Operation Manual

Power Sensors MA24xxA/B/D and MA2400xA

Anritsu

Anritsu Company
490 Jarvis Drive
Morgan Hill, CA 95037-2809
USA

Part Number: 10585-00004
Revision: V
Published: October 2020

Unauthorized Use or Disclosure

Anritsu Company has prepared the product user documentation for use by Anritsu Company personnel and customers as a guide for the proper installation, operation, and maintenance of Anritsu Company equipment and software programs. The drawings, specifications, and information contained therein are the property of Anritsu Company, and any unauthorized use of these drawings, specifications, and information is prohibited; they shall not be reproduced, copied, or used in whole or in part as the basis for manufacture or sale of the equipment or software programs without the prior written consent of Anritsu Company.

Export Management

The Anritsu products identified herein and their respective manuals may require an Export License or approval by the government of the product country of origin for re-export from your country. Before you export these products or any of their manuals, please contact Anritsu Company to confirm whether or not these items are export-controlled. When disposing of export-controlled items, the products and manuals must be broken or shredded to such a degree that they cannot be unlawfully used for military purposes.

Contacting Anritsu for Sales and Service

To contact Anritsu, visit the following URL and select the services in your region: http://www.anritsu.com/contact-us

Table of Contents

Chapter 1—General Information

Chapter 2—Functional Description

Subject Index

Chapter 1 — General Information

1-1 Introduction

This manual provides descriptions and specifications for Anritsu power sensors that are used with Anritsu power meters. It includes care, handling and performance verification information. USB power sensors are not covered in this manual.

Power Meter Models

The following power meter models are available.

- The ML2490 series has the performance required for narrow fast rising-edge pulse power measurements (e.g., radar).
- The ML2480 series is suited for wideband power measurements on signals such as W-CDMA, WLAN, and WiMAX.
- The ML2430 series is designed for CW applications, offering a combination of accuracy, speed and flexibility in a low cost package.

Power Sensor Models

Power sensor models covered in this manual are listed in Table 1-1. Full specifications for each are in Appendix B.

Table 1-1. Power Sensor Models

Type/Model	Frequency Range	Power Range
Standard Diode Sensors		
MA2472D	10 MHz to 18 GHz	–70 dBm to 20 dBm
MA2473D	10 MHz to 32 GHz	–70 dBm to 20 dBm
MA2474D	10 MHz to 40 GHz	–70 dBm to 20 dBm
MA2475D	10 MHz to 50 GHz	–70 dBm to 20 dBm
High Accuracy Diode Sensors		
MA2442D	10 MHz to 18 GHz	–67 dBm to 20 dBm
MA2444D	10 MHz to 40 GHz	–67 dBm to 20 dBm
MA2445D	10 MHz to 50 GHz	–67 dBm to 20 dBm

Table 1-1. Power Sensor Models

Type/Model	Frequency Range	Power Range
Universal Sensors		
MA2481D	10 MHz to 6 GHz	–60 dBm to 20 dBm
MA2482D	10 MHz to 18 GHz	–60 dBm to 20 dBm
Wideband Sensors		
MA2490A	50 MHz to 8 GHz	–60 dBm to 20 dBm
MA2491A	50 MHz to 18 GHz	–60 dBm to 20 dBm
Pulse Sensor		
MA2411B	300 MHz to 40 GHz	–20 dBm to 20 dBm
Thermal Sensors		
MA24002A	10 MHz to 18 GHz	–30 dBm to 20 dBm
MA24004A	10 MHz to 40 GHz	–30 dBm to 20 dBm
MA24005A	10 MHz to 50 GHz	–30 dBm to 20 dBm

Note	Anritsu ML2407A/08A and ML2437A/38A Power Meters must have meter firmware revision 3.10 or higher when used with Anritsu MA24xxD and MA2400xA Series power sensors.

Identification Numbers

The Anritsu model number and serial number is located on the power sensor. Please refer to these numbers when corresponding with Anritsu Customer Service.

1-2 User Documentation

The power meter, power sensor and power analyzer product Information, Compliance, and Safety Guide contains the important safety, legal, and regulatory notices before operating the equipment.

- Product Information, Compliance, and Safety Guide – 10100-00066
- Power Meters and Power Sensors Technical Data Sheet – 11410-00423

Power Sensor documentation, updated software, and other power measurement related product literature can be downloaded from the Anritsu product page Library tab:

https://www.anritsu.com/en-US/test-measurement/rf-microwave/power-meters-and-sensors

Documentation Conventions

The following conventions are used throughout this document:

Instrument Identification

Throughout this manual, the terms MA24xxA/B/D and MA2400xA, *Power Sensor, or DUT (device under test)* are used to refer to the power sensor. When required to identify a specific model, the specific model number is used, such as MA2496A. *This* manual's organization is displayed in the table of contents.

Hard Keys or Front Panel Keys

When testing sensors, the power meter and test equipment front panel hard keys are denoted with a bold Sans Serif font such as "Press the front panel Frequency key."

User Interface, Menus, and Soft Buttons

The power meter user interface consists of menus, button lists, sub-menus, toolbars, and dialog boxes. All of these elements are denoted with a special font, such as the Calibration menu or the AutoCal button.

User Interface Navigation Conventions

Navigation in Power Meter and Test Equipment: Elements in navigation shortcuts or paths (identified as "Navigation") are separated with the pipe symbol ("|"). Menu and dialog box names are distinctive Sans Serif font. Button names are in Title Case. For example, you would enter the power meter Service Mode by pressing the front panel keys in the following sequence:

System | Service **| Diag | 0 |** Enter**:** This string means you would: press the **System** hard key **|** press the Service soft key **|** press the Diag soft key **|** press the **0** keypad hard key **|** Press the Enter soft key.

1-3 Instrument Care

Instrument care and preventive maintenance consist occasional cleaning of the instrument, inspecting and cleaning the RF connectors and all accessories before use..

