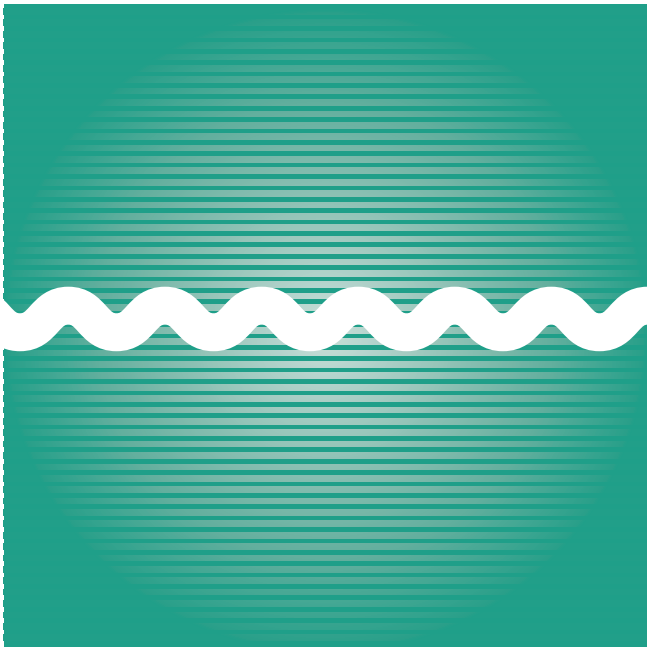


RF MICROWAVE MEASURING INSTRUMENTS

Power Meters

ML2430A Series

Remote Control
GPIB

For Measuring Wide Dynamic Range Power

The Power Meters ML2430A series combine the advantages of thermal meter accuracy, diode meter speed, and peak power meter display graphics. The result is a single instrument that achieves 90 dB dynamic range with a single sensor. The ML2430A series includes graphics display capability as a standard feature. The ruggedized housing and optional high-capacity NiMH battery bring convenience and accuracy to field service applications.

Performance

Speed and Dynamic Range

The 90 dB range standard diode sensor MA2470D series' high sensitivity reaches stable power readings to –70 dBm. 35 kHz sample rates profile cellular, PCS, and other pulsed signals to 0.1 µsec resolution. Superior connector technology achieves industry-leading return loss for improved accuracy through 50 GHz. The 87 dB range MA2440D series high accuracy sensors further improve return loss performance by adding a matching circuit to the MA2470D series' front end.

New power sensor technology achieves industry-leading measurement linearity and high sensitivity.

Universal Power Sensors

The universal power sensor MA2480D series will measure any modulated or multi-tone signal thanks to a patented sensor architecture with three diode pairs. Universal power sensors deliver over 80 dB of dynamic range with speed and accuracy.
Average power measurements on W-CDMA signals can now be made without the need for special power meters. Universal sensors are also ideal for power measurements on other digitally modulated carriers such as HDTV, DAB, or QAM modulated radio links.
The sensor architecture ensures that one of the diode pairs is always operating in its square law region. The meter selects the diode pair operating in its square law region and is designed so that even the peaks of CDMA signals are measured accurately. Anritsu's three stage diode pair approach leads to a very much faster measurement time than the two stage approach used in previous generations of average power sensors. No slowing of measurement speed is observed at switching points, making them transparent to the user.
Universal power sensors are also ideal for applications where multiple signals are present, such as intermodulation measurements and satellite multi carrier power loading measurements.
A unique additional capability of the Anritsu universal power sensor is the ability to use it as a standard diode sensor for fast CW measurements and pulse or TDMA measurements. In this mode the fast response of diode sensors is maintained across the full dynamic range of the sensor, meaning that for the majority of users it is the only sensor that they will ever need - a truly universal power sensor.

GPIB Speed

A speed of >600 continuous readings per second is achieved under a variety of operating conditions including averaging settings, sensor control settings, triggering conditions, operating mode, sensor type, and GPIB interface manufacturer. The ML2430A series offers the ability to measure and transfer a high-speed burst of 200 data points using profile operating mode with sampling rates of 35k per second.

GPIB Emulation

With 99.9% emulation of older meters, the ML2430A series improves ATE system productivity. Typical test system speed improvement is 2 to 10 times faster system speed depending upon the number of measurements taken during the test, the minimal use of wait statements within the code, and the meter model emulated.

Triggering Controls

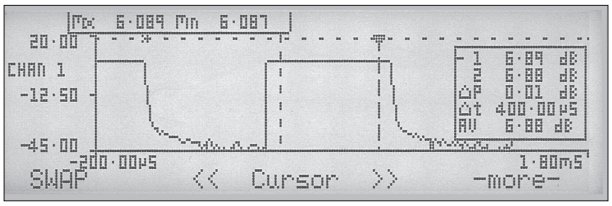
What use is high speed without triggering and sample controls? Data acquisition event arming and triggering functions traditionally found on expensive peak power meters are standard in the ML2430A series. Triggering delay and the sample integration time per reading can be directly controlled by the operator. Trigger sources include, continuous, internal, external TTL, and manual. Thus, data acquisition can be optimally controlled for synchronization with other test equipment.

Burst profile graphics display

The ML2430A features random repetitive sampling for high resolution of fast signals. A time domain graphic display profiles pulsed signals over a power range of –40 to +20 dBm. 35 kHz sampling speed produces clear power profiles of cellular and PCS signals including TDMA, PHS, GSM, and DCS-1800. Pulse top power is easily and repeatably measured using between cursor averaging. Measure pulsetop power over >80 dB dynamic range in readout mode at GPIB speeds >200 readings per second.

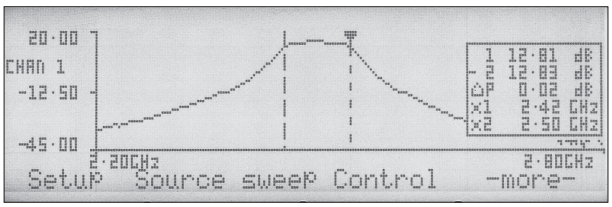
Power vs. Time Graphics Display

The power versus time mode is a strip chart style display for monitoring gain and output power variations over time/temperature, supply voltage, or a component tolerance. In service applications, measurement of power versus time aids trouble shooting of unusual conditions, such as intermittent switches or abnormal power control in a mobile telephone base stations. The power versus time mode provides a clear strip chart display of RF power variation.



Source Sweep Graphic Display

Power sweep or frequency sweep data are acquired at more than 10 sweeps per second over GPIB. Synchronization with synthesizers requires connection (BNC) of a 10.0 V sweep ramp input and an RF blanking/dwell input.



Parallel Printer Connector

Many deskjet series printers can be connected directly to the ML2430A for fast documentation of performance on the bench or in the field. Meter calibration, triggering, and averaging settings are listed with the display printout. Thus, evidence of DUT (device under test) anomalies can be duplicated quickly.

90 dB Dynamic Range

Typical communications industry ATE systems operate over a 60 to 80 dB dynamic range. The MA2470D series' 90 dB dynamic range replaces two 50 dB sensors. Furthermore, an RF switch is no longer needed for the two sensors. This reduces software control complexity and further speeds test execution.

Sensor EEPROM

All power sensor MA2400D series sensors are equipped with internal EEPROMs for storage of calibration factor data vs. frequency. This allows the power meter to interpolate and correct readings automatically, improving accuracy and convenience.

High Reliability

A rugged polycarbonate chassis handles drop shocks and rough field treatment. The absence of vent holes makes the meter splash resistant. A front cover panel and softcase are optional for further environmental protection. Power sensors are also ruggedized for rough handling.

Improved Accuracy

Mismatch uncertainty is typically the largest source of error. The MA2400D series offer a typical 5 to 6 dB improvement in sensor return loss, typically cutting mismatch uncertainty in half. The high accuracy sensors MA2440D series incorporate a matching pad which further improves return loss by 5 to 6 dB — again halving mismatch uncertainty.

Offset Table for Path Loss Correction

Compensating for the true frequency response of attenuators, couplers, cables, switches, and other test setup devices improves measurement accuracy. For this reason, the ML2430A series can apply an offset table of attenuation-versus-frequency in addition to the traditional fixed dB offset capability. When a power sensor connection is preceded with a wideband power limiter, the offset table compensates for frequency response. Thus, the combination achieves an accurate, "burnout-proof" sensor.

Softkey Menu Control

Softkey menus simplify instrument control by making the user interface easier to understand. The numerical keypad simplifies the operator interface.

Battery

The optional NiMH "smart" battery supports high charge density for a typical 8 hour day of operation. Accurate fuel gauging, <2 hour fast charge cycling, and the elimination of NiCd style memory effect further enhance the convenience of this battery technology.

Voltmeter

The ML2430A series also supports high-speed voltage measurement. A rear panel BNC measures voltage or operates as V/GHz input supporting automated sensor calibration factor correction.

High-Power Applications

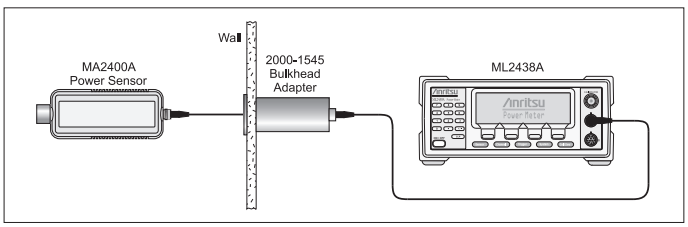
Traditional high-power sensors are expensive and have degraded accuracy specifications. Further, their annual calibration requires more time and expense. Anritsu's User Calibration Factor Tables avoid these problems. Any attenuator or coupler can be compensated by entering frequency and attenuation values into the MA2400D series internal EEPROM. The attenuation device can be semi-permantly attached; the power meter automatically applies compensation during the 0.0 dBm, 50 MHz calibration reference process. The User Calibration Factor Tables are easily deactivated – allowing the power sensor to be used standalone also.

Remote Monitoring by Telephone

Monitor transmitter performance remotely with standard telephone lines using the ML2430A's full duplex RS232 and dial-out capabilities. When the ML2430A detects a high or low limit line violation, it will automatically dial a phone number. The meter's data acquisition settings can adjust to monitor average power or the burst power of specific timeslots. The RS232 port uses the same commands as the GPIB. Contact your Anritsu representative for PC compatible software.

Locate Power Sensors Remotely

When a power sensor's cable must pass through walls or shielded enclosures, the model 2000-1545 bulkhead adapter provides a convenient connection between two sensor cables.



PowerSuite

PowerSuite software runs on a standard PC running Windows® 95 (or higher), via GPIB or RS232. PowerSuite is a very flexible package that provides full user control over measurement settings. The PC screen can be set for continuous update so that changes to the device or system under test can be viewed instantly. Alternatively, plots can be archived for later analysis.

Power Meter Specifications

Model	ML2437A	ML2438A	Comments
Signal Inputs	1	2	
Frequency Range	100 kHz to 65 GHz (sensor dependent)		
Dynamic Range Continuous or Peak	–70 to +20 dBm (dependent on sensor, external coupler or attenuator)		Continuous
Performance	100 kHz (Profile mode)		Nominal video BW
	31.25 kS/s		Sampling rate
Accuracy (Defined by uncertainty calculations with relevant sensor and source match conditions)	CW Mode <0.5% (±0.02 dB absolute accuracy, ±0.04 dB relative accuracy)		Instrumentation Accuracy
	Equivalent Noise Power (512 Moving Average) MA2472D / MA2491A / MA24002A Range 1: 0.5 µW / 2 µW / N/A Range 2: 50 nW / 100 nW / 0.5 nW Range 3: 0.8 nW / 2 nW / 8 µW Range 4: 0.2 nW / 1 nW / 2 µW Range 5 (CW mode): 50 pW / 0.5 nW / 0.5 nW		Equivalent Noise Power is RSS of Zero Set, Zero Drift and noise. Zero Set and Drift is measured over on hour warm-up at constant ambient temperature. Noise is measured over five minutes over 512 averaging after one hour warm up at constant ambient temperature.
Operation	2		Measurement Display-Readout (Numerical)
	Power vs. Time graphic of readout data		Measurement Display-Profile (Graph)
	Single channel power sweep or frequency sweep		Source sweep
	±5 dB range CW (Readout mode) only		Peaking meter
	Dynamic range covered by five overlapping amplifier ranges, R1, R2, R3, R4, and R5 Universal sensor MA2481/82D ranges 1 to 6		Amplifier Range
	Auto or Manual (current range or selectable 1 through 5)		Range Hold
Features (summary)	Monochrome LCD, with backlight and adjustable contrast		Display
	0.1 to 0.001 dB Linear power units, 3 to 6 digit, 1 to 3 digits selectable to right of decimal nW to W; Voltage, 1 to 2 digits selectable to right of decimal		Display resolution in Readout mode
	0.01 dB		Display resolution in Profile mode
	Profile and P vs. T modes: 200 pixels display resolution For a 1 ms Profile window, cursor resolution on the display is 5 µs		Time measurement resolution
	Hold, Max, Min		Measurement hold
	Average, Min, Max		Measurements
	0.00 to 20.00 V (nom.)		Voltage measurement range
	Watt, %, Volts, dBm, dB, dBµV, dBmV, dBr		Display units (Lin) Display units (Log)
	–199.99 to +199.99 dB		Display range
	1		Measurement Gates
	2		Markers
	Fixed value high and low limits with audible, rear panel TTL output, and/or visible Pass/Fail alarm indication Failure indication can latch for transient failure detection		Limit lines
	–199.99 to +199.99 dB (Fixed value or frequency dependent table)		Offset range
Averaging	Auto (Moving), Manual (Moving, Repeat)		Type
	1 to 512		Range
	Low, Medium and High settings apply post average low pass filter to improve visibility at high display resolution		Low-level Averaging
Triggering	Internal, External (TTL or RF Blanking), GPIB, Manual, Continuous		Source
	Manual Single power value set to cover entire measurement dynamic range of sensor Auto Automatically sets trigger level for signal over measurement dynamic range		Trigger modes
	Sets the trigger arming, unless the trigger source is set to EXT TTL When ARMING is set to Blanking ON, only samples taken when the rear panel Digital Input BNC is active will be averaged in the measurement		Arming Sources
	–15 to 20 dBm (all diode sensors, selectable to –25 dBm)		Internal Trigger dynamic range
	1 dB		Internal Trigger level Accuracy (typ.)
	0.1 dB		Internal Trigger settable resolution
	0.0 to 999 ms		Trigger delay range
Triggering	TTL rising or falling edge (BNC input)		External Trigger range
	0.5% of display period or 100 ns		Trigger delay settable resolution
	Profile mode: 10 ms to 7 s P v T mode: 1 m to 24 hrs		
	On-screen indicator/message		Trigger point display (on-screen)
System Configuration	10 storage registers plus RESET default settings		Save/Recall
	Wipes non-volatile memory on power up when active.		Secure mode

