Agilent N9330A Handheld Cable & Antenna Tester

User's Guide

Agilent Technologies

Notices

Manual Part Number

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Software Revision

This guide is valid for A.01.00 revisions of the Agilent N9330A Handheld Cable & Antenna Tester firmware.

CAUTION

A **CAUTION** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a **CAUTION** notice until the indicated conditions are fully understood and met.

WARNING

A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

Warranty

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Agilent N9330A
Handheld Cable & Antenna Tester

1

Overview

Introduction

Agilent has designed the N9330A handheld cable and antenna tester (25 MHz to 4 GHz) to simplify the job of installing and maintaining cable and antenna systems. In addition to measuring SWR, Return Loss and Cable Loss, the N9330A also performs Distance-to-Fault (DTF) measurements that assist in determining cable defect locations, It is also useful in identifying maintenance necessary to maintain peak performance of your cable and antenna systems.

Basic measurement functionality

Basic measurement functionality of the N9330A includes:

- SWR
- Return loss
- Cable loss
- DTF (SWR and return loss)

Optimized usabilities

The Agilent N9330A has the following features:

- 7.2 inch sunlight-viewable display enables you to read the screen easily and clearly under high light levels.
- Rechargeable lithium-ion battery supports a minimum of four hours continuous operation when fully charged.
- Arc-shaped handles and a rugged rubber casing ensure a comfortable and firm hold.
- Auto file naming makes editing file names fast and easy.
- USB interface for easy and fast file saving to PC or memory stick.
- User definable power saving mode.

Front Panel Overview
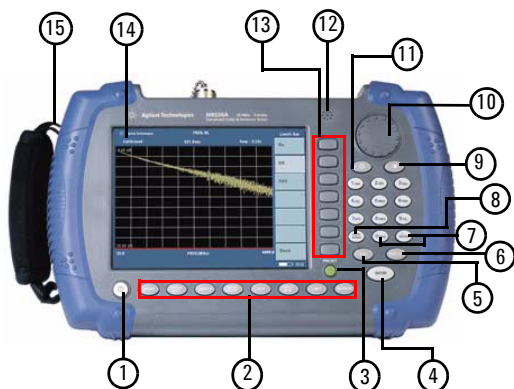
	Caption	Brief Description
1	Standby switch	Turns the tester On or Off
2	Function hardkeys	Including hardkeys: Mode, FREQ/DIST, AMPTD, MEAS/VIEW, SYS, Hold/Run, Limit and Marker
3	Preset hardkey	Returns the tester to a known state
4	Enter hardkey	Confirms a selection or configuration
5	CAL hardkey	Enters a calibration procedure
6	ESC/CLR hardkey	Escapes from a procedure or clears characters or numbers
7	Save and Recall keys	For file operation
8	Auto scale hardkey	Sets the amplitude borders automatically
9	Contrast hardkey	Adjusts the screen contrast
10	Knob	Selects an option or edits a number
11	Brightness hardkey	Adjusts the screen brightness
12	Buzzer	Beeps differently on different actions
13	Softkeys	Indicates current menu functions
14	Screen	Displays measured traces and status
15	Strap handle	For hand carry

Top Panel Overview
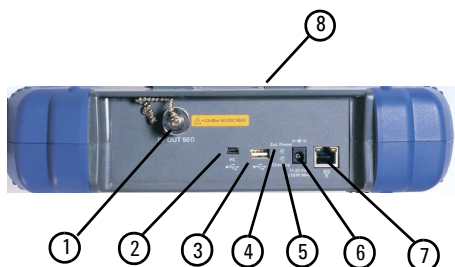
	Caption	**Brief Description**
1	RF Output Connector (N-type)	Outputs swept signal to DUT
2	USB interface Type B (Device)	Connects to a PC
3	USB interface Type A (Host)	Connects to a USB memory stick
4	LED indicator	Lights (On) when external DC power is connected to the tester
5	LED indicator (Charging)	Lights (On) when the battery is charging
6	External DC power connector	Connects to external DC power, for use with either the AC-DC charger-adapter or automotive 12V DC adapter
7	LAN interface	Reserved for future expansion
8	Tilt Stand (rear of instrument)	Allows user to lean instrument back for better viewing when placed on flat surface

Working with Batteries

Always use the original battery type, as supplied with the tester.

Installing a Battery

| CAUTION | Insert a battery with the correct polarity orientation. |

	Step	Notes
1	Open the battery cover	Use a phillips type screwdriver, loosen the retaining screw, then pull the battery cover open.
2	Insert the battery	Observe correct battery polarity orientation when installing.
3	Close the battery cover	Push the cover closed, then re-fasten the cover with the retaining screw.

Viewing Battery Status

Determine the battery status in either of the following methods:

- Check the battery icon in the lower right corner of the front panel screen: it indicates the approximate level of charge.
- Press **[SYS] > {More} > {Status}** to check the current battery voltage.

Charging a Battery

You should only charge the battery when it is installed in the tester.

CAUTION   Never use an incorrect, modified, or damaged charger.

Internal Charging

You may recharge the battery in the N9330A while the tester is operating or when it is turned off.

1 Install the battery in the tester

2 Attach the correct AC/DC adapter and switch external power on.

3 The green LED indicating external power and charging status lights should turn on, indicating that the battery is charging.

When the battery is fully charged, the green charging LED turns off.

The charging time for a fully depleted battery, is approximately four hours.

2

Getting Started
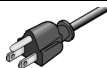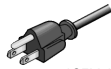
Checking the Shipment

Check the shipment and order list when you receive the shipment.

- Inspect the shipping container for damages. Signs of damage may include a dented or torn shipping container or cushioning material that indicates signs of unusual stress or compacting.

- Carefully remove the contents from the shipping container, and verify if the standard accessories and your ordered options are included in the shipment, according to checklist and AC Power Cord checklist on next page.

For any question or problems, contact Agilent Technologies for consultant and service at: http://www.agilent.com/find/assist

AC Power Cord

Plug Type	Cable Part Number	Plug [a] Description	For use in Country & Region
250V 10A	8121-1703	BS 1363/A	Option 900 United Kingdom, Hong Kong, Singapore, Malaysia
250V 10A	8120-0696	AS 3112:2000	Option 901 Australia, New Zealand
250V 16A	8120-1692	IEC 83 C4	Option 902 Continental Europe, Korea, Indonesia, Italy, Russia
125V 10A	8120-1521	CNS 10917-2 /NEMA 5-15P	Option 903 Unite States, Canada, Taiwan, Mexico
125V 10A	8120-2296	SEV 1011	Option 906 Switzerland
230V 15A	8120-4600	SABS 164-1	Option 917 South Africa, India
125V 15A	8120-4754	JIS C8303	Option 918 Japan
250V 16A	8120-5181	SI 32	Option 919 Israel
250V 16A	8120-8377	GB 1002	Option 922 China

Safety Considerations

Agilent has designed and tested the N9330A in accordance with IEC Publication 61010-1:2001 Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use, and the tester is supplied in a safe condition. The N9330A is also designed for use in Installation Category II and pollution Degree 2 per IEC 61010 and IEC 60664 respectively.

Read the following safety notices carefully before you start to use this tester set to ensure safe operation and to maintain the product in a safe condition.

WARNING   **Personal injury may result if the tester's cover are removed. There are no operator-serviceable parts inside. Always contact Agilent qualified personnel for service. Disconnect the product from all voltage sources while it is being opened.**

WARNING   **This product is a Safety Class I tester. The main plug should be inserted in a power socket outlet only if provided with a protective earth contact. Any interruption of the protective conductor inside or outside of the product is likely to make the product dangerous. Intentional interruption is prohibited.**

WARNING   **Electrical shock may result when cleaning the tester with the power supply connected. Do NOT attempt to clean internally. Use a clean soft cloth to clean the outside case only.**

WARNING   **Danger of explosion if the battery is incorrectly replaced. Replace only with the same or equivalent type recommended.**

WARNING	**Do NOT dispose of batteries in a fire.**
	Do NOT place batteries in the trash. Batteries must be recycled or disposed of properly.

CAUTION	The VxWorks operating system requires full conformity to USB 1.1 or USB 2.0 standards from a USB disk. Not all the USB disk are built that way. If you have problems connecting a particular USB disk, please reboot the analyzer before inserting the next.
	Use USB disk in FAT or FAT32 format, with only one partition for data saving and loading with the tester.

CAUTION	If left the tester unused, a fully charged battery will discharge itself over time.
	Never use a damaged or worn-out adapter or battery.
	If you are charging the batteries internally, even while the tester is powered off, the tester may become warm. To avoid overheating, always disconnect the tester from the AC adapter before storing the tester into the soft carrying case.

CAUTION	Always power on the N9330A *before* connecting an electronic calibrator.

CAUTION	The average continuous power input is limited not to exceed +23 dBm, DC voltage to 50 VDC. Instrument damage may result if these precautions are not followed.

CAUTION	Temperature extremes will affect the ability of the battery to charge. Allow the battery to attain ambient operating temperature before use or charging.
	Storing a battery in extreme hot or cold places will reduce the capacity and lifetime of a battery. Battery storage is recommended at less than 45 ^{o}C.

