

MA24104A Inline High Power Sensor

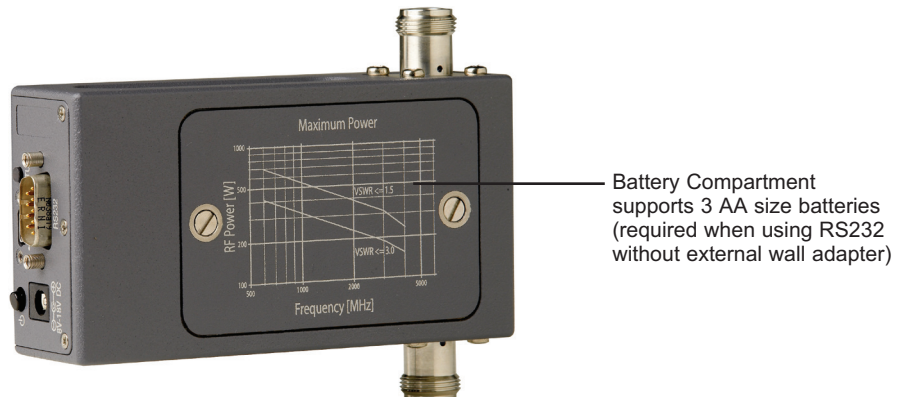
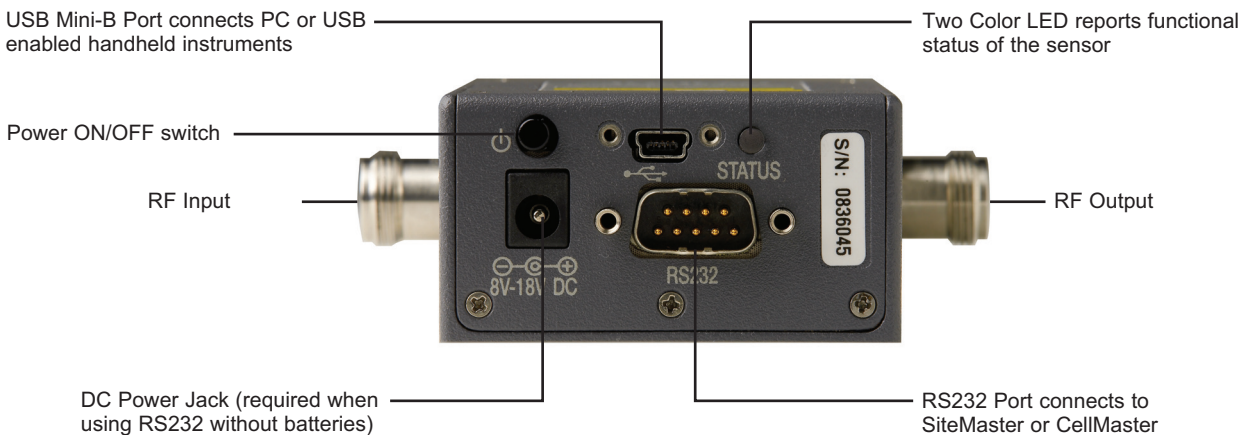
True-RMS, 600 MHz to 4 GHz

A Standalone, Compact, and Highly Accurate Inline High Power Sensor
for your RF Power Measurement Needs

