

# Agilent N1911A/N1912A P-Series Power Meters and N1921A/N1922A Wideband Power Sensors

Data sheet



Agilent Technologies

## LXI Class-C-Compliant Power Meter

A P-Series power meter is a LXI Class-C-compliant instrument, developed using LXI Technology. LXI, an acronym for LAN eXtension for Instrumentation, is an instrument standard for devices that use the Ethernet (LAN) as their primary communication interface.

Hence, it is an easy- to- use instrument especially with the usage of an integrated Web browser that provides a convenient way to configure the instrument's functionality.

## Specification Definitions

There are two types of product specifications:

**Warranted specifications** are specifications which are covered by the product warranty and apply over a range of 0 to 55 °C unless otherwise noted. Warranted specifications include measurement uncertainty calculated with a 95 % confidence.

**Characteristic specifications** are specifications that are not warranted. They describe product performance that is useful in the application of the product. These characteristic specifications are shown in *italics*.

Characteristic information is representative of the product. In many cases, it may also be supplemental to a warranted specification. Characteristic specifications are not verified on all units. There are several types of characteristic specifications. They can be divided into two groups:

One group of characteristic types describes 'attributes' common to all products of a given model or option. Examples of characteristics that describe 'attributes' are the product weight and '50-ohm input Type-N connector'. In these examples, product weight is an 'approximate' value and a 50-ohm input is 'nominal'. These two terms are most widely used when describing a product's 'attributes'.

## General Features

|                      |  |
|----------------------|--|
| Number of channels   | <b>N1911A</b> P-Series power meter, single channel<br><b>N1912A</b> P-Series power meter, dual channel   |
| Frequency range      | <b>N1921A</b> P-Series wideband power sensor, 50 MHz to 18 GHz<br><b>N1922A</b> P-Series wideband power sensor, 50 MHz to 40 GHz   |
| Measurements         | Average, peak and peak-to-average ratio power measurements are provided with free-run or time-gated definitions.<br>Time parameter measurements of pulse rise time, fall time, pulse width, time-to-positive occurrence and time-to-negative occurrence are also provided.   |
| Sensor compatibility | P-Series power meters are compatible with all Agilent P-series wideband power sensors, E-Series sensors, 8480 Series sensors and N8480 Series sensors <sup>1</sup> . Compatibility with the 8480 and E-Series power sensors will be available free-of-charge in firmware release Ax.03.01 and above. Compatibility with N8480 Series power sensors will be available free-of-charge in firmware release A.05.00 and above. |

1. Information contained in this document refers to operations using P-Series sensors. For specifications relating to the use of 8480 and E-Series sensors (except E9320A range), refer to Lit Number 5965-6382E. For specifications relating to the use of E932XA sensors, refer to Lit Number 5980-1469E. For specifications relating to the use of N8480 Series sensors, refer to Lit Number 5989-9333EN.

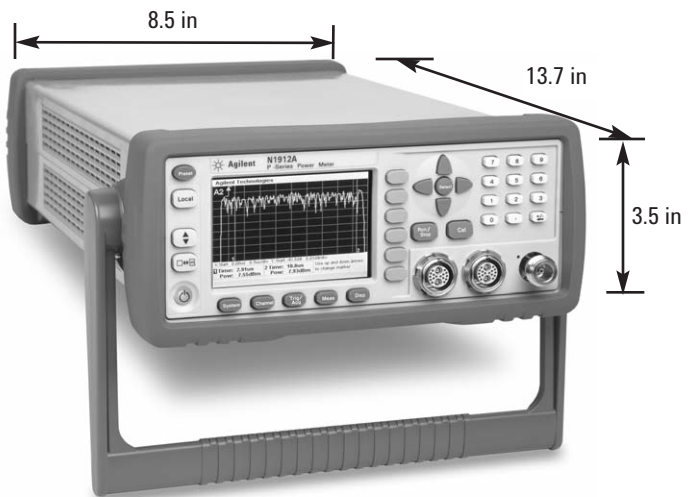
2. The dimensions stated does not include bumper.

## Conditions

The power meter and sensor will meet its specifications when:

- stored for a minimum of two hours at a stable temperature within the operating temperature range, and turned on for at least 30 minutes
- the power meter and sensor are within their recommended calibration period, and
- used in accordance to the information provided in the *User's Guide*.

## Physical Dimensions<sup>2</sup>



# P-Series Power Meter and Sensor

## Key System Specifications and Characteristics<sup>3</sup>

|                                    |   |
|------------------------------------|---|
| Maximum sampling rate              | 100 Msamples/sec, continuous sampling                                       |
| Video bandwidth                    | ≥ 30 MHz  |
| Single-shot bandwidth              | ≥ 30 MHz  |
| Rise time and fall time            | ≤ 13 ns (for frequencies ≥ 500 MHz) <sup>4</sup> ,<br>see Figure 1          |
| Minimum pulse width                | 50 ns <sup>5</sup>  |
| Overshoot                          | ≤ 5 % <sup>4</sup>  |
| Average power measurement accuracy | N1921A: ≤ ± 0.2 dB or ± 4.5 % <sup>6</sup><br>N1922A: ≤ ± 0.3 dB or ± 6.7 % |
| Dynamic range                      | -35 dBm to +20 dBm (> 500 MHz)<br>-30 dBm to +20 dBm (50 MHz to 500 MHz)    |
| Maximum capture length             | 1 second  |
| Maximum pulse repetition rate      | 10 MHz (based on 10 samples per period)                                     |

