

Technical Reference



RSA3408A 8 GHz Real-Time Spectrum Analyzer Performance Verification and Specifications

077-0007-01

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- In North America, call 1-800-833-9200.
- Worldwide, visit www.tektronix.com to find contacts in your area.

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General Safety Summary

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it.

To avoid potential hazards, use this product only as specified.

Only qualified personnel should perform service procedures.

Injury Precautions

Use Proper Power Cord. To avoid fire hazard, use only the power cord specified for this product.

Avoid Electric Overload. To avoid electric shock or fire hazard, do not apply a voltage to a terminal that is outside the range specified for that terminal.

Avoid Electric Shock. To avoid injury or loss of life, do not connect or disconnect probes or test leads while they are connected to a voltage source.

Ground the Product. This product is grounded through the grounding conductor of the power cord. To avoid electric shock, the grounding conductor must be connected to earth ground. Before making connections to the input or output terminals of the product, ensure that the product is properly grounded.

Do Not Operate Without Covers. To avoid electric shock or fire hazard, do not operate this product with covers or panels removed.

Do Not Operate in Wet/Damp Conditions. To avoid electric shock, do not operate this product in wet or damp conditions.

Do Not Operate in an Explosive Atmosphere. To avoid injury or fire hazard, do not operate this product in an explosive atmosphere.

Product Damage Precautions

Use Proper Power Source. Do not operate this product from a power source that applies more than the voltage specified.

Provide Proper Ventilation. To prevent product overheating, provide proper ventilation.

Do Not Operate With Suspected Failures. If you suspect there is damage to this product, have it inspected by qualified service personnel.

Symbols and Terms

Terms in this Manual. These terms may appear in this manual:



WARNING. *Warning statements identify conditions or practices that could result in injury or loss of life.*



CAUTION. *Caution statements identify conditions or practices that could result in damage to this product or other property.*

Terms on the Product. These terms may appear on the product:

DANGER indicates an injury hazard immediately accessible as you read the marking.

WARNING indicates an injury hazard not immediately accessible as you read the marking.

CAUTION indicates a hazard to property including the product.

Symbols on the Product. The following symbols may appear on the product:



WARNING
High Voltage



Protective Ground
(Earth) Terminal



CAUTION
Refer to Manual

**Certifications and
Compliances**

Refer to the specifications section for a listing of certifications and compliances that apply to this product.

Preface

This is the Performance Verification for the RSA3408A 8 GHz Real-Time Spectrum Analyzer. It contains procedures suitable for determining that the analyzer functions, is adjusted properly, and meets the performance characteristics as warranted.

This document also contains the specifications for the RSA3408A analyzer.

Related Manuals

The following documents relate to the use or service of the analyzer:

- The *RSA3408A User Manual* describes how to operate your analyzer.
- The *RSA3408A Programmer Manual* describes how to use a computer to control the analyzer through the GPIB interface.
- The *RSA3408A Service Manual* provides information for maintaining and servicing your analyzer to the module level.

Performance Verification

Performance Verification Procedures

Two types of Performance Verification procedures can be performed on this product; *Brief Procedures* and *Performance Tests*. You may not need to perform all of these procedures, depending on what you want to accomplish.

- To rapidly confirm that the analyzer functions properly and was adjusted properly, do the brief procedures under *Functional Tests* and *Diagnostics*, which begin on page 1-3.

Advantages: These procedures are quick to do, require no external equipment or signal sources, and perform functional and accuracy testing to provide high confidence that the analyzer will perform properly. They can be used as a quick check before making a series of important measurements.

- If more extensive confirmation of performance is desired, do the *Performance Tests*, beginning on page 1-9, after doing the *Functional Tests* and *Diagnostics* just referenced.

Advantages: These procedures add direct checking of warranted specifications.

Disadvantages: They require more time to perform and suitable test equipment is required. (Refer to *Equipment Required* on page 1-11.)

Conventions

Throughout these procedures, the following conventions apply:

- Each test procedure uses the following general format:

Title of Test

Equipment Required

Prerequisites

Procedure

- Each procedure consists of as many steps, substeps, and subparts as required to do the test. Steps, substeps, and subparts are sequenced as follows:

1. First Step

- a. First Substep

- First Subpart

- Second Subpart

- b. Second Substep

2. Second Step

- Instructions for menu selection follow this format:

FRONT PANEL KEY → **Side Menu Key** → **Submenu Key**.

For example, “Press MODE: **DEMODO** → **Digital Demod** → **Constellation**”.

“MODE: **DEMODO**” indicates the **DEMODO** key in the MODE menu area on the front panel.

- In steps and substeps, the lead-in statement in italics tells you what to do, and the instructions that follow tell you how to do it.

The example step below is telling you to set the analyzer controls by pressing the specified key sequence.

Set the RSA3408A analyzer controls:

Press MODE: **DEMODO** → **Digital Demod** → **Constellation**.

STOP. *The symbol at the left is accompanied by information you must read to do the procedure properly.*



Brief Procedures

The *Functional Tests* use the internal calibration signal as a test-signal source for further verifying that the analyzer functions properly.

The *Diagnostics* use internal routines to verify that the instrument functions properly and passes the internal circuit tests.

The following section provides the details.

Functional Tests

The analyzer has a built-in calibration signal source with an amplitude of approximately -20 dBm and frequency of 100 MHz. Using this source, perform this quick functional check to verify that your instrument is operating correctly.

| | |
|---------------------------|--|
| Equipment Required | None |
| Prerequisites | Power on the analyzer and allow a 20 minute warm-up before doing this procedure. |

1. *Initialize the analyzer:*
 - a. Press the **SYSTEM** key on the front panel.
 - b. Press the **Reset All to Factory Defaults** side key.
2. *Check the system version and options:*
 - a. Press the **SYSTEM** key on the front panel.
 - b. Press the **Versions and Installed Options...** side key.
 - c. Check the version in the “Main System” field and the options in the option table.
3. *Check the display brightness:*
 - a. Press the **Cancel-Back** (top) side key.
 - b. Press the **Display Brightness** side key.
 - c. Change the value from 0 to 100% using the general purpose knob to check that the brightness changes normally.
4. *Display spectrum of the calibration signal:*
 - a. Press **S/A** → **Spectrum Analyzer**.
 - b. Press the **PRESET** key on the front panel to reset the analyzer.
 - c. Press **INPUT** → **Signal Input Port...** → **Cal100M**.
The spectrum of the calibration signal appears.
 - d. Check that “INPUT: CAL” and “FREE RUN” are displayed in the status indicator at the upper right of the screen (see Figure 1-1).

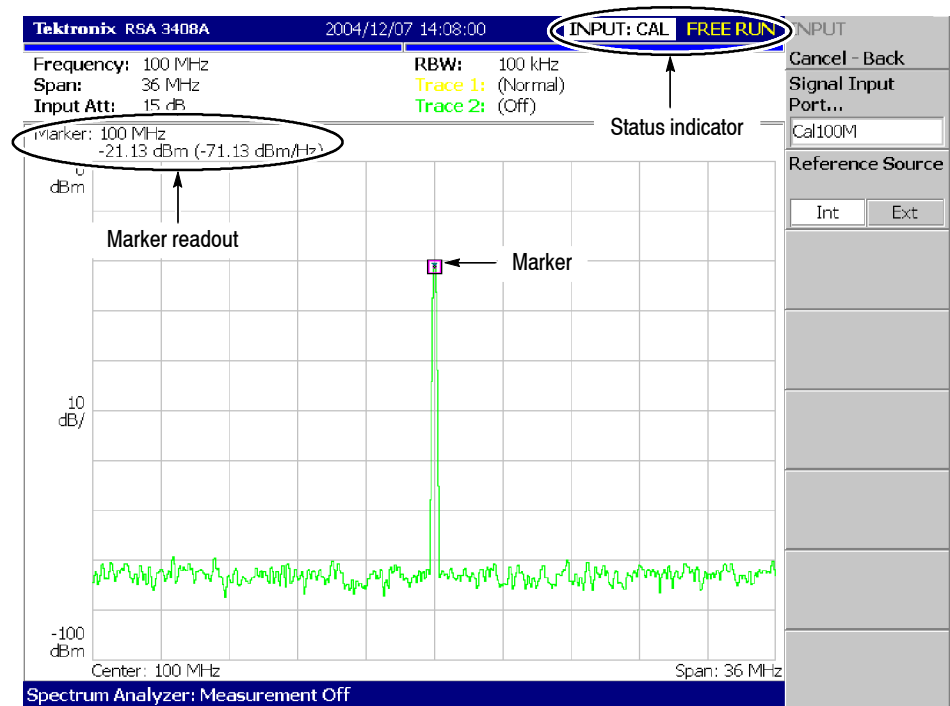


Figure 1-1: Spectrum of the calibration signal (100 MHz, -20 dBm)

5. Check the center frequency and peak amplitude using the marker:
 - a. Press the **PEAK** key on the front panel to place the marker on the peak (see Figure 1-1).
 - b. Check the marker readouts on screen. The frequency should be 100 MHz and the amplitude should be approximately -20 dBm.
 - c. Press **MARKER SETUP** → **Markers** → **Off**. Check that the marker disappears.
6. Check the RBW (Resolution Bandwidth) while changing the span setting.
 - a. Press the **SPAN** key on the front panel.
 - b. Confirm that the span is 36 MHz and the RBW is 100 kHz in the setup display on the upper part of the screen (see Figure 1-2).

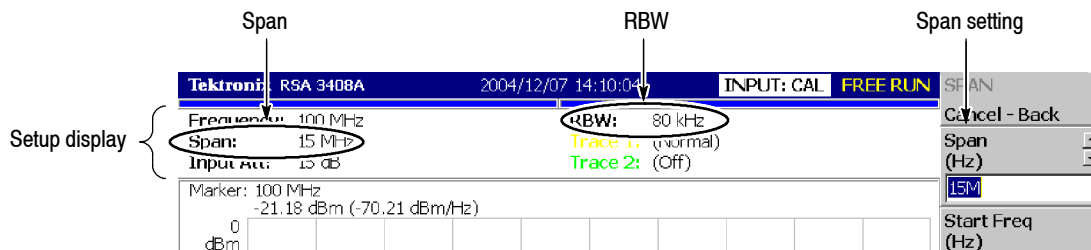


Figure 1-2: Setup display

- c. Using the general purpose knob, change the span setting as listed in Table 1-1 and check that the RBW is displayed correctly.

Table 1-1: Span and RBW

| Span | RBW |
|---------|---------|
| 36 MHz | 100 kHz |
| 15 MHz | 80 kHz |
| 5 MHz | 20 kHz |
| 100 kHz | 500 Hz |
| 1 kHz | 20 Hz |

- d. Using the numeric keypad, set the span back to 36 MHz. (Press **3** → **6** → **MHz**, in that order, on the keypad.)
- 7. Check the reference level:**
- a. Press the **AMPLITUDE** key on the front panel.
 - b. Make sure that the reference level is set to 0 dBm with the **Ref Level** side key. Check that 0 dBm is displayed on the upper left side of the graticule (see Figure 1-3).
 - c. Use the general purpose knob to set the reference level to -30 dBm.
 - d. Confirm that A/D OVERFLOW is indicated in the red box at the top center of the screen. Make sure that -30 dBm is displayed on the upper left side of the graticule and that the spectrum waveform is distorted as shown in Figure 1-3.
 - e. Using the numeric keypad, set the reference level back to 0 dBm. (Press **0** → **ENTER**, in that order, on the keypad.)

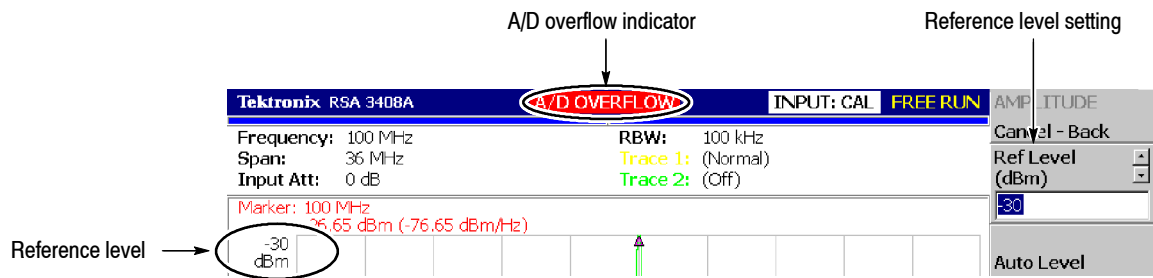


Figure 1-3: Reference level setting and A/D overflow indicator

8. Check the spectrogram display:

- a. Press **S/A** → **S/A with Spectrogram**. Check that the spectrogram is displayed on the lower side of the screen (see Figure 1-4).

