Measurement Guide

Power Meter

for Anritsu RF and Microwave Handheld Instruments

BTS Master™
Site Master™
Spectrum Master™
Cell Master™
PIM Master™
LMR Master™
VNA Master™

Power Meter	**Option 29**
High Accuracy Power Meter	**Option 19**

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

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Chapter 1 — General Information

1-1 Introduction

This Measurement Guide documents the Power Meter and the High Accuracy Power Meter for the following Anritsu instruments:

- BTS Master™
- Site Master™
- Spectrum Master™
- Cell Master™
- PIM Master™
- LMR Master™
- VNA Master™

1-2 Product Information, Compliance, and Safety

Read the Handheld Instruments Product Information, Compliance, and Safety Guide (PN: 10100-00065) for important safety, legal, and regulatory notices before operating the equipment. For additional information and literature covering your product, visit the product page of your instrument on http://www.anritsu.com/ and select the Library tab.

Not all instrument models offer every option. Please refer to the Technical Data Sheet of your instrument for available options.

1-3 Contacting Anritsu

To contact Anritsu, please visit:

http://www.anritsu.com/contact-us

From here, you can select the latest sales, select service and support contact information in your country or region, provide feedback, complete a "Talk to Anritsu" form to have your questions answered, or obtain other services offered by Anritsu.

Updated product information can be found on the Anritsu web site:

http://www.anritsu.com/

Search for the product model number. The latest documentation is on the product page under the Library tab.

1-4 Power Meter

Instruments equipped with the Power Meter measurement mode can be used to make channelized power meter measurements. No external sensor is required.

1-5 High Accuracy Power Meter

Instruments with Option 19 and an appropriate Anritsu power sensor can be used to make High Accuracy Power Measurements. This option provides true RMS measurements with accurate measurements for both CW and complex digitally modulated signals. Table 1-1 lists the Option 19 compatible Anritsu sensors.

Note	The Anritsu sensor is not included with Option 19. A high accuracy power sensor must be purchased separately and the instrument must have compatible firmware that supports your sensor installed. Visit www.anritsu.com for details.

Table 1-1. Option 19 USB Power Sensors

Model	Description	Frequency Range	Connector (50 Ω)	Data Sheet (for complete specifications)
PSN50	High Accuracy RF Power Sensor	50 MHz to 6 GHz	Type N(m)	11410-00414
MA24104A[a]	Inline High Power Sensor	600 MHz to 4 GHz	Type N(f)	11410-00483
MA24105A[b]	Inline Peak Power Sensor	350 MHz to 4 GHz	Type N(f)	11410-00621
MA24103A[b]	Inline Peak Power Sensor	25 MHz to 1 GHz	Type N(f)	11410-00621
MA24106A	High Accuracy RF Power Sensor	50 MHz to 6 GHz	Type N(m)	11410-00424
MA24108A	Microwave USB Power Sensor	10 MHz to 8 GHz	Type N(m)	11410-00504
MA24118A	Microwave USB Power Sensor	10 MHz to 18 GHz	Type N(m)	11410-00504
MA24126A	Microwave USB Power Sensor	10 MHz to 26 GHz	Type K(m)	11410-00504
MA24208A	Universal USB Power Sensor	10 MHz to 8 GHz	Type N(m)	11410-00841
MA24218A	Universal USB Power Sensor	10 MHz to 18 GHz	Type N(m)	11410-00841
MA24330A	Microwave CW USB Power Sensor	10 MHz to 33 GHz	Type K(m)	11410-00906
MA24340A	Microwave CW USB Power Sensor	10 MHz to 40 GHz	Type K(m)	11410-00906
MA24350A	Microwave CW USB Power Sensor	10 MHz to 50 GHz	Type V(m)	11410-00906

a.The MA24104A sensor is discontinued and is replaced by the MA24105A.

b.The MA24103A/105A provide additional measurement capabilities. Refer to Chapter 4 when using the MA24103A/105A.

Chapter 2 — Power Meter

2-1 Introduction

This chapter describes the instrument setup for general power meter measurements.

The Power Meter can display measured power in dBm, dBV, dBmV, dBµV, Volts, or Watts. No external sensor is required. The Power Meter frequency span can be set from 1 kHz to 100 MHz. The Full Band submenu key conveniently sets the frequency range to 100 MHz on the current center frequency in order to simulate a broadband measurement.

The maximum and minimum values of the analog display can be set in the Amplitude menu. The scale of the analog display reflects the Unit selection. Relative Power is a useful feature to obtain the power reading with respect to a specific power level.

Note	Screen captured images are provided as examples. The image and measurement details shown on your instrument may differ from the examples in this measurement guide.

2-2 General Measurement Setup

Please refer to the User Guide for your instrument for directions about selecting the Power Meter mode and file management.

Setting Frequency Span

Press the **Freq** main menu key to set the desired frequency. Choose whether to set frequency parameters manually or to select a signal standard.

Select Manually

Choose the appropriate submenu keys and enter the start and stop frequency, the center frequency, and the span.

Select a Signal Standard

Press the Signal Standard submenu key and select the channel (and Uplink or Downlink) or select the full band.

Select a Frequency Offset

A user defined frequency offset feature can be enabled on supported Anritsu models to offset the frequency displayed on the instrument from the actual swept frequency range. When enabled, the Center Freq, Start Freq, and Stop Freq keys will indicate that a frequency offset has been set (Figure 2-7 on page 2-8). To create a frequency offset, press the Step Size & Offset submenu key and select Freq Offset.

Setting the Amplitude

1. Press the **Amplitude** main menu key.
2. Press the Max submenu key and set the upper scale value. Press the Min submenu key and set the lower scale value.

   or

   Press the Auto Scale submenu key to adjust the range automatically.

Changing the Display Units

The power reading can be displayed in dBm, dBV, dBmV, dBμV, Volt, or Watt. Use the following procedure to change the displayed units:

1. Press the **Amplitude** main menu key.
2. Press the Units submenu key and select the display units.
3. Press the Back submenu key to return to the **Amplitude** menu.

Displaying Relative Power

Use the following procedure to select Relative Power through the Amplitude menu.

1. With the desired base power (reference) level connected to the input of your instrument, press the **Amplitude** main menu key.
2. Press the Relative submenu key.

Note	Relative power is displayed in dB.

Setting Pass Fail Limits

Maximum and minimum limits can be set as follows:

1. On your instrument, press the **Limits** main menu key, or press the **Shift** key, then the **Limit** (6) key.
2. Press the Upper Limit submenu key and use the directional arrow keys, the key pad, or the rotary knob to set the desired upper limit. Then press **Enter**.
3. Press the Lower Limit submenu key and use the directional arrow keys, the key pad, or the rotary knob to set the desired lower limit. Then press **Enter**.
4. Set the Limit submenu key to On to activate the Limit features.

If the measured power is between the limits, then the measurement is displayed in green.

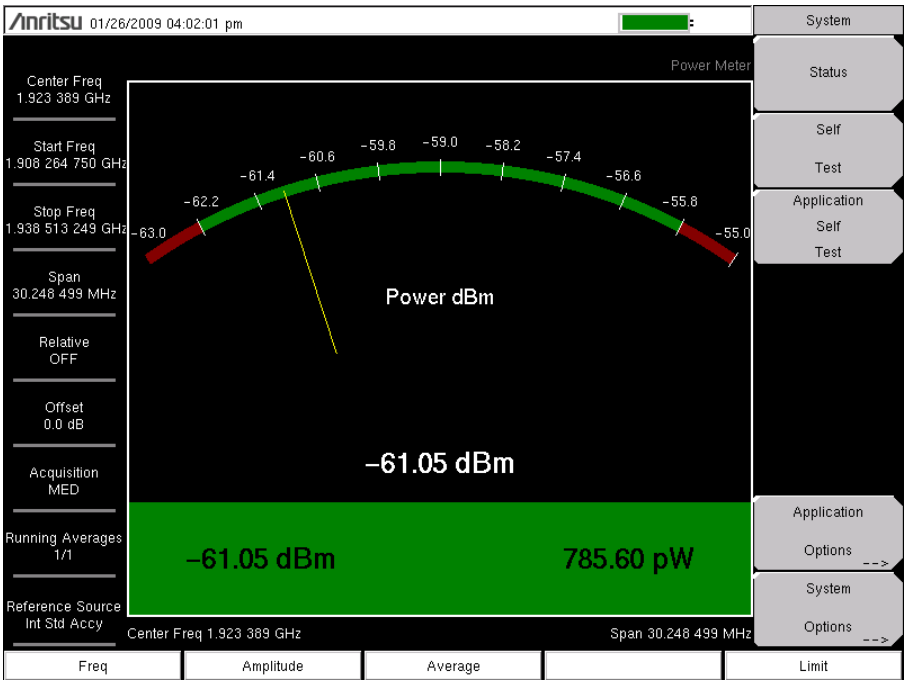


Figure 2-1. Power Meter Display, Passed

If the measured power is not between the limits, then the measurement is displayed in red.

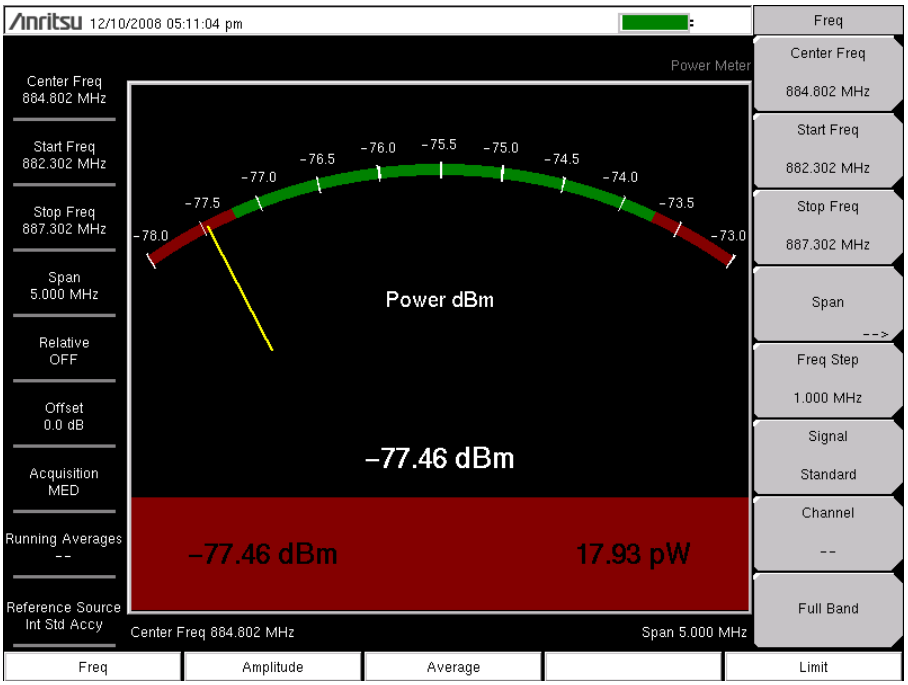


Figure 2-2. Power Meter Display, Failed

2-3 Power Meter Menus

Figure 2-3 shows the map of the Power Meter menus. The following sections describe main menus and associated submenus. Menu maps show all possible submenu keys. Refer to individual menu descriptions for display circumstances.

