

E8486A, V8486A, W8486A, N8486DD and N8486DG Waveguide Power Sensors



Make Accurate and Reliable Measurements from 50 GHz and Up to 220 GHz Frequency Range with Keysight's Family of Waveguide Power Sensors

Covering the V-band, E-band, W-band, D-band and G-band spectrums, Keysight Technologies, Inc. waveguide power sensors deliver superior SWR, high reliability and low loss, while featuring a 50 MHz calibration port to minimize measurement uncertainties. With the waveguide power sensor Option 200 (E8486A, N8486DD and N8486DG), you also benefit from a wide dynamic range, extending down from -60 up to +20 dBm.

Compatible with your current Keysight power meter

Keysight waveguide power sensors (E/V/W-band) are fully compatible with Keysight EPM (E4418/19B, N1913/14A and N1913/14B), EPM-P (E4416/17A) and P-Series (N1911/12A) power meters. The V/W8486A waveguide power sensors are also compatible with discontinued or obsolete power meters such as the 435B, 436A, 437B, 438A, 70100A, E1416A and E4418/19A power meters. Additionally, the N8486DD/DG waveguide power sensors are fully compatible with the N1913/14B and N1913/14A EPM 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 ¹	Maximum power	Connector type
E8486A-100	60 to 90 GHz	-30 to +10 dBm: < ±1% > +10 to +20 dBm: < ±2% ² > +10 to +20 dBm: < +1, -3% ³	200 mW avg, 40 W pk (10 μs per pulse, 0.5% duty cycle)	Waveguide flange: EIA WR-12
E8486A-200 ^{7, 8}	60 to 90 GHz	-60 to -10 dBm: < ±5.1% > -10 to +15 dBm: < ±6.3% > +15 to +20 dBm: < ±6.6%	200 mW avg, 1 W pk (10 μs per pulse, 0.5% duty cycle)	
V8486A	50 to 75 GHz	-30 to +10 dBm: < ±1% > +10 to +20 dBm: < ±2%	200 mW avg, 40 W pk (10 μs per pulse, 0.5% duty cycle)	Waveguide flange: EIA WR-15
W8486A	75 to 110 GHz	-30 to +20 dBm: < ±2%	200 mW avg, 40 W pk (10 μs per pulse, 0.5% duty cycle)	Waveguide flange: EIA WR-10
N8486DD-100	110 to 170 GHz	-30 to +10 dBm: < ±2% ⁴ > +10 to +15 dBm: < ±2.8% (<i>typ</i>) > +15 to +20 dBm: < ±4% (<i>typ</i>)	200 mW avg, 20 W pk (10 μs per pulse, 0.5% duty cycle)	Waveguide flange: EIA WR-6
N8486DD-200	110 to 170 GHz	-52 to -10 dBm: < ±3% ⁵ (<i>typ</i>) > -10 to +10 dBm: < ±4.5% (<i>typ</i>)	200 mW avg, 1 W pk (10 μs per pulse, 0.5% duty cycle)	
N8486DG-100	140 to 220 GHz	-30 to +10 dBm: < ±2% ⁴ > +10 to +15 dBm: < ±2.8% (<i>typ</i>) > +15 to +20 dBm: < ±4% (<i>typ</i>)	200 mW avg, 10 W pk (10 μs per pulse, 0.5% duty cycle)	Waveguide flange: EIA WR-5
N8486DG-200	140 to 220 GHz	-52 to -10 dBm: < ±3% ⁶ (<i>typ</i>) > -10 to +5 dBm: < ±4.5% (<i>typ</i>)	200 mW avg, 1 W pk (10 μs per pulse, 0.5% duty cycle)	

Supplemental characteristics, which are shown in *italics (typ)*, 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 (typ)* or denoted as “*typical*”, “*nominal*” or “*approximate*”.

¹ Negligible deviation except for those power ranges noted.

² For EPM series power meters.

