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## E4418B EPM Series Single-Channel Power Meter

**Product Status:** Currently Orderable | Currently Supported

### Key Specifications

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- Fast measurement speed (up to 200 readings per second, over the GPIB, with E-series sensors)
- Speed improvement of x2 using the 8480 series power sensor (compared to the 437B)
- No range-switching delays with 8480 series sensors, and only one fast-range switch point with E-series sensors
- Code compatibility with 437B and 436A power meters
- GPIB and RS232 connector for remote control of all functions
- Internal rechargeable battery option provides up to 5.5 hours continuous use (option 001)

### Description

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The E4418B power meter is designed for bench and automatic test equipment (ATE) use.

- Fast measurement speed (up to 200 readings per second, over the GPIB, with E-series sensors)
- Speed improvement of x2 using the 8480 series power sensor (compared to the 437B)
- No range-switching delays with 8480 series sensors, and only one fast-range switch point with E-series sensors
- Code compatibility with 437B and 436A power meters
- GPIB and RS232 connector for remote control of all functions
- Internal rechargeable battery option provides up to 5.5 hours continuous use (option 001)

**Read** the E4418B

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# E4418B/9B EPM Series power meter performance characteristics

Specifications describe the instrument's warranted performance and apply after a 30-minute warm-up. These specifications are valid over its operating/environmental range unless otherwise stated and after performing a zero and calibration procedure.

Supplemental characteristics (shown in italics) are intended to provide additional information, useful in applying the instrument by giving typical (expected), but not warranted performance parameters. These characteristics are shown in italics or labeled as "typical", "nominal" or "approximate".

For information on measurement uncertainty calculations, refer to Application Note 64-1C, "Fundamentals of RF and Microwave Power Measurements", literature number 5965-6380E.

**Compatible power sensors:** E4410 and E9300 E-Series, 8480 Series and N8480 Series average power sensors

**Frequency range:** 9 kHz to 110 GHz, sensor dependent

**Power range:** -70 dBm to +44 dBm (100 pW to 25 W), sensor dependent

**Single sensor dynamic range:**  
90 dB maximum (E-Series sensors)  
50 dB maximum (8480 Series sensors)  
55 dB maximum (N8480 Series sensors)

**Display units:**  
Absolute: Watts or dBm  
Relative: Percent or dB

**Display resolution:** Selectable resolution of 1.0, 0.1, 0.01, and 0.001dB in Log mode, or 1 to 4 digits in linear mode

**Default resolution:** 0.01 dB in log mode, 3 digits in linear mode

## Accuracy

**Absolute:**  $\pm 0.02$  dB (log) or  $\pm 0.5\%$  (linear). Please add the corresponding power sensor linearity percentage from Table 6 and Table 9 (for E-Series sensors) and Table 14 (for 8480 Series sensors).

**Relative:**  $\pm 0.04$  dB (Log) or  $\pm 1.0\%$  (linear). Please add the corresponding power sensor linearity percentage from Table 14 (for 8480 Series sensors).

**Zero set (digital settability of zero):** Sensor dependent (refer to Table 1). For E-Series sensors, this specification applies to a zero performed when the sensor input is not connected to the POWER REF.

**Zero drift of sensors:** Sensor dependent, refer to Table 1. For E9300 sensors, refer to Table 11 for complete data.

**Measurement noise:** Sensor dependent, refer to Table 1 and Table 2. For E9300 sensors, refer to Table 11 for complete data.

**Effects of averaging on noise:** Averaging over 1 to 1024 readings is available for reducing noise. Table 1 provides the measurement noise for a particular sensor with the number of averages set at 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.

**Example:**  
8481D power sensor, normal mode, number of averages = 4

**Measurement noise calculation:**  
( $<45$  pW  $\times$  2.75) =  $<121$  pW

\*For specifications pertaining to the N8480 Series power sensors, please refer to the "Agilent N8480 Series Power Sensors Data Sheet", literature number 5989-9333EN.

## Power reference

**Power output:** 1.00 mW (0.0 dBm). Factory set to  $\pm 0.4\%$  traceable to the National Physical Laboratory (NPL), UK<sup>1</sup>.