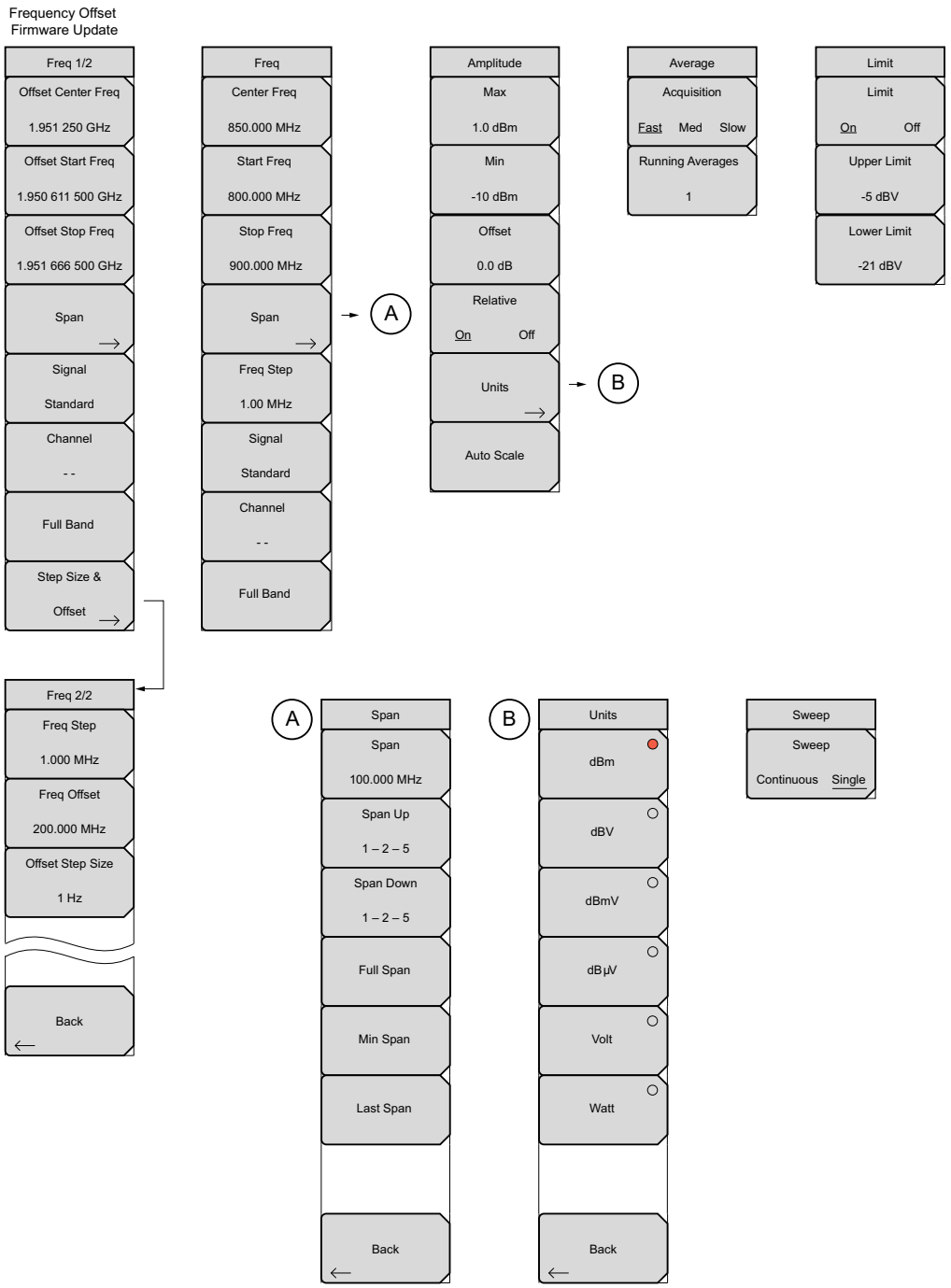
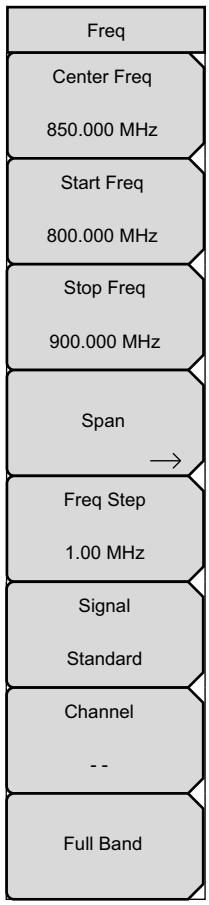


Figure 2-3. Power Meter Menus

2-4 Freq (Frequency) Menu

Key Sequence: **Frequency**

Note	Refer to "Frequency Menu with Offset Function" on page 2-6 if your instrument firmware supports frequency offset (bottom submenu is Step Size & Offset).



Center Freq: Sets the frequency at the center of the measurement. Frequencies can be entered in units of GHz, MHz, kHz, or Hz. Enter the frequency by using the keypad, the rotary knob, or the arrow keys. When the center frequency is entered, the labeling below the analog display shows the center frequency and the span in the most appropriate units based upon the value.

Start Freq: Enter a start frequency by using the keypad, the rotary knob, or the arrow keys. If the entered start frequency is greater than the current stop frequency, then the stop frequency is automatically adjusted to be 1 kHz greater than the start frequency (Min Span).

Stop Freq: Enter a stop frequency by using the keypad, the rotary knob, or the arrow keys. If the entered stop frequency is lower than the current start frequency, then the start frequency is automatically adjusted to be 1 kHz less than the stop frequency (Min Span).

Span: Opens the "Span Menu" on page 2-9.

Freq Step: Sets the interval that is used by the arrow keys. Enter the step amount by using the keypad, the rotary knob, or the arrow keys.

Signal Standard: Opens the signal standard menu, showing the currently selected signal standard and a complete list of signal standards to choose from.

Channel: Sets the channel information for the selected standard. If the particular standard has not been used before, then the channel number defaults to the lowest legal channel number for that standard. If that standard has been used before, then the last used channel will be the default.

Full Band: Sets the frequency of the unit to a 100 MHz span on the current center frequency.

Figure 2-4. Power Meter Freq Menu

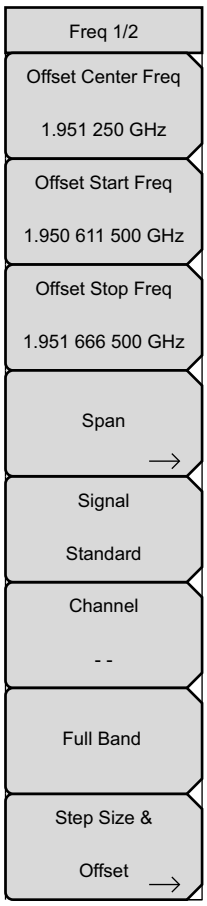
2-5 Frequency Menu with Offset Function

Key Sequence: **Frequency**

A user defined frequency offset can be entered to adjust the frequency displayed on the instrument from the actual swept frequency. When enabled Offset will be displayed at the bottom of the screen (Figure 2-7) and the Center Freq, Start Freq, and Stop Freq keys will indicate that a frequency offset has been turned on.

Set the Freq Offset to 0 Hz to remove the frequency offset.

Note	The Freq Offset will affect the displayed values of Frequencies and Limits. The currently frequency offset value is displayed in the "Freq 2/2 Menu".



(Offset) Center Freq : Sets the frequency at the center of the measurement. Frequencies can be entered in units of GHz, MHz, kHz, or Hz. Enter the frequency by using the keypad, the rotary knob, or the arrow keys. When the center frequency is entered, the labeling below the analog display shows the center frequency and the span in the most appropriate units based upon the value.

(Offset) Start Freq: Enter a start frequency by using the keypad, the rotary knob, or the arrow keys. If the entered start frequency is greater than the current stop frequency, then the stop frequency is automatically adjusted to be 1 kHz greater than the start frequency (Min Span).

(Offset) Stop Freq: Enter a stop frequency by using the keypad, the rotary knob, or the arrow keys. If the entered stop frequency is lower than the current start frequency, then the start frequency is automatically adjusted to be 1 kHz less than the stop frequency (Min Span).

Span: Opens the "Span Menu" on page 2-9.

Signal Standard: Opens the signal standard menu, showing the currently selected signal standard and a complete list of signal standards to choose from.

Channel #: Sets the channel information for the selected standard. If the particular standard has not been used before, then the channel number defaults to the lowest legal channel number for that standard. If that standard has been used before, then the last used channel will be the default.

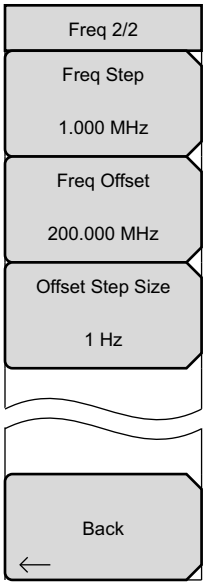
Full Band: Sets the frequency of the unit to a 100 MHz span on the current center frequency.

Step Size & Offset: Opens the "Freq 2/2 Menu" on page 2-7.