³ For all other Keysight power meters

⁴ Linearity specifications do not include zero set, zero noise or measurement noise that dominantly contribute to the measurement uncertainty at the power levels within 17 dB of the lowest measurable power

⁵ Linearity specifications do not include zero set, zero noise or measurement noise that dominantly contribute to the measurement uncertainty at the power levels within 16 dB of the lowest measurable power

⁶ Linearity specifications do not include zero set, zero noise or measurement noise that dominantly contribute to the measurement uncertainty at the power levels within 19 dB of the lowest measurable power

⁷ Linearity specifications do not include zero set, zero noise or measurement noise that dominantly contribute to the measurement uncertainty at the power levels within 20 dB of the lowest measurable power

⁸ Applicable for firmware revision A.01.22 (and above) for N1913/14A and A.02.21 (and above) for N1913/14B EPM power meters.

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.

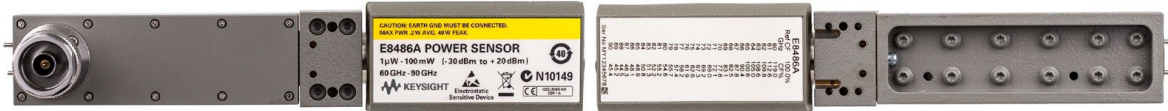


Figure 1. E8486A-100 comes without built-in EEPROM with a dynamic range of -30 to +20 dBm. Users need to pre-enter calibration factors printed on the back of the sensor into the power meter.



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
Frequency range ¹	Option 100/200: 60 to 90 GHz Option 201: 54 to 95 GHz
Power range	Option 100: -30 to +20 dBm (1 μ W to 100 mW) Option 200/201: -60 to +20 dBm (1 nW to 100 mW)
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. Option 200/201: 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 Option 200: < 1.28
Maximum SWR at 50 MHz	Option 100: < 1.066 Option 200: < 1.077
Maximum calibration factor relative uncertainty ²	60 to 64 GHz: 6.4% > 64 to 68 GHz: 5.7% > 68 to 74 GHz: 6.1% > 74 to 79 GHz: 7.3% > 79 to 90 GHz: 6.9%
Maximum power (damage level)	Option 100: 200 mW avg, 40 W pk (10 μ s per pulse, 0.5% duty cycle) Option 200: 200 mW avg, 1 W pk (10 μ s per pulse, 0.5% duty cycle)
Power linearity	Option 100: -30 to +10 dBm: < \pm 1% > +10 to +20 dBm: < \pm 2% (for EPM series power meters) > +10 to +20 dBm: < +1, -3% (for all other Keysight Power meters) Option 200 ³ : -60 to -10 dBm: < \pm 5.1% > -10 to +15 dBm: < \pm 6.3% > +15 to +20 dBm: < \pm 6.6%
Zero set	Option 100: < \pm 200 nW Option 200: < \pm 200 pW
Measurement noise	Option 100: < \pm 450 nW (<i>typ</i>) Option 200: < \pm 450 pW (<i>typ</i>)
Zero drift	Option 100: < \pm 40 nW (<i>typ</i>) Option 200: < \pm 40 pW (<i>typ</i>)
Connector type	50 MHz calibration port: Type N (male), 50 Ω nominal impedance Waveguide flange: UG-387/U Flange, EIA WR-12
Net weight	Net: 0.4 kg (0.9 lb.) / Shipping: 1 kg (2.2 lb.)
Dimensions	38 mm (w) x 199 mm (l) x 60 mm (h)
Calibration cycle	1 year

¹ 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.

² 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 ($|CF1-CF2|/CF1 \times 100$) being less than or equal to $\sqrt{2}$ times the specified maximum uncertainty. $\sqrt{2} \times U_{max}$ with a reference calibration factor of 100%.

³ Applicable for firmware revision A.01.22 (and above) for N1913/14A and A.02.21 (and above) for N1913/14B EPM power meters.