Environmental Requirements

Agilent technologies has designed this tester for use under the following conditions:

- Operating temperature:
  0 to 40 ^{o}C (using AC-DC adapter)
  –10 to 50 ^{o}C (using battery)
- Storage temperature: –40 to 70 ^{o}C
- Humidity: 85% $\pm$ 5%

Electrical Requirements

This tester allows the use of either a lithium battery pack (internal), AC-DC adapter shipped with the tester, or optional Automotive +12VDC adapter for its power supply.

Electrostatic Discharge (ESD) Precautions

This tester was manufactured in an ESD protected environment. This is because most of the semiconductor devices used in this tester are susceptible to damage by static discharge.

Depending on the magnitude of the charge, device substrates can be punctured of destroyed by contact or mere proximity of a static charge. The result can cause degradation of device performance, early failure, or immediate destruction.

ElectroStatic charges are generated in numerous ways, such as simple contact, separation of materials, and normal motions of persons working with static sensitive devices.

When handling or servicing equipment containing static sensitive devices, adequate precautions must be taken to prevent device damage or destruction.

Only those who are thoroughly familiar with industry accepted techniques for handling static sensitive devices should attempt to service circuitry with these devices.

Instrument Markings

The CE mark shows that the product complies with all relevant European Legal Directives
(If accompanied by a year, it signifies when the design was proven).

The CSA mark is a registered trademark of the Canadian Standards Association.

The C-Tick mark is a registered trademark of the Australian Spectrum Management Agency.

ISM1-A   This symbol is an Industrial Scientific and Medical Group 1 Class A product (CISPR 11, Clause 4)

The instruction manual symbol: indicates that the user must refer to specific instructions in the manual.

The standby symbol is used to mark a position of the instrument power switch.

indicates this product complies with the **WEEE Directive** (2002/96/EC) marking requirements and you must not discard this equipment in domestic household waste. Do not dispose in domestic house-hold waste. To return unwanted prod-ucts, contact your local Agilent office, or refer to

http://www.agilent.com/environment/product/

Your first 10 minutes with the N9330A

The N9330A is fitted with a sunlight-viewable screen, which is viewable under all lighting conditions. If you are using your N9330A in direct sunlight, you do NOT need to shield the display from the sunlight. In bright lighting conditions, the display is brighter and easier to read when you allow light to fall directly on the screen.

CAUTION	Use only the original N9330A AC/DC adapter or the original battery for power source.

CAUTION	Do not apply excessive RF or DC signals to the tester RF OUTPUT connector. The maximum damage RF input level is +23 dBm (or +50 VDC signal input).

Power on the N9330A

Pressing the ⏻ standby button switches on the tester. The tester then boots up and runs an internal self-test that includes the following items:

- internal temperature
- battery voltage (if battery powered)
- battery capacity (if battery powered)

Using the tilt stand
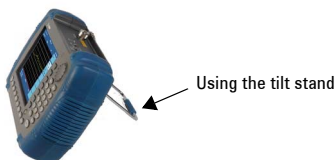
Making the first measurement

Four easy steps:

1 Select a measurement mode.

2 Set the desired measurement range, or select a frequency range from the list of signal standards.

3 Calibrate the tester.

4 Connect the DUT (Device Under Test) to the tester RF OUT connector being careful not to apply a signal which exceeds the maximum signal levels.

Step 1. Selecting a measurement mode

Pressing **[MODE]** brings up a check box for you to choose a measurement mode from the following five modes:

- SWR (Standing Wave Ratio)
- Return loss vs. Frequency
- Cable loss
- DTF-SWR
- DTF-Return loss

Example: selecting the return loss measurement

1 Press **[MODE]** to bring up the mode selection check box

2 Use the rotary control knob to select the Return Loss vs. Frequency

3 Press **[ENTER]** to confirm your selection.

A measurement mode indicator – FREQ-RL will be displayed in the top middle part of the screen.

See "Selecting a Measurement Mode" on page 20 for more information.

Step 2. Setting a measurement range

Pressing **[FREQ/DIST]** brings up a submenu for setting the measurement range.

If you previously chose a frequency domain measurement, the submenu allows you to set the start and stop frequency, or select a pre-defined frequency range from the list of signal standards.

If you previously chose a DTF measurement, the submenu allows you to set the start and stop displayed distance, and other cable measurement related parameters.

Example: setting a frequency range from 1 GHz to 2 GHz

1 Press **{Start} > [1000] > [ENTER]** to set the start frequency to 1 GHz

2 Press **{Stop} > [2000] > [ENTER]** to set the stop frequency to 2 GHz

The start frequency of 1000.0 (in MHz) displays at the left lower corner of screen, and the stop frequency 2000.0 displays at the right lower corner of the screen.

Step 3. Calibrating theN9330A

The N9330A must be calibrated before making an actual measurement (SWR/Return loss/Cable loss/DTF) using the selected frequency span or the full span of the instrument.

The N9330A offers two calibration modes:

• **FullSpan Cal**
  Performs an Open-Short-Load calibration across the full frequency range (25 MHz to 4 GHz). The tester allows you to modify the frequency range for measurement after the FullSpan Cal is performed.

• **SelectedSpan Cal**
  Selected Span calibration is the default calibration mode. Performs an Open-Short-Load calibration across a user-defined frequency range. The tester requires re-calibration if the Selected Frequency Span is changed.

Key Access: **[SYS] > {Cal Mode}**

Example: Performing a calibration

Assuming the Selected Frequency Span is from 1 GHz to 2 GHz for return loss measurement and the **T-combo** calibrator tool is being used.

1 Press **[CAL]** to bring up a dialog box that will guide you through the calibration. The normal calibration order is open, short, and load.

2 Fasten the **Open** end of the T-combo to the RF OUT connector on the top panel of the tester, then press **[ENTER]** to initiate the open calibration.

3 Fasten the **Short** end of the T-combo to the RF OUT connector, then press **[ENTER]** to initiate the short calibration.

4 Fasten the **Load** end of the **T-combo** to the RF OUT connector, then press **[ENTER]** to initiate the load calibration.

To abort a calibration, press the **[ESC/CLR]** button.

For more information about calibration, please refer to "Calibrate the N9330A before making measurements" on page 21.

Step 4. Connecting DUT to RF Output port

Example: Measuring return loss

Assuming you have completed the calibration procedure above. Refer to the following instructions to make a return loss measurement.

• Connect the cable under test to the RF OUT connector on the top panel of the tester.

• The tester immediately performs the measurement and displays a trace on the screen.

If further data analysis is necessary, refer to:

"Using Markers and Pass/Fail Limit Lines" on page 32, "Processing Traces" on page 35.

Contact Agilent Technologies

Agilent maintains sales and service offices around the world to provide you with complete support for your handheld cable and antenna tester. In any correspondence or telephone conversations, refer to your handheld cable and antenna tester by its product number and the full serial number.

Go to http://www.agilent.com/find/assist for help with:

• product selection, configuration, and purchases.

• technical application assistance, and consulting.

• rental options, and refurbished equipment.

• repair, calibration, education and training.

If you do not have access to the internet, call the appropriate number shown below. Or contact your local Agilent Technologies Sales and Service Office.

United States	(tel) 800 829 4444
	(fax) 800 829 4433
Canada	(tel) 877 894 4414
	(fax) 800 746 4866
Latin America	(tel) +1 (305) 269 7500
China	(tel) 800 810 0189
	(fax) 800 820 2816
Korea	(tel) 080 769 0800
	(fax) 080 769 0900
Japan	(tel) +81 426 56 7832
	(fax) +81 426 56 7840
Taiwan	(tel) 0800 047 866
	(fax) 0800 286 331
Europe	(tel) +31 20 547 2111
Australia	(tel) 1 800 629 485
	(fax) +61 (3) 9210 5947
Other Asia Pacific Countries	(tel) +65 6375 8100
	(fax) +65 6755 0042
	Email: tm_ap@agilent.com

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Making Measurements

Selecting a Measurement Mode

Assuming you wish to make a return loss measurement, you need to:

• Press the [**MODE**] hardkey to call up the mode selection check box.

• Use the front-panel knob to select a measurement type from the Mode Select list.

• Press the [**ENTER**] hardkey to confirm your selection.

Selecting "Return Loss" measurement
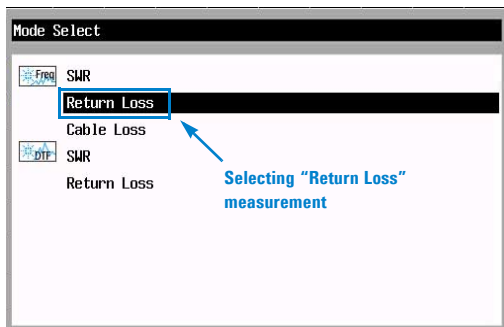
The icon indicates the following frequency domain measurement:

• SWR

• Return loss

• Cable loss

The icon indicates the following Distance to Fault (DTF) measurement:

• SWR

• Return loss

Calibrate the N9330A before making measurements

Before making a measurement (SWR/Return loss/Cable loss/DTF) in a specified frequency range or the full span, you must calibrate your N9330A.

It is important to keep the calibration frequency range as close as possible to the actual sweep frequencies necessary for the measurements. Calibrating over a larger frequency range than the actual measurement range will reduce the accuracy of the test results. For example, using a 1 GHz calibration range when the measurement range is only few kHz.

Performing one calibration is acceptable provided the calibration frequency range selected incorporates all intended measurement frequencies. If the frequency span is changed, a new calibration must be performed for that measurement. A new calibration must be performed if any components used in the calibration setup are changed. For example, a short coaxial cable used to connect the tester to the DUT.