Figure 2-5. Power Meter Freq 1/2 with Offset Function Menu

Freq 2/2 Menu

Key Sequence: **Freq** > Step Size & Offset



Freq Step: Sets the interval that is used by the arrow keys. Enter the step amount by using the keypad, the rotary knob, or the arrow keys.

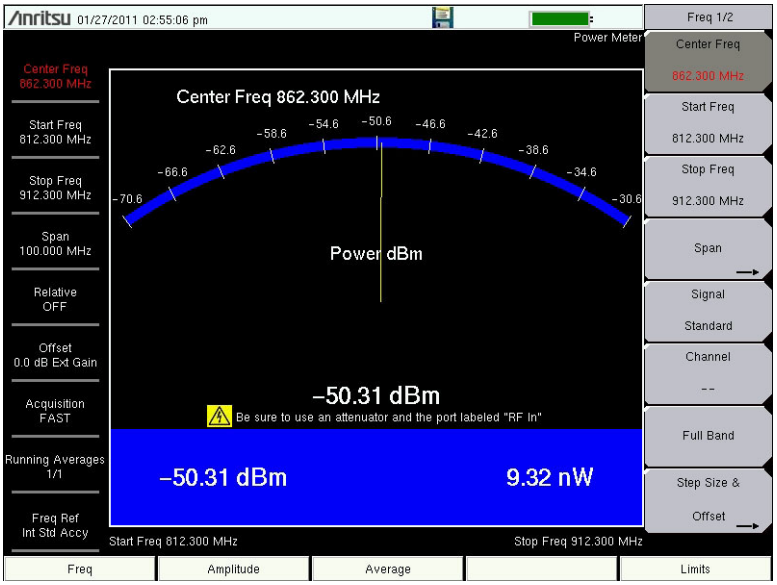
Freq Offset: Enter the desired offset (positive or negative) using the keypad, the arrow keys, or the rotary knob. If entering a frequency using the keypad, the submenu key labels change to GHz, MHz, kHz, and Hz. Press the appropriate units key. Pressing the **Enter** key has the same affect as the MHz submenu key.

Offset Step Size: Enter the desired frequency offset step size. The offset frequency step specifies the amount by which the offset frequency will change when the **Up/Down** arrow keys are pressed.

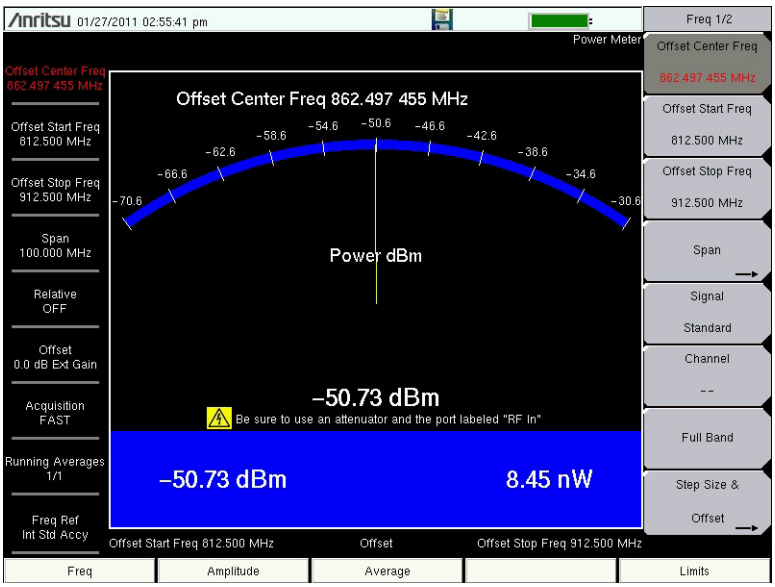
Use the keypad or the rotary knob to change the Offset Step Size.

Back: Returns to the “Frequency Menu with Offset Function” on page 2-6.

Figure 2-6. Power Meter Freq 2/2 with Offset Function Menu



No Offset

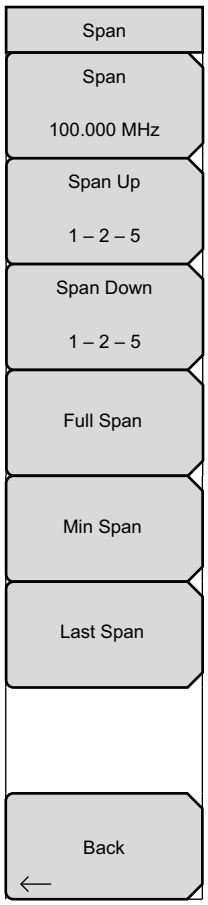


+200 MHz Frequency Offset
(**Freq** > Step Size & Offset > Freq Offset)

Figure 2-7. 200 MHz Frequency Offset Example

2-6 Span Menu

Key Sequence: **Frequency** > Span



Span: Sets the width of the measurement window in GHz, MHz, kHz, or Hz. The center frequency and span are displayed in the message area at the bottom of the status window. The span can be entered with the keypad and then selecting a units (GHz, MHz, kHz, or Hz) submenu key, or by using the arrow keys to change an already selected frequency. Press **Enter** to set the span, or press **Esc** to restore the previous span setting.

Span Up
1 – 2 – 5: Increases the span to the next multiple of 1, 2, or 5.

Span Down
1 – 2 – 5: Decreases the span to the next multiple of 1, 2, or 5.

Full Span: Sets the span to 100 MHz on the current center frequency. Adjusts the center frequency if it is at the edge of the limit of the instrument.

Min Span: Changes the span to 1 kHz.

Last Span: Returns the span to the previous value.

Back: Returns to the “Freq (Frequency) Menu” on page 2-5.

Figure 2-8. Power Meter Span Menu

2-7 Amplitude Menu

Key Sequence: **Amplitude**

Max: Sets the maximum value on the display.

Min: Sets the minimum value on the display.

Offset: Used to set the division offset. When active, each division value is increased or decreased by the offset entered. A value up to ±100 dB can be entered.

Relative
On Off: Press this submenu key to toggle relative power On or Off. This measurement shows the relative level of the desired base power level input to your instrument. When ON, the message **Relative: On nnn dB** (where nnn dB is the current relative value) shows in the message area. The units will be automatically reverted to dBm if necessary.

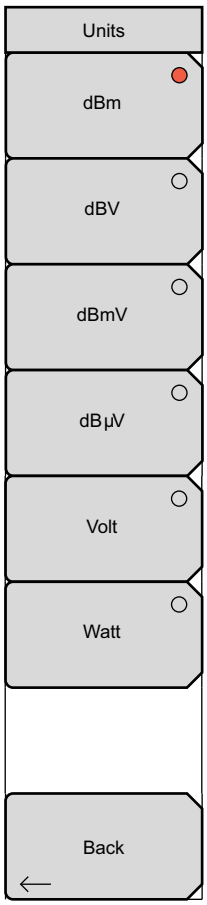
Units: Opens the “Units Menu” on page 2-11. Note that changing the units sets Relative to Off.

Autoscale: Adjusts the Top and Bottom values so that the power meter needle will be shown in the middle of the analog display.

Figure 2-9. Power Meter Amplitude Menu

Units Menu

Key Sequence: **Amplitude** > Units



Units: Select a unit of measure for the power meter.

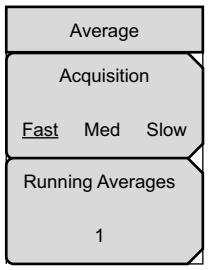
dBm, dBV, dBmV, dBµV, Volt, or Watt. The selected unit is indicated by the red circle.

Back: Returns to the "Amplitude Menu" on page 2-10.

Figure 2-10. Power Meter Units Menu

2-8 Average Menu

Key Sequence: **Average**



Acquisition: Sets the measurement speed:

Fast, processes the power value quickly but with some inaccuracy.

Slow, processes the power value with the most accuracy.

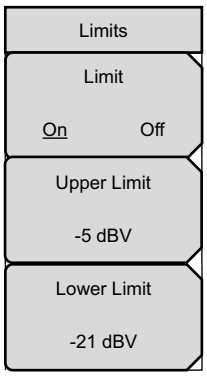
Med, process the power value with greater accuracy than the Fast setting and the process time is faster than the Slow setting. Press the submenu key to toggle through the choices. The selected speed is underlined.

Running Averages: Sets the number of traces used in calculating the average. Enter the desired number by using the keypad, the rotary knob, or the arrow keys. Press **Enter** to set, or press **Esc** to restore the previous setting.

Figure 2-11. Power Meter Average Menu

2-9 Limits Menu

Key Sequence: **Limit**



Limit: Turns the limits On or Off.

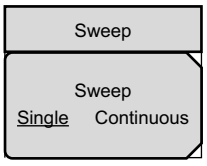
Upper Limit: Sets the upper limit. Enter the desired number by using the keypad, the rotary knob, or the arrow keys. If the keypad was used to enter new values, press the **Esc** button to restore the previous setting, or press **Enter** to set the new setting.

Lower Limit: Sets the lower limit. Enter the desired number by using the keypad, the rotary knob, or the arrow keys. If the keypad was used to enter new values, press the **Esc** button to restore the previous setting, or press **Enter** to set the new setting.

Figure 2-12. Power Meter Limit Menu

2-10 Sweep Menu

Key Sequence: **Shift** > **Sweep** (3) key



Sweep Single/Continuous: This submenu key toggles between continuous sweep and single sweep. In single sweep mode, the results of a sweep are displayed on the screen while the instrument awaits a trigger event to start a new sweep.

Figure 2-13. Power Meter Sweep Menu

2-11 Measure Menu

This menu is not available in Power Meter measurement mode.

2-12 Trace Menu

This menu is not available in Power Meter measurement mode.

2-13 Other Menus

Preset, **File**, **Mode** and **System** are described in the User Guide.

Chapter 3 — High Accuracy Power Meter

3-1 Introduction

When the High Accuracy Power Meter (Option 19) is installed in your instrument, an Anritsu sensor can be used to make power measurements to high accuracy. This high-performance option provides true RMS measurements and accurate measurements for both CW and complex digitally modulated signals. Table 1-1 lists the Option 19 compatible Anritsu sensors.

Note	The Anritsu sensor is not included with Option 19. A high accuracy power sensor must be purchased separately and the instrument must have compatible firmware installed.

