Agilent N1913A and N1914A

EPM Series Power Meters

Consistent results and greater capability

Data Sheet

As signals become more complex, it becomes more difficult to make fast, accurate power measurements. For years, you've depended on Agilent's EPM Series power meters. Today, the Agilent N1913A and N1914A EPM power meters are versatile, user-friendly replacements for the E4418B/19B EPM Series. Best of all, you get these extras for about the same price as the EPM Series. Get consistent results and greater capability—with the new EPM power meters.

Essential specifications

- Frequency range: 9 kHz to 110 GHz
- Power range: –70 dBm to +44 dBm (100 pW to 25 W, depending on the attached power sensor)
- Measurement speed: Up to 400 readings/sec with E-Series sensors
- Absolute accuracy: ±0.02 dB logarithmic, ±0.5% linear
- Relative accuracy: ±0.04 dB logarithmic, ±1% linear

Do more with new-generation EPM power meters

- Get up to four channels [1] to speed and simplify RF average power measurements
- Measure faster with improved measurement speed of 400 readings/sec with the Agilent E-Series sensors
- View test results more easily with the industry's first color LCD readout in an average power meter
- Go beyond GPIB with USB and LAN/LXI-C interfaces
- Automate frequency/power sweep measurements with the optional external trigger in/out feature
- Confirm battery power with a single-button push [2]—and get extra operating time with the optional spare battery
- Easily replace existing 436A. 437B and 438A meters with optional 43x code compatibility [3]
- Enhance manufacturing test by connecting a large external monitor with the unique VGA output option

[1] Additional two optional USB channels available (see Ordering Information, page 9)
[2] Only applicable for models with battery option (see Ordering Information, page 9)
[3] N1913A is backward compatible with the 436A and 437B, while N1914A is compatible with 438A

Agilent Technologies

Take a closer look

N1914A front panel

Industry's first high-resolution color LCD in an average power meter

Softkeys provide menu selection

Arrow keys and Select allow positioning of the cursor for character selection and editing

Preset provides pre-defined instrument configurations such as WiMAX, HSDPA, DME

Numeric keypad

Run/Stop enables single-shot measurements

Display keys select the display format for the active window (single/split screen)

Cal enables fully automatic digital zeroing (corrected for residual offsets) and fully automatic sensor calibration

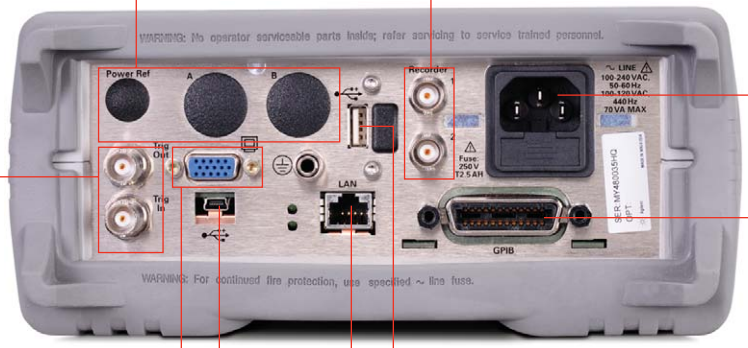
Hardkeys provide access to the most frequently used functions, such as Trigger and Acquisition

USB port for additional sensor connection

Channel A&B sensor connectors

Power reference (0 dBm, 50 MHz)

N1914A back panel



Rear-panel sensor and Power Ref connectors provide an option to replace front-panel connectors

DC recorder outputs (0-1 V)

Line power accepts universal input voltage with automatic range selection

Optional trigger in and out connectors

GPIB connector

Optional VGA output

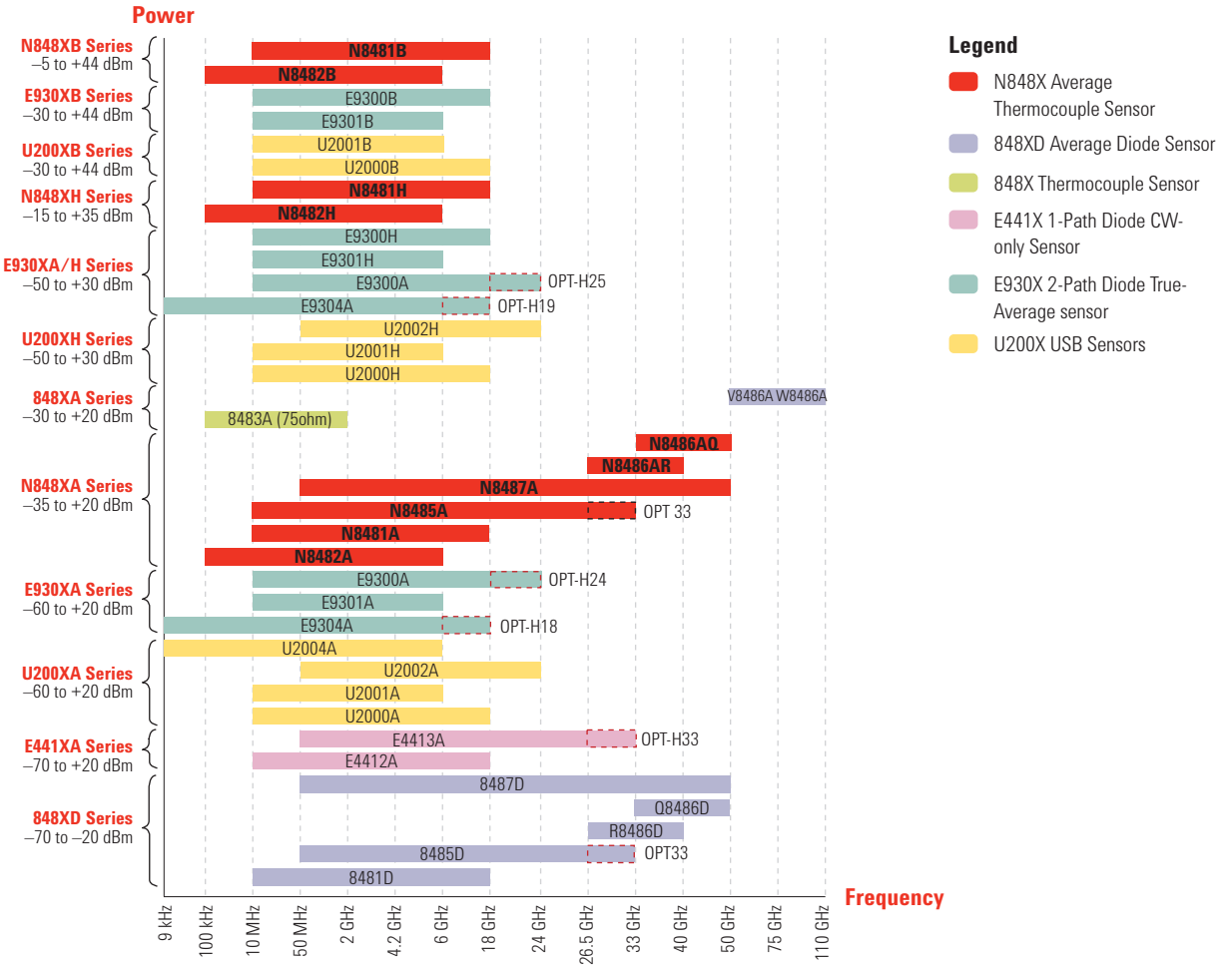
USB port

LAN port

USB port for additional sensor connection

N1913A/14A Series power meter: applications and compatible sensors for average power measurements