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
Frequency range	50 to 75 GHz
Power range	-30 to +20 dBm (1 μ W to 100 mW)
Maximum SWR	< 1.06
Maximum SWR at 50 MHz	< 1.073
Maximum calibration factor relative uncertainty ¹	50 to 53 GHz: 6.13% > 53 to 58 GHz: 5.49% > 58 to 64 GHz: 6.22% > 64 to 68 GHz: 5.73% > 68 to 75 GHz: 6.13%
Maximum power (waveguide port only)	200 mW average, 40 W peak (10 μ s 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: < \pm 1% > +10 to +20 dBm: < \pm 2%
Zero set	< \pm 200 nW
Measurement noise	< \pm 450 nW (typ)
Zero drift	< \pm 40 pW (typ)
Connector type	Waveguide flange: UG-385/U, EIA WR-15
Equivalent waveguide band designators to EIA WR-15	IEC R-620 British WG-25 JAN RG-273 MIL-W-85/3-018
Equivalent flange designator to UG-385/U	MIL-F-3922/67B-002
Calibration cycle	1 year

¹ 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 ($|CF1 - CF2| / CF1 \times 100$) being less than or equal to $\sqrt{2}$ times the specified maximum uncertainty. $\sqrt{2} \times U_{max}$ 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.

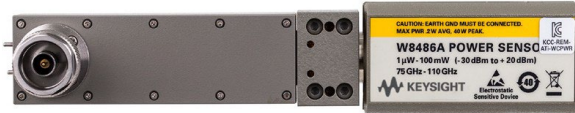


Figure 4. W8486A comes without built-in EEPROM. Users need to pre-enter calibration factors printed on the back of the sensor into the power meter.

Specifications

Specification	Description
Frequency range	75 to 110 GHz
Power range	-30 to +20 dBm (1 μ W to 100 mW)
Maximum SWR	< 1.08
Maximum SWR at 50 MHz	< 1.076
Maximum calibration factor relative uncertainty ¹	75 to 79 GHz: 7.86% > 79 to 94 GHz: 7.24% > 94 to 103 GHz: 6.98% > 103 to 108 GHz: 7.24% > 108 to 110 GHz: 7.77%
Maximum power (waveguide port only)	200 mW average, 40 W peak (10 μ s 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: < \pm 2%
Zero set	< \pm 200 nW
Measurement noise	< \pm 450 nW (typ)
Zero drift	< \pm 40 pW (typ)
Weight	Net: 0.4 kg (0.9 lb.) / Shipping: 1.0 kg (2.2 lb.)
Connector type	Waveguide flange: UG-387/U, EIA WR-10
Calibration cycle	1 year

¹ 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 ($|CF1-CF2|/CF1 \times 100$) being less than or equal to $\sqrt{2}$ times the specified maximum uncertainty. $\sqrt{2} * U_{max}$ with a reference calibration factor of 100%.

N8486DD D-Band / N8486DG G-Band Waveguide Power Sensors

Enable precise high-frequency source power calibration with the N8486DD and N8486DG, supporting the rapidly evolving 6G industry, particularly in R&D design validation and manufacturing. Designed with a WR-6 flange connector for the N8486DD and a WR-5 flange connector for the N8486DG, these sensors allow for accurate and direct waveguide measurements in the D/G-band frequency range and are compatible with Keysight EPM power meters (N1913/14B and N1913/14A). With a wide dynamic range of -52 up to +10 dBm and a built-in EEPROM to store calibration factors, Option 200 ensures the precision and accuracy you need in a single power sensor.



Figure 5. N8486DD-100 comes without built-in EEPROM with a 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 6. N8486DD-200 comes with built-in EEPROM to store calibration factors with extended dynamic range of -52 to +10 dBm.



Figure 7. N8486DG-100 comes without built-in EEPROM with a 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 8. N8486DG-200 comes with built-in EEPROM to store calibration factors with extended dynamic range of -52 to +5 dBm.