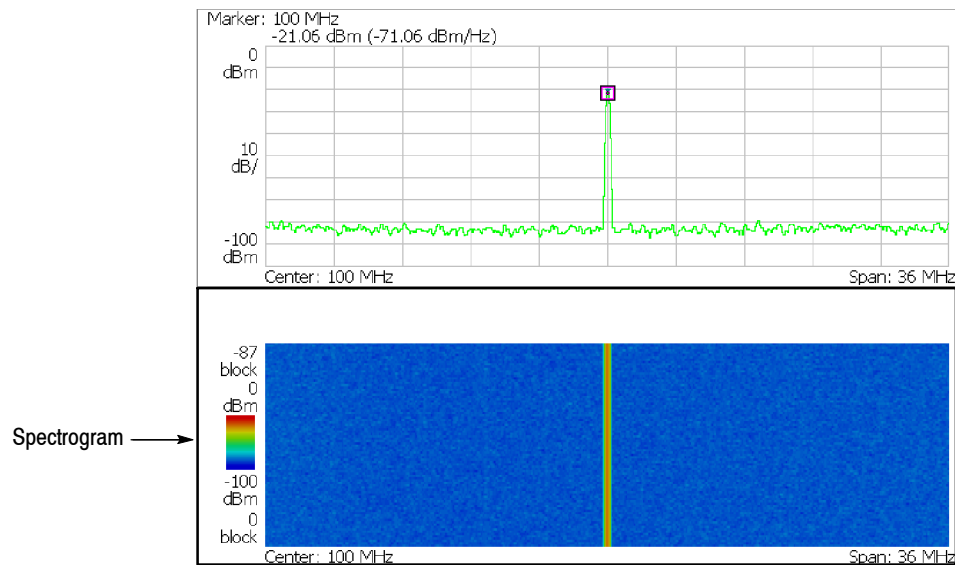


Figure 1-4: Spectrogram display

- b. Press the **RUN/STOP** key on the front panel to stop data acquisition. Confirm that the trace display freezes and **PAUSE** is displayed in the status indicator at the top right of the screen.

Diagnostics

You can run the internal diagnostic program to check hardware states. Table 1-2 shows the test items and their descriptions.

Table 1-2: Internal diagnostic program

| Menu item | Description | Possible failure |
|-------------|---|------------------|
| Temp Sensor | Checks that the temperature sensor works correctly. | RF5 module |
| Data Memory | Checks that the acquisition memory works correctly. | A40 board |

| | |
|---------------------------|--|
| Equipment Required | None |
| Prerequisites | Power on the analyzer and allow a 20 minute warm-up before doing this procedure. |

1. Press **CAL** → **Service...** → **Password**.
2. Enter **270833** and then press the **ENTER** key using the numeric keypad.
3. Press the **DIAG** side key.
4. Select the diagnostic menu item to be executed.
You can press the **All** side key to run all the tests.
5. Check the result shown in the lower left view (“Pass” or “Fail”).

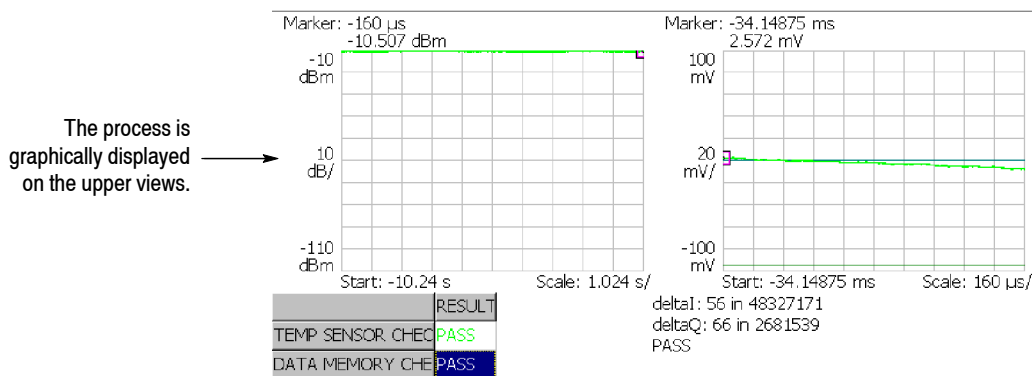


Figure 1-5: Diagnostic screen

Performance Tests

This section contains procedures for checking that the RSA3408A 8 GHz Real-Time Spectrum Analyzer performs as warranted.

The procedures are arranged in four logical groupings:

- Frequency Checks
- Noise Sideband Checks
- Amplitude Checks
- Spurious Response Checks

They check all the characteristics that are designated as checked in Chapter 2, Specification. (The characteristics that are checked appear with the ✓ symbol in the *Characteristics* column in Chapter 2.) You can use the form at the end of this section as a test record.

Read *Performance Verification Procedures* on pages 1-1 and 1-2. Also, if you are not familiar with operating this analyzer, read the *RSA3408A User Manual* before doing any of these procedures.

STOP. *These procedures extend the confidence level provided by the basic procedures described on page 1-3. Perform the basic procedures first and then perform the following procedures if desired.*

Prerequisites

The tests in this section make up an extensive, valid confirmation of performance and functionality when the following requirements are met:

- The cabinet must be installed on the analyzer.
- The instrument must have passed the procedures under *Brief Procedures* found on page 1-3.
- A signal-path compensation must have been done within the recommended calibration interval and at a temperature within ± 3 °C of the present operating temperature. (If at the time you did the prerequisite *Brief Procedures*, the temperature was within the limits just stated, consider this prerequisite met.)
- The analyzer must have been last adjusted at an ambient temperature between +20 °C and +30 °C, must have been operating for a warm-up period of at least 20 minutes, and must be operating at an ambient temperature of between +10 °C and +40 °C.

Equipment Required

These procedures use external, traceable signal sources to directly check warranted characteristics. Table 1-3 shows the required equipment.

Table 1-3: Test equipment

| Item number and description | Minimum requirements | Example | Purpose |
|----------------------------------|---|--|--|
| 1. Signal generator | Frequency range : 10 kHz to 3.5 GHz; Variable amplitude from -70 dBm to +13 dBm into 50 Ω ; Accuracy: ± 1 dB; Function: FM | Agilent 8648D | Checking baseband and RF flatness |
| 2. Signal generator | Frequency range: 10 MHz to 8 GHz; Output level: -30 dBm to +10 dBm; Accuracy: ± 1 dB | Agilent E8257D | Checking RF flatness |
| 3. Signal generator | Frequency: 2 GHz; Output: ≥ -10 dBm; Digital modulation: QPSK; Symbol rate: 4.096 M/s | Rohde & Schwartz SMIQ03B Agilent E4438C | Checking intermodulation distortion |
| 4. Spectrum analyzer | Frequency: >8 GHz; Display scale fidelity: ± 0.13 dB | Agilent E4440A | Checking level linearity |
| 5. Frequency counter | Frequency range: 10 MHz; Aging rate: $< 5 \times 10^{-10}$ /day; Accuracy: <0.01 ppm at 10 MHz | Agilent 53132A option 010 | Checking the reference output frequency accuracy |
| 6. RF power meter | 1 MHz to 8 GHz | Agilent E4418B | Adjusting the signal generator output level |
| 7. RF power sensor | 10 MHz to 8 GHz; RF Flatness: <3 %; Uncertainty of calibration factor data: <2 % (RSS) | Agilent E4412A | Adjusting the signal generator output level |
| 8. Power combiner | Range: 500 MHz to 2 GHz; Isolation: >18 dB; Insertion loss: <1.0 dB | Mini-Circuits ZAPD-21 | Checking intermodulation distortion |
| 9. BNC cable | 50 Ω , 36 in, male to male BNC connectors | Tektronix part number 012-1341-00 | Signal interconnection |
| 10. N-N cable | 50 Ω , 36 in, male to male N connectors | | Signal interconnection |
| 11. N-SMA cable (Three required) | 50 Ω , 36 in, male N to male SMA connectors | | Signal interconnection |
| 12. Terminator | Impedance: 50 Ω ; connectors: female BNC input, male BNC output | Tektronix part number 011-0049-01 | Signal termination for checking frequency accuracy |

Frequency Checks

These procedures check the frequency-related characteristics and are listed as checked in Chapter 2, *Specifications*, Table 2-1 on page 2-2.

Check Frequency Readout Accuracy

| | |
|---------------------------|--|
| Equipment Required | One signal generator (Item 2) One 50 Ω N-N coaxial cable (Item 10) |
| Prerequisites | Refer to page 1-10. |

1. *Prepare for the test:*

a. *Initialize the analyzer:*

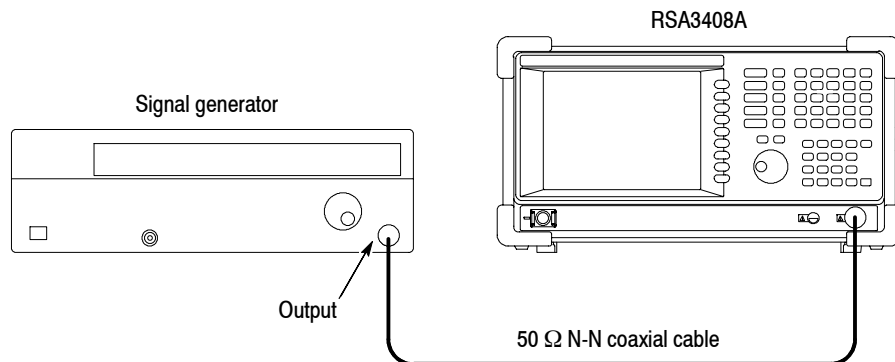
- Press the **SYSTEM** key on the front panel.
- Press the **Reset All to Factory Defaults** side key.

b. *Set the generator controls:*

Frequency 10 MHz
Level -10 dBm

c. *Hook up the signal generator:*

Connect the generator output through a 50 Ω N-N coaxial cable to the analyzer **INPUT**. See the following figure.



2. *Check frequency accuracy in the baseband:*

a. *Modify the analyzer default settings:*

- Press the **FREQUENCY/CHANNEL** key on the front panel.
- With the **Center Freq** side key, set the frequency to 10 MHz using the numeric keypad.
- Press the **SPAN** key on the front panel.
- With the **Span** side key, set the span to 1 MHz using the general purpose knob.

b. *Measure peak frequency:*

- Press the **PEAK** key to place the marker on the peak signal.
- Read the marker readout. Confirm that the value is 10 MHz \pm 1 kHz.

3. *Check frequency accuracy in the RF1 band:*

a. *Modify the generator control:*

Frequency 2 GHz

b. *Modify the analyzer controls:*

- Press the **FREQUENCY/CHANNEL** key on the front panel.
- With the **Center Freq** side key, set the frequency to 2 GHz using the numeric keypad.

c. *Measure peak frequency:*

- Press the **PEAK** key to place the marker on the peak signal.
- Read the marker readout. Confirm that the value is 2 GHz \pm 1.4 kHz.

4. *Check frequency accuracy in the RF2 band:*

a. *Modify the generator control:*

Frequency 5 GHz

b. *Modify the analyzer controls:*

- Press the **FREQUENCY/CHANNEL** key on the front panel.
- With the **Center Freq** side key, set the frequency to 5 GHz using the numeric keypad.

c. *Measure peak frequency:*

- Press the **PEAK** key to place the marker on the peak signal.
- Read the marker readout. Confirm that the value is 5 GHz \pm 2.0 kHz.

5. *Check frequency accuracy in the RF3 band:*

a. *Modify the generator control:*

Frequency 7 GHz

b. *Modify the analyzer controls:*

- Press the **FREQUENCY/CHANNEL** key on the front panel.
- With the **Center Freq** side key, set the frequency to 7 GHz using the numeric keypad.

c. *Measure peak frequency:*

- Press the **PEAK** key to place the marker on the peak signal.
- Read the marker readout. Confirm that the value is 7 GHz \pm 2.4 kHz.

6. *Disconnect the test equipment:*

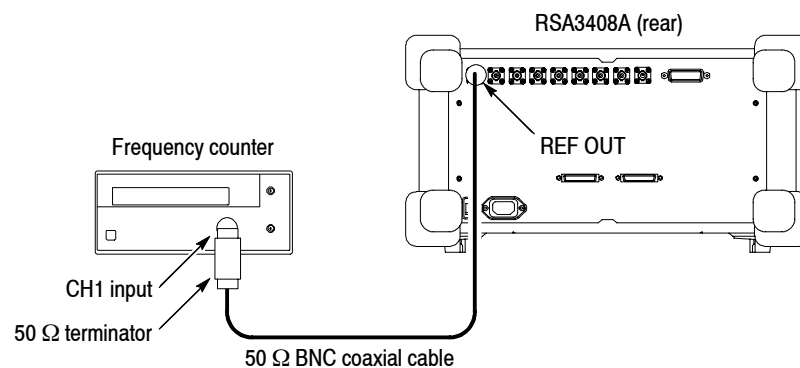
Disconnect the cable at the analyzer input.

Check 10 MHz Reference Output Accuracy

| | |
|---------------------------|--|
| Equipment Required | One frequency counter (Item 5) One 50 Ω BNC coaxial cable (Item 9) One 50 Ω terminator (Item 12) |
| Prerequisites | Refer to page 1-10. The frequency counter must have been operating for a warm-up period of at least 24 hours. |

1. Prepare for the test:**a. Hook up the frequency counter:**

Connect **REF OUT** on the rear panel of the analyzer through a 50 Ω precision coaxial cable and a 50 Ω precision terminator to Channel 1 of the counter. See the following figure.

**b. Set the counter controls:**

Function Frequency 1
Gate time 2 s

2. Check the frequency:

Check that the frequency counter reads 10 MHz \pm 2.0 Hz.

3. Disconnect the hookup:

Disconnect the cable at **REF OUT**.

Noise Sideband Checks

These procedures check the noise sideband-related characteristics and are listed as checked in Chapter 2, *Specifications*, Table 2-2 on page 2-3.

