set to ±0.7% traceable to the US National Institute of Standards and Technology.

Accuracy

±1.2% worst case (±0.9% rss) for one year.

Power Meter Supplemental Characteristics

Power Reference

Frequency

50 MHz nominal

SWR

1.05 maximum

Connector

Type N (f), 50 Ω

Measurement Speed

Over the GP-IB, three measurement speed modes are available as shown, along with the typical maximum measurement speed for each mode:

- ***Normal:** 20 readings/second*
- ***x2:** 40 readings/second*
- ***Fast:** 200 readings/second, for Agilent E-series power sensors only*

Maximum measurement speed is obtained using binary output in free run trigger mode.

Zero Drift of Sensors

Power sensor dependent (refer to Table 5-3).

Measurement Noise

Power sensor dependent (refer to Table 5-2 and Table 5-3).

Averaging effects on measurement noise. Averaging over 1 to 1024 readings is available for reducing noise. Table 5-3 provides the measurement noise for a particular power sensor with the number of averages set to 16 for normal mode and 32 for x2 mode. Use the "Noise Multiplier" for the appropriate mode (normal or x2) and number of averages to determine the total measurement noise value.

For example, for an Agilent 8481D power sensor in normal mode with the number of averages set to 4, the measurement noise is equal to:

(<45 pW x 2.75) = <124 pW

Table 5-2: Noise Multiplier

Number of Averages	1	2	4	8	16	32	64	128	256	512	1024
Noise Multiplier (Normal Mode)	*5.5*	*3.99*	*2.75*	*1.94*	*1.0*	*0.85*	*0.61*	*0.49*	*0.34*	*0.24*	*0.17*
Noise Multiplier (x2 mode)	*6.5*	*4.6*	*3.25*	*2.3*	*1.63*	*1.0*	*0.72*	*0.57*	*0.41*	*0.29*	*0.2*

Table 5-3: Power Sensor Specifications±

Power Sensor	*Zero Drift*[1]	*Measurement Noise*[2]
Agilent 8481A	<±10 nW	<110 nW
Agilent 8481B	<±10 µW	<110 µW
Agilent 8481D	<±4 pW	<45 pW
Agilent 8481H	<±1 µW	<10 µW
Agilent 8482A	<±10 nW	<110 nW
Agilent 8482B	<±10 µW	<110 µW
Agilent 8482H	<±1 µW	<10 µW
Agilent 8483A	<±10 nW	<110 nW
Agilent 8485A	<±10 nW	<110 nW
Agilent 8485D	<±4 pW	<45 pW
Agilent R8486A	<±10 nW	<110 nW
Agilent R8486D	<±6 pW	<65 pW
Agilent Q8486A	<±10 nW	<110 nW
Agilent Q8486D	<±6 pW	<65 pW
Agilent V8486A	<±40 nW	<450 nW
Agilent W8486A	<±40 nW	<450 nW
Agilent 8487A	<±10 nW	<110 nW
Agilent 8487D	<±4 pW	<45 pW
Agilent ECP-E18A	<± 15 pW	<70 pW
Agilent ECP-E26A	<± 15 pW	<70 pW

1. Within 1 hour after zero set, at a constant temperature, after a 24 hour warm-up of the power meter.
2. The number of averages at 16 (for normal mode) and 32 (for x2 mode), at a constant temperature, measured over a 1 minute interval and 2 standard deviations. For Agilent E-series power sensors the measurement noise is measured within the low range. Refer to the relevant power sensor manual for further information.

Settling Time

0 to 99% settled readings over the GP-IB.

