

Technical Reference



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

077-0007-00

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Tektronix Japan, Ltd., Shinagawa Intercity Building B 6th Floor, 2-15-2 Konan, Minato-ku, Tokyo 108-6106 Japan
Tektronix, Inc., P.O. Box 500, Beaverton, OR 97077

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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 Complies

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.

Contacting Tektronix

Phone	1-800-833-9200*
Address	Tektronix, Inc. Department or name (if known) 14200 SW Karl Braun Drive P.O. Box 500 Beaverton, OR 97077 USA
Web site	www.tektronix.com
Sales support	1-800-833-9200, select option 1*
Service support	1-800-833-9200, select option 2*
Technical support	www.tektronix.com/support 1-800-833-9200, select option 3* 6:00 a.m. – 5:00 p.m. Pacific time

* **This phone number is toll free in North America. After office hours, please leave a voice mail message. Outside North America, contact a Tektronix sales office or distributor; see the Tektronix web site for a list of offices.**

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).

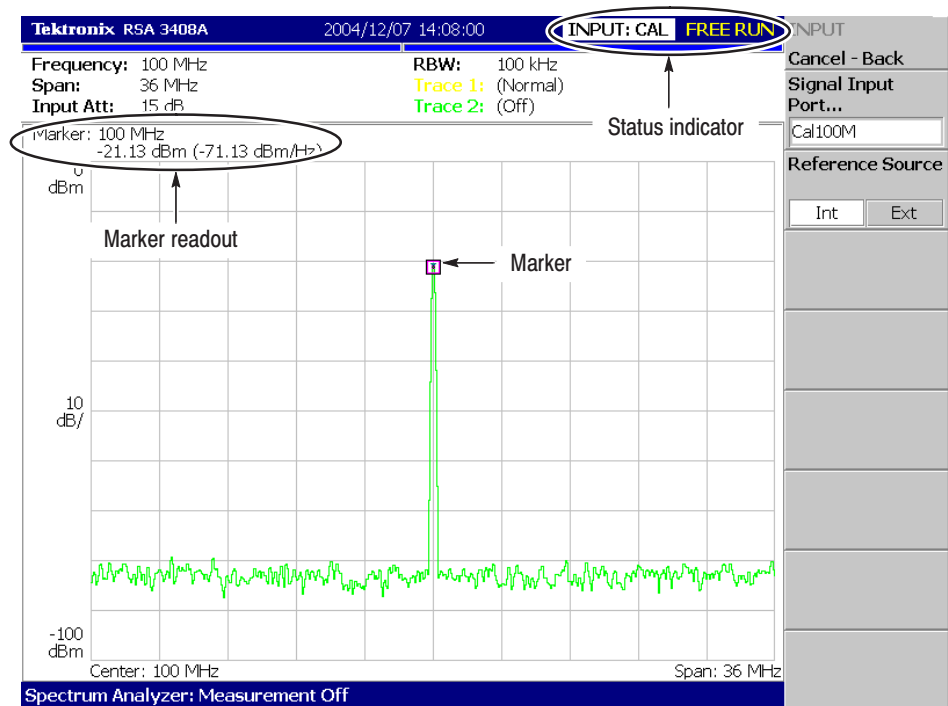


Figure 1-1: Spectrum of the calibration signal (100 MHz, -20 dBm)

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).

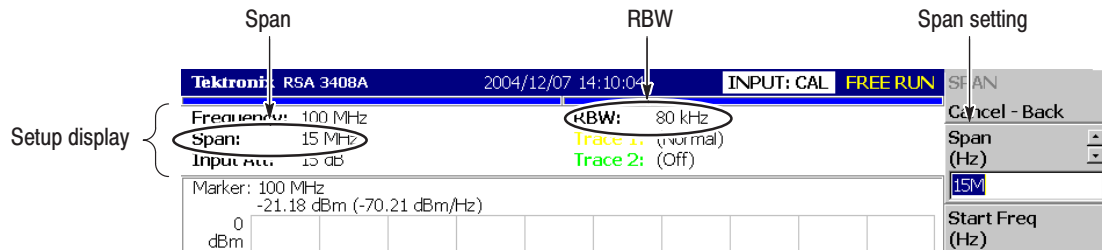


Figure 1-2: Setup display

- 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.)