3-2 Required Equipment

One or more of the following USB Power Sensors:

- PSN50
- MA24103A
- MA24104A
- MA24105A
- MA24106A
- MA24108A
- MA24118A
- MA24126A
- MA24208A
- MA24218A
- MA24330A
- MA24340A
- MA24350A

3-3 General Measurement Setup

Power values are displayed in both dBm and Watts. The Relative Power feature allows the display of power changes with respect to a desired reference value in both dB and % (percent). Limit values can be turned on as needed to indicate if a measurement is within or outside specified limits. Running Averages and a Max/Hold feature are also available.

The High Accuracy Power Sensor attaches to your instrument with the supplied cable.

The zeroing feature improves accuracy by removing measured system noise. Refer to Table 3-1 for the power range in which accuracy is improved. Calibration factors can be used to correct both efficiency and mismatch loss.

Table 3-1. Power Range for Improving Accuracy via Zeroing to Remove Noise

Sensor	Power Range
PSN50	–20 dBm to –30 dBm
MA24104A	+3 dBm to +13 dBm
MA24105A	+3 dBm to +51.76 dBm
MA24103A	+3 dBm to +51.76 dBm
MA24106A, MA24108A, MA24118A, MA24126A	–30 dBm to –40 dBm
MA24208A, MA24218A	–45 dBm to –60 dBm
MA24330A, MA24340A, MA24350A	–50 dBm to –70 dBm

Additional attenuators can be used to ensure that the power does not exceed the specified measurement range. The Enter Offset feature allows entering offset values for any cables and attenuators.

This measurement example uses an Anritsu PSN50 sensor and an attenuator for the high power measurement.

1. Connect the USB A/mini-B cable between the sensor and your instrument.
2. Press the **On/Off** key to turn on your instrument.
3. Press the **Shift** key, then the **Mode** (9) key. Use the **Up/Down** arrow keys or rotary knob to select High Accuracy Power Meter mode and press **Enter**.

Changing the Display Units

The power reading can be displayed in dBm or Watts. Use the following procedure to change the displayed units:

1. Press the **Amplitude** main menu key.
2. Press the Units submenu key and select the display units.
3. Press the Back submenu key to return to the Power Meter menu.

Zero and Cal

1. Press the **Zero/Cal** main menu key and press the Cal Factor submenu key. Enter the Center Frequency, or press the Signal Standard key and the **Up/Down** arrow keys to select a particular standard. The calibration factors are derived for the corresponding center frequency. The channel number is not required because the calibration factor frequencies are rounded to the nearest 500 MHz. The Cal Factor message in the display window shows Cal Factor ON if the Cal Factor command has been properly sent to the sensor.
2. With no power applied to the sensor, press the Zero submenu key to zero the sensor. This step is recommended when making power measurements below –20 dBm.

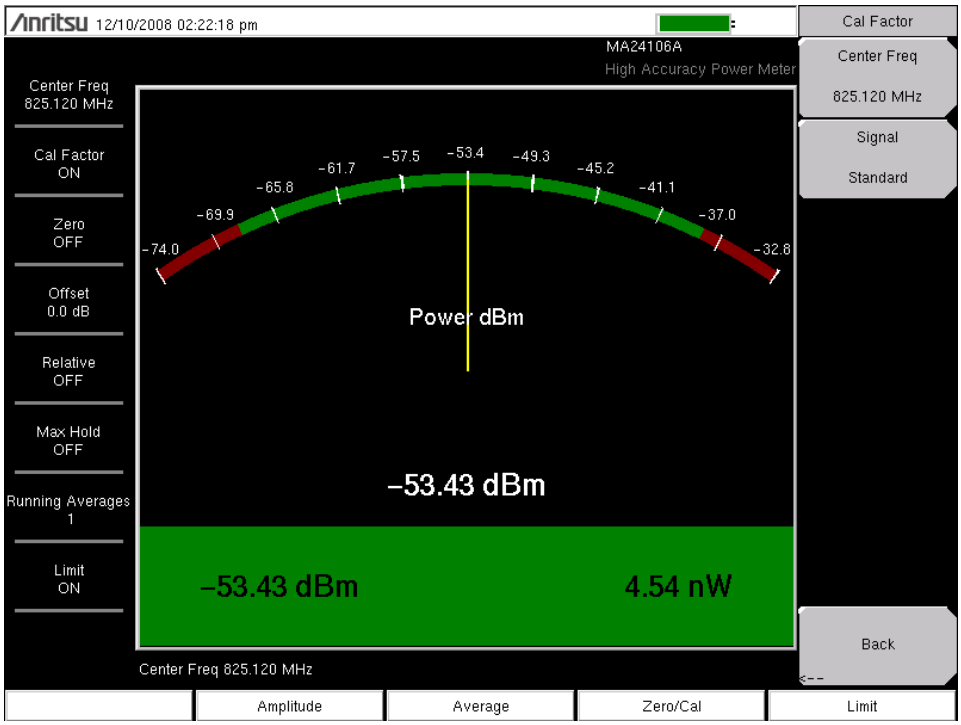


Figure 3-1. Cal Factor Menu on the High Accuracy Power Meter

Changing the Scale of the Analog Display

1. Press the **Amplitude** main menu key.

2. Press the Auto Scale submenu key to align the power meter needle in the middle of the analog display. The maximum and minimum values align accordingly.

3. Press the Max submenu key and use the arrow keys, rotary knob, or numeric key pad to manually set the maximum value of the analog display.

4. Press the Min submenu key and use the arrow keys, rotary knob, or numeric key pad to manually set the minimum value of the analog display.

Note	With no offset, the maximum value for the display is the upper measurement range, which is +20 dBm. With an offset, such as with 10 dB of attenuation, the upper value can be set to +30 dBm. With an offset of xx dB, the upper value can be set to +20 dBm plus xx dB.

Using Attenuators

1. Press the **Amplitude** main menu key, and press the Enter Offset submenu key.

2. Enter the offset value for the attenuator at the frequency of operation.

Displaying Relative Power

1. Press the **Amplitude** main menu key.

2. With the desired base power level being available at the sensor, press the Relative submenu key. The power reading shows 0 dB and 100%. If you are measuring a 10 dBm signal, and if the Relative key is pressed, then a drop to 7 dBm will show as –3 dB and 50%.

Averaging/Max Hold/Run Hold

1. Press the **Average** main menu key.
2. Press the Running Averages submenu key. Use the arrow keys, rotary knob, or numeric keypad to enter the desired number of averages.
3. Press the Max Hold submenu key to toggle between Max Hold On and Max Hold Off. If averaging is selected, then Max Hold displays the maximum value of the non-averaged data.

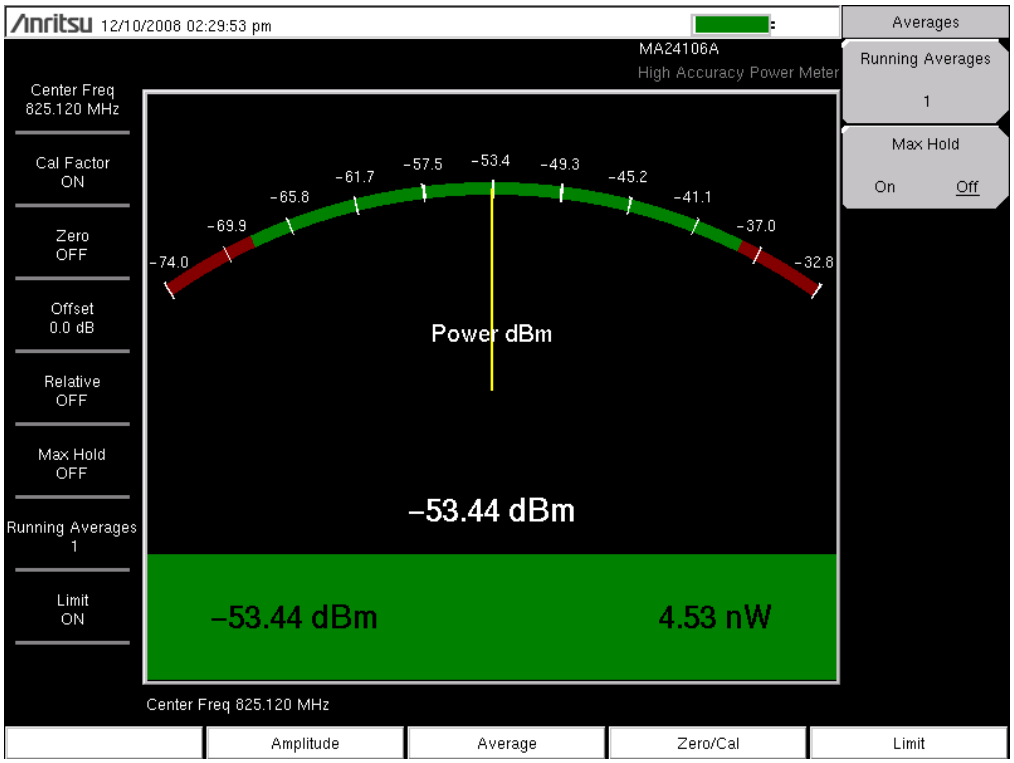


Figure 3-2. Averages Menu on the High Accuracy Power Meter

Limits

1. Press the **Limit** main menu key.
2. Press the Lower Limit submenu key. Enter the lower limit value in dBm or in Watts.
3. Press the Upper Limit submenu key. Enter the upper limit value in dBm or in Watts.
4. Press the Limit On/Off submenu key to turn the limits On and Off. The number display turns green (if the measurement is passing) or red (if the measurement is failing).
5. Press the **Amplitude** main menu key, and press the Units submenu key to change between dBm and Watts.

Note	Screen images are provided as examples. The images and measurement details that are shown on your instrument may differ from the examples in this measurement guide.