**Accuracy:** For two years:  
 $\pm 0.5\%$  ( $23 \pm 3$  °C)  
 $\pm 0.6\%$  ( $25 \pm 10$  °C)  
 $\pm 0.9\%$  (0 to 55 °C)

**Frequency:** 50 MHz nominal

**SWR:** 1.06 maximum  
(1.08 maximum for Option 003)

**Connector type:** Type-N (f), 50  $\Omega$

## Measurement speed

Three measurement speed modes, over the GPIB, are available as shown, along with the typical maximum measurement speed for each mode.

**With E4418B power meter**  
**Normal:** 20 readings/second  
**x2:** 40 readings/second  
**Fast:** 200 readings/second

**With E4419B power meter**  
Measurement speed is reduced, for example, with both channels in FAST mode, the typical maximum measurement speed is 100 readings/second.

Fast mode is for E-series sensors only.

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

1. National metrology institutes of member states of the Metre Convention, such as the National Institute of Standards and Technology in the USA, are signatories to the Comité International des Poids et Mesures Mutual Recognition Arrangement. Further information is available from the Bureau International des Poids et Mesures, at <http://www.bipm.fr/>

# E4418B/9B EPM Series power meter performance characteristics

**Table 1**

Model	Zero set	Zero drift <sup>1</sup>	Measurement noise <sup>2</sup>
E9300A, E9301A, E9304A <sup>3</sup>	±500 pW	<±150 pW	<700 pW
E9300B, E9301B <sup>3</sup>	±500 nW	<±150 nW	<700 nW
E9300H, E9301H <sup>3</sup>	±5 nW	<±1.5 nW	<7 nW
E4412A, E4413A	±50 pW	<±15 pW	<70 pW
N8481A, N8482A, N8485A	±25 nW	<±3 nW	<80 nW
8481A, 8482A, 8483A, 8485A, 8487A, R8486A, Q8486A	±50 nW	<±10 nW	<110 nW
8481B, 8482B	±50 μW	<±10 μW	<110 μW
8481D, 8485D, 8487D	±20 pW	<±4 pW	<45 pW
8481H, 8482H	±5 μW	<±1 μW	<10 μW
R8486D, Q8486D	±30 pW	<±6 pW	<65 pW
V8486A, W8486A	±200 nW	<±40 nW	<450 nW

1. Within one 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 one-minute interval and two standard deviations. For E-series sensors, the measurement noise is measured within the low range. Refer to the relevant sensor manual for further information.

3. Specification applies to the low power path, 15% to 75% relative humidity.

**Table 2**

No. of averages	1	2	4	8	16	32	64	128	256	512	1024
<b>Noise multiplier</b>											
Normal mode	5.5	3.89	2.75	1.94	1	0.85	0.61	0.49	0.34	0.24	0.17
x2 mode	6.5	4.6	3.25	2.3	1.63	1	0.72	0.57	0.41	0.29	0.2



## E4418B/9B EPM Series power meter performance characteristics (continued)

### Settling time <sup>1</sup>

Manual filter, 10-dB decreasing power step for normal and x2 modes (not across range switch points for E-Series and N8480 Series sensors)

Table 3

No. of averages	1	2	4	8	16	32	64	128	256	512	1024
<b>Settling time with E-Series sensors (s)</b>											
Normal mode	0.07	0.12	0.21	0.4	1	1.8	3.3	6.5	13	27	57
x2 mode	0.04	0.07	0.12	0.21	0.4	1	1.8	3.4	6.8	14.2	32
<b>Settling time with N8480 Series sensors (s)</b>											
Normal mode	0.15	0.2	0.3	0.5	1.1	1.9	3.4	6.6	13	27	57
x2 mode	0.15	0.18	0.22	0.35	0.55	1.1	1.9	3.5	6.9	14.5	33
<b>Settling time with 8480 Series sensors (s)</b>											
Normal mode	0.15	0.2	0.3	0.5	1.1	0.9	3.4	6.6	13	27	57
x2 mode	0.15	0.18	0.22	0.35	0.55	1.1	1.9	3.5	6.9	14.5	33

\*E-Series sensors in Fast mode (using free run trigger), within the range –50 dBm to +17 dBm, the settling time is:

E4418B: 10 ms <sup>2</sup>

E4419B: 20 ms <sup>2</sup>

1. Settling time: 0 to 99% settled readings over the GPIB

2. When a power step crosses through the sensor's auto-range switch point, add 25 ms. Refer to the relevant sensor manual for switch point information.