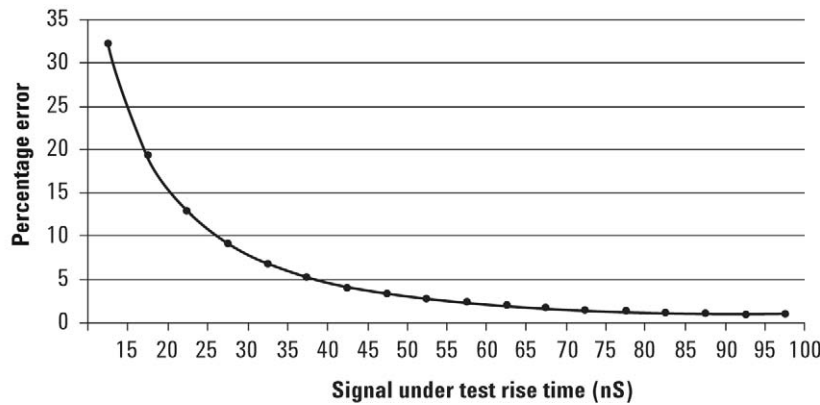


Figure 1. Measured rise time percentage error versus signal under test rise time

Although the rise time specification is ≤ 13 ns, this does not mean that the P-series meter and sensor combination can accurately measure a signal with a known rise time of 13 ns. The measured rise time is the root sum of the squares (RSS) of the signal under test rise time and the system rise time (13 ns):

$$\text{Measured rise time} = \sqrt{(\text{signal under test rise time})^2 + (\text{system rise time})^2},$$

and the % error is:

$$\% \text{ Error} = ((\text{measured rise time} - \text{signal under test rise time}) / \text{signal under test rise time}) \times 100$$

3. See Appendix A on page 9 for measurement uncertainty calculations.
4. Specification applies only when the Off video bandwidth is selected.
5. The Minimum Pulse Width is the recommended minimum pulse width viewable on the power meter, where power measurements are meaningful and accurate, but not warranted.
6. Specification is valid over a range of -15 to +20 dBm, and a frequency range of 0.5 to 10 GHz, DUT Max. SWR < 1.27 for the N1921A, and a frequency range of 0.5 to 40 GHz, DUT Max. SWR < 1.2 for the N1922A. Averaging set to 32, in Free Run mode.

# P-Series Power Meter Specifications

## Meter uncertainty

---

|                           |             |
|---------------------------|-------------|
| Instrumentation linearity | $\pm 0.8\%$ |
|---------------------------|-------------|

---

## Timebase

---

|                |                             |
|----------------|-----------------------------|
| Timebase range | <i>2 ns to 100 msec/div</i> |
| Accuracy       | $\pm 10$ ppm                |
| Jitter         | $\leq 1$ ns                 |

---

## Trigger

### Internal trigger

|                      |                                      |
|----------------------|--------------------------------------|
| Range                | <i>-20 to +20 dBm</i>                |
| Resolution           | <i>0.1 dB</i>                        |
| Level accuracy       | $\pm 0.5$ dB                         |
| Latency <sup>7</sup> | <i>160 ns <math>\pm</math> 10 ns</i> |
| Jitter:              | $\leq 5$ ns rms                      |

---

### External TTL trigger input

|                                   |  |
|-----------------------------------|--|
| High                              | $> 2.4$ V  |
| Low                               | $< 0.7$ V  |
| Latency <sup>8</sup>              | <i>90 ns <math>\pm</math> 10 ns</i>  |
| Minimum trigger pulse width       | <i>15 ns</i>   |
| Minimum trigger repetition period | <i>50 ns</i>   |
| Maximum trigger voltage input     | <i>15 V emf from 50 <math>\Omega</math> dc (current <math>&lt;</math> 100 mA), or 60 V emf from 50 <math>\Omega</math> (pulse width <math>&lt;</math> 1 s, current <math>&lt;</math> 100 mA)</i> |
| Impedance                         | <i>50 <math>\Omega</math></i>  |
| Jitter                            | $\leq 5$ ns rms  |

---

### External TTL trigger output

|                      |                                     |
|----------------------|-------------------------------------|
| High                 | $> 2.4$ V                           |
| Low                  | $< 0.7$ V                           |
| Latency <sup>9</sup> | <i>30 ns <math>\pm</math> 10 ns</i> |
| Impedance            | <i>50 <math>\Omega</math></i>       |
| Jitter               | $\leq 5$ ns rms                     |

---

### Trigger delay

|                  |   |
|------------------|---|
| Delay range      | $\pm 1.0$ s, maximum                                |
| Delay resolution | <i>1 % of delay setting</i><br><i>10 ns maximum</i> |

---

### Trigger hold-off

|            |  |
|------------|--|
| Range      | <i>1 <math>\mu</math>s to 400 ms</i>                           |
| Resolution | <i>1 % of selected value</i><br><i>(to a minimum of 10 ns)</i> |

---

### Trigger level threshold hysteresis

|            |                |
|------------|----------------|
| Range      | $\pm 3$ dB     |
| Resolution | <i>0.05 dB</i> |

---

7. Internal trigger latency is defined as the delay between the applied RF crossing the trigger level and the meter switching into the triggered state.