Caution	Do not operate or store the power measurement equipment in extreme environments. Refer to the instrument Technical Data Sheet for the specified operating and storage conditions,

Connector Care

Clean the instrument with a soft, lint-free cloth dampened with water or water with a mild cleaning solution. Clean the RF connectors and center pins with a cotton swab dampened with denatured alcohol. Visually inspect the connectors. The fingers of the female connectors and the pins of the male connectors should be unbroken and uniform in appearance. If you are unsure whether the connectors are undamaged, gauge the connectors to confirm that the dimensions are correct.

Visually inspect the test port cables. The test port cable should be uniform in appearance and not stretched, kinked, dented, or broken.

Visually inspect connectors for general wear, cleanliness, and for damage such as bent pins or connector rings. Repair or replace damaged connectors immediately. Dirty connectors can limit the accuracy of your measurements. Damaged connectors can harm the instrument. Connection of cables carrying an electrostatic potential, excess power, or excess voltage can damage the connector, the instrument, or both.

To prevent damage to your instrument, do not use pliers or wrenches to tighten connectors. Inadequate torque settings can affect measurement accuracy. Over-tightening connectors can cause damage to the connector or instrument, Refer to the connector type torque settings listed in Table 1-2 on page 1-6.

Connecting

Connect RF connectors as follows:

1. Carefully align the connectors. The male connector center pin must slip concentrically into the contact fingers of the female connector.
2. Align and push connectors straight together. Do not twist or screw them together. A slight resistance can usually be felt as the center conductors mate.
3. To tighten, turn the connector nut, not the connector body. Damage can occur to the center conductor and to the outer conductor if the connector body is twisted.
4. If you use a torque wrench, initially tighten by hand so that approximately 1/8 turn or 45 degrees of rotation remains for the final tightening with the torque wrench.

   Relieve any side pressure on the connection (such as from long or heavy cables) in order to assure consistent torque. Use an open-end wrench to keep the connector body from turning while tightening with the torque wrench.

Disconnecting

Disconnect RF connectors as follows:

1. If a wrench is needed, use an open-end wrench to keep the connector body from turning while loosening with a second wrench.
2. Complete the disconnection by hand, turning only the connector nut.
3. Pull the connectors straight apart without twisting or bending.

Torque Settings

The recommended torque settings for the USB power sensor and Power Master is listed in Table 1-2.

Table 1-2. Connector Wrench Requirements – Torque Wrenches and Settings – Open End Wrenches

Connector Type	Torque Wrench Model Number	Torque Specification	Open End Wrench
3.5 mm/SMA	01-201	8 in-lbs (0.90 N·m)	01-204
K (2.92 mm)	01-201	8 in-lbs (0.90 N·m)	01-204
V (1.85 mm)	01-201	8 in-lbs (0.90 N·m)	01-204
N	01-200	12 in-lbs (1.35 N·m)	01-202

Mechanical Shock

Handle power measurement devices with care. Avoid dropping, tossing, or allowing any form of mechanical shock that will compromise the power measurement accuracy.

ESD Caution

The power sensors and Power Master, like other high performance instruments, are susceptible to electrostatic discharge (ESD) damage. Coaxial cables and antennas often build up a static charge, which (if allowed to discharge by connecting directly to the instrument without discharging the static charge) may damage the Enter Instrument Name (BTS Master, etc.) input circuitry. Instrument operators must be aware of the potential for ESD damage and take all necessary precautions.

Operators should exercise practices outlined within industry standards such as JEDEC-625 (EIA-625), MIL-HDBK-263, and MIL-STD-1686, which pertain to ESD and ESDS devices, equipment, and practices. This may be as simple as temporarily attaching a short or load device to the cable or antenna prior to attaching to the Enter Instrument Name (BTS Master, etc.). It is important to remember that the operator may also carry a static charge that can cause damage. Following the practices outlined in the above standards will ensure a safe environment for both personnel and equipment.

Chapter 2 — Functional Description

2-1 Introduction

Anritsu sensors are classified into three general types:

- MA2400xA Thermal Sensors
- MA247xX, MA244xX, MA249xX, and MA2411X Diode Sensors
- MA248xX Universal Sensors

Internal EEPROM

All Anritsu power sensors contain an internal EEPROM for storage of calibration data as a function of frequency, power, and temperature. The power meter to interpolate and correct readings automatically.

Sensor Function

All the above sensors have one common function:

For a given signal frequency, they translate a sensed input power into an output voltage. The Anritsu ML2400 Series power meters interpret the sensor voltages with signal frequencies and output correct power readings.

Power Sensing Elements

Both diode sensors and thermal sensors have a single power sensing element. Therefore, they have only one voltage versus power relationship. Universal sensors have three power sensing elements, and they have three sets of voltage versus power relationships.

Power Sensor Problem Solving

The most common cause of power sensor problems is excess input power. Applying power exceeding the labeled damage levels will damage the sensing element(s) such that its voltage versus power relationships are changed, resulting in erroneous power readings.

The other most common cause of power sensor problems is damaged connectors. Connections should be tightened with the proper torque wrench applied to the coupling nut only. Any attempt to torque or untorque a connection using the body of the power sensor may result in either connector damage, or in the connector becoming unthreaded from the body.

Since the connector-to-body threads have thread-locking compound applied, slight unthreading of the connector from the body may not be physically apparent. Unthreaded or damaged connectors will change the voltage versus power relationships. These changes are usually manifested as a poor input match.

Any suspect power sensor should have two parameters tested:

- SWR (reflection coefficient magnitude)
- Sensitivity

Refer to Chapter 3 for test instructions.

Note	There are no user serviceable parts inside the power sensors. Contact your local Anritsu Service Center and return the power sensor with a detailed description of the observed problems.

2-2 Sensor Descriptions

MA247xD Standard Diode Sensors

Description

The Anritsu MA247xD standard diode sensors are designed for use with the ML2430, ML2480 and ML2490 series power meters. They are 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% making them the choice for precision measurements. The 4 µs rise time of these sensors is fast enough for power measurements on GSM and similar TDMA systems that use GMSK modulation.