Signal characteristics >	CW	Modulated							
	CW	Pulse/ averaged	AM/FM profiled	Wireless standards					
				Mobile Phone			WLAN	WPAN	WMAN
Typical application examples >	Metrology lab	Radar/ navigation	Mobile radio	GSM EDGE GPRS	CDMA2000 cdmaONE IDEN	3G HSPA LTE	802.11a/b/g 802.11n	Bluetooth RFID ZigBee	Wimax Wibro
Thermocouple sensors N8480A/B/H, 8483A, R/Q8486A, N8486AR/AQ	•	•	•	• Avg.only	• Avg.only	• Avg.only	• Avg.only	• Avg.only	• Avg.only
Diode sensors 8480D, V8486A, W8486A	•	•	•	• Avg.only	• Avg.only	• Avg.only	• Avg.only	• Avg.only	• Avg.only
Diode sensors compensated for extended range E4412/13A	•		FM only						
Two-path diode-stack sensors E9300 Series	•	•	•	• Avg.only	• Avg.only	• Avg.only	• Avg.only	• Avg.only	• Avg.only
USB Sensors U2000 Series	•	•	•	• Avg.only	• Avg.only	• Avg.only	• Avg.only	• Avg.only	• Avg.only



N1913A/14A EPM Series power meters 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".

Compatible power sensors:
- Agilent 8483A & 8480D Series
- Agilent E9300 E–Series
- Agilent E4410 E–Series
- Agilent N8480 Series
- Agilent U2000 Series

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 (Agilent E- Series power sensors)
- 50 dB maximum (Agilent 8483A & 8480D Series power sensors)
- 55 dBm maximum (Agilent N8480 Series power sensors)
- 80 dBm maximum (Agilent U2000 Series USB 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
0.01dB in logarithmic mode or three digits in linear mode

Accuracy

Absolute accuracy: ±0.02 dB (Logarithmic) or ±0.5% (Linear). Please add the corresponding power sensor linearity percentage from Tables 6, 9 and 10 (for the E-Series sensors), Table 14 (for the 8480 series sensors) and Table 16 (for N8480 sensors) to assess the overall system accuracy.

Relative accuracy: ±0.04 dB (Logarithmic) or ±1.0% (Linear). Please add the corresponding power sensor linearity percentage from the mentioned tables above to assess the overall system accuracy.

Zero Set (digital settability of zero):
Power sensor dependent (refer Table 1), this specification applies when zeroing is performed with the sensor input disconnected from the POWER REF.

Zero Drift of Sensors
This parameter is also called long term stability and is the change in the power meter indication over a long time (within one hour) at a constant temperature after a 24- hour warm- up of the power meter. 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 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 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

1 mW Power Reference

Power output:
1.00 mW (0.0 dBm). Factory set to ±0.4 % traceable to the National Physical Laboratories (NPL), UK

Accuracy (for two years):
±0.4 % (25 ±10 °C)
±1.2 % (0 - 55 °C)

Frequency: 50 MHz nominal

SWR: 1.05 (typical), 1.08 (0 - 55°C)

Connector type: Type N (f), 50 Ω

Measurement speed

Using remote interface (over the GPIB, USB or LAN), three measurement speed modes are available as shown, along with the typical maximum measurement speed for each mode:

With N1913A power meter:
- Normal: 20 readings/second
- x2: 40 readings/second
- Fast: 400 readings/second.

With the N1914A power meter:
The measurement speed is reduced, for example, with both channels in FAST mode, the typical maximum measurement speed is 200 readings/second.

Fast mode is for Agilent E- Series power sensors only.

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

N1913A/14A EPM Series power meters performance characteristics (continued)

Table 1: Power sensors zero set, zero drift and measurement noise

Model	Zero set	Zero drift [1]	Measurement noise [2]
E9300A, E9301A, E9304A [3]	±500 pW	*<±150 pW*	*<700 pW*
E9300B, E9301B [3]	±500 nW	*<±150 nW*	*<700 nW*
E9300H, E9301H [3]	±5 nW	*<±1.5 nW*	*<7 nW*
E4412A, E4413A	±50 pW	*<±15 pW*	*<70 pW*
N8481A, N8482A, N8485A, N8487A, N8486AR, N8486AQ	±25 nW	*<±3 nW*	*<80 nW*
8483A	±50 nW	*<±10 nW*	*<110 nW*
N8481B, N8482B	±50 µW	*<±10 µW*	*<110 µW*
8481D, 8485D, 8487D	±20 pW	*<±4 pW*	*<45 pW*
N8481H, N8482H	±5 µW	*<±1 µW*	*<10 µW*
R8486D, Q8486D	±30 pW	*<±6 pW*	*<65 pW*
V8486A, W8486A	±200 nW	*<±40 nW*	*<450 nW*

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 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: Noise multiplier

No. of averages	1	2	4	8	16	32	64	128	256	512	1024
Noise multiplier											
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*

Settling time [1]

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: Settling time

No. of averages	1	2	4	8	16	32	64	128	256	512	1024
Settling time with E-Series sensors (s)											
Normal mode	*0.08*	*0.13*	*0.24*	*0.45*	*1.1*	*1.9*	*3.5*	*6.7*	*14*	*27*	*57*
x2 mode	*0.07*	*0.09*	*0.15*	*0.24*	*0.45*	*1.1*	*1.9*	*3.6*	*6.7*	*14*	*27*
Settling time with N8480 Series sensors (s)											
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*
Settling time with 8480 Series sensors (s)											
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*

E-Series sensors In FAST mode (using free run trigger), within the range –50 dBm to +17 dBm, for a 10 dB decreasing power step, the settling time is:

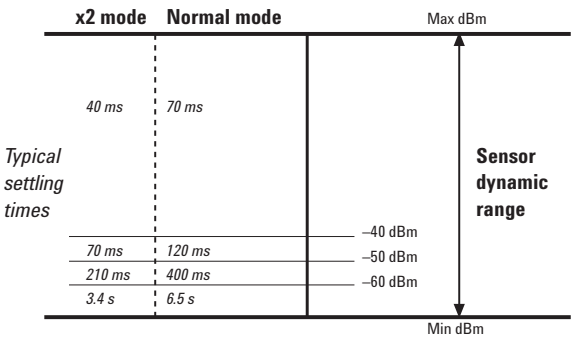
N1913A: 10 ms [2]
N1914A: 20 ms [2]

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.

