

Instrument Messages and Functional Tests

Agilent CSA Spectrum Analyzer

This manual provides documentation for the following instruments:

N1996A-503 (100 kHz to 3 GHz)

N1996A-506 (100 kHz to 6 GHz)



Agilent Technologies

Manufacturing Part Number: N1996-90005

Printed in USA

February 2006

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1 Instrument Messages

Introduction

Error messages are displayed when a particular event triggers them. They appear on the front panel at the bottom of the display. The message will remain until you press the Esc key or another message is displayed in its place. Error messages are also sent to the remote error queue. There are three types of messages.

Errors	Error messages appear when a requested operation has failed. (For example, “Measurement not available”, “No peak found”) Error messages are often generated during remote operation when an invalid programming command has been entered. (For example, “Undefined header”)
Warnings	Warning messages appear when a requested operation has completed successfully but there are modifications and/or side effects. (For example, if you requested too high a stop frequency then “Data out of range” is displayed and the analyzer sets itself to the highest available stop frequency.)
Advisories	Advisory messages tell the front panel user some useful information. (For example, “File saved successfully” or “Making spectrum measurements...”) Advisory messages appear on the display, but they are not logged in the remote error queue.

Sometimes an instrument condition (signals/settings) requires a warning or advisory. These are not single events, but rather are a condition that is detected for a while and then later is cleared. Instrument conditions are annotated on the front panel display. Refer to the front/rear panel descriptions in the Measurement Guide for more details. (An example warning condition might be: an over-range input signal or an external frequency reference unlock. An example of an advisory condition might be too small number of samples per display point for good detection.)

Error Queue

The error queue is viewed/queried and managed remotely.

Remote interface (LAN)	When an error situation is caused by a command sent over a remote interface, the resulting messages are output to the queue for that interface. To return an error, you must query the queue for that interface. An error event that is caused by a front panel action is not reported to any remote interface queue. However, an on-going status condition is usually caused by an internal event and they are reported to the remote error queue.
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Table 1-1. Characteristics of the Error Queue

Characteristic	Remote Interface Error Queue
Capacity (maximum number of messages)	100

Table 1-1. Characteristics of the Error Queue

Characteristic	Remote Interface Error Queue
Overflow Handling	Linear (first-in/first-out) When the queue is full, additional new errors are replaced with the message: “-350, Queue overflow”
Viewing Entries	Send the SCPI query to the desired interface. SYSTem:ERRor?
Clearing the Queue	Send *CLS command to the desired interface. Clears errors in the queue for this particular interface only.

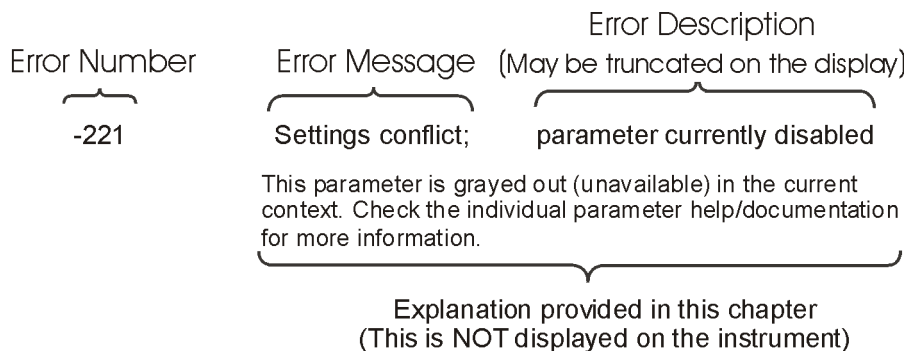
Error Message Format

The error/warning messages are listed in numerical order according to the error message number. Advisories and informational messages do not have numbers and will be listed in alphabetical order.

An explanation is usually included with each error to further clarify its meaning. Some errors are specified in industry standards and there are references to the IEEE Standard 488.2-1992, *IEEE Standard Codes, Formats, Protocols and Common Commands for Use with ANSI / IEEE Std 488.1-1987*. New York, NY, 1992.

Error messages are displayed at the bottom of the screen in the status line. The error number is available in the error queue by querying the remote interface.

Figure 1-1. Error Message Example



pk716b

Error Message Ranges

Events do not generate more than one type of error. For example, an event that generates a query error will not generate a device-specific, execution, or command error.