8. External trigger latency is defined as the delay between the applied trigger crossing the trigger level and the meter switching into the triggered state.

9. External trigger output latency is defined as the delay between the meter entering the triggered state and the output signal switching.

## P-Series Wideband Power Sensor Specifications

The P-series wideband power sensors are designed for use with the P-Series power meters only.

| Sensor model | Frequency range  | Dynamic range  | Damage level   | Connector type |
|--------------|------------------|--|--|----------------|
| N1921A       | 50 MHz to 18 GHz | -35 dBm to +20 dBm ( $\geq 500$ MHz)<br>-30 dBm to +20 dBm (50 MHz to 500 MHz) | +23 dBm (average power);<br>+30 dBm (< 1 $\mu$ s duration)<br>(peak power) | Type N (m)     |
| N1922A       | 50 MHz to 40 GHz | -35 dBm to +20 dBm ( $\geq 500$ MHz)<br>-30 dBm to +20 dBm (50 MHz to 500 MHz) | +23 dBm (average power);<br>+30 dBm (< 1 $\mu$ s duration)<br>(peak power) | 2.4 mm (m)     |

### Maximum SWR

| Frequency band     | N1921A | N1922A |
|--------------------|--------|--------|
| 50 MHz to 10 GHz   | 1.2    | 1.2    |
| 10 GHz to 18 GHz   | 1.26   | 1.26   |
| 18 GHz to 26.5 GHz |        | 1.3    |
| 26.5 GHz to 40 GHz |        | 1.5    |

## Sensor Calibration Uncertainty<sup>10</sup>

**Definition:** Uncertainty resulting from non-linearity in the sensor detection and correction process. This can be considered as a combination of traditional linearity, cal factor and temperature specifications and the uncertainty associated with the internal calibration process.

| Frequency band     | N1921A | N1922A |
|--------------------|--------|--------|
| 50 MHz to 500 MHz  | 4.5 %  | 4.3 %  |
| 500 MHz to 1 GHz   | 4.0 %  | 4.2 %  |
| 1 GHz to 10 GHz    | 4.0 %  | 4.4 %  |
| 10 GHz to 18 GHz   | 5.0 %  | 4.7 %  |
| 18 GHz to 26.5 GHz |        | 5.9 %  |
| 26.5 GHz to 40 GHz |        | 6.0 %  |

### Physical characteristics

|                            |            |   |
|----------------------------|------------|---|
| Dimensions                 | N1921A     | 135 mm x 40 mm x 27 mm (5.3 in x 1.6 in x 1.1 in) |
|                            | N1922A     | 127 mm x 40 mm x 27 mm (5.0 in x 1.6 in x 1.1 in) |
| Weights with cable         | Option 105 | 0.4 kg (0.88 lb)                                  |
|                            | Option 106 | 0.6 kg (1.32 lb)                                  |
|                            | Option 107 | 1.4 kg (3.01 lb)                                  |
| Fixed sensor cable lengths | Option 105 | 1.5 m (5-feet)                                    |
|                            | Option 106 | 3.0 m (10-feet)                                   |
|                            | Option 107 | 10 m (31-feet)                                    |

10. Beyond 70 % humidity, an additional 0.6 % should be added to these values.

## 1 mW Power Reference

**Note:** The 1 mW power reference is provided for calibration of E-Series, 8480 Series and N8480 Series sensors. The P-Series sensors are automatically calibrated and therefore do not need this reference for calibration

|                         |  |
|-------------------------|--|
| Power output            | 1.00 mW (0.0 dBm). Factory set to $\pm 0.4$ % traceable to the National Physical Laboratory (NPL) UK |
| Accuracy (over 2 years) | $\pm 1.2$ % (0 to 55 °C)<br>$\pm 0.4$ % (25 $\pm$ 10 °C)   |
| Frequency               | 50 MHz nominal   |
| SWR                     | 1.08 (0 to 55 °C)<br>1.05 typical  |
| Connector type          | Type N (f), 50 $\Omega$  |

### Rear-panel inputs/ outputs

|                                  |   |
|----------------------------------|---|
| Recorder output                  | Analog 0-1 Volt, 1 k $\Omega$ output impedance, BNC connector. For dual-channel instruments there will be two recorder outputs. |
| GPIO, 10/100BaseT LAN and USB2.0 | Interfaces allow communication with an external controller.   |
| Ground                           | Binding post, accepts 4 mm plug or bare-wire connection   |
| Trigger input                    | Input has TTL compatible logic levels and uses a BNC connector  |
| Trigger output                   | Output provides TTL compatible logic levels and uses a BNC connector  |
| Line power                       |   |
| Input voltage range              | 90 to 264 Vac, automatic selection  |
| Input frequency range            | 47 to 63 Hz and 440 Hz  |
| Power requirement                | N1911A           not exceeding 50 VA (30 Watts)<br>N1912A           not exceeding 75 VA (50 Watts)                              |