Continued on next page

Model	ML2437A	ML2438A	Comments
Interfaces	Yes		Remote monitoring
	Yes		Modem Compatibility
	>600 readings/sec (per input channel) Emulation of Anritsu ML4803, Agilent 436, 437 and 438		GPIB (IEEE–488.2, IEC–625)
	Compatible with Deskjet 540 and 340 Models (other 500 Series and 300 Series and later are typically compatible). Canon BJC 80.		Parallel Printer Port
	Supports software download and Instrument control 1200, 2400, 4800, 9600, 19200, 38400, 57600 Baud rates supported		RS232
	Operating Modes: Display voltage reading on selected channel Voltage proportional to frequency for sensor calibration factor compensation Blanking Input -TTL levels only Selectable positive or negative polarity Input Range: 0 to 20 V Resolution: 0.5 mV Control: Adjustable voltage to frequency relationship		Cal Factor Voltage Input (BNC)
	TTL, maximum frequency of 800 kHz		External trigger (BNC)
	Two outputs configurable to Log or Lin Operating Modes: Selectable channel adjusted for calibration factors and other power reading correction settings Pass/Fail – Selectable TTL High or Low Channel output -Near real time analog Uncalibrated AC Modulation Output -Output 1 only Dwell Output -Output 2 only Output Range: –5.0 to +5.0 V Resolution: 0.1 mV		Analogue Output (BNC)
Reference Calibrator	1 mW		Power
	±1.2% per year		Power accuracy (Traceable to National Standards)
	50 MHz (nom.)		Frequency
	<1%		Frequency Accuracy
	<1.04		VSWR
	N (f)		Connector type
General	MIL-T28800F, class 3		
Non Volatile RAM Battery	Lithium (10 year life)		
Battery Option	>6 hr usable with 3000 mAhr (NiMH) battery		
DC Power Requirements	12 to 24 VDC, Reverse protected to –40 V Maximum input 30 V		
AC Power Requirements	85 VAC to 264 VAC, 47 Hz to 440 Hz, 40 VA (max.)		
CE	EMC: 2014/30/EU, EN61326-1, EN61000-4-2 LVD: 2014/35/EU, EN61010-1 RoHS: (EU) 2015/863		
RCM	Australia and New Zealand: RCM AS/NZS 4417:2012		
KCC	South Korea: KCC-REM-A21-0004		
Operating Temperature	0°C to +50°C		
Storage Temperature	–40°C to +70°C		
Moisture	Splash and rain resistant, 95% humidity non-condensing		
Dimensions	223 (W) × 88 (H) × 390 (D) mm		
Mass	3 kg (excluding battery option)		
Warranty	Power meters have a standard 3 year warranty. Power sensors have a standard 1 year warranty.		

Power Sensors

Power Sensors for every application

Anritsu's power sensors have been designed with just one thing in mind: everything. The range of sensors provide frequency coverage to 50 GHz, with dynamic range up to 90 dB, and includes both diode and thermal based technologies.
The Anritsu diode-based sensors offer speed, sensitivity, and dynamic range with designs using half- or full-wave diode rectifiers constructed from zero-bias Schottky diodes. The rectifier output is low-pass filtered, forming an envelope detector.

Standard Diode Sensors: MA2470D

Designed for high dynamic range, high accuracy CW and TDMA measurements, these power sensors have 90 dB dynamic range and linearity better than 1.8%. This makes them the choice for precision measurements. The rise-time of these sensors is fast enough for power measurements on GSM and similar TDMA systems that use GMSK modulation.

High Accuracy Diode Sensors: MA2440D

With its built in 3 dB attenuator, the MA2440D sensors minimize input VSWR. They are typically used when high measurement accuracy is required over a large dynamic range, for example when measuring amplifiers. High accuracy diode sensors have a dynamic range of 87 dB compared to the 90 dB of standard diode sensors. In all other respects, the performance of the sensors is identical to the standard diode sensor.

Universal Power Sensors: MA2480D

The MA2480A series are true RMS sensors with a dynamic range of 80 dB. These power sensors are modulation independent and can be used for average power measurements on a wide variety of signals, including multi-tone or W-CDMA signals. The sensor architecture consists of three pairs of diodes, each one configured to work in its square law region over the dynamic range of the sensor. Option 1 provides TDMA measurement capability, calibrating one of the diode pairs for linearity over a wide dynamic range.

Thermal Power Sensors: MA24000A

The Anritsu thermal sensors MA24000A series provide excellent power measurement accuracy over 50 dB of dynamic range. Thermal sensors use Seebeck elements, where the combined effect of a thermal gradient and charge migration between dissimilar metals gives a true reading of the average power of any incident waveform. Anritsu thermal sensors have class leading SWR and a built-in EEPROM with calibration factor and linearity correction data. This results in assured accuracy when measuring any signal.

Power Sensor Specifications

Sensor	Frequency Range	CW Dynamic Range (dBm)	SWR	Rise Time*1 (ms)	Sensor Linearity*2	RF Connector*3
Standard Diode Sensors						
MA2472D	10 MHz to 18 GHz	–70 to +20 CW mode –43 to +20 Profile mode	<1.17; 10 MHz to 50 MHz*4 <1.90; 10 MHz to 50 MHz <1.17; 50 MHz to 150 MHz <1.12; 150 MHz to 2 GHz <1.22; 2 GHz to 12.4 GHz <1.25; 12.4 GHz to 18 GHz <1.35; 18 GHz to 32 GHz <1.50; 32 GHz to 40 GHz <1.63; 40 GHz to 50 GHz	<0.004	<1.8%, ≤18 GHz <2.5%, ≤40 GHz <3.5%, ≤50 GHz for MA2475D*5	N (m)
MA2473D	10 MHz to 32 GHz					K (m)
MA2474D	10 MHz to 40 GHz					K (m)
MA2475D	10 MHz to 50 GHz					V (m)
Temperature accuracy: <1% <40 GHz, <1.5% <50 GHz, 5°C to 50°C						
High Accuracy Diode Sensors						
MA2442D	10 MHz to 18 GHz	–67 to +20 CW mode –40 to +20 Profile mode	<1.17; 10 MHz to 150 MHz <1.08; 150 MHz to 2 GHz <1.16; 2 GHz to 12.4 GHz <1.21; 12.4 GHz to 18 GHz <1.29; 18 GHz to 32 GHz <1.44; 32 GHz to 40 GHz <1.50; 40 GHz to 50 GHz	<0.004	<1.8%, ≤18 GHz <2.5%, ≤40 GHz <3.5%, ≤50 GHz for MA2445D*6	N (m)
MA2444D	10 MHz to 40 GHz					K (m)
MA2445D	10 MHz to 50 GHz					V (m)
Temperature accuracy: <1% <40 GHz, <1.5% <50 GHz, 5°C to 50°C						
Universal Power Sensors						
MA2481D	10 MHz to 6 GHz	–60 to +20	<1.17; 10 MHz to 150 MHz <1.12; 150 MHz to 2 GHz <1.22; 2 GHz to 6 GHz <1.22; 6 GHz to 12.4 GHz <1.25; 12.4 GHz to 18 GHz	<0.004 with Option 1 only	<3%, ≤6 GHz <3%, ≤18 GHz (1.8% CW with Option 1)	N (m)
MA2482D	10 MHz to 18 GHz					
Option 1	Adds fast CW mode to Universal Power Sensors for high speed measurements of CW signal plus TDMA and pulse measurements.					
Temperature accuracy: <1%, 15°C to 35°C						
Thermal Sensor						
MA24002A	10 MHz to 18 GHz	–30 to +20	<1.90; 10 MHz to 50 MHz <1.17; 50 MHz to 150 MHz <1.10; 150 MHz to 2 GHz <1.15; 2 GHz to 12.4 GHz <1.20; 12.4 GHz to 18 GHz <1.25; 18 GHz to 32 GHz <1.30; 32 GHz to 40 GHz <1.40; 40 GHz to 50 GHz	<15	1.8%, <18 GHz*7 2.0%, <40 GHz*7 2.5%, <50 GHz*7	N (m)
MA24004A	10 MHz to 40 GHz					K (m)
MA24005A	10 MHz to 50 GHz					V (m)
Temperature accuracy: <1% <30 GHz <+10 dBm, <1.5% ≥30 GHz ≥+10 dBm						

*1: 0.0 dBm, room temperature with standard 1.5 m sensor cable.
*2: Sensor linearity specifications are ± value. Pulse/modulated performance only specified with 1.5 m sensor cable length option.
*3: Each MA2400A/D Series sensor incorporates precision RF connectors with hexagon coupling nut for attachment by industry standard torque wrench.
*4: MA2472D only.
*5: MA2475D Linearity applicable from –70 to +15 dBm.
Add 1% for power levels >+15 dBm
2000-1537-R supplied as standard with the power meter.
*6: MA2445D Linearity applicable from –67 to +15 dBm.
Add 1% for power levels >+15 dBm
*7: MA245005D Linearity applicable from –30 to +15 dBm.
Add 1% for power levels >+15 dBm

Power Meters & Sensors Selection Guide

Choose the right power meter and power sensor for your measurement application.

Power Sensors	Standard Diode	High-Accuracy Diode	Universal	Thermal
Model Number	MA2470D Series	MA2440D Series	MA2480D Series	MA2400xA
Power Measurement	Average (RMS)	Average (RMS)	Average (RMS)	Average (RMS)
Measurement Application (Examples)	CW, GMSK, GFSK, 8PSK	CW, GMSK	CW, GMSK, GFSK, 8PSK, QPSK, QAM	Any Modulation
	TDMA, FDMA, IS136	TDMA, FDMA	TDMA, FDMA, CDMA, OFDM, Radar	Any Access Scheme
Compatible Power Meters	ML24xxA/B	ML24xxA/B	ML24xxA/B	ML24xxA/B

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Power Meter Models
ML2437A	CW Power Meter, Single Input
ML2438A	CW Power Meter, Dual Input
	Options
ML2400A-05	Front Bail Handle
ML2400A-06	Rear Mount Input A on ML2437A
ML2400A-07	Rear Input A and Reference on ML2437A
ML2400A-08	Rear Mount Inputs A, B and Reference on ML2438A
ML2400A-09	Rear Mount Inputs A and B on ML2438A
2000-1603	NiMH Battery
2000-996-R	Desktop Battery Charger with Power Supply
2000-1534-R	Desktop Battery Charger with Power Supply (for use in Japan only)
2000-1538-R	3 m Sensor Cable
2000-1539-R	5 m Sensor Cable
2000-1540-R	10 m Sensor Cable
2000-1541-R	30 m Sensor Cable
2000-1542-R	50 m Sensor Cable
2000-1543-R	100 m Sensor Cable
2000-1545	Bulkhead Adapter
ML2400A-98	Calibration to ISO 17025 and/or ANSI/NCSL Z540
ML2400A-99	Premium Calibration
	Option 5, 2400-82, and 2400-83 are mutually exclusive for any given ML2430A unit. Options 6, 7, 8 and 9 are mutually exclusive for any given ML2430A unit. Pulse/modulated performance only specified with 1.5 m sensor cable length.
	Standard Accessories
	PowerSuite ML243xA only
	Power Cord (for destination country)
	1.5 m Sensor Cord (one per meter input)
	Certificate of Calibration (also included with sensors)

Model/Order No.	Name
	General Options and Accessories
760–209	Hard-side Transit Case
D41310	Soft Carry Case with Shoulder Strap
2000-1535	Front Panel Cover
2000-1536-R	0.3 m Sensor Cable
2000-1537-R	1.5 m Sensor Cable
2000-1538-R	3 m Sensor Cable
2000-1539-R	5 m Sensor Cable
2000-1540-R	10 m Sensor Cable
2000-1541-R	30 m Sensor Cable
2000-1542-R	50 m Sensor Cable
2000-1543-R	100 m Sensor Cable
2000-1544	RS-232 Bootload Cable
2400-82	Rack Mount, Single Unit
2400-83	Rack Mount, Side-by-Side
	(Options 5, 2400-82, and 2400-83 are mutually exclusive)
	Power Sensor Models
MA2472D	Standard Diode Sensor (10 MHz to 18 GHz, –70 to 20 dBm)
MA2473D	Standard Diode Sensor (10 MHz to 32 GHz, –70 to 20 dBm)
MA2474D	Standard Diode Sensor (10 MHz to 40 GHz, –70 to 20 dBm)
MA2475D	Standard Diode Sensor (10 MHz to 50 GHz, –70 to 20 dBm)
MA2442D	High Accuracy Diode Sensor (10 MHz to 18 GHz, –67 to 20 dBm)
MA2444D	High Accuracy Diode Sensor (10 MHz to 40 GHz, –67 to 20 dBm)
MA2445D	High Accuracy Diode Sensor (10 MHz to 50 GHz,–67 to 20 dBm)
MA2481D	Universal Sensor (10 MHz to 6 GHz, –60 to 20 dBm)
MA2482D	Universal Sensor (10 MHz to 18 GHz, –60 to 20 dBm)
MA24002A	Thermal Sensor (10 MHz to 18 GHz, –30 to 20 dBm)
MA24004A	Thermal Sensor (10 MHz to 40 GHz, –30 to 20 dBm)
MA24005A	Thermal Sensor (10 MHz to 50 GHz, –30 to 20 dBm)

See your Anritsu Representative or Components catalogue for available Attenuators, Limiters, Coaxial adapters, Waveguide-to-Coaxial adapters, Splitters & Dividers, Loads, Bridges, Open/Shorts, and Calibrated Torque wrenches.

For the complete and most up-to-date power meter and sensor specifications;
Technical Datasheet p/n: 11410-00423.

Software upgrades, Labview drivers and additional literature can be downloaded from the Anritsu website at www.anritsu.com

Inline Peak Power Sensor

MA24105A

350 MHz to 4 GHz

A Standalone, Compact, and Highly Accurate Bi-directional Inline Peak Power Sensor for your RF Power Measurement Needs

The Inline Peak Power Sensor MA24105A is designed to take accurate average power measurements from 2 mW to 150 W and peak power measurements from 2 W to 300 W, over the frequency range of 350 MHz to 4 GHz. 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 LTE, LTE-TDD, GSM/EDGE, CDMA, W-CDMA, WiMAX, TD-SCDMA, WLAN, and LTE. The forward direction path also include a 4 MHz bandwidth channel that has peak and comparator/integrator circuits that add measurement functions such as PEP power, crest factor, CCDF, and burst average power. Another detection circuit on the reverse direction adds reverse power measurement capabilities including reverse power, reflection coefficient (magnitude), return-loss, and SWR. 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. This MA24105A comes standard with application software (PowerXpert™) for use with PC that mimics the user interface of a power meter.