## E4418B/9B EPM Series power meter performance characteristics (continued)

### Power meter functions

**Accessed by key entry:** either hardkeys, or softkey menu, and programmable.

**Zero:** Zeros the meter. (Power reference calibrator is switched off during zeroing).

**Cal:** Calibrates the meter using internal (power reference calibrator) or external source. Reference cal factor settable from 1% to 150%, in 0.1% increments.

**Frequency:** Entered frequency range is used to interpolate the calibration factors table.

**Range:** 1 kHz to 999.9 GHz, settable in 1-kHz steps.

**Cal factor:** Sets the calibration factor for the meter. Range: 1% to 150%, in increments of 0.1%.

**Relative:** Displays all successive measurements relative to the last displayed value.

**Offset:** Allows power measurements to be offset by  $-100$  dB to  $+100$  dB, settable in 0.001-dB increments, to compensate for external loss or gain.

**Save/recall:** Store up to 10 instrument states via the save/recall menu.

**dBm/W:** Selectable units of either Watts or dBm in absolute power; or percent or dB for relative measurements.

**Filter (averaging):** Selectable from 1 to 1024. Auto-averaging provides automatic noise compensation.

**Duty cycle:** Duty cycle values between 0.001% to 99.999%, in increments of 0.001%, can be entered to display a peak power representation of measured power. The following equation is used to calculate the displayed peak power value:  $\text{peak power} = \text{measured power} / \text{duty cycle}$ .

**Sensor cal tables:** Selects cal factor versus frequency tables corresponding to specified sensors (8480 Series only).

**Limits:** High and low limits can be set in the range  $-150$  dBm to  $+230$  dBm, in 0.001-dBm increments.

**Preset default values:** dBm mode, rel off, power reference off, duty cycle off, offset off, frequency 50 MHz, AUTO average, free run, AUTO range (for E-Series sensors).

**Display:** Selectable single and split screen formats are available. Quasi-analog display is available for peaking measurements. The dual-channel power meter can simultaneously display any two configurations of A, B, A/B, B/A, A-B, B-A and relative.

### General specifications

#### Dimensions

The following dimensions exclude front and rear 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

**E4418B:** 4.0 kg (8.8 lb) net, 7.9 kg (17.4 lb) shipping

**E4419B:** 4.1 kg (9.0 lb) net, 8.0 kg (17.6 lb) shipping

#### Rear panel connectors

**Recorder outputs:** Analog 0 to 1-Volt, 1-k $\Omega$  output impedance, BNC connector. E4419B recorder outputs are dedicated to channel A and channel B.

**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 connector. 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.

**GPIO:** Allows communication with an external controller.

**RS-232/422:** Allows communication with an external RS-232/422 controller. Male/plug 9 position D-subminiature connector.

**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 W)

## E4418B/9B EPM Series power meter performance characteristics (continued)

### Battery Option 001 operational characteristics<sup>1</sup>

The following information describes characteristic performance based at a temperature of 25 °C unless otherwise noted.

**Typical operating time:** up to 3.5 hours with LED backlight on; up to 5.5 hours with LED backlight off (E4418B power meter).

**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-hr operation with LED backlight off. Power meter is operational whilst charging.

**Service life** (to 70% of initial capacity at 25 °C): 450 charge/discharge cycles

**Chemistry:** Nickel metal hydride

**Weight:** 1 kg

### 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:** 3000 meters (9840 feet).

#### Storage conditions

**Storage temperature:** -20 °C to +70 °C.

**Non-operating maximum humidity:** 90% at 65 °C (non-condensing).

**Non-operating maximum altitude:** 15240 meters (50,000 feet).

#### 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:** GBIB interface operates to IEEE 488.2. RS-232 and RS-422 serial interface supplied as standard.