### Remote programming

|                    |   |
|--------------------|---|
| Interface          | GPIO interface operates to IEEE 488.2 and IEC65<br>10/100BaseT LAN interface<br>USB 2.0 interface |
| Command language   | SCPI standard interface commands  |
| GPIO compatibility | SH1, AH1, T6, TE0, L4, LE0, SR1, RL1, PP1, DC1, DT1, C0   |

### Measurement speed

Measurement speed via remote interface  $\geq 1500$  readings per second

### Regulatory information

|                               |  |
|-------------------------------|--|
| Electromagnetic compatibility | Complies with the requirements of the EMC Directive 89/336/EEC.  |
| Product safety                | Conforms to the following product specifications:<br>EN61010-1: 2001/IEC 1010-1:2001/CSA C22.2 No. 1010-1:1993<br>IEC 60825-1:1993/A2:2001/IEC 60825-1:1993+A1:1997+A2:2001<br>Low Voltage Directive 72/23/EEC |

### Physical characteristics

|            |  |
|------------|--|
| Dimensions | The following dimensions exclude front and rear panel protrusions: |
|------------|--|

88.5 mm H x 212.6 mm W x 348.3 mm D (3.5 in x 8.5 in x 13.7 in)

|                 |        |                                |
|-----------------|--------|--------------------------------|
| Net weight      | N1911A | ≤ 3.5 kg (7.7 lb) approximate  |
|                 | N1912A | ≤ 3.7 kg (8.1 lb) approximate  |
| Shipping weight | N1911A | ≤ 7.9 kg (17.4 lb) approximate |
|                 | N1912A | ≤ 8.0 kg (17.6 lb) approximate |

### Environmental conditions

|                                   |   |  |
|-----------------------------------|---|--|
| General                           | Complies with the requirements of the EMC Directive 89/336/EEC. |  |
| Operating                         |   |  |
| Temperature                       | 0 °C to 55 °C   |  |
| Maximum humidity                  | 95 % at 40 °C (non-condensing)                                  |  |
| Minimum humidity                  | 15 % at 40 °C (non-condensing)                                  |  |
| Maximum altitude                  | 3,000 meters (9,840 feet)                                       |  |
| Storage                           |   |  |
| Non-operating storage temperature | −30 °C to +70 °C  |  |
| Non-operating maximum humidity    | 90 % at 65 °C (non-condensing)                                  |  |
| Non-operating maximum altitude    | 15,420 meters (50,000 feet)                                     |  |

## System Specifications and Characteristics

The video bandwidth in the meter can be set to High, Medium, Low and Off. The video bandwidths stated in the table below are not the 3 dB bandwidths, as the video bandwidths are corrected for optimal flatness (except the Off filter). Refer to Figure 2 for information on the flatness response. The Off video bandwidth setting provides the warranted rise time and fall time specification and is the recommended setting for minimizing overshoot on pulse signals.

### Dynamic response - rise time, fall time, and overshoot versus video bandwidth settings

| Parameter                          | Video bandwidth setting |                |              |           |           |
|------------------------------------|-------------------------|----------------|--------------|-----------|-----------|
|                                    | Low: 5 MHz              | Medium: 15 MHz | High: 30 MHz | Off       |           |
|                                    |                         |                |              | < 500 MHz | > 500 MHz |
| Rise time/ fall time <sup>11</sup> | < 56 ns                 | < 25 ns        | ≤ 13 ns      | < 36 ns   | ≤ 13 ns   |
| Overshoot <sup>12</sup>            |                         |                |              | < 5 %     | < 5 %     |

*For option 107 (10m cable), add 5 ns to the rise time and fall time specifications.*

## Recorder Output and Video Output

The recorder output is used to output the corresponding voltage for the measurement a user sets on the Upper/Lower window of the power meter.

The video output is the direct signal output detected by the sensor diode, with no correction applied. The video output provides a DC voltage proportional to the measured input power through a BNC connector on the rear panel. The DC voltage can be displayed on an oscilloscope for time measurement. This option replaces the recorder output on the rear panel. The video output impedance is 50 ohm.

11. Specified as 10 % to 90 % for rise time and 90 % to 10 % for fall time on a 0 dBm pulse.

12. Specified as the overshoot relative to the settled pulse top power.

## Characteristic Peak Flatness

The peak flatness is the flatness of a peak-to-average ratio measurement for various tone separations for an equal magnitude two-tone RF input. Figure 2 refers to the relative error in peak-to-average ratio measurements as the tone separation is varied. The measurements were performed at -10 dBm with power sensors with 1.5 m cable lengths.