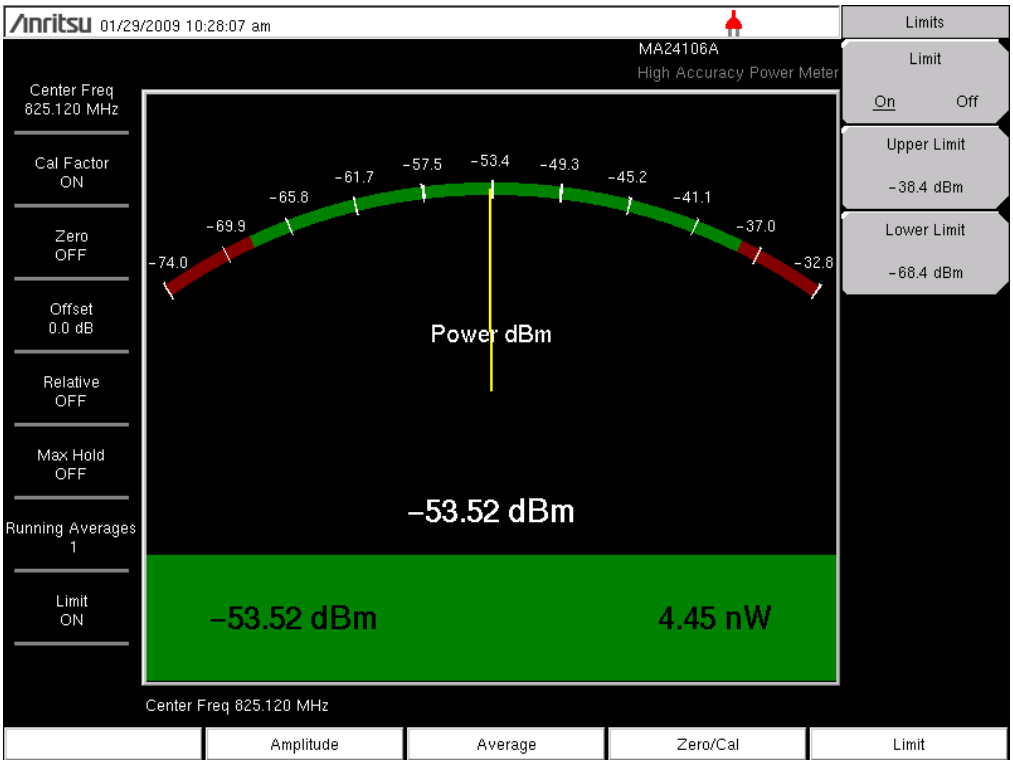


Figure 3-3. Limits Menu on the High Accuracy Power Meter

3-4 High Accuracy Power Meter Menus

Figure 3-4 shows the map of the High Accuracy Power Meter menus. The following sections describe main menus and associated submenus. Menu maps show all possible submenu keys. Refer to individual menu descriptions for display circumstances.

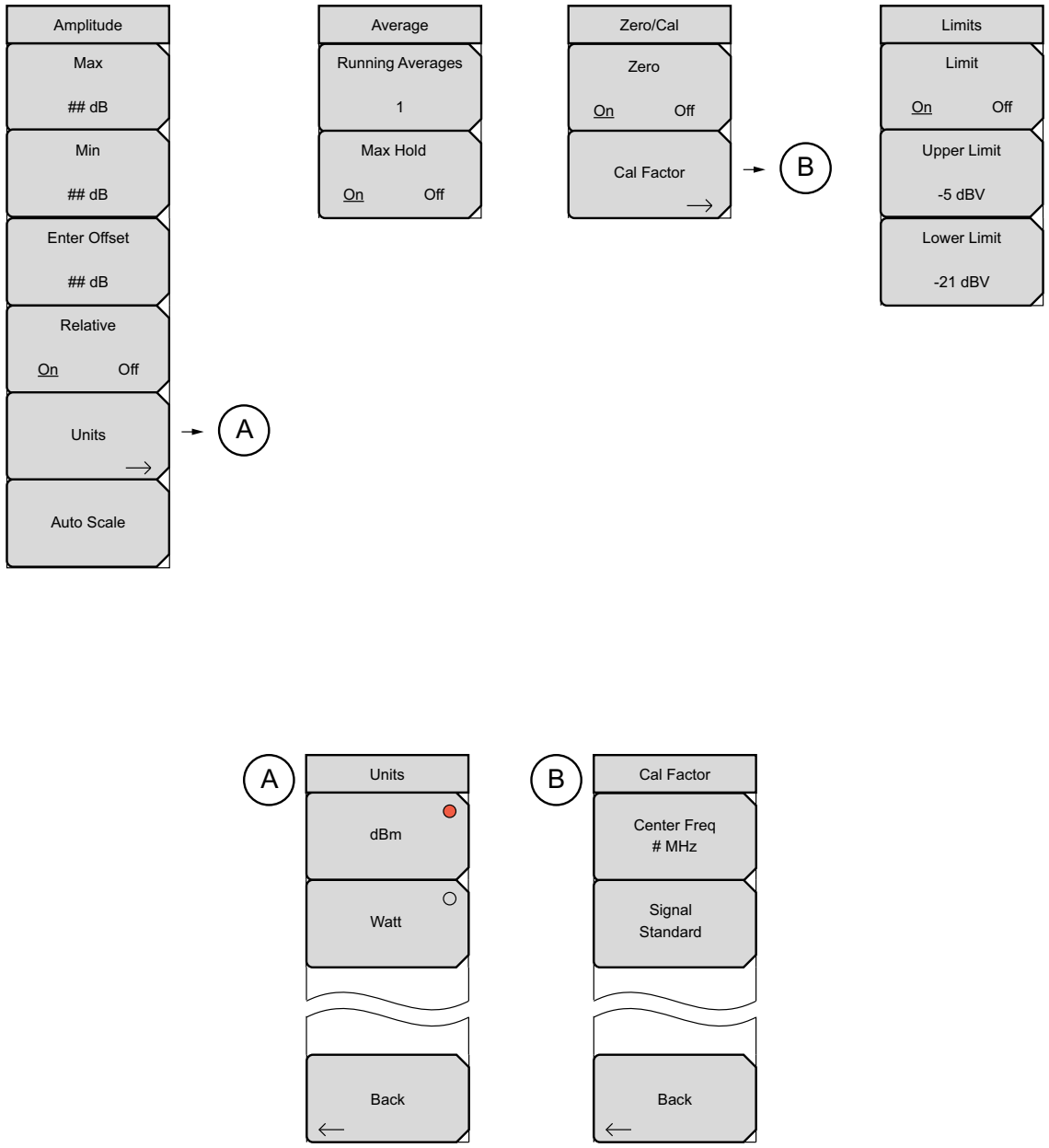
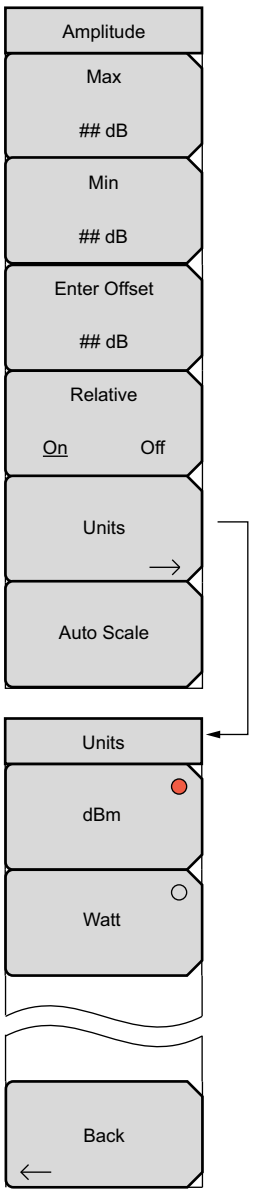


Figure 3-4. High Accuracy Power Meter Menus

3-5 Amplitude Menu

Key Sequence: **Amplitude**



Max: Sets the maximum value on the display.

Min: Sets the minimum value on the display.

Enter Offset: Turns Offset On or Off. When on, a value of ±100 dB can be entered.

Relative: Press this submenu key to toggle relative power On or Off. This measurement shows the relative level of the desired base power level input to your instrument. When ON, the message **Relative: On nnn dB** (where nnn dB is the current relative value) shows in the message area. The units will be automatically reverted to dBm if necessary.

Units: Opens the Units menu.

dBm or Watt: Select a unit of measure for the power meter. The selected unit is indicated by the red circle.

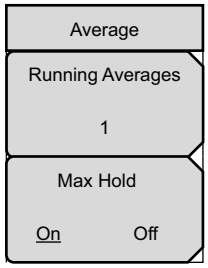
Back: Returns to the **Amplitude** Menu.

Autoscale: Adjusts the Top and Bottom values so that the power meter needle will be shown in the middle of the analog display.

Figure 3-5. High Accuracy Power Meter Amplitude Menu

3-6 Average Menu

Key Sequence: **Average**



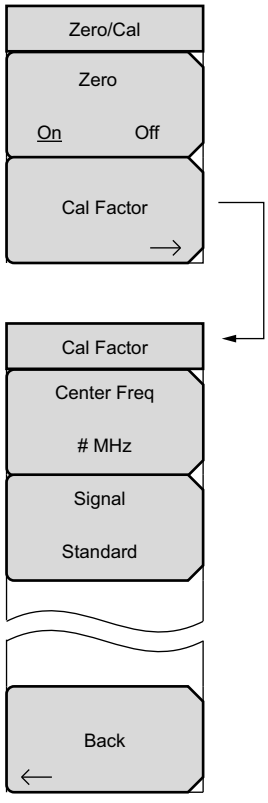
Running Averages: Sets the number of measurements to be averaged.

Max Hold: Sets the displayed measurement to show the maximum measured power when On. Note that changing any parameter resets this feature.

Figure 3-6. High Accuracy Power Meter Average Menu

3-7 Zero/Cal Menu

Key Sequence: **Zero/Cal**



Zero: With no power applied to the sensor and pressed On, the sensor is set to zero. This is recommended when making power measurements below –20 dBm.

Cal Factor: Press this submenu key to open the Cal Factor menu. Set the desired frequency by setting the center frequency or using a signal standard.

Center Freq: Press this submenu key, then use the number keypad, arrow keys, or rotary knob to set the frequency.

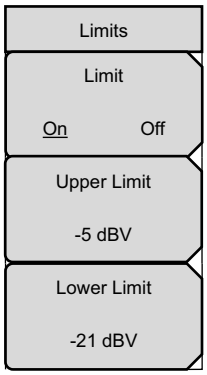
Signal Standard: Press this submenu key to open a list box and select a signal standard.

