User Manual

Tektronix

**YBA250
Antenna and Transmission Line
Analyzer**

071-1047-01

www.tektronix.com

WARRANTY

Tektronix warrants that the products that it manufactures and sells will be free from defects in materials and workmanship for a period of one (1) year from the date of purchase from an authorized Tektronix distributor. If any such product proves defective during this warranty period, Tektronix, at its option, either will repair the defective product without charge for parts and labor, or will provide a replacement in exchange for the defective product. Batteries are excluded from this warranty.

In order to obtain service under this warranty, Customer must notify Tektronix of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service. Customer shall be responsible for packaging and shipping the defective product to the service center designated by Tektronix, shipping charges prepaid, and with a copy of customer proof of purchase. Tektronix shall pay for the return of the product to Customer if the shipment is to a location within the country in which the Tektronix service center is located. Customer shall be responsible for paying all shipping charges, duties, taxes, and any other charges for products returned to any other locations.

This warranty shall not apply to any defect, failure or damage caused by improper use or improper or inadequate maintenance and care. Tektronix shall not be obligated to furnish service under this warranty a) to repair damage resulting from attempts by personnel other than Tektronix representatives to install, repair or service the product; b) to repair damage resulting from improper use or connection to incompatible equipment; c) to repair any damage or malfunction caused by the use of non-Tektronix supplies; or d) to service a product that has been modified or integrated with other products when the effect of such modification or integration increases the time or difficulty of servicing the product.

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Preface

The YBA250 Antenna and Transmission Line Analyzer is part of the NetTek BTS Field Tool family: a high performance, portable, field ready tester optimized for fast trouble resolution and easy BTS antenna performance verification. It is based on the familiar and easy-to-use Windows CE operating system, so you will spend less time learning the instrument and more time troubleshooting the network.

The YBA250 is optimized for fast identification of base station antenna and transmission line trouble, and easy location of those faults. The YBA250 enables you to quickly analyze a system using Return Loss or VSWR. System performance can also be analyzed in terms of insertion loss, which can be measured using the Cable Loss measurement. Then using the distance-to-fault capability, you can identify problem areas and their location.

Using Tektronix' advanced calibration technique, the YBA250 enables you to reference a single calibration for use across the entire frequency range, which eliminates the need to perform a calibration each time the frequency or display range is changed. To further minimize troubleshooting time and improve effectiveness, users can control the YBA250's accuracy and resolution to optimize measurement results. For easier interpretation of these results, the YBA250 also enables user-defined masks to qualify antenna performance providing faster analysis, plus allowing users to share masks and results.

About this Manual

This manual is divided into four sections: *Getting Started*, *Operating Basics, Reference* and *Appendices*.

The *Getting Started* section describes how to start using your YBA250 Antenna and Transmission Line Analyzer.

The *Operating Basics* section shows you how to operate the YBA250.

The *Reference* section explains how to perform specific tests with the YBA250.

The *Appendices* contain reference information such as specifications, a functional verification procedure and other information that you might need occasionally.

Additional Information

The YBA250 Antenna and Transmission Line Analyzer contains online help to enable you to quickly get explanations of how to use your YBA250. The online help is the first place you should look for information about operating the YBA250.

The YBA250 Antenna and Transmission Line Analyzer is based on the NetTek Analyzer Platform. Important information about configuring and operating the NetTek Analyzer Platform is contained in the *Y350C NetTek Analyzer Platform User Manual* (Tektronix part number 071-0805-XX). There is also extensive online help for the NetTek Analyzer Platform.

Conventions

This manual uses the following convention. The statement **Start > Help** is requesting that you open the Start menu and select Help. To do this, tap the Start button in the toolbar at the bottom of the desktop window; then tap Help in the resulting menu.

Software Version

This manual supports YBA250 Antenna and Transmission Line Analyzers running software version 1.2XX. To verify your software version, select **Tools > Software Info** when the YBA250 application is running.

Contacting Tektronix

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

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

General Safety Summary

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it. To avoid potential hazards, use this product only as specified.

Only qualified personnel should perform service procedures.

While using this product, you may need to access other parts of the system. Read the *General Safety Summary* in other system manuals for warnings and cautions related to operating the system.