**Command language:** SCPI standard interface commands. 436A and 437B code compatible (E4418B only); 438A code compatible (E4419B only).

**GPIB compatibility:** SH1, AH1, T6, TE0, L4, LE0, SR1, RL1, PP1, DC1, DT1, C0.

**Battery:** Lithium polycarbon monofluoride, approximate lifetime 5 years at 25 °C

<sup>1</sup> Characteristics describe product performance that is useful in the application of the product, but is not covered by the product warranty.

# E4418B/9B EPM Series power meter ordering information

## Power meters

**E4418B:** Single-channel EPM Series power meter

**E4419B:** Dual-channel EPM Series power meter

### Standard inclusion with each power meter

**Power sensor cable:** E4418B has one 1.5-meter (5-ft) sensor cable. E4419B has two 1.5-meter (5-ft) sensor cables.

**Power cord:** One 2.4-meter (7.5-ft) cable. Power plug matches destination requirements.

**Documentation:** A hard copy and CD version of the English language User's Guide and Programming Guide is provided with the EPM power meter as standard. A selection can be made to delete the hard copy.

**Warranty:** Included with each EPM Series power meter<sup>1</sup> is a standard 12-month return-to-Agilent warranty and service plan. A selection can be made to extend the initial warranty and service plan to 3 years.

## Power

**Option E441xB-001:** Mains power and internal rechargeable battery

## Connectors

**Option E441xB-002:** Parallel rear panel sensor input connector(s) and front panel reference calibrator connector

**Option E441xB-003:** Parallel rear panel sensor input connectors and rear panel reference calibrator connector

## Calibration test data

**Option E441xB-A6J:** ANSI Z540 compliant calibration test data including measurement uncertainties

**Option E441xB-1A7:** ISO17025 compliant calibration test data including measurement uncertainties

## Documentation

**Option E441xB-OBO:** Delete hard copy manual set from standard inclusion with power meter

**Option E441xB-915:** English language Service Manual

**Option E441xB-916:** English language manual set (hard copy Users Guide and Programming Guide)

**Option E441xB-ABD:** German localization (hard copy Users Guide and English Programming Guide)

**Option E441xB-ABE:** Spanish localization (hard copy Users Guide and English Programming Guide)

**Option E441xB-ABF:** French localization (hard copy Users Guide and English Programming Guide)

**Option E441xB-ABJ:** Japanese localization (hard copy Users Guide and English Programming Guide)

## Cables

**Option E441xB-004:** Delete power sensor cable from standard inclusion with power meter

**11730A:** Power sensor and SNS noise source cable, length 1.5 meters (5 ft)

**11730B:** Power sensor and SNS noise source cable, length 3 meters (10 ft)

**11730C:** Power sensor and SNS noise source cable, length 6.1 meters (20 ft)

**11730D:** Power sensor cable, length 15.2 meters (50 ft)

**11730E:** Power sensor cable, length 30.5 meters (100 ft)

**11730F:** Power sensor cable, length 61 meters (200 ft)

## Accessories

**Option E441xB-908:** Rackmount kit (one instrument)

**Option E441xB-909:** Rackmount kit (two instruments)

**34131A:** Transit case for half-rack 2U high instruments

**34141A:** Yellow soft carry/operating case

**34161A:** Accessory pouch

**E9287A<sup>2</sup>:** Spare battery pack for the EPM power meter

## Complementary equipment

**11683A:** Range calibrator

Verifies the accuracy and linearity of the EPM series power meters. Outputs corresponding to meter readings of 3, 10, 30, 100 and 300  $\mu$ W and 1, 3, 10, 30 and 100 mW are provided. Calibration uncertainty is  $\pm 0.25\%$  on all ranges.

## Service options

### Warranty

Return-to-Agilent warranty and service plan that extends initial plan to 3 years

### Calibration<sup>3</sup>

For 3 years, order 36 months of the appropriate calibration plan shown below.