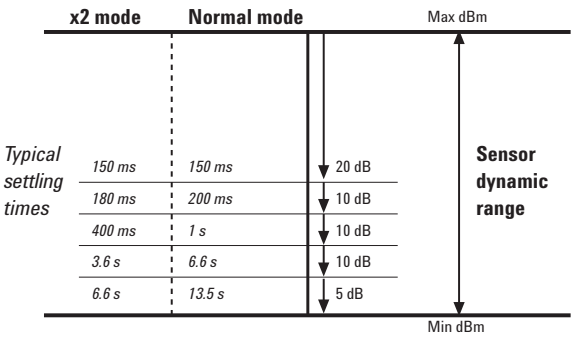
N1913A/14A EPM Series power meters performance characteristics (continued)

Settling time (continued)

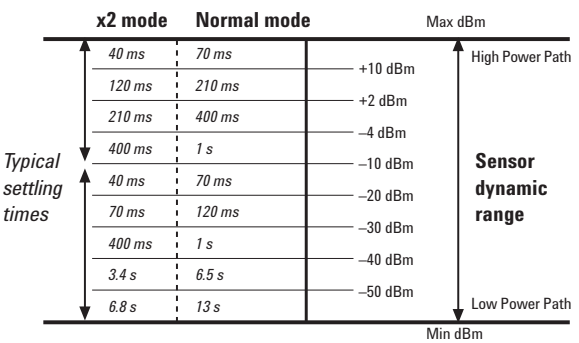
Auto filter, 10 dB decreasing power step for normal and X2 modes (not across the range switch points for E-Series and N8480 Series sensors)



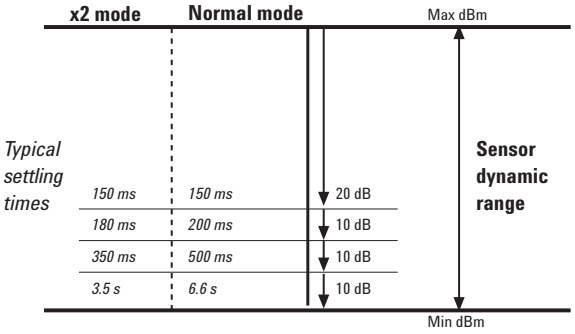
With E-Series E4412/13A sensors



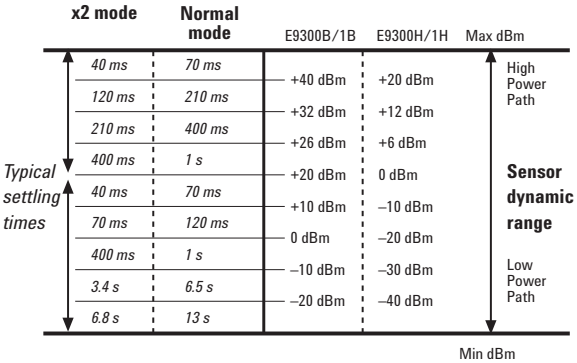
With N8480 Series sensors



With E-Series E9300A/01A/04A sensors



With 8480 Series sensors



With E-Series E9300B/01B/00H/01H sensor

N1913A/14A EPM Series power meters performance characteristics (continued)

Power Meter Functions

Accessed by key entry: Either hard keys, or soft key 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. Frequency range from1 kHz to 999.9 GHz. Also settable in 1 kHz steps.

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

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 0.001dB 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 0.001% increments, can be entered to display a peak power representation of measured power. The following equation is used to calculate the displayed peak power value: peak power = measured power/duty cycle.

Sensor cal tables: Selects cal factor versus frequency tables corresponding to specified sensors.

Limits: High and low limits can be set in the range –150.000 dBm to +230.000 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 and N8480 Series).

Display: Color display with selectable single and split screen formats are available. A 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. With the optional USB ports, additional dual channel (C & D), adds up to total 4-channels measurement display.

Power Meter 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:

Model	Net	Shipping
N1913A	*3.6 kg (8.0 lb)*	*8.2 kg (18.1 lb)*
N1914A	*3.7 kg (8.2 lb)*	*8.2 kg (18.3 lb)*

Rear panel connectors

Recorder outputs: Analog 0 to 1 Volt, 1 kΩ output impedance, BNC connector. N1914A recorder outputs are dedicated to channel A and channel B.

GPIB, USB 2.0 and 10/100BaseT LAN: Interfaces to allow communication with an external controller

Trigger Input (Optional):
Input has TTL compatible logic levels and uses a BNC connector.
High: >2.4 V Low: <0.7 V

Trigger Output (Optional):
Output provides TTL compatible logic levels and uses a BNC connector.
High: >2.4 V Low: <0.7 V

Ground: Binding post, accepts 4 mm plug or bare wire connection

USB Host (Options): USB ports which connects to U2000 series USB power sensors

VGA Out (Options): Standard 15-pin VGA connector, allows connection of external VGA monitor

Line power

Input voltage range: 90 to 264 VAC, automatic selection

Input frequency range: 47 to 63 Hz and 400 Hz @ 110 Vac

Power Requirement: 75 VA (50 Watts)

N1913A/14A EPM Series power meters performance characteristics (continued)

Battery option operational characteristics[1]

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

Typical operating time: up to 6 hours with LCD backlight on; up to 7.5 hours with LCD backlight off (N1913A power meter).

Charge time: Approximately, 2.5 hours to charge fully from an empty state. Power meter is operational whilst charging.

Battery type: Lithium-ion (Li-ion)

Battery Storage temperature: –20 °C to 60 °C, ≤80 % RH

Environmental characteristics

Electromagnetic Compatibility
Complies with the essential requirements of EMC Directive (2004/108/EC) as follows:

- IEC61326- 1:2005 / EN61326- 1:2006
- CISPR11:2003 / EN55011:2007 (Group 1, Class A)

The product also meets the following EMC standards:

- Canada: ICES/NMB- 001:2004
- Australia/New Zealand: AS/NZS CISPR 11:2004

Product Safety:
This product conforms to the requirements of the following safety standards:

- IEC 61010- 1:2001 / EN 61010- 1:2001
- CAN/CSA- C22.2 No.61010- 1- 04
- ANSI/UL61010- 1:2004

Low Voltage Directive:
This product conforms to the requirements of European Council Directive "2006/95/EC".

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: 4,600 meters (15,000 feet)

Storage Conditions

Non-Operating Storage Temperature: –40 °C to +70 °C

Non-Operating Maximum Humidity: 90 % at 65 °C (non-condensing)

Non-Operating Maximum Altitude: 4,600 meters (15,000 feet)

Remote programming

Interface: GPIB, USB and LAN interfaces operates to IEEE 488.2 standard.

Command language:
SCPI standard interface commands.
436A and 437B code compatible (N1913A option 200); 438A code compatible (N1914A option 200).

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

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

N1913A/14A EPM Series power meters ordering information

Power meters

N1913A: Single-channel average power meter
N1914A: Dual-channel average power meter

Each unit power meter is shipped with:

- 11730A power sensor cable: 1.5 m/5 ft (one cable for N1913A, two cables for N1914A)
- Power cord
- USB adaptor cable
- Standard calibration certificate
- Users and Programming guide (English version, in hardcopy and CD-ROM)
- Installation guide
- IO Libraries CD-ROM
- Standard 12-month, return-to-Agilent warranty and service plan

Options

Model	Description
N191xA-102	Single/dual-channel average power meter, battery
N191xA-103	Single/dual-channel average power meter, battery, two rear USB ports
N191xA-104	Single/dual-channel average power meter, VGA
N191xA-105	Single/dual-channel average power meter, battery, one front and one rear USB port, VGA
N191xA-106	Single/dual-channel average power meter, one front and one rear USB port
N191xA-107	Single/dual-channel average power meter, external trigger IN/OUT
N191xA-108	Parallel rear panel sensor input connectors and front panel reference calibrator connector, two rear USB ports
N191xA-109	Parallel rear panel sensor input connectors and rear panel reference calibrator connector, two rear USB ports
N1913A-200	436A and 437B code compatibility
N1914A-200	438A code compatibility