⚠ **WARNING.** *Do not connect to any source which may be subject to the effects of lightning.*

To Avoid Fire or Personal Injury

Use Proper Power Cord. Use only the power cord specified for this product and certified for the country of use.

Connect and Disconnect Properly. Do not connect or disconnect probes or test leads while they are connected to a voltage source.

Observe All Terminal Ratings. To avoid fire or shock hazard, observe all ratings and markings on the product. Consult the product manual for further ratings information before making connections to the product.

The common terminal is at ground potential. Do not connect the common terminal to elevated voltages.

Replace Batteries Properly. Replace batteries only with the proper type and rating specified.

Recharge Batteries Properly. Recharge batteries only as specified.

Use Proper AC Adapter. Use only the AC adapter specified for this product.

Do Not Operate Without Covers. Do not operate this product with covers or panels removed.

Wear Eye Protection. Wear eye protection if exposure to high-intensity rays or laser radiation exists.

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

Do Not Operate in an Explosive Atmosphere.

Safety Terms and Symbols

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

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

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

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

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

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

CAUTION indicates a hazard to property including the product.

Symbols on the Product. These symbols may appear on the product:

⚠
CAUTION
Refer to Manual

Battery Recycling

This product contains a Lithium Ion battery, which must be recycled or disposed of properly. For the location of a local battery recycler in the U.S. or Canada, please contact:

RBRC   (800) BATTERY
Rechargeable Battery Recycling Corp.   (800) 227-7379
P.O. Box 141870   www.rbrc.com
Gainesville, Florida 32614

Getting Started

Getting Started

This section contains a description of the YBA250 Antenna and Transmission Line Analyzer and basic information you need to start using the YBA250.

Product Description
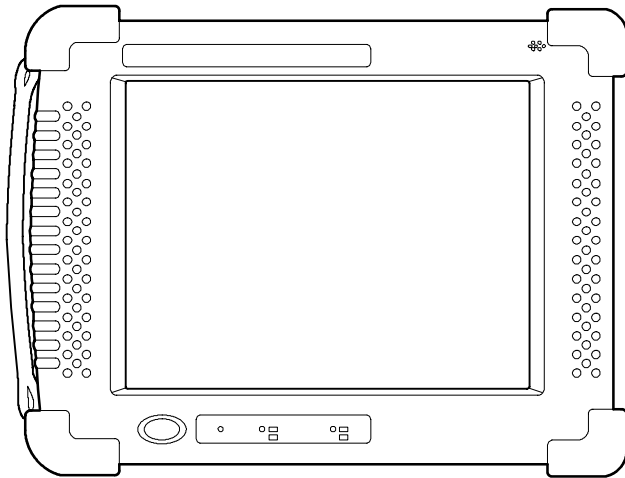
Figure 1‑1: YBA250 Antenna and Transmission Line Analyzer

The YBA250 Antenna and Transmission Line Analyzer enables you to determine the health of base station transceiver antenna systems by measuring the return loss or VSWR (Voltage Standing Wave Ratio) of each antenna in the system. The YBA250 also enables you to determine the distance to a fault in the transmission line leading to the antenna.

The standard YBA250 actually consists of two parts, the instrument module and the NetTek Analyzer Platform. The instrument module contains the hardware and software needed to perform antenna analysis. The NetTek Analyzer Platform is the "computer" that runs the software in the instrument module. The YBA250 can be purchased as just an instrument module that can be added to a NetTek Analyzer Platform that you already have.

You can attach up to three additional instrument modules onto the NetTek Analyzer Platform to expand the instrument's test capabilities. Instrument modules communicate with the platform through the internal bus and to the Base Station or device under test through their own input and output connectors.

The NetTek Analyzer Platform is based on the Windows CE operating system. With the purchase of PCMCIA Ethernet and modem cards, network and Internet capabilities are possible.

NetTek Analyzer Platform product features include the following:
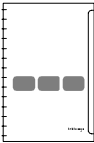
- Color display with touchscreen interface

- Modular instrument architecture

- Ruggedized package

- Removable battery packs

- Infrared communications

- I/O ports

- Software applications and utilities that support communications, power management, instrument configuration, text editing, web browsing and more.