N8486DD Specifications

Specification	Description									
Frequency range	110 to 170 GHz									
Power range	Option 100: -30 to +20 dBm (1 μ W to 100 mW) Option 200: -52 to +10 dBm (6.3 nW to 10 mW)									
Type of power measurement	Option 100: -30 to +20 dBm (Average) Option 200: -52 to -10 dBm (Average) > -10 to +10 dBm (CW)									
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. 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	<table border="0"> <tr> <td></td> <td style="text-align: center;"><u>23 (+/- 3°C)</u></td> <td style="text-align: center;"> <u>0 to 55°C</u></td> </tr> <tr> <td>Option 100:</td> <td>110 to 150 GHz: < 1.07 > 150 to 170 GHz: < 1.08</td> <td>110 to 130 GHz: < 1.09 > 130 to 150 GHz: < 1.11 > 150 to 170 GHz: < 1.10</td> </tr> <tr> <td>Option 200:</td> <td>110 to 130 GHz: < 1.28 > 130 to 150 GHz: < 1.27 > 150 to 170 GHz: < 1.33</td> <td></td> </tr> </table>		<u>23 (+/- 3°C)</u>	<u>0 to 55°C</u>	Option 100:	110 to 150 GHz: < 1.07 > 150 to 170 GHz: < 1.08	110 to 130 GHz: < 1.09 > 130 to 150 GHz: < 1.11 > 150 to 170 GHz: < 1.10	Option 200:	110 to 130 GHz: < 1.28 > 130 to 150 GHz: < 1.27 > 150 to 170 GHz: < 1.33	
	<u>23 (+/- 3°C)</u>	<u>0 to 55°C</u>								
Option 100:	110 to 150 GHz: < 1.07 > 150 to 170 GHz: < 1.08	110 to 130 GHz: < 1.09 > 130 to 150 GHz: < 1.11 > 150 to 170 GHz: < 1.10								
Option 200:	110 to 130 GHz: < 1.28 > 130 to 150 GHz: < 1.27 > 150 to 170 GHz: < 1.33									
Maximum SWR at 50 MHz	Option 100: < 1.053 Option 200: < 1.095									
Maximum calibration factor relative uncertainty ¹	Option 100: 110 to 130 GHz: 8% > 130 to 140 GHz: 9% > 140 to 150 GHz: 7.5% > 150 to 170 GHz: 8.7% Option 200: 110 to 130 GHz: 7.6% (typ) > 130 to 140 GHz: 8.4% (typ) > 140 to 150 GHz: 6.8% (typ) > 150 to 170 GHz: 7.9% (typ)									
Maximum power (damage level)	Option 100: 200 mW avg, 20 W pk (10 μ s per pulse, 0.5% duty cycle) Option 200: 200 mW avg, 1 W pk (10 μ s per pulse, 0.5% duty cycle)									
Power linearity	Option 100 ² : -30 to +10 dBm: < \pm 2% > +10 to +15 dBm: < \pm 2.8% (typ) > +15 to +20 dBm: < \pm 4% (typ) Option 200 ³ : -52 to -10 dBm: < \pm 3% (typ) > -10 to +10 dBm: < \pm 4.5% (typ)									
Zero set	Option 100: < \pm 200 nW Option 200: < \pm 1.3 nW									
Measurement noise	Option 100: < \pm 450 nW (typ) Option 200: TBD									
Zero drift	Option 100: < \pm 40 nW (typ) Option 200: TBD									
Connector type	50 MHz calibration port: Type N (male), 50 Ω nominal impedance Waveguide flange: UG-387/U-M, WM-1651/WR-6, IEEE 1785.2 interface									

¹ 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 ($|CF1 - CF2|/CF1 \times 100$) being less than or equal to $\sqrt{2}$ times the specified maximum uncertainty. $\sqrt{2} \times U_{max}$ with a reference calibration factor of 100%.