Check Noise Sideband

| | |
|---------------------------|--|
| Equipment Required | One signal generator (Item 3) One 50 Ω N-N coaxial cable (Item 10) |
| Prerequisites | Refer to page 1-10. |

1. Prepare for the test:

a. Initialize the analyzer:

- Press the **SYSTEM** key on the front panel.
- Press the **Reset All to Factory Defaults** side key.

b. Modify the default settings:

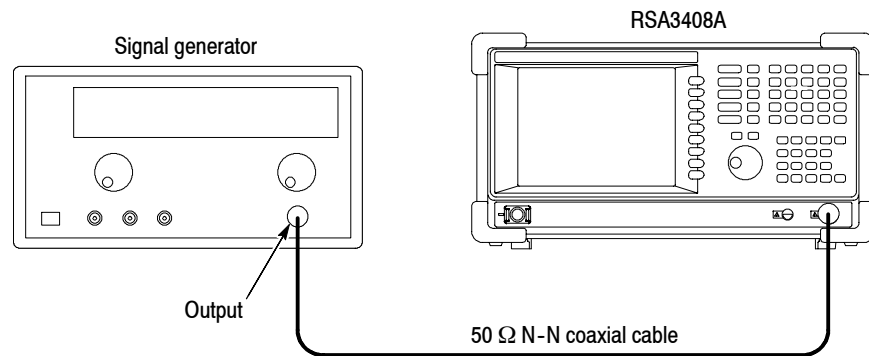
- Press the **FREQUENCY/CHANNEL** key on the front panel.
- The **Center Freq** menu item is selected by default.
Set the frequency to 1 GHz using the numeric key pad.
- Press the **AMPLITUDE** key on the front panel.
- Press the **RF Atten/Mixer** side key to select **Mixer**.
- With the **Mixer Level** side key, set the level to -10 dBm.
- Press **TRACE/AVG** → **Trace 1 Type...** → **Average**.
- Press the **Number Of Averages** side key and set the value to 50 using the general purpose knob.

c. Set the generator controls:

Frequency 1000 MHz
 Amplitude 0 dBm
 RF output On

d. Hook up the signal generator:

Connect the generator output through a 50 Ω N-N coaxial cable to the analyzer **INPUT**. See the following figure.



2. Check phase noise for a span of 50 kHz:

a. Modify the analyzer controls:

- Press the **SPAN** key on the front panel.
- With the **Span** side key, set the span to 50 kHz using the general purpose knob or the numeric keypad.

b. Perform the C/N measurement:

- Press **MEASURE** → **C/N** → **MEAS SETUP**.
- Press the **Offset Frequency** side key and set the value to 10 kHz using the general purpose knob.
- Press the **Carrier Bandwidth** side key and set the value to 5 kHz using the general purpose knob.
- Press the **Noise Bandwidth** side key and set the value to 1 kHz using the general purpose knob.

c. Check against limits:

Read the phase noise (C/No) at the bottom of the screen.
Confirm that the value is 110 dB/Hz or more.

3. *Check phase noise for a span of 500 kHz:*
 - a. *Modify the analyzer controls:*
 - Press the **SPAN** key on the front panel.
 - With the **Span** side key, set the span to 500 kHz using the general purpose knob or the numeric keypad.
 - b. *Perform the C/N measurement:*
 - Select **MEASURE** → **C/N** → **MEAS SETUP**.
 - Press the **Offset Frequency** side key and set the value to 100 kHz using the general purpose knob.
 - Press the **Carrier Bandwidth** side key and set the value to 50 kHz using the general purpose knob.
 - Press the **Noise Bandwidth** side key and set the value to 10 kHz using the general purpose knob.
 - c. *Check against limits:*

Read the phase noise (C/No) at the bottom of the screen.
Confirm that the value is 112 dB/Hz or more.
4. *Check phase noise for a span of 5 MHz:*
 - a. *Modify the analyzer controls:*
 - Press the **SPAN** key on the front panel.
 - With the **Span** side key, set the span to 5 MHz using the general purpose knob or the numeric keypad.
 - b. *Perform the C/N measurement:*
 - Select **MEASURE** → **C/N** → **MEAS SETUP**.
 - Press the **Offset Frequency** side key and set the value to 1 MHz using the general purpose knob.
 - Press the **Carrier Bandwidth** side key and set the value to 300 kHz using the general purpose knob.
 - Press the **Noise Bandwidth** side key and set the value to 100 kHz using the general purpose knob.
 - c. *Check against limits:*

Read the phase noise (C/No) at the bottom of the screen.
Confirm the value is 132 dB/Hz or more.
5. *Disconnect the test equipment:* Disconnect the cable at the analyzer input.

Amplitude Checks

These procedures check the amplitude-related characteristics and are listed as checked in Chapter 2, *Specifications*, Table 2-4 on page 2-5.

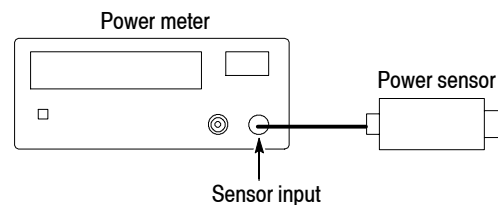
Check Absolute Amplitude Accuracy

| | |
|---------------------------|--|
| Equipment Required | One signal generator (Item 1) One power meter (Item 6) One power sensor (Item 7) One 50 Ω N-N coaxial cables (Item 10) |
| Prerequisites | Refer to page 1-10. |

1. Set up the power meter and sensor:

NOTE. Store the power sensor correction factors in the power meter, if you have not yet done so.

- a. Connect the power meter and the power sensor. See the following figure.



- b. Warm up the power meter and sensor for more than 20 minutes.
- c. Press **ZERO** on the power meter.
- d. Connect the RF input of the power sensor to the power reference output of the power meter. See Figure 1-6 on page 1-20.
- e. Turn on **POWER REF** and execute the calibration.
- f. Disconnect the RF input of the power sensor from the reference output of the power meter.

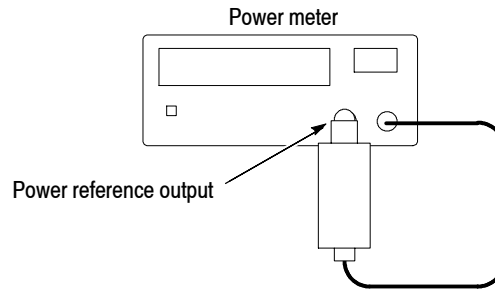


Figure 1-6: Hookup for calibrating the power sensor

Baseband.

2. Set the signal generator output:

a. Hook up the instruments:

Connect the signal generator (Item 1) output through a 50 Ω N-N coaxial cable to the power sensor input. See Figure 1-7.

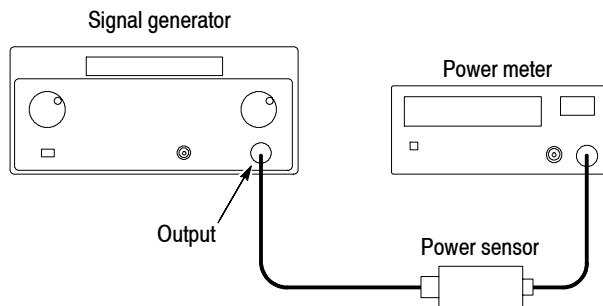


Figure 1-7: Hookup for setting the signal generator output

b. Set the signal generator controls:

Frequency 25 MHz
 Level -10 dBm

c. Set the power meter control:

Frequency 10 MHz

d. Adjust the output level of the signal generator so that the power meter reads -10 dBm ± 0.05 dBm.

e. Disconnect the cable from the power sensor input.

3. *Prepare for the test:*

a. *Hook up the instruments:*

Connect the signal generator output through a 50 Ω N-N coaxial cable to the RSA3408A **INPUT**. See Figure 1-8.

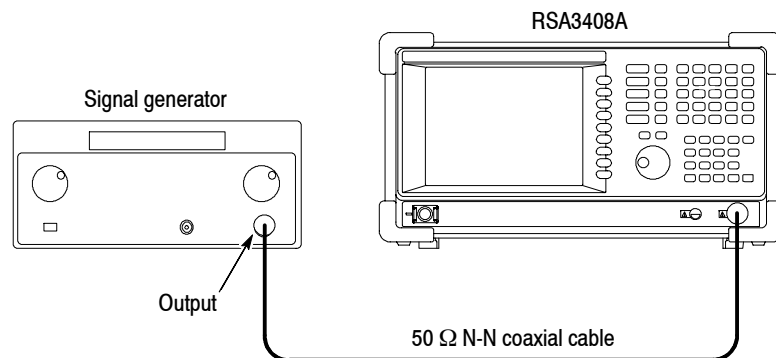


Figure 1-8: Hookup for checking the absolute amplitude accuracy

b. *Initialize the analyzer:*

- Press the **SYSTEM** key on the front panel.
- Press the **Reset All to Factory Defaults** side key.

c. *Modify the default settings:*

- Press the **FREQUENCY/CHANNEL** key on the front panel.
- With the **Center Freq** side key, set the frequency to 25 MHz using the numeric keypad.
- Press the **SPAN** key on the front panel.
- With the **Span** side key, set the span to 10 MHz using the general purpose knob.

d. *Calibrate the analyzer gain:*

- Press **CAL** → **Calibrate Gain**.
- Press **Amplitude** → **Auto Level**.

4. *Check the amplitude:*
 - a. Press the **PEAK** key on the front panel to place the marker on the peak.
 - b. Check that the marker readout is within $-10 \text{ dBm} \pm 0.3 \text{ dB}$.
5. *Disconnect the hookup:*

Disconnect the cable at the analyzer input.

RF.

6. *Modify the signal generator output:*
 - a. *Hook up the test equipment:*

Connect the signal generator output through a 50Ω N-N coaxial cable to the power sensor input. See Figure 1-7 on page 1-20.
 - b. *Modify the signal generator controls:*

| | |
|-----------------|---------|
| Frequency | 100 MHz |
| Level | -20 dBm |
 - c. *Modify the power meter control:*

| | |
|-----------------|---------|
| Frequency | 100 MHz |
|-----------------|---------|
 - d. Adjust the output level of the signal generator so that the power meter reads $-20 \text{ dBm} \pm 0.05 \text{ dBm}$.
 - e. Disconnect the cable from the power sensor input.
7. *Modify the test hookup and preset the instrument controls:*
 - a. *Hook up the instruments:*

Connect the signal generator output through a 50Ω N-N coaxial cable to the RSA3408A **INPUT**. See Figure 1-8 on page 1-21.
 - b. *Modify the analyzer controls:*
 - Press the **FREQUENCY/CHANNEL** key on the front panel.
 - With the **Center Freq** side key, set the frequency to 100 MHz using the numeric keypad.
 - Press the **AMPLITUDE** key on the front panel.
 - Press the **RF Atten/Mixer** side key to select **RF Att**.
 - With the **RF Att** side key, set the attenuation to 0 dB.

- c. *Calibrate the analyzer gain:*
 - Press **CAL** → **Calibrate Gain**.
 - Press **Amplitude** → **Auto Level**.
- 8. *Check the amplitude:*
 - a. Press the **PEAK** key on the front panel to place the marker on the peak.
 - b. Check that the marker readout is within $-20\text{ dBm} \pm 0.5\text{ dB}$.
- 9. *Disconnect the test equipment:*
Disconnect the cable at the analyzer input.

**Check Input Attenuator
Setting Uncertainty**

| | |
|---------------------------|--|
| Equipment Required | One signal generator (Item 1) One 50 Ω N-N coaxial cables (Item 10) |
| Prerequisites | Refer to page 1-10. |

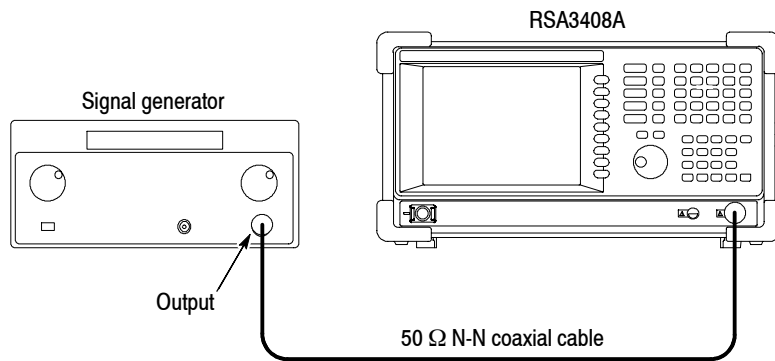
1. Prepare for the test:

a. Set the generator controls:

Frequency 100 MHz
 Amplitude -25 dBm
 RF output On

b. Hook up the generator:

Connect the generator output through a 50 Ω N-N coaxial cable to the analyzer **INPUT**. See the following figure.



c. Initialize the analyzer:

- Press the **SYSTEM** key on the front panel.
- Press the **Reset All to Factory Defaults** side key.

- d. *Modify the default settings:*
 - Press the **FREQUENCY/CHANNEL** key on the front panel.
 - With the **Center Freq** side key, set the frequency to 100 MHz using the numeric keypad.
 - Press the **SPAN** key on the front panel.
 - With the **Span** side key, set the span to 10 MHz using the general purpose knob.
 - Press the **AMPLITUDE** key on the front panel.
 - With the **Ref Level** side key, set the reference level to -20 dBm using the general purpose knob.
 - Press the **RF Atten/Mixer** side key to select **RF Att**.
 - With the **RF Att** side key, set the attenuation to 0 dB using the numeric keypad or the general purpose knob.
2. *Measure the reference amplitude at 0 dB attenuation:*
 - a. Press the **PEAK** key on the front panel to place the marker on the peak.
 - b. Record the peak amplitude at the marker readout as the reference value. (Let the value be P_0 .)
3. *Check the amplitude for the attenuation from 5 to 30 dB:*
 - a. Press the **RF Att** side key and set the attenuation (initially 5 dB).
 - b. Press the **PEAK** key on the front panel to place the marker on the peak.
 - c. Record the peak amplitude at the marker readout. (Let the value be P_X .)
 - d. Check that the error ($P_X - P_0$) is within ± 0.5 dB.
 - e. Repeat substeps a through d for attenuation from 5 to 30 dB in 5 dB steps.
4. *Modify the generator controls:*

Amplitude -5 dBm

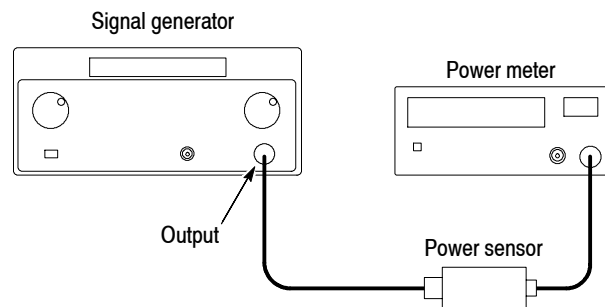
5. *Modify the analyzer controls:*
 - a. Press the **AMPLITUDE** key on the front panel.
 - b. With the **Ref Level** side key, set the reference level to 0 dBm using the general purpose knob.
 - c. Make sure that RF Att is set to 30 dB.
6. *Measure the reference amplitude at 30 dB attenuation:*
 - a. Press the **PEAK** key on the front panel to place the marker on the peak.
 - b. Record the peak amplitude at the marker readout as the reference value. (Let the value be P_1 .)
7. *Check the amplitude for attenuation from 35 to 55 dB:*
 - a. Press the **RF Att** side key and set the attenuation (initially 35 dB).
 - b. Press the **PEAK** key on the front panel to place the marker on the peak.
 - c. Record the peak amplitude at the marker readout. (Let the value be P_X .)
 - d. Check that the error ($P_X - P_1$) is within ± 0.2 dB.
 - e. Repeat substeps a through d for attenuation from 35 to 55 dB in 5 dB steps.
8. *Disconnect the test equipment:*

Disconnect the cable at the analyzer input.