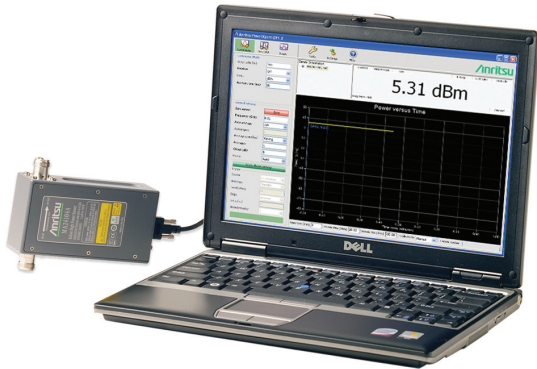


MA24104A at a Glance

Feature	Benefit
Broad Frequency Range (600 MHz to 4 GHz)	Covers all major cellular and communication bands, such as WLL, GSM/EDGE, CDMA/EV-DO, WCDMA/HSDPA, WiMAX, and TD-SCDMA
Widest Dynamic Range Inline Power Sensor in its Class	Eliminates need for additional low level power sensors
True-RMS Measurements to 150 W	Enables accurate average power measurements of modulated signals
Standalone, Low Cost, Plug and Play Device	No extra elements or element holder required
Compatible with Anritsu Handhelds	No base unit needed
High Power Handling	Ideal for high crest factor signal and base station transmitter output power measurements
1 mW Calibration Need Eliminated	Reduces test time and handling in production
Operates using USB power, external wall adapter, or AA batteries	Provides flexibility



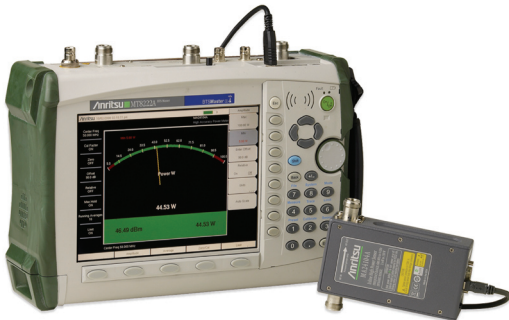
Complements Your Existing Instrument



The Anritsu MA24104A Inline High Power Sensor is designed to take accurate average power measurements from 600 MHz to 4 GHz and power levels from 2 mW to 150 W. The sensor employs a “dual path” architecture that enables True-RMS measurements over the entire frequency and dynamic range allowing users to measure CW, multi-tone and digitally modulated signals such as GSM/EDGE, CDMA/EV-DO, WCDMA/HSDPA, WiMAX, and TD-SCDMA. The presence of a micro-controller along with signal conditioning circuitry, ADC, and power supply in the sensor makes it a complete miniature power meter.

Operation with PC

The power sensor can be used with a PC running Microsoft® Windows via USB. It comes with PowerXpert™ application (version 2.0 or greater) for data display, analysis, and sensor control. The software provides a front panel display making the PC appear like a traditional power meter. The application has abundant features like data logging, power versus time graph, and offset table that enable quick and accurate measurements.



Operation with Anritsu Handheld Instruments

Handheld instruments having the high accuracy power meter software Option 19 can operate the MA24104A Inline High Power Sensor. The MA24104A is currently compatible with Site Master™ (S3xxE), Spectrum Master™ (MS271xE and MS272xB), Cell Master™ (MT8212E), BTS Master™ (MT822xB), VNA Master™ (MS202xA/B and MS203xA) and Economy Benchtop Spectrum Analyzers (MS271xB). The power sensor easily connects to these instruments via a USB A/mini-B cable. An additional benefit of using the USB connection is that a separate DC supply (or battery) is not needed since the necessary power is supplied by the instrument.



In contrast, instruments with an RS-232 serial interface require an external DC supply or three AA batteries in addition to the RS-232 serial cable. These RS-232 instruments include the Site Master™ (S3xxD), Cell Master™ (MT8212B and MS2711D) and LMR Master™ (S412D) products. Measurements outside of the laboratory, such as during cellular base station installation, maintenance, and repair are easy when battery power is used.