Features

- Wide dynamic range sensors (–70 dBm to +20 dBm)
- Accurate CW average power measurements
- Wide frequency coverage from 10 MHz to 50 GHz (sensor dependent)
- Calibration factors stored in EEPROM

MA244xD High Accuracy Diode Sensors

Description

The Anritsu MA244xD standard diode sensors are designed for use with the ML2430, ML2480 and ML2490 series power meters. They are designed for high dynamic range, high accuracy CW and TDMA measurements. With a built-in 3 dB attenuator, the MA244xD minimizes input SWR and is best used where the best measurement accuracy is required over a large dynamic range, as when measuring amplifiers. The MA244xD sensors have a dynamic range of 87 dB compared to the 90 dB dynamic range of MA247xD standard diode sensors.

Features

- Wide dynamic range sensors (–67 dBm to +20 dBm)
- Accurate CW average power measurements
- Wide frequency coverage from 10 MHz to 50 GHz (sensor dependent)
- Calibration factors stored in EEPROM

MA248xD Universal Sensors

Description

The MA248xD series are true RMS sensors with a dynamic range of 80 dB. These power sensors can be used for average power measurements on CW, multi-tone and modulated RF waveforms such as 3G, 4G, and OFDM. 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. Therefore, it measures true RMS power regardless of the type or bandwidth of the modulation of the input signal. Option 1 provides TDMA measurement capability, calibrating one of the diode pairs for linearity over a wide dynamic range, thus making it a truly universal sensor.

Features

- True-RMS detection enables accurate average power measurements of any signal type
- 80 dB dynamic range
- Option 1 enables fast and accurate (1.8% linearity) CW average power measurements
- Wide frequency coverage from 10 MHz to 18 GHz (sensor dependent)
- Calibration factors stored in EEPROM

MA249xA Wideband Sensors

Description

The Anritsu MA249xA wideband power sensors are designed for use with the Anritsu ML2480 and ML2490 series power meters. These sensors provide peak power, crest factor, average power, rise time, fall time, maximum power, minimum power and statistical data of wideband signals.

Features

- Ideal for measuring radar and communication signals like WiMAX, WCDMA, WLAN, GSM, and others
- CW and Average power measurements as low as –60 dBm
- 20 MHz video bandwidth
- Sampling rate of 64 MS/s with ML2480 and ML2490 series power meters

MA2411B Pulse Sensors

Description

The Anritsu MA2411B pulse power sensors are designed for use with the ML2480 and ML2490 series power meters. These sensors are used for pulse profiling and provide peak power, crest factor, average power, rise time, fall time, maximum power, minimum power and statistical data of wideband signals. The MA2411x Series Power Sensors requires the ML2480 series power meter to be equipped with 1 GHz Calibrator (Option 15).

Features

- Ideal for measuring pulsed radar and communication signals
- 50 MHz video bandwidth
- Upper measurement frequency range of 40 GHz
- An industry best 8 ns rise time

MA2400xA Thermal Sensors

Description

The Anritsu MA2400xA series thermal sensors 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.

Features

- True-RMS detection enables accurate average power measurements of any signal type
- 50 dB dynamic range
- Wide frequency coverage from 10 MHz to 50 GHz (sensor dependent)
- Calibration factors stored in EEPROM

MA246xD Fast Diode Sensors (obsolete)

Description

The MA246xD fast diode sensors from Anritsu have a rise time of 0.6 µs. This, together with a sensor video bandwidth of 1.25 MHz, makes them the ideal solution for power measurements on N-CDMA (IS-95) signals.

The MA246xD sensors can be used with the ML2407A/08A (obsolete products), ML2430, ML2480, and ML2490 series power meters. This combination of meter and sensor provides fast signal processing and sampling speeds. Average power, peak power and crest factor on N-CDMA signals can be measured and displayed.

The MA246xD are dual diode sensors that deliver a greater than 80 dB dynamic range, which makes them suitable for both open and closed loop power control testing. Pulses down to 1 μs can also be captured and displayed, thanks to the sensor rise time of 0.6 μs. In profile mode the meter can be used to measure average power across narrow pulses, an increasingly common test method for amplifiers in digitally modulated systems.

Features

- Ideal for measuring CDMA signals
- Average, peak and crest factor measurements
- 1.25 MHz video bandwidth

Chapter 3 — Performance Verification

3-1 Introduction

This chapter contains test procedures for verifying power sensor performance.

3-2 General Information

Anritsu sensors are classified into three general types:

- MA2400xA Thermal Sensors
- MA247xx, MA244xx, MA249xx, and MA2411x Diode Sensors
- MA248xx Universal Sensors

Sensor Function

All the above sensors have one common function:

For a given signal frequency, they translate a sensed input power into an output voltage. The Anritsu ML2400 Series power meters interpret the sensor voltages with signal frequencies and output correct power readings.

Power Sensing Elements

Both diode sensors and thermal sensors have a single power sensing element. Therefore, they have only one voltage versus power relationship. Universal sensors have three power sensing elements, and they have three sets of voltage versus power relationships.

Power Sensor Problems

The most common cause of power sensor problems is excess input power. Applying power exceeding the labeled damage levels will damage the sensing element(s) such that its voltage versus power relationships are changed resulting in erroneous power readings.

The other most common cause of power sensor problems is damaged connectors. Connections should be tightened with the proper torque wrench applied to the coupling nut only. Any attempt to torque or untorque a connection using the body of the power sensor may result in either connector damage, or in the connector becoming unthreaded from the body.

Since the connector-to-body threads have thread-locking compound applied, slight unthreading of the connector from the body may not be physically apparent. Unthreaded or damaged connectors will change the voltage versus power relationships. These changes are usually manifested as a poor input match.

Any suspect power sensor should have two parameters tested:

- SWR (magnitude of reflection coefficient)
- Sensitivity

3-3 SWR Performance

Power sensor SWR performance (in terms of reflection coefficient magnitude) is tested in this section. SWR values for each sensor model are listed in Appendix B, "Specifications". The uncertainty of the SWR performance of the power sensors is determined by using the Anritsu 37000 Vector Network Analyzer and 54000 Scalar Measurement systems.

Refer to the "SWR Performance Data" tables in Appendix A to record test data.

Note	The SWR performance data in the tables of Appendix A is expressed in reflection coefficient magnitude.