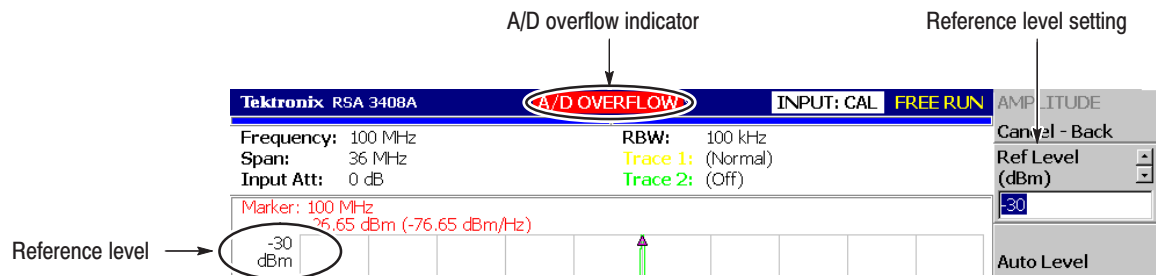


Figure 1-3: Reference level setting and A/D overflow indicator

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).

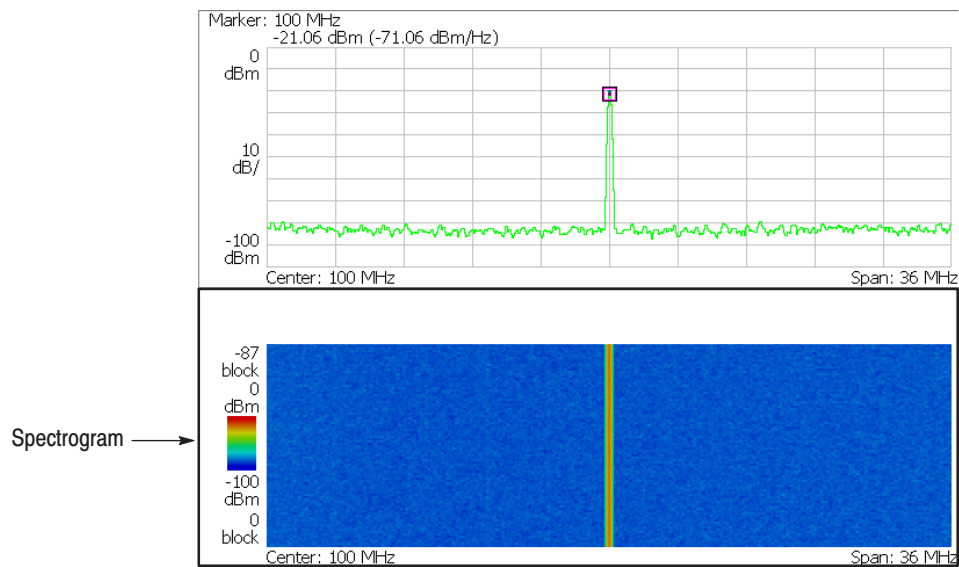


Figure 1-4: Spectrogram display

- 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 may press the **All** side key to run all the tests.
5. Check the result shown in the lower left view with “Pass” or “Fail”.