MA24104A Applications

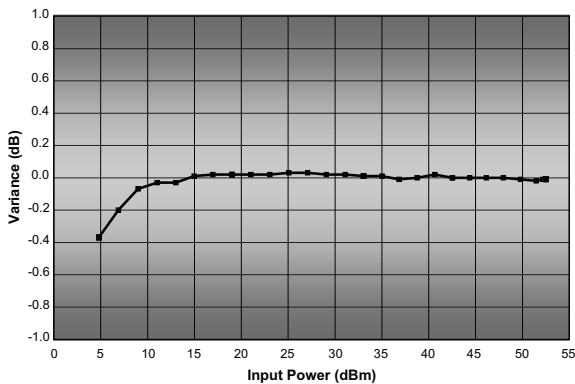


Figure 1. Measurement linearity error referenced to an ideal thermal power sensor measurement of a 1 GHz CW signal.

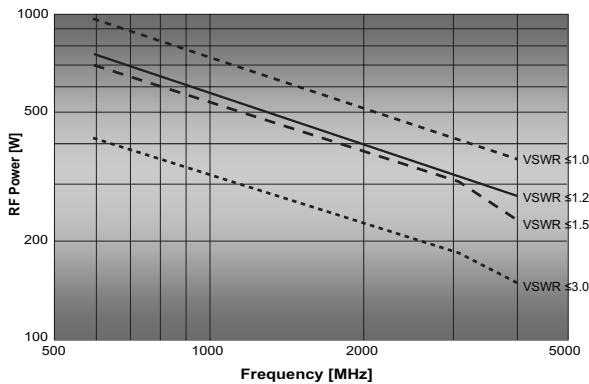


Figure 2. Maximum power handling capacity of the sensor terminated with a load having VSWR of ≤ 1.0 , ≤ 1.2 , ≤ 1.5 and ≤ 3.0 .

High Accuracy Measurements

Accurate power measurements in the field are important for verifying that transmitter outputs are operating at specified levels. For example, service technicians need to verify base station output power because lower output power can quickly translate into large coverage differences. Highly accurate average power measurements to 150 W are assured as the calibration data is stored directly in the sensor and all necessary corrections (frequency and temperature) are done inside the microprocessor of the sensor. Also, the return loss and directivity of the instrument are optimized to maintain high accuracy. The standards used to calibrate this sensor are directly traceable to NIST.

Continuous Monitoring of Radio Systems

This sensor is designed to have good match and low insertion loss making it ideal for continuous power monitoring of transmitter systems and antennas. The data logging function in the PowerXpert software application for PC equips the user the ability to record measured power over time to a hard disc or other storage media. This is useful for long term drift measurements, environmental testing, and trend analysis. A user settable data logging interval allows measurement speed adjustment to match the user test application requirements. Data are stored as comma-separated files that can be directly opened in Microsoft® Excel allowing powerful custom analysis of measured data.

Ideal for Field

The MA24104A power sensor provides lab performance accuracy in a rugged and portable field solution. The sensor is accurate over a wide temperature range (0 °C to 55 °C), making it perfect for cellular base station installation and maintenance applications. Field and service technicians will appreciate the small size and lightweight of this stand-alone unit as they will not have to carry extra elements, heavy high power attenuators, or power meters. The unit is designed to accept three standard (size AA) batteries that can be Alkaline, Lithium or rechargeable Nickel-metal hydride (NiMH) when operation via the RS232 port is required. A very easy to use PC application with a large display makes the job even easier for technicians who need accurate measurement results quickly.

CW Measurements of CW, Pulsed, or Modulated Signals

The MA24104A is rated to meet all specifications up to an average input power level of 150 W. Although the average power of all signals should be kept at or below 150 W, time varying and burst signals having peak powers less than the limits shown in the Maximum Power graph can be measured. To ensure accurate readings, the peak to average ratio (crest factor) of signals must be less than 12 dB.