Standard Accessories

The tables below provide a list of the standard accessories supplied with the YBA250 Antenna and Transmission Line Analyzer Module.

For a complete list of standard and optional accessories, see *Appendix B*, beginning on page B-1.

Table 1-1: Standard module accessories

	N Connector Plastic Cover. Used to protect RF Input.
	User Manual. Contains information on setup and basic operation.
	CD-ROM. Contains instrument software and an Adobe Acrobat PDF version of the User Manual.

Installing a YBA250 Module

If you purchased a YBA250 Antenna and Transmission Line Analyzer module for use on a NetTek Analyzer Platform you already have, use the following procedure to install the YBA250 module onto the NetTek Analyzer Platform or to attach the YBA250 module onto another module. Refer to Figure 1-3 throughout the following procedure.

⚠ **CAUTION.** *To prevent damage to the NetTek Analyzer Platform or YBA250 module, you must power down the NetTek Analyzer Platform before installing a YBA250 module.*

Use the following procedure to install a YBA250 module on a NetTek Analyzer Platform.

1. Select **Start > Shutdown**.

2. In the Shut Down dialog box, select **Shutdown**.

3. Disconnect all cables to the NetTek Analyzer Platform.

4. Place the NetTek Analyzer Platform face down on a flat uncluttered surface. The NetTek Analyzer Platform should be supported only by its four corner bumpers.

5. Remove the bus door from the rear of the NetTek Analyzer Platform or instrument module. See Figure 1‑2.
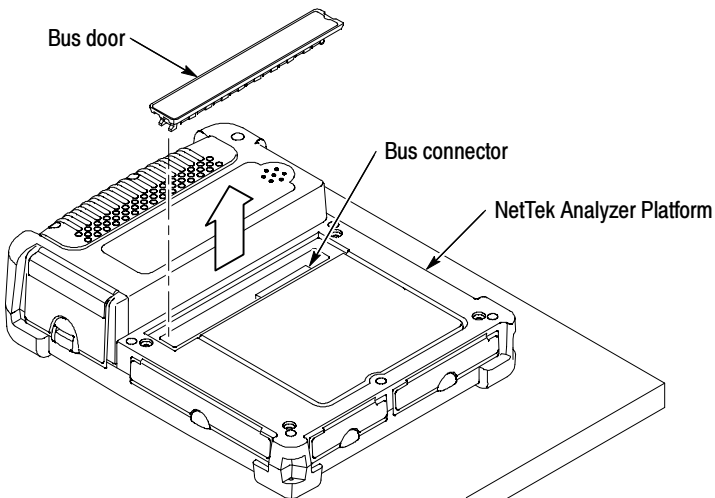
Figure 1‑2: Removing the bus door

6. Carefully lower the YBA250 module onto the NetTek Analyzer Platform to engage the bus connectors. See Figure 1‑3.

7. Press down firmly to seat the connector and ensure contact.

8. Locate the thumb screws. See Figure 1‑3.

9. For each thumb screw, push down on the head and turn it 1/4 turn in a counter-clockwise direction and let it pop up to extend the length.
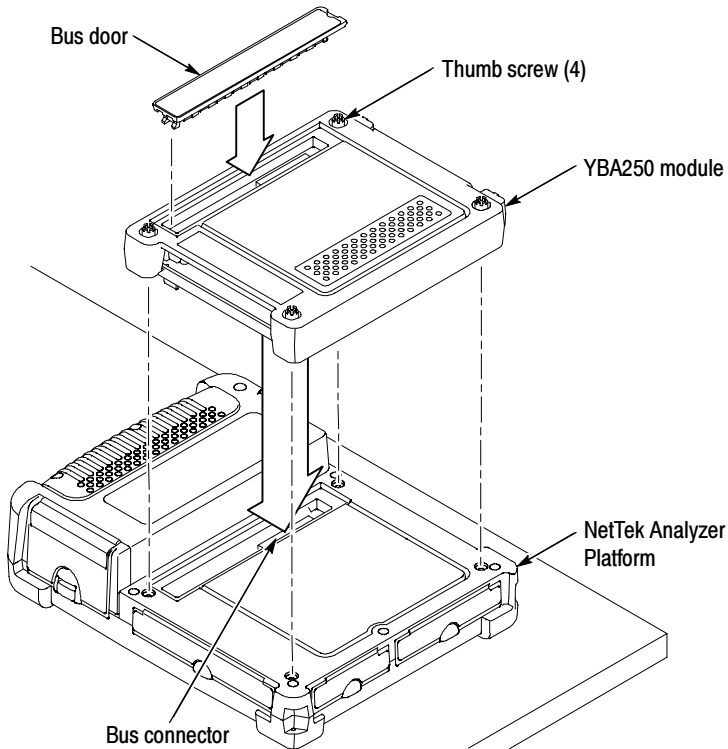
Figure 1‑3: Attaching the YBA250 module