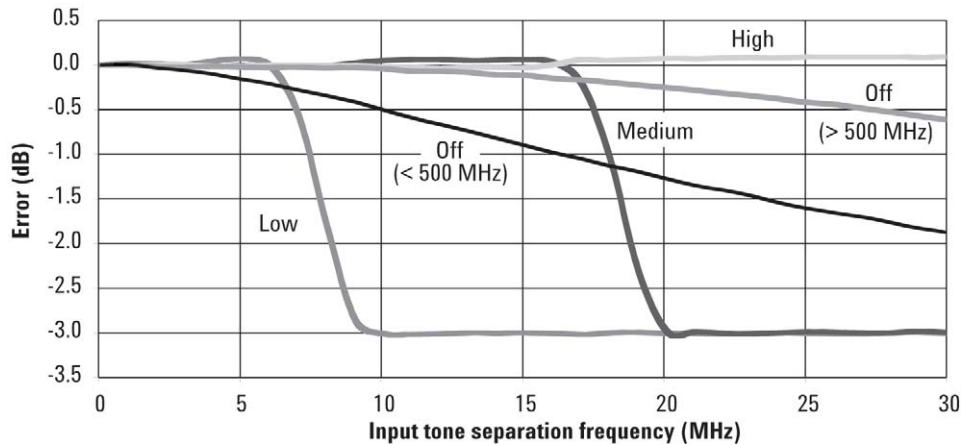


Figure 2. N192XA Error in peak-to-average measurements for a two-tone input (High, Medium, Low and Off filters)

### Noise and drift

| Sensor model   | Zeroing                      | Zero set         |           | Zero drift <sup>13</sup> | Noise per sample | Measurement noise (Free run) <sup>14</sup> |
|----------------|------------------------------|------------------|-----------|--------------------------|------------------|--|
|                |                              | < 500 MHz        | > 500 MHz |                          |                  |  |
| N1921A /N1922A | No RF on input<br>RF present | 200 nW<br>550 nW | 200 nW    | 100 nW                   | 2 μW             | 50 nW                                      |

| Measurement average setting | 1 | 2   | 4   | 8   | 16  | 32  | 64   | 128 | 256 | 512  | 1024 |
|-----------------------------|---|-----|-----|-----|-----|-----|------|-----|-----|------|------|
| Free run noise multiplier   | 1 | 0.9 | 0.8 | 0.7 | 0.6 | 0.5 | 0.45 | 0.4 | 0.3 | 0.25 | 0.2  |

| Video BW setting            |           | Low 5 MHz | Medium 15 MHz | High 30 MHz | Off |
|-----------------------------|-----------|-----------|---------------|-------------|-----|
| Noise per sample multiplier | < 500 MHz | 0.5       | 1             | 2           | 1   |
|                             | ≥ 500 MHz | 0.45      | 0.75          | 1.1         | 1   |

### Effect of video bandwidth setting

The noise per sample is reduced by applying the meter video bandwidth filter setting (High, Medium or Low). If averaging is implemented, this will dominate any effect of changing the video bandwidth.

### Effect of time-gating on measurement noise

The measurement noise on a time-gated measurement will depend on the time gate length. 100 averages are carried out every 1 μs of gate length. The Noise-per-Sample contribution in this mode can approximately be reduced by  $\sqrt{(\text{gate length}/10 \text{ ns})}$  to a limit of 50 nW.

13. Within 1 hour after a zero, at a constant temperature, after 24 hours warm-up of the power meter. This component can be disregarded with Auto-zero mode set to ON.

14. Measured over a one-minute interval, at a constant temperature, two standard deviations, with averaging set to 1.



# Appendix A

## Uncertainty calculations for a power measurement (settled, average power)

[Specification values from this document are in **bold italic**, values calculated on this page are underlined.]

### Process:

1. Power level: .....
2. Frequency: .....

### 3. Calculate meter uncertainty:

Calculate noise contribution

- If in Free Run mode, Noise = **Measurement noise x free run multiplier**
- If in Trigger mode, Noise = **Noise-per-sample x noise per sample multiplier**

- |  |   |
|--|---|
| Convert noise contribution to a relative term <sup>15</sup> = <u>Noise/Power</u> ..... | % |
| <b>Instrumentation linearity</b> .....   | % |
| <b>Drift</b> .....   | % |
| RSS of above three terms => <u>Meter uncertainty</u> = .....                           | % |

### 4. Zero Uncertainty

(Mode and frequency-dependent) = Zero set/Power = .....

### 5. Sensor calibration uncertainty

(Sensor, frequency, power and temperature-dependent) = .....

- |   |   |
|---|---|
| 6. <u>System contribution</u> , coverage factor of 2 => $sys_{RSS}$ = ..... | % |
| (RSS three terms from steps 3, 4 and 5)                                     |   |

### 7. Standard uncertainty of mismatch

**Max SWR** (Frequency-dependent) = .....

convert to reflection coefficient,  $|\rho_{Sensor}| = (SWR-1)/(SWR+1) =$  .....

Max DUT SWR (Frequency dependent) = .....

convert to reflection coefficient,  $|\rho_{DUT}| = (SWR-1)/(SWR+1) =$  .....

