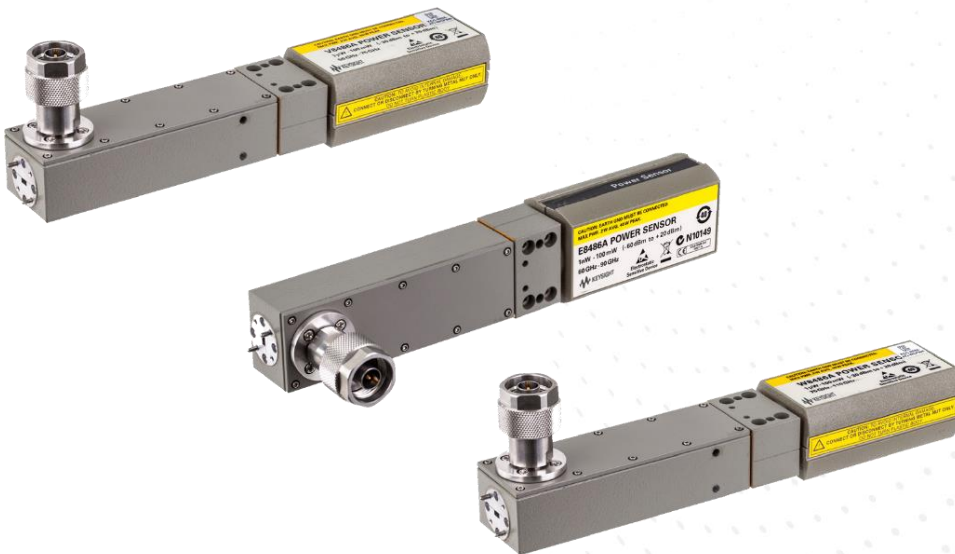


# E8486A, V8486A and W8486A Waveguide Power Sensors



## Make accurate and reliable measurements in the 50 to 110 GHz frequency range with Keysight's family of waveguide power sensors

Covering the V-band, E-band and W-band spectrums, the Keysight Technologies, Inc. waveguide power sensors offer best SWR, high reliability and low loss, and come with a 50 MHz calibration port to reduce measurement uncertainties. And with the Keysight E8486A (Option 200) waveguide sensor, you also get a wide dynamic range spanning from -60 to +20 dBm.

### Compatible with your current Keysight power meter

Keysight waveguide power sensors are fully compatible with Keysight EPM (E4418B/19B, N1913A/14A), EPM-P (E4416A/17A) and P-Series (N1911A/12A) power meters. The V8486A and W8486A are also compatible with the discontinued or obsolete power meters such as 435B, 436A, 437B, 438A, 70100A, E1416A, E4418A, and E4419A power meters.

### Best SWR available

In RF and microwave power measurements, the largest single source of error is usually sensor and source mismatch. To minimize any measurement uncertainty caused by mismatch, Keysight waveguide sensors offer excellent SWR of 1.06 (> 30 dB return loss).

### 50 MHz calibration

For easy calibration with the power meter, Keysight waveguide power sensors incorporate a 50 MHz calibration port. This eliminates the variance in making measurements with different meter/sensor combinations and the uncertainties due to temperature changes. It also provides traceability to the U.S. National Institute of Standards and Technology (NIST) at millimeter-wave frequencies.

### High reliability

Keysight waveguide sensors use the same proven Modified Barrier Integrated Diode (MBID) technology found in other Keysight sensors, and always operates in the square-law characteristic for true-average detection.