² Linearity specifications do not include zero set, zero noise or measurement noise that dominantly contribute to the measurement uncertainty at the power levels within 17 dB of the lowest measurable power

³ Linearity specifications do not include zero set, zero noise or measurement noise that dominantly contribute to the measurement uncertainty at the power levels within 16 dB of the lowest measurable power

Net weight	Net: 0.426 kg (0.94 lb.) / Shipping: 1.2 kg (2.6 lb.)
Dimensions	38 mm (w) x 199 mm (l) x 60 mm (h)
Calibration cycle	1 year

N8486DG Specifications

Specification	Description
Frequency range	140 to 220 GHz
Power range	Option 100: -30 to +20 dBm (1 μ W to 100 mW) Option 200: -52 to +5 dBm (6.3 nW to 3.1 mW)
Type of power measurement	Option 100: -30 to +20 dBm (Average) Option 200: -52 to -10 dBm (Average @ 140 to 220 GHz) > -10 to +10 dBm (CW @ 140 to 170 GHz) > -10 to +5 dBm (CW @ > 170 to 220 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. 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	<u>23 (+/- 3°C)</u> <u>0 to 55°C</u> Option 100: 140 to 160 GHz: < 1.13 > 160 to 220 GHz: < 1.10 Option 200: 140 to 170 GHz: < 1.33 > 170 to 190 GHz: < 1.32 > 190 to 210 GHz: < 1.41 > 210 to 220 GHz: < 1.14
Maximum SWR at 50 MHz	Option 100: < 1.057 Option 200: < 1.093
Maximum calibration factor relative uncertainty ¹	Option 100: 140 to 150 GHz: 8.2% > 150 to 160 GHz: 7.3% > 160 to 170 GHz: 7.0% > 170 to 180 GHz: 9.1% > 180 to 190 GHz: 11.7% > 190 to 200 GHz: 9.2% > 200 to 210 GHz: 8.5% > 210 to 220 GHz: 10.1% Option 200: 140 to 160 GHz: 9.9% (typ) > 160 to 170 GHz: 9.5% (typ) > 170 to 190 GHz: 9.7% (typ) > 190 to 200 GHz: 9.4% (typ) > 200 to 210 GHz: 9.9% (typ) > 210 to 220 GHz: 10.2% (typ)
Maximum power (damage level)	Option 100: 200 mW avg, 10 W pk (10 μ s per pulse, 0.5% duty cycle) Option 200: 200 mW avg, 1 W pk (10 μ s per pulse, 0.5% duty cycle)

¹ 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 ($|CF1 - CF2|/CF1 \times 100$) being less than or equal to $\sqrt{2}$ times the specified maximum uncertainty. $\sqrt{2} \times U_{max}$ with a reference calibration factor of 100%.

² Linearity specifications do not include zero set, zero noise or measurement noise that dominantly contribute to the measurement uncertainty at the power levels within 17 dB of the lowest measurable power

³ Linearity specifications do not include zero set, zero noise or measurement noise that dominantly contribute to the measurement uncertainty at the power levels within 19 dB of the lowest measurable power

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 are unique to each sensor. The CF corrects for the frequency response of the sensor. The Reflection Coefficient (Rho or ρ) relates to the SWR based on the following formula: $SWR = (1+\rho)/(1-\rho)$. 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	E-band power sensor, 60 to 90 GHz, -30 to +20 dBm
	E8486A-200	E-band power sensor, 60 to 90 GHz, -60 to +20 dBm
	E8486A-201	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
D-Band	N8486DD-100	D-band power sensor, 110 to 170 GHz, -30 to +20 dBm
	N8486DD-200	D-band power sensor, 110 to 170 GHz, -52 to +10 dBm
G-Band	N8486DG-100	G-band power sensor, 140 to 220 GHz, -30 to +20 dBm
	N8486DG-200	G-band power sensor, 140 to 220 GHz, -52 to +5 dBm
Standard shipped accessories		
Hex ball driver		
Waveguide mounting screws		

Keysight enables innovators to push the boundaries of engineering by quickly solving design, emulation, and test challenges to create the best product experiences. Start your innovation journey at www.keysight.com.