### 8. Combined measurement uncertainty @ k=1

|  |   |
|--|---|
| $U_C = \sqrt{\left(\frac{Max(\rho_{DUT}) \cdot Max(\rho_{Sensor})}{\sqrt{2}}\right)^2 + \left(\frac{sys_{RSS}}{2}\right)^2}$ | % |
|--|---|

Expanded uncertainty, k = 2, =  $U_C \cdot 2 =$  .....

15. The noise-to-power ratio is capped for powers > 100  $\mu$ W, in these cases use: Noise/100  $\mu$ W.

## Worked Example

### Uncertainty calculations for a power measurement (settled, average power)

[Specification values from this document are in **bold italic**, values calculated on this page are underlined.]

#### Process:

- |                       |              |
|-----------------------|--------------|
| 1. Power level: ..... | <u>1 mW</u>  |
| 2. Frequency: .....   | <u>1 GHz</u> |

3. Calculate meter uncertainty: *In free run, auto zero mode average = 16*

    Calculate noise contribution

- If in Free Run mode, **Noise** = **Measurement noise x free run multiplier** = **50 nW x 0.6 = 30 nW**
- If in Trigger mode, **Noise** = **Noise-per-sample x noise per sample multiplier**

- |  |               |
|--|---------------|
| Convert noise contribution to a relative term <sup>16</sup> = <u>Noise/Power</u> = <b>30 nW/100 μW</b> ..... | <u>0.03 %</u> |
| <b>Instrumentation linearity</b> .....   | <u>0.8 %</u>  |
| <b>Drift</b> .....   | -             |
| RSS of above three terms => <b>Meter uncertainty</b> = .....   | <u>0.8 %</u>  |

#### 4. Zero Uncertainty

|   |               |
|---|---------------|
| (Mode and frequency dependent) = Zero set/Power = ..... | <u>0.03 %</u> |
| <i>300 nW/1 mW</i>                                      |               |

|   |              |
|---|--------------|
| 5. Sensor calibration uncertainty<br>(Sensor, frequency, power and temperature-dependent) = ..... | <u>4.0 %</u> |
|---|--------------|

|   |               |
|---|---------------|
| 6. <b>System contribution</b> , coverage factor of 2 => $sys_{RSS}$ = ..... | <u>4.08 %</u> |
| (RSS three terms from steps 3, 4 and 5)                                     |               |

|   |             |
|---|-------------|
| 7. Standard uncertainty of mismatch<br><b>Max SWR</b> (Frequency-dependent) = ..... | <u>1.25</u> |
|---|-------------|

|  |              |
|--|--------------|
| convert to reflection coefficient, $ \rho_{Sensor}  = (SWR-1)/(SWR+1) = .....$ | <u>0.111</u> |
|--|--------------|

|   |             |
|---|-------------|
| Max DUT SWR (Frequency-dependent) = ..... | <u>1.26</u> |
|---|-------------|

|   |              |
|---|--------------|
| convert to reflection coefficient, $ \rho_{DUT}  = (SWR-1)/(SWR+1) = .....$ | <u>0.115</u> |
|---|--------------|

#### 8. Combined measurement uncertainty @ k = 1

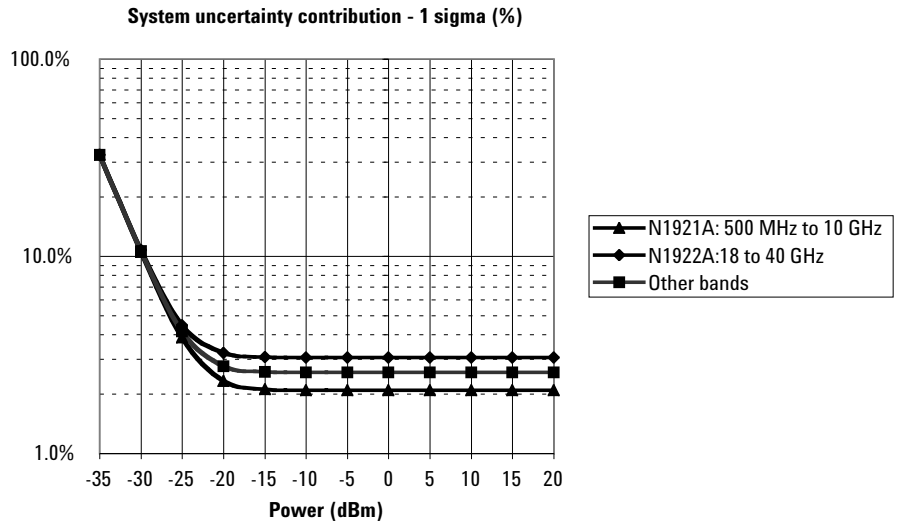
|  |               |
|--|---------------|
| $U_C = \sqrt{\left(\frac{\text{Max}(\rho_{DUT}) \cdot \text{Max}(\rho_{Sensor})}{\sqrt{2}}\right)^2 + \left(\frac{sys_{RSS}}{2}\right)^2}$ ..... | <u>2.23 %</u> |
|--|---------------|

|  |                |
|--|----------------|
| Expanded uncertainty, k = 2, = $U_C \cdot 2 = .....$ | <u>±4.46 %</u> |
|--|----------------|