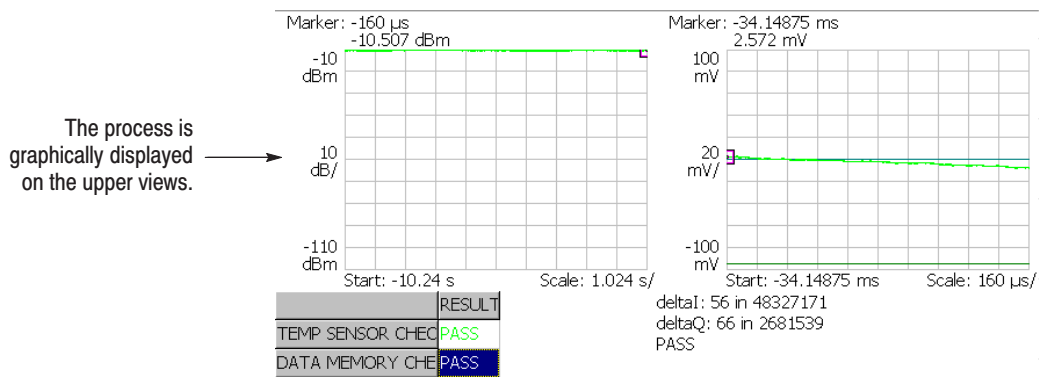


Figure 1–5: Diagnostic screen

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* that start on page 1-1. 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. (The warm-up requirement is usually met in the course of meeting the Brief Procedures prerequisites listed above.)

Equipment Required

These procedures use external, traceable signal sources to directly check warranted characteristics. The required equipment list follows this introduction.

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:

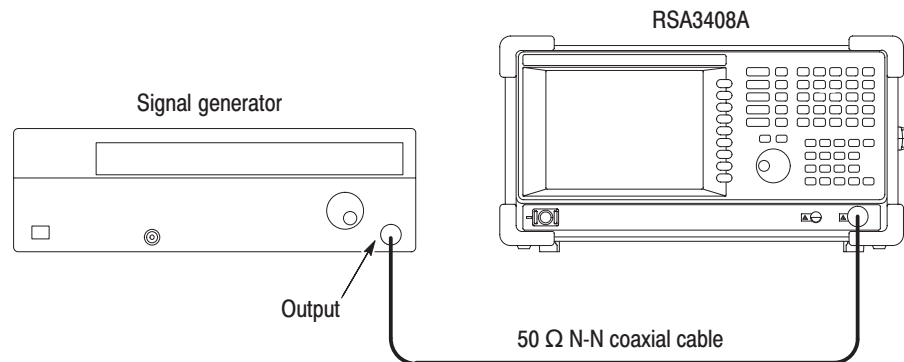
- Press the **SYSTEM** key on the front panel.
- Press the **Reset All to Factory Defaults** side key.

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 figure below.



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.
- Press **MEASURE** → **Carrier Frequency**.
- Read the measurement result at the bottom of the screen. Confirm that the value is 10 MHz \pm 1.2 Hz.

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 1.2 kHz.
- Press **MEASURE** → **Carrier Frequency**.
- Read the measurement result at the bottom of the screen. Confirm that the value is 2 GHz \pm 210 Hz.

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 1.5 kHz.
- Press **MEASURE** \rightarrow **Carrier Frequency**.
- Read the measurement result at the bottom of the screen. Confirm that the value is 5 GHz \pm 510 Hz.

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 1.7 kHz.
- Press **MEASURE** \rightarrow **Carrier Frequency**.
- Read the measurement result at the bottom of the screen. Confirm that the value is 7 GHz \pm 710 Hz.