**R-50C-001-3:** Standard calibration plan

**R-50C-021-3 Z540 calibration plan:**

The E-Series and 8480 Series power sensors have a 12-month return-to-Agilent warranty and service plan. For more information, contact your local sales and service office.

1. Only for EPM series power meter with Option E441XB-001 installed.

2. For Option E441XB-001, the 36-month warranty does not apply to the E9287A battery pack.

3. Options not available in all countries.



## E-Series CW power sensor specifications

### Widest dynamic range: 100 pW to 100 mW (–70 dBm to +20 dBm)

Table 4

Model	Maximum SWR	Maximum SWR	Maximum power	Connector type
E 4412A	10 MHz – 18 GHz	*10 MHz to <30 MHz: 1.22 30 MHz to <2 GHz: 1.15 2 GHz to <6 GHz: 1.17 6 GHz to <11 GHz: 1.2 11 GHz to <18 GHz: 1.27	200 mW (+23 dBm)	Type-N (m)
E4413A	50 MHz – 26.5 GHz	50 MHz to <100 MHz: 1.21 100 MHz to <8 GHz: 1.19 8 GHz to <18 GHz: 1.21 18 GHz to 26.5 GHz: 1.26	200 mW (+23 dBm)	APC-3.5 mm (m)

### Calibration factor (CF) and reflection coefficient (Rho)

Calibration factor and reflection coefficient data are provided at 1 GHz increments on a data sheet included with the power sensor. This data is unique to each sensor. If you have more than one sensor, match the serial number on the Certificate of Calibration (COC) with the serial number on the power sensor you are using. The CF corrects for the frequency response of the sensor. The EPM power meter automatically reads the CF data stored in the sensor and uses it to make the corrections. For power levels greater than 0 dBm, add 0.5%/dB to the calibration factor uncertainty specification.

Reflection coefficient (Rho) relates to the SWR according to the following formula:  $SWR = 1 + Rho / 1 - Rho$

Maximum uncertainties of the CF data are listed in Table 5a, for the E4412A power sensor, and Table 5b for the E4413A power sensor. The uncertainty analysis for the calibration of the sensors was done in accordance with the ISO/TAG4 Guide. The uncertainty data reported on the calibration certificate is the expanded uncertainty with a 95% confidence level and a coverage factor of 2.

Table 5a. E4412A calibration factor uncertainty at 1mW (0 dBm)

Frequency	Uncertainty* (%)
10 MHz	1.8
30 MHz	1.8
50 MHz	Reference
100 MHz	1.8
1.0 GHz	1.8
2.0 GHz	2.4
4.0 GHz	2.4
6.0 GHz	2.4
8.0 GHz	2.4
10.0 GHz	2.4
11.0 GHz	2.4
12.0 GHz	2.4
14.0 GHz	2.4
16.0 GHz	2.6
18.0 GHz	2.6

Table 5b. E4413A calibration factor uncertainty at 1mW (0 dBm)

Frequency	Uncertainty* (%)
50 MHz	Reference
100 MHz	1.8
1.0 GHz	1.8
2.0 GHz	2.4
4.0 GHz	2.4
6.0 GHz	2.4
8.0 GHz	2.4
10.0 GHz	2.6
11.0 GHz	2.6
12.0 GHz	2.8
14.0 GHz	2.8
16.0 GHz	2.8
17.0 GHz	2.8
18.0 GHz	2.8
20.0 GHz	3.0
24.0 GHz	3.0
26.0 GHz	3.0
28.0 GHz	3.0

\* Applies to sensors with serial prefix US 3848 or greater



## E-Series CW power sensor specifications (continued)

### Power linearity

Table 6

Power	Temperature (25 °C ±5 °C)	Temperature (0 °C to 55 °C)
100 pW to 10 mW (-70 dBm to +10 dBm)	±3%	±7%
10 mW to 100 mW (+10 dBm to +20 dBm)	±4.5%	±10%