Calibration Mode

The N9330A offers two calibration modes:

- **FullSpan Cal**
  Runs an open-short-load calibration across the full frequency span (25 MHz to 4 GHz). A FullSpan Cal ignores the frequency changes during measurements.

- **SelectedSpan Cal**
  Performs an open-short-load calibration across a user-defined frequency span. A SelectedSpan Cal requires a re-calibration of the tester, after changing the measurement frequency range. Normally, the selected span should be set as close to the actual swept frequency range.

Key access: **[SYS] > {Cal Mode}**

Types of Calibrators

Two types of calibrator tools are available from Agilent for use with the tester:

- **T-combo calibrator**
  This is a T-shaped mechanical calibrator. It consists of a calibrated open, short and 50 Ω load. Using the T-combo calibrator will result in a more accurate calibration than when using the an Electronic calibrator.

- **Electronic calibrator**
  The Electronic calibrator enables you to perform a one-step calibration process. It automatically performs an open, short, and 50Ω load calibration. The Electronic calibrator is a faster but less accurate than when using a T-combo mechanical calibrator.

Calibrating procedure introduction

Choose either the T-combo or the Electronic calibrator to perform a calibration process. Different combinations of calibration mode and calibrator may benefit the measurement accuracy differently. (Assuming the measurement resolution remains unchanged):

- Using SelectedSpan calibration mode and the T-combo calibrator provides a more accurate calibration.

- Selecting FullSpan calibration mode and electronic calibrator is the simplest, most convenient calibration.

The tester default setting is the SelectedSpan calibration mode. Agilent recommends using the SelectedSpan calibration mode for best results.

It is important to keep the calibration frequency range as close as possible to the actual sweep frequencies necessary for the measurements. Calibrating over a larger frequency span than the actual measurement range will reduce the

accuracy. For example, using a 1 GHz calibration range when the measurement range is only few kHz.

Calibrate with an electronic calibrator

NOTE	Never connect an electronic calibrator to the tester until *after* powering on the N9330A.

The tester needs about 35 sec. to record the data of an Electronic calibrator the first time a new Electronic calibrator is used with a specific tester.

After the initial use of an Electronic calibrator, the tester requires approximately 12 sec. to perform the automated open-short-load calibration.

The Electronic calibrator performs an automatic, open-short-load consecutively:

1 Press **[CAL]** to bring up a dialog box for calibration guidance.

2 Connect the Electronic calibrator to the RF OUT connector on the top panel of the tester. Connect the USB cable between the electronic calibrator and the tester USB port. The correct USB cable is supplied with an Electronic calibrator.

3 Press **[ENTER]** to start calibration.

Calibrate with a T-combo calibrator

Using a T-combo calibrator is a three step process requiring the user to manually change the open-short-load components. The default order of the calibration process is open-short-load.

1 Press **[CAL]** to bring up the dialog box for calibration guidance.

2 Connect the "Open" component of the T-combo calibrator to the RF OUT connector of the tester. Press **[ENTER]** to start the open calibration.

3 Connect the "Short" component of the T-combo calibrator to the RF OUT connector of the tester. Press **[ENTER]** to start the short calibration.

4 Connect the "Load" component of the T-combo calibrator to the RF OUT connector of the tester. Press **[ENTER]** to start the load calibration.

A "Calibrated" indicator will be displayed on the upper left corner of the screen when the calibration is completed.

Using User Cal Mode   A **User Cal Mode** is an optional selection when using a mechanical calibrator. The User Cal Mode allows the user to choose one cal standard from the open-short-load to perform a customized calibration.

For example, pressing **[CAL] > {User Cal Mode} > {Open}** initiates a calibration using the Open calibration standard only.

Measuring Return Loss/SWR/Cable Loss

Return loss is the measurement of the signal reflection characteristics of a cable and antenna system. A return loss measurement is useful in detecting problems in the antenna feedline system and the antenna itself. A portion of the incident power is reflected back to the source from transmission line faults as well as from the antenna itself. The ratio of the reflected voltage to the incident voltage is called the reflection coefficient. The reflection coefficient is a complex number, meaning it has both magnitude and phase information. In S-parameter terms, return loss is referred to as an S11 measurement.

SWR and cable loss measurement derive from return loss measurement.

> **NOTE** Test signals can cause interference. When testing cables attached to an antenna, the test signal is radiated from the antenna. Verify that the signal used for the test CANNOT cause interference to other antennas.

Perform a basic return loss measurement

When measuring return loss, SWR, or cable loss with your N9330A, follow the same operation procedure as shown below.

To make a return loss (versus. frequency) measurement over a frequency range of 50 to 400 MHz, perform the following steps:

1 Press **[MODE]** to call up a measurement mode menu. Rotate the front-panel knob to select a measurement mode (for this example, Return Loss). Press the **[ENTER]** hardkey to confirm your selection. For more detailed information, refer to "Selecting a Measurement Mode" on page 20.

2 Press the **{Start}** softkey to call up the start frequency menu. Press **{50} > [ENTER]** to set the start frequency to 50 MHz.

3 Press the **{Stop}** softkey to call up the stop frequency menu. Press **{400} > [ENTER]** to set the stop frequency to 400 MHz.

4 Press the **[CAL]** hardkey to call up the calibration process menu. Follow the instructions for performing the calibration. For more information about calibration, refer to "Calibrate the N9330A before making measurements" on page 21. A "Calibrated" indicator will be displayed on the upper left corner of the screen when the calibration is completed.

5 Remove the calibrator and connect the DUT to the RF OUT connector of the tester. The tester will then then measure the return loss of the DUT.

Adjusting the measurement resolution

The tester has three resolution settings, 521, 261, or 131 points. Press the **[MEAS/VIEW]** hardkey, then the **{Resolution}** softkey to choose the resolution setting desired, then press the **[ENTER]** hardkey to enter the selection.

The higher the resolution, the more accurate the measurement results. However, a higher resolution setting will require a longer sweep time.

Using Marker/Limit

For further trace analysis, refer to:

"Using markers" on page 32.

"Using Pass/Fail Limit Lines" on page 33

"Trace Operation" on page 35.

For performing an isolated return loss measurement, refer to:

"Using single sweep" on page 43.

For minimizing the interference, refer to:

"Enabling interference immunity" on page 43.

Measuring Distance to Fault (DTF)

For this measurement, an internally generated signal emits from the RF OUT port of the tester and is transmitted to the cable and antenna system (DUT). The tester receives and processes the signal power reflected from faults and imperfections.

In performing a DTF measurement, the tester uses frequency domain reflectometry. The transmitted and reflected signals contain information about the distance to the faults. This information is used to determine the physical distance to the faults. The tester displays the physical distance to the probable faults, corrected for cable loss and the velocity propagation factor of the cable.

Perform a DTF measurement

To make a DTF-return loss measurement over a frequency range of 50 to 400 MHz, perform the following steps:

1 Press **[FREQ/DIST] > {Start} > 50 > [ENTER]** to set the start frequency to 50 MHz.

2 Press **{Stop} > 400 > [ENTER]** to set the stop frequency to 400 MHz.

3 Press the **[MODE]** hardkey to select a measurement mode. Rotate the front-panel knob to highlight and select the DTF-Return loss, and press **[ENTER]** to confirm your selection.

4 Press **[CAL]** to bring up the calibration process guidance. Follow the instructions to perform a calibration. For more information about calibration, refer to "Calibrate the N9330A before making measurements" on page 21.

5 Remove the calibrator and connect the cable under test (DUT) to the RF OUT connector on the top panel of the tester. The DTF measurement starts and the results are displayed on the screen. A peak in the horizontal trace indicates a defective location. For a more precise

measurement, enter the cable loss and velocity factor information.

The measured distance and the displayed distance can be different.

The measured distance refers to the distance the tester has measured according to the frequency ranges you specified. You can check the measured distance by pressing {DTF Config}

The displayed distance refers to that part of the entire measured distance chosen. The displayed distance may be manually set by pressing [FREQ/DIST] > {Start}, and {Stop}.

Adjusting the measurement resolution

The tester has three resolution settings, 521, 261, or 131 points. Press the **[MEAS/VIEW]** hardkey, then the **{Resolution}** softkey to choose the resolution setting desired, then press the **[ENTER]** hardkey to enter the selection.

The higher the resolution, the more accurate the measurement results. However, a higher resolution setting will require a longer sweep time.

Using Marker/Limit

For further trace analysis, refer to:

"Using markers" on page 32.

"Using Pass/Fail Limit Lines" on page 33

"Trace Operation" on page 35.

For getting an isolated return loss signal, refer to:

"Using single sweep" on page 43.

For minimizing the interference, refer to:

"Enabling interference immunity" on page 43.

Measured distance

It is not always understood how frequency range affects measured distance and resolution, and may appears counter-intuitive. This section is intended to help simplify understanding the DTF measurement.

In the following equations:

Resolution refers to the number of points that are measured and used in the displayed trace. Pressing **[MEAS/VIEW] > {Resolution}** enables you to change the resolution setting.

- (V_t/V_c) refers to the velocity factor of a cable, its transmission rate relative to light. The velocity factor may be set by pressing **{Velo Factor}**.

- F2 and F1 refer to the stop and start frequency (MHz).