Check Level Linearity

| | |
|---------------------------|---|
| Equipment Required | One signal generator (Item 2) One spectrum analyzer (Item 4) One power meter (Item 6) One power sensor (Item 7) One 50 Ω N-N coaxial cable (Item 10) |
| Prerequisites | Refer to page 1-10. |

1. *Set up the power meter and sensor:*
Do step 1 on page 1-19 to set up the power meter and sensor.
2. *Set the signal generator output:*
 - a. *Hook up the instruments:*
Connect the signal generator (Item 1) output through a 50 Ω N-N coaxial cable to the power sensor input. See the following figure.



- b. *Set the signal generator controls:*

Frequency 100 MHz
 Level +10 dBm

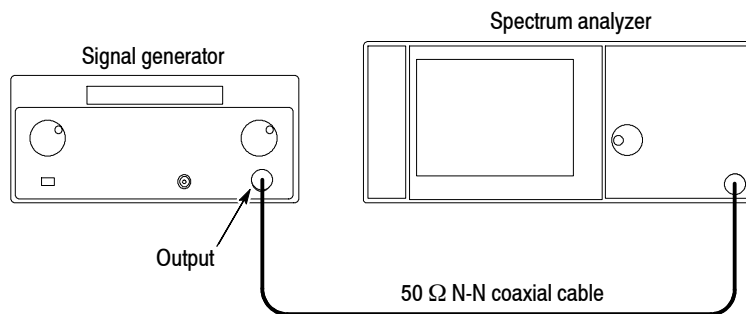
3. Determine the reference power in 0 to -30 dBm:

- a. Measure the power and record it as Pr0.
- b. Set the signal generator amplitude to 0 to -30 dBm in 10 dB steps and measure the power as Pr1 to 4, respectively.

| Signal generator amplitude | Reference power |
|----------------------------|-----------------|
| +10 dBm | Pr0 |
| 0 dBm | Pr1 |
| -10 dBm | Pr2 |
| -20 dBm | Pr3 |
| -30 dBm | Pr4 |

4. Modify the hookup:

- a. Connect the generator output through a 50 Ω N-N coaxial cable to the spectrum analyzer (Item 4) input. See the following figure.



- b. Set the signal generator control:

Amplitude -30 dBm

- c. Set the spectrum analyzer controls:

Measurement mode SA mode
 Reference level -20 dBm
 Center frequency 100 MHz
 Span 1 MHz
 RF attenuation 10 dB
 RBW Auto

5. Set the reference offset:

a. Set the spectrum analyzer control:

Average 10

b. Measure the peak power Ppr using the maker peak.

c. Modify the spectrum analyzer control:

Reference offset Pr4 - Ppr

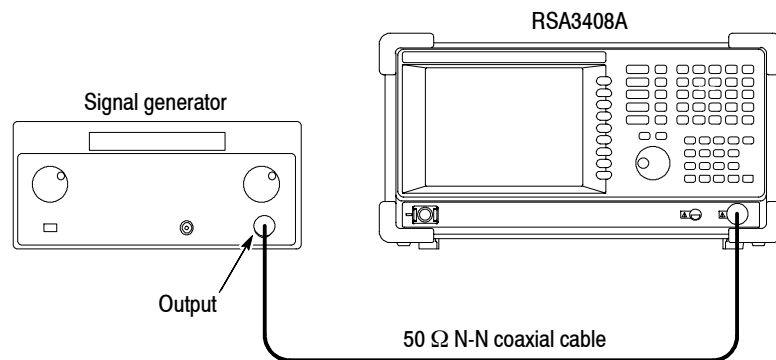
6. Determine the reference power in -40 to -50 dBm:

Set the signal generator amplitude to -40 and -50 dBm to measure the power as Pr5 and 6, respectively.

| Signal generator amplitude | Reference power |
|----------------------------|-----------------|
| -40 dBm | Pr5 |
| -50 dBm | Pr6 |

7. Modify the hookup:

a. Connect the signal generator output to the RSA3408A analyzer input. See the following figure.



b. Set the signal generator control:

Amplitude +10 dBm

c. Modify the RSA3408A analyzer controls:

Center frequency 100 MHz
 Span 5 MHz
 Reference level 10 dBm
 RF attenuation 20dB

8. Measure the power:

- a. Measure the power and record it as Pm0.
- b. Set the signal generator amplitude to 0 to -50 dBm in 10 dB steps to measure the power as Pm1 to 6.
- c. Get the level linearity Pfx (x = 1 to 6) as:

$$Pfx = (Pmx - Pm0) - (Prx - Pr0)$$

Table 1-4: Level linearity test result

| Signal generator amplitude | Reference power | Measured power | Level linearity |
|----------------------------|-----------------|----------------|---------------------------------|
| +10 dBm | Pr0 | Pm0 | - |
| 0 dBm | Pr1 | Pm1 | Pf1 = (Pm1 - Pm0) - (Pr1 - Pr0) |
| -10 dBm | Pr2 | Pm2 | Pf2 = (Pm2 - Pm0) - (Pr2 - Pr0) |
| -20 dBm | Pr3 | Pm3 | Pf3 = (Pm3 - Pm0) - (Pr3 - Pr0) |
| -30 dBm | Pr4 | Pm4 | Pf4 = (Pm4 - Pm0) - (Pr4 - Pr0) |
| -40 dBm | Pr5 | Pm5 | Pf5 = (Pm5 - Pm0) - (Pr5 - Pr0) |
| -50 dBm | Pr6 | Pm6 | Pf6 = (Pm6 - Pm0) - (Pr6 - Pr0) |

9. Disconnect the test equipment:

Disconnect the cable at the analyzer input.

Spurious Response Checks

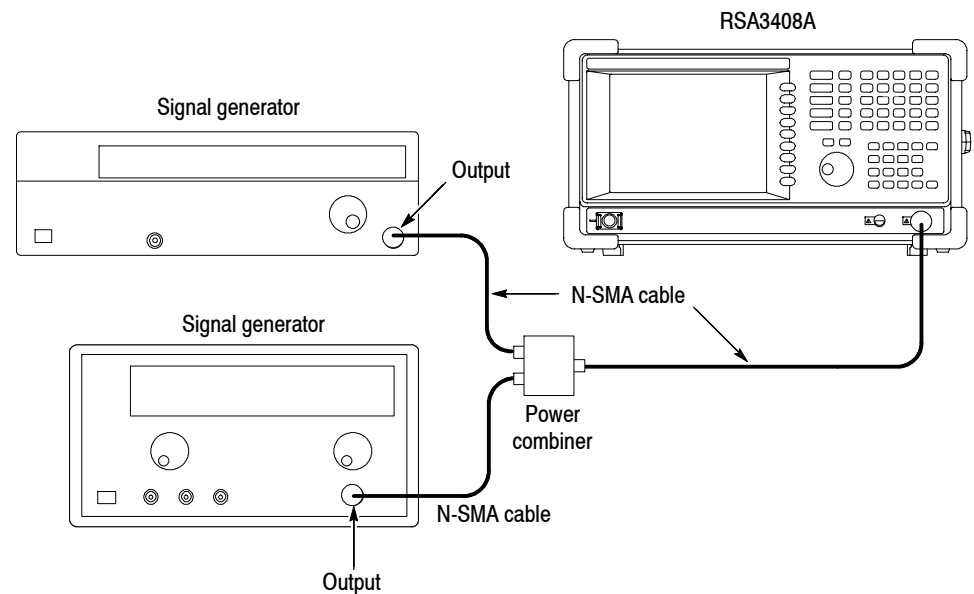
These procedures check the spurious-related characteristics and are listed as checked in Chapter 2, *Specifications*, Table 2-5 on page 2-6.

Check 3rd Order Intermodulation Distortion

| | |
|---------------------------|--|
| Equipment Required | Two signal generators (Items 2 and 3) One power combiner (Item 8) Three 50 Ω N-SMA coaxial cables (Item 11) |
| Prerequisites | Refer to page 1-10. |

1. Prepare for the test:

- a. Connect each generator output through a 50 Ω N-SMA coaxial cable to each power combiner input. See the following figure.



- b. Connect the power combiner output through a 50 Ω N-SMA coaxial cable to the analyzer **INPUT**.

c. *Set the signal generator (Item 2) controls:*

Frequency 1999.85 MHz
Level 0 dBm
ALC BW 100 Hz

d. *Set the signal generator (Item 3) controls:*

Frequency 2000.15 MHz
Level 0 dBm
ALC BW 100 Hz

e. *Initialize the analyzer:*

- Press the **SYSTEM** key on the front panel.
- Press the **Reset All to Factory Defaults** side key.

f. *Modify the default controls:*

- Press the **FREQUENCY/CHANNEL** key on the front panel.
- With the **Center Freq** side key, set the frequency to 2 GHz using the numeric keypad.
- Press the **SPAN** key on the front panel.
- With the **Span** side key, set the span to 1 MHz using the general purpose knob.
- Press the **AMPLITUDE** key on the front panel.
- With the **Ref Level** side, and set the level to 5 dBm using the general purpose knob.
- Press the **RF Atten/Mixer** side key to select **Rf Att**.
- With the **RF Att** side key, set the attenuation to 15 dB using the general purpose knob.
- Press the **RBW/FFT** key on the front panel.
- Press the **RBW/FFT** side key to select **Man**.
- Press the **Extended Resolution** side key to select **On**.
- Press the **RBW** side key, set the RBW to 2 kHz.

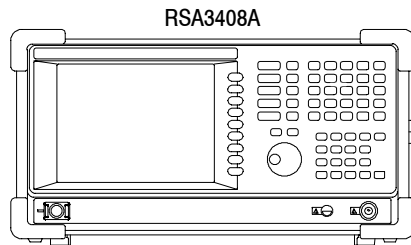
-
- g.** *Modify the generator output level:*
- Press **MARKERS**: ◀ or ▶ to place the marker on the signal of 1999.85 MHz.
 - Adjust the generator (Item 2) output level so that the signal level is -10 dBm.
 - Press **MARKERS**: ◀ or ▶ to place the marker on the signal of 2000.15 MHz.
 - Adjust the generator (Item 3) output level so that the signal level is -10 dBm.
- 2.** *Check the amplitude:*
- a.** *Modify the analyzer controls:*
- Press **TRACE/AVG** → **Trace 1 Type...** → **Average**.
 - Press the **Number Of Averages** side key and set the value to 50 using the general purpose knob.
 - Press the **MARKER SETUP** key.
 - Press the **Markers** side key to select **Delta**.
- b.** *Measure the amplitude for the signals of 1999.55 MHz and 2000.45 MHz:*
- Press the **Select Marker** side key to select **1**.
 - Place the first marker at the signal of 1999.55 MHz using the **MARKERS**: ◀ or ▶ key.
 - Press the **Select Marker** side key to select **2**.
 - Place the second marker at the signal of 2000.45 MHz using the **MARKERS**: ◀ or ▶ key.
- c.** *Check against limits:*
Read the first and the second marker readouts. Confirm that the larger value meets the requirement of -78 dBc.
- 3.** *Disconnect the test equipment:*
Disconnect the cable at the analyzer input.

Check Displayed Average Noise Level

| | |
|---------------------------|---------------------|
| Equipment Required | None |
| Prerequisites | Refer to page 1-10. |

1. Prepare for the test:**a. Initialize the analyzer:**

- Press the **SYSTEM** key on the front panel.
- Press the **Reset All to Factory Defaults** side key.

**b. Modify the analyzer controls:**

- Press the **FREQUENCY/CHANNEL** key on the front panel.
- With the **Center Freq** side key, set the frequency to 10 MHz using the general purpose knob.
- Press the **SPAN** key on the front panel.
- With the **Span** side key, set the span to 1 MHz using the general purpose knob.
- Press the **AMPLITUDE** key on the front panel.
- With the **Ref Level** side key, set the level to -30 dBm using the general purpose knob.
- Press the **RBW/FFT** key on the front panel.
- Press the **RBW/FFT** side key to select **Man**.
- With the **RBW** side key, set the value to 10 kHz using the general purpose knob.