Back: Press this submenu key to return to the Zero/Cal menu.

Figure 3-7. High Accuracy Power Meter Zero/Cal Menu

3-8 Limit Menu

Key Sequence: **Limit**



Limit: Turns the limits On or Off.

Upper Limit: Sets the upper limit. Enter the desired number by using the keypad, the rotary knob, or the arrow keys. If the keypad was used to enter new values, press the **Esc** button to restore the previous setting, or press **Enter** to set the new setting.

Lower Limit: Sets the lower limit. Enter the desired number by using the keypad, the rotary knob, or the arrow keys. If the keypad was used to enter new values, press the **Esc** button to restore the previous setting, or press **Enter** to set the new setting.

Figure 3-8. High Accuracy Power Meter Limit Menu

3-9 Sweep Menu

This menu is not available in High Accuracy Power Meter measurement mode.

3-10 Measure Menu

This menu is not available in High Accuracy Power Meter measurement mode.

3-11 Trace Menu

This menu is not available in High Accuracy Power Meter measurement mode.

3-12 Other Menus

Preset, **File**, **Mode** and **System** are described in the User Guide.

Chapter 4 — Inline Peak Power Sensor MA24103A/105A

4-1 Introduction

This chapter describes the setup and use of the model MA24103A/105A Inline Peak Power Sensor for high accuracy power meter measurements.

The MA24103A/105A is an in-line type of power sensor module that can acquire forward and reverse measurements when connected to an Anritsu Handheld instrument with High Accuracy Power Meter (Option 19) installed. Forward measurements include Average Power, Crest Factor, Peak Envelope Power (PEP), Burst Average Power, and CCDF. Reverse measurements include Average Power, Reflection Coefficient, Return Loss, and VSWR. The frequency range for MA24105A is 350 MHz to 4000 MHz, and the power range is from 2 mW to 150 W, depending upon measurement function. The frequency range for MA24103A is 25 MHz to 1 GHz, and the power range is from 2 mW to 150 W, depending upon measurement function.

In the analog meter view, as shown in Figure 4-2, forward measurements are displayed in the dial portion of the meter. The reverse measurement is displayed below the dial in a rectangular box. To view all of the forward and reverse measurements in table format, use the Summary display (as shown in Figure 4-3). Figures showing measurement screens may differ from any actual screen on your instrument.

Note	The inline power sensor MA24103A is only compatible with instruments that have the latest firmware of V4.70 or higher.

4-2 Required Equipment

In order to use the MA24103A/105A Inline Peak Power Sensor, your Anritsu handheld instrument must have all of the following:

- The High Accuracy Power Meter (Option 19) installed
- Up-to-date firmware
- A USB Interface
- A USB cable assembly (supplied with the MA24103A/105A), Type USB-A / MICRO-B Latch

Figure 4-1. MA24103A/105A Inline Peak Power Sensor

4-3 Sensor Power Meter Interface

Sensor and High Accuracy Power Meter Interface

Firmware in both the MA24103A/105A Inline Peak Power Sensor and in Option 19 interact to provide additional functions in the connected Anritsu handheld instrument. The firmware for the High Accuracy Power Meter (Option 19) and the firmware of your instrument must be up-to-date versions. Refer to Section 4-2 “Required Equipment” on page 4-1.

Main Menu Keys

When the MA24103A/105A is connected to your Anritsu handheld instrument with Option 19 installed, the five main menu keys are displayed at the bottom of the measurement display.

Display, Amplitude, Average, Zero/Cal, and Limit Keys

These main menu keys and the Display menu with its submenu keys are shown in Figure 4-2. The screen that is displayed in Figure 4-2 is an example and may not match any actual screen on your instrument.

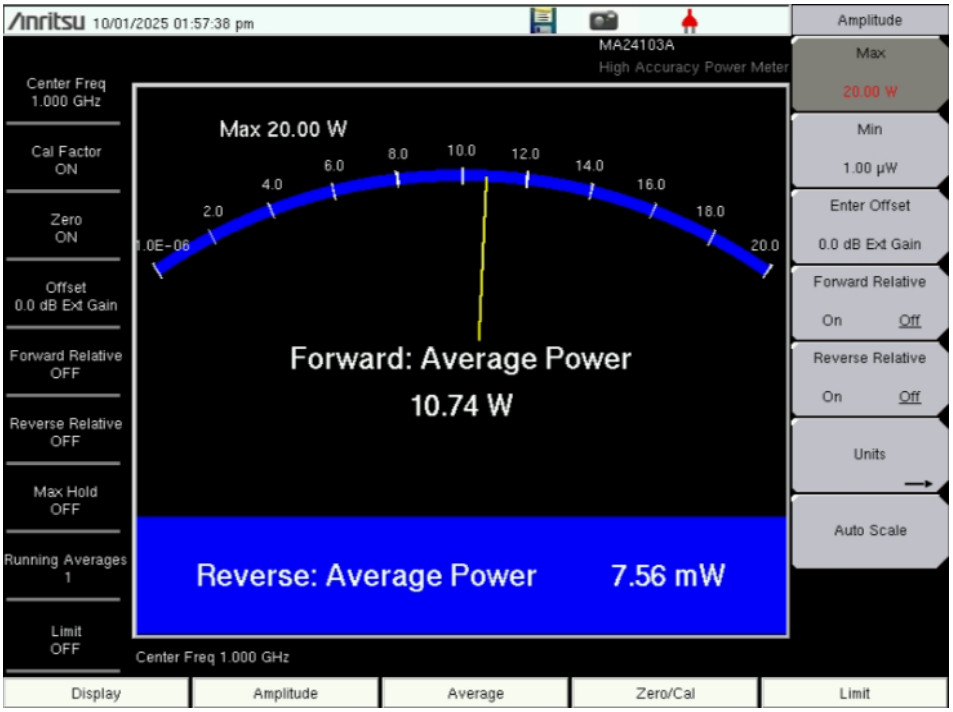


Figure 4-2. Forward and Reverse Average Power

Figure 4-3. Power Meter Summary Display

4-4 Connection Setup

Connect the MA24103A/105A to the Anritsu handheld instrument with Option 19.

1. Connect the USB cable between the sensor and your instrument. The MA24103A/105A green power light is illuminated when power is available via the USB cable (refer to Figure 4-1 on page 4-2).
2. Press the **On/Off** key to turn on your instrument.
3. If the instrument is already On when the sensor USB cable is connected, an Attention message is displayed. Refer to Figure 4-4.

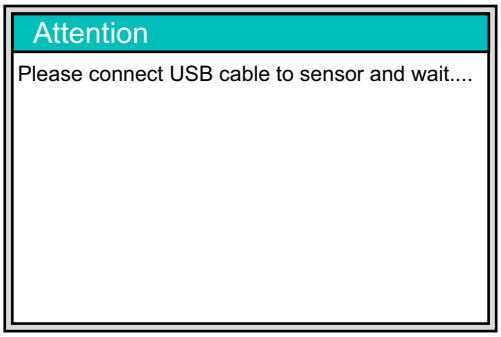


Figure 4-4. USB Connection Message

4. When the Attention message box is no longer displayed, the connection is enabled.

4-5 General Measurement Setup

Please refer to the User Guide for your instrument for directions about selecting the High Accuracy Power Meter mode and about file management.

Changing the Display Units

The power reading can be displayed in dBm or Watts. Use the following procedure to change the displayed units:

1. Press the **Amplitude** main menu key.
2. Press the Units submenu key and select the display units (press either dBm or Watt).
3. Press the Back submenu key to return to the Amplitude menu.

Zero and Calibrate

The zeroing feature improves accuracy by removing measured system noise.The power range in which accuracy is improved is from + 3 dBm to + 13 dBm. Calibration factors can be used to correct both efficiency and mismatch loss.

1. Press the **Zero/Cal** main menu key and then press the Cal Factor submenu key. Enter the Center Frequency. The calibration factors are derived for the center frequency.

   Alternatively, press the Signal Standard submenu key and then the **Up/Down** arrow keys to select a particular standard and band. Because most standard bands are less than 500 MHz wide, and because calibration factor frequencies are rounded to the nearest 500 MHz, a specific channel number is not required. The calibration factors are derived for the corresponding signal standard frequency.

   The Cal Factor message in the Instrument Settings Summary of the display window shows **Cal Factor ON** if the Cal Factor command has been successfully sent to the sensor.
2. With no power applied to the sensor, press the Zero submenu key to zero the sensor. This step is recommended when making power measurements below +13 dBm.

Changing the Scale of the Analog Display

1. Press the **Amplitude** main menu key.
2. Press the Auto Scale submenu key to align the power meter needle in the middle of the analog display. The maximum and minimum values align accordingly.
3. Press the Max submenu key and use the arrow keys, rotary knob, or numeric keypad to manually set the maximum value of the analog display.
4. Press the Min submenu key and use the arrow keys, rotary knob, or numeric keypad to manually set the minimum value of the analog display.

Using Attenuators

1. Press the **Amplitude** main menu key, and then press the Enter Offset submenu key.
2. Enter an offset value from +100 dB to 0 to –100 dB (gain or loss) for the attenuator at the frequency of operation.

Selecting Measurements

1. Press the **Display** main menu key, and then press Forward, Reverse, or Summary. Refer to Figure 4-2 on page 4-3. Summary displays both forward and reverse measurements in table format, as shown in Figure 4-3 on page 4-4.
2. When selecting Forward or Reverse, refer to Section 4-6 "Menus" on page 4-7 for additional information regarding the submenu measurement keys for Forward and Reverse measurements.

4-6 Menus

Figure 4-5 shows the menu group of High Accuracy Power Meter menus for the MA24103A/105A Inline Peak Power Sensor. The sections that follow Figure 4-5 describe main menus and associated submenus. The submenus are listed in the order that they appear on the display from top to bottom under each main menu.

4-7 MA24103A/105A Menu Group

Menu maps show all possible submenu keys. Refer to individual menu descriptions for display circumstances.