The measured distance (in meters) of a DTF measurement is determined by the following equation:

Distance= (Resolution x 150 x V_t/V_c) / (F_2–F_1)

$V_c = 3 \times 10^8$

From this equation, you can adjust the measurement:

- To Increase the measured distance:
  - Increase the number of points, or
  - Reduce the frequency span.

- To decrease the measured distance:
  - Reduce the number of points, or
  - Increase the frequency span.

3 Making Measurements

Agilent N9330A
Handheld Cable & Antenna Tester

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Using Functions

Using Markers and Pass/Fail Limit Lines

Markers and limit lines are used for measurement trace analysis.

Using markers

Markers are used to track the specified points on a trace. You may apply up to six markers and visually track up to six points on each trace. Each of the six markers has the following settings:

- On
  Activates a Marker and places a vertical, colored bar, with the Marker number ranging from M1 to M6 to the foot of the bar.

- Off
  Deactivates a marker and erases the Marker bar.

- Edit
  Brings up a dialog box and allows you to set the position of a marker.

NOTE	Rotating the knob will move the position of a marker.

- Marker to Peak
  Places the active marker on the highest indicated value of the trace.

- Marker to Minimum
  Places the active marker on the lowest indicated value of the trace.

- Delta
  Is associated with the reference marker (Marker 1 is the default reference marker). Therefore, Marker 1 must be applied before creating the delta. Delta displays the value difference between the reference marker position and the delta marker position. Only one delta marker can be associated with a given reference marker.

General steps for adding a marker

Take adding Marker 1 for example:

	Step	Note
1	Press [**Marker**] hardkey to call up a submenu of markers	
2	Press {**Mark 1**} softkey to enter a submenu of Marker 1	
3	Press {**On**} softkey to activate Marker 1	Marker 1 sets its position refer to its previous position
4	Press {**Edit**} softkey to set the position of the Marker 1	Rotating the front-panel knob also positions the marker

Using Pass/Fail Limit Lines

Limit lines will alert the user to a measurement that exceeds the upper limit value of a trace. Limits are set in dB, and define the location of the limit lines displayed on the screen.

The tester applies upper limits only. Limit lines are used as pass/fail indicators:

• If the amplitude of a measured trace is below the limit line, a green *Pass* indicator is displayed in the upper right corner of the screen.

• If the amplitude of a trace is above a limit line, a red *Fail* indicator is displayed in the upper right corner of the screen. A limit fail beep sound can be turned on for an additional trace fail indicator.

Two types of limit lines

- Single limit
  A single limit value is applied over the full frequency range, 25 MHz to 4 GHz. A maximum of two single limit lines may be applied.

- Multiple limit segment
  After setting a limit segment, the limit line is valid only for your selected frequency/distance range and amplitude range. A maximum of five limit segments may be applied.

Setting up a limit line

Refer to the following example to add a limit line.

Example: adding limit 1

	Step	Note
1	Press **[Limit]** hardkey to access a submenu of limit settings	
2	Press **[Multi-Limit]** softkey to access the multi limit segments submenu	Use this feature if setting multiple limit values on a trace.
3	Press {**Limit 1**} softkey to access a submenu of the limit 1	choosing the specific segment number.
4	Press {**On**} softkey to activate a limit line	This will set the limit line at previously configured limit value.
4	Press **[Edit]** softkey to set the position of a limit line	To adjust the limit line to your specifications.
5	Press {**Prev segment/Next segment**} to continue setting specifications for a multi-limit trace.	For multi limit traces.

Processing Traces

Trace overlap and trace operation are used in the tester for post trace processing. Very useful in comparing measurements to identify differences and faults.

Trace Operation

Trace operation mathematically adds or subtracts the current measured trace to a previously saved trace. This will provide information that may indicate when a cable or antenna system is degrading in performance and would require maintenance.i

NOTE	The previously saved trace must have the same setup, with consistent measurement parameters as the current trace. For example, the same mode, resolution, and frequency/distance range.

Example: A saved a trace (data) has been entered into the local memory of the tester. The trace was measured under return loss mode in GSM full band (880 MHz to 960 MHz), with 521 data points.

Perform the following steps for a trace operation:

1 Press **[MEAS/VIEW] > {Trace Operation}** to access the check box for selecting a math operation mode:

- Trace – Memory
  Current active trace mathematically subtracts the trace from local memory of the tester.

- Trace + Memory
  Current active trace mathematically adds the trace from local memory of the tester.

2 Rotate the knob to select a mode and press **[ENTER]**

3 The tester brings up a list of existing trace data in the local memory the tester.

4 Rotate the knob to select a trace that has the same measurement mode, resolution and frequency range, and press **[ENTER]**.

The tester displays the mathematically calculated trace on its screen.

Trace overlap

The tester allows a previously saved trace to be recalled onto the currently displayed screen. The two displayed traces are identified by different colors.

Trace overlap is a real-time tool for quick comparisons between the current trace and a previously saved trace. The tester cannot save the overlaid traces into either local memory or external USB memory stick.

NOTE	The previously saved trace must have consistent measurement parameters with the current trace. For example, the same mode, resolution, and frequency/distance range.

Example: To compare the current measurement trace to a saved trace (data) in the local memory of the tester. They were both measured in the return loss mode, GSM full band (880 MHz to 960 MHz), resolution 521 points.

Perform the following steps to do a trace overlap operation:

1 Press **[MEAS/VIEW] > {Trace Overlap} > {Select Trace}** to display a list of trace data stored in the local memory the tester.

2 Use the front-panel knob to select a trace and press **[ENTER]**.

The tester will display the saved trace, while continuously making measurement of the DUT (current measured trace). The two traces are displayed on the screen simultaneously:

- Trace one is displayed as a static trace and is green in color. It is the saved trace results recalled from the local memory of the tester.
- Trace two is yellow in color and is repeatedly scanned. It is the currently measured trace result.

Saving and Recalling a file

N9330A allows you to save trace data, instrument setups, or the displayed screen graphic information into the local memory of the tester. With a USB memory stick inserted, you can also save trace data and screen copies into an external memory devices.

File	Format	Max. # (Internal memory)
Trace data	*. data	200
Instrument setting	*.data	15
Screen copy	*.jpg	Stored onto USB disk

Trace data includes both the measurement data and the instrument setup information. Trace data and instrument setup files are saved with a ".data" file extension.

Save a trace data

Trace data includes the measured data and the current instrument setups. Save Data does not include limit lines. Limit lines can be saved using the Save Setup feature.

- Pressing **[Save] > {Save Data}** allows you save the trace data into local memory ONLY. It also activates the auto file naming editor and automatically saves the current trace data with a name that is consecutive to name of the latest saved file.
  This mode does NOT allow you to edit the file name. For example, if the previously saved file name is "Chicago_site1", the current trace data will be automatically named as "Chicago_site2".

- Pressing **[Save] > {Save Data as}** allows you to:

  - select a destination where a trace data is saved:
    Local or USB.

  - edit a user defined file name.
    See "Editing a file name" on page 39.

Save an instrument setup

The tester will save instrument setups to the local memory. The maximum number of instrument setups that can be saved is 15.

Pressing **[Save] > {Save Setup}** saves the current instrument settings to the tester's local memory. The tester will record the following instrument settings:

- calibration mode
  records FullSpan or SelectedSpan calibration mode
- measurement mode
  records measurement modes with their ancroyn: RL, SWR, CL, DTF-RL, or DTF-SWR
- parameters
  records frequency/distance range, and date and time. Limit lines, if activated, will be saved using Save Setup.

Copy a screen

Press **[Save] > {Copy Screen}** to save the currently displayed screen onto an external USB memory stick, in JPEG format. Each screen copied is an 8-bit colored, 640*480 resolution graph.
Copy screen will include any limit lines, if shown on screen. However, a screen shot is not editable.

NOTE Insert a memory stick into the USB connector before copying screen.

Editing a file name

A valid file name may consist of capitalized letters (A to Z), decimal numbers (0 to 9), and symbols (dot and underscore).

Pressing **[Save] > {Save Data as}** accesses a dialog box with the last file name used. Press [ESC/CLR] to erase the current file name, before editing or creating a new file name.

Input a new file name   Use the numerical keypad to input characters, numbers, and symbols.

- A single press on a numerical button inputs a decimal number.
- Consecutive press on a numerical button selects a letter or symbol.

Recall a trace data

To recall a trace data perform the following steps:

1 Pressing **[Recall] > {Recall Data}** accesses a dialog box for selecting the trace data to be recalled.

2 Rotate the knob to select a trace data.

3 Press **[ENTER]** hardkey to confirm the selection.

Trace data can be deleted from the trace data list in local memory by:

- Press **{Delete Trace}** softkey to delete a trace data.
- Press **{Delete All}** to delete all the trace data from the list.

Recall an instrument setup

The following steps show the steps to recall a stored instrument setup:

1 Press **[Recall] > {Recall Setup}** to bring up a dialog box for selecting which instrument setup is to be recalled.

2 Rotate the knob to select the desired trace data.

3 Press the **[ENTER]** hardkey to confirm your selection.

Viewing system statistics

Check system status

Pressing **[SYS] > {More} > {Status}** shows the primary information and current status of the tester, including:

- mode number, current firmware version, product serial number, main board serial number, and option status.

- current calibration mode and status, calibration temperature range, current internal temperature, current main battery capacity, and external power input status.