Advisory Messages (in alphabetical order)
(Message text with no error numbers)

These are advisory types of error messages. They provide useful information about instrument operation.

-400 to -499, Standard SCPI Query Errors

These errors indicate that the analyzer output queue control has detected a problem with the message exchange protocol described in IEEE 488.2, Chapter 6. Errors in this class set the query error bit (bit 2) in the event status register (IEEE 488.2, section 11.5.1). These errors correspond to message exchange protocol errors described in IEEE 488.2, 6.5. In this case:

- Either an attempt is being made to read data from the output queue when no output is either present or pending, or
- Data in the output queue has been lost.

-300 to -399, Standard SCPI Device-Specific Errors

An error number in the range -399 to -300 indicates that the analyzer has detected an error where some device operations did not properly complete, possibly due to an abnormal hardware or firmware condition. This is not a error in response to a SCPI query or command, or command execution. The occurrence of any error in this class will cause the device-specific error bit (bit 3) in the event status register to be set.

-200 to -299, Standard SCPI Execution Errors

These errors indicate that an error has been detected during analyzer execution.

-100 to -199, Standard SCPI Command Errors

These errors indicate that the analyzer parser detected an IEEE 488.2 syntax error. Errors in this class set the command error bit (bit 5) in the event status register (IEEE 488.2, section 11.5.1). In this case:

- Either an IEEE 488.2 syntax error has been detected by the parser (a control-to-device message was received that is in violation of the IEEE 488.2 standard. Possible violations include a data element which violates device listening formats or whose type is unacceptable to the device.), or
- An unrecognized header was received. These include incorrect device-specific headers and incorrect or unimplemented IEEE 488.2 common commands.

101 to 199, Measurement Integrity

Errors with making measurements: triggering, over range, bad acquisition/data, bad settings.

2 Master Error Message List

Advisory Messages (in alphabetical order)

An advisory is simply a message that lets you know something useful - for example “File saved successfully” or “Loading return loss measurement...”. Operation completion and running status indications are common types of advisories. Advisories have no number and are not logged in the error queue.

Message	Description/Correction Information
1-port insertion loss state initialization complete...	The instrument is ready to perform the 1-port insertion loss measurement.
2-port insertion loss state initialization complete	The instrument is ready to perform the 2-port insertion loss measurement.
Adjacent channel state initialization complete	The instrument is ready to perform the adjacent channel power measurement.
Distance to fault state initialization complete	The instrument is ready to perform the distance to fault measurement.
File <filename> saved	The file you named or the file auto-named by the instrument has been saved.
Initializing 1-port insertion loss state...	The instrument is in the process of setting all states required to perform the 1-port insertion loss measurement. Wait until you see a message stating this task is complete.
Initializing 2-port insertion loss state...	The instrument is in the process of setting all states required to perform the 2-port insertion loss measurement. Wait until you see a message stating this task is complete.
Initializing adjacent channel state...	The instrument is in the process of setting all states required to perform the adjacent channel power measurement. Wait until you see a message stating this task is complete.
Initializing distance to fault state...	The instrument is in the process of setting all states required to perform the distance to fault measurement. Wait until you see a message stating this task is complete.
Initializing power supply monitor	The instrument is in the process of setting all states required to monitor the power supply. Wait until you see a message stating this task is complete.

Message	Description/Correction Information
Initializing power supply state...	The instrument is in the process of setting all states required for the power supply. Wait until you see a message stating this task is complete.
Initializing return loss state...	The instrument is in the process of setting all states required to perform the return loss measurement. Wait until you see a message stating this task is complete.
Initializing spectrum analyzer state...	The instrument is in the process of setting all states required to perform spectrum analysis measurements. Wait until you see a message stating this task is complete.
Initializing time and frequency reference settings	The instrument is in the process of setting time and frequency references. Wait until you see a message stating this task is complete.
Initializing time and frequency state...	The instrument is in the process of setting all states required to perform measurements involving time and frequency. Wait until you see a message stating this task is complete.
Loading 1-port insertion loss measurement...	You have selected the 1-port insertion loss measurement. The instrument is preparing to make this measurement.
Loading 2-port insertion loss state...	You have selected the 2-port insertion loss measurement. The instrument is preparing to make this measurement.
Loading adjacent channel measurement...	You have selected the adjacent channel power measurement. The instrument is preparing to make this measurement.
Loading distance to fault measurement...	You have selected the distance to fault measurement. The instrument is preparing to make this measurement.
Loading return loss measurement...	You have selected the return loss measurement. The instrument is preparing to make this measurement.
Loading spectrum analyzer measurement...	You have selected the spectrum analyzer measurement. The instrument is preparing to make this measurement.
Make calibration connections then press continue	Follow the instructions in the calibration diagram. Press Cont in the menu keys.