Cables	
11730A	Power sensor cable: 1.5 m/5 ft
11730B	Power sensor cable: 3.0 m/10 ft
11730C	Power sensor cable: 6.1 m/20 ft
11730D	Power sensor cable: 15.2 m/50 ft
11730E	Power sensor cable: 30.5 m/100 ft
11730F	Power sensor cable: 61.0 m/200 ft

Other accessories	
34131A	Transit case
34141A	Soft carrying case
34161A	Accessory pouch
N191xA-300	Spare battery pack
N191xA-908	Rackmount kit (one Instrument)
N191xA-909	Rackmount kit (two Instruments)

Warranty	
R-50C-011-3	Agilent Calibration Upfront Plan 3-year coverage
R-50C-011-5	Agilent Calibration Upfront Plan 5-year coverage
R-51B-001-3C	1 year Return-to-Agilent warranty extended to 3 years
R-51B-001-5C	1 year Return-to-Agilent warranty extended to 5 years

GPIB products	
82357B	USB/GPIB converter
10833x	GPIB cables

Additional documentation
Selections can be made for the localization of the User's Guide, and Programming Guide

N191XA-ABA: Manual Set (English Users Guide, and English Programming Guide
N191XA-ABJ: Japanese localization printed Users Guide and Programming Guide
N191XA-0B0: Delete manual set (English Users Guide, and English Programming Guide)

E-Series power sensor specifications

The E-Series of power sensors have their calibration factors stored in EEPROM and operate over a wide dynamic range. They are designed for use with the EPM Series of power meters and two classes of sensors are available:

- CW power sensors (E4412A and E4413A).
- Average power sensors (E9300 sensors).

E-Series CW power sensor specifications

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

Table 4: E4410 Series max SWR specification

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)

* Applies to sensors with serial prefix US 3848 or greater

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 data sheet 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

E-Series CW power sensor specifications (continued)

Power linearity

Table 6: E4410 Series power linearity specification

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%

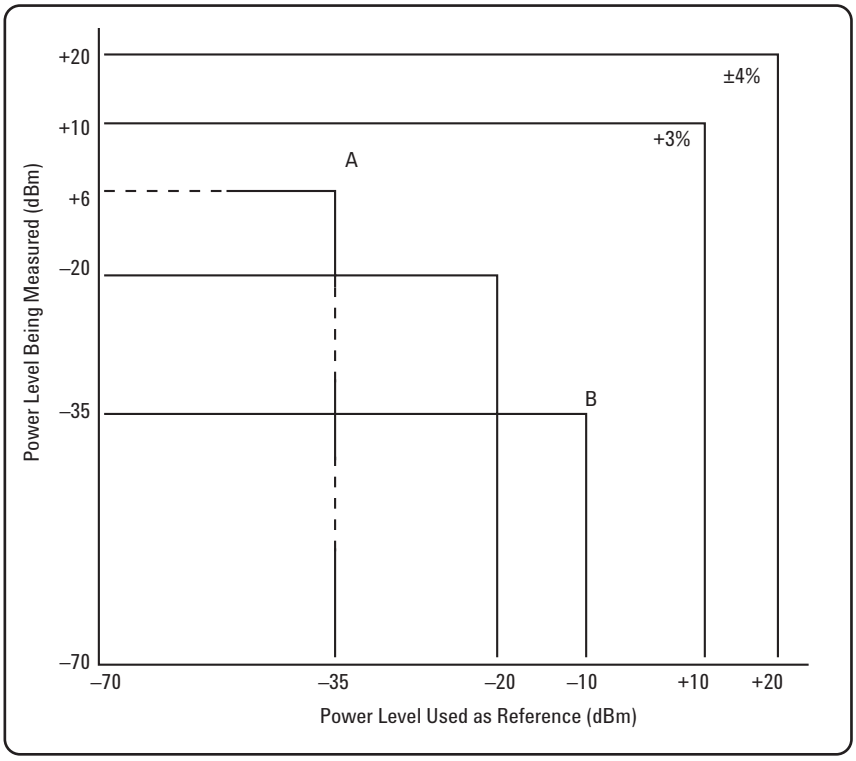


Figure 1. Relative mode power measurement linearity with EPM Series power meter/E-Series CW power sensor at 25 °C ± 5 °C (typical)

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 x 1 mW
P = 10 6/10 x 1 mW
P = 3.98 mW
3% x 3.98 mW = 119.4 µW

Example B:
P = 10 (P)/10 x1 mW
P = 10 -35/10 x 1 mW
P = 316 nW
3% x 316 nW = 9.48 nW

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

E-Series E9300 average power sensor specifications

The E-Series E9300 wide dynamic range, average power sensors are designed for use with the EPM family of power meters. These 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.

The E-Series E9300 power sensors have two independent measurement paths (high and low power paths) as shown in Table 7:

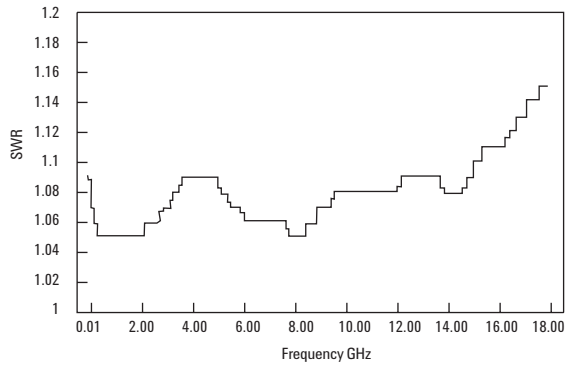
Table 7: E9300 Series two-path specification

	"A" suffix sensors	"B" suffix sensors	"H" suffix sensors
High power path	–10 to +20 dBm	+20 to +44 dBm	0 to +30 dBm
Low power path	–60 to –10 dBm	–30 to +20 dBm	–50 to 0 dBm

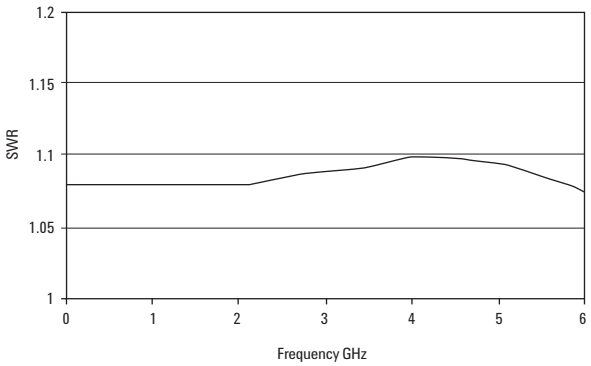
Table 8: E9300 Series sensors specification

Model	Frequency range	Maximum SWR (25 °C ± 10 °C)	Maximum SWR (0 °C to 55 °C)	Maximum power	Connector type
–60 dBm to +20 dBm wide dynamic range sensors					
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)
–30 dBm to +44 dBm wide dynamic range sensors					
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)
–50 dBm to +30 dBm wide dynamic range sensors					
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)

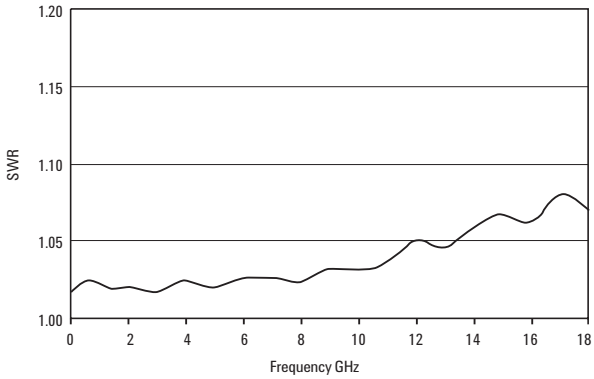
E-Series E9300 average power sensor specifications (continued)