Running a self test

Pressing **[SYS] > {More} > {Self Test}** triggers the tester to run a self test on the following items:

- Temperature
- RTC battery voltage
- RF PLL
- LO PLL

Some Helpful Hints

Preset the tester

Pressing the green button (the **[Preset]** hardkey) returns the tester parameters/settings to a known default state.

N9330A Default Settings

Settings	Default
measurement mode	return loss (vs.freq)
start frequency	25 MHz
stop frequency	4000 MHz
signal standard	custom
start distance	0 m
stop distance	9 m
calibration mode	SelectedSpan
calibration status	Uncalibrated
calibrator indicator	mechanic
trace resolution	521 point
marker(s)	all Off
single/multiple limit(s)	all Off
limit beep	Off
active [FREQ/DIST]	FREQ
active [HOLD/RUN]	RUN
single sweep	Off
IIM (interference immunity)	Off
velocity factor	0.5
windowing	none
unit	meter
language	Depends on previous language setting
date format	YYYY-MM-DD

Adjust amplitude scale

Adjusting the amplitude scale can improve the clarity and view ability of the amplitude of a trace. the following methods are for adjusting the amplitude scale:

- Pressing **[Auto Scale]** hardkey automatically adjust the amplitude scale to best fit the current trace view.

- Pressing **[AMPTD] > {Top}**, or **[AMPTD] > {Bottom}** manually set the amplitude scale.

Using single sweep

Using single sweep allows you to get an isolated return loss signal. In a single sweep, the tester sweeps from the start to the stop frequency/distance for only one time, and holds the trace static.

Key access: **[MEAS/View] > {Single}**

Enabling interference immunity

Other signals can interfere with Return Loss/SWR measurement. You can minimize the effect of the interference on the measurement by activating interference immunity in the tester.

Key access: **[MEAS/VIEW] > {IIM}**

NOTE	Use of interference immunity increases the measurement time. Interference immunity should be used if a known interference signal exists or the Return Loss/SWR measurement displays suspicious characteristics, such as a spike or rapid movements in the noise floor.

Holding a measurement

The user may hold (pause) a measurement.

- Pressing **[HOLD/RUN]** hardkey pauses (holds) a measurement, and displays the last trace scan.
- Pressing the **[HOLD/RUN]** hardkey again will restart the measurement.

Quick access to freq/dist setups

Pressing **[FREQ/DIST]** allows the user to quickly access to frequency or distance setup submenu:

- When the measurement mode is SWR, return loss or cable loss, pressing **[FREQ/DIST]** hardkey accesses a submenu for the frequency range configuration.
- When the measurement mode is DTF-SWR, or DTF-return loss, pressing **[FREQ/DIST]** hardkey accesses a submenu for distance and DTF measurement configuration.

Connector Care

Connectors quality is a critical link for a precision measurement. RF connectors are manufactured to extremely precise tolerances and must be used and maintained with care to protect the measurement accuracy and repeatability.

Taking proper care of cables and connectors will protect your tester's ability to make accurate measurements. Inaccurate measurements often result of improper connections, dirty, or damaged connectors.

Worn, damaged, out of tolerance, or dirty connectors degrade the accuracy and repeatability of RF measurements.

CAUTION   Always take proper electrostatic precautions before touching the center conductor of any connector, or cable that is connected to the tester.

Repeatability

If two identical measurements are made with the tester, the differences in the measured data should be so small that they do not affect the value of the measurement. Connector repeatability may be a cause of poor measurement results. Connector repeatability problems may be affected by:

• Dirty or damaged connectors

• Connections that have been made without using proper torque techniques (this applies when connections to the tester have been removed, then reconnected.)

Extending the life of your cables and connectors

• Minimize the bending of test cables. A single sharp bend can damage a RF cable.

• Avoid repeated connection and disconnection of all RF cable connections.

• Do not bend cables at or near the RF connectors. This may affect the RF performance.

• Inspect all connectors for dirt, nicks, and other signs of damage or wear before connection. A bad connector can ruin a good connector instantly.

• Clean dirty connectors. Dirt and foreign matter can cause poor electrical connections, affect RF measurements, and may permanently damage the connectors.

| CAUTION | Never exceed the recommended connector torque values when attaching cables or damage may result. |

Proper Connector Torque

Connector	Torque cm-kg	Torque N-cm	Torque in-lbs
Type-N	52	508	45
3.5 mm	9.2	90	8
SMA	5.7	56	5

Using signal standards

There are 88 signal standards available in the tester. They can be accessed and selected for use in measurement setups.

The following is a list of common signal standards with their uplink, downlink and full span ranges.

Signal Standard	Start freq. (MHz)	Stop freq. (MHz)
Bluetooth US/Europe uplink	2400.0	2484.0
Bluetooth US/Europe downlink	2400.0	2484.0
Bluetooth US/Europe full band	2400.0	2484.0
Bluetooth Japan uplink	2472.0	2497.0
Bluetooth Japan downlink	2472.0	2497.0
Bluetooth Japan full band	2472.0	2497.0
C 450 P uplink	453	464
C 450 P downlink	463	474
C 450 P fullband	453	474
C 450 SA uplink	465	470
C 450 SA downlink	455	460
C 450 SA fullband	455	470
CDMA China 12 uplink	872	915
CDMA China 12 downlink	917	960
CDMA China 12 fullband	872	960
Cellular uplink	824	849
Cellular downlink	869	894
Cellular fullband	824	894
Cellular 700 MHz uplink	776	794
Cellular 700 MHz downlink	746	764
Cellular 700 MHz fullband	746	794
DCS GSM 1800 uplink	1710	1785
DCS GSM 1800 downlink	1805	1880
DCS GSM 1800 fullband	1710	1880
Digital Multimedia Broadcasting (DMB)	2592.5	2692.5
GSM 900 uplink	880	915

Signal Standard	Start freq. (MHz)	Stop freq. (MHz)
GSM 900 downlink	925	960
GSM 900 fullband	880	960
IEEE 802 11 FH uplink	2402	2495
IEEE 802 11 FH downlink	2402	2495
IEEE 802 11 FH fullband	2402	2495
IEEE 802 11 DS uplink	2412	2484
IEEE 802 11 DS downlink	2412	2484
IEEE 802 11 DS fullband	2412	2484
IEEE 802 11 B G uplink	2400	2484
IEEE 802 11 B G downlink	2400	2484
IEEE 802 11 B G fullband	2400	2484
IMT 2000 UMTS WCDMA uplink	1920	1980
IMT 2000 UMTS WCDMA downlink	2110	2170
IMT 2000 UMTS WCDMA fullband	1920	2170
ISM 2 4 GHz uplink	2400	2484
ISM 2 4 GHz downlink	2400	2484
ISM 2 4 GHz fullband	2400	2484
JTACS/NTAC Japan ARIB uplink	887	925
JTACS/NTAC Japan ARIB downlink	832	870
JTACS/NTAC Japan ARIB fullband	832	925
NMT 411 uplink	411	420
NMT 411 downlink	421	430
NMT 411 fullband	411	430
NMT 450 uplink	450	460
NMT 450 downlink	460	470
NMT 450 fullband	450	470
NMT 450 20 kHz CDMA2000 uplink	451	484
NMT 450 20 kHz CDMA2000 downlink	461	494
NMT 450 20 kHz CDMA2000 fullband	451	494
NMT 450 25 kHz CDMA2000 uplink	411	458
NMT 450 25 kHz CDMA2000 downlink	421	468
NMT 450 25 kHz CDMA2000 fullband	411	468
NMT 900 MATS E uplink	890	915
NMT 900 MATS E downlink	935	960

Signal Standard	Start freq. (MHz)	Stop freq. (MHz)
NMT 900 MATS E fullband	890	960
PCS GSM 1900 uplink	1850	1910
PCS GSM 1900 downlink	1930	1990
PCS GSM 1900 fullband	1850	1990
PCS Korea uplink	1750	1780
PCS Korea downlink	1840	1870
PCS Korea fullband	1750	1870
PDC 800 uplink	898	940
PDC 800 downlink	843	885
PDC 800 fullband	843	940
PDC 1500 uplink	1525	1549
PDC 1500 downlink	1477	1501
PDC 1500 fullband	1477	1549
PHS uplink	1895	1918
PHS downlink	1895	1918
PHS fullband	1895	1918
SMR 800 uplink	806	821
SMR 800 downlink	851	866
SMR 800 fullband	806	866
SMR 1500 uplink	1453	1465
SMR 1500 downlink	1501	1513
SMR 1500 fullband	1453	1513
TACS/ETACS uplink+C22	872	915
TACS ETACS downlink	917	960
TACSETACS fullband	872	960
Tetra uplink	380	430
Tetra downlink	380	430

Using cable folder

In DTF measurement, you are required to input the velocity factor and the average cable loss (dB/m). In case that you do not remember the velocity factor and the average cable loss of the cable-under-test, use the cable folder to find the cable type.

When you are making a DTF measurement, pressing **{Cable}** brings up a dialog box for frequency band selection first. You should select any of the following categories:

• Standard (measure in 1000 MHz)

• Standard (measure in 2000 MHz)

• Standard (measure in 2500 MHz)

• Customized cables

Press **[ENTER]** to confirm the selection. Then the tester displays a cable list in the frequency band. Each category of cables is listed with cable type velocity factor and average cable loss.