Required Equipment

- Anritsu 37000 Vector Network Analyzer
- Anritsu 54000 Scalar Network Analyzer

Measurement

1. Follow the manufacturer's S_{11} (or return loss) calibration procedure to perform calibration on the network analyzer.

2. Connect the power sensor to the network analyzer test port, and measure the power sensor input match.

   Usually, network analyzers measure match in terms of return loss in dB. The return loss to magnitude of reflection coefficient conversion equations are:

$$\rho = 10^{RL/20}$$

$$RL = -20 \log \rho$$

where

RL = Return Loss in dB

ρ = Reflection coefficient magnitude

3. Record the measured data in the applicable test records in Section A-4 of Appendix A.

   If the measured reflection coefficient plus measurement uncertainty is larger than the specification limit, the power sensor may be defective.

3-4 Sensitivity Performance

The following test verifies the sensitivity performance of the power sensor. Refer to the "Sensitivity Performance Data" table in Appendix A to record test data.

Required Equipment

- Anritsu 68387B Synthesized Signal Generator or equivalent with a minimum power accuracy of ±1 dB at 2 GHz for power levels from +20 dBm to –10 dBm
- Anritsu ML2400 Series Power Meter or equivalent (ML2480 Series Power Meter required for MA249xA and MA2411A/B Series power sensors)
- Anritsu 41KC-20 Fixed Attenuator or equivalent with attenuation accuracy of better than ±0.5 dB at 2 GHz (required for testing the Universal power sensor)
- Various adapters as needed

Setup: ML24xx Power Meter

The following procedure sets the Anritsu ML24xx power meter to the voltage measurement mode:

1. Press the following **hard** or soft keys in the sequence shown:

   System | More | More | More

2. Press the blank key between the Identity and –back– soft keys.
3. Press **0** on the numeric keypad.
4. Press the blank key between the Identity and –back– soft keys.
5. Press the following hard or soft keys in the sequence shown:

   Control | DSP CAL | **3** | Enter | **Sensor**

Note	Anritsu ML2407A/08A and ML2437A/38A Power Meters must have meter firmware revision 3.10 or higher when used with Anritsu MA24xxD and MA2400xA Series power sensors.

Setup: ML248xA Power Meter

The following procedure sets the Anritsu ML248xA power meter to the voltage measurement mode. This meter is required for testing MA249xA and MA2411A/B Series power sensors.

1. Press the following **hard** or soft keys in the sequence shown:

   Channel | Setup | CW | **Exit** | **System** | Service | Diag | **0** | Enter

2. Press the Set DSP Cal num... soft key.
3. Press the following **hard** or soft keys in the sequence shown:

   Sel | **3** | Enter | **Exit**

   The instrument is now displaying sensor voltage in dBV (ignoring the dBm unit that follows the numerical readout):

   dBV = 10 log V, where V is the sensor output voltage.

Setup: ML248xB/9xA Power Meters

The following procedure sets the Anritsu ML248xB/9xA power meter to the voltage measurement mode. This meter is required for testing MA249xA and MA2411A/B Series power sensors.

1. Press the following hard or soft keys in the sequence shown:

   Channel | Setup | CW | Exit | System | Service | Diag | 0 | Enter

2. Press the DSP Diag Commands soft key.
3. Press the following hard or soft keys in the sequence shown:

   Sel | 3 | Enter | Send Command

   The instrument is now displaying sensor voltage in dBV (ignoring the dBm unit that follows the numerical readout):

   dBV = 10 log V, where V is the sensor output voltage.

Procedure: Standard Power Sensors

This procedure applies to the following power sensors:

- MA2400xD Thermal Sensors

- MA247xD Series Standard Diode Power Sensors
- MA244xD Series High Accuracy Power Sensors
- MA246xx Series Fast Sensors (obsolete)
- MA249xA Series Wideband Power Sensors
- MA2411A/B Pulse Power Sensor.

1. Connect the power sensor to the sensor cable and connect the cable to the power meter.
2. Without connecting the sensor to the signal source, zero the power meter by pressing the **Cal/Zero** key, then the Zero soft key.

Note	When using the Anritsu ML2480 Series Power Meter, press the Zero Sensor A function key.

3. Set the signal source to 2 GHz and adjust the signal source power to the specified power in the table below for the sensor to be tested.
4. Connect the power sensor to the signal source.
5. Read the sensor output voltage on the power meter and record in Section A-5 of Appendix A.

Procedure: Universal Power Sensors

The following procedure applies to MA248xx universal power sensors.

1. Connect the power sensor to the sensor cable and connect the cable to the power meter.
2. Without connecting the sensor to the signal source, zero the power meter by pressing the **Cal/Zero** key, then the Zero soft key.
3. Set the signal source to 2 GHz and adjust the signal source power to the first power level specified in the table below for the MA248xx universal power sensor.
4. Connect the power sensor to the signal source.
5. Set the range hold on the power meter by pressing the following keys in sequence:

   Sensor | Setup | More

6. Press the Hold soft key until the display reads: Range Hold = 2.

7. Read and record the sensor output voltage in the table.

8. Adjust the signal source power to the second power level specified in the table.

9. Set the range hold on the power meter by pressing the following keys in sequence:

   Sensor | Setup | More

10. Press the Hold soft key until the display reads: Range Hold = 3.

11. Read and record the sensor output voltage in the table.

12. Insert a 20 dB fixed-attenuator between the power sensor and the signal source.

13. Adjust the signal source power to the third power level specified in the table below for the MA248xx universal power sensors. Remember to take into account the added 20 dB attenuator.