16. The noise-to-power ratio is capped for powers > 100 μW, in these cases use: Noise/100 μW instead.

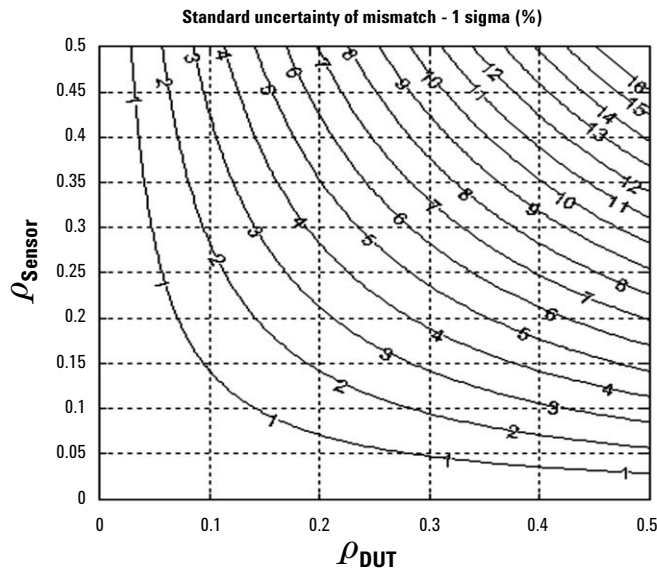
# Graphical Example

## A. System contribution to measurement uncertainty versus power level (equates to step 6 result/2)



Note: The above graph is valid for conditions of free-run operation, with a signal within the video bandwidth setting on the system. Humidity < 70 %.

## B. Standard uncertainty of mismatch



| SWR  | $\rho$ | SWR  | $\rho$ |
|------|--------|------|--------|
| 1.0  | 0.00   | 1.8  | 0.29   |
| 1.05 | 0.02   | 1.90 | 0.31   |
| 1.10 | 0.05   | 2.00 | 0.33   |
| 1.15 | 0.07   | 2.10 | 0.35   |
| 1.20 | 0.09   | 2.20 | 0.38   |
| 1.25 | 0.11   | 2.30 | 0.39   |
| 1.30 | 0.13   | 2.40 | 0.41   |
| 1.35 | 0.15   | 2.50 | 0.43   |
| 1.40 | 0.17   | 2.60 | 0.44   |
| 1.45 | 0.18   | 2.70 | 0.46   |
| 1.5  | 0.20   | 2.80 | 0.47   |
| 1.6  | 0.23   | 2.90 | 0.49   |
| 1.7  | 0.26   | 3.00 | 0.50   |

Note: The above graph shows the Standard Uncertainty of Mismatch =  $\rho_{DUT} \cdot \rho_{Sensor} / \sqrt{2}$ , rather than the Mismatch Uncertainty Limits. This term assumes that both the Source and Load have uniform magnitude and uniform phase probability distributions.

## C. Combine A & B

$$U_C = \sqrt{(Value\ from\ Graph\ A)^2 + (Value\ from\ Graph\ B)^2}$$

Expanded Uncertainty, k = 2, = 2.  $U_C = \dots \pm \dots \%$

## Ordering Information

| Model  | Description                              |
|--------|--|
| N1911A | P-series single-channel peak power meter |
| N1912A | P-series dual-channel peak power meter   |

### Standard-shipped accessories

- Power cord (plug matches country destination requirements)
- Product CD-ROM (contains English-language and localized manuals)
- IO Libraries CD-ROM
- Hardcopy User Manual (English)
- Programming Guide (English)
- Installation guide (English)
- USB adapter cable (p/n 8121-1354) (CA-ASSY USB type A-B plugs 4 - cond 6.0ft.)
- Calibration Certificate

### Warranty

- Standard 1-year, return-to-Agilent warranty and service plan for the N1911A/12A
- 3 months for standard-shipped accessories

## Options

| Meter      | Description   |
|------------|---|
| N191xA-003 | P-series single/dual-channel with rear panel sensors and power ref connectors |
| N191xA-H01 | P-series single/dual-channel with video output                                |

| Sensors    | Description                                     |
|------------|---|
| N192xA-105 | P-Series sensors fixed 1.5m (5ft) cable length  |
| N192xA-106 | P-Series sensors fixed 3.0m (10ft) cable length |
| N192xA-107 | P-Series sensors fixed 10m (31ft) cable length  |

| Cables     | Description                              |
|------------|--|
| N1917A     | P-series meter cable adaptor, 1.5m (5ft) |
| N1917B     | P-Series meter cable adaptor, 3m (10ft)  |
| N1917C     | P-Series meter cable adaptor, 10m (31ft) |
| N191xA-200 | 11730x cable adaptor                     |

| Other Accessories | Description   |
|-------------------|---|
| 34131A            | Transit case for half-rack 2U-high instruments (e.g., 34401A) |
| 34161A            | Accessory pouch   |
| N191xA-908        | Rack mount kit (one instrument)                               |
| N191xA-909        | Rack mount kit (two instruments)                              |