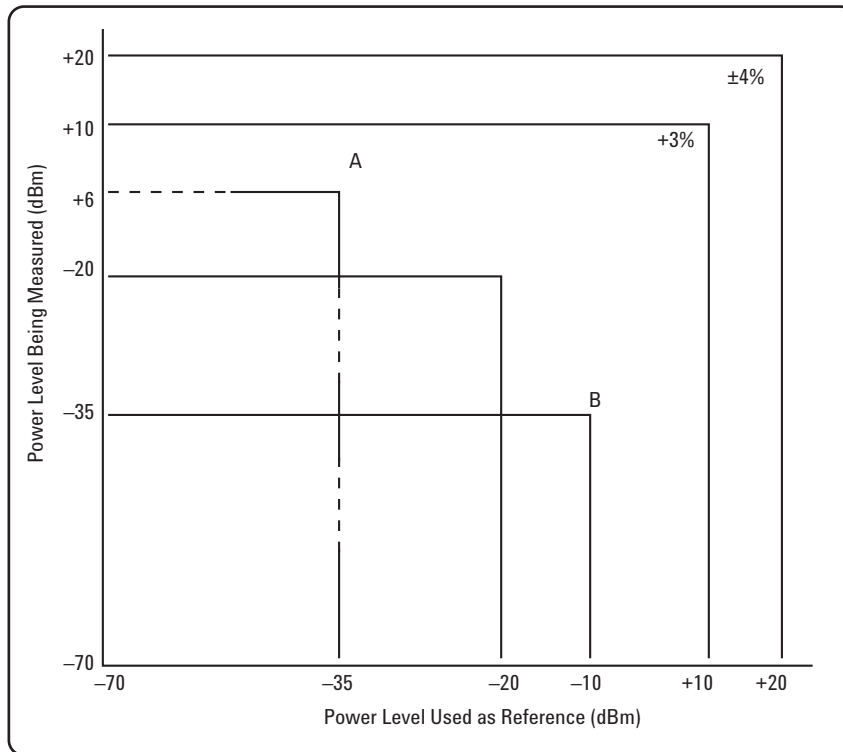


Figure 1. Relative mode power measurement linearity with EPM Series power meter/E-Series CW power sensor at 25 °C ± 5 °C (typical)

The chart in **Figure 1** shows the typical uncertainty in making a relative power measurement, using the same power meter channel and the same power sensor to obtain the reference and the measured values. Example A illustrates a relative gain (amplifier measurement). Example B illustrates a relative loss (insertion loss measurement). This chart assumes negligible change in frequency and mismatch occur when transitioning from the power level used as the reference to the power level being measured.

**Example A:**

$$P = 10(P)/10 \times 1 \text{ mW}$$

$$P = 10 \text{ 6}/10 \times 1 \text{ mW}$$

$$P = 3.98 \text{ mW}$$

$$3\% \times 3.98 \text{ mW} = 119.4 \text{ }\mu\text{W}$$

**Example B:**

$$P = 10 (P)/10 \times 1 \text{ mW}$$

$$P = 10 \text{ -35}/10 \times 1 \text{ mW}$$

$$P = 316 \text{ nW}$$

$$3\% \times 316 \text{ nW} = 9.48 \text{ nW}$$

where P = power in Watts,  
and (P) = power in dBm

### General

**Dimensions:**

E4412A:  
130 mm L x 38 mm W x 30 mm H

E4413A:  
102 mm L x 38 mm W x 30 mm H

**Weight:** 0.18 kg (0.4 lb).



## E-Series average power sensor specifications

Specifications are valid ONLY after proper calibration of the power meter and apply for CW signals unless otherwise stated. Specifications apply over the temperature range 0 °C to 55 °C unless otherwise stated, and specifications quoted over the temperature range 25 °C ±10 °C, conform to the standard environmental test conditions as defined in TIA/EIA/IS-97-A and TIA/EIA/IS-98-A [1].