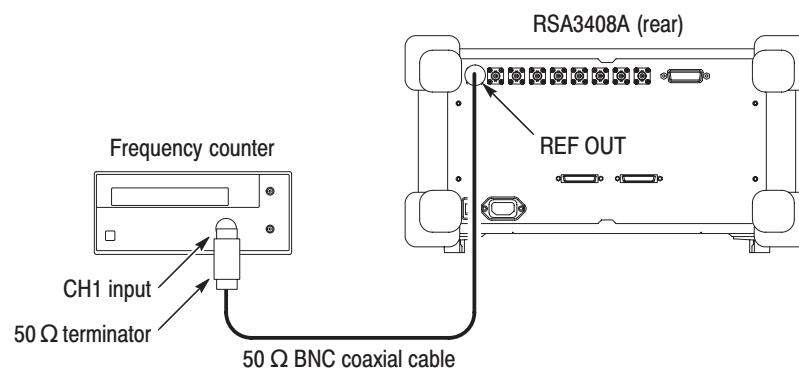
6. *Disconnect the test equipment:* Disconnect the cable at the analyzer input.

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 figure below.

**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 1.2 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:*

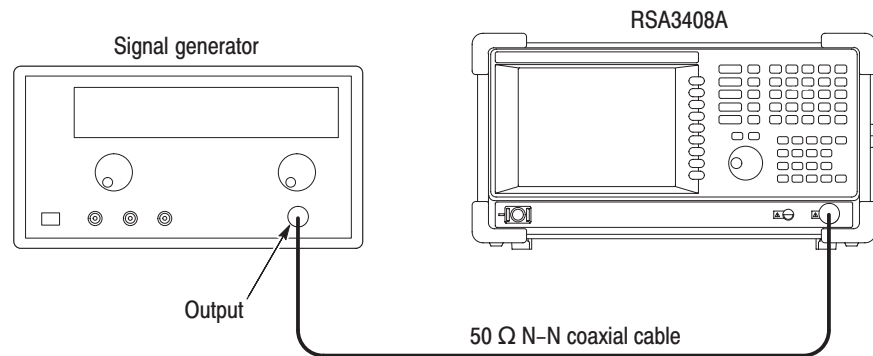
- Press the **AMPLITUDE** key on the front panel
- Press the **RF Atten/Mixer** side key to select **Mixer**.
- With the **Mixer Level** side key, set the level to –10 dBm.
- Press **TRACE/AVG** → **Trace 1 Type...** → **Average**.
- Press the **Number Of Averages** side key and set the value to 50 using 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 figure above on the next page.



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 dBc/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 dBc/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.

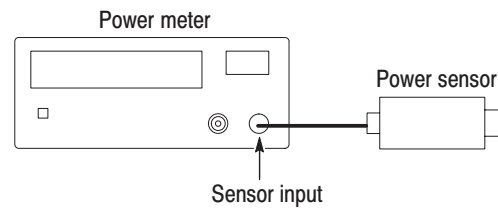
Check Absolute Amplitude Accuracy

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 figure below.



- 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.

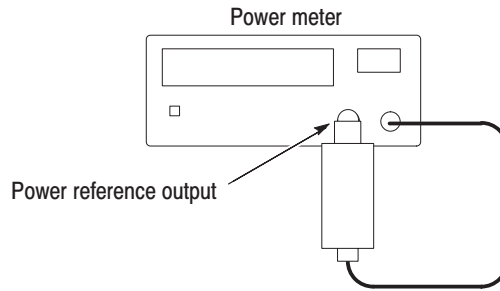


Figure 1-6: Hookup for calibrating the power sensor

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.

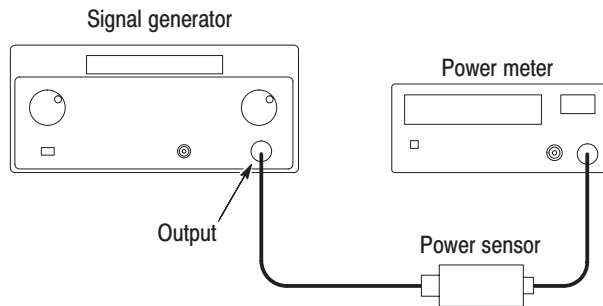


Figure 1-7: Hookup for setting the signal generator output

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.