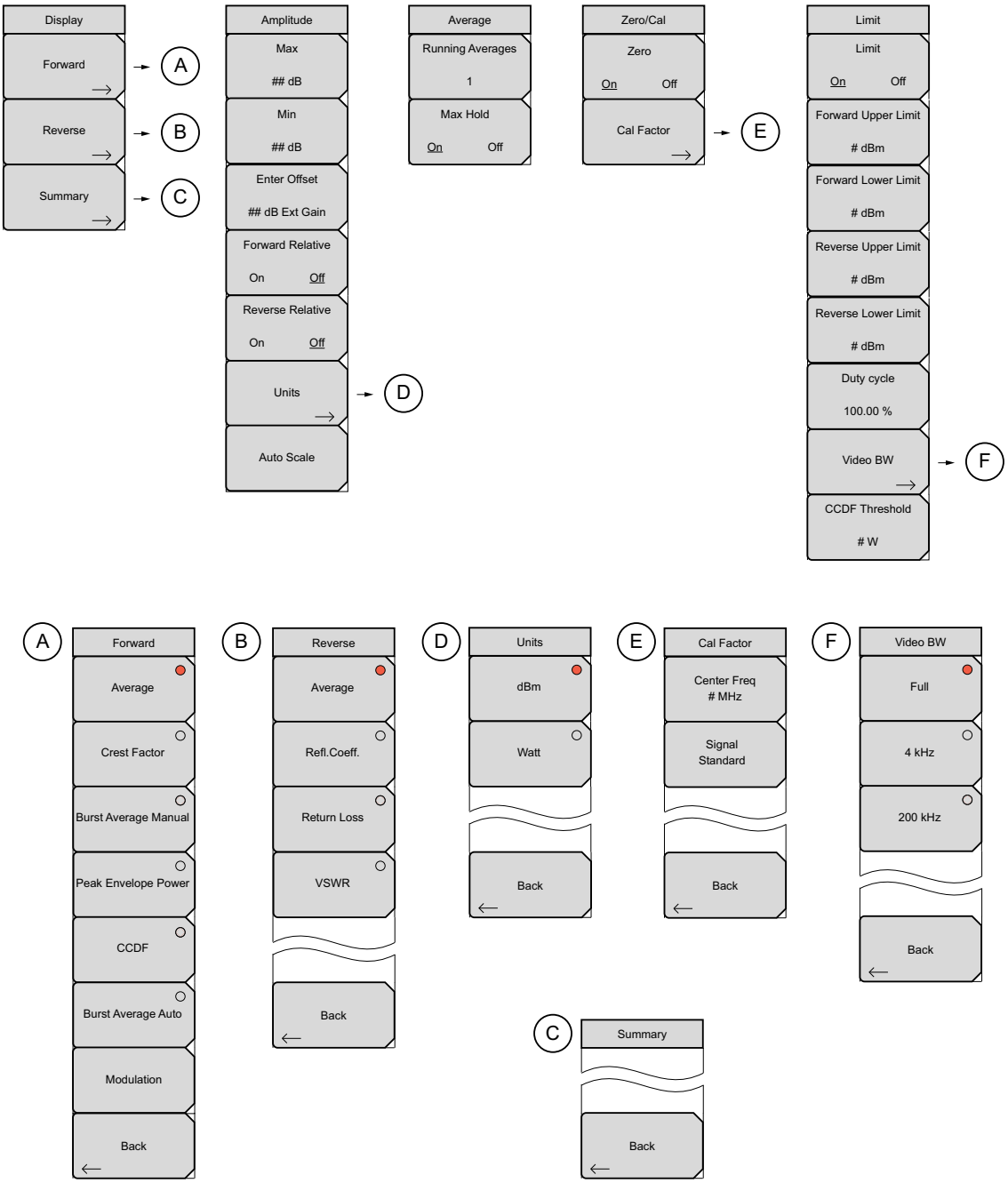
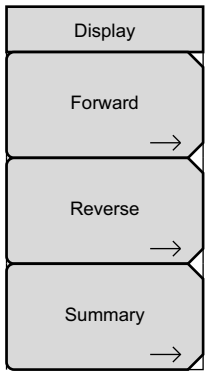


Figure 4-5. MA24103A/105A Menu Group for High Accuracy Power Meter

4-8 Display Menu

Key Sequence: **Display**



Forward: Press this submenu key to open the Forward menu, which lists the forward direction measurement parameters. Select the desired measurement parameter, then press the Back submenu key to return to the Display menu.

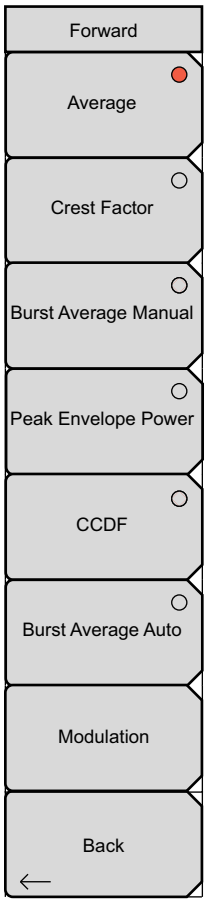
Reverse: Press this submenu key to open the Reverse menu, which lists the reverse direction measurement parameters. Select the desired measurement parameter, then press the Back submenu key to return to the Display menu.

Summary: Press this submenu key to display the Summary table, which includes both forward and reverse measurements. Each parameter value is displayed. Press the Back submenu key to return to the Display menu.

Figure 4-6. Display Menu

4-9 Forward Menu

Key Sequence: **Display** > Forward



Press the submenu key for the desired measurement parameter. Then press the Back submenu key.

Average: Press this submenu key to have the sensor measure the average power in the forward direction.

Crest Factor: Press this submenu key to have the sensor measure the Crest Factor in the forward direction. Crest Factor is a ratio of peak power to average power.

Burst Average Manual: Press this submenu key to have the sensor measure the average power within the signal bursts (in the forward direction). In manual, you must define the duty cycle of the bursts in order to complete the averaging calculation. Refer to the "Duty Cycle" submenu key in the "Limits Menu" on page 4-16.

Peak Envelope Power: Press this submenu key to have the sensor measure the peak power in the forward direction.

CCDF: Press this submenu key to have the sensor measure the value of the Complementary Cumulative Distribution Function (CCDF). A Cumulative Distribution Function (CDF) describes the probability that the signal power is less than or equal to a threshold value. The Complementary Cumulative Distribution Function (CCDF) describes the probability that the signal power is greater than a threshold value. For directions to set the threshold, refer to the "CCDF Threshold" submenu key in the "Limits Menu" on page 4-16.

Burst Average Auto: Press this submenu key to have the sensor measure the average power within the signal bursts (in the forward direction). In auto, the sensor determines the duty cycle of the bursts in order to complete the averaging calculation.

Modulation: Press this submenu key to select the modulation type for Peak Envelope Power (PEP) measurement only. First press the Peak Envelope Power submenu key (or check to ensure that the circle on its key face is red). Then press Modulation. The Select Modulation type list box is displayed. Use the arrow keys or the rotary knob to highlight the desired modulation type, and then press **Enter** to select. The selection of a specific modulation type provides a correction factor to refine the PEP calculation. Refer to Figure 4-8 on page 4-11.

Back: Press this submenu key to return to the Display menu.

Figure 4-7. Forward Menu

The Select Modulation Type list box contains modulation types that are used to apply a correction factor that refines the Peak Envelope Power (PEP) calculation. The list shown in Figure 4-8 is a sample and may not match the list that is displayed on your instrument.

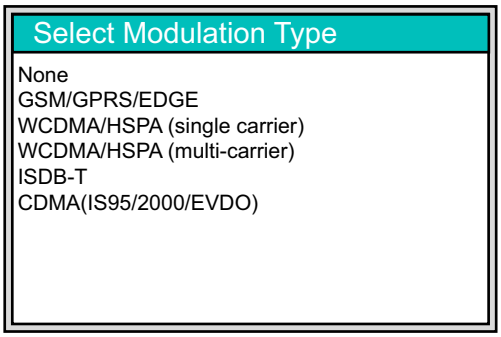
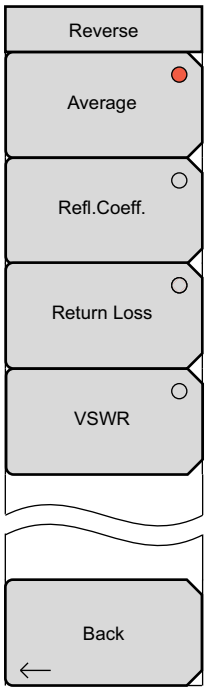


Figure 4-8. Example Modulation Types for Peak Envelope Power (PEP)

4-10 Reverse Menu

Key Sequence: **Display** > Reverse



Press the submenu key for the desired measurement parameter. Then press the Back submenu key.

Average: Press this submenu key to have the sensor measure the average power in the reverse direction.

Refl. Coeff. Press this submenu key to measure the reflection coefficient (reflected power / forward power).

Return Loss: Press this submenu key to measure return loss.

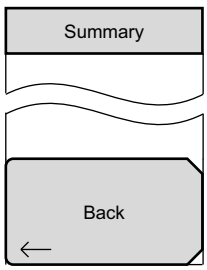
VSWR: Press this submenu key to measure VSWR.

Back: Press this submenu key to return to the Display menu.

Figure 4-9. Reverse Menu

4-11 Summary Menu

Key Sequence: **Display** > Summary



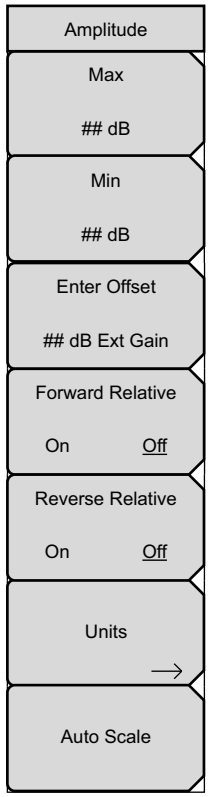
Pressing the Summary submenu key displays a table of all of the forward and reverse measurements. Refer to Figure 4-3 on page 4-4.

Back: To return to the Display menu, press the Back submenu key.

Figure 4-10. Summary Menu

4-12 Amplitude Menu

Key Sequence: **Amplitude**



Max: Press this submenu key to set the maximum value on the display.

Min: Press this submenu key to set the minimum value on the display.

Enter Offset: Press this submenu key and then use the numeric keypad to enter a value. A Units menu is displayed to allow you to select the value as Gain or Loss. Pressing **Enter** sets the value to Gain by default.