Master Error Message List
 Advisory Messages (in alphabetical order)

Message	Description/Correction Information
Making a single 1-port insertion loss measurement and pausing...	The instrument is performing the 1-port insertion loss measurement one time and then is waiting for you to press Cont , Single , or to select another measurement.
Making a single adjacent channel measurement and pausing...	The instrument is performing the adjacent channel power measurement one time and is then waiting for you to press Cont , Single , or to select another measurement.
Making a single distance to fault measurement and pausing...	The instrument is performing the distance to fault measurement one time and is then waiting for you to press Cont , Single , or to select another measurement.
Making a single return loss measurement and pausing...	The instrument is performing the return loss measurement one time and is then waiting for you to press Cont , Single , or to select another measurement.
Making a single spectrum measurement and pausing...	The instrument is performing a spectrum analyzer measurement one time and is then waiting for you to press Cont , Single , or to select another measurement.
Paused, press Cont or Single to continue	The instrument has stopped making any measurements. Press Cont or Single from the front-panel keys to start the measurement again.
Performing calibration...	The instrument is in the process of calibrating. Wait until you see the calibration is complete message before pressing another key.
Power supply state initialization complete...	The instrument is ready to make measurements.
Preamp Gain is not available in this Mode	Preamp Gain function is not available in some of the optional measurement Modes.
Preset, recalling power up state: <Powerup>	The instrument is setting all functions to those states you set when you saved your "Powerup" user state or the "Powerup" state set at the factory.
Prototype firmware version <string>	You are running a pre-release version of the firmware.
Recalled file <filename>	A previously saved file is now available for use.

Message	Description/Correction Information
Recalling state: <state name>	The specified state you saved is being recalled.
Reporting power supply monitor readings	Information about the power supply is displayed.
Reporting power supply monitor readings and pausing...	Information about the power supply is reported and the instrument is waiting for your next command.
Reporting time and frequency reference settings	The settings for the time and frequency reference are displayed.
Reporting time and frequency reference settings and pausing...	The settings for the time and frequency reference are displayed and the instrument is waiting for your next command.
Return loss state initialization complete	The instrument is ready to perform the return loss measurement.
Setting noise correction On sets sensitivity to Low	Noise Correction (On) and Sensitivity (High) are mutually exclusive settings. Setting the value of one has forced the other to change state.
Setting sensitivity to High sets noise correction Off.	Sensitivity (High) and Noise Correction (On) are mutually exclusive. Setting the value of one has forced the other to change state.
Spectrum analyzer state initialization complete	The instrument is ready to perform spectrum analysis measurements.
Time and frequency state initialization complete	The time and frequency reference monitor is now operating.
<Time source> active, ignoring time/date set to:<time/date setting>	The time source (usually GPS) is active. The previous setting for the time/date is being ignored.
Updated <device> firmware from <previous firmware revision number> to <new firmware revision number>	Firmware revision update is complete.
Updating firmware for <device> from <previous firmware revision number> to <new firmware revision number>	Firmware revision is updating.
Waiting for start up initialization to complete...	The instrument is preparing to make measurements. Wait until you see the message stating initialization is complete before selecting a measurement.

-400 to -499, Standard SCPI Query Errors

Err#	Message	Verbose/Correction Information
-400	Query Error	There was a problem with a query command. The exact problem cannot be specifically identified.
-410	Query INTERRUPTED	Some condition caused an INTERRUPTED query to occur. For example, a query was followed by DAB or GET before a response was completely sent.
-420	Query UNTERMINATED	Some condition caused an UNTERMINATED query to occur. For example, the device was addressed to talk and an incomplete program message was received.
-430	Query DEADLOCKED	Some condition caused a DEADLOCKED query to occur. For example, both the input buffer and the output buffer are full and the analyzer cannot continue. The analyzer automatically discards output to correct the deadlock.
-440	Query UNTERMINATED after indefinite response	A query was received in the same program message after a query requesting an indefinite response was executed.