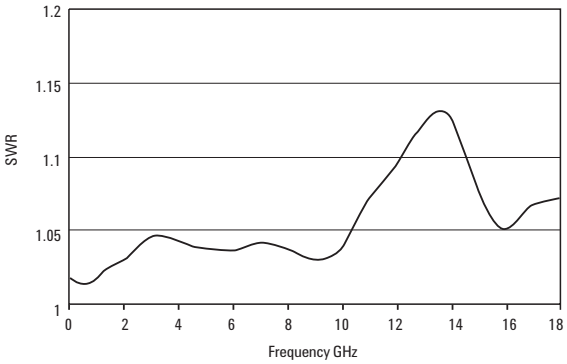
Typical SWR, 10 MHz to 18 GHz (25 °C ±10 °C) for E9300A and E9301A sensor



Typical SWR, 9 kHz to 6 GHz (25 °C ±10 °C) for E9304A sensors



Typical SWR, 10 MHz to 18 GHz (25 °C ±10 °C) for E9300B and E9301B sensors



Typical SWR, 10 MHz to 18 GHz (25 °C ±10 °C) for E9300H and E9301H sensors

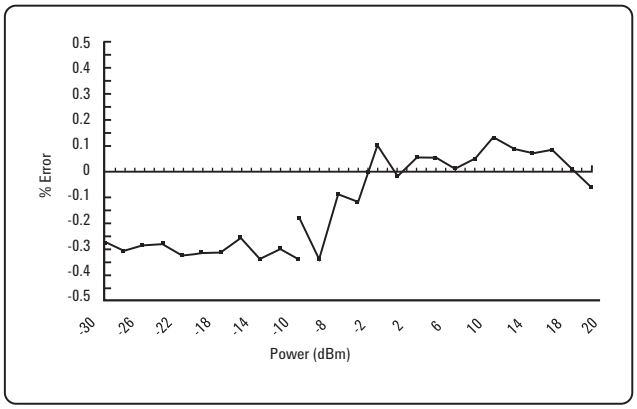
E-Series E9300 average power sensor specifications (continued)

Power linearity *

Table 9: E9300 Series Power linearity (after zero and cal at ambient environmental conditions) Sensor

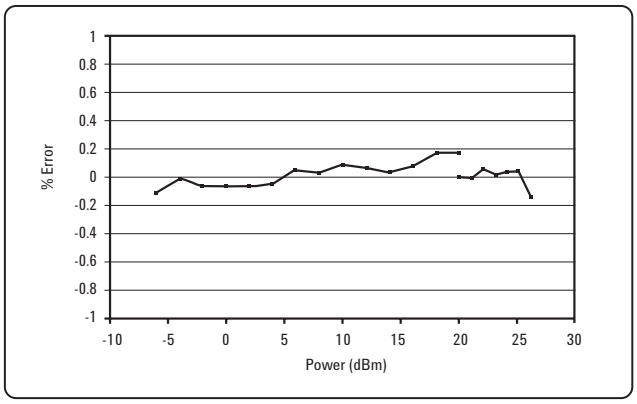
Sensor	Power	Linearity (25 °C ±10 °C)	Linearity (0 °C to 55 °C)
E9300A, E9301A, E9304A	–60 to –10 dBm	±3.0%	±3.5%
	–10 to 0 dBm	±2.5%	±3.0%
	0 to +20 dBm	±2.0%	±2.5%
E9300B, E9301B	–30 to +20 dBm	±3.5%	±4.0%
	+20 to +30 dBm	±3.0%	±3.5%
	+30 to +44 dBm	±2.5%	±3.0%
E9300H, E9301H	–50 to 0 dBm	±4.0%	±5.0%
	0 to +10 dBm	±3.5%	±4.0%
	+10 to +30 dBm	±3.0%	±3.5%

*after zero and calibration at ambient environmental conditions



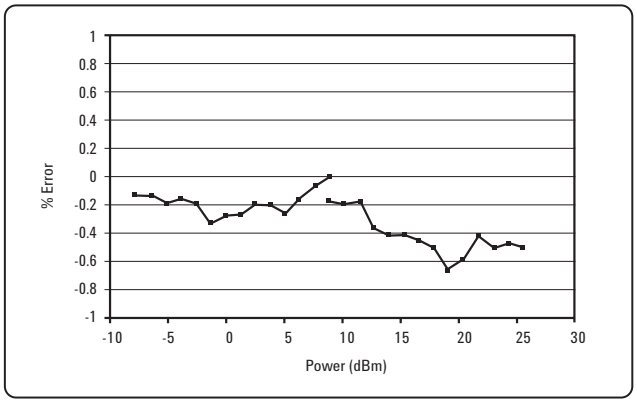
Typical E9300A/01A/04A power linearity at 25 °C, after zero and calibration, with associated measurement uncertainty

Power range	Measurement uncertainty
–30 to –20 dBm	±0.9%
–20 to –10 dBm	±0.8%
–10 to 0 dBm	±0.65%
0 to +10 dBm	±0.55%
+10 to +20 dBm	±0.45%



Typical E9300B/01B power linearity at 25 °C, after zero and calibration, with associated measurement uncertainty

Power range	Measurement uncertainty
–6 to 0 dBm	± 0.65%
0 to +10 dBm	± 0.55%
+10 to +20 dBm	± 0.45%
+20 to +26 dBm	± 0.31%



Typical E9300H/01H power linearity at 25 °C, after zero and calibration, with associated measurement uncertainty

Power range	Measurement uncertainty
–26 to –20 dBm	± 0.9%
–20 to –10 dBm	± 0.8%
–10 to 0 dBm	± 0.65%
0 to +10 dBm	± 0.55%
+10 to +20 dBm	± 0.45%
+20 to +26 dBm	± 0.31%

E-Series E9300 average power sensor specifications (continued)

Effects of change in temperature on linearity

Note: If the temperature changes after calibration and you choose not to re-calibrate the sensor, the following additional power linearity error should be added to the linearity specs in Table 9

For small changes in temperature:
The typical maximum additional power linearity error due to small temperature change after calibration is ±0.15%/°C (valid after zeroing the sensor).

For large changes in temperature:
Refer to Table 10.

