



Microwave CW USB Power Sensors

Low Cost, Compact, and Highly Accurate Power Sensors
for RF and Microwave Applications

MA24330A

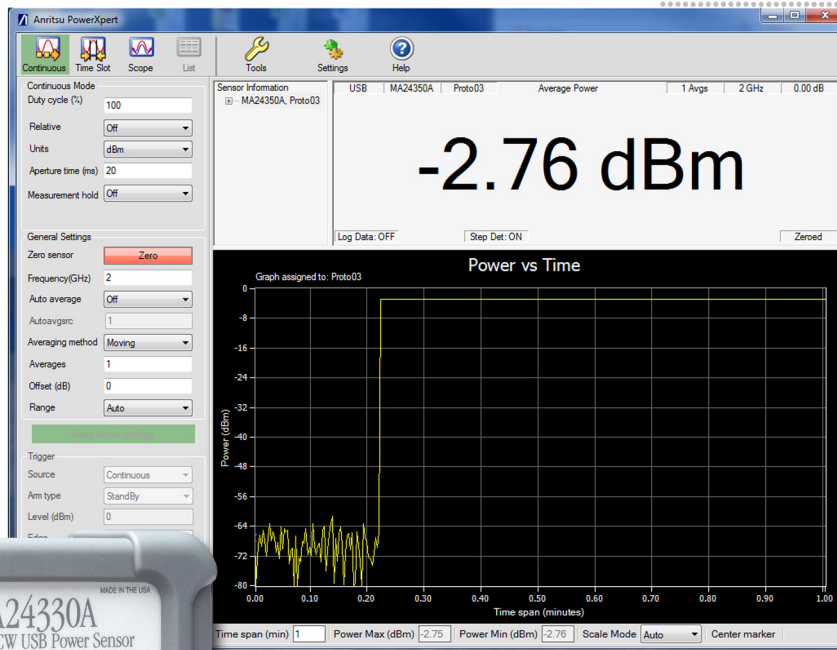
10 MHz to 33 GHz

MA24340A

10 MHz to 40 GHz

MA24350A

10 MHz to 50 GHz



Introduction

The MA243x0A series Microwave CW USB Power Sensors employ a single-path diode architecture to provide fast, accurate average power measurements from 10 MHz up to 50 GHz with 90 dB of dynamic range.

Features and Benefits

- Broad Frequency Range (10 MHz up to 50 GHz): Ideal for general purpose, aerospace and defense, satellite and wireless communications applications
- Accurate Power Measurements with over 90 dB Dynamic Range
- Best-in-Class Damage Protection (+26 dBm CW, +32 dBm peak < 10 μ s): Protects instrumentation investment
- No Zeroing Required (for signals > -50 dBm) and Elimination of 1 mW Reference Calibration: Reduces test time and handling in production while maintaining absolute accuracy
- Advanced Trigger Capabilities: Facilitates time dependent power measurements
- NIST Traceable Calibration: Provides high-accuracy measurements and ensures absolute accuracy
- Calibration Traceable to SI Units via National Metrology Institutes
- Easy to Use with PC or Select Anritsu Handheld Instruments: No benchtop power meter unit needed
- Silicone Protective Covering (removable): Provides additional field durability
- External Trigger Latching: For pulses as narrow as 20 ns



MA243x0A Series Microwave CW USB Power Sensors

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Definitions

All specifications and characteristics apply under the following conditions, unless otherwise stated:

| | |
|---------------------------------|---|
| Warm-Up Time | 60 minutes |
| Operating Temperature Range | 0 °C to 50 °C |
| Characteristic Performance | Characteristic specifications are not tested and are not warranted. |
| ISO GUM Measurement Uncertainty | Zero and Noise uncertainty expressed with coverage factor of k=3. Average and Relative Power uncertainty expressed with coverage factor of k=2. |
| Calibration Cycle | Anritsu recommended calibration interval is 12 months. All specifications subject to change without notice. For the most current data sheet, please visit the Anritsu web site: www.anritsu.com |
| Notes | Sensors may have degraded performance when dropped without the removable protective covering. This cover is required for warranted operation. |