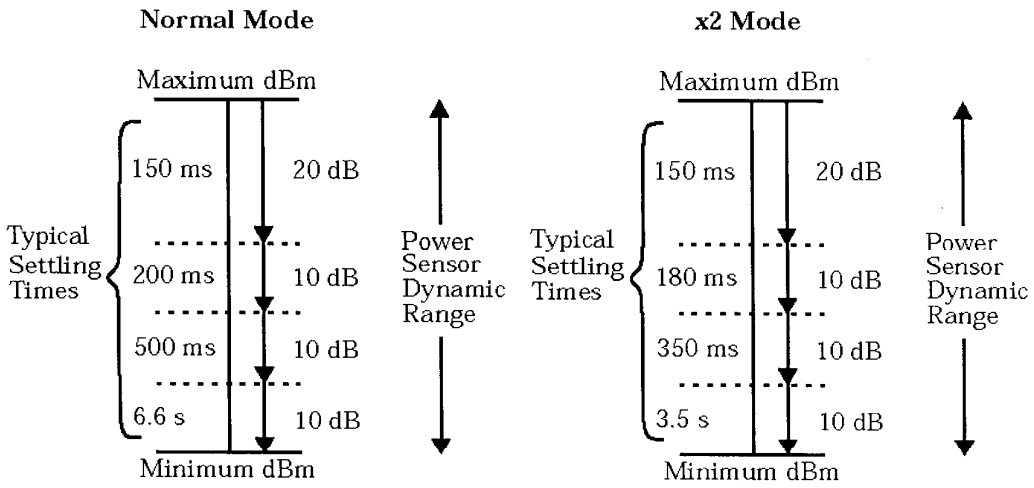
For Agilent 8480 series power sensors

Manual filter, 10 dB decreasing power step:

Table 5-4: Settling Time

Number of Averages	1	2	4	8	16	32	64	128	256	512	1024
Settling Time (s) (Normal Mode)	*0.15*	*0.2*	*0.3*	*0.5*	*1.1*	*1.9*	*3.4*	*6.6*	*13*	*27*	*57*
Response Time (s) (x2 mode)	*0.15*	*0.18*	*0.22*	*0.35*	*0.55*	*1.1*	*1.9*	*3.5*	*6.9*	*14.5*	*33*

Auto filter, default resolution, 10 dB decreasing power step, normal and x2 speed modes:



For Agilent E-series power sensors

In FAST mode, within the range -50 dBm to +17 dBm, for a 10 dB decreasing power step, the settling time is 10 ms[1].

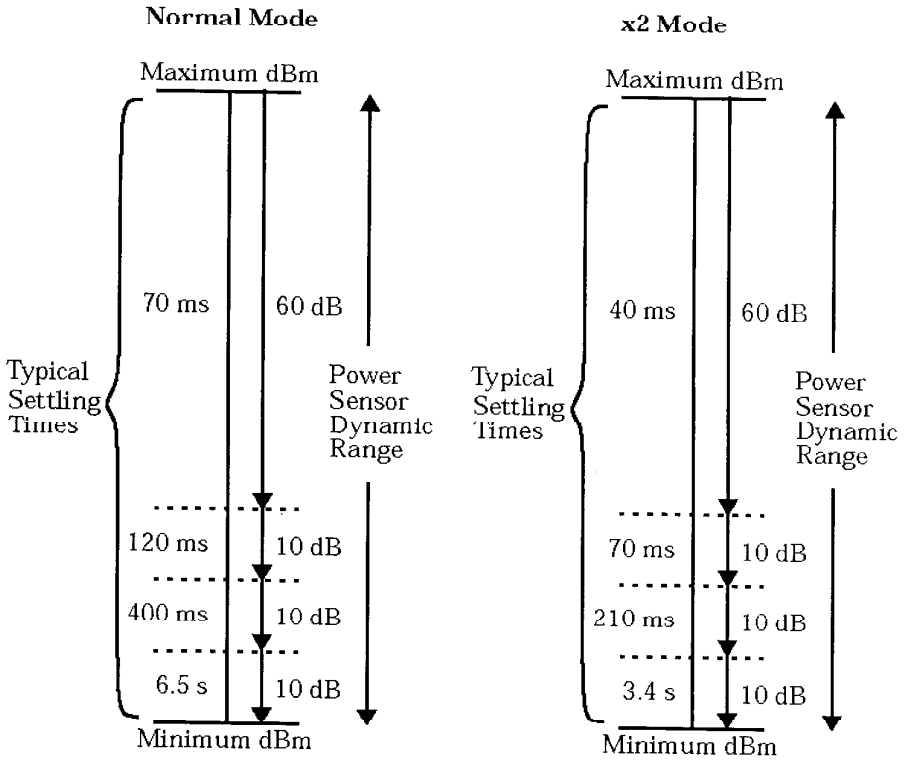
[1] *When a decreasing power step crosses the power sensor's auto-range switch point, add 25 ms. Refer to the relevant power sensor manual for further information.*

For Agilent E-series power sensors in normal and x2 speed modes, manual filter, 10 dB decreasing power step:

Table 5-5: Settling Time

Number of Averages	1	2	4	8	16	32	64	128	256	512	1024
Settling Time (s) (Normal Mode)	*0.07*	*0.12*	*0.21*	*0.4*	*1*	*1.8*	*3.3*	*6.5*	*13*	*27*	*57*
Response Time (s) (x2 mode)	*0.04*	*0.07*	*0.12*	*0.21*	*0.4*	*1*	*1.8*	*3.4*	*6.8*	*14.2*	*32*

Auto filter, default resolution, 10 dB decreasing power step, normal and x2 speed modes:



Power Sensor Specifications

Definitions

Zero Set

In any power measurement, the power meter must initially be set to zero with no power applied to the power sensor. Zero setting is accomplished within the power meter by digitally correcting for residual offsets.