- Press **TRACE/AVG** → **Trace 1 Type...** → **Average**.
 - Press the **Number Of Averages** side key and set the value to 50.
 - Press **MEASURE** → **Channel Power** → **MEAS SETUP**.
 - Press the **Channel Bandwidth** side key and set the value to 1 MHz using the general purpose knob.
2. *Check noise in the baseband:*
Read the measurement result of Density at the bottom of the screen.
Check that the value is -151 dBm/Hz or less.
3. *Check noise at 2 GHz in the RF1 band:*
- a. *Modify the analyzer control:*
 - Press the **FREQUENCY/CHANNEL** key on the front panel.
 - With the **Center Freq** side key, set the frequency to 2 GHz using the general purpose knob.
 - Press the **AMPLITUDE** key on the front panel.
 - With the **Ref Level** side key, set the level to -50 dBm using the general purpose knob.
 - Press the **RF Atten/Mixer** side key to select **RF Att**.
 - With the **RF Att** side key, set the attenuation to 0 dB using the general purpose knob.
 - b. *Check against limits:*
Read the measurement result of Density at the bottom of the screen.
Check that the value is -150 dBm/Hz or less.
4. *Check noise at 3 GHz in the RF1 band:*
- a. *Modify the analyzer control:*
 - Press the **FREQUENCY/CHANNEL** key on the front panel.
 - With the **Center Freq** side key, set the frequency to 3 GHz using the general purpose knob.
 - b. *Check against limits:*
Read the measurement result of Density at the bottom of the screen.
Check that the value is -150 dBm/Hz or less.

5. *Check noise at 7 GHz in the RF3 band:*

a. *Modify the analyzer control:*

- Press the **FREQUENCY/CHANNEL** key on the front panel.
- With the **Center Freq** side key, set the frequency to 7 GHz using the general purpose knob.

b. *Check against limits:*

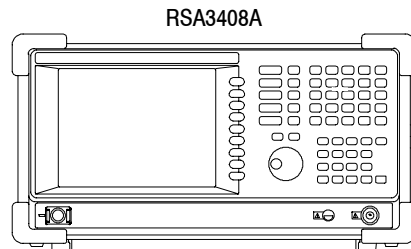
Read the measurement result of Density at the bottom of the screen.
Check that the value is -142 dBm/Hz or less.

Check Residual Response

| | |
|---------------------------|---------------------|
| Equipment Required | None |
| Prerequisites | Refer to page 1-10. |

1. Prepare for the test:**a. Initialize the analyzer:**

- Press the **SYSTEM** key on the front panel.
- Press the **Reset All to Factory Defaults** side key.

**b. Modify the default settings:**

- Press the **FREQUENCY/CHANNEL** key on the front panel.
- With the **Center Freq** side key, set the frequency to 20 MHz using the general purpose knob.
- Press the **SPAN** key on the front panel.
- With the **Span** side key, set the span to 40 MHz using the general purpose knob.
- Press the **AMPLITUDE** key on the front panel.
- With the **Ref Level** side key, set the level to -30 dBm using the general purpose knob.
- Press the **RBW/FFT** key on the front panel.
- Press the **RBW/FFT** side key to select **Man**.
- With the **RBW** side key, set the RBW to 100 kHz using the general purpose knob.
- Press **TRACE/AVG** → **Trace 1 Type...** → **Average**.
- Press the **Number Of Averages** side key and set the value to 50 using the general purpose knob.

2. *Check residual response in the baseband:*

a. *Measure residual response:*

- Press the **LINES** key on the front panel.
- Press the **Show Line** side key to select **Vertical**.
- Press the **Number Of Line** key to select **1**.
- With the **Line1** side key, set the value to 1 MHz using the numeric keypad.
- Press the **Show Line** side key to select **Horizontal**.
- Press the **Number Of Line** key to select **1**.
- With the **Line1** side key, set the value to -93 dBm using the numeric keypad.

b. *Check against limits:*

Confirm that the residual signal level is -93 dBm or less at 1 MHz or more.

3. *Check residual response in the RF1 band:*

a. *Modify the analyzer controls:*

- Press the **FREQUENCY/CHANNEL** key on the front panel.
- With the **Center Freq** side key, set the frequency to 2 GHz using the numeric keypad.
- Press the **SPAN** key on the front panel.
- With the **Span** side key, set the span to 3 GHz using the numeric keypad.

b. *Measure residual response:*

- Press the **LINES** key
- Press the **Show Line** side key to select **Horizontal**.
- Press the **Number Of Line** key to select **1**.
- Press the **Line1** side key and set the value to -90 dBm using the numeric keypad.

c. *Check against limits:*

Confirm that the residual signal level is -90 dBm or less.

4. *Check residual response in the RF2 band:*
 - a. *Modify the analyzer controls:*
 - Press the **FREQUENCY/CHANNEL** key on the front panel.
 - With the **Center Freq** side key, set the frequency to 5 GHz using the numeric keypad.
 - b. *Measure residual response:*

Press the **PEAK** key to place the marker at the peak on the noise floor.
 - c. *Check against limits:*

Read the marker readout. Confirm that the residual signal level is -85 dBm or less within the whole bandwidth.

5. *Check residual response in the RF3 band:*
 - a. *Modify the analyzer controls:*
 - Press the **FREQUENCY/CHANNEL** key on the front panel.
 - With the **Center Freq** side key, set the frequency to 6.5 GHz using the numeric keypad.
 - b. *Measure residual response:*

Press the **PEAK** key to place the marker at the peak on the noise floor.
 - c. *Check against limits:*

Read the marker readout. Confirm that the residual signal level is -85 dBm or less within the whole bandwidth.

Check Spurious Response

| | |
|---------------------------|--|
| Equipment Required | One signal generator (Item 2) One 50 Ω N-N coaxial cable (Item 10) |
| Prerequisites | Refer to page 1-10. |

1. Prepare for the test:

a. Initialize the analyzer:

- Press the **SYSTEM** key on the front panel.
- Press the **Reset All to Factory Defaults** side key.

b. Modify the default controls:

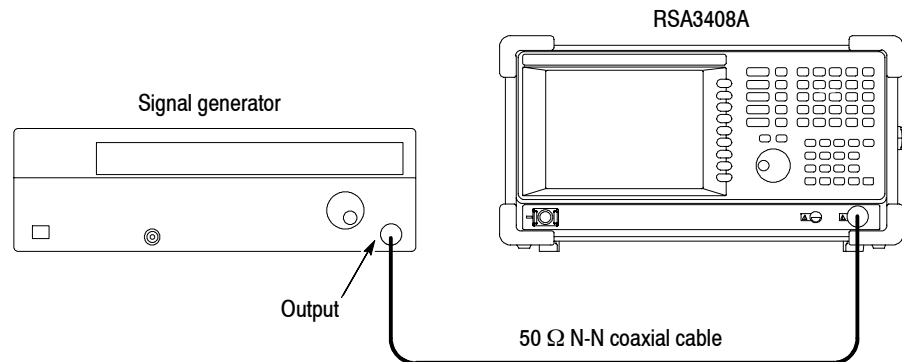
- Press the **SPAN** key on the front panel.
- With the **Span** side key, set the span to 10 MHz using the general purpose knob.
- Press the **RBW/FFT** key on the front panel.
- Press the **RBW/FFT** side key to select **Man**.
- With the **RBW** side key, set the value to 50 kHz using the general purpose knob.
- Press **TRACE/AVG** → **Trace 1 Type...** → **Average**.
- Press the **Number Of Averages** side key and set the value to 50.
- Press the **MARKER SETUP** key.
- Press the **Markers** side key to select **Delta**.

c. Set the generator controls:

Level -5 dBm

d. Hook up the signal generator:

Connect the generator output through a 50 Ω N-N coaxial cable to the analyzer **INPUT**. See the following figure.



2. *Check spurious response:*

a. *Modify the generator controls:*

Set the generator output frequency to the value as shown in Table 1-5 (initially 25 MHz).

b. *Modify the analyzer controls:*

- Press the **FREQUENCY/CHANNEL** key on the front panel.
- With the **Center Freq** side key, set the frequency to the same value as the generator output using the numeric keypad.

c. *Measure the amplitude:*

- Press the **Select Marker** side key to select **1**.
- Press the **PEAK** key and then the **MARKERS: ▼** (marker down) key once to place the first marker at the peak on the noise floor.
- Press the **Select Marker** side key to select **2**.
- Press the **PEAK** key to place Marker 2 on the peak signal.
- Read the delta marker readout ($\Delta 1-2$) on the screen. Check that the components other than the carrier meet the requirement as shown in Table 1-5 (initially -73 dBc).

- d. Repeat substeps a through c until all frequency settings listed in Table 1-5 are checked.

Table 1-5: Spurious measurement

| Band | Frequency | Spurious response |
|-------------|------------------|--------------------------|
| Baseband | 25 MHz | -73 dBc |
| RF1 | 2 GHz | -73 dBc |
| RF2 | 5 GHz | -70 dBc |
| RF3 | 7 GHz | -70 dBc |

3. *Disconnect the test equipment:*
Disconnect the cable at the analyzer input.

Test Record

Photocopy the following test record pages and use them to record the performance test results for your analyzer.

RSA3408A Test Record

Serial Number:

Certificate Number:

Calibration Date:

Technician:

Frequency readout test

| Frequency | Low limit | Test result | High limit |
|-----------|-----------------|-------------|-----------------|
| 10 MHz | 9,999 kHz | | 10,001 kHz |
| 2 GHz | 1,999,998.6 kHz | | 2,000,001.4 kHz |
| 5 GHz | 4,999,998.0 kHz | | 5,000,002.0 kHz |
| 7 GHz | 6,999,997.6 kHz | | 7,000,002.4 kHz |

10 MHz reference output test

| 10 MHz reference output test | Low limit | Test result | High limit |
|------------------------------|----------------|-------------|-----------------|
| Accuracy | 9,999,998.0 Hz | | 10,000,002.0 Hz |

Noise sideband test

| Span | Offset | Low limit | Test result | High limit |
|---------|---------|-----------|-------------|------------|
| 50 kHz | 10 kHz | 110 dB/Hz | | |
| 500 kHz | 100 kHz | 112 dB/Hz | | |
| 5 MHz | 1 MHz | 132 dB/Hz | | |

Absolute amplitude accuracy test

| Frequency | Test level | Low limit | Test result | High limit |
|-----------|------------|-----------|-------------|------------|
| 25 MHz | -10 dBm | -10.3 dBm | | -9.7 dBm |
| 100 MHz | -20 dBm | -20.5 dBm | | -19.5 dBm |

| Input attenuator setting uncertainty test | | | | |
|--|---------------------------------------|------------------|---|-------------------|
| Attenuation | Measurement (P_X) | Low limit | Test result ($P_X - P_{0/i}$) | High limit |
| 0 dB | P_0 : | - | - | - |
| 5 dB | | -0.2 dB | | +0.2 dB |
| 10 dB | | -0.2 dB | | +0.2 dB |
| 15 dB | | -0.2 dB | | +0.2 dB |
| 20 dB | | -0.2 dB | | +0.2 dB |
| 25 dB | | -0.2 dB | | +0.2 dB |
| 30 dB | | -0.2 dB | | +0.2 dB |
| 30 dB | P_1 : | - | - | - |
| 35 dB | | -0.2 dB | | +0.2 dB |
| 40 dB | | -0.2 dB | | +0.2 dB |
| 45 dB | | -0.2 dB | | +0.2 dB |
| 50 dB | | -0.2 dB | | +0.2 dB |
| 55 dB | | -0.2 dB | | +0.2 dB |

| Level linearity test | | | | |
|-----------------------------|------------------|--------------------|-------------------|--|
| Amplitude | Low limit | Test result | High limit | |
| 0 dB | -0.2 dB | | +0.2 dB | |
| -10 dB | -0.2 dB | | +0.2 dB | |
| -20 dB | -0.2 dB | | +0.2 dB | |
| -30 dB | -0.2 dB | | +0.2 dB | |
| -40 dB | -0.2 dB | | +0.2 dB | |
| -50 dB | -0.2 dB | | +0.2 dB | |

| 3rd order intermodulation distortion test | Low limit | Test result | High limit |
|--|------------------|--------------------|-------------------|
| 3 rd order intermodulation distortion +5 dBm reference level, 2 GHz center frequency | | | -78 dBc |

Displayed average noise level test

| Frequency | Low limit | Test result | High limit |
|-----------|-----------|-------------|-------------|
| 10 MHz | | | -151 dBm/Hz |
| 2 GHz | | | -150 dBm/Hz |
| 3 GHz | | | -150 dBm/Hz |
| 7 GHz | | | -142 dBm/Hz |

Residual response test

| Band | Frequency range | Low limit | Test result | High limit |
|----------|-----------------|-----------|-------------|------------|
| Baseband | 1 to 40 MHz | | | -93 dBm |
| RF1 | 0.5 to 3.5 GHz | | | -90 dBm |
| RF2 | 3.5 to 6.5 GHz | | | -85 dBm |
| RF3 | 5 to 8 GHz | | | -85 dBm |

Spurious response test

| Frequency | Low limit | Test result | High limit |
|-----------|-----------|-------------|------------|
| 25 MHz | | | -73 dBc |
| 2 GHz | | | -73 dBc |
| 5 GHz | | | -70 dBc |
| 7 GHz | | | -70 dBc |

Specifications

Specifications

This section contains the RSA3408A 8 GHz Real-Time Spectrum Analyzer specifications. All specifications are guaranteed unless labeled *Typical*. Typical specifications are provided for your convenience.

NOTE. *In these tables, those warranted characteristics that are checked in the Performance Verification appear with the ✓ symbol in the Characteristics column.*

Performance Conditions

The performance limits in this specification are valid with these conditions:

- The analyzer must have been calibrated and adjusted at an ambient temperature between +20 °C and +30 °C.
- The analyzer must be in an environment with temperature, altitude, humidity, and vibration within the operating limits described in these specifications.
- The analyzer must have had a warm-up period of at least 20 minutes.