More Applications

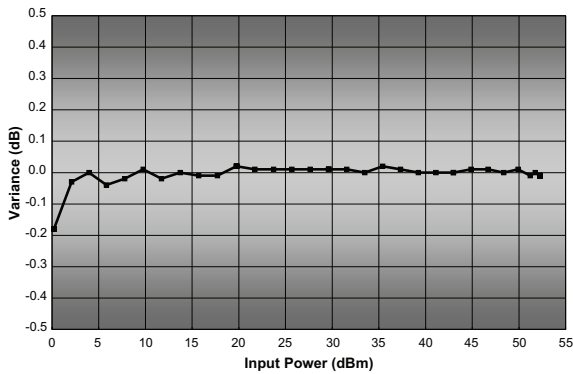


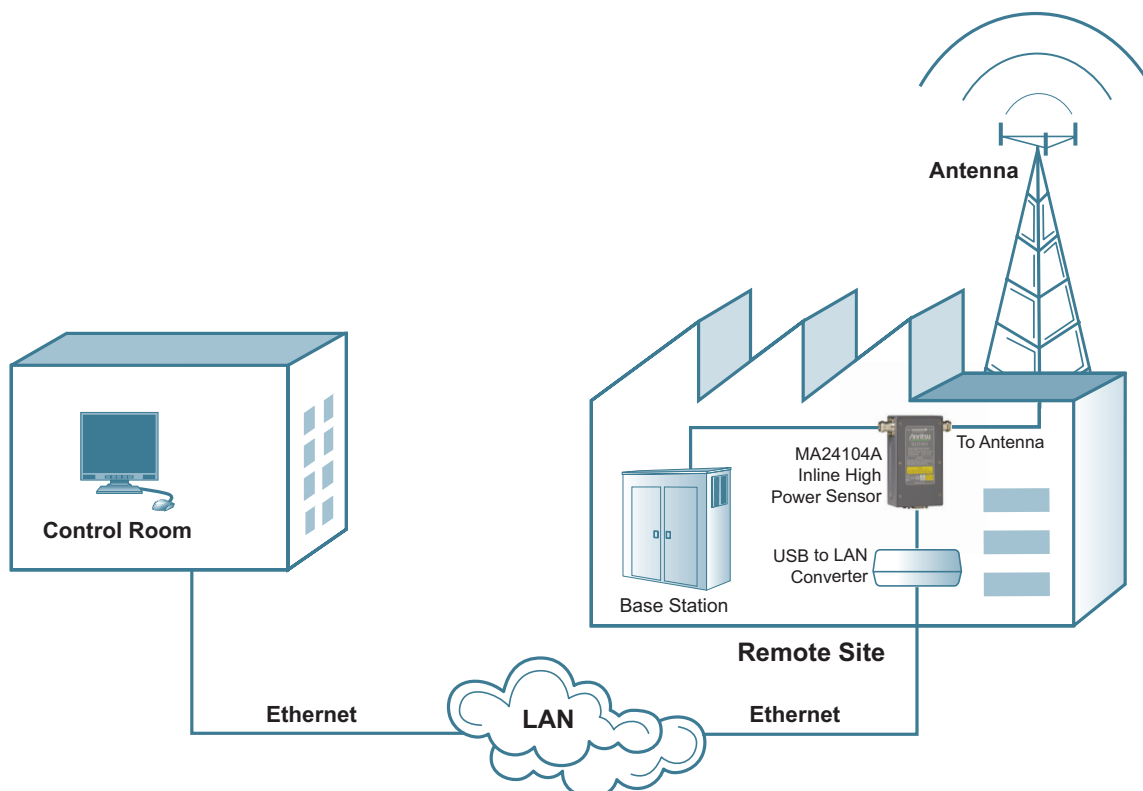
Figure 3. Measurement linearity error referenced to an ideal thermal power sensor measurement of a WCDMA signal at 2 GHz.