Zero Drift

This parameter is also called long term stability and is the change in the power meter indication over a long time (usually one hour) for a constant input power at a constant temperature, after a defined warm-up interval.

Measurement Noise

This parameter is also known as short term stability and is specified as the change in the power meter indication over a short time interval (usually one minute) for a constant input power at a constant temperature.

Battery Option 001 Operational Characteristics

The following information describes characteristic performance based at a temperature of 25 °C unless otherwise noted. Characteristics describe product performance that is useful in the application of the product, but is not covered by the product warranty.

Typical Operating Time

Up to 2 hours with LED backlight on; up to 3 hours with LED backlight off.

Charge Time

< 2 hours to charge fully from an empty state: 50 minutes charging enables 1 hour of operation with LED backlight ON; 35 minutes charging enables 1 hour of operation with the LED backlight OFF. Power meter is operational whilst charging.

Service Life

To 70% of initial capacity at 25 °C: approximately 450 charge/discharge cycles.

Chemistry

Nickel Metal Hydride.

Weight

1 kg.

General Characteristics

Rear Panel Connectors

Recorder Output

Analog 0-1 Volt, 1 kΩ output impedance, BNC connector.

GP-IB

Allows communication with an external GP-IB controller.

RS-232/422

Allows communication with an external RS-232 or RS422 controller. Male Plug 9 position D-subminiature connector.

Remote Input/Output

A TTL logic level is output when the measurement exceeds a predetermined limit. TTL inputs are provided to initiate zero and calibration cycles. RJ-45 series shielded modular jack assembly.

TTL output: high = 4.8 V max; low = 0.2 V max
TTL input: high = 3.5 V min, 5 V max; low = 1 V max, -0.3 V min

Ground

Binding post, accepts 4 mm plug or bare-wire connection.

Line Power

- ***Input Voltage Range:*** *85 to 264 Vac, automatic selection*
- ***Input Frequency Range:*** *50 to 440 Hz*
- ***Power Requirement:*** *approximately 50 VA (14 Watts)*

Environmental Characteristics

General Conditions

Complies with the requirements of the EMC Directive 89/336/EEC. This includes Generic Immunity Standard EN 50082-1: 1992 and Radiated Interference Standard EN 55011:1991/CISPR11:1990, Group 1 - Class A.

Operating Environment

Temperature

0°C to 55°C

Maximum Humidity

95% at 40°C (non-condensing)

Minimum Humidity

15% at 40°C (non-condensing)

Maximum Altitude

3,000 meters (9,840 feet)

Storage Conditions

Storage Temperature

-20°C to +70°C

Non-Operating Maximum Humidity

90% at 65°C (non-condensing)

Non-Operating Maximum Altitude

15,240 meters (50,000 feet)

General

Dimensions

The following dimensions exclude front and rear panel protrusions:
212.6 mm W x 88.5 mm H x 348.3 mm D (8.5 in x 3.5 in x 13.7 in)

Weight

Net

4.0 Kg (8.8 lb)5.0 Kg (11 lb) with option 001

Shipping

7.9 Kg (17.4 lb)8.9 Kg (19.6 lb) with option 001

Safety

Conforms to the following Product Specifications:

- EN61010-1: 1993/IEC 1010-1:1990+A1/CSA C22.2 No. 1010-1:1993
- EN60825-1: 1994/IEC 825-1: 1993 Class 1
- Low Voltage Directive 72/23/EEC

Remote Programming

Interface

GP-IB interface operates to IEEE 488.2. RS-232 and RS-422 interfaces are supplied as standard.

Command Language

SCPI standard interface commands. Agilent 437B code compatible.

GP-IB Compatibility

SH1, AH1, T6, TE0, L4, LE0, SR1, RL1, PP1, DC1, DT1, C0

Non-Volatile Memory

Battery

Lithium Polycarbon Monoflouride, approximate lifetime 5 years at 25°C.