-300 to -399, Standard SCPI Device-Specific Errors

Err#	Message	Verbose/Correction Information
-300	Device-specific error	An instrument error occurred and the exact problem cannot be specifically identified. Report this error to the nearest Agilent Technologies sales or service office.
-310	System error; Could not access the license file Missing a required option, please install one of <frequency range option (506 or 503)> Option <frequency range option (506 or 503)> is missing a valid license key Option <frequency range option 506 or 503> is missing from the DIF board	An internal system-type error has occurred. The exact problem cannot be specifically identified. Report this error to the nearest Agilent Technologies sales or service office. There was a problem trying to access the license file. Options in the file will not be enabled. One of these options must be installed for proper operation. You have the option on the DIF board, but you must have a valid license key in the license file as well. The option is valid in the license file, but you must have the option on the DIF board as well.
-311	Memory error	There is a physical problem with the instrument memory, such as a parity error.
-312	PUD memory lost	Protected user data saved by the *PUD command has been lost.
-313	Calibration memory lost	The nonvolatile calibration data used by the *CAL? command has been lost.
-314	Save/recall memory lost	The nonvolatile data saved by the *SAV? command has been lost.
-315	Configuration memory lost	The nonvolatile configuration data saved by the instrument has been lost.
-320	Storage fault	A problem was found while using data storage. The error is not an indication of physical damage or failure of any mass storage element.

Master Error Message List
 -300 to -399, Standard SCPI Device-Specific Errors

Err#	Message	Verbose/Correction Information
-321	Out of memory	An internal operation needed more memory than was available. Report this error to the nearest Agilent Technologies sales or service office.
-330	Self-test failed;	A self-test failure occurred. Report this error to the nearest Agilent Technologies sales or service office.
-340	Calibration failed	The instrument requires alignment.
-350	Queue overflow	An error occurred that did not get put in the error queue because the queue was full.
-360	Communication error	There was a problem with instrument remote communications. The exact problem cannot be specifically identified.
-361	Parity error in program message	A parity bit was not correct when the data was received.
-362	Framing error in program message	A stop bit was not detected when data was received. For example, on a remote bus port.
-363	Input buffer overrun	A software or hardware input buffer on a port overflowed with data because of improper or nonexistent pacing.
-365	Time out error	There was a time-out problem in the instrument. The exact problem cannot be specifically identified.

-200 to -299, Standard SCPI Execution Errors

Err#	Message	Verbose/Correction Information
-220	Execution error;No peak found	No signal peak was found within the defined parameters of the search.
-221	Settings conflict; Feature is not supported for the current measurement. Sweep Time cannot be set while in FFT sweeps Trigger is not available with spans > 0 Hz.	A legal command was received but it could not be executed due to the current device state. Some functionality is available in one measurement, but not in another. (See the measurements under the Meas key.) This error occurs if you send a SCPI command or push a gray-out key that is not available in the current selected measurement. For examples, see the Trigger section. The sweep time for FFT sweeps is set by the calculations. It cannot be manually controlled. Trigger is only available in zero span.
-222	Data out of range; Clipped to the lower limit Clipped to the upper/higher limit	A data element was found but the instrument could not be set to that value because it was outside the range defined for the command. You tried to set the span to a value that is outside the maximum allowable span of the instrument.
-241	Hardware missing; Option not installed	The optional hardware is not installed.
-256	File name not found; File <filename>	A legal command or query could not be executed because the file name was not found in the specified location. The file is missing or empty.
-257	File name error; Allowable extensions are .trc or .xls Allowable extension is .png Allowable extension is .sta	A legal command or query could not be executed because there was an error with the file name on the device media. For example, maybe you tried to copy to a duplicate file name or the name you selected is too long. You are using the wrong type of file extension for the current data file type.

-100 to -199, Standard SCPI Command Errors

Err#	Message	Verbose/Correction Information
-109	Missing parameter	Fewer parameters were received than what is required for this command.
-120	Numeric data error; Value not supported	An error was found in a data element that appears to be numeric. The exact problem cannot be identified. The value you entered is outside the allowable parameters of this function.

101 to 199, Measurement Integrity

Errors with making measurements: triggering, over range, bad acquisition/data, bad settings.