The E-Series E9300 power sensors have two independent measurement path as shown:

**Table 7**

	"A" suffix sensors	"B" suffix sensors	"H" suffix sensors
<b>High power path</b>	-10 to +20 dBm	+20 to +44 dBm	0 to +30 dBm
<b>Low power path</b>	-60 to -10 dBm	-30 to +20 dBm	-50 to 0 dBm

**Table 8**

Model	Frequency range	Maximum SWR (25 °C ± 10 °C)	Maximum SWR (0 to 55 °C)	Maximum power	Connector type
<b>-60 dBm to +20 dBm wide dynamic range sensors</b>					
E9300A	10 MHz to 18 GHz	10 MHz to 30 MHz: 1.15 30 MHz to 2 GHz: 1.13 2 GHz to 14 GHz: 1.19 14 GHz to 16 GHz: 1.22 16 GHz to 18 GHz: 1.26	10 MHz to 30 MHz: 1.21 30 MHz to 2 GHz: 1.15 2 GHz to 14 GHz: 1.20 14 GHz to 16 GHz: 1.23 16 GHz to 18 GHz: 1.27	+25 dBm (320 mW) average; +33 dBm peak (2 W) ( < 10 µsec)	Type-N (m)
E9301A	10 MHz to 6 GHz	10 MHz to 30 GHz: 1.15 30 MHz to 2 GHz: 1.13 2 GHz to 6 GHz: 1.19	10 MHz to 30 MHz: 1.21 30 MHz to 2 GHz: 1.15 2 GHz to 6 GHz: 1.20	+25 dBm (320 mW) average; +33 dBm peak (2 W) ( < 10 µsec)	Type-N (m)
E9304A	9 kHz to 6 GHz	9 kHz to 2 GHz: 1.13 2 GHz to 6 GHz: 1.19	9 kHz to 2 GHz: 1.15 2 GHz to 6 GHz: 1.20	+25 dBm (320 mW) average; +33 dBm peak (2 W)( < 10 µsec)	Type-N (m)
<b>-30 dBm to +44 dBm wide dynamic range sensors</b>					
E9300B	10 MHz to 18 GHz	10 MHz to 8 GHz: 1.12 8 to 12.4 GHz: 1.17 12.4 to 18 GHz: 1.24	10 MHz to 8 GHz: 1.14 8 to 12.4 GHz: 1.18 12.4 to 18 GHz: 1.25	0 to 35 °C: 30 W avg 35 to 55 °C: 25 W avg < 6 GHz: 500 W pk > 6 GHz: 125 W pk 500 W.µS per pulse	Type-N (m)
E9301B	10 MHz to 6 GHz	10 MHz to 6 GHz: 1.12	10 MHz to 6 GHz: 1.14	0 to 35 °C: 30 W avg 35 to 55 °C: 25 W avg < 6 GHz: 500 W pk > 6 GHz: 125 W pk 500 W.µS per pulse	Type-N (m)
<b>-50 dBm to +30 dBm wide dynamic range sensors</b>					
E9300H	10 MHz to 18 GHz	10 MHz to 8 GHz: 1.15 8 to 12.4 GHz: 1.25 12.4 to 18 GHz: 1.28	10 MHz to 8 GHz: 1.17 8 to 12.4 GHz: 1.26 12.4 to 18 GHz: 1.29	3.16 W avg 100 W pk 100 W.µS per pulse	Type-N (m)
E9301H	10 MHz to 6 GHz	10 MHz to 6 GHz: 1.15	10 MHz to 6 GHz: 1.17	3.16 W avg 100 W pk 100 W.µS per pulse	Type-N (m)

## E-Series average power sensor specifications (continued)

### Switch point data

The E9300 power sensors have two paths as shown in Table 7. The power meter automatically selects the proper power level path. To avoid unnecessary switching when the power level is near the switch point, switching point hysteresis has been added.

#### Example with E9300 "A" suffix sensors:

Hysteresis causes the low power path to remain selected until approximately  $-9.5$  dBm as the power level is increased. Above this power, the high power path will be selected. The high power path will remain selected until approximately  $-10.5$  dBm is reached as the signal level decreases. Below this power, the low power path will be selected.