Sensor Specifications

Frequency

| | |
|----------|----------------------------------|
| MA24330A | 10 MHz to 33 GHz, K(m) Connector |
| MA24340A | 10 MHz to 40 GHz, K(m) Connector |
| MA24350A | 10 MHz to 50 GHz, V(m) Connector |

Power Measurement

| | | | | | | | | |
|--------------------------|--|---------------|----------------|-------------|--------------|---------------|---------------|---------------|
| | <50 MHz | 50 to 150 MHz | >0.15 to 2 GHz | >2 to 6 GHz | >6 to 18 GHz | >18 to 33 GHz | >33 to 40 GHz | >40 to 50 GHz |
| VSWR | 1.9:1 | 1.17:1 | 1.08:1 | 1.16:1 | 1.21:1 | 1.29:1 | 1.44:1 | 1.5:1 |
| Dynamic Range | -70 dBm to +20 dBm | | | | | | | |
| Damage Levels at RF Port | +26 dBm, ±20 V DC (+32 dBm peak <10 µs pulse and 10 % duty cycle), minimum | | | | | | | |

Response

| | |
|--------------------------|---------------------|
| Signal Channel Rise Time | 8 µs characteristic |
| Sampling Rate | 140 kS/s |

Trigger

| | |
|----------------------------------|-------------------------------------|
| Source ¹ | Bus, Continuous, Internal, External |
| Arm Type (for Internal/External) | Auto, Single, Multiple, Standby |

Internal Trigger

| | |
|------------------|---------------------------------------|
| Dynamic Range | -35 dBm to +20 dBm |
| Level Accuracy | ±0.5 dB characteristic |
| Slope | Positive or Negative |
| Delay Range | -5 ms to +10 s |
| Delay Resolution | 10 µs |
| Hysteresis | 0 dB to 10 dB, with 0.1 dB resolution |
| Trigger Hold Off | 0 s to 10 s, with 0.01 ms resolution |

External Trigger

| | |
|---------------------------|-------------------------------------|
| External Trigger Input | MCX (female), 5.5 V maximum |
| Input Impedance | 4 kΩ nominal |
| Type | TTL/CMOS |
| Slope | Positive or Negative |
| Delay Range | -5 ms to +10 s |
| Delay Resolution | 10 µs |
| High Level Input Voltage | 2.3 V min, 3.0 V max |
| Low Level Input Voltage | 1.3 V min, 1.6 V max |
| Latency ² | 7.1 µs max |
| Trigger Pulse Width | 20 ns min |
| Trigger Repetition Period | 7.1 µs min |
| Trigger Holdoff | 0 s to 10 s with 0.01 ms resolution |

1. Bus trigger is not available in PowerXpert application.

2. Latency is defined as the time delay between the defined edge of the applied trigger and the sensor switching into the triggered state.

Measurement Uncertainty

| | | | | | |
|---------------------------------|-----------------|----------|-------------------|-------------------|--------|
| Average Power (dB) ³ | 25 °C to 35 °C: | | | | |
| | Range (dBm) | ≤18 GHz | >18 GHz to 40 GHz | >40 GHz to 50 GHz | |
| | -70 to <+15 | 0.11 | 0.13 | 0.19 | |
| | +15 to +20 | 0.14 | 0.17 | 0.23 | |
| | 0 °C to 50 °C: | | | | |
| | Range (dBm) | ≤18 GHz | >18 GHz to 40 GHz | >40 GHz to 50 GHz | |
| -70 to <+15 | 0.14 | 0.17 | 0.25 | | |
| +15 to +20 | 0.18 | 0.21 | 0.29 | | |
| Zero ⁴ | Set | | Drift | | |
| | Range (dBm) | Watt | dBm | Watt | dBm |
| | -70 to -20 | 9.68E-11 | -70.14 | 8.90E-11 | -70.50 |
| | >-20 to 0 | 4.95E-09 | -53.05 | 4.14E-09 | -53.83 |
| | >0 to +20 | 1.56E-08 | -48.08 | 1.72E-08 | -47.65 |
| Noise ⁵ | Range (dBm) | Watt | dBm | | |
| | -70 to -20 | 3.53E-11 | -74.52 | | |
| | >-20 to 0 | 6.51E-11 | -71.86 | | |
| | >0 to +20 | 6.30E-10 | -62.01 | | |