Features and Benefits

- Broad frequency range (350 MHz to 4 GHz)
  - Covers all major cellular and communication bands, such as LTE, LTE-TDD, GSM/EDGE, CDMA/EV-DO, W-CDMA/HSPA+, WiMAX, and TD-SCDMA
- Widest dynamic range inline power sensor in its class
  - Eliminates need for additional low level power sensors
- Forward and reverse measurements
  - Measures both transmitted power and reflection from antenna or other reflections using the single inline tool
- True-RMS measurements to 150 W
  - Enables accurate average power measurements of modulation signals
- Standalone, low cost, plug-and-play device
  - No extra elements or element holder required

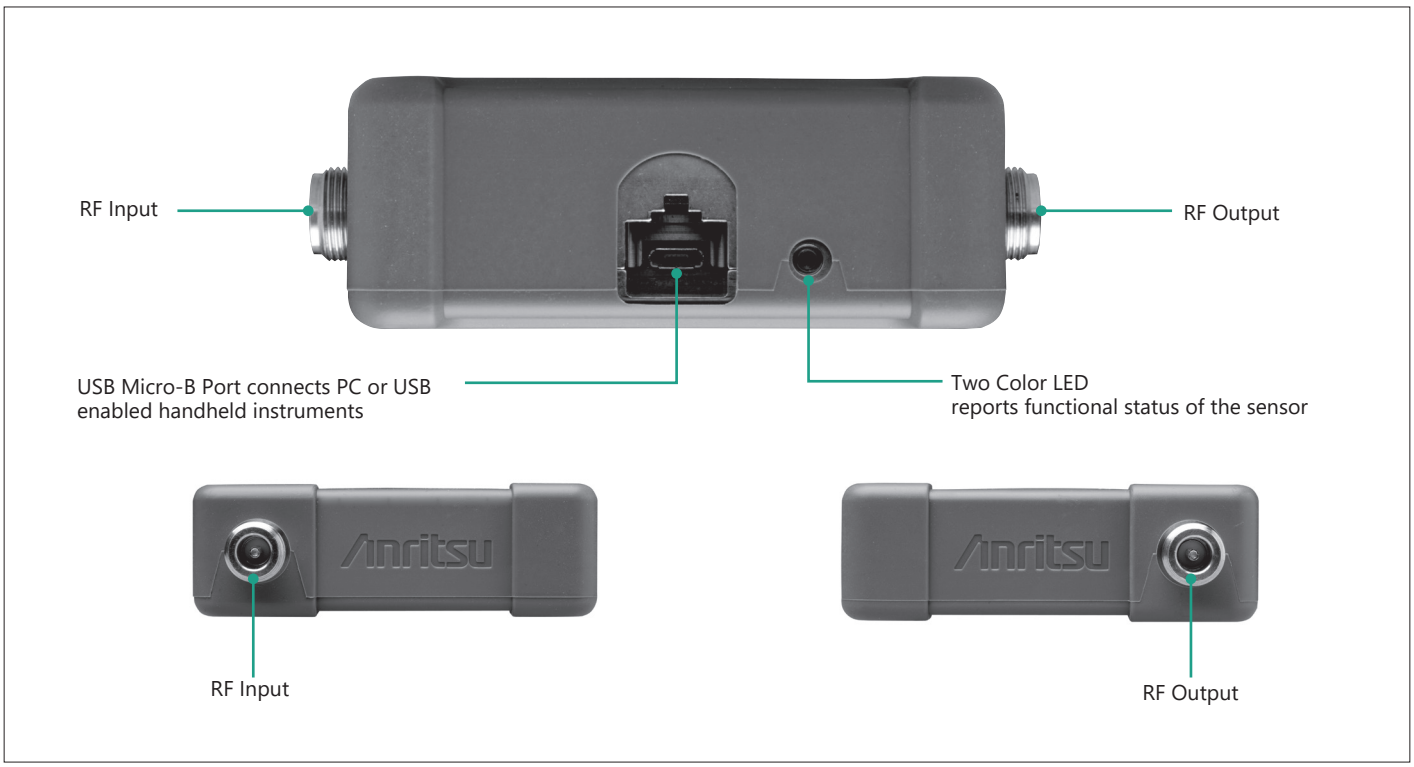
Complements Your Existing Instrument

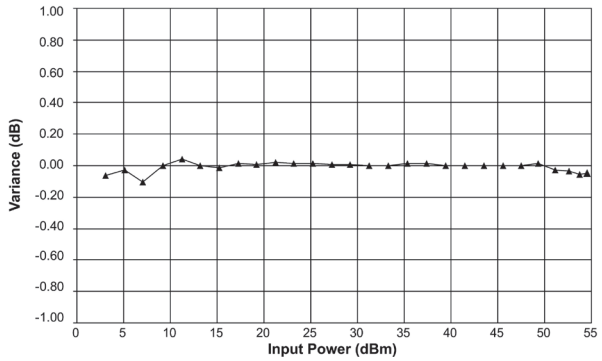
Operation with Personal Computer (PC)

The power sensor can be used with a personal computer running Microsoft® Windows via USB. It comes with a complimentary copy of the PowerXpert application (version 2.11 or greater) for data display, analysis, and sensor control. The software provides a front panel display making the personal computer 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.

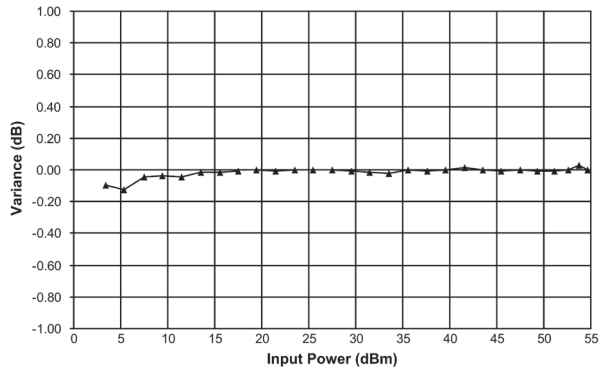
Operation with Anritsu Handheld Instruments

The MA24105A is compatible with most Anritsu RF and microwave handheld analyzers. In some cases the high-accuracy power meter software option (Option 19) is required.

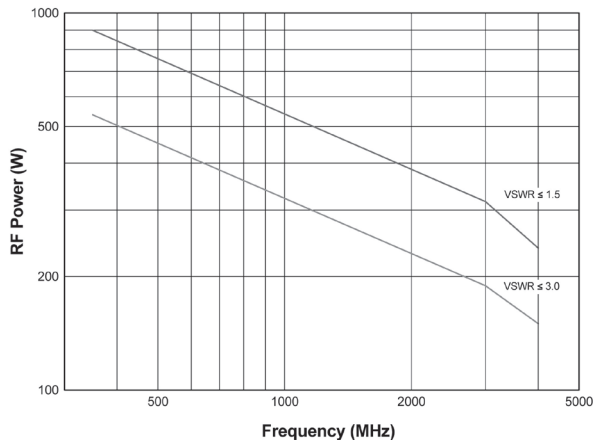




Measurement linearity error referenced to an ideal thermal power sensor measurement of a 900 MHz CW signal in the forward direction.



Measurement linearity error referenced to an ideal thermal power sensor measurement of a 900 MHz CW signal in the reverse direction.



Maximum power handling capacity of the sensor terminated with a load having VSWR of ≤ 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 disk 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-separate files that can be directly opened in Microsoft Excel allowing powerful custom analysis of measured data.

Ideal for Field Use

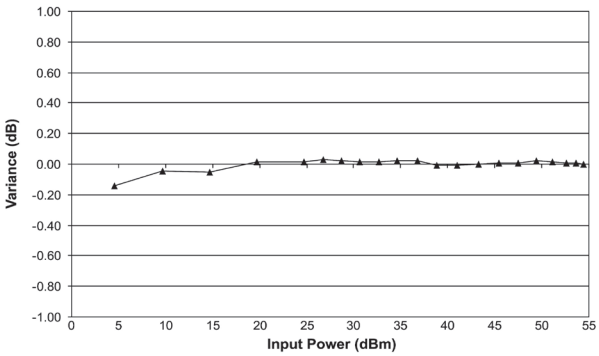
The MA24105A provides lab performance accuracy in a rugged and portable field solution. The sensor is accurate over a wide temperature range (0°C to 55°C), making it perfect for cellular base station installation and maintenance applications. Field and service technicians will appreciate the small size and lightweight of this stand-alone unit as they will not have to carry extra elements, heavy high power attenuators, or power meters. A very easy-to-use PC application with a large display makes the job even easier for technicians who need accurate measurement results quickly.

Average Measurements of CW, Pulsed, or Modulated Signals

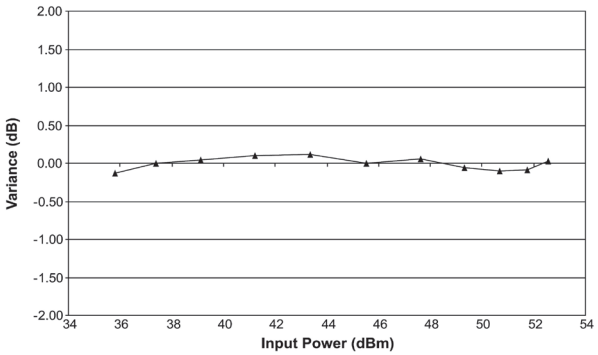
The MA24105A is rated to meet all specifications up to an average input power level of 150 W. Although the average power of all signals should be kept at or below 150 W, time varying and burst signals having peak powers less than the limits shown in the Maximum Power graph can be measured. To ensure accurate readings, the peak to average ratio (crest factor) of signals must be less than 12 dB.

Peak Power, Crest Factor, Burst Average, and Complementary Cumulative Distribution Function (CCDF)

The MA24105A and associated PowerXpert application provide information critical to development, manufacture and operation of modern communications systems. The peak power function enables the user to determine the maximum power of the modulated signal envelope. The ratio between the peak power and average power result provides the crest factor. Of particular use in TDMA systems, the burst average function uses duty cycle information obtained either automatically or as user-entry to calculate the average power during a burst based on the measurement of average power. Critical to those working with spread spectrum systems, which exhibit a non-deterministic envelope, the CCDF feature shows the percentage of the time that the peak power exceeds a user-set threshold.



Forward average power linearity error referenced to an ideal thermal power sensor measurement of a W-CDMA signal at 2 GHz.



Forward peak power linearity error referenced to Anritsu MA2491A peak power sensor measurement of a W-CDMA signal.

Reverse Power, Reflection Coefficient (magnitude), Return Loss, and Standing Wave Ratio (SWR)

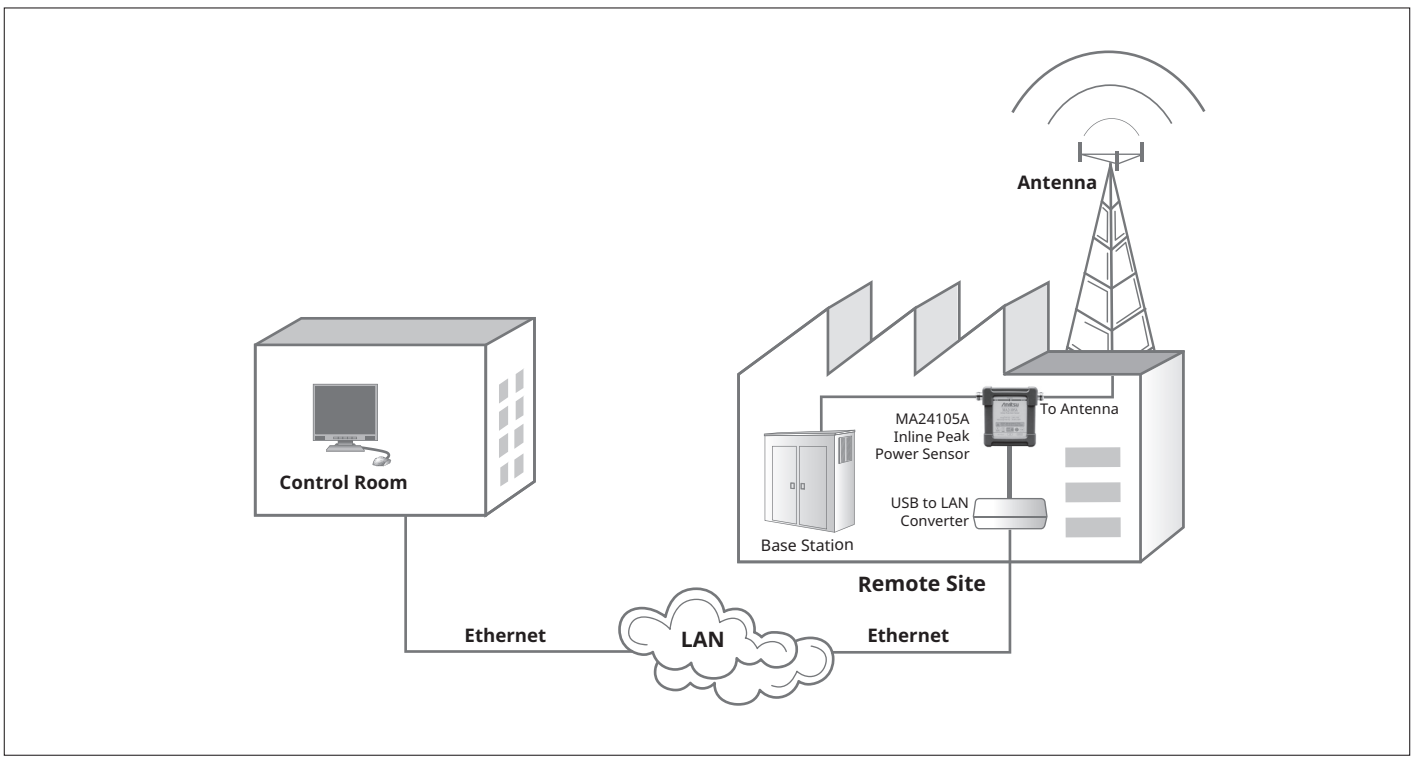
The MA24105A sensor's capability to measure both forward and reverse average power also permits the user to gain information about the load mismatch. This result is conveniently available in reflection coefficient (magnitude), return loss and SWR forms.