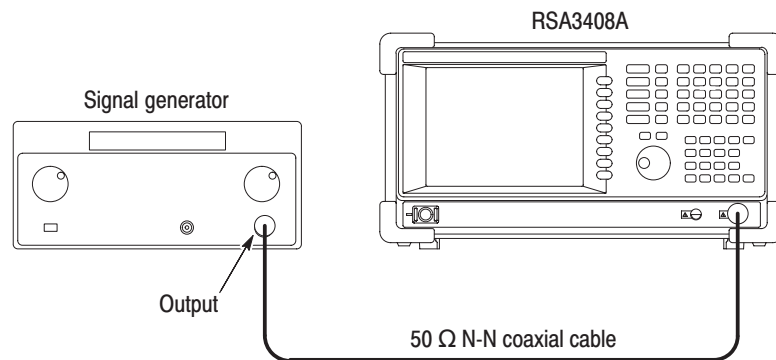


Figure 1–8: Hookup for checking the absolute amplitude accuracy

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.

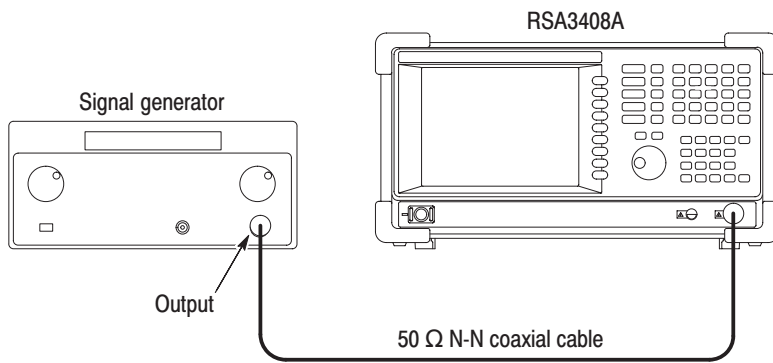
1. Prepare for the test:

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 figure below.



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:*

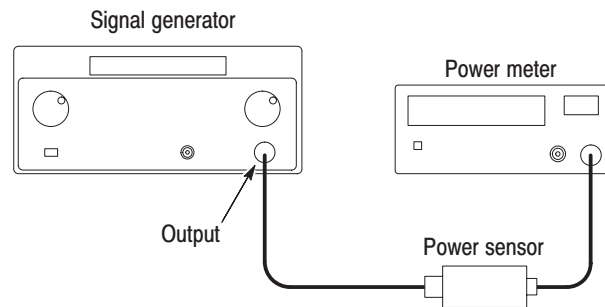
Amplitude -5 dBm

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 figure below.

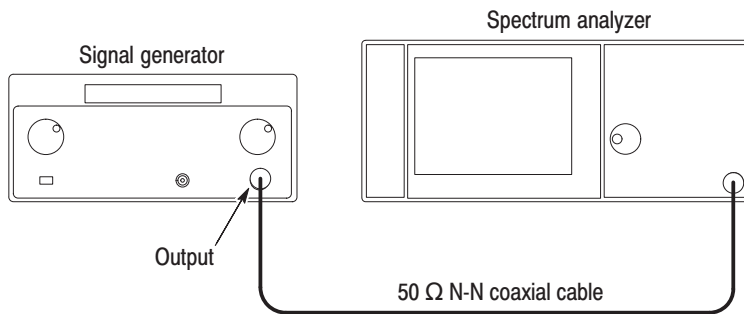


- b. *Set the signal generator controls:*
 - Frequency 100 MHz
 - Level +10 dBm

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 figure below.