Forward Relative
On Off: Press this submenu key to toggle relative forward power On or Off. This measurement displays the relative level of the desired base power level input to the instrument.

Reverse Relative
On Off: Press this submenu key to toggle relative reverse power On or Off. This measurement displays the relative level of the desired base power level input to the instrument.

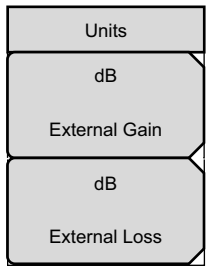
Units: Press this submenu key to display the Units menu, which allows a choice of dBm or Watt.

Auto Scale: Press this submenu key to adjust the top and bottom values so that the power meter needle is displayed near the middle of the analog scale.

Figure 4-11. Amplitude Menu

External Amplitude Units Menu

Key Sequence: **Amplitude** > Enter Offset > **Number Entry**



In the Amplitude menu, press the Enter Offset submenu key, and then enter a value from the numeric keypad. This Units menu is displayed.

dB External Gain: Press this submenu key to set the entered value as Gain.

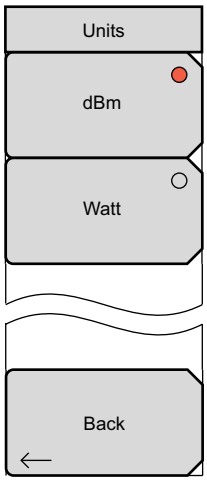
dB External Loss: Press this submenu key to set the entered value as Loss.

Pressing **Enter** rather than a submenu key selects Gain as the default.

Figure 4-12. Units Menu (External Amplitude)

4-13 Units Menu

Key Sequence: **Amplitude** > Units



dBm: Press this submenu key to select dBm as the units of displayed power.

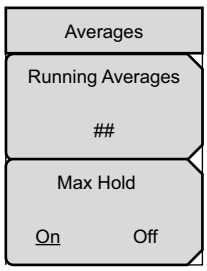
Watt: Press this submenu key to select Watt as the units of displayed power.

Back: Press this submenu key to return to the Amplitude menu.

Figure 4-13. Units Menu (Amplitude)

4-14 Averages Menu

Key Sequence: **Average**



Running Averages: Press this submenu key to set the number of measurements to be averaged. Use the numeric keypad to enter a number from 1 to 100 or use the arrow keys or the rotary knob. Press **Enter** to set the number.

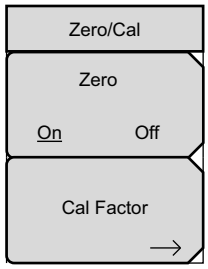
Max Hold

On Off: Press this submenu key to toggle the Max Hold setting On or Off. When On, Max Hold sets the displayed measurement to show the maximum measured power. Note that changing any parameter resets this feature.

Figure 4-14. Averages Menu

4-15 Zero/Cal Menu

Key Sequence: **Zero/Cal**



Zero
On Off: With no power applied to the sensor, press this submenu key to toggle the setting to On. A message is displayed: Please remove RF input power and press ENTER.

When Enter is pressed, another message is displayed: Zeroing... Please wait at least 1 minute and 20 seconds. When the message is no longer displayed, the zeroing is complete.

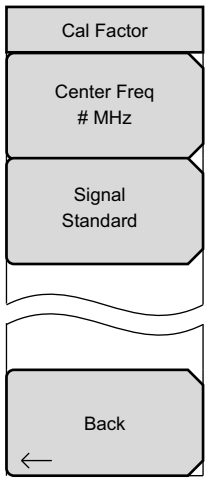
Cal Factor: Press this submenu key to display the Cal Factor menu.

Figure 4-15. Zero/Cal Menu

Please connect USB cable to sensor and wait...

4-16 Cal Factor Menu

Key Sequence: **Zero/Cal** > Cal Factor



Center Freq: Press this submenu key to set the center frequency. Use the arrow keys or the rotary knob to change the value and then press **Enter**. Or use the numeric keypad, and then press a Units submenu key for GHz, MHz, kHz, or Hz. Pressing **Enter** is the same as pressing MHz.

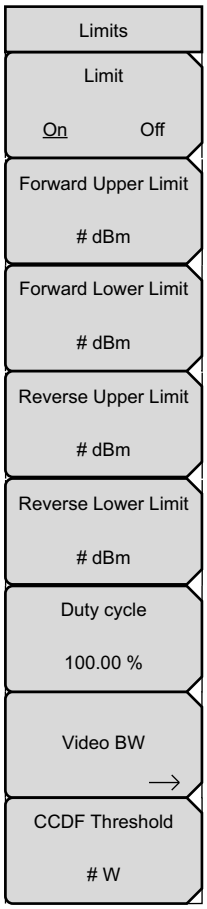
Signal Standard: Press this submenu key to display a list box of signal standards. Highlight a standard with the arrow keys or rotary knob and then press **Enter**.

Back: Press this submenu key to return to the Zero/Cal menu.

Figure 4-16. Cal Factor Menu

4-17 Limits Menu

Key Sequence: **Limit**



Limit

On Off: Press this submenu key to toggle limit settings On or Off.

Forward Upper Limit: Press this submenu key to set the Forward Upper Limit. Enter the desired number by using the keypad, the rotary knob, or the arrow keys. If the keypad was used to enter new values, press the Esc button to restore the previous setting, or press Enter (or the dB submenu key) to set the new value.

Forward Lower Limit: Press this submenu key to set the Forward Lower Limit. Enter the desired number by using the keypad, the rotary knob, or the arrow keys.

Reverse Upper Limit: Press this submenu key to set the Reverse Upper Limit. Enter the desired number by using the keypad, the rotary knob, or the arrow keys.

Reverse Lower Limit: Press this submenu key to set the Reverse Lower Limit. Enter the desired number by using the keypad, the rotary knob, or the arrow keys.

Duty Cycle: Press this submenu key to set the Duty Cycle that is used only in calculating the Burst Average Manual measurements. Refer to the "Burst Average Manual" submenu key in the "Forward Menu" on page 4-10. Enter the duty cycle of the burst signal by using the keypad, the rotary knob, or the arrow keys. Set the new value by pressing **Enter** or the % submenu key.

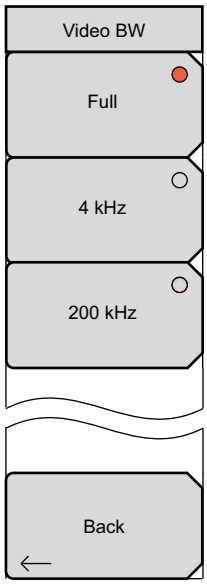
Video BW: Press this submenu key to display the Video BW menu.

CCDF Threshold: Press this submenu key to set the CCDF Threshold power. Use the numeric keypad to enter the power value. Press a submenu key in the Units menu that is displayed for the power units: W, mW, µW, nW, pW, or fW. Pressing **Enter** is the same as pressing W. Refer to the "CCDF" submenu key in the "Forward Menu" on page 4-10.

Figure 4-17. Limits Menu

4-18 Video BW Menu

Key Sequence: **Limit** > Video BW



Refer to the "Peak Envelope Power" submenu key in the "Forward Menu" on page 4-10.

Full: Press this submenu key to set **Full** as the video bandwidth of the PEP (Peak Envelope Power) circuit[a] of the MA24103A/105A Inline Peak Power Sensor.

4 kHz: Press this submenu key to set **4 kHz** as the video bandwidth of the PEP (Peak Envelope Power) circuit[a] of the MA24103A/105A Inline Peak Power Sensor.

200 kHz: Press this submenu key to set **200 kHz** as the video bandwidth of the PEP (Peak Envelope Power) circuit[a] of the MA24103A/105A Inline Peak Power Sensor.

Back: Press this submenu key to return to the Limits menu.

Figure 4-18. Video BW Menu

a. PEP circuits are used on the following measurements: Peak Envelope Power, Crest Factor, CCDF, and Burst Average Power (Auto Mode).

4-19 Additional Menus

Additional Menus Opened with Keypad Menu Keys

Additional menus are available in some instrument modes by pressing the **Shift** key and a number key from **1** though **9** on the numeric keypad,

Instrument Mode Selector

Key Sequence: **Shift** > **Mode** (9) key

System Menu

Key Sequence: **Shift** > **System** (8) key

Refer to the User Guide for your instrument for a description of the System menu.

File Menu

Key Sequence: **Shift** > **File** (7) key

Refer to the User Guide for your instrument for a description of the File menu.

Limits Menu (Instrument)

Key Sequence: **Shift** > **Limit** (6) key

Do not use this menu with the MA24103A/105A Inline Peak Power Sensor. Use the **Limits** main menu key to display the appropriate Limits menu.

Trace Menu

Key Sequence: **Shift** > **Trace** (5) key

This menu is not available when using the MA24103A/105A Inline Peak Power Sensor.

Measure Menu

Key Sequence: **Shift** > **Measure** (4) key

This menu is not available when using the MA24103A/105A Inline Peak Power Sensor.

Sweep Menu

Key Sequence: **Shift** > **Sweep** (3) key

This menu is not available when using the MA24103A/105A Inline Peak Power Sensor.

Calibrate Menu

Key Sequence: **Shift** > **Calibrate** (2) key

This key combination displays the Zero/Cal menu. Refer to "Zero/Cal Menu" on page 4-15.

Preset Menu

Key Sequence: **Shift** > **Preset** (1) key

Refer to the User Guide for your instrument for a description of the Preset menu.

Appendix A — Error Messages

A-1 Introduction

This chapter provides a list of information and error messages that could be displayed on your instrument. If any error condition persists, contact your local Anritsu Service Center (http://www.anritsu.com/Contact.asp).

A-2 High Accuracy Power Meter Messages

Warning! Power Supply Error.

Verify that the supply is connected properly.

Warning! RF Power Level is too high.

The specified upper measurement range is +20 dBm. Do not exceed this.

Warning! Sensor not zeroed properly.

The sensor should be zeroed with nothing connected to it.

Warning! Specified temperature range (0 to 50C) exceeded.

The sensor is only specified from 0 to 50C.

Warning! Temperature has changed. Zero sensor again.

Temperature changed more than allowable limit after zeroing sensor.

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