10. Tighten the screws by pressing in just slightly and turning them in a clockwise direction. Use the coin slot in the top of the thumb screw if you require additional torque. Be sure to tighten all screws evenly, but do not overtighten.

11. To recess the thumb screw heads, push and turn each screw head 1/4 turn in a clockwise direction.

12. To maintain the enclosure seal integrity, reinstall the bus door into the rear of the YBA250 module.

Removing a YBA250 Module

Use the following procedure to remove a YBA250 module from a NetTek Analyzer Platform.

1. Select **Start > Shutdown** to shut down the NetTek Analyzer Platform.

2. Disconnect all cables to the NetTek Analyzer Platform.

3. Place the NetTek Analyzer Platform face down on a flat uncluttered surface. The NetTek Analyzer Platform should be supported only by its four corner bumpers.

4. To release the thumb-screw heads, push and turn each screw head 1/4 turn in a counter-clockwise direction.

5. Disengage all four screws by turning them in a counter clockwise direction. A tool or coin may be required if the screws were tightened with a coin or other tool.

6. Pull up on the YBA250 module to remove it.

7. To maintain enclosure seal integrity, reinstall the bus door into the rear of the NetTek Analyzer Platform.

Installing a Battery

The battery is not installed when the NetTek Analyzer Platform is shipped from the factory. To operate the YBA250 from its internal power source in the field, use the following procedure to install the battery into the NetTek Analyzer Platform.

NOTE. *The NetTek Analyzer Platform comes standard with a single battery. You can add a second battery to increase the operating time. Replace a battery with the specified type only. To purchase a battery from Tektronix, please refer to the* Y350C and Y350M NetTek Analyzer Platform User Manual *for the correct part number.*

1. Place the NetTek Analyzer Platform on a flat surface with the touch-screen display facing towards you and the battery

compartment door facing up. See Figure 1-4 for component locations.

2. Push the battery door latch towards the rear of the analyzer.

3. Lift up the battery compartment door and rotate it towards the rear of the analyzer.
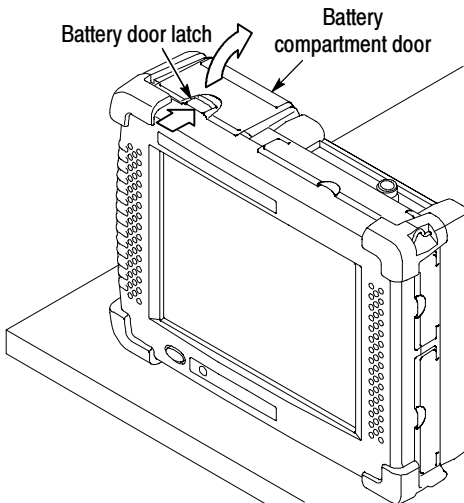
Figure 1-4: NetTek Analyzer Platform battery compartment