- Power uncertainty expressed with coverage factor of k=2 for CW measurement after zero operation. Includes calibration factor and linearity over temperature uncertainties, but not the effects of mismatch, zero set and drift, or noise.
- Zero uncertainty expressed with coverage factor of k=3. One hour warm-up followed by a Zero operation. Measured with 256 averages and 40 ms aperture and with the temperature kept within ±1 °C.
Zero Set: Average of the reported power over one hour.
Zero Drift: Two sigma value of the reported power over one hour.
Specified Zero Set, Drift and Noise are valid at 30 °C ± 5 °C.
- Two sigma noise at 10.2 seconds of integration time (integration time = aperture time x averaging number). Effect of noise can be reduced by increasing the number of averages and/or increasing the aperture time. Noise is inversely proportional to the square root of number of ADC samples used per measurement; the number of ADC samples per measurement is the product of the sample rate, aperture time, and number of averages used. Noise uncertainty is expressed with coverage factor of k=3.

PowerXpert™

PC Requirements (version 3.0 or greater)

| | |
|----------------------|---|
| Processor and RAM | Minimum: Equivalent to Intel® Pentium® III with 1 GB RAM or Intel® Pentium® IV with 512 MB RAM Recommended: Equivalent to Intel® Pentium® IV with 1 GB RAM |
| Operating System | Microsoft® Windows® 8, Windows® 7, and Windows® XP |
| Hard-Disk Free Space | 100 MB minimum |
| Display Resolution | 1024 × 768 minimum |
| Interface | USB 2.0 high speed |

System

| | |
|--|--|
| Measurand | Average power |
| Measurement Resolution | 0.01 dB max via PowerXpert™, 0.001 dB max via remote command |
| Offset Correction ⁶ | -100 dB to +150 dB |
| Averaging Type | Auto, Manual Moving, Repeat |
| Number of Averages (Manual) ⁷ | 1 to 65,536 |
| Auto Average Resolution ⁸ | 1 dB, 0.1 dB, 0.01 dB |
| Auto Average Source | Scope Data Point Number: 1 to 16,384 |

Continuous Average Mode

| | |
|-------------------------------|--|
| Duty Cycle Correction | 0.01 % to 100 % |
| Aperture Time | 0.01 ms to 1 s |
| Measurement Time ⁹ | $N \times (\text{aperture time} \times C_t) + T_{com}$ Continuous: >2,100 readings/s (minimum aperture, one average) Buffered: >5,600 readings/s (minimum aperture, one average) |
| Buffer Size | 8192 |

Scope Mode

| | |
|--------------------------------|---|
| Capture Time | 0.01 ms to 1 s |
| Data Points | 1 to 16,384 |
| Resolution | 0.01 ms max |
| Measurement Time ¹⁰ | $N \times (\text{capture time} \times C_t) + (P_n \times 0.038 \text{ ms}) + T_{com}$ |

List Mode

| | |
|------------------------|---|
| Number of Measurements | 1 to 1000 |
| Input Parameters | Frequency (GHz), aperture time (ms), averages |