Err#	Message	Verbose/Correction Information
103	Measurement not available	The measurement you have requested is not a measurement available in the mode you currently have set. You can request a different measurement. Or, if you want to run the requested measurement, you must change the mode setting to a mode that includes the requested measurement. Use the INSTRUMENT[:SElect] command to set the correct mode. To verify the measurements available in a mode, refer to the User's and Programmer's Reference Guide.

Master Error Message List
101 to 199, Measurement Integrity

3 Functional Tests

What You Will Find in This Chapter

This chapter describes the functional tests and provides information on how to perform them.

What Are the Functional Tests?

Functional tests are tests of various instrument parameters that give a high degree of confidence that the analyzer is operating correctly. They are recommended as a check of analyzer operation for incoming inspection or after a repair. Measurement uncertainty analysis is not available for functional tests, and the analyzer is checked against limits that are wider than the published specifications. The functional tests are designed to test an analyzer operating within the temperature range defined by the analyzer specifications using a minimum set of test equipment. If a test does not pass, performance tests must be run to confirm a problem exists.

Functional Test Versus Performance Verification

Functional tests use a minimum set of test equipment to check a much smaller range of parameters (and a limited number of data points for each parameter) than do performance verification tests. Functional tests use limits that are wider than the published specifications; measurement uncertainty analysis is *not* available for functional tests.

NOTE If a functional test does not pass, you must run performance verification tests to confirm that a problem exists.

Performance verification tests span a wide range of instrument parameters and provide the highest level of confidence that the instrument conforms to published specifications. These tests can be time consuming and require extensive test equipment.

This chapter includes the following:

- “[Before Performing a Functional Test](#)” on page 23 (what to do first).
- “[Test Equipment](#)” on page 24 (a list of the equipment required for *all* of the tests).
- Functional Tests:
 - “[Displayed Average Noise Level \(DANL\)](#)” on page 26
 - “[Frequency Response \(Flatness\)](#)” on page 29

Each functional test includes:

- Test limits (pass/fail criteria)
- A description of the test
- The equipment required for the test
- A figure showing how to connect the equipment
- Step-by-step instructions
- One or more tables in which to record the measurement results

Before Performing a Functional Test

1. Ensure that you have the proper test equipment.
2. Switch on the unit under test (UUT) and let it warm up for 30 minutes.
3. Allow sufficient warm-up time for the required test equipment (refer to individual instrument documentation for warm-up specifications).
4. Ensure that the analyzer's frequency reference is set to Internal:
 - a. Press **System**.
 - b. If the **Freq/Time/Ref** menu key does *not* indicate Int Ref, press **Freq/Time/Ref** menu key.
 - c. Using the up and down arrow navigation keys, highlight Internal Reference.
 - d. Press **Select**.

NOTE Functional test accuracy depends on the precision of the test equipment used. Ensure that all of the test equipment is calibrated before running a functional test.

Test Equipment

The table below summarizes the test equipment needed to perform all of the functional tests. Alternate equipment model numbers are given in case the recommended equipment is not available.

If neither the recommended nor the alternative test equipment are available, substitute equipment that meets or exceeds the critical specifications listed.

Item	Critical Specifications	Recommended Agilent Model	Alternate Agilent Model
Adapters			
Type N(m) to Type N(m)	<i>Frequency:</i> 10 MHz to 6 GHz <i>VSWR:</i> 1.08:1	1250-1742	
Type N(f) to 3.5 mm(f) (for use with 20 GHz or 26.5 GHz source)	<i>Frequency:</i> 10 MHz to 6 GHz <i>VSWR:</i> 1.08:1	1250-1745	
Type N(f) to 2.4 mm(f) (for use with >26.5 GHz source)	<i>Frequency:</i> 10 MHz to 6 GHz <i>VSWR:</i> ≤1.08:1	11903B	
Cables			
Type N(m) to Type N(m), ≤36 inches long	<i>Frequency:</i> 10 MHz to 6 GHz <i>VSWR:</i> 1.4:1	11500B	
Cable, BNC(m) to BNC(m), ≥36 inches long	<i>Frequency:</i> 10 MHz nominal	10503	
Signal Source			
Synthesized Sweeper (if 8665B, ESG or PSG is not available)	<i>Frequency Range:</i> 10 MHz to 6 GHz <i>Power Level:</i> -10 to +5 dBm	83620A/B, 83630A/B, 83640A/B, 83650A/B	
Synthesized Signal Generator (if 8360-Series sweeper is not used)	<i>Frequency Range:</i> 10 MHz to 6 GHz <i>Power Level:</i> -10 to +5 dBm	8665B, E8257D, E8267D, or E4438C Opt 506	
Miscellaneous Equipment			
Power Meter	Compatible with power sensor	E4419A/B	
Power Sensor	<i>Frequency Range:</i> 10 MHz to 6 GHz <i>VSWR:</i> ≤1.13:1 <i>Cal Factor Uncertainty:</i> <2.3% <i>Linearity Uncertainty:</i> 0% at levels <10 dBm	8481A	