4. Locate the battery retaining tab. (See Figure 1-5.)

5. Push down on the tab with your finger to release the battery retaining door.

6. Lift up the battery retaining door and rotate it towards the rear of the analyzer. You must hold the door in place to install the battery.
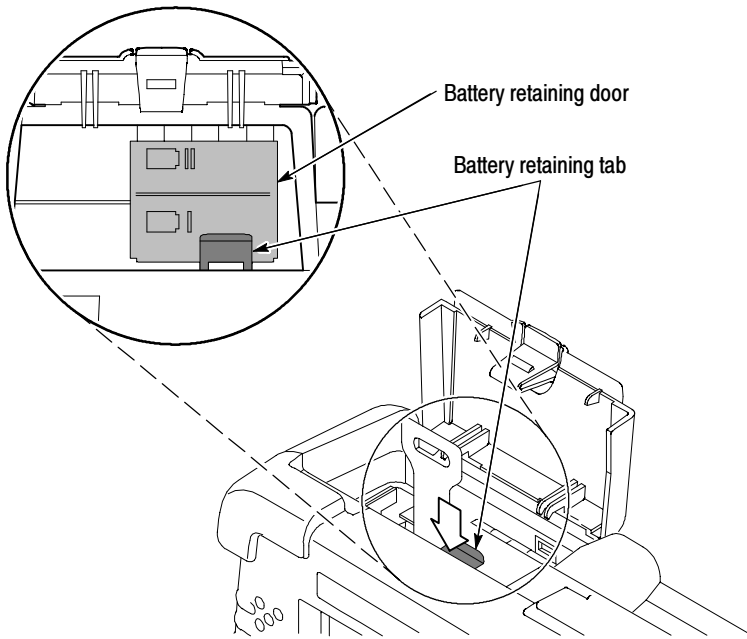
Figure 1‑5: Battery retaining tab

7. Position the battery as shown in Figure 1‑6. The battery electrical contacts, on the bottom of the battery, must face in the direction shown in Figure 1‑6. Be careful to fold the battery removal strap under the battery during installation or it will be difficult to remove the battery.
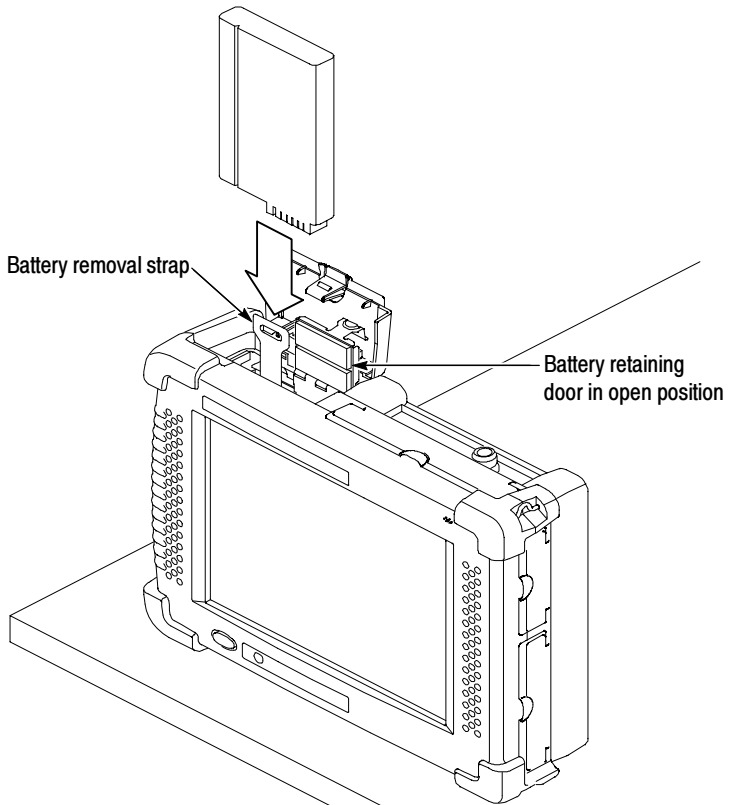
Figure 1‑6: Installing a battery

8. Lower the battery into the battery compartment and apply a firm pressure to seat its electrical contacts.

9. Rotate the battery retaining door down over the battery; then press down until you hear the latch click.

10. Close and latch the battery compartment door.

Removing a Battery

Use the following procedure to remove a battery for external charging or replacement.

1. Place the NetTek Analyzer Platform on a flat surface with the touch-screen display facing towards you and the battery compartment door facing up. See Figure 1-6 for component locations.