Optimized for Production

The MA24105A 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 cable only transfers digital data (corrected power), minimizing test station complexity, sensor handling and test times.

Remote Monitoring via LAN or Data-Logging

Since the USB 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 at the measurement site along with the MA24105A.
In this way, power monitoring can be performed across continents if desired or data can be logged in a .csv file for offline analysis.



Specifications

Sensor	Frequency Range	350 MHz to 4 GHz				
	Dynamic Range	2 mW to 150 W (+3 to +51.76 dBm)				
	Input Return Loss	≥29.5 dB from 350 MHz to 3 GHz ≥26.5 dB from >3 GHz to 4 GHz				
	Insertion Loss (typ.)	≤0.15 dB from 350 MHz to 1.25 GHz ≤0.20 dB from >1.25 GHz to 4 GHz				
	Directivity	≥28 dB from 350 MHz to <1 GHz ≥30 dB from ≥1 GHz to ≤3 GHz ≥28 dB from >3 GHz to 4 GHz				
	Measurement Channel	2 (Forward and Reverse)				
	Signal Channel Bandwidth	Average: 100 Hz Peak (Selectable): 4 MHz (full) 200 kHz 4 kHz				
Base Average Power Measurement	Measurement Range	Range 1: 2 mW to 6.31 W (+3 to +38 dBm) Range 2: 6.31 W to 150 W (+38 to +51.76 dBm)				
	Maximum Power*1	150 W average, 300 W pulse				
	Measurement Uncertainty*2	±3.8% (Range 1 and Range 2)				
	Effect of Noise*3	±170 µW (Range 1) ±1.9 mW (Range 2)				
	Effect of Zero Set*4	±250 µW (Range 1) ±3.0 mW (Range 2)				
	Effect of Zero Drift*4	±230 µW (Range 1) ±2.7 mW (Range 2)				
	Effect of Temperature (0°C to 50°C)	±0.06 dB				
	Effect of Digital Modulation*5	±0.02 dB				
Forward Average Power Measurement	Forward Average Power Uncertainty is same as Base Average Power Uncertainty					
Forward Peak Power Measurement*6	Measurement Range	2 W to 300 W (+33 to +54.77 dBm)				
	Burst Signal Measurement Base Uncertainty	Repetition Rate: ≥10/s Duty Cycle: ≥10%	Full Bandwidth: ± (Base Average Power Uncertainty +7% + 400 mW)			
			4 kHz and 200 kHz Bandwidth: ± (Base Average Power Uncertainty + 3% + 200 mW)			
	Effect of Low Repetition Rate (≤ 10/s)	±1.6% ±150 mW				
	Effect of Low Duty Cycle (0.1 to 10%)	±100 mW				
	Effect of Short Burst Width (500 ps to 1 µs) (200 ps to <500 ps)	 ±5% ±10%				
	Effect of Temperature on Peak Circuit (0°C to 50°C)	±6%				
	Spread-spectrum Measurement Uncertainty	± (Base Average Power Uncertainty + 15% + 400 mW)				
Reverse Power Measurement*6	Measurements Range	2 mW to 150 W (+3 to +51.76 dBm)				
	Maximum Power*1	150 W average				
	Measurement Uncertainty*2	± (Base Average Power Uncertainty)				
	Spread-spectrum Measurement Uncertainty	± (Base Average Power Uncertainty + 15% + 400 mW)				
Complementary Cumulative Distribution Function (CCDF)	Measurement Uncertainty*7	±0.2%				
	Threshold Range	2 mW to 300 mW (+3 to +54.77 dBm)				
	Accuracy of Threshold	± (Base Average Power Uncertainty + 5% + 500 mW)				
Burst Average Power	Measurement Uncertainty (User Mode)	Same as Base Average Power Uncertainty except Zero Set, Zero Drift and Noise are divided by duty cycle (t/T)				
	Measurement Uncertainty (Auto Mode)*8	± (Base Average Power Uncertainty except Zero Set, Zero Drift and Noise are divided by duty cycle (t/T) ±2%)				
Combination Measurements	Reflection Measurement Uncertainty	± (Base Average Power Uncertainty + Reverse Power Measurement Uncertainty)				
	Crest Factor Uncertainty	± (Base Average Power Uncertainty + Forward Peak Power Measurement Uncertainty)				
System	Measurand	Forward/Reverse True-RMS/Average power	Peak Power	Crest Factor	Burst Average Power	CCDF
	Measurement Resolution	0.01 dB				0.01%
	Offset Range	100 dB				100%
	Averaging Range	1 to 512				
	Measurement Speed (typ.)	1.7 meas. per second	2.5 meas. per second	1.4 meas. per second	0.7 meas. per second	1.6 meas. per second
	Interface	USB 2.0				
	Host Operating System (PowerXpert version 2.11 compatibility)	Microsoft Window 7, Windows Vista, Windows XP, and Windows 2000				

Continued on next page

General	USB	Current (via host USB)*10	180 mA (typ.) at 5 V
	Dimensions*9	87 (W) × 102 (H) × 30 (D) mm	
	Mass	535 g (1.18 lb)	
Environmental*11	Operating Temperature Range	0°C to +50°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's half-sine, 11 ms duration	
	Vibration	Sinusoidal: 5 Hz to 55 Hz, 3 g's max. Random: 10 Hz to 500 Hz Power Spectral Density: 0.03 g^2/Hz	
	CE	EMC: 2014/30/EU, EN61326-1, EN61000-4-2 LVD: 2014/35/EU, EN61010-1 RoHS: (EU) 2015/863	

All specs are applicable after twenty minutes warm-up at room temperature and after zeroing 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: All measurement errors "Effects" should be RSSed before directly added to "Base" error for overall measurement uncertainty.
∗6: 150 mA max.
∗7: Maximum power depends upon the system SWR and frequency of operation
∗8: Not including N connector.
∗9: Measurement speed is the rate at which the measurement or calculation is updated in a data log.
∗10: Pulse Power >+37 dBm, T >50 µs (Full BW), T >400 µs (200 kHz BW), T >20 ms (4 kHz BW)
∗11: Average Power >+33 dBm, Pulse width >5 µs (Full BW), Pulse Width >40 µs (200 kHz BW), Pulse Width >2 ms (4 kHz BW)

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main Frame
MA24105A	Inline Peak Power Sensor
	Available Options
MA24105A-098	Option 98, Standard calibration to Z540, ISO-17025
MA24105A-099	Option 99, Premium calibration to Z540, ISO-17025
	Included Accessories
2000-1606-R	1.8 m USB 2.0 A to Micro-B cable
10585-00021	Quick Start Guide
	Optional Accessories
	Calibrated Torque Wrenches
01-200	Calibrated torque wrench for N connector
	Power Attenuators
3-1010-122	DC to 12.4 GHz, 20 dB, 5 W, 50Ω, N (m) to N (f)
3-1010-123	DC to 8.5 GHz, 30 dB, 50 W, 50Ω, N (m) to N (f)
3-1010-124	DC to 8.5 GHz, 40 dB, 100 W, 50Ω, N (m) to N (f)
42N50-20	DC to 18 GHz, 20 dB, 5 W, 50Ω, N (m) to N (f)
42N50A-30	DC to 18 GHz, 30 dB, 50 W, 50Ω, N (m) to N (f)
1010-121	DC to 18 GHz, 40 dB, 100 W, 50Ω, N (m) to N (f)
1010-127-R	DC to 3 GHz, 30 dB, 150 W, 50Ω, N (m) to N (f)
1010-128-R	DC to 3 GHz, 40 dB, 150 W, 50Ω, N (m) to N (f)
	Precision Terminations
	(To be used in conjunction with appropriate Power Attenuators)
28N50-3	DC to 8.6 GHz, 50Ω, N (m)
28N50-2	DC to 18 GHz, 40 dB, 50Ω, N (m)
28NF50-2	DC to 18 GHz, 40 dB, 50Ω, N (f)
	Precision Coaxial Adapters
510-90	DC to 3.3 GHz, N (m) to 7/16 DIN (f)
510-91	DC to 3.3 GHz, N (f) to 7/16 DIN (f)
510-92	DC to 3.3 GHz, N (m) to 7/16 DIN (m)
510-93	DC to 3.3 GHz, N (f) to 7/16 DIN (m)
33NFNF50B	DC to 18 GHz, N (f) to N (f)
33NNF50B	DC to 18 GHz, N (m) to N (f)
33NN50B	DC to 18 GHz, N (m) to N (m)
34AN50	DC to 18 GHz, GPC-7 to N (m)
34ANF50	DC to 18 GHz, GPC-7 to N (f)
34NFK50	DC to 18 GHz, N (f) to K (m)
34NFKF50	DC to 18 GHz, N (f) to K (f)
34NK50	DC to 18 GHz, N (m) to K (m)
34NKF50	DC to 18 GHz, N (m) to K (f)

USB Power Sensors

MA24106A/MA24108A/MA24118A/MA24126A

50 MHz to 6 GHz/10 MHz to 8 GHz/10 MHz to 18 GHz/10 MHz to 26 GHz

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

MA24106A

MA24118A

MA24108A

MA24126A

Anritsu USB power sensors eliminate the need of traditional benchtop power meters. These are highly accurate, standalone instruments that communicate with a PC via USB. The power measurement capability of these sensors is intended to mimic that of a traditional thermal (thermo-electric) power sensor with a wider dynamic range. These sensors are ideal for measuring average power of CW, modulated RF waveforms such as 3G, 4G, OFDM, and multi-tone signals. In other words, these sensors measure true RMS power regardless of the type of the input signal.
The presence of a micro-controller along with signal conditioning circuitry, ADC, and power supply in the sensors makes them a complete miniature power meter. These Anritsu USB power sensors come standard with application software (PowerXpert™) for use with PC that mimics the user interface of a power meter.
In addition to the average power measurement capability, the MA24108A, MA24118A and MA24126A sensors have internal and external triggering capability that facilitates individual slot power measurements of TDMA waveforms as well as burst power measurements of periodic and non-periodic waveforms.
These capabilities can be invoked in the power sensor by operating the sensor in Scope or Time slot mode.
Anritsu USB power sensors are compatible with most Anritsu RF and microwave handheld instruments. The high accuracy power meter software option (e.g., Option 19) may be required.

Features and Benefits

- Broad frequency range (10 MHz to 26 GHz)
  – Covers all major cellular bands
- True RMS measurements over 63 dB or more of dynamic range enables accurate modulated power measurements
- NIST Traceable calibrations
  – Provides traceable measurements needed for aerospace applications
- Compatible with Anritsu handhelds
  – No base unit needed
- Built-in internal and external trigger (only used with PC)
  – Facilitates multi-slot measurement of TDD waveforms (e.g. GSM, WiMAX, and TD-SCDMA)
- High power handling (+33 dBm)
  – Provides protection from overpowering the sensors
- 1 mW calibration need eliminated
  – Reduces test time and handling in production
- Worldwide calibration and service centers
  – Ensure reduced downtime and quick support

MA24106A Specifications

Sensor	Frequency Range	50 MHz to 6 GHz
	Dynamic Range	–40 to +23 dBm
	Input Return Loss	>26 dB (50 MHz to <2 GHz) >20 dB, (2 GHz to 6 GHz)
	Measurement Ranges	Range 1, –40 to –5 dBm Range 2, –5 to +23 dBm
	Signal Channel Bandwidth	100 Hz (typ.)
Measurement Uncertainty	Linearity	±0.13 dB (power level <+18 dBm) ±0.18 dB (power level ≥+18 dBm)
	Calibration Factor*1	±0.035 dB
	Noise*2	<2.5 nW (–40 to –5 dBm) <0.6 µW (–5 to +23 dBm)
	Zero Set	<10 nW (–40 to –5 dBm) <1.7 µW (–5 to +23 dBm)
	Zero Drift*3	<3.0 nW (–40 to –5 dBm) <0.5 µW (–5 to +23 dBm)
	Temperature Compensation*4 (0°C to 50°C)	±0.06 dB
	Effect of Digital Modulation*4	±0.02 dB (power level <+18 dBm) ±0.10 dB (power level ≥+18 dBm)
System	Measurand	True-RMS/Average power
	Measurement Resolution	0.01 dB
	Offset Range	±100 dB
	Averaging Range	1 to 256
	Measurement Speed*5	10 measurement per second (typ.)
	Range	Auto ranging between Range 1 and Range 2
	Interface	USB 2.0
	Host Operating System (Anritsu Power Meter PC application compatibility)	Microsoft® Windows 7/8/10, Windows Vista®, Windows XP and Windows 2000
General	Current (via host USB)*6	100 mA typical at 5 V
	Maximum DC Voltage at RF Port	±25 V
	Maximum CW Power	+33 dBm
	Dimensions*7	60.4 (W) × 22.2 (H) × 84.2 (L) mm (typ.) (2.37 × 0.87 × 3.31 in)
	Mass	180 grams (typ.) (6.4 oz.)
Environmental*8	Operating Temperature Range	0°C to +50°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 Hz to 55 Hz, 3 g max. Random: 10 Hz to 500 Hz, Power Spectral Density 0.03 g^2/Hz
	CE	EMC: 2014/30/EU, EN61326-1, EN61000-4-2 LVD: 2014/35/EU, EN61010-1 RoHS: (EU) 2015/863

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

∗1: Expanded uncertainty with K = 2 for absolute power measurements on CW signal at 0 dBm calibration level from 50 MHz to 6 GHz.
∗2: Expanded uncertainty with K = 2 after zero operation when measured with 128 averages for 5 minutes.
In high aperture time mode, noise is 1.3 nW and 0.3 µW 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 error with reference to a CW signal of equal power and frequency at 25°C.
∗5: One measurement per second, typical in high aperture time mode.
∗6: 150 mA max.
∗7: Not including N connector.
∗8: Tests were performed per MIL-PRF-28800F (Class 2)