Table 10: Typical maximum additional power linearity error due to temperature change (valid after zeroing the sensor)

Sensor	Power	Additional power linearity error (25 °C ± 10 °C)	Additional power linearity error (0 °C to 55 °C)
E9300A, E9301A, E9304A	–60 to –10 dBm	±1.5%	±2.0%
	–10 to 0 dBm	±1.5%	±2.5%
	0 to +20 dBm	±1.5%	±2.0%
E9300B, E9301B	–30 to +20 dBm	±1.5%	±2.0%
	+20 to +30 dBm	±1.5%	±2.5%
	+30 to +44 dBm	±1.5%	±2.0%
E9300H, E9301H	–50 to 0 dBm	±1.5%	±2.0%
	0 to +10 dBm	±1.5%	±2.5%
	+10 to 30 dBm	±1.5%	±2.0%

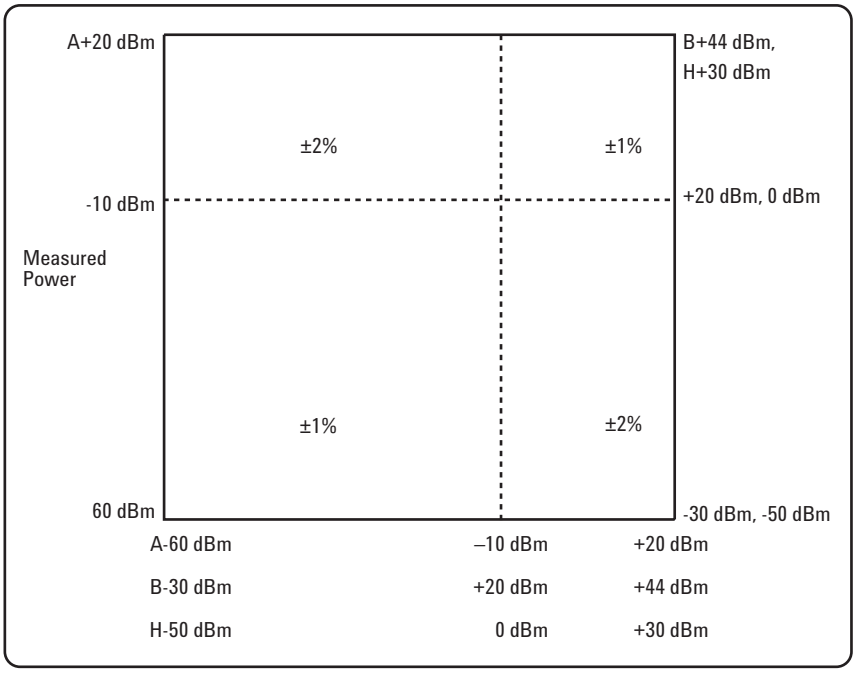


Figure 2. Relative mode power measurement linearity with an EPM Series power meter, at 25 °C ±10 °C (typical)

Figure 2 shows the typical uncertainty in making a relative power measurement, using the same power meter channel and same power sensor to obtain the reference and the measured values, and assumes that negligible change in frequency and mismatch error occur when transitioning from the power level used as the reference to the power level being measured.

E-Series E9300 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.

E9300 "A" suffix sensors example: 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 =±0.5% (=±0.02 dB)*
Switching point hysteresis: *0.5 dB typical*

Table 11: E9300 Series sensor switch point specification

E9300 Sensor suffix	Conditions [1]	Zero set	Zero drift [2]	Measurement noise [3]
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 µW*	*700 nW*
	High power path (15% to 75% RH)	500 µW	*150 µW*	*500 µW*
	High power path (75% to 95% RH)	500 µW	*3000 mW*	*500 µW*
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 µW*	*7 nW*
	High power path (15% to 75% RH)	5 µW	*1.5 µW*	*5 µW*
	High power path (75% to 95% RH)	5 µW	*30 mW*	*5 µW*

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 E9300 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 + Rho)/(1 - Rho)

Maximum uncertainties of the CF data are listed in Tables 12a and 12b. As the E-Series E9300 power sensors have two independent measurement paths (high and low power paths), there are two calibration factor uncertainty tables. 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.

Table 12a: Calibration factor uncertainties (low power path)

Frequency	Uncertainty (%) (25 °C ±10 °C)	Uncertainty (%) (0 °C 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 °C 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%

8480D Series diode and 8483A thermocouple power sensor specifications

Calibration factor uncertainties

These thermocouple and diode power sensors provide extraordinary accuracy, stability, and SWR over a wide range of frequencies (100 kHz to 110 GHz) and power levels -70 dBm to +20 dBm).

Table 13: Typical root sum of squares (rss) uncertainty on the calibration factor data printed on the power sensor

Freq (GHz)	8483A	8481D	8485D	8487D	R8486D	Q8486D
0.0001	1.3	–	–	–	–	–
0.0003	1.2	–	–	–	–	–
0.001	1.1	–	–	–	–	–
0.003	1.2	–	–	–	–	–
0.01	1.2	–	–	–	–	–
0.03	1.2	–	–	–	–	–
0.05	1.2	–	–	–	–	–
0.1	1.2	–	–	–	–	–
0.3	1.2	–	–	–	–	–
1	1.2	0.8	1.4	1.3	–	–
2	1.2	0.8	1.4	1.3	–	–
4	–	0.8	1.7	1.4	–	–
6	–	0.9	1.7	1.4	–	–
8	–	1.0	1.7	1.4	–	–
10	–	1.1	1.9	1.5	–	–
12	–	1.2	1.9	1.5	–	–
14	–	1.1	2.0	1.6	–	–
16	–	1.5	2.1	1.7	–	–
18	–	1.7	2.2	1.7	–	–
22	–	–	2.7	1.9	–	–
26.5	–	–	2.8	2.2	3.0	–
28	–	–	2.9*	2.3	3.2	–
30	–	–	3.2*	2.4	3.0	–
33	–	–	3.3*	2.6	3.0	4.2
34.5	–	–	–	2.6	3.0	4.2
37	–	–	–	2.7	3.0	4.2
40	–	–	–	3.0	–	4.2
42	–	–	–	3.2	–	4.9
44	–	–	–	2.5	–	5.1
46	–	–	–	3.8	–	5.5
48	–	–	–	3.8	–	5.8
50	–	–	–	5.0	–	6.2

*These uncertainties only apply to Option 033.

8480D Series diode and 8483A thermocouple power sensor specifications (continued)