2. Push the battery door latch towards the rear of the NetTek Analyzer Platform.

3. Lift up the battery compartment door and rotate it towards the rear of the instrument.

4. Locate the battery retaining tab (see Figure 1-5).

5. Push down and back on the tab with your finger to release the battery retaining door.

6. Lift up the battery retaining door and rotate it towards the rear of the instrument. You must hold the door in place to install a battery.

7. Pull up on the battery removal strap to remove the battery. See Figure 1-7. If the strap is not accessible, place your hand over the battery compartment and tilt the NetTek Analyzer Platform upside down. The battery should come out of the compartment. Be careful to not to drop the battery.

Battery removal strap
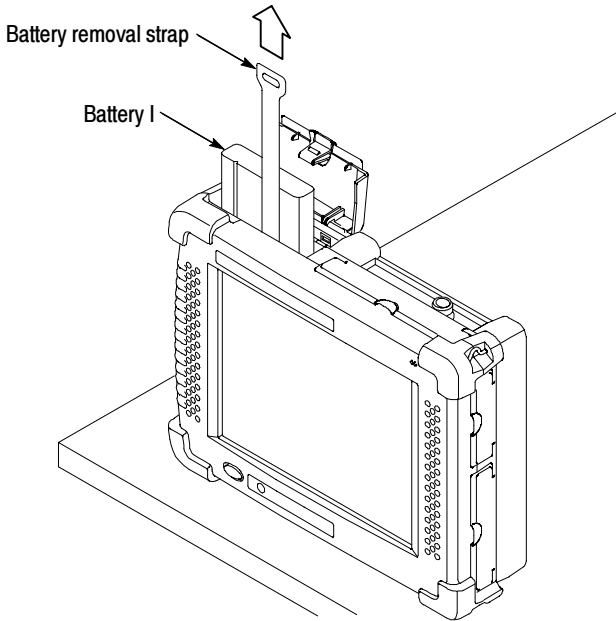
Battery I

Figure 1-7: Removing a battery

8. Follow the procedure on page 1-8 steps 7 through 10 to install a new or freshly charged battery.

Charging a Battery

NetTek Analyzer Platform batteries are calibrated and partially charged at the factory. When batteries are calibrated, the NetTek Analyzer Platform can provide an estimate of how much longer the YBA250 can be operated before the instrument will automatically power off. The YBA250 will always warn you before it powers off, so that you can save important test results or settings.

NOTE. *To achieve optimum performance from a new battery, fully charge the battery. Then fully discharge the battery by leaving the YBA250 running (see Start > Help > Settings > Power Management for information on disabling the power saver function), then fully charge the battery again.*

To verify the status of your batteries at any time:

1. Select **Start > Settings > Control Panel**.

2. Open (double-tap) the Power Management icon. The **Batteries** tab lists the status of each battery.

If the battery charge is low, see *Battery Charging,* in the *Y350C Net-Tek Analyzer Platform User Manual*, for charging instructions.

Optimizing Battery Life

For tips on how to maximize battery operating time, refer to the NetTek Analyzer Platform online help. Select *Start > Help > Settings > Power Management*.

Connecting the Desktop Power Supply

To supply external power for bench or desktop use, connect the Desktop Power Supply to the NetTek Analyzer Platform as shown in Figure 1-8.

The universal power supply operates from 100 to 240 VAC mains. See the *Y350CNetTek Analyzer Platform User Manual* for power cord options.
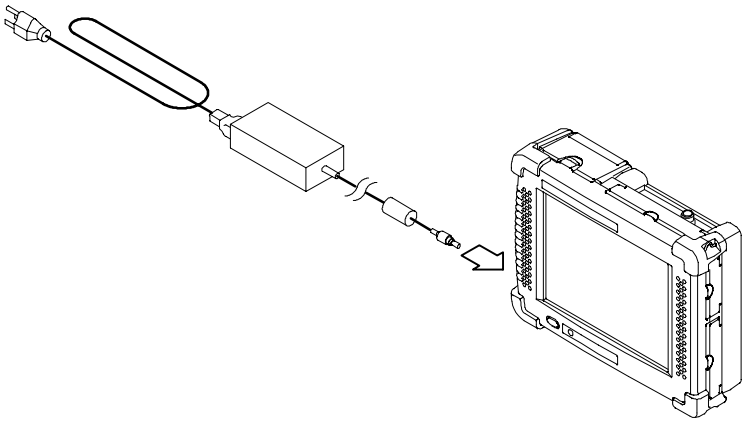
Figure 1-8: Desktop power supply

Connecting the In-Vehicle Power Supply

To supply external power or charge an analyzer battery from your vehicle, connect the In-Vehicle Adapter to the NetTek Analyzer Platform as shown in Figure 1‑9.