MA24108A/MA24118A/MA24126A Specifications

Model		MA24108A	MA24118A	MA24126A
Sensor	Frequency Range	10 MHz to 8 GHz	10 MHz to 18 GHz	10 MHz to 26 GHz
	Dynamic Range (CW)	–40 to +20 dBm		
	Dynamic Range (Timeslot)	–40 to +20 dBm		
	Dynamic Range (Scope)	–40 to +20 dBm		
	SWR	<1.17, 10 MHz to 150 MHz <1.12, 150 MHz to 2 GHz <1.22, 2 GHz to 8 GHz	<1.17, 10 MHz to 150 MHz <1.12, 150 MHz to 2 GHz <1.22, 2 GHz to 12 GHz <1.25, 12 GHz to 18 GHz	<1.90, 10 MHz to 50 MHz <1.17, 50 MHz to 150 MHz <1.12, 150 MHz to 2 GHz <1.22, 2 GHz to 12 GHz <1.25, 12 GHz to 18 GHz <1.35, 18 GHz to 26 GHz
	Signal Channel Rise Time	8 µs (typ.)		
	Video Bandwidth	50 kHz (typ.)		
	Sampling Rate	140 ks/s (typ.)		
	Measurement Ranges	Range 1, +20 to –7 dBm (typ.) Range 2, –7 to –40 dBm (typ.) Auto ranging between range 1 and 2		
Measurement Uncertainty	Linearity	<3%		
	Cal Factor*1	<2.3% at 10 MHz <1.5%, 50 MHz to 8 GHz	<2.3% at 10 MHz <1.5%, 50 MHz to 18 GHz	<3.5% at 10 MHz <2.0%, 50 MHz to 2 GHz <2.5%, 3 GHz to 8 GHz <3.0%, 9 GHz to 15 GHz <3.5%, 16 GHz to 26 GHz
	Noise*2	<8 µW, Range 1 <40 nW, Range 2		
	Zero Set*3	<1 µW, Range 1 <10 nW, Range 2		
	Zero Drift*4	<0.5 µW, Range 1 <3 nW, Range 2		
	Effect of Temperature	<1.4%		
	Effect of Digital Modulation*5	<0.5%, <+18 dBm <1.4%, >+18 dBm		
System	Measurand	Average power		
	Measurement Resolution*6	0.01 dB max via PowerXpert, 0.001 dB max via remote command		
	Offset Correction*7	–100 to +150 dB		
	Averaging	Auto, Manual		
	Type	Moving, Repeat		
	Number of Averages (manual)*8	1 to 40,000		
	Auto Average	Resolution*9: 1 dB, 0.1 dB, 0.01 dB, 0.001 dB Source (slot # or scope data point number) Timeslot: 1 to 128 Scope: 1 to 1024		
Continuous Average Mode	Duty Cycle Correction	0.01% to 100%		
	Aperture Time	0.01 ms to 300 ms		
	Measurement Time*10	N × (Capture Time × 2.5) + T_d + T_{com}		
Scope Mode	Capture Time	0.01 ms to 300 ms		
	Data Points	1 to 1024		
	Resolution	0.007 ms, max via remote command 0.01 ms, max via PowerXpert		
	Measurement Time*11	N × (Capture Time × 3.75) +(P_n × T_{dp}) + T_{com}		
Time Slot Mode	Maximum Number of Slots	128		
	Slot width	0.01 ms to 100 ms		
	Maximum Capture Time	300 ms (slot width × number of slots)		
	Resolution	0.007 ms, max via remote command 0.01 ms, max via PowerXpert		
	Exclusion Periods	Start Exclusion: 0 ms to 10 ms End Exclusion: 0 ms to 10 ms		
	Measurement Time*11	N × (Capture Time × 3.75) + (P_n × T_{dp}) + T_{com}		

Continued on next page

Model		MA24108A	MA24118A	MA24126A
Trigger	Source*12	Bus, Continuous, Internal, and External		
	Internal Trigger	Dynamic Range: –20 to +20 dBm Level Accuracy: ± 0.5 dB (typ.) Slope: Positive or negative Delay Range: –5 ms to +10 s Delay Resolution: 10 µs		
	External Trigger	Impedance: 100kΩ Type: TTL/CMOS Slope: Positive or negative Delay Range: –5 ms to +10 s Delay Resolution: 10 µs Positive Threshold Voltage: 2.0 V (typ.) Negative Threshold Voltage: 1.2 V (typ.) Hysteresis: 0.8 V (typ.)		
General	RF Connector	N (m), K (m) (MA24126A)		
	Interface to Host	USB 2.0 full speed (compatible with USB 1.0 and 1.1)		
	Current Consumption	150 mA (typ.)		
	External Trigger Input	MCX (f), 12 V max		
	Damage Levels at RF Port	+33 dBm, ±20 V DC		
	Dimensions	45 (W) × 25 (H) × 110 (L) mm, excluding N connector and silicone protective covering		
	Mass	230 g (0.51 lb)		
Environmental*13	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 Hz to 55 Hz, 3 g max. Random: 10 Hz to 500 Hz Power Spectral Density: 0.03 g^2/Hz		
	CE	EMC: 2014/30/EU, EN61326-1, EN61000-4-2 LVD: 2014/35/EU, EN61010-1 RoHS: (EU) 2015/863		
PowerXpert v2.0 (PC requirements)	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 7, Windows Vista®, Windows XP and Windows 2000		
	Hard-disk Free Space	100 MB, minimum		
	Display Resolution	1024 × 768, minimum		
	Interface	USB 2.0 full speed (compatible with USB 1.0 and 1.1)		

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

∗1: Expanded uncertainty with K = 2 for absolute power measurements on CW signal at 0 dBm and calibration frequencies 10 MHz, 50 MHz, 100 MHz, 300 MHz, 500 MHz, and 1 GHz to 8 GHz (for MA24108A), or to 18 GHz (MA24118A) or to 26 GHz (for MA24126A) in 1 GHz increments.
∗2: Expanded uncertainty with K = 2 after zero operation when measured with 1 average, and 20 ms aperture time for 5 minutes. Effect of Noise can be reduced by increasing the number of averages and/or increasing the aperture time. Noise goes down as square root of number of averages and aperture time. For example with 128 averages, the Noise is 3.5 nW (40 nW divided by √128). Effect of increased aperture time is calculated in the same way.
∗3: Expanded uncertainty with K = 2 after zero operation when measured with 1 average, and 20 ms aperture time for 5 minutes.
∗4: Expanded uncertainty with K = 2 after one hour warm-up and zero operation, 1 average, 20 ms aperture time, and keeping the temperature within ±1°C.
∗5: Measurement error with reference to a CW signal of equal power and frequency at 25°C.
∗6: Resolution in PowerXpert application is 2 digits after the decimal. Native resolution of the sensor is 3 digits after the decimal.
∗7: Offset correction feature is available only through PowerXpert application. There is no remote command for it in the sensor firmware.
∗8: Maximum number of averages allowed in Continuous Average mode and Timeslot mode is 40,000. In scope, the maximum number of averages is equal to 8231936 divided by data points.
∗9: Averaging resolution of 0.001 dB is not available with PowerXpert application. It is defined as the place after the decimal to which the reading becomes stable. E.g. if 0.01 is selected then the reading will typically be stable ±0.01 dB. Please refer to the remote operation chapter in the user guide for information regarding access to this feature.
∗10: Speed is defined as the data throughput at the "A" end of the USB A to Micro-B Cable (p/n 2000-1606-R). T_d is the delay compensation for smaller Capture Times, T_d = 0 for Capture Time >9 ms, T_d = 3 ms for 2 ms <Capture Time <9 ms, T_d = 5 ms for Capture Time <2 ms, T_{com} = 5 ms, command processing time.
∗11: Speed is defined as the data throughput at the "A" end of the USB A to Micro-B Cable (p/n 2000-1606-R). Where N is the number of repeat averages, N = 1 for moving average mode, P_n = Number of points, T_{dp} = 0.05 ms (Communication delay (approx) due to each point), T_{com} = 5 ms, command processing time.
∗12: Bus trigger not available in PowerXpert application.
∗13: Tests were performed per MIL-PRF-28800F (Class 2).

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main Frame
MA24106A	True-RMS USB Power Sensor, 50 MHz to 6 GHz
	Included Accessories
2000-1566-R	1.8 m USB A to Mini-B Cable
10585-00021	Quick Start Guide
	Available Options
MA24106A-097	Option 97, Accredited calibration to ISO17025 and ANSI/NCSL Z540. Test report and uncertainty data included
MA24106A-098	Option 98, Standard calibration to ISO17025 and ANSI/NCSL Z540
MA24106A-099	Option 99, Premium calibration to ISO17025 and ANSI/NCSL Z540. Test report and uncertainty data included
	Optional Accessories
2000-1593-R	3.0 m USB A to Mini-B cable
2000-1594-R	5.0 m USB A to Mini-B cable
01-200	Calibrated torque wrench for N connector
01-204	Calibrated torque wrench for K and V connectors
3-1010-123	N (m) to N (f), DC to 8.5 GHz, 30 dB, 50 W, 50Ω
3-1010-124	N (m) to N (f), DC to 8.5 GHz, 40 dB, 100 W, 50Ω
3-1010-122	N (m) to N (f), DC to 12.4 GHz, 20 dB, 5 W, 50Ω
42N50-20	N (m) to N (f), DC to 18 GHz, 20 dB, 5 W, 50Ω
42N50-30	N (m) to N (f), DC to 18 GHz, 30 dB, 50 W, 50Ω
510-90	N (m) to 7/16 DIN (f), DC to 3.3 GHz
510-91	N (f) to 7/16 DIN (f), DC to 3.3 GHz
510-92	N (m) to 7/16 DIN (m), DC to 3.3 GHz
510-93	N (f) to 7/16 DIN (m), DC to 3.3 GHz
33NFNF50B	N (f) to N (f), DC to 18 GHz
33NNF50B	N (m) to N (f), DC to 18 GHz
33NN50B	N (m) to N (m), DC to 18 GHz
34AN50	GPC-7 to N (m), DC to 18 GHz
34ANF50	GPC-7 to N (f), DC to 18 GHz
34NFK50	N (f) to K (m), DC to 18 GHz
34NFKF50	N (f) to K (f), DC to 18 GHz
34NK50	N (m) to K (m), DC to 18 GHz
34NKF50	N (m) to K (f), DC to 18 GHz
2300-528	Sensor calibration utility, MA24106A CalXpert™

Model/Order No.	Name
	Main Frame
MA24108A	10 MHz to 8 GHz USB Power Sensor
MA24118A	10 MHz to 18 GHz USB Power Sensor
MA24126A	10 MHz to 26 GHz USB Power Sensor
	Included Accessories
10585-00021	Quick Start Guide
2000-1605-R	1.5 m BNC (m) to MCX (m) cable
2000-1606-R	1.8 m USB A to Micro-B cable with latch
	Available Options
MA24108A-097	Option 97, Accredited calibration to ISO17025 and ANSI/NCSL Z540. Test report and uncertainty data included
MA24108A-098	Option 98, Standard calibration to ISO17025 and ANSI/NCSL Z540
MA24108A-099	Option 99, Premium calibration to ISO17025 and ANSI/NCSL Z540. Test report and uncertainty data included
MA24118A-097	Option 97, Accredited calibration to ISO17025 and ANSI/NCSL Z540. Test report and uncertainty data included
MA24118A-098	Option 98, Standard calibration to ISO17025 and ANSI/NCSL Z540
MA24118A-099	Option 99, Premium calibration to ISO17025 and ANSI/NCSL Z540. Test report and uncertainty data included
MA24126A-097	Option 97, Accredited calibration to ISO17025 and ANSI/NCSL Z540. Test report and uncertainty data included
MA24126A-098	Option 98, Standard calibration to ISO17025 and ANSI/NCSL Z540
MA24126A-099	Option 99, Premium calibration to ISO17025 and ANSI/NCSL Z540. Test report and uncertainty data included
	Optional Accessories
01-200	Calibrated torque wrench for N connector
01-204	Calibrated torque wrench for K and V connectors
2000-1614-R	Cable, 5.0 m USB A to Micro-B cable with latch
3-1010-123	N (m) to N (f), DC to 8.5 GHz, 30 dB, 50 W, 50Ω
3-1010-124	N (m) to N (f), DC to 8.5 GHz, 40 dB, 100 W, 50Ω
3-1010-122	N (m) to N (f), DC to 12.4 GHz, 20 dB, 5 W, 50Ω
42N50-20	N (m) to N (f), DC to 18 GHz, 20 dB, 5 W, 50Ω
42N50-30	N (m) to N (f), DC to 18 GHz, 30 dB, 50 W, 50Ω
41KB-3	Power attenuator, DC to 26.5 GHz, 3 dB, 50Ω, K (m) to K (f)
41KB-6	Power attenuator, DC to 26.5 GHz, 6 dB, 50Ω, K (m) to K (f)
41KB-10	Power attenuator, DC to 26.5 GHz, 10 dB, 50Ω, K (m) to K (f)
41KB-20	Power attenuator, DC to 26.5 GHz, 20 dB, 50Ω, K (m) to K (f)
43KB-3	Power attenuator, DC to 26.5 GHz, 3 dB, 50Ω, K (m) to K (f)
43KB-6	Power attenuator, DC to 26.5 GHz, 6 dB, 50Ω, K (m) to K (f)
43KB-10	Power attenuator, DC to 26.5 GHz, 10 dB, 50Ω, K (m) to K (f)
43KB-20	Power attenuator, DC to 26.5 GHz, 20 dB, 50Ω, K (m) to K (f)
510-90	N (m) to 7/16 DIN (f), DC to 3.3 GHz
510-91	N (f) to 7/16 DIN (f), DC to 3.3 GHz
510-92	N (m) to 7/16 DIN (m), DC to 3.3 GHz
510-93	N (f) to 7/16 DIN (m), DC to 3.3 GHz
33NFNF50B	N (f) to N (f), DC to 18 GHz
33NNF50B	N (m) to N (f), DC to 18 GHz
33NN50B	N (m) to N (m), DC to 18 GHz
34AN50	GPC-7 to N (m), DC to 18 GHz
34ANF50	GPC-7 to N (f), DC to 18 GHz
34NFK50	N (f) to K (m), DC to 18 GHz
34NFKF50	N (f) to K (f), DC to 18 GHz
34NK50	N (m) to K (m), DC to 18 GHz
34NKF50	N (m) to K (f), DC to 18 GHz
1091-26	Precision coaxial adapter, DC to 18 GHz, N (m) to SMA (m)
1091-27	Precision coaxial adapter, DC to 18 GHz, N (m) to SMA (f)
1091-80-R	Precision coaxial adapter, DC to 18 GHz, N (f) to SMA (m)
1091-81-R	Precision coaxial adapter, DC to 18 GHz, N (f) to SMA (f)

Microwave Universal USB Power Sensors

MA24208A/MA24218A

True-RMS, 10 MHz to 8/18 GHz

Remote Control
USB

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

The Universal USB power sensors MA24208A and MA24218A are designed to provide accurate average power measurements from 10 MHz to 8 GHz and 18 GHz, respectively, over 80 dB of dynamic range. The sensors employ a patented "triple path" architecture that provides True-RMS measurements over the entire frequency and dynamic range (similar to thermal sensors), enabling users to make highly accurate average power measurements for CW, multi-tone, and digitally modulated signals up to 18 GHz.