- 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 P_{pr} using the marker peak.

c. Modify the spectrum analyzer control:

Reference offset $P_{r4} - P_{pr}$

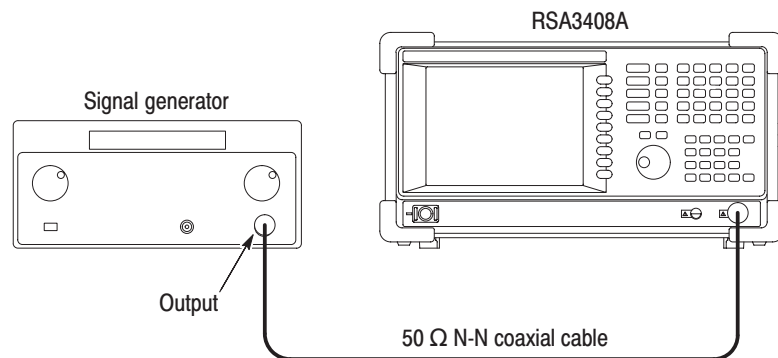
6. Determine the reference power in -40 to -50 dBm:

Set the signal generator amplitude to -40 and -50 dBm to measure the power as P_{r5} and P_{r6} , respectively.

Signal generator amplitude	Reference power
-40 dBm	P_{r5}
-50 dBm	P_{r6}

7. Modify the hookup:

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



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 20 dB

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

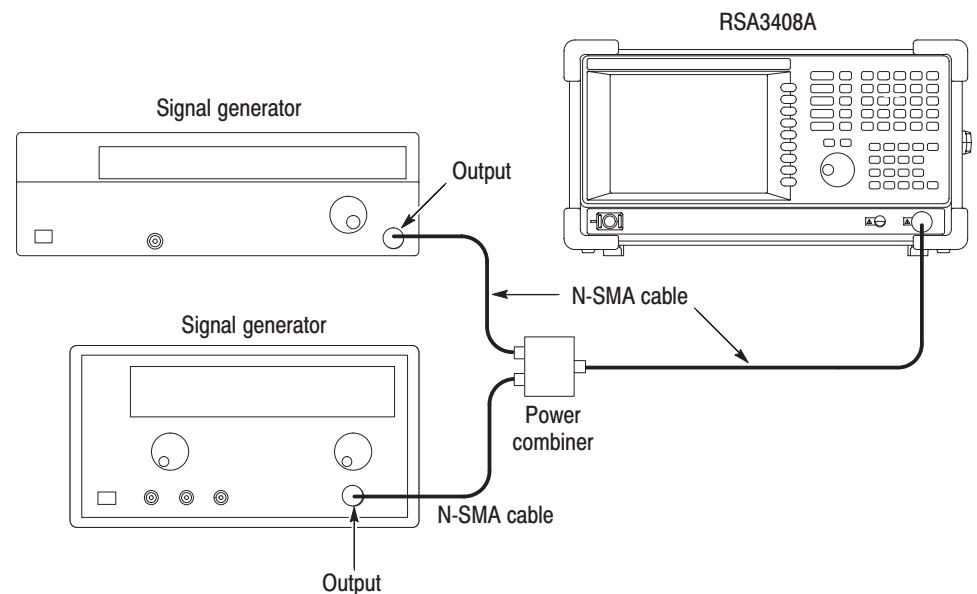
These procedures check the spurious-related characteristics and are listed as checked in Chapter 2, *Specifications*, Table 2–5 on page 2–6.

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 figure below.



- 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:*

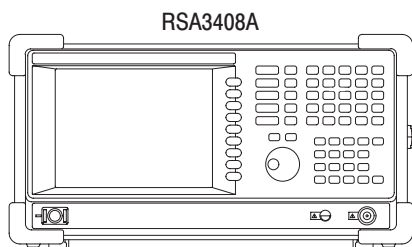
Read the first and the second marker readouts. Confirm that the larger value meets the requirement of -78 dBc.
3. *Disconnect the test equipment:* Disconnect the cable at the analyzer input.

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:*

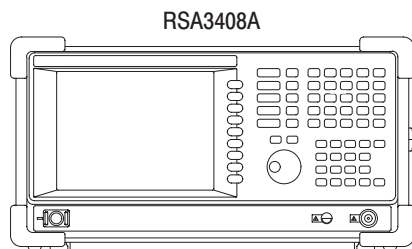
Read the measurement result of Density at the bottom of the screen. Check that the value is -142 dBm/Hz or less.