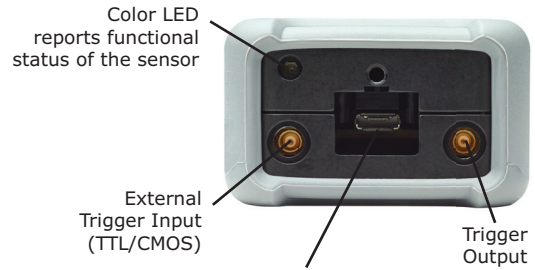
6. Offset correction feature is available only through the PowerXpert application. There is no remote command for it in the sensor firmware.
7. Maximum number of averages allowed in Continuous Average mode is 65,536. In Scope mode, the maximum number of averages is equal to 16,777,216 divided by the number of data points.
8. Averaging resolution of 0.001 dB is not available with the PowerXpert application. It is defined as the place after the decimal to which the reading becomes stable. For example, if 0.01 is selected, then the reading will typically be stable within ± 0.01 dB. Please refer to the remote operation chapter in the user guide for information regarding access to this feature.
9. Speed is defined as the data throughput at the "A" end of the USB A to Micro-B Cable (p/n 2000-1816-R), where:
Number of Repeat Averages = N (N = 1 for moving average mode)
Capture Time Coefficient = $C_t = 8.238$
Command Processing Time = $T_{com} = 0.347$ ms
Speed may vary depending on the speed of and load on the CPU controlling the sensor. Specified results obtained with Intel® Core™ i5-3550 CPU running at 3.30 GHz
10. Speed is defined as the data throughput at the "A" end of the USB A to Micro-B Cable (p/n 2000-1816-R), where:
Number of Repeat Averages = N (N = 1 for moving average mode)
Capture Time Coefficient = $C_t = 8.238$
Number of Points = P_n
Command Processing Time = $T_{com} = 0.289$ ms

General

| | |
|---------------------|---|
| RF Connector | K male (MA24330A, MA24340A) V male (MA24350A) |
| Interface to Host | USB 2.0 high speed |
| Current Consumption | 410 mA to 450 mA characteristic (20 °C to 30 °C) |
| Size | 110 mm x 46 mm x 25.6 mm, excluding K or V connector and silicone protective covering |
| Weight | 397 g (0.88 lb) |
| Warranty | 1 year |



K and V Type connectors designed for use with a torque wrench ensuring repeatable connections



Color LED reports functional status of the sensor

External Trigger Input (TTL/CMOS)

Trigger Output

USB Micro-B port for connectivity to host (PC or Anritsu handheld instrument)

Operational Requirements

Tests were performed per MIL-PRF-28800F (Class 3).

| | |
|-----------------------------|--|
| Operating Temperature Range | 0 °C to 50 °C |
| Storage Temperature Range | -40 °C to +71 °C |
| Humidity | 45 % relative humidity at 50 °C (non-condensing) 75 % relative humidity at 40 °C (non-condensing) 95 % relative humidity at 30 °C (non-condensing) |
| Altitude | 4600 m operational max |
| Shock | 30 g _n half-sine, 11 ms duration |
| Vibration | Sinusoidal: 5 Hz to 55 Hz, 3 g max Random: 10 Hz to 500 Hz Power Spectral Density: 0.03 g ² / Hz |

Regulatory Compliance

| | |
|---------------------------|--|
| European Union | EMC 2014/30/EU, EN 61326:2013, CISPR 11/EN 55011, IEC/EN 61000-4-2/3/4/5/6/8/11 Low Voltage Directive 2014/35/EU Safety EN 61010-1:2010 RoHS Directive 2011/65/EU |
| Australia and New Zealand | RCM AS/NZS 4417:2012 |
| South Korea | KCC-REM-A21-0004 |

Ordering Information

Available Models

| | |
|----------|-------------------------|
| MA24330A | 33 GHz USB Power Sensor |
| MA24340A | 40 GHz USB Power Sensor |
| MA24350A | 50 GHz USB Power Sensor |

Included Accessories

| | |
|-------------|------------------------------|
| 10585-00021 | Quick Start Guide |
| 2000-1605-R | 1.5 m BNC(m) to MCX(m) cable |
| 2000-1816-R | 1.8 m USB A to Micro-B cable |