14. Set the range hold on the power meter by pressing the following keys in sequence:

   Sensor | Setup | More

15. Press the Hold soft key until the display reads: Range Hold = 4.

16. Read and record the sensor output voltage in Section A-5 of Appendix A.

Table 3-1. Sensitivity Performance Test

Sensor	Sensor Input Power (dBm)	Actual (dBV) Measured	Sensitivity (dBV)
MA2411A/B	+20		+3.6 to +4.3
MA244xx	0		–7.7 to –6.1
MA246xx	0		–7.7 to –5.9
MA247xx	0		–5.7 to –3.9
MA248xx	+9		–36 to –33
	–7		–36 to –33
	–24		–36 to –33
MA249xx	+20		+3.6 to +4.3

Table 3-1. Sensitivity Performance Test

Sensor	Sensor Input Power (dBm)	Actual (dBV) Measured	Sensitivity (dBV)
MA2400xA	+10		-29 to -26

If the Actual Measurement (dBV) voltage recorded is not within the voltage range shown in the Sensitivity (dBV) column, the power sensor may be defective.

Caution	Be sure to return the power meter to power measurement mode as described in the next section.

Return Meter to Power Measurement Mode

ML248xx/ML249xA Power Meter

The following key sequence returns the Anritsu ML24xx/ML249xA power meter to the factory default power measurement mode.

Press the following **hard** or soft keys in the sequence shown:

System | Setup | More | Preset | Factory

ML24xx Power Meter

The following key sequence returns the Anritsu ML248xx power meter to the factory default power measurement mode. Press the following **hard** or soft keys in the sequence shown:

1. Press the **Preset** menu key.
2. Press the down arrow(▼) on the keypad until Factory is highlighted.
3. Press the Select soft key.
4. Press the Yes soft key.

3-5 Measurement Uncertainty

General Information

Overall power measurement uncertainty has many component parts:

Instrument Accuracy

The accuracy of the meter used to read the power sensor.

Sensor Linearity and Temperature Linearity

Sensor linearity and temperature linearity describe the relative power level response over the dynamic range of the sensor. Temperature linearity should be considered when operating the sensor at other than room temperature.

Noise, Zero Set and Drift

These are factors within the test system that impact measurement accuracy at the bottom of a power sensor dynamic range.

Mismatch Uncertainty

Mismatch uncertainty is typically the largest component of measurement uncertainty. The error is caused by differing impedances between the power sensor and the device to which the power sensor is connected. Mismatch uncertainty can be calculated as shown in the following equation:

$$\%\ \text{Mismatch Uncertainty} = 100[|1 + \Gamma_1\Gamma_2|^2 - 1]$$

$$\text{dB Mismatch Uncertainty} = 20\log|1 + \Gamma_1\Gamma_2|$$

where

Γ_1 and Γ_2 are the two different impedances that are connected together.

Sensor Calibration Factor Uncertainty

Sensor Calibration Factor Uncertainty is defined as the accuracy of the sensor calibration at a standard calibration condition. Anritsu follows the industry standard condition of calibration at reference power = 0 dBm (1 mW) and ambient temperature = 25 °C.

Reference Power Uncertainty

Reference power uncertainty specifies the maximum possible output drift of the power meter 50 MHz, 0.0 dBm power reference between calibration intervals.

Uncertainty Examples

For calculations specific to your applications, please refer to the "Anritsu Power Measurement Uncertainty Calculator" which is available for download at www.anritsu.com.

An example of measurement uncertainty is detailed for several power sensors in the table below. Anritsu power sensors with an ML2437A power meter are used to measure the power of a 16 GHz, 7 dBm signal from a source with a 1.5:1 SWR.

Table 3-2. Measurement Uncertainty Examples (1 of 2)

Sensor Model Series	Probability Distribution	MA24002A	MA2442D	MA2472D
Instrumentation Accuracy	Rectangular	0.50%	0.50%	0.50%
Sensor Linearity	Rectangular	1.80%	1.80%	1.80%
Noise, 256 Average	Normal at 2σ	0.01%	0.01%	0.00%
Zero Set and Drift	Rectangular	0.06%	0.04%	0.01%
Mismatch Uncertainty	Rectangular	3.67%	3.84%	4.49%
Sensor Cal Factor Uncertainty	Normal at 2σ	1.60%	0.79%	0.83%
Reference Power Uncertainty	Rectangular	1.20%	1.20%	1.20%

Table 3-2. Measurement Uncertainty Examples (2 of 2)

Sensor Model Series	Probability Distribution	MA24002A	MA2442D	MA2472D
Reference to Sensor Mismatch Uncertainty	Rectangular	0.36%	0.36%	0.44%
Temperature Linearity, ±20 °C	Rectangular	1.00%	1.00%	1.00%
RSS, Room Temperature	–	4.59%	4.52%	5.10%
Sum of Uncertainties, Room Temperature	–	9.19%	8.55%	9.27%
RSS ±20 °C	–	4.70%	4.63%	5.20%
Sum of Uncertainties ±20 °C	–	10.19%	9.55%	10.27%

3-6 Cal Factor Uncertainty

Calibration Factor data is stored within the sensor EEPROM. Power sensor calibration is performed at regional Anritsu Service Centers. Contact your Anritsu representative for local calibration and service support.

Calibration Factor Uncertainty Tables

The values in Table 3-3 starting on page 3-12 are the uncertainty of the (cal factor) information stored in the EEPROM for a coverage factor of two. The percentages shown are twice the root of the sum of the squares of the individual contributors to calibration factor uncertainty. The values for model series MA2400xA are listed in Table 3-4.

Note	Calibration Factor Uncertainty figures for the MA248xx series universal sensors are taken in CW (Option 1) measurement mode.

Table 3-3. Uncertainty of (Cal Factor) Information Stored in Sensor EEPROM (1 of 4)