Maximum SWR and power linearity

Table 14: 8480 Series maximum SWR and power linearity

Model	Frequency range	Maximum SWR	Power linearity [1]	Maximum power	Connector type	Weight
100 mW sensors, 1 µW to 100 mW (–30 dBm to +20 dBm)						
8483A (75-Ohm)	100 kHz to 2 GHz	100 kHz to 600 kHz: 1.80 600 kHz to 2 GHz: 1.18	+10 dBm to + 20 dBm: (±3%)	300 mW avg, 10 W pk	Type - N (m) 75 Ohm	Net: 0.2 kg (0.38 lb) Shipping: 0.5 kg (1.0 lb)
V8486A	50 GHz to 75 GHz	50 GHz to 75 GHz: 1.06	–30 dBm to + 10 dBm: (±1%) +10 dBm to + 20 dBm: (±2%)	200 mW avg, 40 W pk (10.µs per pulse, 0.5% duty cycle)	Waveguide flange UG-385/U	Net: 0.4 kg (0.9 lb) Shipping: 1 kg (2.1 lb)
W8486A	75 GHz to 110 GHz	75 GHz to 110 GHz: 1.08	(±2%)	200 mW avg, 40 W pk (10.µs per pulse, 0.5% duty cycle)	Waveguide flange UG-387/U	Net: 0.4 kg (0.9 lb) Shipping: 1 kg (2.1 lb)
High sensitivity sensors, 100 pW to 10 µW (–70 dBm to –20 dBm)						
8481D [2]	10 MHz to 18 GHz	10 MHz to 30 MHz: 1.40 30 MHz to 3 GHz: 1.15 4 GHz to 10 GHz: 1.20 10 GHz to 15 GHz: 1.30 15 GHz to 18 GHz: 1.35	–30 dBm to –20 dBm: (±1%)	100 mW avg, 100 m W pk	Type - N (m)	Net: 0.16 kg (0.37 lb) Shipping: 0.9 kg (2.0 lb)
8485D [2]	50 MHz to 26.5 GHz	0.05 GHz to 0.1 GHz: 1.19 0.1 GHz to 4 GHz: 1.15 4 GHz to 12 GHz: 1.19 12 GHz to 18 GHz: 1.25 18 GHz to 26.5 GHz: 1.29	–30 dBm to –20 dBm: (±2%)	100 mW avg, 100 m W pk	APC - 3.5mm (m)	Net: 0.2 kg (.38 lb) Shipping: 0.5 kg (1.0 lb)
Option 8485D-033	50 MHz to 33 GHz	26.5 GHz to 33 GHz: 1.35	–30 dBm to –20 dBm: (±2%)	100 mW avg, 100 m W pk	APC - 3.5mm (m)	Net: 0.2 kg (0.38 lb) Shipping: 0.5 kg (1.0 lb)
8487D [2]	50 kHz to 50 GHz	0.05 GHz to 0.1 GHz: 1.19 0.1 GHz to 4 GHz: 1.15 2 GHz to 12.4 GHz: 1.20 12.4 GHz to 18 GHz: 1.29 18 GHz to 34 GHz: 1.37 34 GHz to 40 GHz: 1.61 40 GHz to 50 GHz: 1.89	–30 dBm to –20 dBm: (±2%)	100 mW avg, 100 m W pk 10 W.µs per pulse	2.4 mm (m)	Net: 0.2 kg (0.38 lb) Shipping: 0.5 kg (1.0 lb)
R8486D [2]	26.5 GHz to 40 GHz	26.5 GHz to 40 GHz: 1.40	–30 dBm to –25 dBm: (±3%) –25 dBm to –20 dBm: (±5%)	100 mW avg, or pk 40 V dc max	Waveguide flange UG-599/U	Net: 0.26 kg (0.53 lb) Shipping: .66 kg (1.3 lb)
Q8486D [2]	33 GHz to 50 GHz	33 GHz to 50 GHz: 1.40	–30 dBm to –25 dBm: (±3%) –25 dBm to –20 dBm: (±5%)	100 mW avg, or pk 40 V dc max	Waveguide flange UG-383/U	Net: 0.26 kg (0.53 lb) Shipping: .66 kg (1.3 lb)

1. Negligible deviation except for those power ranges noted.
2. Includes 11708A 30 dB attenuator for calibrating against 0 dBm, 50 MHz power reference. The 11708A is factory set to 30 dB ±0.05 dB at 50 MHz, traceable to NIST. SWR < 1.05 at 50 MHz.

N8480 Series thermocouple power sensor specifications

The N8480 Series power sensors (excluding Option CFT) measure power levels from –35 dBm to +44 dBm (316 nW to 25.1 W), at frequencies from 100 kHz to 50 GHz and have two independent power measurement range (upper and lower range).

Meanwhile, the N8480 sensors with Option CFT only measure power levels from –30 dBm to +44 dBm (1 µW to 25.1 W) in single range. Similiar to the E- Series power sensors, the N8480 Series power sensors are also equipped with EEPROM to store sensor's characteristics such as model number, serial number, linearity, temperature compensation, calibration factor, and so forth.

This feature ensures the correct calibration data is applied by any compatible power meter connected with N8480 Series power sensor, and to ensure the accuracy of the measurements.

Calibration factor uncertainties

Table 15: N8480 Series Calibration factor uncertainty at 25 °C ± 3 °C

Frequency	N8481A	N8481B	N8481H	N8482A	N8482B	N8482H	N8485A	N8487A	N8486AR	N8486AQ
100 kHz to 10 MHz	–	–	–	0.91	1.48	0.89	–	–	–	–
10 MHz to 30 MHz	0.82	1.42	0.77	0.78	1.43	0.79	0.82	–	–	–
30M Hz to 500 MHz	0.77	1.48	0.89	0.77	1.49	0.89	1.24	1.33	–	–
500 MHz to 1.2 GHz	0.78	1.48	0.89	0.78	1.49	0.89	1.26	1.35	–	–
1.2 GHz to 6 GHz	0.91	1.58	1.06	0.89	1.56	1.02	1.35	1.41	–	–
6 GHz to 14 GHz	1.26	1.77	1.46	–	–	–	1.66	1.61	–	–
14 GHz to 18 GHz	1.59	1.92	1.73	–	–	–	1.83	1.73	–	–
18 GHz to 26.5 GHz	–	–	–	–	–	–	2.67	2.26	–	–
26.5 GHz to 33 GHz	–	–	–	–	–	–	3.32	2.58	2.68	–
33 GHz to 34 GHz	–	–	–	–	–	–	–	2.80	3.19	3.14
34 GHz to 35 GHz	–	–	–	–	–	–	–	2.80	3.19	3.40
35 GHz to 40 GHz	–	–	–	–	–	–	–	2.80	3.19	3.14
40 GHz to 45 GHz	–	–	–	–	–	–	–	3.66	–	3.19
45 GHz to 50 GHz	–	–	–	–	–	–	–	4.23	–	3.26

N8480 Series thermocouple power sensor specifications (continued)