Available Options

| | |
|--------------|---|
| MA24330A-097 | Option 97: ISO/IEC 17025 and ANSI/NCSL Z540-1 or ANSI/NCSLI Z540.3 (includes test report, uncertainty data, and accreditation symbol) |
| MA24340A-097 | |
| MA24330A-098 | Option 98: Standard calibration ISO/IEC 17025 and ANSI/NCSL Z540-1 |
| MA24340A-098 | |
| MA24350A-098 | |
| MA24330A-099 | Option 99: Premium calibration ISO/IEC 17025 and ANSI/NCSL Z540-1 (includes test report and uncertainty data) |
| MA24340A-099 | |
| MA24350A-099 | |

Optional Accessories

Calibrated Torque Wrenches

| | |
|--------|---|
| 01-201 | Calibrated torque wrench for K and V connectors |
|--------|---|

Precision Fixed Attenuators

| | |
|---------|---|
| 41KB-3 | DC to 26.5 GHz, 3 dB, 50 Ω , K(m) to K(f) |
| 41KB-6 | DC to 26.5 GHz, 6 dB, 50 Ω , K(m) to K(f) |
| 41KB-10 | DC to 26.5 GHz, 10 dB, 50 Ω , K(m) to K(f) |
| 41KB-20 | DC to 26.5 GHz, 20 dB, 50 Ω , K(m) to K(f) |
| 41KC-3 | DC to 40 GHz, 3 dB, 50 Ω , K(m) to K(f) |
| 41KC-6 | DC to 40 GHz, 6 dB, 50 Ω , K(m) to K(f) |
| 41KC-10 | DC to 40 GHz, 10 dB, 50 Ω , K(m) to K(f) |
| 41KC-20 | DC to 40 GHz, 20 dB, 50 Ω , K(m) to K(f) |
| 41V-3 | DC to 60 GHz, 3 dB, 50 Ω , V(m) to V(f) |
| 41V-6 | DC to 60 GHz, 6 dB, 50 Ω , V(m) to V(f) |
| 41V-10 | DC to 60 GHz, 10 dB, 50 Ω , V(m) to V(f) |
| 41V-20 | DC to 60 GHz, 20 dB, 50 Ω , V(m) to V(f) |
| 43KB-3 | DC to 26.5 GHz, 3 dB, 50 Ω , K(m) to K(f) |
| 43KB-6 | DC to 26.5 GHz, 6 dB, 50 Ω , K(m) to K(f) |
| 43KB-10 | DC to 26.5 GHz, 10 dB, 50 Ω , K(m) to K(f) |
| 43KB-20 | DC to 26.5 GHz, 20 dB, 50 Ω , K(m) to K(f) |
| 43KC-3 | DC to 40 GHz, 3 dB, 50 Ω , K(m) to K(f) |
| 43KC-6 | DC to 40 GHz, 6 dB, 50 Ω , K(m) to K(f) |
| 43KC-10 | DC to 40 GHz, 10 dB, 50 Ω , K(m) to K(f) |
| 43KC-20 | DC to 40 GHz, 20 dB, 50 Ω , K(m) to K(f) |

Precision Coaxial Adapters

| | |
|-----------|--|
| 33KFKF50B | DC to 40 GHz, 50 Ω , K(f) to K(f) |
| 33KKF50B | DC to 40 GHz, 50 Ω , K(m) to K(f) |
| 33VVF50C | DC to 70 GHz, 50 Ω , V(f) to V(f) |
| 33VVF50C | DC to 70 GHz, 50 Ω , V(m) to V(f) |
| 34NKF50 | DC to 18 GHz, 50 Ω , N(m) to K(f) |
| 34NFKF50 | DC to 18 GHz, 50 Ω , N(f) to K(f) |

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Data subject to change without notice.
For the most recent specifications, visit: www.anritsu.com.

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