| Warranty & Calibration | Description   |
|------------------------|---|
| N191xA-1A7             | ISO17025 calibration data including Z540 compliance     |
| N191xA-A6J             | ANSI Z540 compliant calibration test data               |
| R-51B-001-3C           | Return to Agilent Warranty up front - 3 years plan      |
| R-51B-001-5C           | Return to Agilent Warranty up front - 5 years plan      |
| R-50C-011-3            | Agilent Calibration up front - 3 years plan             |
| R-50C-011-5            | Agilent Calibration up front - 5 years plan             |
| R-50C-016-3            | ISO 17025 Compliant Calibration up front - 3 years plan |
| R-50C-016-5            | ISO 17025 Compliant Calibration up front - 5 years plan |
| R-50C-021-3            | ANSI Z540-1-1994 Calibration up front - 3 years plan    |
| R-50C-021-5            | ANSI Z540-1-1994 Calibration up front - 5 years plan    |

| Documentation | Description  |
|---------------|--|
| N191xA-ABA    | English language manual set                            |
| N191xA-0B0    | Delete manual set                                      |
| N191xA-0BK    | Additional English language manual set                 |
| N191xA-0BW    | Service guide  |
| N191xA-ABF    | French localization user guide                         |
| N191xA-ABJ    | Japanese localization user guide                       |
| N192xA-0B1    | P-series sensor additional English language manual set |



### Agilent Email Updates

[www.agilent.com/find/emailupdates](http://www.agilent.com/find/emailupdates)

Get the latest information on the products and applications you select.



### Agilent Direct

[www.agilent.com/find/agilentdirect](http://www.agilent.com/find/agilentdirect)

Quickly choose and use your test equipment solutions with confidence.



[www.agilent.com/find/open](http://www.agilent.com/find/open)

Agilent Open simplifies the process of connecting and programming test systems to help engineers design, validate and manufacture electronic products. Agilent offers open connectivity for a broad range of system-ready instruments, open industry software, PC-standard I/O and global support, which are combined to more easily integrate test system development.



[www.lxistandard.org](http://www.lxistandard.org)

LXI is the LAN-based successor to GPIB, providing faster, more efficient connectivity. Agilent is a founding member of the LXI consortium.

## Remove all doubt

Our repair and calibration services will get your equipment back to you, performing like new, when promised. You will get full value out of your Agilent equipment throughout its lifetime. Your equipment will be serviced by Agilent-trained technicians using the latest factory calibration procedures, automated repair diagnostics and genuine parts. You will always have the utmost confidence in your measurements.

Agilent offers a wide range of additional expert test and measurement services for your equipment, including initial start-up assistance onsite education and training, as well as design, system integration, and project management.

For more information on repair and calibration services, go to

[www.agilent.com/find/removealldoubt](http://www.agilent.com/find/removealldoubt)

## www.agilent.com

[www.agilent.com/find/powermeter](http://www.agilent.com/find/powermeter)

For more information on Agilent Technologies' products, applications or services, please contact your local Agilent office. The complete list is available at:

[www.agilent.com/find/contactus](http://www.agilent.com/find/contactus)

### Phone or Fax Americas

|               |                |
|---------------|----------------|
| Canada        | (877) 894-4414 |
| Latin America | 305 269 7500   |
| United States | (800) 829-4444 |

### Asia Pacific

|           |                |
|-----------|----------------|
| Australia | 1 800 629 485  |
| China     | 800 810 0189   |
| Hong Kong | 800 938 693    |
| India     | 1 800 112 929  |
| Japan     | 0120 (421) 345 |
| Korea     | 080 769 0800   |
| Malaysia  | 1 800 888 848  |
| Singapore | 1 800 375 8100 |
| Taiwan    | 0800 047 866   |
| Thailand  | 1 800 226 008  |

### Europe & Middle East

|                |                     |
|----------------|---------------------|
| Austria        | 01 36027 71571      |
| Belgium        | 32 (0) 2 404 93 40  |
| Denmark        | 45 70 13 15 15      |
| Finland        | 358 (0) 10 855 2100 |
| France         | 0825 010 700*       |
|                | *0.125€/minute      |
| Germany        | 07031 464 6333**    |
|                | **0.14€/minute      |
| Ireland        | 1890 924 204        |
| Israel         | 972-3-9288-504/544  |
| Italy          | 39 02 92 60 8484    |
| Netherlands    | 31 (0) 20 547 2111  |
| Spain          | 34 (91) 631 3300    |
| Sweden         | 0200-88 22 55       |
| Switzerland    | 0800 80 53 53       |
| United Kingdom | 44 (0) 118 9276201  |

Other European Countries:

[www.agilent.com/find/contactus](http://www.agilent.com/find/contactus)

Revised: July 17, 2008

Product specifications and descriptions in this document subject to change without notice.

© Agilent Technologies, Inc. 2009

Printed in USA, July 10, 2009

5989-2471EN



**Agilent Technologies**