## Waveguide power sensors comparison table

| Model      | Frequency range | Power linearity <sup>1</sup>             | Maximum power  | Connector type                                  |
|------------|-----------------|--|--|---|
| E8486A-100 | 60 to 90 GHz    | -30 to +10 dBm: < $\pm 1\%$              | 200 mW avg, 40 W pk<br>(10 $\mu$ s per pulse, 0.5% duty cycle) | Waveguide flange:<br>UG-387/U Flange, EIA WR-12 |
|            |                 | +10 to +20 dBm: < $\pm 2\%$ <sup>2</sup> |  |   |
|            |                 | +10 to +20 dBm: < +1, -3% <sup>3</sup>   |  |   |
| E8486A-200 | 60 to 90 GHz    | -60 to -30 dBm: < $\pm 1.5\%$            | 200 mW avg, 1 W pk<br>(10 $\mu$ s per pulse, 0.5% duty cycle)  | Waveguide flange:<br>UG-387/U Flange, EIA WR-12 |
|            |                 | -30 to +10 dBm: < 1.5%                   |  |   |
|            |                 | +10 to +20 dBm: < $\pm 1.5\%$            |  |   |
| V8486A     | 50 to 75 GHz    | -30 to +10 dBm: < $\pm 1\%$              | 200 mW avg, 40 W pk<br>(10 $\mu$ s per pulse, 0.5% duty cycle) | Waveguide flange:<br>UG-385/U                   |
|            |                 | +10 to +20 dBm: < $\pm 2\%$              |  |   |
| W8486A     | 75 to 110 GHz   | -30 to +20 dBm: < $\pm 2\%$              | 200 mW avg, 40 W pk<br>(10 $\mu$ s per pulse, 0.5% duty cycle) | Waveguide flange:<br>UG-387/U                   |

1. Negligible deviation except for those power ranges noted.

2. For EPM series power meters.

3. For all other Keysight power meters.

Supplemental characteristics, which are shown in italics, are intended to provide additional information, useful in applying the power sensors by giving typical, but not warranted performance parameters. These characteristics are shown in *italics* or denoted as “*typical*”, “*nominal*” or “*approximate*”.

## E8486A E-Band Waveguide Power Sensor

Meet the rapid demand in E-band telecommunication applications with the E8486A waveguide power sensor. Designed with a WR-12 flange connector, the E8486A makes precise and direct waveguide measurements in the E-band frequency range and is compatible with most Keysight power meters. A wide dynamic range of -60 to +20 dBm and a SWR performance of 1.06 minimize measurement uncertainty caused by mismatch, providing high accuracy even with low power signals. With the E8486A waveguide power sensor, get the precision and accuracy you need for E-band applications in a single power sensor.

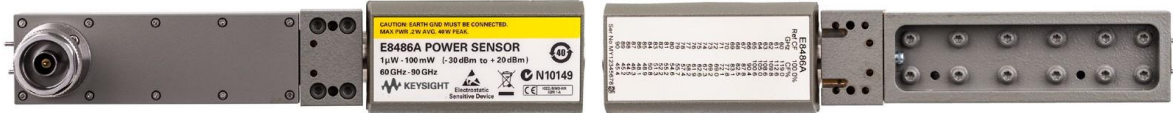


Figure 1. E8486A-100 comes without built-in EEPROM with dynamic range of -30 to +20 dBm. Users need to pre-enter calibration factors printed on the back of the sensor into the power meter.



Figure 2. E8486A-200 comes with built-in EEPROM to store calibration factors with extended dynamic range of -60 to +20 dBm.

## Specifications

| Specification  | Description  |
|--|--|
| Power range  | Option 100: 1 $\mu$ W to 100 mW (-30 to +20 dBm)<br>Option 200: 1 nW to 100 mW (-60 to +20 dBm)  |
| Frequency range <sup>1</sup>                                 | 60 to 90 GHz   |
| Calibration factor input                                     | Option 100: Does not include EEPROM. Users need to pre-enter calibration factors into the power meter; the calibration factor label will be provided on the power sensor unit.<br>Option 200: Comes with EEPROM to store calibration factors. Users simply need to input the frequency and the correct calibration factor will be applied. |
| Maximum SWR  | Option 100: < 1.06<br>Option 200: < 1.28   |
| Maximum SWR at 50 MHz  | Option 100: < 1.066<br>Option 200: < 1.077   |
| Maximum Calibration Factor Relative Uncertainty <sup>2</sup> | 60 GHz to 64 GHz: 6.4%<br>> 64 GHz to 68 GHz: 5.7%<br>> 68 GHz to 74 GHz: 6.1%<br>> 74 GHz to 79 GHz: 7.3%<br>> 79 GHz to 90 GHz: 6.9%   |
| Maximum power (damage level)                                 | Option 100: 200 mW avg, 40 W pk (10 $\mu$ s per pulse, 0.5% duty cycle)<br>Option 200: 200 mW avg, 1 W pk (10 $\mu$ s per pulse, 0.5% duty cycle)  |