Features and Benefits

- Broad frequency range (10 MHz to 18 GHz): ideal for general purpose, aerospace and satellite and wireless communications applications
- True-RMS measurements over 80 dB dynamic range: enables average power measurement on CW, multi-tone, and digitally modulated signals - independent of modulation bandwidth
- Best-in-Class damage protection (+30 dBm CW, +34 dBm peak <10 µs): protects instrumentation investment
- No zeroing required (for signals >–45 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 (for example, GSM, WiMAX, TD-SCDMA, and LTE)
- NIST traceable calibration: provides high-accuracy measurements
- 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

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 three sigma confidence level. Average and Relative Power uncertainty expressed with two sigma confidence level.
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 website: www.anritsu.com

Notes: MA24208A and MA24218A sensors may have degraded performance when dropped without the removable protective covering.
This cover is required for warranted operation.

Sensor Specifications

Frequency

MA24208A	10 MHz to 8 GHz
MA24218A	10 MHz to 18 GHz

Power Measurement

Dynamic Range	–60 to +20 dBm			
	≤150 MHz	>150 MHz to 2 GHz	>2 GHz to 12.4 GHz	>12.4 GHz to 18 GHz
VSWR, max	1.17:1	1.12:1	1.22:1	1.25:1
Measurement Range 1	+20 to +4 dBm approximate			
Measurement Range 2	<+4 to –16 dBm approximate			
Measurement Range 3	<–16 to –60 dBm approximate Auto and fixed ranging available			
Damage Levels at RF Port	+30 dBm, ±20 V DC (+34 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 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 to 10 dB, with 0.1 dB resolution
Trigger Hold Off	0 to 10 sec, with 0.01 ms resolution

External Trigger

External Trigger Input	MCX (f), 5.5 V (max.)
Impedance	4kΩ (nom.)
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 Hold Off	0 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)*1

	Over 0°C to 50°C ambient temperature range:			
Range (dBm)	≤0.05 GHz	>0.05 GHz to 2 GHz	>2 GHz to 12.4 GHz	>12.4 GHz to 18 GHz
–60 to <–16	0.14	0.14	0.14	0.17
–16 to <+4	0.14	0.14	0.13	0.13
+4 to +20	0.14	0.15	0.15	0.14
	Over 20°C to 30°C ambient temperature range:			
Range (dBm)	≤0.05 GHz	>0.05 GHz to 2 GHz	>2 GHz to 12.4 GHz	>12.4 GHz to 18 GHz
–60 to <–16	0.13	0.12	0.14	0.14
–16 to <+4	0.11	0.10	0.13	0.11
+4 to +20	0.11	0.10	0.10	0.11

Relative Power (dB)*1

≤0.05 GHz:

	Over 0°C to 50°C			Over 20°C to 30°C		
Range (dBm)	+4 to +20	–16 to <+4	–60 to <–16	+4 to +20	–16 to <+4	–60 to <–16
–60 to <–16	0.14	0.13	0.03	0.08	0.09	0.03
–16 to <+4	0.14	0.04	0.13	0.06	0.03	0.09
+4 to +20	0.05	0.14	0.14	0.05	0.06	0.08

>0.05 GHz to 2 GHz:

	Over 0°C to 50°C			Over 20°C to 30°C		
Range (dBm)	+4 to +20	–16 to <+4	–60 to <–16	+4 to +20	–16 to <+4	–60 to <–16
–60 to <–16	0.16	0.16	0.03	0.11	0.12	0.03
–16 to <+4	0.17	0.05	0.16	0.09	0.04	0.12
+4 to +20	0.06	0.17	0.16	0.06	0.09	0.11

>2 GHz to 12.4 GHz:

	Over 0°C to 50°C			Over 20°C to 30°C		
Range (dBm)	+4 to +20	–16 to <+4	–60 to <–16	+4 to +20	–16 to <+4	–60 to <–16
–60 to <–16	0.16	0.16	0.04	0.12	0.14	0.04
–16 to <+4	0.17	0.05	0.16	0.10	0.04	0.14
+4 to +20	0.06	0.17	0.16	0.07	0.10	0.12

>12.4 GHz to 18 GHz:

	Over 0°C to 50°C			Over 20°C to 30°C		
Range (dBm)	+4 to +20	–16 to <+4	–60 to <–16	+4 to +20	–16 to <+4	–60 to <–16
–60 to <–16	0.14	0.15	0.04	0.12	0.14	0.04
–16 to <+4	0.11	0.06	0.15	0.10	0.05	0.14
+4 to +20	0.06	0.11	0.14	0.06	0.10	0.12

Zero*2

	Set		Drift	
Range (dBm)	Watts	dBm	Watts	dBm
–60 to <–16	3.32E-10	–64.78	3.44E-10	–64.64
–16 to <+4	3.87E-08	–44.12	4.29E-08	–43.67
+4 to +20	1.07E-06	–29.70	9.96E-07	–30.02

Noise*3

Range (dBm)	Watts
–60 to <–16	1.23E-10
–16 to <+4	1.01E-08
+4 to +20	8.56E-07

Effect of Digital Modulation*4

Range (dBm)	dB
–60 to <–16	–0.048 to 0.080
–16 to <+4	–0.038 to 0.088
+4 to +20	–0.055 to 0.067

*1: Power uncertainty expressed with two sigma confidence level 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.

*2: Zero uncertainty expressed with three sigma confidence level. 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.

*3: 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 three sigma confidence level.

*4: Measurement error with reference to a CW signal of equal power and frequency between 20°C to 30°C in Normal mode and average power ≤+20 dBm. In general, the error caused by modulation depends on the peak to average power ratio and RF bandwidth of the signal.

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*1	–100 to +150 dB
Averaging	Auto, Manual
Type	Moving, Repeat
Number of Averages (Manual)*2	1 to 65,536
Auto Average Resolution*3	1 dB, 0.1 dB, 0.01 dB
Auto Average Source	Timeslot Number: 1 to 128 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*4	N × (aperture time × C_t) + 0.375 ms + T_{com} Continuous: >1,600 readings/s (minimum aperture, one average) Buffered: >11,000 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*5	N × (capture time × C_t) + (P_n × 0.042 ms) + T_{com}

Timeslot Mode

Maximum Number of Slots	128
Slot Width	0.01 ms to 100 ms
Maximum Capture Time	1000 ms (slot width × number of slots)
Resolution	0.01 ms max via remote command 0.01 ms max via PowerXpert™
Exclusion Periods	Start Exclusion: 0 ms to 10 ms End Exclusion: 0 ms to 10 ms
Measurement Time*6	N × (slot width × number of slots × C_t) + (P_n × 0.064 ms) + T_{com}

List Mode

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

*1: Offset correction feature is available only through the PowerXpert application. There is no remote command for it in the sensor firmware.

*2: Maximum number of averages allowed in Continuous Average mode and Timeslot 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.

*3: 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.

*4: 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 = 1.62
Command Processing Time = T_{com} = 0.2 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

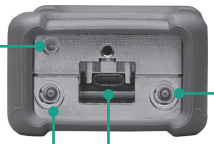
*5: Speed is defined as the data throughput at the "A" end of the USB A to Micro-B Cable (p/n 2000-1816-R), where:
Number of Repeat Averages = N (N = 1 for moving average mode)
Capture Time Coefficient = C_t = 1.645
Number of Points = P_n
Command Processing Time = T_{com} = 0.24 ms

*6: 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 = 1.625
Number of Points = P_n
Command Processing Time = T_{com} = 0.29 ms

General

RF Connector	N male
Interface to Host	USB 2.0 high speed
Current Consumption	410 mA to 450 mA characteristic (20°C to 30°C)
Dimensions	110 (W) × 46 (H) × 25.6 (D) mm, excluding N connector and silicone protective covering
Mass	397 g (0.88 lb)
Warranty	1 year

N Type connector designed for use with a torque wrench ensuring repeatable connections



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
Relative 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, 2.34 g rms Power Spectral Density: 0.01 g^2/Hz
CE	EMC: 2014/30/EU, EN61326-1, EN61000-4-2 LVD: 2014/35/EU, EN61010-1 RoHS: (EU) 2015/863
RCM	Australia and New Zealand: RCM AS/NZS 4417-2012
KCC	South Korea: KCC-REM-A21-0004

Training at Anritsu

Anritsu has designed courses to help you stay up to date with technologies important to your job. For available training courses, visit: www.anritsu.com/training

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Available Models
MA24208A	8 GHz USB Universal Power Sensor
MA24218A	18 GHz USB Universal 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
MA24208A-097	Option 97: ISO/IEC 17025 and ANSI/NCSL Z540-1 or ANSI/NCSLI Z540.3 (includes test report, uncertainty data, and accreditation symbol)
MA24208A-098	Option 98: Standard calibration ISO/IEC 17025 and ANSI/NCSL Z540-1
MA24208A-099	Option 99: Premium calibration ISO/IEC 17025 and ANSI/NCSL Z540-1 (includes test report and uncertainty data)
MA24218A-097	Option 97: ISO/IEC 17025 and ANSI/NCSL Z540-1 or ANSI/NCSLI Z540.3 (includes test report, uncertainty data, and accreditation symbol)
MA24218A-098	Option 98: Standard calibration ISO/IEC 17025 and ANSI/NCSL Z540-1
MA24218A-099	Option 99: Premium calibration ISO/IEC 17025 and ANSI/NCSL Z540-1 (includes test report and uncertainty data)
	Optional Accessories
	Calibrated Torque Wrenches
01-200	Calibrated torque wrench for N connector
01-204	Calibrated torque wrench for K and V connectors

Model/Order No.	Name
	Power Attenuators
3-1010-123	DC to 8.5 GHz, 30 dB, 50 W, 50Ω, N (m) to N (f)
3-1010-124	DC to 8.5 GHz, 40 dB, 100 W, 50Ω, N (m) to N (f)
3-1010-122	DC to 12.4 GHz, 20 dB, 5 W, 50Ω, N (m) to N (f)
42N50-20	DC to 18 GHz, 20 dB, 5 W, 50Ω, N (m) to N (f)
42N50A-30	DC to 18 GHz, 30 dB, 50 W, 50Ω, N (m) to N (f)
41KB-3	DC to 26.5 GHz, 3 dB, 50Ω, K (m) to K (f)
41KB-6	DC to 26.5 GHz, 6 dB, 50Ω, K (m) to K (f)
41KB-10	DC to 26.5 GHz, 10 dB, 50Ω, K (m) to K (f)
41KB-20	DC to 26.5 GHz, 20 dB, 50Ω, K (m) to K (f)
43KB-3	DC to 26.5 GHz, 3 dB, 50Ω, K(m) to K (f)
43KB-6	DC to 26.5 GHz, 6 dB, 50Ω, K (m) to K (f)
43KB-10	DC to 26.5 GHz, 10 dB, 50Ω, K (m) to K (f)
43KB-20	DC to 26.5 GHz, 20 dB, 50Ω, K (m) to K (f)
	Precision Coaxial Adapters
510-90-R	DC to 3.3 GHz, N (m) to 7/16 DIN (f)
510-91-R	DC to 3.3 GHz, N (f) to 7/16 DIN (f)
510-92-R	DC to 3.3 GHz, N (m) to 7/16 DIN (m)
510-93-R	DC to 3.3 GHz, N (f) to 7/16 DIN (m)
33NFNF50B	DC to 18 GHz, N (f) to N (f)
33NNF50B	DC to 18 GHz, N (m) to N (f)
33NN50B	DC to 18 GHz, N (m) to N (m)
34AN50	DC to 18 GHz, GPC-7 to N (m)
34ANF50	DC to 18 GHz, GPC-7 to N (f)
34NFK50	DC to 18 GHz, N (f) to K (m)
34NFKF50	DC to 18 GHz, N (f) to K (f)
34NK50	DC to 18 GHz, N (m) to K (m)
34NKF50	DC to 18 GHz, N (m) to K (f)
1091-26-R	DC to 18 GHz, N (m) to SMA (m)
1091-27-R	DC to 18 GHz, N (m) to SMA (f)
1091-80-R	DC to 18 GHz, N (f) to SMA (m)
1091-81-R	DC to 18 GHz, N (f) to SMA (f)

Microwave CW USB Power Sensors

MA24330A	MA24340A	MA24350A
10 MHz to 33 GHz	10 MHz to 40 GHz	10 MHz to 50 GHz

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

The Microwave CW USB Power Sensors MA243x0A series 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.

Key Features

- Broad frequency range (10 MHz up to 50 GHz): ideal for general purpose, aerospace, 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 µs): 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

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 website: www.anritsu.com

Notes: Sensors may have degraded performance when dropped without the removable protective covering.
This cover is required for warranted operation.