Optimized for Production

The MA24104A facilitates lab quality measurements on the production floor for a fraction of cost of existing solutions. Since the sensor is connected directly to the PC, there is no need for a base unit saving valuable rack space. The Inline Sensor can measure signals with levels as low as 2 mW, thus eliminating the need of terminated power sensors in the production line resulting in reduced capital expenditure and set up costs. The sensor's speed is optimized for best accuracy and noise performance thus making it suitable for wide variety of ATE applications. Multiple sensors can be connected and remote controlled via a single PC allowing flexibility to match specific measurement needs. A software toolkit is supplied with every sensor containing a sample program with source code for controlling the sensor. The 1 mW reference calibrator typically needed by power meters has also been eliminated as the connecting USB or RS232 cable only transfers digital data (corrected power), minimizing test station complexity, sensor handling and test times.

Remote Monitoring via LAN

Since the USB or RS232 cable connected to the sensor only transfers corrected power back to the host, a 1 mW reference calibrator is not required. USB data transfer capabilities limit the cable length to 5 meters prohibiting remote monitoring. However, this limitation can be overcome by installing a low cost USB-to-LAN hub converter (e.g. BELKIN® F5L009) at the measurement site along with the MA24104A. In this way, power monitoring can be performed across continents if desired.



Specifications

Sensor

Frequency range	600 MHz to 4 GHz
Dynamic range	2 mW to 150 W (+3 dBm to +51.76 dBm)
Input return loss	> 29.5 dB from 600 MHz to 3 GHz > 26.5 dB from 3 GHz to 4 GHz
Insertion loss	< 0.15 dB from 600 MHz to 1.25 GHz < 0.20 dB from 1.25 GHz to 4 GHz
Directivity	> 30 dB from 600 MHz to 3 GHz > 26 dB from 3 GHz to 4 GHz
Measurement channel	1 (Forward only)
Signal channel bandwidth	100 Hz, typical

Average Power Measurement

Measurement ranges	Range 1: +3 dBm to +40 dBm Range 2: +40 dBm to +51.76 dBm
Measurement Uncertainty ⁽¹⁾	3.8 % (Range 1 and Range 2)
Maximum power ⁽⁷⁾	150 W CW; see maximum power table for limits pertaining to pulsed or modulated measurements
Noise ⁽²⁾	< 100 μ W (Range 1) < 24 mW (Range 2)
Zero set	< 398 μ W (Range 1) < 68 mW (Range 2)
Zero drift ⁽³⁾	< 119 μ W (Range 1) < 20 mW (Range 2)
Temperature compensation (0 °C to 50 °C)	\pm 0.06 dB
Effect of digital modulation ⁽⁴⁾	\pm 0.02 dB

System

Measurand	True-RMS/Average power
Measurement resolution	0.01 dB
Offset range	\pm 100 dB
Averaging range	1 to 256
Measurement speed ⁽⁵⁾	10 meas. per second, typical
Range	Auto ranging between Range 1 and 2
Interface	USB 2.0, RS232
Host operating system (PowerXpert version 2.0 compatibility)	Microsoft® Windows® Vista, Windows 7, Windows XP, and Windows 2000

General

USB	Current (via host USB) ⁽⁶⁾	100 mA typical at 5V
RS232	Power supply	(100 to 240) V, (50 to 60) Hz
	Battery type	AA batteries (quantity 3)
	Interface	9-pin D-sub female connector
	RS-232 cable length	1.8 m
	Size (W × H × D) ⁽⁸⁾	71 mm x 37 mm x 127 mm
	Weight	445 g (0.98 lbs) without batteries

Environmental⁽⁹⁾

Operating Temperature Range	0 °C to +55 °C
Storage Temperature Range	-51 °C to +71 °C
Humidity	45% relative humidity at 55 °C (non-condensing) 75% relative humidity at 40 °C (non-condensing) 95% relative humidity at 30 °C (non-condensing)
Shock	30 g half-sine, 11 ms duration
Vibration	Sinusoidal: 5-55 Hz, 3 g _n max. Random: 10-500 Hz, Power Spectral Density: 0.03 g _n ² /Hz
EMC	Meets EN 61326, EN 55011
Safety	Meets EN 61010-1

Notes:

All specs are applicable after twenty minutes warm-up at room temperature unless specified otherwise.