| Specification     | Description   |
|-------------------|---|
| Power linearity   | Option 100: -30 to +10 dBm: < ±1%<br>+10 to +20 dBm: < ±2% (for EPM series power meters)<br>+10 to +20 dBm: < +1, -3% (for all other Keysight Power meters)<br>Option 200: -60 to -30 dBm: < ±1.5%<br>-30 to +10 dBm: < 1.5%<br>+10 to +20 dBm: < ±1.5% |
| Zero set          | Option 100: < ±200 nW<br>Option 200: < ±200 pW  |
| Measurement noise | Option 100: < 450 nW<br>Option 200: < 450 pW  |
| Zero drift        | Option 100: < ±40 nW<br>Option 200: < ±40 pW  |
| Connector type    | 50 MHz calibration port: Type N (male), 50 Ω nominal impedance<br>Waveguide flange: UG-387/U Flange, EIA WR-12  |
| Net weight        | Net: 0.4 kg (0.9 lb)<br>Shipping: 1 kg (2.2 lb)   |
| Dimensions        | 38 mm (w) x 199 mm (l) x 60 mm (h)  |
| Calibration Cycle | 1 year  |

- Option 201 is a standard E8486A-200 that has been calibrated at an extended frequency (54 to 95 GHz). Refer to E8486A Option 201 Product Note (E8486-90701) for more details.
- The characterized calibration factor should not deviate between periodic calibrations by more than the specified maximum uncertainty in the table. Compliance is confirmed by the relative deviation  $\left(\frac{|CF_1 - CF_2|}{CF_1} \times 100\right)$  being less than or equal to  $\sqrt{2}$  times the specified maximum uncertainty.  $\sqrt{2} * U_{max}$  with a reference calibration factor of 100%.

## V8486A V-Band Waveguide Power Sensor

Make accurate average power measurements from 50 to 75 GHz with the V8486A V-band power sensor. A special option for the V8486A that extends the power range down to -60 dBm is available. Contact your local Keysight field engineer or sales office for more information.



Figure 3. V8486A comes without built-in EEPROM. Users need to pre-enter calibration factors printed on the back of the sensor into the power meter.

### Specifications

| Specification  | Description  |
|--|--|
| Power range  | -30 to +20 dBm   |
| Frequency range  | 50 to 75 GHz   |
| Maximum SWR  | < 1.06   |
| Maximum SWR at 50 MHz  | < 1.073  |
| Maximum Calibration Factor Relative Uncertainty <sup>3</sup> | 50 GHz to 53 GHz: 6.13%<br>> 53 GHz to 58 GHz: 5.49%<br>> 58 GHz to 64 GHz: 6.22%<br>> 64 GHz to 68 GHz: 5.73%<br>> 68 GHz to 75 GHz: 6.13%        |
| Maximum power (waveguide port only)                          | 200 mW average, 40 W peak (10 μs pulse, 0.5% duty cycle) or equivalent such that 200 mW maximum average power and 40 W peak power are not exceeded |
| Power linearity  | -30 to +10 dBm: < ±1%<br>+10 to +20 dBm: < ±2%   |
| Zero set   | < ±200 nW  |
| Measurement noise  | < 450 nW   |
| Zero drift   | < ±40 pW   |
| Connector type   | EIA WR-15, UG-385/U  |
| Equivalent waveguide band designators to EIA WR-15           | IEC R-620<br>British WG-25<br>JAN RG-273<br>MIL-W-85/3-018   |
| Equivalent flange designator to UG-385/U                     | MIL-F-3922/67B-002   |
| Calibration Cycle  | 1 year   |

3. The characterized calibration factor should not deviate between periodic calibrations by more than the specified maximum uncertainty in the table. Compliance is confirmed by the relative deviation  $\left(\frac{CF1-CF2}{CF1} \times 100\right)$  being less than or equal to  $\sqrt{2}$  times the specified maximum uncertainty.  $\sqrt{2} * U_{max}$  with a reference calibration factor of 100%.