Frequency (GHz)	MA2421A MA2421D MA2422A MA2422B MA2422D	MA2468B MA2468D MA2481B MA2481D (option 1)	MA2469B MA2469C MA2469D MA2472B MA2472D MA2482A MA2482D (option 1)	MA2442A MA2442B MA2442D	MA2490A	MA2491A	MA2423A MA2423B MA2423D	MA2473A MA2473D	MA2424A MA2424B MA2424D	MA2474A MA2474D	MA2444A MA2444D	MA2411A MA2411B	MA2425A MA2425B MA2425D	MA2475A MA2475D	MA2445A MA2445D
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
0.01[a]	2.20	1.80	1.80	1.60	N.A.	N.A.	2.20	1.90	2.20	1.90	1.90	N.A.	2.20	1.80	1.80
0.05	0.82	0.56	0.56	0.56	0.66	0.66	1.43	1.48	1.43	1.48	1.48	2.32	1.03	1.10	1.10
0.10	0.69	0.56	0.56	0.55	0.84	0.84	1.36	1.37	1.36	1.37	1.37	2.27	0.92	0.94	0.94
0.30	0.78	0.57	0.57	0.56	0.83	0.83	1.40	1.42	1.40	1.42	1.41	2.25	1.01	1.03	1.02
0.50	0.66	0.56	0.56	0.55	0.77	0.77	0.96	0.96	0.96	0.96	0.96	1.20	0.94	0.94	0.94
1.00	0.67	0.55	0.55	0.55	1.06	1.06	0.99	0.99	0.99	0.99	0.99	1.35	0.99	0.99	0.98
2.00	0.65	0.60	0.60	0.56	1.11	1.11	1.04	1.04	1.04	1.04	1.04	1.67	0.91	0.90	0.90
3.00	0.63	0.59	0.59	0.55	1.15	1.15	1.03	1.05	1.03	1.05	1.04	1.66	0.90	0.92	0.90
4.00	0.64	0.60	0.60	0.56	1.10	1.10	1.63	1.64	1.63	1.64	1.63	3.01	1.05	1.05	1.05
5.00	0.61	0.60	0.60	0.56	1.18	1.18	1.38	1.39	1.38	1.39	1.38	2.46	0.96	0.98	0.97
6.00	0.59	0.62	0.62	0.58	1.18	1.18	1.45	1.45	1.45	1.45	1.45	2.60	1.11	1.11	1.11
7.00	0.59	N.A.	0.63	0.59	1.23	1.23	1.25	1.26	1.25	1.26	1.25	2.11	0.93	0.94	0.93
8.00	0.59	N.A.	0.65	0.60	1.26	1.26	1.56	1.56	1.56	1.56	1.56	2.80	0.98	0.98	0.98
9.00	0.63	N.A.	0.68	0.62	N.A.	1.27	1.88	1.89	1.88	1.89	1.89	3.49	0.97	0.98	0.97

Table 3-3. Uncertainty of (Cal Factor) Information Stored in Sensor EEPROM (2 of 4)

Frequency (GHz)	MA2421A MA2421D MA2422A MA2422B MA2422D	MA2468B MA2468D MA2481B MA2481D (option 1)	MA2469B MA2469C MA2469D MA2472B MA2472D MA2482A MA2482D (option 1)	MA2442A MA2442B MA2442D	MA2490A	MA2491A	MA2423A MA2423B MA2423D	MA2473A MA2473D	MA2424A MA2424B MA2424D	MA2474A MA2474D	MA2444A MA2444D	MA2411A MA2411B	MA2425A MA2425B MA2425D	MA2475A MA2475D	MA2445A MA2445D
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
10.00	0.66	N.A.	0.70	0.65	N.A.	1.25	1.79	1.79	1.79	1.79	1.79	3.22	1.25	1.25	1.25
11.00	0.69	N.A.	0.71	0.66	N.A.	1.27	1.72	1.72	1.72	1.72	1.72	2.99	1.16	1.16	1.16
12.00	0.71	N.A.	0.73	0.68	N.A.	1.35	1.44	1.44	1.44	1.44	1.44	2.21	1.39	1.39	1.39
13.00	0.75	N.A.	0.78	0.74	N.A.	1.44	2.39	2.40	2.39	2.40	2.39	4.36	1.50	1.51	1.50
14.00	0.78	N.A.	0.83	0.78	N.A.	1.45	2.02	2.03	2.02	2.03	2.02	3.49	1.75	1.75	1.75
15.00	0.81	N.A.	0.84	0.79	N.A.	1.44	2.12	2.13	2.12	2.13	2.12	3.56	1.90	1.91	1.90
16.00	0.84	N.A.	0.83	0.79	N.A.	1.59	2.90	2.90	2.90	2.90	2.90	5.29	2.07	2.08	2.08
17.00	0.92	N.A.	0.89	0.86	N.A.	1.60	2.29	2.30	2.29	2.30	2.29	3.60	2.45	2.46	2.45
18.00	0.92	N.A.	0.89	0.88	N.A.	1.75	2.28	2.28	2.28	2.28	2.28	3.53	2.43	2.43	2.43
19.00	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	2.86	2.84	2.86	2.84	2.84	4.18	2.65	2.65	2.65
20.00	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	2.51	2.48	2.51	2.48	2.47	3.15	2.86	2.86	2.86
21.00	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	2.44	2.46	2.44	2.46	2.44	2.88	2.71	2.73	2.71
22.00	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	2.58	2.53	2.58	2.53	2.50	2.83	2.85	2.89	2.87
23.00	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	2.75	2.81	2.75	2.81	2.80	3.86	2.91	2.92	2.91
24.00	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	2.79	2.95	2.79	2.95	2.94	3.97	2.70	2.73	2.71
25.00	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	3.75	3.39	3.75	3.39	3.38	5.55	3.08	3.10	3.09

Table 3-3. Uncertainty of (Cal Factor) Information Stored in Sensor EEPROM (3 of 4)