If you wish to create customized cable library, you need to use *N9330A Post Analysis Tool* to send the customized cable list to the tester.

System Setups

Setting screen resolution

Three types of screen resolution choices are available:

• 521

• 261

• 131

The higher resolution you set, the more precise trace you get, but longer sweep time you need to spend.

Key access: **[MEAS/VIEW] > {Resolution}**

Choosing a unit

Two types of distance units are available:

• meter

• foot

Key access: **[SYS] > {Units}**

The change of unit is displayed at the left lower corner of the screen.

Setting date and time

Key access: **[SYS] > {Clock}**

The date and time display on the top line of the screen.

Firmware upgrade

A N9330A provides an easy and fast access for firmware update.

| **NOTE** | When updating firmware, make sure there will be a constant power supply for at least 10 minutes. |

Refer to the following steps to upgrade the firmware:

1 Copy the firmware upgrading application onto the root level of a USB memory stick.

2 Insert the USB memory stick into the USB connector on the top panel of the tester.

3 Press **[SYS] > {Upgrade}** to activate the inner updating procedure**.** Then the tester will then perform the upgrading automatically.

4 The tester promotes a message to indicate the firmware upgrading is in process.

5 After firmware upgrading completes, power off the tester and reboot it.

5

Key Reference

AMPTD

Sets the displayed amplitude range. Use the numerical keypad to input the amplitude value or rotate the knob to increase or decrease the amplitude value.
The tester saves the previous modified amplitude range and recalls it when the tester is powered on.

The displayed amplitude range is different when the tester is in different mode:

- Return loss
  In this mode, the default unit dB does not display on the screen.
- Cable loss
  In this mode, the default unit dB does not display on the screen.
- SWR (Standing Wave Ratio)
- DTF_Return loss
  In this mode, the default unit dB does not display on the screen.
- DTF_SWR

Top

Sets the displayed top amplitude value.

Tester will automatically revise your input by a minimum amplitude increment, if you previously input an improper top amplitude.

Key access: **[AMPTD] > {Top}**

Bottom

Sets the displayed bottom amplitude.

Tester will automatically revise your input by a minimum amplitude increment, if you previously input improper bottom amplitude.

Key access: **[AMPTD] > {Bottom}**

| CAUTION | Damage to the tester may result when the input power is greater than +23 dBm or 50 VDC. |

CAL

Activates the calibration process for the tester. A calibration process performs open, short and load (OSL) calibrations. You can either follow the instructions from the tester to run a calibration or customize a calibration.

You can select either an electronic calibrator or a T-combo mechanical calibrator to perform an open-short-load calibration.

- **T-combo calibrator**
  Is a T-shaped mechanical calibrator. The three parts of the T-combo are the open, short and 50 Ω load. The T-combo calibrator is a more accurate calibration than the electronic calibrator and will improve the measurement range of the tester.

- **Electronic calibrator**
  The electronic calibrator enables you to perform a one-connection calibration process. It performs an open, short, and 50 W load calibration consecutively. The electronic calibrator is faster but less accurate than the mechanical calibrator.

When a calibration is completed, a "Calibrated" indicator displays on the left top corner the screen.

Refer to "Calibrate the N9330A before making measurements" on page 21, for more information.

Bypass Electronic Calibrator

The electronic calibrator is the default setting for the tester. However, a user may choose to use either the to electronic calibrator, or T-combo mechanical calibrator.
When using the T-combo mechanical calibrator, the user will bypass the default electronic calibrator process by pressing **[CAL] > {Bypass E Calib}**. The tester will then access the manual open-short-load calibration.

Key access: **[CAL] > {Bypass E Calib}**

User Cal Mode

The user may define a custom calibration process instead of using the tester default, open-short-load combination. Pressing **[Cal] > {User Cal Mode}** to select the calibration item for your customized calibration.

NOTE   User defined calibration accepts only the T-combo calibrator. The electronic calibrator is not compatible with any user defined calibration mode. A User Cal requires the user to perform an open-short-load calibration process.

Key access: **[CAL] > {User Cal Mode}**

Distance

When you are using the DTF (Distance to Fault) mode, pressing **[FREQ/DIST]** brings up a submenu of setting DTF parameters, instead of frequency range. The tester saves the latest defined DTF parameters and recalls them when you power on the tester next time.

Start

Sets the displayed start distance. You can pre-define the default unit to be either meters or feet by pressing **[SYS] > {Units}**. The minimum distance increment is 0.1 m or 0.1 foot.

Key access: **{Start}**

Stop

Sets the displayed stop distance. Stop distance is always greater than the start distance. The maximum stop distance is calculated from the following equation:

(Resolution * 150 * V_t/V_c) / (F_2–F_1)

In this equation,

- Resolution means the current resolution of the trace. Pressing **[MEAS/VIEW] > {Resolution}** enables you to select resolution setups: 131, 261 or 521 points.
- V_t/V_c means the velocity factor of a cable.
- V_c means velocity of light.
- F_2 means the stop frequency and F_1 refers to the start frequency. The offset between F2 and F1 should always be greater than a tenth of current resolution (Resolution/10). For example, if the current resolution is 521, then F_2–F_1 should be greater than 52.1 MHz.

Key access: **{Stop}**

DTF Config

Lists and edits the DTF parameters.

Key access: **{DTF Config}**

Pressing **{DTF Config}** brings up a check list, showing the parameters in a DTF measurement:

- Start Distance
  When you rotate knob to highlight this parameter and press **[ENTER]**, the displayed start distance becomes editable. This is equivalent to pressing **[FREQ/DIST] > {Start}** in DTF mode.

- Stop Distance
  When you rotate knob to highlight this parameter and press **[ENTER]**, the displayed stop distance becomes editable. This is equivalent to pressing **[FREQ/DIST] > {Stop}** in DTF mode.

- Start Frequency
  When you rotate knob to highlight this parameter and press **[ENTER]**, the start frequency becomes editable. This is equivalent to pressing **[FREQ/DIST] > {Start}** when in non-DTF mode. Changing frequency range changes the maximum measured and displayed distance.

- Stop Frequency
  When you rotate knob to highlight this parameter and press **[ENTER]**, the stop frequency becomes editable. This is equivalent to pressing **[FREQ/DIST] > {Stop}** when in non-DTF mode. Changing frequency range changes the maximum measured and displayed distance. Refer to "Distance" on page 58, for more information.

- Resolution
  When you rotate knob to highlight this parameter and press **[ENTER]**, the trace resolution becomes editable. This is equivalent to pressing **[Meas/View] > {Resolution}**. Changing the resolution changes the maximum measured and displayed distance.

- Windowing
  When you rotate knob to highlight this parameter and press **[ENTER]**, the windowing menu is presented. This is equivalent to pressing **{Window}** in DTF mode.

- Cable
  When you rotate knob to highlight this parameter and press **[ENTER]**, a cable library is brought up. This is equivalent to pressing **{Cable}** in DTF mode.

- Velocity Factor
  When you rotate knob to highlight this parameter and press **[ENTER]**, the velocity factor becomes editable. This is equivalent to pressing **{Velocity Factor}** in DTF mode.

- Cable Loss
  When you rotate knob to highlight this parameter and press **[ENTER]**, the cable loss becomes editable. This is equivalent to pressing **{Cable Loss}** in DTF mode.

Cable Loss

Sets the average loss of a transmission cable, with minimum increment is 0.001. Use either dB/m or dB/foot as its unit.

Key access: **{Cable Loss}**

Velocity Factor

Sets the velocity factor of a transmission cable. Velocity factor has no unit. It refers to the rate of a signal's transmission speed in a particular cable versus its transmission speed in vacuum. Velocity factor ranges from 0.01 to 1.

Key access: **{Velocity Factor}**

Cable

The cable library consists of four categories of cables:

- Standard cables below 1000 MHz
- Standard cables below 2000 MHz
- Standard cables below 2500 MHz
- Customized cables

Key access: **{Cable}**

In each category, commonly used cables are listed with cable type, velocity factor, and cable loss. If you need to customize cables, use the *N9330A Post Analysis Tool* (PC software) to send customized cable list to the tester.

Window

- Adds window to traces. Five options of windowing include:
  - Rectangular windowing
  - Hamming windowing
  - 3-sample Blackman windowing
  - 4-sample Blackman windowing
  - None

Key access: **{Window}**

Enter and ESC/CLR

[ENTER] and [ESC/CLR] are the frequently used keys on the tester.

Enter

• Terminates date entry and enters into the analyzer a numerical value keyed from numeric keypad on the front panel.

• Terminates filename entries.

Key access: [ENTER]

ESC/CLR

• Clears data entries.

• Exits from a functional block.

Key access: [ESC/CLR]

Frequency

Sets the measurement frequency range. The default unit is MHz and the tester provides this unit only. The tester saves the latest defined frequency range and recalls the frequency setup when you power on the tester next time.

Start

Sets the start frequency. The minimum increment is 0.1 MHz. Use numerical keypad to input the frequency and press **[ENTER]** to confirm your input. Or rotate the knob to increase or decrease the frequency. You can also press **{Left}** or **{Right}** to move the cursor to the digit you want to edit on, then rotate the knob to modify the value.

Key access: **[FREQ/DIST] > {Start}**

Stop

Sets the stop frequency. The minimum increment is 0.1 MHz.