Electrical Characteristics

Table 2- 1: Frequency

| Characteristics | Description |
|-------------------------------------|---|
| Measurement frequency | |
| Frequency range | Overall: DC to 8 GHz Baseband: DC to 40 MHz RF1: 40 MHz to 3.5 GHz RF2: 3.5 GHz to 6.5 GHz RF3: 5 GHz to 8 GHz |
| Center frequency setting resolution | 0.1 Hz |
| ✓ Frequency marker readout accuracy | Baseband: $\pm(\text{RE} \times \text{MF} + 0.001 \times \text{Span} + 0.2)$ Hz RF1 to 3: $\pm(\text{RE} \times \text{MF} + 0.001 \times \text{Span} + 2)$ Hz RE: Reference frequency error; MF: Marker frequency [Hz] The first term of these formula shows the frequency uncertainty due to the reference frequency error. The second term shows the uncertainty due to the limited bin number. Because more than 500 bins are available in the frequency display, 0.5 bin uncertainty corresponds to 0.001. The third term shows the residual FM. |
| Residual FM (<i>Typical</i>) | 2 Hz p-p |
| Span accuracy | ± 1 bin |
| RBW filter bandwidth accuracy | 0.1% against noise bandwidth |
| Reference frequency | |
| Aging per day | 1×10^{-9} (after 30 days of operation) |
| Aging per year | 1×10^{-7} (after 30 days of operation) |
| Temperature drift | 1×10^{-7} (10 to 40 °C) |
| ✓ Total frequency error | 2×10^{-7} (within one year after calibration) |
| Reference output level | >0 dBm |
| External reference input | 10 MHz, -10 to +6 dBm. Spurious level must be <-80 dBc within 100 kHz offset. |

Table 2-2: Noise sideband

| Characteristics | Description | |
|--------------------------------------|---|---|
| | Noise sideband | Offset |
| Frequency = 1000 MHz | -105 dBc/Hz -110 dBc/Hz -110 dBc/Hz -110 dBc/Hz -112 dBc/Hz -132 dBc/Hz -138 dBc/Hz -138 dBc/Hz -138 dBc/Hz | 1 kHz 10 kHz 20 kHz 30 kHz 100 kHz 1 MHz 5 MHz 7 MHz 10 MHz |
| Frequency = 2000 MHz | -103 dBc/Hz -109 dBc/Hz -109 dBc/Hz -109 dBc/Hz -112 dBc/Hz -132 dBc/Hz -138 dBc/Hz -138 dBc/Hz -138 dBc/Hz | 1 kHz 10 kHz 20 kHz 30 kHz 100 kHz 1 MHz 5 MHz 7 MHz 10 MHz |
| Frequency = 6000 MHz | -97 dBc/Hz -106 dBc/Hz -106 dBc/Hz -106 dBc/Hz -111 dBc/Hz -132 dBc/Hz -137 dBc/Hz -137 dBc/Hz -137 dBc/Hz | 1 kHz 10 kHz 20 kHz 30 kHz 100 kHz 1 MHz 5 MHz 7 MHz 10 MHz |
| Frequency = 1000 MHz, <i>Typical</i> | -107 dBc/Hz -112 dBc/Hz -112 dBc/Hz -112 dBc/Hz -115 dBc/Hz -135 dBc/Hz -140 dBc/Hz -140 dBc/Hz -140 dBc/Hz | 1 kHz 10 kHz 20 kHz 30 kHz 100 kHz 1 MHz 5 MHz 7 MHz 10 MHz |

Table 2-2: Noise sideband (Cont.)

| Characteristics | Description | |
|--------------------------------------|-------------|---------|
| Frequency = 2000 MHz, <i>Typical</i> | -105 dBc/Hz | 1 kHz |
| | -111 dBc/Hz | 10 kHz |
| | -111 dBc/Hz | 20 kHz |
| | -111 dBc/Hz | 30 kHz |
| | -115 dBc/Hz | 100 kHz |
| | -135 dBc/Hz | 1 MHz |
| | -140 dBc/Hz | 5 MHz |
| | -140 dBc/Hz | 10 MHz |
| Frequency = 6000 MHz, <i>Typical</i> | -99 dBc/Hz | 1 kHz |
| | -108 dBc/Hz | 10 kHz |
| | -108 dBc/Hz | 20 kHz |
| | -108 dBc/Hz | 30 kHz |
| | -113 dBc/Hz | 100 kHz |
| | -134 dBc/Hz | 1 MHz |
| | -139 dBc/Hz | 5 MHz |
| | -139 dBc/Hz | 10 MHz |

Table 2-3: Input

| Characteristics | Description |
|----------------------------|--|
| Signal input | |
| Input connector | N type (RF and baseband input); BNC type (Option 03 IQ input) |
| Input impedance | 50 Ω |
| VSWR | <1.4 (2.5 GHz, RF attenuation \geq 10 dB) <1.8 (7.5 GHz, RF attenuation \geq 10 dB) |
| <i>Typical</i> | <1.4 (300 kHz to 40 MHz, RF attenuation \geq 10 dB) <1.3 (40 MHz to 3 GHz, RF attenuation \geq 10 dB) <1.4 (3 GHz to 8 GHz, RF attenuation \geq 10 dB) |
| Maximum input level | |
| Maximum DC voltage | \pm 0.2 V (RF1 to 3) \pm 5 V (Baseband) \pm 5 V (Option 03 IQ input) |
| Maximum input power | +30 dBm (RF1 to 3, RF attenuation \geq 10 dB) |
| Input attenuator | |
| RF/Baseband attenuator | 0 to 55 dB (5 dB step) |
| I/Q attenuator (Option 03) | 0 to 35 dB (5 dB step) |

Table 2-4: Amplitude

| Characteristics | Description |
|--|--|
| Reference level | |
| Reference level setting range | Baseband: -30 to +20 dBm (5 dB step) RF: -50 to +30 dBm (1 dB step) Option 03 IQ input: -10 to +20 dBm (5 dB step) |
| Accuracy (-10 to -50 dBm) | ±0.2 dB (at 100 MHz, 10 dB attenuation, 20 to 30 °C) |
| Frequency response (RF attenuation ≥ 10 dB) | |
| at 20 to 30 °C | ±0.5 dB (100 kHz to 40 MHz) ±1.2 dB (40 MHz to 3.5 GHz) ±1.7 dB (3.5 GHz to 6.5 GHz) ±1.7 dB (5 GHz to 8 GHz) |
| <i>Typical</i> | ±0.3 dB (100 kHz to 40 MHz) ±0.5 dB (40 MHz to 3.5 GHz) ±1.0 dB (3.5 GHz to 6.5 GHz) ±1.0 dB (5 GHz to 8 GHz) |
| at 10 to 40 °C | ±0.7 dB (100 kHz to 40 MHz) ±1.5 dB (40 MHz to 3.5 GHz) ±2.0 dB (3.5 GHz to 6.5 GHz) ±2.0 dB (5 GHz to 8 GHz) |
| ✓ Absolute amplitude accuracy at calibration point (20 to 30 °C) | Baseband: ±0.3 dB (at 25 MHz, -10 dBm signal) RF: ±0.5 dB (at 100 MHz, -20 dBm signal, 0 dB attenuation) |
| ✓ Input attenuator setting uncertainty | ±0.2 dB (at 100 MHz) |
| ✓ Level linearity in display range | ±0.2 dB (0 to -50 dBfs); ±0.12 dB (0 to -50 dBfs, <i>Typical</i>) |

Table 2-5: Spurious response

| Characteristics | Description |
|--|---|
| 1 dB compression input | +2 dBm (RF attenuation = 0 dB, 2 GHz) |
| 2 nd harmonic distortion (-30 dBm tone at input mixer) | -65 dBc (10 MHz to 1400 MHz) -70 dBc (1400 MHz to 1750 MHz) |
| 3 rd order intermodulation distortion (Reference level = +5 dBm , RF attenuation adjusted optimally, Total signal power = -7 dBm) | |
| ✓ Center frequency = 2 GHz | -78 dBc |
| 100 MHz to 3 GHz | -75 dBc |
| 3 GHz to 8 GHz | -72 dBc |
| ✓ Displayed average noise level | -144 dBm/Hz (100 Hz to 10 kHz) -151 dBm/Hz (10 kHz to 10 MHz) -151 dBm/Hz (10 MHz to 100 MHz) -150 dBm/Hz (100 MHz to 1 GHz) -150 dBm/Hz (1 GHz to 2 GHz) -150 dBm/Hz (2 GHz to 3 GHz) -142 dBm/Hz (3 GHz to 5 GHz) -142 dBm/Hz (5 GHz to 8 GHz) |
| Local feed-through to input connector (Typical) | -40 dBm (local frequency 4.2 to 5 GHz) -55 dBm (local frequency 5 to 6 GHz) -60 dBm (local frequency 6 to 7 GHz) -60 dBm (local frequency 7 to 7.7 GHz) |
| Image Suppression (Typical) | |
| 1 st IF | 75 dB (40 MHz to 3.5 GHz) 70 dB (3.5 GHz to 8 GHz) |
| 2 nd and 3 rd IF | 80 dB (40 MHz to 3.5 GHz) 75 dB (3.5 GHz to 8 GHz) |
| Alias suppression (Typical) | 65 dB (DC to 40 MHz) |
| ✓ Residual response (Reference level = -30 dBm, RBW = 100 kHz) | |
| Baseband, 1 to 40 MHz | -93 dBm (Span = 40 MHz) |
| RF1, 0.5 to 3.5 GHz | -90 dBm (Span = 3 GHz) |
| RF2, 3.5 to 6.5 GHz | -85 dBm (Span = 3 GHz) |
| RF3, 5 to 8 GHz | -85 dBm (Span = 3 GHz) |
| ✓ Spurious response (Span = 10 MHz, Reference level = 0 dBm, RBW = 50 kHz) | |
| Baseband, 25 MHz | -73 dBc (Signal frequency = 25 MHz, Signal level = -5 dBm) |
| RF1, 2 GHz | -73 dBc (Signal frequency = 2 GHz, Signal level = -5 dBm) |
| RF2, 5 GHz | -70 dBc (Signal frequency = 5 GHz, Signal level = -5 dBm) |
| RF3, 7 GHz | -70 dBc (Signal frequency = 7 GHz, Signal level = -5 dBm) |

Table 2-6: Acquisition

| Characteristics | Description |
|--|---|
| Real-time capture bandwidth | Baseband: 40 MHz; RF: 36 MHz; IQ: 40 MHz (Option 03 only) |
| A/D converter | 14 bits, 102.4 Msps |
| Sampling rate (Real Time S/A, Demod, and Time modes) | |
| 40 MHz span (Baseband) | 51.2 Msps |
| 40 MHz span (IQ, Option 03) | 51.2 Msps |
| 36 MHz span (RF) | 51.2 Msps |
| 20 MHz span | 25.6 Msps |
| 10 MHz span | 12.8 Msps |
| 5 MHz span | 6.4 Msps |
| 2 MHz span | 2.56 Msps |
| 1 MHz span | 1.28 Msps |
| 500 kHz span | 640 ksps |
| 200 kHz span | 256 ksps |
| 100 kHz span | 128 ksps |
| 50 kHz span | 64 ksps |
| 20 kHz span | 25.6 ksps |
| 10 kHz span | 12.8 ksps |
| 5 kHz span | 6.4 ksps |
| 2 kHz span | 2.56 ksps |
| 1 kHz span | 1.28 ksps |
| 500 Hz span | 640 sps |
| 200 Hz span | 256 sps |
| 100 Hz span | 128 sps |
| Acquisition length (Real Time S/A, Demod, and Time modes) | Minimum: 1024 samples Maximum: 16,384,000 samples (Standard); 65,536,000 samples (Option 02) |
| Acquisition length setting resolution | 1024 samples (Real Time S/A, Demod, and Time modes) |
| Acquisition memory size | Standard: 64 MB; Option 02: 256 MB |

Table 2-7: Trigger

| Characteristics | Description |
|--|--|
| Trigger mode | Free run, Triggered |
| Trigger event source | Power (Span BW), Frequency mask (Option 02), External |
| Pre/Post trigger setting | Trigger position is settable from 0 to 100% of total data length. |
| Power trigger | 0 to -40 dBfs |
| Frequency mask trigger (Option 02) | |
| Mask resolution | 1 bin |
| Level range | 0 to -60 dBfs |
| Real-time event detection bandwidth | Baseband: 40 MHz (1024 point FFT, 50% overlapping) RF: 36 MHz (1024 point FFT, 50% overlapping) |
| External trigger | |
| Threshold voltage | -1.5 to +1.5 V settable |
| Setting Resolution | 0.1 V |
| Input impedance | >2 k Ω |
| Trigger output voltage | High: >2.0 V, Low: <0.4 V (output current <1 mA) |
| Trigger marker position timing uncertainty | ± 2 sample points (Power/External trigger) |

Table 2-8: RBW (Resolution Bandwidth)

| Characteristics | Description |
|---|-----------------------------------|
| Filter shape | Gaussian, Rectangle, Root Nyquist |
| Setting range | 1 Hz to 10 MHz |
| Minimum settable RBW (extended resolution on) | |
| Span >2 GHz | 100 kHz |
| 1 GHz < Span ≤ 2 GHz | 50 kHz |
| 500 MHz < Span ≤ 1 GHz | 20 kHz |
| 20 MHz < Span ≤ 500 MHz | 10 kHz |
| 500 kHz < Span ≤ 20 MHz | 1 kHz |
| 200 kHz < Span ≤ 500 kHz | 500 Hz |
| 100 kHz < Span ≤ 200 kHz | 200 Hz |
| 50 kHz < Span ≤ 100 kHz | 100 Hz |
| 20 kHz < Span ≤ 50 kHz | 50 Hz |
| 10 kHz < Span ≤ 20 kHz | 20 Hz |
| 5 kHz < Span ≤ 10 kHz | 10 Hz |
| 2 kHz < Span ≤ 5 kHz | 5 Hz |
| 1 kHz < Span ≤ 2 kHz | 2 Hz |
| 100 Hz ≤ Span ≤ 1 kHz | 1 Hz |