Item	Critical Specifications	Recommended Agilent Model	Alternate Agilent Model
Power Splitter	<i>Frequency Range:</i> 10 MHz to 6 GHz <i>Output VSWR</i> 10 MHz to 4 GHz: $\leq 1.10:1$ 4 GHz to 6 GHz: $<1.20:1$ <i>Output Tracking</i> 10 MHz to 4 GHz: <0.15 dB 4 GHz to 6 GHz: <0.20 dB	11667A	
Termination	50 Ω Type-N(m) Frequency: 100 kHz to 6 GHz	909A Option 012	

Displayed Average Noise Level (DANL)

Test Limits (with 0 dB input attenuation)

See [Table 3-1](#). for values.

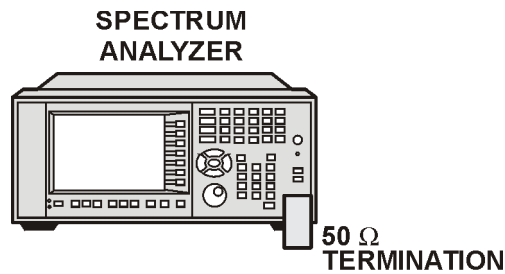
Test Description

The Displayed Average Noise Level (DANL) of the spectrum analyzer is measured within the specified frequency ranges. The analyzer input is terminated into a 50Ω load. The device under test (DUT) is placed in a narrow span. 100 sweeps are averaged, and the marker is used to measure the trace amplitude at the center frequency. A test is performed to assure the measurement is not performed in the presence of a residual response. If a residual response exists, the marker is moved to ensure that the noise level, and not the residual amplitude, is being measured.

This test is performed on all analyzers with the preamp (if available) turned off.

Item	Critical Specifications (for this test)	Recommended Agilent Model
Termination	50Ω Type-N(m) Frequency: 100 kHz to 6 GHz	909A Option 012

Figure 3-1. DANL Test Setup



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Procedure

1. Connect the 50 Ω termination to RF input of the analyzer, as shown in [Figure 3-1](#).
2. Press **Mode Preset** (restore factory preset values) on the analyzer.
3. Set up the spectrum analyzer by pressing:
 - FREQ**, Center Frequency, 50, MHz
 - Span**, 1, kHz
 - AMPTD**, Ref Level, -70, dBm

AMPTD, Elec Atten, 0, dB
BW, Res BW, 10, Hz
Meas Setup, Avg Number, 100, Enter
Avg Type, Log-Pwr Avg (Video)
Average, Repeat
Trace/Detector, Trace Type, Average

4. Press **Single**, and wait until the message “Paused, press Cont or Single to continue” is displayed at the bottom of the screen.
5. Press **Marker, Normal**. If necessary, use the knob to move the marker away from any residual response. A residual response is a false signal that may appear on screen without any signals being applied to the analyzer input.
6. Record the marker amplitude value in the DANL column of [Table 3-1](#). for 50 MHz.
7. Press **Marker, Off**.
8. Set the analyzer center frequency to the next frequency listed in [Table 3-1](#).
9. Press **Single**, and wait until the message “Paused, press Cont or Single to continue” is displayed at the bottom of the screen.
10. Press **Marker, Normal**. If necessary, use the knob to move the marker away from any residual response. A residual response is a false signal that may appear on screen without any signals being applied to the analyzer input.
11. Record the marker amplitude value in the DANL column of [Table 3-1](#). for the current center frequency.
12. Press **Marker, Off**.
13. For analyzers with Opt 503, repeat [step 8](#) through [step 12](#) for center frequencies up to 3 GHz listed in [Table 3-1](#).
14. For analyzers with Opt 506, repeat [step 8](#) through [step 12](#) for all center frequencies listed in [Table 3-1](#).