Key access: **[FREQ/DIST] > {Stop}**

Signal Standard

Includes a frequency range list of several signal standards. When you select a signal standard from the list, the tester automatically sets the start and stop frequency according to the frequency of the signal standard you just selected. Refer to "Using signal standards" on page 46 for more information.

Key access: **[FREQ/DIST] > {Signal Standard}**

NOTE   When in DTF mode, pressing [Freq/Dist] brings up a submenu of setting the distance range, instead of frequency range.

Limit

Sets the pass/fail bar for traces. Two individual single limit lines and single limit line with five multiple limit segments are selectable. The tester also provides a limit beep function to alert a failure of limit judgement. If traces are below a limit or a limit segments, the tester judges the measurement as "passed", if the traces are above the limit bars, the tester judges the measurement as "failed".

Limit 1

Pressing **[LIMIT] > {Limit 1}** brings up a sub menu for editing a single limit applied horizontally across the displayed bandwidth.

The amplitude range of a single limit varies according to the current measurement mode. Refer to "AMPTD" on page 54 for more information.

Key access: **[LIMIT] > {Limit 1}**

Limit 2

Pressing **[Limit] > {Limit 2}** brings up a sub menu for editing a single limit that applies a second horizontal limit line across the displayed bandwidth.

The amplitude range of a single limit varies according to the current measurement mode. Refer to "AMPTD" on page 54 for more information.

Key access: **[LIMIT] > {Limit 2}**

Multiple Limit

Pressing **{Multi Limit}** brings up a submenu for editing multiple limit segments. Up to five individual limit segments may be applied. Each segment requires a defined frequency and amplitude value of the start and end point for the segment.

NOTE Limit segments may not overlap with each other and segments must have a horizontal component, that is. they cannot be vertical.

Key access: **[LIMIT] > {Multi Limit}**

Limit Beep

The tester emits a beeping sound when the trace is above the limit bar to indicate the measurement fails as defined in the limit setups.

Key access: **[LIMIT] > {Limit Beep}**

Marker

Provides frequency and amplitude readout for a particular point or multiple points on a trace. The tester provides 6 markers, with 6 different colors. You can turn on or off any one of them, or turn off all of them at them same time.

Marker readout displays at the lower side of the screen, in a format of (frequency, amplitude). The tester always uses MHz as its default frequency unit and dB as its default amplitude unit except for SWR measurement.

Marker 1...6

Provides editable markers, labeled from Marker1 to Marker6. Two methods of placing a marker onto a particular point on a trace:

- Turn on a marker and rotate the knob to move the marker to the point.
- Turn on a marker and press **[Edit]** to manually set the marker to a specified point.

Key access: **[MARKER] > {Marker1...6} > {Edit}**

Delta

Calculates and reads out the frequency and amplitude offsets of Markers, comparing to Marker1. When using delta function, the tester keeps the marker on the trace as it is, but the readout changes to the frequency and amplitude offsets comparing to the Marker1.

Key access: **[MARKER] > {Marker2...6} > {Delta}**

Marker to Peak

Places a marker to the point that has the highest amplitude on the trace.

Key access: **[MARKER] > {Marker1...6} > {Marker to Peak}**

Marker to Minimum

Places a marker to the point that has the lowest amplitude on the trace.

Key access:
[MARKER] > {Marker1…6} > {Marker to Minimum}

Marker All off

Turn off all the active markers.

Key access: **[MARKER] > {Marker All off}**

Meas/View

Five functional blocks are available under [**MEAS/VIEW**]:
- Setting the trace resolution
- Enabling the single sweep
- Performing mathematical operation on two traces
- Performing trace overlap comparison
- Enabling interference immunity

Resolution

Three types of trace resolution are selectable:
- 131 points
- 261 points
- 521 points

Key access: **[MEAS/VIEW] > {Resolution}**

Single

Toggles the single sweep between on and off. When single sweep is off, the tester sweeps continuously.

Key access: **[MEAS/VIEW] > {Single}**

IIM (Interference Immunity)

Toggles the interference immunity between on and off. When IIM is on, the sweep speed becomes slower than normal.

Key access: **[MEAS/VIEW] > {IIM}**

Trace Operation

Mathematically compares current trace with a pre-stored trace. Trace operation requires both measurements be made using the same parameters, mode, resolution, and frequency/distance range.

Pressing **{Trace Operation}** brings up a check box for you to choose a trace operation mode:

- Off
  The tester turns off trace operation function.
- Trace−Memory
  Current trace subtracts pre-stored trace.
- Trace+Memory
  Current trace adds pre-stored trace.

Key access: **[MEAS/VIEW] > {Trace Operation}**

Trace Overlap

Overlaps currently displayed measurement trace with a previously-stored trace, using a different color. Trace Overlap requires both measurements be made using the same parameters, mode, resolution, and frequency/distance range.

Key access: **[MEAS/VIEW] > {Trace Overlap}**

Mode

Accesses the check box menu for selecting the measurement mode from the following five options:

• Standing wave ratio (SWR)

• Return loss

• Cable loss

• Distance-to-Fault (DTF)

  • Standing wave ratio

  • Return loss

Key access: **[MODE]**

System

Personalizes the tester and manages system setups.

Cal Mode

Toggles calibration mode between full span calibration and selected span calibration.

Key access: **[SYS] > {Cal Mode}**

Power Manager

Enables the power saving mode. The tester will turn off the LCD backlight and display after non-use of from one minute to 60 minutes, user definable. Pressing any key on the front panel, except the power switch, brings the tester back to its previous state immediately.

Key access: **[SYS] > {Power Manager}**

Units

Toggles the default setting unit of distance between meter and foot.

Key access: **[SYS] > {Units}**

Language

Enables you to select a regional language displayed on the screen. Choices are: English, French, German, Italian, Spanish, Portugal, Russian, Korean, Japanese, Simplified Chinese and Traditional Chinese.

Key access: **[SYS] > {Language}**

Clock

Accesses the date and time settings.

Key access: **[SYS] > {Clock}**

Status

Shows the systematic information of the tester.

Key access: **[SYS] > {Status}**

Upgrade

Enables the firmware upgrade process.

1 Copy the upgrade application onto the root level of a USB memory stick.

2 Insert the USB memory stick into the USB interface of the tester on its top panel.

3 Press **[SYS] > {Upgrade}** to initiate firmware upgrade.

4 The tester will promotes a message to indicate firmware upgrading is in process.

5 After upgrading completes, power off the tester then reboot it.

Key access: **[SYS] > {Upgrade}**

Self Test

Runs a self test on temperature and hardware.

Key access: **[SYS] > {Self Test}**

E Calib Test

Verifies the communication between the electronic calibrator and the tester.

Key access: **[SYS] > {E Calib Test}**

Intelligent

Toggles the ability to identify the calibration loads (Open/Short/Load) from each other between on and off.

Key access: **[SYS] > {Intelligent}**

Fast Meas

Toggles the fast sweep between on and off.

Key access: **[SYS] > {Fast Meas}**

License key

Brings up a window for inputting a license code for an option.

Key access: **[SYS] > {License key}**

6

Instrument Messages

Error Message List

Error Code	Error Message	Description
-310	System error	Failed to write to file.
-311	System error	Failed to load system file.
-312	System error	Failed to delete file.
-313	System error	Failed to read file.
-314	System error	Failed to save file.
525	Read Ext. power voltage error	Failed to read Ext. power voltage.
526	RTC battery low voltage	RTC battery Low voltage.
527	Read RTC battery error	Failed to read RTC battery.
528	Read main battery error	Failed to read main battery.
529	Temperature sensor communication error	Failed to temperature sensor communication.
530	Read RTC time error	Failed to read RTC time.
531	Read Ecal serial number error	Failed to read electronic calibrator serial number.
701	RF PLL error	RF PLL unlocked.
702	LO PLL error	LO PLL unlocked.
703	RF and LO error	RF and LO PLL unlocked.

Warning List

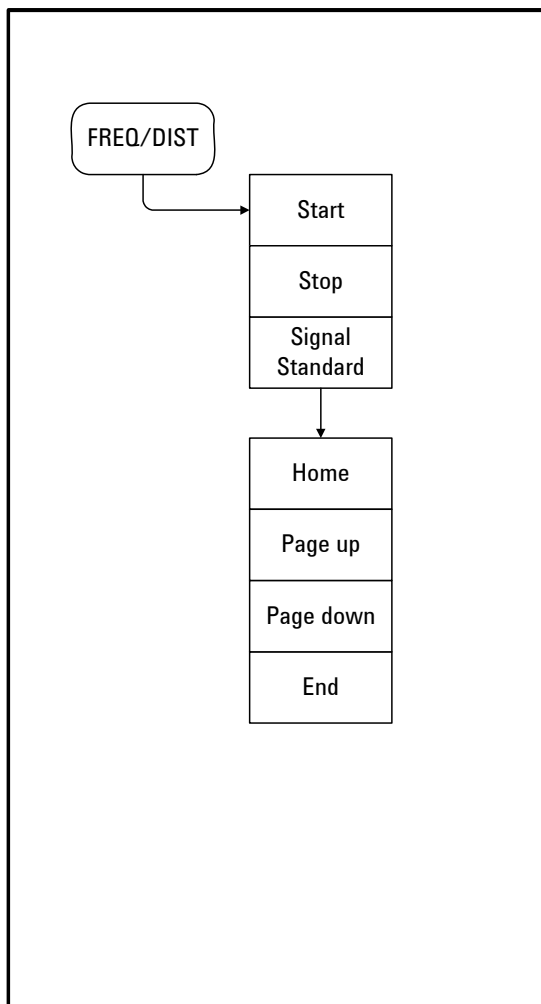| No.	Warning Message
1	Open segment error. Overlapped with other segment(s). Continue in 3 seconds.
2	Open segment error. The start is greater than the stop. Continue in 3 seconds.
3	Edit segment error. The start is greater than the stop. Continue in 3 seconds.
4	Edit segment error. Overlapped with other segment(s). Continue in 3 seconds.
5	Trace operation error. Incompatible traces. Continue in 3 seconds.
6	Trace overlap error. Incompatible traces. Continue in 3 seconds.
7	Edit segment error. Segment cannot be vertical. Continue in 3 seconds.
8	File name already exists, overwrite it? Press ENTER to overwrite. Press ESC to abort.
9	File name too long. Max. 20 char allowed. Press ENTER/ESC to abort.
10	Calibration invalid. Frequency changed. Continue in 3 seconds.
11	Calibration will be invalidated. Temperature out of range. Press ENTER/ESC to abort.
12	Cannot open segment. Segment cannot be vertical. Continue in 3 seconds.
13	Save file error. File name cannot be null. Press ENTER/ESC to abort.