MA243x0A Specifications

Sensor Specifications

Frequency	10 MHz to 33 GHz, K (m) Connector (MA24330A) 10 MHz to 40 GHz, K (m) Connector (MA24340A) 10 MHz to 50 GHz, V (m) Connector (MA24350A)								
Power Measurement	VSWR	<50 MHz	50 MHz to 150 MHz	>0.15 GHz to 2 GHz	>2 GHz to 6 GHz	>6 GHz to 18 GHz	>18 GHz to 33 GHz	>33 GHz to 40 GHz	>40 GHz to 50 GHz
		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 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							

Continued on next page

Internal Trigger	Dynamic Range	–35 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 to 10 dB, with 0.1 dB resolution
	Trigger Hold Off	0 to 10 s, with 0.01 ms resolution
External Trigger	External Trigger Input	MCX (f), 5.5 V maximum
	Input Impedance	4kΩ (nom.)
	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 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

		25°C to 35°C			0°C to 50°C		
Average Power (dB)*3	Range (dBm)	≤18 GHz	>18 GHz to 40 GHz	>40 GHz to 50 GHz	≤18 GHz	>18 GHz to 40 GHz	>40 GHz to 50 GHz
	–70 to <+15	0.11	0.13	0.19	0.14	0.17	0.25
	+15 to +20	0.14	0.17	0.23	0.18	0.21	0.29

		Set		Drift	
Zero*4	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

	Range (dBm)	Watt	dBm
Noise*5	–70 to –20	3.53E-11	–74.52
	>–20 to 0	6.51E-11	–71.86
	>0 to +20	6.30E-10	–62.01

*3: 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.
*4: 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.
*5: Two sigma noise at 10.2 seconds of integration time (integration time = aperture time × 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 to +150 dB
	Averaging	Auto, Manual
	Type	Moving, Repeat
	Number of Averages (Manual)*7	1 to 65,536
	Auto Average Resolution*8	1, 0.1, 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 × (aperture time × 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

Continued on next page

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 × (capture time × C_t) + (P_n × 0.038 ms) + T_{com}
List Mode	Number of Measurements	1 to 1000
	Input Parameters	Frequency (GHz), aperture time (ms), averages
General	RF Connector	K (m) (MA24330A, MA24340A) V (m) (MA24350A)
	Interface to Host	USB 2.0 high speed
	Current Consumption	410 mA to 450 mA characteristic (+20°C to +30°C)
	Dimensions	110 (W) × 46 (H) × 25.6 (D) mm, excluding K or V connector and silicone protective covering
	Mass	397 g (0.88 lb)
	Warranty	1 year
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
	CE	EMC: 2014/30/EU, EN61326-1, EN61000-4-2 LVD: 2014/35/EU, EN61010-1 RoHS: (EU) 2015/863
	RCM	Australia and New Zealand: RCM AS/NZS 4417: 2012
	KCC	South Korea: KCC-REM-A21-0004

*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

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	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	ISO/IEC 17025 and ANSI/NCSL Z540-1 or ANSI/NCSLI Z540.3
MA24340A-097	(includes test report, uncertainty data, and accreditation symbol)
MA24330A-098	Standard calibration ISO/IEC 17025 and ANSI/NCSL Z540-1
MA24340A-098	
MA24350A-098	
MA24330A-099	Premium calibration ISO/IEC 17025 and ANSI/NCSL Z540-1
MA24340A-099	(includes test report and uncertainty data)
MA24350A-099	
	Optional Accessories
	Calibrated Torque Wrenches
01-201	Calibrated torque wrench for K and V connectors

Model/Order No.	Name
	Precision Fixed Attenuators
41KB-3	DC to 26.5 GHz, 3 dB, 50Ω, K (m) to K (f)
41KB-6	DC to 26.5 GHz, 6 dB, 50Ω, K (m) to K (f)
41KB-10	DC to 26.5 GHz, 10 dB, 50Ω, K (m) to K (f)
41KB-20	DC to 26.5 GHz, 20 dB, 50Ω, K (m) to K (f)
41KC-3	DC to 40 GHz, 3 dB, 50Ω, K (m) to K (f)
41KC-6	DC to 40 GHz, 6 dB, 50Ω, K (m) to K (f)
41KC-10	DC to 40 GHz, 10 dB, 50Ω, K (m) to K (f)
41KC-20	DC to 40 GHz, 20 dB, 50Ω, K (m) to K (f)
41VA-3	DC to 70 GHz, 3 dB, 50Ω, V (m) to V (f)
41VA-6	DC to 70 GHz, 6 dB, 50Ω, V (m) to V (f)
41VA-10	DC to 70 GHz, 10 dB, 50Ω, V (m) to V (f)
41VA-20	DC to 70 GHz, 20 dB, 50Ω, V (m) to V (f)
41VA-30	DC to 70 GHz, 30 dB, 50Ω, V (m) to V (f)
41VA-40	DC to 70 GHz, 40 dB, 50Ω, V (m) to V (f)
43KB-3	DC to 26.5 GHz, 3 dB, 50Ω, K (m) to K (f)
43KB-6	DC to 26.5 GHz, 6 dB, 50Ω, K (m) to K (f)
43KB-10	DC to 26.5 GHz, 10 dB, 50Ω, K (m) to K (f)
43KB-20	DC to 26.5 GHz, 20 dB, 50Ω, K (m) to K (f)
43KC-3	DC to 40 GHz, 3 dB, 50Ω, K (m) to K (f)
43KC-6	DC to 40 GHz, 6 dB, 50Ω, K (m) to K (f)
43KC-10	DC to 40 GHz, 10 dB, 50Ω, K (m) to K (f)
43KC-20	DC to 40 GHz, 20 dB, 50Ω, K (m) to K (f)
	Precision Coaxial Adapters
33KFKF50B	DC to 40 GHz, 50Ω, K (f) to K (f)
33KKF50B	DC to 40 GHz, 50Ω, K (m) to K (f)
33VFVF50C	DC to 70 GHz, 50Ω, V (f) to V (f)
33VVF50C	DC to 70 GHz, 50Ω, V (m) to V (f)
34NKF50	DC to 18 GHz, 50Ω, N (m) to K (f)
34NFKF50	DC to 18 GHz, 50Ω, N (f) to K (f)

mmWave Power Analyzer

MA24507A/MA24510A Power Master™

9 kHz to 70 GHz, 9 kHz to 110 GHz

Frequency Selectable mmWave Power Analyzer

Excellent Eco Product

MA24507A

MA24507A

MA24510A

Traditional power meters are broadband and have limited power ranges, so engineers and technicians are using spectrum analyzers that include many unneeded features, cost hundreds of thousands of dollars, and take up half the test bench just to make simple, frequency-based RF amplitude measurements. The Power Master MA24507A and MA24510A solutions are the world's first frequency selectable mmWave power analyzer. Unlike spectrum analyzers that are bulky, expensive, and complex or power meters that are not frequency dependent and have limited dynamic range, the MA24507A enables simple, numeric, frequency-based amplitude measurements of up to six signals from 9 kHz to 70 GHz with a device foot print slightly larger than a cell phone and at a fraction of the price of a spectrum analyzer with equivalent frequency and dynamic range coverage.

Key Features

- Able to measure very low power signals as low as –90 dBm
- Excellent for over-the-air testing, especially with mmWave signals that have high propagation loss
- User settings to control measurement speeds and noise floor
- Channel Monitor mode in PowerXpert for monitoring up to six frequency channels at once
- Power Hunter mode in PowerXpert for searching up to six signals within a frequency range
- Mounting holes for direct mounting to probes for on-wafer testing

Definitions

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

Warm-Up Time	30 minutes
Operating Temperature Range	0°C to 50°C
Typical Performance	Typical performance indicates the measured performance of an average unit. Typical performance does not include guard-bands and is not covered by the product warranty. Typical specifications are shown in parenthesis, such as (–102 dB), or noted as Typical.
Characteristic Performance	Characteristic performance indicates a performance designed-in and verified during the design phase. Characteristic performance is not covered by the product warranty.
ISO GUM Measurement Uncertainty	Uncertainty expressed with coverage factor of k = 2.
Calibration Cycle	Anritsu recommended calibration interval is 12 months.
Specifications Subject to Change	All specifications subject to change without notice. For the most current data sheet, please visit the Anritsu website: www.anritsu.com

Specifications

Frequency

Range	MA24507A: 9 kHz to 70 GHz, V (m) Connector (1.85 mm) MA24510A: 9 kHz to 110 GHz, W1 (m) Connector (1.0 mm)
Internal Reference	Accuracy: ±0.2 ppm (0°C to 50°C) Aging: ±1.0 ppm/year aging
Continuous Mode Span	30 kHz to 2 GHz max. in Channel Power Measurement 10 kHz to Full Span in CW Max. Measurement
Channel Monitor Mode Span	1 kHz to 20 MHz

Power Measurement

Maximum Amplitude

Frequency	Max. Power*
≤6.15 GHz	+15 dBm
>6.15 GHz	+10 dBm

*: Characteristic

Average Noise Floor

Channel Power Measurement	Channel Span	Noise Floor*1
	30 kHz	–88 dBm
	10 MHz	–64 dBm
	1 GHz	–40 dBm
CW Max. Measurement	Resolution	NoiseFloor*2
	High	–100 dBm
	Medium	–90 dBm
	Low	–80 dBm

*1: Measured at 1 GHz center frequency
*2: Measured at 1 GHz center frequency; 3 MHz span

Damage Level

Continuous	+30 dBm CW, ±10 VDC max.

Ranges*

Lower	≤–10 dBm
Upper	>–10 dBm

*: Power Master allows the user to define the operating range. To avoid clipping or saturating signals, the upper range is recommended for signals above –10 dBm. Signals at or below –10 dBm will typically be able to use the lower range.

Input Match (typical)

Frequency	V Connector		W1 Connector	
	VSWR	Return Loss	VSWR	Return Loss
9 kHz to 12.4 GHz	1.29:1	18 dB	1.29:1	18 dB
>12.4 GHz to 26.5 GHz	1.43:1	15 dB	1.67:1	12 dB
>26.5 GHz to 40 GHz	1.58:1	13 dB	1.67:1	12 dB
>40 GHz to 50 GHz	1.67:1	12 dB	1.67:1	12 dB
>50 GHz to 70 GHz	2.10:1	9 dB	2.10:1	9 dB
>70 GHz to 110 GHz	—	—	2.10:1	9 dB

Measurement Speed (readings/s, characteristic)

		Span*		
		300 kHz	20 MHz	1 GHz
Channel Power Measurement		7	20	10
CW Max. Measurement	High	0.8	15	6
	Medium	4	25	10
	Low	20	25	10

*: Measured at 1 GHz center frequency; no averages

Trigger Source

Bus
Continuous

Measurement Uncertainty

Power Measurements

Amplitude Accuracy*

Frequency	20°C to 30°C (after 30 minute warm-up)		0°C to 50°C (after 60 minute warm-up)	
	Maximum	Typical	Maximum	Typical
9 kHz to 644 MHz	±1.3 dB	±0.5 dB	±2.0 dB	±0.5 dB
>644 MHz to 40 GHz	±1.8 dB	±0.5 dB	±3.0 dB	±1.0 dB
>40 GHz to 70 GHz	±2.0 dB	±0.5 dB	±3.0 dB	±1.0 dB
>70 GHz to 90 GHz	±2.2 dB	±0.5 dB	±3.0 dB	±1.0 dB
>90 GHz to 110 GHz	±2.5 dB	±0.5 dB	±3.0 dB	±1.0 dB

*: Accuracy excludes effects of Noise and Mismatch uncertainty.
Characteristic values between 67 GHz and 70 GHz.

Relative Power Accuracy

Frequency	Accuracy
9 kHz to <6.15 GHz	±0.3 dB
6.15 GHz to <40 GHz	±0.3 dB
40 GHz to ≤110 GHz	±0.3 dB (typical with W1 connector)

PowerXpert™

PC Requirements (version 4.0 or greater)

Processor and RAM	Equivalent to Quad Core i5 fourth generation or higher CPU, 8 GB RAM
Operating System	Microsoft® Windows® 10, 8.1, or 7; 64-bit
Hard-Disk Free Space	100 MB minimum
Display Resolution	1024 × 768 minimum
Interface	USB 3.0

System

Measurand	Channel power, CW peak power
Measurement Resolution	0.01 dB max. via PowerXpert, 0.01 dB max. via remote command
Offset Correction*	–100 dB to +150 dB
Units	dBm, nW, µW, mW, W
Averaging	Manual
Averaging Type	Moving
Number of Averages	1 to 1,000

*: Offset correction feature is available only through the PowerXpert application. There is no remote command for it in the analyzer firmware.

Continuous Mode

Measurements	Channel power, CW max.
Center Frequency	9.5 kHz to (Max. Freq. – 500 Hz)
Span	30 kHz to 2 GHz (Channel power), 1 kHz to Full span (CW max.)
Resolution	High, medium, low

Power Hunter Mode

Measurement	CW max. only
Start Frequency	9 kHz to (Max. Freq. – 1 kHz)
Stop Frequency	10 kHz to Max. Freq.
Set Minimum Power Range	–130 to 0 dBm

Channel Monitor Mode

Measurements	Channel power, CW max.
Channel Frequencies	(9 kHz + Span/2) to (Max. Freq. – Span/2)
Span	1 kHz to 20 MHz
Number of Channels	Up to 6

General

RF Connector	MA24507A: V male (1.85 mm) MA24510A: W1 male (1.0 mm)
Interface to Host	USB 3.0
Current Consumption	900 mA max.
Dimensions	84 (W) × 155 (H) × 27 (D) mm (3.3 × 6.1 × 1.1 in)
Mass	282 g (0.62 lb)
Warranty	1 year

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
Relative Humidity (non-condensing)	45% at +50°C 75% at +40°C 95% at +30°C
Altitude	4600 m operational max.
Shock	30 g half-sine, 11 ms duration
Vibration	Sinusoidal: 5 Hz to 55 Hz, 3 g max. Random: 10 Hz to 500 Hz, 2.34 g rms Power Spectral Density: 0.01 g^2/Hz

Compliance

CE	EMC: 2014/30/EU, EN61326-1, EN61000-4-2 LVD: 2014/65/EU, EN61010-1 RoHS: (EU) 2015/863 Australia and New Zealand RCM AS/NZS 4417:2012 South Korea KCC-REM-A21-0004