## W8486A W-Band Waveguide Power Sensor

The W8486A waveguide power sensor measures average power over the frequency range 75 to 110 GHz and power range –30 to +20 dBm.



Figure 4. W8486A comes without built-in EEPROM. Users need to pre-enter calibration factors printed on the back of the sensor into the power meter.

### Specifications

| Specification  | Description  |
|--|--|
| Power range  | -30 to +20 dBm   |
| Frequency range  | 75 to 110 GHz  |
| Maximum SWR  | < 1.08   |
| Maximum SWR at 50 MHz  | < 1.076  |
| Maximum Calibration Factor Relative Uncertainty <sup>4</sup> | 75 GHz to 79 GHz: 7.86%<br>> 79 GHz to 94 GHz: 7.24%<br>> 94 GHz to 103 GHz: 6.98%<br>> 103 GHz to 108 GHz: 7.24%<br>> 108 GHz to 110 GHz: 7.77%   |
| Maximum power (waveguide port only)                          | 200 mW average, 40 W peak (10 μs pulse, 0.5% duty cycle) or equivalent such that 200 mW maximum average power and 40 W peak power are not exceeded |
| Power linearity  | -30 to +20 dBm: < ±2%  |
| Zero set   | < ±200 nW  |
| Measurement noise  | < 450 nW   |
| Zero drift   | < ±40 pW   |
| Weight   | Net: 0.4 kg (0.9 lb)<br>Shipping: 1.0 kg (2.2 lb)  |
| Connector type   | Waveguide flange: UG-387/U   |
| Calibration Cycle  | 1 year   |

4. The characterized calibration factor should not deviate between periodic calibrations by more than the specified maximum uncertainty in the table. Compliance is confirmed by the relative deviation  $\left(\frac{|CF1-CF2|}{CF1}\right) \times 100$  being less than or equal to  $\sqrt{2}$  times the specified maximum uncertainty.  $\sqrt{2} * U_{max}$  with a reference calibration factor of 100%.

## Mechanical characteristic

Mechanical characteristics such as center conductor protrusion and pin depth are not performance specifications. They are, however, important supplemental characteristics related to electrical performance. At no time should the pin depth of the connector be protruding.

## Calibration factor and reflection coefficient

Calibration factor (CF) and reflection coefficient (Rho) data is unique to each sensor. The CF corrects for the frequency response of the sensor. The reflection coefficient (Rho or  $\rho$ ) relates to the SWR based on the following formula:  $SWR = \frac{1+\rho}{1-\rho}$ . Maximum relative uncertainties of the CF data are listed in each waveguide's respective tables. The relative uncertainty analysis for the calibration data was done in accordance with 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.

## Ordering Information

|                                     | Model                                  | Description   |
|-------------------------------------|--|---|
| E-Band                              | E8486A-100<br>E8486A-200<br>E8486A-201 | E-band power sensor, 60 to 90 GHz, -30 to +20 dBm<br>E-band power sensor, 60 to 90 GHz, -60 to +20 dBm<br>E-band power sensor, 54 to 95 GHz, -60 to +20 dBm |
| V-Band                              | V8486A                                 | V-band power sensor, 50 to 75 GHz, -30 to +20 dBm   |
| W-Band                              | W8486A                                 | W-band power sensor, 75 to 110 GHz, -30 to +20 dBm  |
| <b>Standard shipped accessories</b> |  |   |
| Hex ball driver                     |  |   |
| Waveguide mounting screws           |  |   |
| User's and Service Guide, English   |  |   |