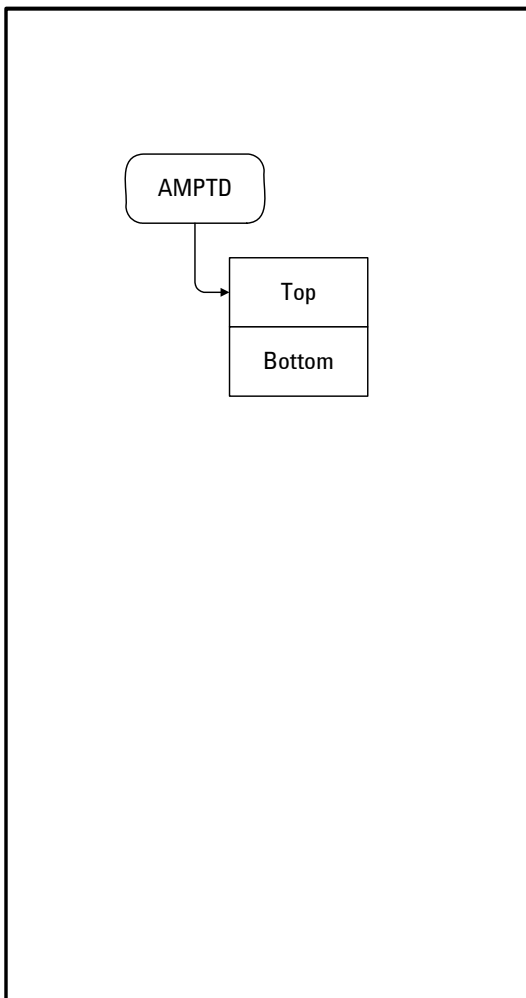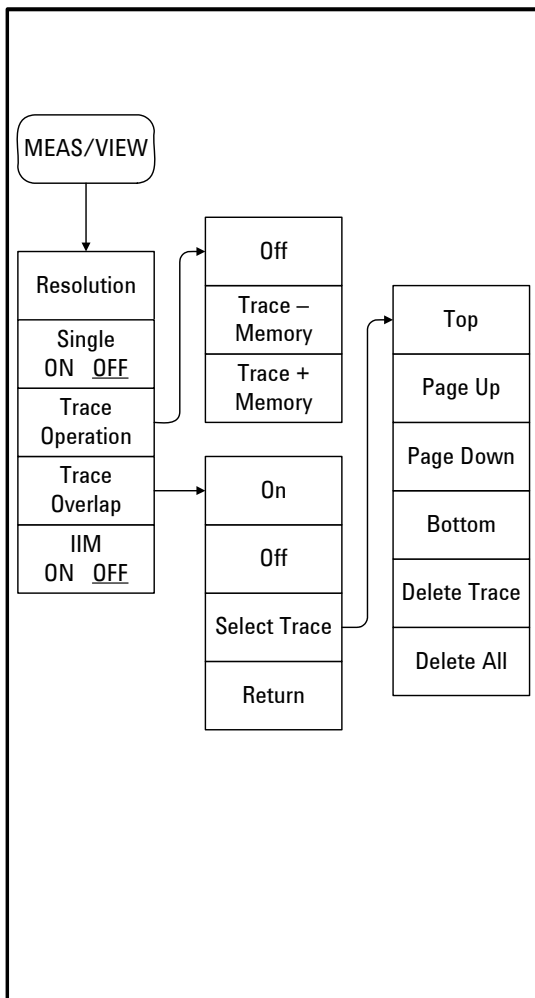| No.	Warning Message
14	Save trace error. Memory is full. Continue in 3 seconds.
15	Cannot modify the value now Continue in 3 seconds.
16	Changing CAL mode invalidates calibration. Press ENTER to continue Press ESC to abort.
17	Changing frequency invalidates calibration. Press ENTER to continue Press ESC to abort.
18	Delete this trace? Press ENTER to continue. Press ESC to abort.
19	Delete all traces? Press ENTER to continue. Press ESC to abort.
20	Freq range is changed. BW is below min. BW. Continue in 3 seconds.
21	Cannot upgrade. There isn't application in the U-disk. Press ENTER/ESC to abort.
22	Upgrade complete. Press ENTER/ESC to abort.

Agilent N9330A
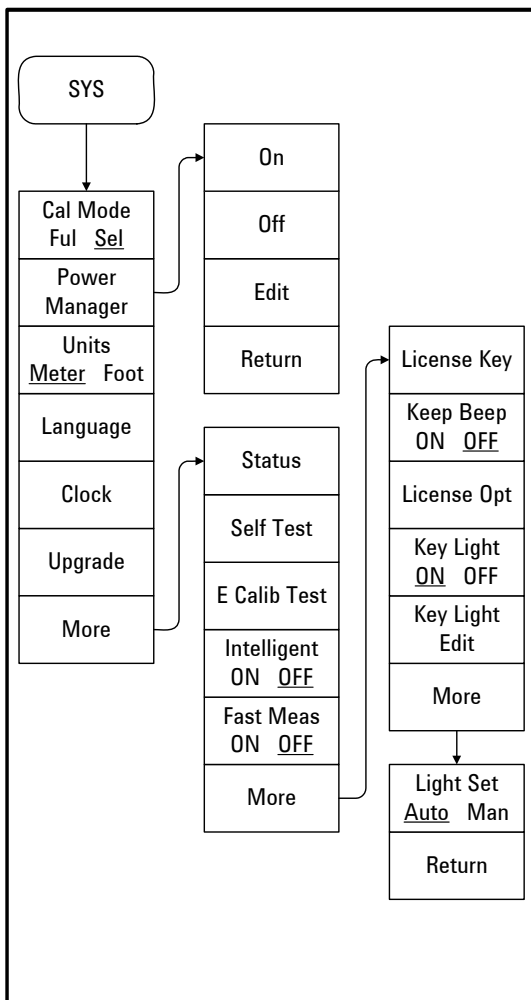**Handheld Cable & Antenna Tester**

7

Menu Map

FREQ/DIST

AMPTD

MEAS/VIEW

SYS

SYS

Cal Mode
Ful   Sel

Power
Manager

Units
Meter   Foot

Language

Clock

Upgrade

More

On

Off

Edit

Return

Status

Self Test

E Calib Test

Intelligent
ON   OFF

Fast Meas
ON   OFF

More

License Key

Keep Beep
ON   OFF

License Opt

Key Light
ON   OFF

Key Light
Edit

More

Light Set
Auto   Man

Return

LIMIT

```
┌─────────────────────────────────────────────────────────┐
│                                                           │
│   ╭─────────╮                                             │
│   │  LIMIT  │                                             │
│   ╰────┬────╯          ┌──────────────┐                   │
│        │               │     On       │                   │
│        ▼               ├──────────────┤                   │
│   ┌─────────┐          │     Off      │                   │
│   │ Limit 1 │          ├──────────────┤                   │
│   ├─────────┤          │    Edit      │                   │
│   │ Limit 2 │          ├──────────────┤                   │
│   ├─────────┤          │    Return    │                   │
│   │ Multi   │          └──────────────┘                   │
│   │ Limit   │                         ┌──────────────┐     │
│   ├─────────┤                         │     On       │     │
│   │ Limit   │                         ├──────────────┤     │
│   │ Beep    │          ┌──────────────┤     Off      │     │
│   │ ON OFF  │          │ Segment 1    ├──────────────┤     │
│   └─────────┘          ├──────────────┤    Edit      │     │
│                        │ Segment 2    ├──────────────┤     │
│                        ├──────────────┤    Return    │     │
│                        │ Segment 3    └──────────────┘     │
│                        ├──────────────┤                    │
│                        │ Segment 4    │                    │
│                        ├──────────────┤                    │
│                        │ Segment 5    │                    │
│                        ├──────────────┤                    │
│                        │   Return     │                    │
│                        └──────────────┘                    │
│                                                           │
└─────────────────────────────────────────────────────────┘
```

Marker

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