Frequency (GHz)	MA2421A MA2421D MA2422A MA2422B MA2422D	MA2468B MA2468D MA2481B MA2481D (option 1)	MA2469B MA2469C MA2469D MA2472B MA2472D MA2482A MA2482D (option 1)	MA2442A MA2442B MA2442D	MA2490A	MA2491A	MA2423A MA2423B MA2423D	MA2473A MA2473D	MA2424A MA2424B MA2424D	MA2474A MA2474D	MA2444A MA2444D	MA2411A MA2411B	MA2425A MA2425B MA2425D	MA2475A MA2475D	MA2445A MA2445D
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
26.00	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	3.28	3.22	3.28	3.22	3.21	4.98	2.79	2.82	2.80
27.00	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	2.78	2.83	2.78	2.83	2.81	3.82	3.03	3.06	3.04
28.00	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	2.77	2.81	2.77	2.81	2.79	3.83	3.18	3.21	3.19
29.00	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	2.47	2.50	2.47	2.50	2.48	2.92	2.67	2.69	2.68
30.00	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	3.02	3.03	3.02	3.03	3.03	4.52	2.73	2.73	2.73
31.00	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	2.93	2.95	2.93	2.95	2.94	4.29	2.74	2.75	2.74
32.00	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	2.91	2.95	2.91	2.92	2.92	4.21	2.89	2.87	2.87
33.00	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	3.32	3.33	3.33	5.24	2.86	2.84	2.84
34.00	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	2.97	3.02	3.01	4.48	2.94	2.97	2.96
35.00	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	3.19	3.22	3.21	4.95	2.65	2.67	2.66
36.00	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	2.96	3.00	2.99	4.38	3.61	3.63	3.62
37.00	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	2.75	2.80	2.79	3.76	3.16	3.20	3.18
38.00	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	3.62	3.74	3.71	5.85	5.02	5.09	5.07
39.00	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	3.68	3.78	3.76	6.12	3.49	3.54	3.52
40.00	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	3.57	3.61	3.59	5.86	2.97	2.99	2.97
41.00	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	9.85	10.67	10.20

Table 3-3. Uncertainty of (Cal Factor) Information Stored in Sensor EEPROM (4 of 4)

Frequency (GHz)	MA2421A MA2421D MA2422A MA2422B MA2422D	MA2468B MA2468D MA2481B MA2481D (option 1)	MA2469B MA2469C MA2469D MA2472B MA2472D MA2482A MA2482D (option 1)	MA2442A MA2442B MA2442D	MA2490A	MA2491A	MA2423A MA2423B MA2423D	MA2473A MA2473D	MA2424A MA2424B MA2424D	MA2474A MA2474D	MA2444A MA2444D	MA2411A MA2411B	MA2425A MA2425B MA2425D	MA2475A MA2475D	MA2445A MA2445D
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
42.00	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	9.74	10.56	10.08
43.00	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	9.30	10.17	9.66
44.00	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	8.87	9.78	9.25
45.00	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	8.66	9.58	9.05
46.00	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	8.43	9.37	8.83
47.00	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	8.47	9.41	8.87
48.00	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	9.03	9.92	9.41
49.00	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	9.29	10.15	9.65
50.00	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	10.16	10.95	10.49

a. 10 MHz cal factor uncertainty applies to MA242xD, MA244xD, MA246xD, MA247xD, and MA248xD models only.

Table 3-4. MA2400xA Sensor Cal Factor Uncertainty

Frequency	MA24002A	MA24004A	MA24005A
(GHz)	%	%	%
10 MHz to 50 MHz	2.00	3.00	3.00
50 MHz to 6 GHz	1.00	2.50	2.50
6 GHz to 18 GHz	1.60	4.60	3.70
18 GHz to 26 GHz	N.A.	6.00	5.00
26 GHz to 40 GHz	N.A.	6.50	7.50
40 GHz to 50 GHz	N.A.	N.A.	10.50

Appendix A — Test Records

A-1 Introduction

This appendix provides tables for recording the results of the performance verification tests (Chapter 3). They provide the means for maintaining an accurate and complete record of instrument performance.

A-2 Measurement Uncertainty

All test records are provided with a measurement uncertainty, which consists of the type-B[1] components. The error contributions are measurement method, test equipment, standards, and other correction factors (for example, calibration factors and mismatch error) per the prescribed test procedure. The statement(s) of compliance with specification[2] is based on a 95% coverage probability for the expanded uncertainty of the measurement results on which the decision of compliance is based. For some of the measured values it is not possible to make a statement of compliance with specification[2]. Other values of coverage probability for the expanded uncertainty may be reported, where practicable.

A-3 Test Records

We recommend that you make a copy of the test record pages each time a test procedure is performed. By dating each test record copy, a detailed history of the instrument's performance can be accumulated.

1. BIPM JCGM 100:2008 Evaluation of measurement data–Guide to the expression of uncertainty in measurement.
2. LAC–G8:03/2009: Guidelines on the Reporting of Compliance with Specification.

Model:	Date:	Operator:
Serial Number:		Options:

A-4 SWR Performance Data

Note	The SWR performance data in the following tables is expressed in reflection coefficient magnitude.

MA247xA

Frequency	37000 System Reflection Coefficient Uncertainty	Measured	Reflection Coefficient Magnitude Specification
10 MHz – 50 MHz	0.010 [a]		0.310
50 MHz – 150 MHz	0.012		0.078
0.15 GHz – 2 GHz	0.012		0.057
2 GHz – 12.4 GHz	0.013		0.099
12.4 GHz – 18 GHz	0.014		0.111
18 GHz – 32 GHz	0.015		0.149
32 GHz – 40 GHz	0.017		0.200
40 GHz – 50 GHz	0.020		0.240

a. 10 MHz to 50 MHz uncertainty is from 54000 Scalar Measurement System.

Model:	Date:	Operator:
Serial Number:		Options:

MA2472B/D

Frequency	37000 System Reflection Coefficient Uncertainty	Measured	Reflection Coefficient Magnitude Specification
10 MHz – 50 MHz	0.010 [a]		0.078
50 MHz – 150 MHz	0.012		0.078
0.15 GHz – 2 GHz	0.012		0.057
2 GHz – 12.4 GHz	0.013		0.099
12.4 GHz – 18 GHz	0.014		0.111

a. 10 MHz to 50 MHz uncertainty is from 54000 Scalar Measurement System.

Model:	Date:	Operator:
Serial Number:		Options:

MA2400xA

Frequency	37000 System Reflection Coefficient Uncertainty	Measured	Reflection Coefficient Magnitude Specification
10 MHz – 50 MHz	0.010 [a]		0.310
50 MHz – 150 MHz	0.012		0.078
0.15 GHz – 2 GHz	0.012		0.048
2 GHz – 12.4 GHz	0.013		0.070
12.4 GHz – 18 GHz	0.014		0.091
18 GHz – 32 GHz	0.015		0.111
32 GHz – 40 GHz	0.017		0.130
40 GHz – 50 GHz	0.020		0.167

a. 10 MHz to 50 MHz uncertainty is from 54000 Scalar Measurement System.