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:

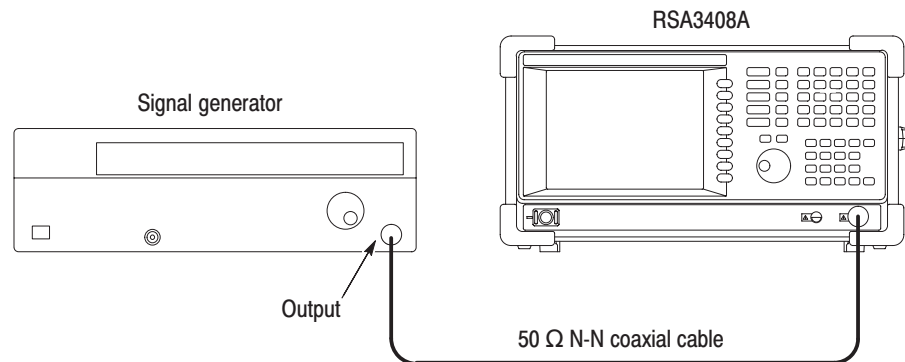
- Press the **SPAN** key on the front panel.
- With the **Span** side key, set the span to 10 MHz using the general purpose knob.
- Press the **RBW/FFT** key on the front panel.
- Press the **RBW/FFT** side key to select **Man**.
- With the **RBW** side key, set the value to 50 kHz using the general 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 figure above on the next page.



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	Measurement	Low limit	Test result	High limit
10 MHz	Marker	9,999 kHz		10,001 kHz
	Carrier frequency meas.	9,999,998.8 Hz		10,000,001.2 Hz
2 GHz	Marker	1,999,998.8 kHz		2,000,001.2 kHz
	Carrier frequency meas.	1,999,999,790 Hz		2,000,000,210 Hz
5 GHz	Marker	4,999,998.5 kHz		5,000,001.5 kHz
	Carrier frequency meas.	4,999,999,490 Hz		5,000,000,510 Hz
7 GHz	Marker	6,999,998.3 kHz		7,000,001.7 kHz
	Carrier frequency meas.	6,999,999,290 Hz		7,000,000,710 Hz

10 MHz reference output test	Low limit	Test result	High limit
Accuracy	9,999,998.8 Hz		10,000,001.2 Hz

Noise sideband test

Span	Offset	Low limit	Test result	High limit
50 kHz	10 kHz	100 dBc/Hz		
500 kHz	100 kHz	112 dBc/Hz		
5 MHz	1 MHz	132 dBc/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 ($P_X - P_{0/1}$)	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 ≥ 10 dB) <1.8 (7.5 GHz, RF attenuation ≥ 10 dB)
<i>Typical</i>	<1.4 (300 kHz to 40 MHz, RF attenuation ≥ 10 dB) <1.3 (40 MHz to 3 GHz, RF attenuation ≥ 10 dB) <1.4 (3 GHz to 8 GHz, RF attenuation ≥ 10 dB)
Maximum input level	
Maximum DC voltage	±0.2 V (RF1 to 3) ±5 V (Baseband) ±5 V (Option 03 IQ input)
Maximum input power	+30 dBm (RF1 to 3, RF attenuation ≥ 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 = 20 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 Mbytes; Option 02: 256 Mbytes