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main Frame
MA24507A	9 kHz to 70 GHz mmWave Power Analyzer
MA24510A	9 kHz to 110 GHz mmWave Power Analyzer
	Included Accessories
2000-1605-R	1.5 m BNC (m) to MCX (m) cable
2000-1859-R	USB 3.0 Type C to Type A Cable, 1 m
	Available Options
MA24507A-098	Standard Calibration ISO/IEC 17025 and ANSI/NCSL Z540-1
MA24507A-099	Premium Calibration ISO/IEC 17025 and ANSI/NCSL Z540-1 (includes test report and uncertainty data)
MA24510A-098	Standard Calibration ISO/IEC 17025 and ANSI/NCSL Z540-1
MA24510A-099	Premium Calibration ISO/IEC 17025 and ANSI/NCSL Z540-1 (includes test report and uncertainty data)
	Optional Accessories
	Calibrated Torque Wrenches
01-201	Calibrated torque wrench for K and V connectors
	Precision Fixed Attenuators
41VA-3	DC to 70 GHz, 3 dB, 50Ω, V (m) to V (f)
41VA-6	DC to 70 GHz, 6 dB, 50Ω, V (m) to V (f)
41VA-10	DC to 70 GHz, 10 dB, 50Ω, V (m) to V (f)
41VA-20	DC to 70 GHz, 20 dB, 50Ω, V (m) to V (f)
41VA-30	DC to 70 GHz, 30 dB, 50Ω, V (m) to V (f)
41VA-40	DC to 70 GHz, 40 dB, 50Ω, V (m) to V (f)
	Precision Coaxial Adapters
33VFVF50C	DC to 70 GHz, 50Ω, V (f) to V (f)
33VVF50C	DC to 70 GHz, 50Ω, V (m) to V (f)
34WV50	DC to 65 GHz, W1 (m) to V (m), 50Ω
34WVF50	DC to 65 GHz, W1 (m) to V (f), 50Ω
34WFV50	DC to 65 GHz, W1 (f) to V (m), 50Ω
34WFVF50	DC to 65 GHz, W1 (f) to V (f), 50Ω
33WW50	DC to 110 GHz, W1 (m) to W1 (m), 50Ω
33WWF50	DC to 110 GHz, W1 (m) to W1 (f), 50Ω
33WFWF50	DC to 110 GHz, W1 (f) to W1 (f), 50Ω
	Waveguide to Coaxial Adapters (right angle)
35WR22VF	33 GHz to 50 GHz, WR22 to V (f)
35WR19VF	40 GHz to 60 GHz, WR19 to V (f)
35WR15VF	50 GHz to 65 GHz, WR15 to V (f)
35WR10WF	75 GHz to 110 GHz, WR10 to W1 (f)
SC7442	60 GHz to 90 GHz, WR12 to W1 (f)
	Waveguide to Coaxial End Launch Adapters (straight through)
1091-460-R	17.6 GHz to 26.7 GHz, WR42 to V (f)
1091-459-R	26.4 GHz to 40.1 GHz, WR28 to V (f)
1091-458-R	33.0 GHz to 50.1 GHz, WR22 to V (f)
1091-457-R	39.3 GHz to 59.7 GHz, WR19 to V (f)
1091-456-R	49.9 GHz to 67.0 GHz, WR15 to V (f)
1091-402-R	49.9 GHz to 75.8 GHz, WR15 to W1 (f)
1091-401-R	60.5 GHz to 92.0 GHz, WR12 to W1 (f)
1091-400-R	73.8 GHz to 110 GHz, WR10 to W1 (f)
	Directional Horn Antennas
2000-1867-R	17.6 GHz to 26.7 GHz, WR42, 25 dBi gain
2000-1868-R	26.4 GHz to 40.1 GHz, WR28, 25 dBi gain
2000-1869-R	33.0 GHz to 50.1 GHz, WR22, 25 dB gain
2000-1870-R	39.3 GHz to 59.7 GHz, WR19, 25 dBi gain
2000-1871-R	49.9 GHz to 75.8 GHz, WR15, 25 dBi gain
2000-1872-R	60.0 GHz to 90.0 GHz, WR12, 25 dBi gain
2000-1873-R	75.0 GHz to 110.0 GHz, WR10, 25 dBi gain
	USB Cable Extenders
2000-1888-R	USB 3.0 Powered Cable Extender, 10 m, (32 ft) (up to two can be used in series for a total length of 20 m)

USB Peak Power Sensors

MA24400A (MA24406A/08A/18A/19A/40A/41A) series

High-Speed Response Peak Power Sensor Equipped with Various Modulated Wave Signal Measurement and Analysis Functions

NEW
MA24408A


MA24406A


MA24408A


MA24418A


MA24419A


MA24440A


MA24441A

The USB Peak Power Sensors MA24400A are designed to meet the challenges of signal measurement and characterization in a complex world of wireless communications. This series is designed to provide accurate, peak power measurements from 50 MHz to 6/8/18/40 GHz with up to 80 dB of dynamic range and 195 MHz of video bandwidth. The MA24400A sensors employ a parallel processing methodology that performs the multi-step process of RF power measurement at incredible, unmatched speeds. While conventional power meters and USB sensors perform steps serially, resulting in long re-arm times and missed data, the MA24400A sensors capture, display, and measure every pulse, glitch, and detail with virtually no gaps in data and zero latency.

Key Features

- 6/8/18/40 GHz RF power sensors
- Up to 195 MHz VBW with 3 ns rise time
- 100,000 measurements per second
- 10 GSa/s effective sample rate
- 100 MSa/s continuous sample rate
- Crest factor and statistical measurements (e.g. CCDF)
- Synchronized multi-channel measurements
- Microwave peak power analyzer advanced measurement and analysis software

Specifications

Frequency Range

Model	MA24406A	MA24408A	MA24418A	MA24419A	MA24440A	MA24441A
Frequency Range	50 MHz to 6 GHz	50 MHz to 8 GHz	50 MHz to 18 GHz	50 MHz to 18 GHz	50 MHz to 40 GHz	50 MHz to 40 GHz

Power Measurement

Model		MA24406A	MA24408A	MA24418A	MA24419A	MA24440A	MA24441A
Dynamic Range	Average	–60 to +20 dBm	–53 to +20 dBm*1	–34 to +20 dBm	–50 to +20 dBm	–34 to +20 dBm	–50 to +20 dBm
	Pulse	–50 to +20 dBm	–43 to +20 dBm*2	–24 to +20 dBm	–40 to +20 dBm	–24 to +20 dBm	–40 to +20 dBm
VSWR (max.) (GHz)		1.25 (0.05 to 6)	1.20 (0.05 to 6) 1.25 (6 to 8)	1.15 (0.05 to 2.0) 1.28 (2.0 to 16) 1.34 (16 to 18)	1.15 (0.5 to 2.0) 1.20 (2.0 to 6.0) 1.28 (6.0 to 16) 1.34 (16 to 18)	1.25 (0.05 to 4.0) 1.65 (4.0 to 38) 2.00 (38 to 40)	1.25 (0.05 to 4.0) 1.65 (4.0 to 38) 2.00 (38 to 40)
Damage Level	RF Port Input	+23 dBm, ±10.0 VDC (+30 dBm peak for 1 µs), minimum					
Response	Single Channel Rise Time (fast/std)	3 ns/<10 µs	4 ns/<10 µs	5 ns/<10 µs	<100 ns/<10 µs	5 ns/<10 µs	<100 ns/<10 µs
	Video Bandwidth (fast/std)	195 MHz/350 kHz	165 MHz/350 kHz	70 MHz/350 kHz	6 MHz/350 kHz	70 MHz/350 kHz	6 MHz/350 kHz
	Single Shot Bandwidth	35 MHz	35 MHz	35 MHz	6 MHz	35 MHz	6 MHz
	Sampling Rate	100 $MS_{a/s}$, characteristic					
	Effective Sampling Rate	10 $GS_{a/s}$, characteristic					

*1: –53 dBm > 6 GHz, –60 dBm < 6 GHz
*2: –43 dBm > 6 GHz, –50 dBm < 6 GHz

Triggering

Model		MA24406A	MA24408A	MA24418A	MA24419A	MA24440A	MA24441A
Source		Continuous, Internal, External TTL, Crossover (from another sensor)					
Arm Type		Continuous, Single, Trigger Holdoff, Frame (gap) Holdoff					
Internal Trigger	Dynamic Range	–38 to 20 dBm	–38 to 20 dBm	–10 to 20 dBm	–27 to 20 dBm	–10 to 20 dBm	–27 to 20 dBm
	Min Pulse Width (fast/std)	10 ns/3 µs	3 µs	10 ns/3 µs	200 ns/3 µs	10 ns/3 µs	200 ns/3 µs
	Slope	Positive or Negative					
	Trigger Holdoff	100 ns to 1 s with 10 ns resolution					
External Trigger	External Trigger Input	SMB (f)					
	Impedance	10 kΩ					
	Type	TTL					
	Slope	Positive or Negative					
	High Level Input Voltage	2.4 V min, 5.5 V max.					
	Low Level Input Voltage	–0.1 V min, 0.7 V max.					
	Latency	<10 ns (Latency is defined as the time delay between the defined edge of the applied trigger and the sensor switching into the triggered state.)					
	Trigger Pulse Width	10 ns min.					
	Trigger Repetition Period	20 ns min.					
	Trigger Holdoff	100 ns to 1 s with 10 ns resolution					

PC Requirements

Processor	1.3 GHz or higher recommended
RAM	512 MB (1 GB or more recommended)
Operating System	Microsoft® Windows® 10 Microsoft® Windows® 8 (32-bit and 64-bit) Microsoft® Windows® 7 (32-bit and 64-bit)
Hard-Disk Free Space	Min 1.0 GB free space to install and run
Display Resolution	800 × 600 (1280 × 1024 or higher recommended)
Interface	USB 2.0 high speed

General

RF Connector	N (m) (MA24406A, MA24408A, MA24418A, MA24119A) 2.92 mm (m) (MA24440A, MA24441A)
Interface to Host	USB 2.0 high speed
Size	145 (W) × 43 (H) × 43 (D) mm, excluding N connector
Weight	363 g (0.8 lb)
Warranty	3 year

Environmental Requirements

Operating Temperature Range	0°C to +55°C
Storage Temperature Range	–40°C to +70°C
Relative Humidity (non-condensing)	45% at 50°C 75% at 40°C 95% at 30°C
Altitude	3048 m operational max.
Shock	30 g half-sine, 11 ms duration
Vibration	Sinusoidal: 5 Hz to 55 Hz, 3 g max. Random: 10 Hz to 500 Hz, 2.34 g rms Power Spectral Density: 0.01 g^2/Hz

Regulatory Compliance

CE	EMC: 2014/30/EU, EN61326-1, EN61000-4-2 LVD: 2014/35/EU, EN61010-1 RoHS: (EU) 2015/863

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names.
The actual name of the item may differ from the Order Name.

Model/Order No.	Name
	Main Frame
MA24406A	USB Peak Power Sensor, 50 MHz to 6 GHz
MA24408A	USB Peak Power Sensor, 50 MHz to 8 GHz
MA24418A	USB Peak Power Sensor, 50 MHz to 18 GHz
MA24419A	USB Peak Power Sensor, 50 MHz to 18 GHz
MA24440A	USB Peak Power Sensor, 50 MHz to 40 GHz
MA24441A	USB Peak Power Sensor, 50 MHz to 40 GHz
	Included Accessories
11410-00976	Information Card
806-390-R	0.9 m BNC (m) to SMB (m) cable
806-389-R	0.9 m SMB (m) to SMB (m) cable
806-391-R	1.8 m USB A (m) to USB B (m) cable
	Available Options
MA24406A-097 MA24408A-097 MA24418A-097 MA24419A-097 MA24440A-097 MA24441A-097	Accredited Calibration to ISO/IEC 17025 and ANSI/NCSL Z540-1 or ANSI/NCSL Z540.3 (includes test report, uncertainty data, and accreditation symbol)
	Optional Accessories
	Attenuators
3-1010-122	Attenuator, DC to 12.4 GHz, 20 dB, 5 W, N (m) to N (f), 50Ω
3-1010-123	Attenuator, DC to 8.5 GHz, 30 dB, 50 W, N (m) to N (f), 50Ω
3-1010-124	Attenuator, DC to 8.5 GHz, 40 dB, 100 W, N (f) to N (m), 50Ω
42N50-20	Attenuator, DC to 18 GHz, 20 dB, 5 W, N (m) to N (f), 50Ω
42N50A-30	Attenuator, DC to 18 GHz, 30 dB, 50 W, N (m) to N (f), 50Ω
43KB-3	Fixed Attenuator, 3 dB, DC to 26.5 GHz, K (m) to K (f), 50Ω
43KB-6	Fixed Attenuator, 6 dB, DC to 26.5 GHz, K (m) to K (f), 50Ω
43KB-10	Fixed Attenuator, 10 dB, DC to 26.5 GHz, K (m) to K (f), 50Ω
43KB-20	Fixed Attenuator, 20 dB, DC to 26.5 GHz, K (m) to K (f), 50Ω
43KC-3	Fixed Attenuator, 3 dB, DC to 40 GHz, K (m) to K (f), 50Ω
43KC-6	Fixed Attenuator, 6 dB, DC to 40 GHz, K (m) to K (f), 50Ω
43KC-10	Fixed Attenuator, 10 dB, DC to 40 GHz, K (m) to K (f), 50Ω
43KC-20	Fixed Attenuator, 20 dB, DC to 40 GHz, K (m) to K (f), 50Ω
41KB-3	Precision Fixed Attenuator, 3 dB, DC to 26.5 GHz, K (m) to K (f), 50Ω
41KB-6	Precision Fixed Attenuator, 6 dB, DC to 26.5 GHz, K (m) to K (f), 50Ω
41KB-10	Precision Fixed Attenuator, 10 dB, DC to 26.5 GHz, K (m) to K (f), 50Ω
41KB-20	Precision Fixed Attenuator, 20 dB, DC to 26.5 GHz, K (m) to K (f), 50Ω
41KC-3	Precision Fixed Attenuator, 3 dB, DC to 40 GHz, K (m) to K (f), 50Ω
41KC-6	Precision Fixed Attenuator, 6 dB, DC to 40 GHz, K (m) to K (f), 50Ω
41KC-10	Precision Fixed Attenuator, 10 dB, DC to 40 GHz, K (m) to K (f), 50Ω
41KC-20	Precision Fixed Attenuator, 20 dB, DC to 40 GHz, K (m) to K (f), 50Ω
	Coaxial Adapters
510-90-R	Adapter, DC to 3.3 GHz, N (m) to 7/16 DIN (f), 50Ω
510-91-R	Adapter, DC to 3.3 GHz, N (f) to 7/16 DIN (f), 50Ω
510-92-R	Adapter, DC to 3.3 GHz, N (m) to 7/16 DIN (m), 50Ω
510-93-R	Adapter, DC to 3.3 GHz, N (f) to 7/16 DIN (m), 50Ω
1091-26-R	Adapter, DC to 18 GHz, N (m) to SMA (m), 50Ω
1091-27-R	Adapter, DC to 18 GHz, N (m) to SMA (f), 50Ω
1091-80-R	Adapter, DC to 18 GHz, N (f) to SMA (m), 50Ω
1091-81-R	Adapter, DC to 18 GHz, N (f) to SMA (f), 50Ω
34AN50	Precision Adapter, DC to 18 GHz, GPC-7 to N (m), 50Ω
34ANF50	Precision Adapter, DC to 18 GHz, GPC-7 to N (f), 50Ω
34NFK50	Precision Adapter, DC to 18 GHz, N (f) to K (m), 50Ω
34NFKF50	Precision Adapter, DC to 18 GHz, N (m) to K (f), 50Ω
34NK50	Precision Adapter, DC to 18 GHz, N (m) to K (m), 50Ω
34NKF50	Precision Adapter, DC to 18 GHz, N (m) to K (f), 50Ω
33NFNF50B	Calibration Grade Adapter, DC to 18 GHz, N (f) to N (f), 50Ω
33NNF50B	Calibration Grade Adapter, DC to 18 GHz, N (m) to N (f), 50Ω
33NN50B	Calibration Grade Adapter, DC to 18 GHz, N (m) to N (m), 50Ω