Table 2-9: Trace and display line

| Characteristics | Description |
|------------------|--|
| Number of traces | 2 |
| Trace type | Normal, Average, Max Hold, Min Hold |
| Display detector | Positive peak, Negative peak, and Positive-Negative peak |
| Display line | Horizontal line 1 and 2, Vertical line 1 and 2 |

Table 2- 10: Display

| Characteristics | Description |
|---------------------------|--|
| Views | |
| S/A mode | Spectrum |
| S/A with Spectrogram mode | Spectrum and Spectrogram |
| Real Time S/A mode | Spectrum and Spectrogram |
| Analog Demod mode | Overview: Power versus Time/Spectrogram Subview: Spectrum Main view: Measurement Results |
| Time mode | Overview: Power versus Time/Spectrogram Subview: Spectrum Main view: Measurement results |
| LCD | |
| Size | 213 mm (8.4 in) |
| Resolution | 800 × 600 pixels |
| Color | Maximum 256 colors |

Table 2- 11: Measurement function

| Characteristics | Description |
|-------------------|--|
| S/A mode | Channel power, Adjacent channel power ratio, Occupied bandwidth, Emission bandwidth, Carrier to Noise ratio, Carrier frequency, Spurious |
| Analog Demod mode | I/Q versus Time, AM depth, FM deviation, PM deviation |
| Time mode | I/Q versus Time, Power versus Time, Frequency versus Time, CCDF |

Table 2- 12: Analog demodulation accuracy

| Characteristics | Description |
|-----------------------------|--|
| Accuracy (<i>Typical</i>) | |
| AM demodulation | ±2% (-10 dBfs input at center, 10 to 60% modulation depth) |
| PM demodulation | ±3° (-10 dBfs input at center) |
| FM demodulation | ±1% of span (-10 dBfs input at center) |

Table 2- 13: Pulse measurement

| Characteristics | Description |
|-----------------------|---|
| Measurement functions | Pulse width, Pulse peak power, On/Off ratio, Pulse ripple, Pulse repetition interval, Duty cycle, Pulse-Pulse phase, Channel power, OBW, EBW, Frequency deviation |
| Pulse length | Minimum 20 samples; Maximum 260,000 samples |

Table 2- 14: Digital demodulation (Option 21 only)

| Characteristics | Description |
|-----------------------|---|
| Demodulator | |
| Carrier type | Continuous and Burst |
| Modulation format | BPSK, QPSK, $\pi/4$ shift DQPSK, OQPSK, 8PSK, 16QAM, 64QAM, 256QAM, GMSK, GFSK, ASK, FSK |
| Measurement filter | Root cosine |
| Reference filter | Cosine, Gauss |
| Filter parameter | α /BT: 0.0001 to 1, 0.0001 step |
| Maximum symbol rate | 51.2 Msps |
| Standard setup | PDC, PHS, NADC, TETRA, GSM, CDPD, and Bluetooth |
| Measurement functions | Constellation, EVM, I/Q versus Time, Eye diagram, Symbol table, AM/AM, AM/PM, CCDF, PDF |
| Display format | |
| Vector diagram | Symbol/Locus display, Frequency error measurement, and Origin offset measurement |
| Constellation diagram | Symbol display, Frequency error measurement, and Origin offset measurement |
| Eye diagram | I, Q, and Trellis displays (1 to 16 symbols) |
| Error vector diagram | EVM, Magnitude error, Phase error, Waveform quality (Q) measurement, Frequency error measurement, and Origin offset measurement |
| Symbol table | Binary, Octal, Hexadecimal |
| AM/AM | Measured amplitude versus Reference amplitude 1 dB compression measurement |
| AM/PM | Phase error versus Reference amplitude |
| CCDF | Probability of exceed versus Power level, Crest factor measurement |
| PDF | Probability of occurrence versus Power level |

Table 2- 14: Digital demodulation (Option 21 only) (Cont.)

| Characteristics | Description | |
|--------------------------|------------------------|-------------|
| Accuracy | | |
| QPSK EVM | EVM (<i>Typical</i>) | Symbol rate |
| Center frequency = 1 GHz | 0.5% | 100 kHz |
| | 0.5% | 1 MHz |
| | 0.6% | 4 MHz |
| | 0.9% | 10 MHz |
| | 1.6% | 20 MHz |
| Center frequency = 2 GHz | 0.5% | 100 kHz |
| | 0.5% | 1 MHz |
| | 0.6% | 4 MHz |
| | 0.9% | 10 MHz |
| | 1.8% | 20 MHz |
| Center frequency = 3 GHz | 0.5% | 100 kHz |
| | 0.5% | 1 MHz |
| | 0.6% | 4 MHz |
| | 0.9% | 10 MHz |
| | 1.8% | 20 MHz |
| Center frequency = 5 GHz | 0.7% | 100 kHz |
| | 0.7% | 1 MHz |
| | 0.9% | 4 MHz |
| | 1.6% | 10 MHz |
| | 2.4% | 20 MHz |
| $\pi/4$ DQPSK EVM | EVM (<i>Typical</i>) | Symbol rate |
| Center frequency = 1 GHz | 0.6% | 100 kHz |
| | 0.6% | 1 MHz |
| | 0.6% | 4 MHz |
| | 0.9% | 10 MHz |
| | 1.8% | 20 MHz |
| Center frequency = 2 GHz | 0.6% | 100 kHz |
| | 0.6% | 1 MHz |
| | 0.6% | 4 MHz |
| | 0.9% | 10 MHz |
| | 1.8% | 20 MHz |
| Center frequency = 3 GHz | 0.6% | 100 kHz |
| | 0.6% | 1 MHz |
| | 0.6% | 4 MHz |
| | 0.9% | 10 MHz |
| | 1.8% | 20 MHz |
| Center frequency = 5 GHz | 0.7% | 100 kHz |
| | 0.7% | 1 MHz |
| | 0.9% | 4 MHz |
| | 1.6% | 10 MHz |
| | 2.4% | 20 MHz |

Table 2-14: Digital demodulation (Option 21 only) (Cont.)

| Characteristics | Description | |
|--------------------------|--------------------------------------|---|
| 16/64QAM EVM | EVM (<i>Typical</i>) | Symbol rate |
| Center frequency = 1 GHz | 0.5% 0.5% 0.5% 0.7% 1.2% | 100 kHz 1 MHz 4 MHz 10 MHz 20 MHz |
| Center frequency = 2 GHz | 0.5% 0.5% 0.5% 0.7% 1.2% | 100 kHz 1 MHz 4 MHz 10 MHz 20 MHz |
| Center frequency = 3 GHz | 0.5% 0.5% 0.5% 0.7% 1.2% | 100 kHz 1 MHz 4 MHz 10 MHz 20 MHz |
| Center frequency = 5 GHz | 0.9% 0.5% 0.7% 1.3% 2.0% | 100 kHz 1 MHz 4 MHz 10 MHz 20 MHz |

Table 2-15: ACLR measurement (Option 27)

| Characteristics | Description |
|--|---|
| ACLR (3GPP down link, Test model 1, 16 ch, 1800 to 2200 MHz carrier frequency) | |
| Real-Time measurement | 66 dB (5MHz offset) 68 dB (10MHz offset) |
| Sweep measurement with noise correction (<i>Typical</i>) | 68 dB (5MHz offset) 70 dB (10MHz offset) |

Table 2-16: Wireless LAN measurement (Option 29)

| Characteristics | Description |
|---------------------------------|--|
| Residual EVM (<i>Typical</i>) | |
| IEEE 802.11a/g, 54 Mbps OFDM | ≤ -44 dB (center frequency = 2.447 GHz) ≤ -42 dB (center frequency = 5.5 GHz) |
| IEEE 802.11b, 11 Mbps CCK | ≤ 0.7% (center frequency = 2.447 GHz) |

Table 2-17: Controller

| Characteristics | Description |
|-----------------|----------------------------|
| Controller | |
| CPU | Intel Celeron 1.2 GHz |
| DRAM | 512 MB DIMM |
| OS | Windows XP |
| System bus | PCI |
| Storage medium | |
| Hard disk | ≥40 GB, 2.5 inch IDE |
| Floppy disk | 1.44 MB 3.5 inch |
| Interface | |
| Printer port | USB |
| GPIB | IEEE 488.2 |
| LAN | 10/100 BASE-T (IEEE 802.3) |
| Mouse | USB |
| Keyboard | USB |
| Monitor out | VGA (D-SUB 15 pins) |

Table 2-18: External output connector

| Characteristics | Description |
|---|---|
| Preamp power connector | |
| Connector type | LEMO 6 poles |
| Pin assignment | Pin 1: NC, Pin 2: ID1, Pin 3: ID2, Pin 4: -12 V, Pin 5: GND, Pin 6: +12 V |
| Digital I/Q output (Option 05) | |
| Connector type | MDR (3M) 50 pins × 2 |
| Pin assignment | Refer to page 2-19. |
| Data output | I data: 16-bit LVDS; Q data: 16-bit LVDS |
| Control output | Clock: LVDS, max 51.2 MHz; Data valid: LVDS, not used |
| Control input | Output enable: Connecting GND enables output |
| Setup time | >5 ns (data transition to clock rising edge). See Figure 2-1. |
| Hold time | >5 ns (clock rising edge to data transition). See Figure 2-1. |
| Flatness of output data before correction | |
| Amplitude | +1/-5 dB (36 MHz span); +1/-2 dB (20 MHz span) |
| Phase | ±100° (36 MHz span); ±15° (20 MHz span) |

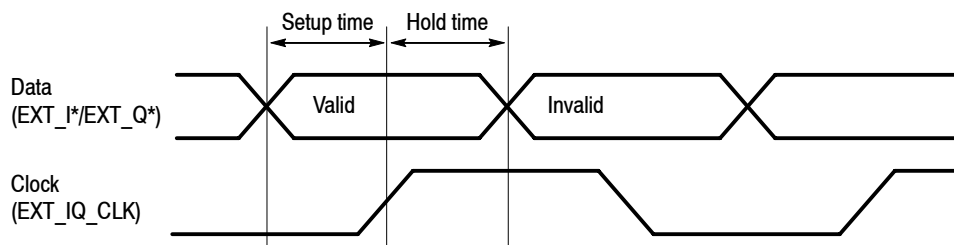


Figure 2-1: Definition of the setup and hold time

Table 2-19: Power requirements

| Characteristics | Description |
|----------------------|--|
| Rating voltage | 100 to 240 VAC |
| Voltage range | 90 to 250 VAC |
| Line frequency | 47 to 63 Hz |
| Mains Fuse Data | Densei-Lambda supplies: 5 A, Time-delayed, 250 V (not operator replaceable) Cosel supply: 2 A, Time-delayed, 250 V (not operator replaceable) |
| Heat dissipation | |
| Maximum power | 400 VA |
| Maximum line current | 5 A rms at 50 Hz (90 V line with 5% clipping) |
| Surge current | Maximum 52 A peak (25 °C) for ≤5 line cycles after the product has been turned off for at least 30 s. |

Physical Characteristics

Table 2-20: Physical characteristics

| Characteristics | Description |
|-----------------|---|
| Dimensions | |
| Width | 425 mm (16.7 in) without belts |
| Height | 215 mm (8.5 in) without feet |
| Depth | 425 mm (16.7 in) without cover and feet |
| Net weight | 20 kg |

Environmental Characteristics

Table 2-21: Environmental characteristics

| Characteristics | Description |
|----------------------------|--|
| Temperature | |
| Operating | +10 to +40 °C |
| Nonoperating | -20 to +60 °C |
| Relative humidity | |
| Operating and nonoperating | 20 to 80% (no condensation), maximum wet-bulb temperature 29 °C |
| Altitude | |
| Operating | Up to 3000 m (10000 ft) |
| Nonoperating | Up to 12000 m (40000 ft) |
| Vibration | |
| Operating | 2.65 m/s ² rms (0.27 G rms), 5 to 500 Hz |
| Nonoperating | 22.3 m/s ² rms (2.28 G rms), 5 to 500 Hz |
| Shock | |
| Nonoperating | 196 m/s ² (20 G), half-sine, 11 ms duration Three shocks in each direction along each major axis, total of 18 shocks |
| Cooling clearance | |
| Bottom | 20 mm (0.79 in) |
| Both sides | 50 mm (1.97 in) |
| Rear | 50 mm (1.97 in) |