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 (\odot) 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%	100 kHz
	0.5%	1 MHz
	0.5%	4 MHz
	0.7%	10 MHz
	1.2%	20 MHz
Center frequency = 2 GHz	0.5%	100 kHz
	0.5%	1 MHz
	0.5%	4 MHz
	0.7%	10 MHz
	1.2%	20 MHz
Center frequency = 3 GHz	0.5%	100 kHz
	0.5%	1 MHz
	0.5%	4 MHz
	0.7%	10 MHz
	1.2%	20 MHz
Center frequency = 5 GHz	0.9%	100 kHz
	0.5%	1 MHz
	0.7%	4 MHz
	1.3%	10 MHz
	2.0%	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 Mbyte DIMM
OS	Windows XP
System bus	PCI
Storage medium	
Hard disk	≥40 Gbytes, 2.5 inch IDE
Floppy disk	1.44 Mbyte 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)

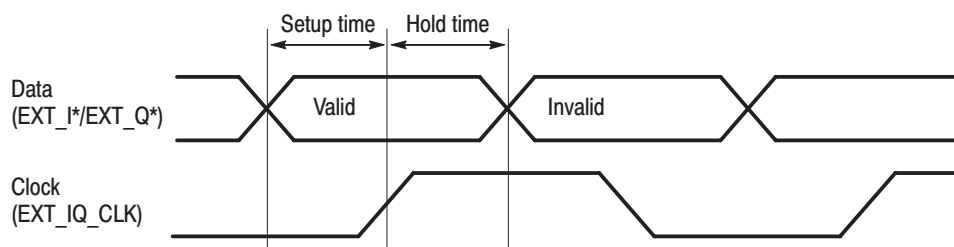


Figure 2-1: Definition of the setup and hold time

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.																
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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.																
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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.														
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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	<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>										
Pollution Degree	<p>A measure of the contaminates 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>										
Safety Certification Compliance	<table border="1"> <tr> <td data-bbox="175 1444 597 1476">Equipment Type</td> <td data-bbox="604 1444 1453 1476">Test and measuring</td> </tr> <tr> <td data-bbox="175 1484 597 1516">Safety Class</td> <td data-bbox="604 1484 1453 1516">Class I (as defined in IEC61010-1) – grounded product</td> </tr> <tr> <td data-bbox="175 1524 597 1556">Operating Temperature Range</td> <td data-bbox="604 1524 1453 1556">+5 to +40 °C</td> </tr> <tr> <td data-bbox="175 1564 597 1596">Overvoltage Category</td> <td data-bbox="604 1564 1453 1596">Overvoltage Category II (as defined in IEC61010-1)</td> </tr> <tr> <td data-bbox="175 1604 597 1635">Pollution Degree</td> <td data-bbox="604 1604 1453 1635">Pollution Degree 2 (as defined in IEC61010-1). Note: Rated for indoor use only.</td> </tr> </table>	Equipment Type	Test and measuring	Safety Class	Class I (as defined in IEC61010-1) – grounded product	Operating Temperature Range	+5 to +40 °C	Overvoltage Category	Overvoltage Category II (as defined in IEC61010-1)	Pollution Degree	Pollution Degree 2 (as defined in IEC61010-1). Note: Rated for indoor use only.
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Pollution Degree	Pollution Degree 2 (as defined in IEC61010-1). Note: Rated for indoor use only.										

Digital IQ Output Connector Pin Assignment (Option 05 Only)

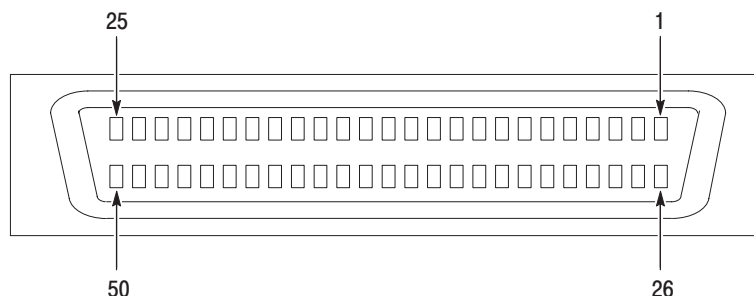


Figure 2-2: Digital IQ output connector pin assignment

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	Ground
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	