15. The DANL values recorded should be less than the Test Limits listed in [Table 3-1](#).

Table 3-1. Displayed Average Noise Level (DANL) Results

Center Frequency (MHz)	Displayed Average Noise Level (dBm)	Test Limits (dBm)
Option 503 and 506		
50		-123.60
1000		-120.0
2000		-116.21
3000		-120.99
Option 506		
3050		-120.82
4000		-117.52
5000		-114.25
6000		-110.88

Frequency Response (Flatness)

Test Limits

See [Table 3-2](#). for values.

Test Description

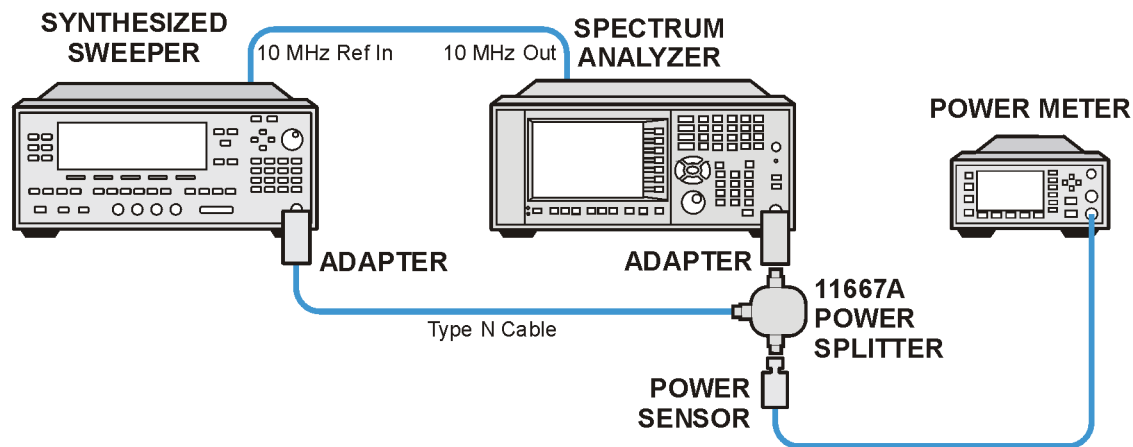
The frequency response test measures the spectrum analyzer amplitude deviation from the reference value at 50 MHz. The output of a source is fed through a power splitter to a power sensor and the analyzer. The signal source amplitude is measured with a power meter to eliminate error due to source flatness. The frequency response is measured from 10 MHz to either 3 GHz or 6 GHz, depending on the maximum frequency range of your analyzer.

To measure frequency response, the source power level is adjusted at 50 MHz to place the displayed signal approximately two divisions below the reference level. The analyzer marker amplitude and the power meter power level are recorded. This process is repeated at each new source frequency and analyzer center frequency, and all measurements are normalized to the measurement made at 50 MHz.

Item	Critical Specifications (for this test)	Recommended Agilent Model
Adaptor, Type N(m) to Type N(m)	<i>Frequency:</i> 10 MHz to 6 GHz <i>VSWR:</i> ≤1.08:1	1250-1472
Adaptor, Type N(f) to 3.5 mm(f) (for use with 20 GHz or 26.5 GHz source)	<i>Frequency:</i> 10 MHz to 6 GHz <i>VSWR:</i> ≤1.08:1	1250-1745
Adaptor, Type N(f) to 2.4 mm(f) (for use with >26.5 GHz source)	<i>Frequency:</i> 10 MHz to 6 GHz <i>VSWR:</i> ≤1.08:1	11903B
Cable, Type N(m) to Type N(m), ≥36 inches long	<i>Frequency:</i> 10 MHz to 6 GHz <i>VSWR:</i> ≤1.4:1	11500B
Cable, BNC (m) to BNC (m), ≥36 inches long	<i>Frequency:</i> 10 MHz nominal	10503
Power Meter	Compatible with power sensor	E4419A/B
Power Sensor	<i>Frequency Range:</i> 10 MHz to 6 GHz <i>VSWR:</i> ≤1.13:1 <i>Cal Factor Uncertainty:</i> <2.3% <i>Linearity Uncertainty:</i> 0% at levels <10 dBm	8481A