Table 2-22: Certifications and compliances

| Characteristic | Description | | | | | | | | | | | | | | | | | | |
|---|--|------------------------------|---|---------------|--|---------------|---|---------------|--|---------------|---|---------------|---|----------------|---|--------------|----------------------------------|--------------|--|
| EC Declaration of Conformity - EMC | <p>Meets intent of Directive 89/336/EEC for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities:</p> <table border="0"> <tr> <td>EN 61326</td> <td>EMC requirements for Class A electrical equipment for measurement, control and laboratory use. ¹</td> </tr> <tr> <td>IEC 61000-4-2</td> <td>Electrostatic discharge immunity (Performance criterion B)</td> </tr> <tr> <td>IEC 61000-4-3</td> <td>RF electromagnetic field immunity (Performance criterion A)</td> </tr> <tr> <td>IEC 61000-4-4</td> <td>Electrical fast transient / burst immunity (Performance criterion B)</td> </tr> <tr> <td>IEC 61000-4-5</td> <td>Power line surge immunity (Performance criterion B)</td> </tr> <tr> <td>IEC 61000-4-6</td> <td>Conducted RF immunity (Performance criterion A)</td> </tr> <tr> <td>IEC 61000-4-11</td> <td>Voltage dips and interruptions immunity (Performance criterion B)</td> </tr> <tr> <td>EN 61000-3-2</td> <td>AC power line harmonic emissions</td> </tr> <tr> <td>EN 61000-3-3</td> <td>Power line voltage fluctuation/flicker</td> </tr> </table> | EN 61326 | EMC requirements for Class A electrical equipment for measurement, control and laboratory use. ¹ | IEC 61000-4-2 | Electrostatic discharge immunity (Performance criterion B) | IEC 61000-4-3 | RF electromagnetic field immunity (Performance criterion A) | IEC 61000-4-4 | Electrical fast transient / burst immunity (Performance criterion B) | IEC 61000-4-5 | Power line surge immunity (Performance criterion B) | IEC 61000-4-6 | Conducted RF immunity (Performance criterion A) | IEC 61000-4-11 | Voltage dips and interruptions immunity (Performance criterion B) | EN 61000-3-2 | AC power line harmonic emissions | EN 61000-3-3 | Power line voltage fluctuation/flicker |
| EN 61326 | EMC requirements for Class A electrical equipment for measurement, control and laboratory use. ¹ | | | | | | | | | | | | | | | | | | |
| IEC 61000-4-2 | Electrostatic discharge immunity (Performance criterion B) | | | | | | | | | | | | | | | | | | |
| IEC 61000-4-3 | RF electromagnetic field immunity (Performance criterion A) | | | | | | | | | | | | | | | | | | |
| IEC 61000-4-4 | Electrical fast transient / burst immunity (Performance criterion B) | | | | | | | | | | | | | | | | | | |
| IEC 61000-4-5 | Power line surge immunity (Performance criterion B) | | | | | | | | | | | | | | | | | | |
| IEC 61000-4-6 | Conducted RF immunity (Performance criterion A) | | | | | | | | | | | | | | | | | | |
| IEC 61000-4-11 | Voltage dips and interruptions immunity (Performance criterion B) | | | | | | | | | | | | | | | | | | |
| EN 61000-3-2 | AC power line harmonic emissions | | | | | | | | | | | | | | | | | | |
| EN 61000-3-3 | Power line voltage fluctuation/flicker | | | | | | | | | | | | | | | | | | |
| Australia/New Zealand Declaration of Conformity - EMC | <p>Complies with EMC provision of Radiocommunications Act per the following standard(s):</p> <table border="0"> <tr> <td>AS/NZS 2064.1/2</td> <td>Industrial, Scientific, and Medical Equipment: 1992</td> </tr> </table> | AS/NZS 2064.1/2 | Industrial, Scientific, and Medical Equipment: 1992 | | | | | | | | | | | | | | | | |
| AS/NZS 2064.1/2 | Industrial, Scientific, and Medical Equipment: 1992 | | | | | | | | | | | | | | | | | | |
| EC Declaration of Conformity - Low Voltage | <p>Compliance was demonstrated to the following specification as listed in the Official Journal of the European Union:</p> <p>Low Voltage Directive 73/23/EEC, amended by 93/68/EEC</p> <table border="0"> <tr> <td>EN 61010-1:2001</td> <td>Safety requirements for electrical equipment for measurement control and laboratory use.</td> </tr> </table> | EN 61010-1:2001 | Safety requirements for electrical equipment for measurement control and laboratory use. | | | | | | | | | | | | | | | | |
| EN 61010-1:2001 | Safety requirements for electrical equipment for measurement control and laboratory use. | | | | | | | | | | | | | | | | | | |
| U.S. Nationally Recognized Testing Laboratory Listing | <table border="0"> <tr> <td>UL61010-1</td> <td>Standard for electrical measuring and test equipment.</td> </tr> </table> | UL61010-1 | Standard for electrical measuring and test equipment. | | | | | | | | | | | | | | | | |
| UL61010-1 | Standard for electrical measuring and test equipment. | | | | | | | | | | | | | | | | | | |
| Canadian Certification | <table border="0"> <tr> <td>CAN/CSA C22.2 No. 61010-1-04</td> <td>CSA safety requirements for electrical and electronic measuring and test equipment.</td> </tr> </table> | CAN/CSA C22.2 No. 61010-1-04 | CSA safety requirements for electrical and electronic measuring and test equipment. | | | | | | | | | | | | | | | | |
| CAN/CSA C22.2 No. 61010-1-04 | CSA safety requirements for electrical and electronic measuring and test equipment. | | | | | | | | | | | | | | | | | | |
| Additional Compliance | <table border="0"> <tr> <td>ANSI/ISA 82.02.01:2004</td> <td>Safety standard for electrical and electronic test, measuring, controlling, and related equipment.</td> </tr> <tr> <td>IEC61010-1</td> <td>Safety requirements for electrical equipment for measurement, control, and laboratory use.</td> </tr> </table> | ANSI/ISA 82.02.01:2004 | Safety standard for electrical and electronic test, measuring, controlling, and related equipment. | IEC61010-1 | Safety requirements for electrical equipment for measurement, control, and laboratory use. | | | | | | | | | | | | | | |
| ANSI/ISA 82.02.01:2004 | Safety standard for electrical and electronic test, measuring, controlling, and related equipment. | | | | | | | | | | | | | | | | | | |
| IEC61010-1 | Safety requirements for electrical equipment for measurement, control, and laboratory use. | | | | | | | | | | | | | | | | | | |

¹ Emissions which exceed the levels required by this standard may occur when this equipment is connected to a test object.

Table 2-22: Certifications and compliances (Cont.)

| Characteristic | Description |
|----------------------------------|---|
| Overvoltage Category Description | <p>Terminals on this product may have different installation (overvoltage) category designations. The installation categories are:</p> <p>CAT III Distribution-level mains (usually permanently connected). Equipment at this level is typically in a fixed industrial location.</p> <p>CAT II Local-level mains (wall sockets). Equipment at this level includes appliances, portable tools, and similar products. Equipment is usually cord-connected.</p> <p>CAT I Secondary (signal level) or battery operated circuits of electronic equipment.</p> |
| Overvoltage Category | Overvoltage Category II (as defined in IEC61010-1) |
| Pollution Degree Description | <p>A measure of the contaminants that could occur in the environment around and within a product. Typically the internal environment inside a product is considered to be the same as the external. Products should be used only in the environment for which they are rated.</p> <p>Pollution Degree 1 No pollution or only dry, nonconductive pollution occurs. Products in this category are generally encapsulated, hermetically sealed, or located in clean rooms.</p> <p>Pollution Degree 2 Normally only dry, nonconductive pollution occurs. Occasionally a temporary conductivity that is caused by condensation must be expected. This location is a typical office/home environment. Temporary condensation occurs only when the product is out of service.</p> <p>Pollution Degree 3 Conductive pollution, or dry, nonconductive pollution that becomes conductive due to condensation. These are sheltered locations where neither temperature nor humidity is controlled. The area is protected from direct sunshine, rain, or direct wind.</p> <p>Pollution Degree 4 Pollution that generates persistent conductivity through conductive dust, rain, or snow. Typical outdoor locations.</p> |
| Pollution Degree | Pollution Degree 2 (as defined in IEC61010-1). Note: Rated for indoor use only. |
| Safety Certification Compliance | |
| Equipment Type | Test and measuring |
| Safety Class | Class I (as defined in IEC61010-1) - grounded product |
| Operating Temperature Range | +5 to +40 °C |

Digital IQ Output Connector Pin Assignment (Option 05 Only)

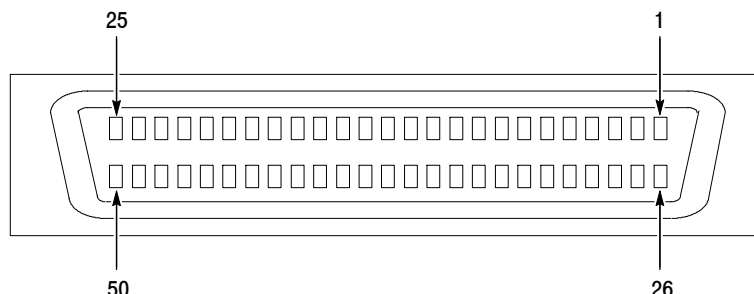


Figure 2-2: Digital IQ output connector pin assignment

Table 2-23: I OUTPUT connector pin assignment

| Pin number | Signal name | Description |
|------------|-------------|--|
| 1 | IQ_ENABLE* | IQ output enable signal input Open: IQ output disable Connect to GND: IQ output enable |
| 26 | GND | Ground |
| 2 | GND | |
| 27 | GND | |
| 3 | EXT_I0- | I output data (bit 0), LVDS |
| 28 | EXT_I0+ | |
| 4 | EXT_I1- | I output data (bit 1), LVDS |
| 29 | EXT_I1+ | |
| 5 | EXT_I2- | I output data (bit 2), LVDS |
| 30 | EXT_I2+ | |
| 6 | EXT_I3- | I output data (bit 3), LVDS |
| 31 | EXT_I3+ | |
| 7 | GND | Ground |
| 32 | GND | |
| 8 | EXT_I4- | I output data (bit 4), LVDS |
| 33 | EXT_I4+ | |
| 9 | EXT_I5- | I output data (bit 5), LVDS |
| 34 | EXT_I5+ | |

Table 2-23: I OUTPUT connector pin assignment (Cont.)

| Pin number | Signal name | Description |
|------------|-------------|------------------------------|
| 10 | EXT_I6- | I output data (bit 6), LVDS |
| 35 | EXT_I6+ | |
| 11 | EXT_I7- | I output data (bit 7), LVDS |
| 36 | EXT_I7+ | |
| 12 | GND | Ground |
| 37 | GND | |
| 13 | EXT_I8- | I output data (bit 8), LVDS |
| 38 | EXT_I8+ | |
| 14 | EXT_I9- | I output data (bit 9), LVDS |
| 39 | EXT_I9+ | |
| 15 | EXT_I10- | I output data (bit 10), LVDS |
| 40 | EXT_I10+ | |
| 16 | EXT_I11- | I output data (bit 11), LVDS |
| 41 | EXT_I11+ | |
| 17 | GND | Ground |
| 42 | GND | |
| 18 | EXT_I12- | I output data (bit 12), LVDS |
| 43 | EXT_I12+ | |
| 19 | EXT_I13- | I output data (bit 13), LVDS |
| 44 | EXT_I13+ | |
| 20 | EXT_I14- | I output data (bit 14), LVDS |
| 45 | EXT_I14+ | |
| 21 | EXT_I15- | I output data (bit 15), LVDS |
| 46 | EXT_I15+ | |
| 22 | GND | Ground |
| 47 | GND | |
| 23 | GND | |
| 48 | GND | |
| 24 | EXT_IQ_DAV- | Not used |
| 49 | EXT_IQ_DAV+ | |
| 25 | EXT_IQ_CLK- | IQ output clock, LVDS |
| 50 | EXT_IQ_CLK+ | |

Table 2-24: Q OUTPUT connector pin assignment

| Pin number | Signal name | Description |
|------------|-------------|--|
| 1 | IQ_ENABLE* | IQ output enable signal input Open: IQ output disable Connect to GND: IQ output enable |
| 26 | GND | Ground |
| 2 | GND | |
| 27 | GND | |
| 3 | EXT_Q0- | Q output data (bit 0), LVDS |
| 28 | EXT_Q0+ | |
| 4 | EXT_Q1- | Q output data (bit 1), LVDS |
| 29 | EXT_Q1+ | |
| 5 | EXT_Q2- | Q output data (bit 2), LVDS |
| 30 | EXT_Q2+ | |
| 6 | EXT_Q3- | Q output data (bit 3), LVDS |
| 31 | EXT_Q3+ | |
| 7 | GND | Ground |
| 32 | GND | |
| 8 | EXT_Q4- | Q output data (bit 4), LVDS |
| 33 | EXT_Q4+ | |
| 9 | EXT_Q5- | Q output data (bit 5), LVDS |
| 34 | EXT_Q5+ | |
| 10 | EXT_Q6- | Q output data (bit 6), LVDS |
| 35 | EXT_Q6+ | |
| 11 | EXT_Q7- | Q output data (bit 7), LVDS |
| 36 | EXT_Q7+ | |
| 12 | GND | Ground |
| 37 | GND | |
| 13 | EXT_Q8- | Q output data (bit 8), LVDS |
| 38 | EXT_Q8+ | |
| 14 | EXT_Q9- | Q output data (bit 9), LVDS |
| 39 | EXT_Q9+ | |
| 15 | EXT_Q10- | Q output data (bit 10), LVDS |
| 40 | EXT_Q10+ | |

Table 2-24: Q OUTPUT connector pin assignment (Cont.)

| Pin number | Signal name | Description |
|------------|-------------|------------------------------|
| 16 | EXT_Q11- | Q output data (bit 11), LVDS |
| 41 | EXT_Q11+ | |
| 17 | GND | Ground |
| 42 | GND | |
| 18 | EXT_Q12- | Q output data (bit 12), LVDS |
| 43 | EXT_Q12+ | |
| 19 | EXT_Q13- | Q output data (bit 13), LVDS |
| 44 | EXT_Q13+ | |
| 20 | EXT_Q14- | Q output data (bit 14), LVDS |
| 45 | EXT_Q14+ | |
| 21 | EXT_Q15- | Q output data (bit 15), LVDS |
| 46 | EXT_Q15+ | |
| 22 | GND | Ground |
| 47 | GND | |
| 23 | GND | |
| 48 | GND | |
| 24 | NC | Not used |
| 49 | NC | |
| 25 | NC | |
| 50 | NC | |