- (1) Expanded uncertainty with K=2 for power measurements of a CW signal with a matched load. Measurement results referenced to the input side of the sensor.
- (2) Expanded uncertainty with K=2 after zero operation when measured with 128 averages for 5 minutes. In high aperture time mode, noise is 50 µW and 12 mW in range 1 and range 2 respectively.
- (3) After one hour warm-up and zero operation. Measured with 128 averages for one hour keeping the temperature within ±1 °C.

(4) Measurement uncertainty with reference to a CW signal of equal power and frequency at 25 °C.

(5) One measurement per second, typical in high aperture time (HAT) mode.

(6) 150 mA max.

(7) Maximum power depends upon the system SWR and frequency of operation (see maximum power table)

(8) Not including N connector.

(9) Tests were performed per MIL-PRF-28800F (Class 2)

Ordering Information

MA24104A Inline High Power Sensor

Available Options

Option Number	Description
MA24104A-098	Option 98, Standard calibration to Z540, ISO-2005 17025
MA24104A-099	Option 99, Premium calibration

Included Accessories

Model	Description
2000-1566-R	1.8 m USB 2.0 A to Mini-B cable
2300-526	Product CD - Anritsu PowerXpert and USB power sensors
40-168-R	External Power Supply (as required)
800-441	1.8 m RS-232 cable
69747	AA batteries (qty 3)
10585-00021	Quick Start Guide

Optional Accessories

Calibrated Torque Wrenches

Model	Description
01-200	Calibrated torque wrench for N connector

Cables

Models	Description
2000-1593-R	3.0 m USB 2.0 A to Mini-B cable
2000-1594-R	5.0 m USB 2.0 A to Mini-B cable

Power Attenuators

Model	Frequency range	Rating	Connectors
3-1010-122	DC to 12.4 GHz	20 dB, 5 W, 50 Ω	N male to N female
3-1010-123	DC to 8.5 GHz	30 dB, 50 W, 50 Ω	N male to N female
3-1010-124	DC to 8.5 GHz	40 dB, 100 W, 50 Ω	N male to N female
42N50-20	DC to 18 GHz	20 dB, 5 W, 50 Ω	N male to N female
42N50A-30	DC to 18 GHz	30 dB, 50 W, 50 Ω	N male to N female
1010-121	DC to 18 GHz	30 dB, 100 W, 50 Ω	N male to N female
1010-127-R	DC to 3 GHz	30 dB, 150 W, 50 Ω	N male to N female
1010-128-R	DC to 3 GHz	40 dB, 150 W, 50 Ω	N male to N female

Precision Terminations

(To be used in conjunction with appropriate Power Attenuators)

Model	Frequency range	Description	Connectors
28N50-3	DC to 8.6 GHz	50 Ω	N male
28N50-2	DC to 18 GHz	40 dB, 50 Ω	N male
28NF50-2	DC to 18 GHz	40 dB, 50 Ω	N female

Precision Coaxial Adapters

Model	Frequency range	Connectors
510-90	DC-3.3 GHz	N male to 7/16 DIN female
510-91	DC-3.3 GHz	N female to 7/16 DIN female
510-92	DC-3.3 GHz	N male to 7/16 DIN male
510-93	DC-3.3 GHz	N female to 7/16 DIN male
33N50B	DC to 18 GHz	N female to N female
33N50B	DC to 18 GHz	N male to N female
33N50B	DC to 18 GHz	N male to N male
34AN50	DC to 18 GHz	GPC-7 to N male
34ANF50	DC to 18 GHz	GPC-7 to N female
34NFK50	DC to 18 GHz	N female to K male
34NFKF50	DC to 18 GHz	N female to K female
34NK50	DC to 18 GHz	N male to K male
34NKF50	DC to 18 GHz	N male to K female



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