Item	Critical Specifications (for this test)	Recommended Agilent Model
Power Splitter	<i>Frequency Range:</i> 10 MHz to 6 GHz <i>Output VSWR</i> 10 MHz to 4 GHz: $\leq 1.10:1$ 4 GHz to 6 GHz: $\leq 1.20:1$ <i>Output Tracking</i> 10 MHz to 4 GHz: ≤ 0.15 dB 4 GHz to 6 GHz: ≤ 0.20 dB	11667A
Synthesized Sweeper (if 8665B, ESG or PSG is not available)	<i>Frequency Range:</i> 10 MHz to 6 GHz <i>Power Level:</i> -10 to +5 dBm	83620A/B, 83630A/B, 83640A/B, 83650A/B
Synthesized Signal Generator (if 8360-Series sweeper is not used)	<i>Frequency Range:</i> 10 MHz to 6 GHz <i>Power Level:</i> -10 to +5 dBm	8665B, E8257D, E8267D, or E4438C Opt 506

Figure 3-2. Frequency Response Test Setup



ee83a

Procedure

10 MHz to 3 or 6 GHz Frequency Response

1. Zero and calibrate the power meter and power sensor as described in the power meter operation manual.
2. Configure the equipment as shown in [Figure 3-2](#).

NOTE Connect the power splitter to the spectrum analyzer input using the appropriate adapter. Do not use a cable.

3. Press **Mode Preset** on the analyzer.

4. Set up the spectrum analyzer by pressing:

FREQ, Center Freq, 50, MHz
CF Step, 50, MHz
Span, 100, kHz
AMPTD, Ref Level, -8, dBm
AMPTD, Elec Atten, 10, dB
Scale /Div, 1, dB
BW, Res BW, 1, kHz

5. Preset the source and set the source controls as follows:

FREQUENCY, CW, 50, MHz
AMPLITUDE, -4, dBm

6. On the power meter, enter the power sensor's cal factor for 50 MHz.

7. Adjust the source output power for a power meter display of $-10 \text{ dBm} \pm 0.1 \text{ dB}$.

NOTE The power level of the source remains unchanged for the duration of the test.

8. Press the **Peak Search** key on the signal analyzer to position the marker on the peak of the signal.

9. Record the power meter reading in the Power Meter Amplitude column of Table 1 for the 50 MHz Center Frequency.

10. Calculate the frequency response error at 50 MHz using the following equation and record the results in the Frequency Response Error column of Table 1:

$$\text{Meas Error} = \text{Meas Amp} - \text{Power Meter}$$

11. Perform the following steps for each Center Frequency listed in [Table 3-2](#). (stop at 3 GHz for analyzers with Opt 503):

- a. Tune the source to the frequency listed in the Center Frequency column.
- b. Enter the power sensor cal factor for the new test frequency.
- c. Tune the analyzer center frequency to the new test frequency
- d. Press Peak Search on the analyzer.
- e. Enter the power meter reading in the Power Meter Amplitude column
- f. Enter the analyzer marker amplitude reading in the Analyzer Amplitude column.

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g. Compute the frequency response error using the following equation and record the results in the Frequency Response Error column:

$$\text{Meas Error} = \text{Meas Amp} - \text{Power Meter}$$

12. In **Table 3-2.**, normalize the frequency response to the value at 50 MHz by subtracting the frequency response error at 50 MHz from the frequency response error at all other frequencies listed and record the amplitude in the column labeled, “Normalized Frequency Response”. For example, if the frequency response at 500 MHz is 0.13 dB, and the frequency response at 50 MHz is 0.04 dB, the normalized frequency response would be 0.09 dB (0.13 - 0.04)

13. The frequency response functional test is completed.

Table 3-2. Frequency Response Results 10 MHz to 3 GHz or 6 GHz

Center Frequency (MHz)	Analyzer Amplitude Meas Amp (dBm)	Power Meter Measurement Power Meter (dBm)	Frequency Response Error Meas Error (dB)	Normalized Frequency Response (dB)	Frequency Response Error Test Limits (dB)
Option 503 and 506					
50				0.0 (Ref)	0.0 (Ref)
10					±.78
250					±.78
500					±.78
1000					±.78
1500					±1.13
2000					±1.13
2500					±1.13
3000					±1.45
Option 506					
3500					±1.85
4000					±1.85
4500					±1.85
5000					±1.85
5500					±1.85
6000					±1.85

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