# N1913A/14A EPM Series Power Meters Ordering Information *(continued)*

## Options *(continued)*

| Documentation | |
|---|---|
| N191xA-0B0 | Delete hard copy English language User’s Guide |
| N191xA-0BF | Hard copy English language Programming Guide |
| N191xA-0B1 | Hard copy English language User's Guide and Installation Guide |
| N191xA-0BK | Hard copy English language User's Guide and Programming Guide |
| N191xA-ABJ | Hard copy Japanese localization User’s Guide and 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 to 18 GHz | *10 MHz to <30 MHz: 1.22<br>30 MHz to <2 GHz: 1.15<br>2 GHz to <6 GHz: 1.17<br>6 GHz to <11 GHz:1.2<br>11 GHz to <18 GHz: 1.27 | 200 mW (+23 dBm) | Type-N (m) |
| E4413A | 50 MHz to 26.5 GHz | 50 MHz to <100 MHz: 1.21<br>100 MHz to <8 GHz: 1.19<br>8 GHz to <18 GHz: 1.21<br>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

# E-Series CW Power Sensor Specifications *(continued)*

## 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.

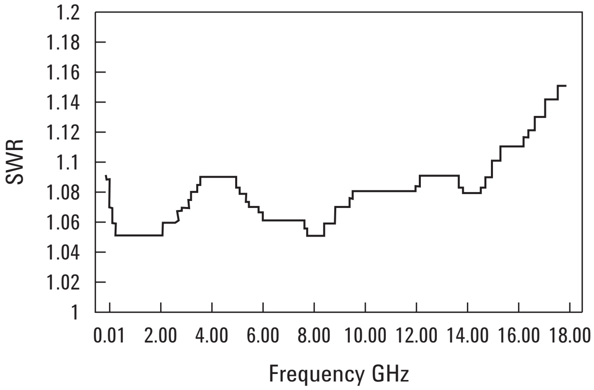
*Table 5a: E4412A calibration factor uncertainty at 1 mW (0 dBm)*

| 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 |

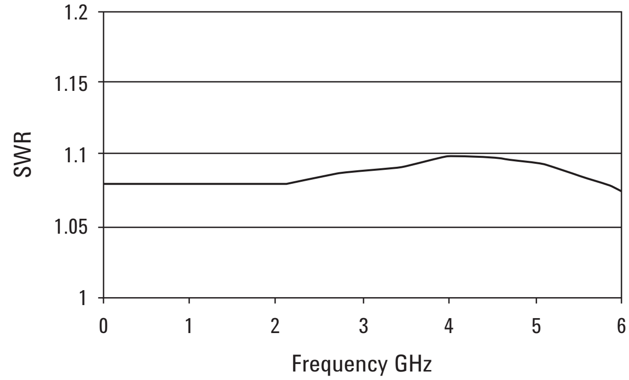
*Table 5b: E4413A calibration factor uncertainty at 1 mW (0 dBm)*

| 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 |

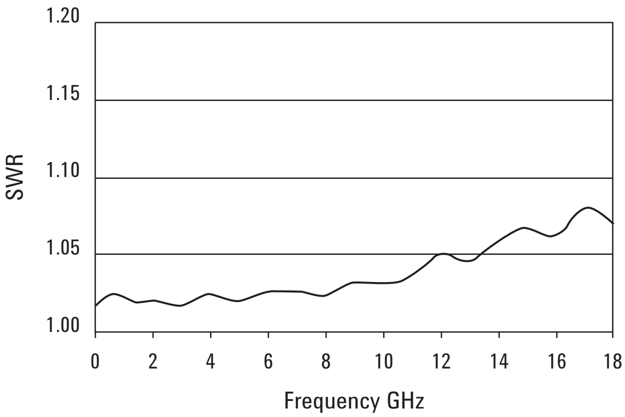
# E-Series E9300 Average Power Sensor Specifications *(continued)*



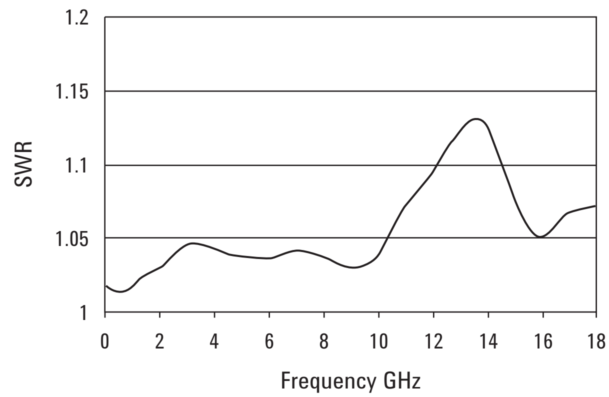

Typical SWR, 10 MHz to 18 GHz (25 °C ±10 °C)
for E9300A and E9301A sensor




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 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% |

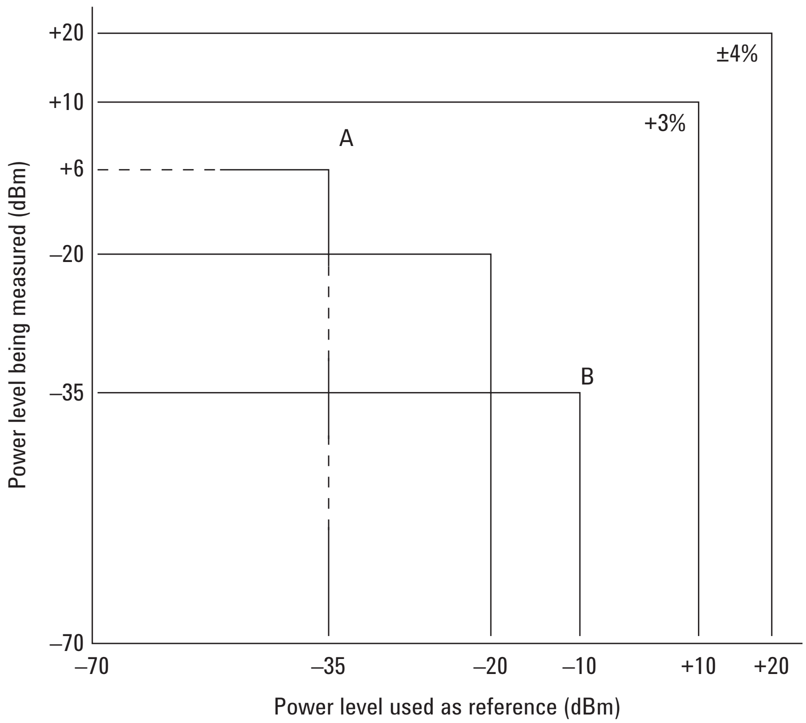



Figure 1. Relative mode power measurement linearity with EPM Series power meter/E-Series CW power sensor at 25 °C ± 5 °C (typical)


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