**Switching point linearity:** *Typically  $\pm 0.5\%$  ( $\pm 0.02$  dB)*

**Switching point hysteresis:** *0.5 dB typical*

Table 11

E9300 sensor suffix	Conditions <sup>1</sup>	Zero set	Zero drift <sup>2</sup>	Measurement noise <sup>3</sup>
A	Lower power path (15% to 75% RH)	500 pW	150 pW	700 pW
	Lower power path (75% to 95% RH)	500 pW	4,000 pW	700 pW
	High power path (15% to 75% RH)	500 nW	150 nW	500 nW
	High power path (75% to 95% RH)	500 nW	3000 nW	500 nW
B	Lower power path (15% to 75% RH)	500 nW	150 nW	700 nW
	Lower power path (75% to 95% RH)	500 nW	4 $\mu$ W	700 nW
	High power path (15% to 75% RH)	500 $\mu$ W	150 $\mu$ W	500 $\mu$ W
	High power path (75% to 95% RH)	500 $\mu$ W	3000 mW	500 $\mu$ W
H	Lower power path (15% to 75% RH)	5 nW	1.5 nW	7 nW
	Lower power path (75% to 95% RH)	5 nW	40 $\mu$ W	7 nW
	High power path (15% to 75% RH)	5 $\mu$ W	1.5 $\mu$ W	5 $\mu$ W
	High power path (75% to 95% RH)	5 $\mu$ W	30 mW	5 $\mu$ W

1. RH is the abbreviation for relative humidity.

2. Within 1 hour after zero set, at a constant temperature, after a 24-hour warm-up of the power meter with power sensor connected.

3. The number of averages at 16 for normal mode and 32 for x2 mode, at a constant temperature, measured over a one minute interval and two standard deviations.

## E-Series average power sensor specifications (continued)

### Calibration factor (CF) and reflection coefficient (Rho)

Calibration factor and reflection coefficient data are provided at frequency intervals on a data sheet included with the power sensor. This data is unique to each sensor. If you have more than one sensor, match the serial number on the Certificate of Calibration (COC) with the serial number on the power sensor you are using. The CF corrects for the frequency response of the sensor. The EPM series power meter automatically reads the CF data stored in the sensor and uses it to make the corrections.

Reflection coefficient (Rho) relates to the SWR according to the following formula:

$$SWR = (1 + \text{Rho}) / (1 - \text{Rho})$$

Maximum uncertainties of the CF data are listed in tables 12a and 12b, for each individual measurement path (high power and low power, as shown in Table 7). The uncertainty analysis for the calibration of the sensors was done in accordance with the ISO Guide. The uncertainty data reported on the calibration certificate is the expanded uncertainty with a 95% confidence level and a coverage factor of 2.

### General

**Dimensions:** 130 mm L x 38 mm W x 30 mm H

**Weight:** 0.18 kg (0.4 lbs)

**Table 12a.** Calibration factor uncertainties (low power path)

Frequency	Uncertainty (%) (25 °C ±10 °C)	Uncertainty (%) (0° to 55 °C)
10 MHz to 30 MHz	± 1.8%	±2.2%
30 MHz to 500 MHz (E9304A: 9 kHz to 500 MHz)	±1.6%	±2.0%
500 MHz to 1.2 GHz	±1.8%	±2.5%
1.2 GHz to 6 GHz	±1.7%	±2.0%
6 GHz to 14 GHz	±1.8%	±2.0%
14 GHz to 18 GHz	± 2.0 %	±2.2%

**Table 12b.** Calibration factor uncertainties (high power path)

Frequency	Uncertainty (%) (25 °C ±10 °C)	Uncertainty (%) (0° to 55 °C)
10 MHz to 30 MHz	± 2.1%	±4.0%
30 MHz to 500 MHz (E9304A: 9 kHz to 500 MHz)	±1.8%	±3.0%
500 MHz to 1.2 GHz	±2.3%	±4.0%
1.2 GHz to 6 GHz	±1.8%	±2.1%
6 GHz to 14 GHz	±1.9%	±2.3%
14 GHz to 18 GHz	± 2.2 %	±3.3%



#### References:

[1] TIA is the Telecommunications Industry Association; EIA is the Electronic Industries Association. TIA/EIA/IS-97-A is the recommended minimum performance standards for base stations supporting dualmode wideband spread spectrum cellular mobile stations. TIA/EIA/IS-98-A is the recommended minimum performance standards for dual-mode wideband spread spectrum cellular mobile stations.