Maximum SWR and power linearity for standard N8480 Series power sensors

Table 16: N8480 Series maximum SWR and power linearity

Model	Frequency range	Maximum SWR [1]	Power linearity [1, 2]	Maximum power	Connector type	Weight
100mW sensors. Power range [3]: 316nW to 100 mW (–35 dBm to +20 dBm)						
N8481A	10 MHz to 18 GHz	10 MHz to 30 MHz: 1.37 30 MHz to 50 MHz: 1.14 50 MHz to 2 GHz: 1.08 2 GHz to 12.4 GHz: 1.16 12.4 GHz to 18 GHz: 1.23	–1 dBm to +15 dBm (±0.52%) +15 dBm to +20 dBm (±0.80%)	+25 dBm 15 W/2 µs	Type - N(m)	Net: 0.181 kg (0.40 lb) Shipping: 0.90 kg (1.98 lb)
N8482A	100 kHz to 6 GHz	100 kHz to 300 kHz: 1.54 300 kHz to 1 MHz: 1.17 1 MHz to 2 GHz: 1.06 2 GHz to 6 GHz: 1.07			Type - N(m)	Net: 0.181 kg (0.40 lb) Shipping: 0.90 kg (1.98 lb)
N8485A	10 MHz to 26.5 GHz	10 MHz to 50 MHz: 1.33 50 MHz to 100 MHz: 1.08 100 MHz to 2 GHz: 1.05 2 GHz to 12.4 GHz: 1.14 12.4 GHz to 18 GHz: 1.19 18 GHz to 26.5 GHz: 1.26			APC - 3.5mm(m)	Net: 0.183 kg (0.40 lb) Shipping: 0.90 kg (1.98 lb)
N8485A Option 033	10 MHz to 33 GHz	26.5 GHz to 33 GHz: 1.32			APC - 3.5mm(m)	Net: 0.183 kg (0.40 lb) Shipping: 0.90 kg (1.98 lb)
N8487A	50 MHz to 50 GHz	50 MHz to 100 MHz: 1.08: 100 MHz to 2 GHz: 1.05 2 GHz to 12.4 GHz: 1.10 12.4 GHz to 18 GHz: 1.16 18 GHz to 26.5 GHz: 1.22 26.5 GHz to 40 GHz: 1.30 40 GHz to 50 GHz: 1.34			2.4 mm (m)	Net: 0.154 kg (0.34 lb) Shipping: 0.874 kg (1.92 lb)
N8486AR	26.5 GHz to 40 GHz	26.5 GHz to 40 GHz: 1.40			Waveguide flange UG-599/U	Net: 0.202 kg (0.45 lb) Shipping: 0.922 kg (2.03 lb)
N8486AQ	33 GHz to 50 GHz	33 GHz to 50 GHz: 1.50			Waveguide flange UG-383/U	Net: 0.204 kg (0.45 lb) Shipping: 0.924 kg (2.03 lb)
High power sensors. Power range [3]: 316 µW to 21.1W (–5 dBm to +44 dBm)						
N8481B	10 MHz to 18 GHz	10 MHz to 2 GHz:1.09 2 GHz to 12.4 GHz: 1.14 12.4 GHz to 18 GHz: 1.23	+29 dBm to +39 dBm (±0.52%)	+49 dBm 500 W/1 µs	Type - N(m)	Net: 0.684 kg (1.51 lb) Shipping: 1.404 kg (3.09 lb)
N8482B	100 kHz to 6 GHz	100 kHz to 2 GHz: 1.08 2 GHz to 6 GHz: 1.16	+39 dBm to +44 dBm (±0.80%)		Type - N(m)	Net: 0.684 kg (1.51 lb) Shipping: 1.404 kg (3.09 lb)
High power sensors. Power range [3]: 31.6 µW to 3.2W (–15 dBm to +35 dBm)						
N8481H	10 MHz to 18 GHz	10 MHz to 8 GHz: 1.20 8 GHz to 12.4 GHz: 1.25 12.4 GHz to 18 GHz: 1.30	+17 dBm to +30 dBm (±0.52%)	+40 dBm 100 W/1 µs	Type - N(m)	Net: 0.234 kg (0.52 lb) Shipping: 0.954 kg (2.10 lb)
N8482H	100 kHz to 6 GHz	100 kHz to 6 GHz: 1.13	+30 dBm to +35 dBm (±0.80%)		Type - N(m)	Net: 0.234 kg (0.52 lb) Shipping: 0.954 kg (2.10 lb)

1. At 25 °C ± 10 °C
2. The N8480 Series power sensors' linearity is negligible except for the power range specified in the table
3. For N8480 Standard (excluding the CFT option)

N8480 Series thermocouple power sensor specifications (continued)

Switch point data

Switching point is applicable for standard N8480 Series power sensors only.

The N8480 Series power sensors have two power measurement ranges; a lower range and upper range. The power meter automatically selects the proper power range. To avoid unnecessary switching when the power level is near switching point, a **Switching Point Hysteresis** has been added.

Switching point hysteresis: *0.5 dB typical*

Example of switching point hysteresis on N8481/2H power sensors, this hysteresis causes the lower range to remain selected until approximately 17.5 dBm as the power level is increased, above this power the upper range is selected.

The upper range remains selected until approximately 16.5 dBm as the signal level decreases, below this power the lower range is selected.

For more detailed specifications,refer to the **Agilent N8480 Series thermocouple power sensors datasheet (5989-9333EN)**

U2000 Series USB power sensor specifications

The U2000 Series USB power sensors are true average, wide-dynamic-range RF/microwave power sensors, based on a dual-sensor diode pair/attenuator/diode pair topology.

The U2000 Series USB power sensors can be operated on N1913A/14A via the USB host port (options).

Frequency and power ranges

Table 17: U2000 Series USB sensors frequency and power ranges

Model	Frequency range	Power range	Maximum power
U2000A	10 MHz to 18 GHz	–60 dBm to +20 dBm	+25 dBm avg, 20 VDC
U2001A	10 MHz to 6 GHz		+33 dBm pk, <10 µs
U2002A	50 MHz to 24 GHz		
U2004A	9 kHz to 6 GHz	–60 dBm to +20 dBm	+25 dBm avg, 5 VDC
			+33 dBm pk, <10 µs
U2000B	10 MHz to 18 GHz	–30 dBm to +44 dBm	+45 dBm avg, 20 VDC
U2001B	10 MHz to 6 GHz		+47 dBm pk, 1 µs
U2000H	10 MHz to 18 GHz	–50 dBm to +30 dBm	+33 dBm avg, 20 VDC
U2001H	10 MHz to 6 GHz		+50 dBm pk, 1 µs
U2002H	50 MHz to 24 GHz	–50 dBm to +30 dBm	+33 dBm avg, 10 VDC
			+50 dBm pk, 1 µs

Power Accuracy

Table 18: U2000 Series USB sensors power accuracy

Model	Power range	Accuracy [1] (25 °C ± 10 °C)	Accuracy [1] (0 °C to 55 °C)
U2000/1/2/4A	–60 dBm to +20 dBm	±3.0%	±3.5%
U2000/1/2H	–50 dBm to +30 dBm	±4.0%	±5.0%
U2000/1B	–30 dBm to +44 dBm	±3.5%	±4.0%

Specifications valid with the following conditions:

- After zeroing
- Number of averages = 1024
- After 30 minutes of power-on warm-up

1. This accuracy is essentially a combination of linearity, instrumentation accuracy, and traceability to absolute accuracy at 50 MHz, 0 dBm.
   Note: Mismatch uncertainty, calibration factor uncertainty, and power level dependent terms (zero set, drift, and noise) are excluded in this specification.

U2000 Series USB power sensor specifications (continued)

Maximum SWR

Table 19: U2000 Series USB sensors maximum SWR

Model	Frequency range	Max SWR (25 °C ± 10 °C)	Max SWR (0 °C to 55 °C)
U2000A	10 MHz to 30 MHz	1.15	1.21
	30 MHz to 2 GHz	1.13	1.15
	2 GHz to 14 GHz	1.19	1.20
	14 GHz to 16 GHz	1.22	1.23
	16 GHz to 18 GHz	1.26	1.27
U2001A	10 MHz to 30 MHz	1.15	1.21
	30 MHz to 2 GHz	1.13	1.15
	2 GHz to 6 GHz	1.19	1.20
U2002A	50 MHz to 2 GHz	1.13	1.15
	2 GHz to 14 GHz	1.19	1.20
	14 GHz to 16 GHz	1.22	1.23
	16 GHz to 18 GHz	1.26	1.27
	18 GHz to 24 GHz	1.30	1.30
U2004A	9 kHz to 2 GHz	1.13	1.15
	2 GHz to 6 GHz	1.19	1.20
U2000B	10 MHz to 2 GHz	1.12	1.14
	2 GHz to 12.4 GHz	1.17	1.18
	12.4 GHz to 18 GHz	1.24	1.25
U2001B	10 MHz to 2 GHz	1.12	1.14
	2 GHz to 6 GHz	1.17	1.18
U2000H	10 MHz to 8 GHz	1.15	1.17
	8 GHz to 12.4 GHz	1.25	1.26
	12.4 GHz to 18 GHz	1.28	1.29
U2001H	10 MHz to 6 GHz	1.15	1.17
U2002H	50 MHz to 8 GHz	1.15	1.17
	8 GHz to 12.4 GHz	1.25	1.26
	12.4 GHz to 18 GHz	1.28	1.29
	18 GHz to 24 GHz	1.30	1.31

For more detailed specifications,refer to the **Agilent U2000 Series USB power sensors datasheet (5989-6278EN)**

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