Model:	Date:	Operator:
Serial Number:		Options:

MA244xx (Except MA2442B/D)

Frequency	37000 System Reflection Coefficient Uncertainty	Measured	Reflection Coefficient Magnitude Specification
10 MHz – 50 MHz	0.010 [a]		0.310
50 MHz – 150 MHz	0.012		0.078
0.15 GHz – 2 GHz	0.012		0.038
2 GHz – 12.4 GHz	0.013		0.074
12.4 GHz – 18 GHz	0.014		0.095
18 GHz – 32 GHz	0.015		0.127
32 GHz – 40 GHz	0.017		0.180
40 GHz – 50 GHz	0.020		0.200

a. 10 MHz to 50 MHz uncertainty is from 54000 Scalar Measurement System.

Model:	Date:	Operator:
Serial Number:		Options:

MA2442B/D

Frequency	37000 System Reflection Coefficient Uncertainty	Measured	Reflection Coefficient Magnitude Specification
10 MHz – 50 MHz	0.010 [a]		0.078
50 MHz – 150 MHz	0.012		0.078
0.15 GHz – 2 GHz	0.012		0.038
2 GHz – 12.4 GHz	0.013		0.074
12.4 GHz – 18 GHz	0.014		0.095

a. 10 MHz to 50 MHz uncertainty is from 54000 Scalar Measurement System.

Model:	Date:	Operator:
Serial Number:		Options:

MA2481A

Frequency	37000 System Reflection Coefficient Uncertainty	Measured	Reflection Coefficient Magnitude Specification
10 MHz – 50 MHz	0.010 [(a)]		0.310
50 MHz – 150 MHz	0.012		0.078
0.15 GHz – 2 GHz	0.012		0.057
2 GHz – 6 GHz	0.013		0.099

a. 10 MHz to 50 MHz uncertainty is from 54000 Scalar Measurement System.

Model:	Date:	Operator:
Serial Number:		Options:

MA2481B/D, MA2482A/D

Frequency	37000 System Reflection Coefficient Uncertainty	Measured	Reflection Coefficient Magnitude Specification
10 MHz – 50 MHz	0.010 [a]		0.078
50 MHz – 150 MHz	0.012		0.078
0.15 GHz – 2 GHz	0.012		0.057
2 GHz – 12.4 GHz	0.013		0.099
12.4 GHz – 18 GHz	0.014		0.111

a. 10 MHz to 50 MHz uncertainty is from 54000 Scalar Measurement System.

Model:	Date:	Operator:
Serial Number:		Options:

MA249xA

Frequency	37000 System Reflection Coefficient Uncertainty	Measured	Reflection Coefficient Magnitude Specification
50 MHz – 150 MHz	0.012		0.078
0.15 GHz – 2.5 GHz	0.012		0.057
2.5 GHz – 12.4 GHz	0.013		0.099
12.4 GHz – 18 GHz	0.014		0.111

Model:	Date:	Operator:
Serial Number:		Options:

MA2411x

Frequency	37000 System Reflection Coefficient Uncertainty	Measured	Reflection Coefficient Magnitude Specification
300 MHz – 2.5 GHz	0.012		0.070
2.5 GHz – 26 GHz	0.015		0.149
26 GHz – 40 GHz	0.017		0.200

Model:	Date:	Operator:
Serial Number:		Options:

MA2421A/D (obsolete)

Frequency	37000 System Reflection Coefficient Uncertainty	Measured	Reflection Coefficient Magnitude Specification
10 MHz – 50 MHz	0.010 [a]		0.048
50 MHz – 150 MHz	0.012		0.048
0.15 GHz – 2 GHz	0.012		0.048
2 GHz – 12.4 GHz	0.013		0.070
12.4 GHz – 18 GHz	0.014		0.091
18 GHz – 32 GHz	0.015		0.111
32 GHz – 40 GHz	0.017		0.130
40 GHz – 50 GHz	0.020		0.167

a. 10 MHz to 50 MHz uncertainty is from 54000 Scalar Measurement System.

Model:	Date:	Operator:
Serial Number:		Options:

MA2468A, MA2469A, MA2469B (obsolete)

Frequency	37000 System Reflection Coefficient Uncertainty	Measured	Reflection Coefficient Magnitude Specification
10 MHz – 50 MHz	0.010 [a]		0.310
50 MHz – 150 MHz	0.012		0.078
0.15 GHz – 2 GHz	0.012		0.057
2 GHz – 12.4 GHz	0.013		0.099
12.4 GHz – 18 GHz	0.014		0.111

a. 10 MHz to 50 MHz uncertainty is from 54000 Scalar Measurement System.

Model:	**Date:**	**Operator:**
Serial Number:		**Options:**

MA2468B/D, MA2469C/D (obsolete)

Frequency	37000 System Reflection Coefficient Uncertainty	Measured	Reflection Coefficient Magnitude Specification
10 MHz – 50 MHz	0.010 [a]		0.078
50 MHz – 150 MHz	0.012		0.078
0.15 GHz – 2 GHz	0.012		0.057
2 GHz – 12.4 GHz	0.013		0.099
12.4 GHz – 18 GHz	0.014		0.111

a. 10 MHz to 50 MHz uncertainty is from 54000 Scalar Measurement System.

Model:	Date:	Operator:
Serial Number:		Options:

A-5 Sensitivity Performance Data

Sensor Sensitivity Performance

Sensor	Sensor Input Power (dBm)	Actual (dBV) Measured	Sensitivity (dBV)
MA2411A/B	+20		+3.6 to +4.3
MA244xx	0		–7.7 to –6.1
MA246xx	0		–7.7 to –5.9
MA247xx	0		–5.7 to –3.9
MA248xx	+9		–36 to –33
	–7		–36 to –33
	–24		–36 to –33
MA249xx	+20		+3.6 to +4.3
MA2400xA	+10		-29 to -26

Index

10585-00004

V

Anritsu Company
490 Jarvis Drive
Morgan Hill, CA 95037-2809
USA
http://www.anritsu.com/