Plug into vehicle
12 VDC power outlet
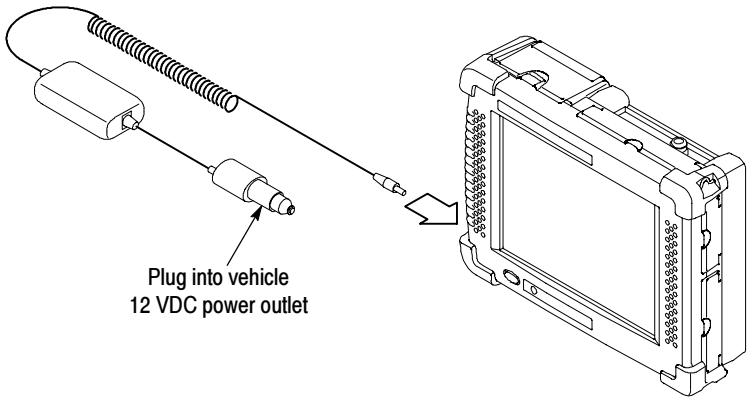
Figure 1‑9: In-vehicle power adapter

Setting Up the Tilt Stand

For floor or desktop use, attach the tilt stand to the NetTek Analyzer Platform and fold into place. See Figure 1--10.
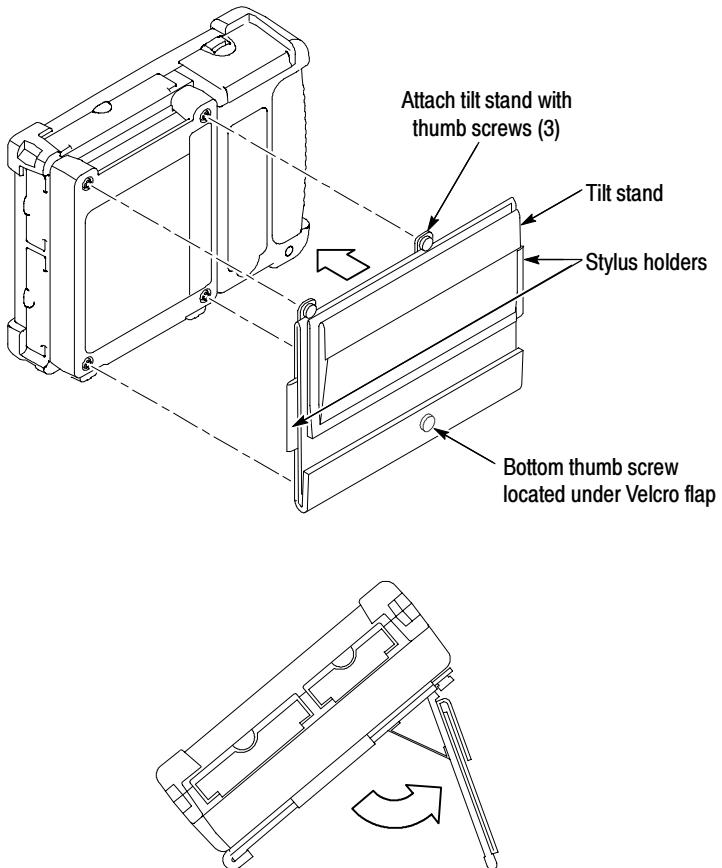
Figure 1-- 10: NetTek Analyzer Platform tilt stand

To install the tilt stand with two or more instrument modules attached, use the provided storage pack spacers as shown in Figure 1-11.

Spacer(s)

Velcro fastener

Tilt stand

Instrument module

Additional instrument module
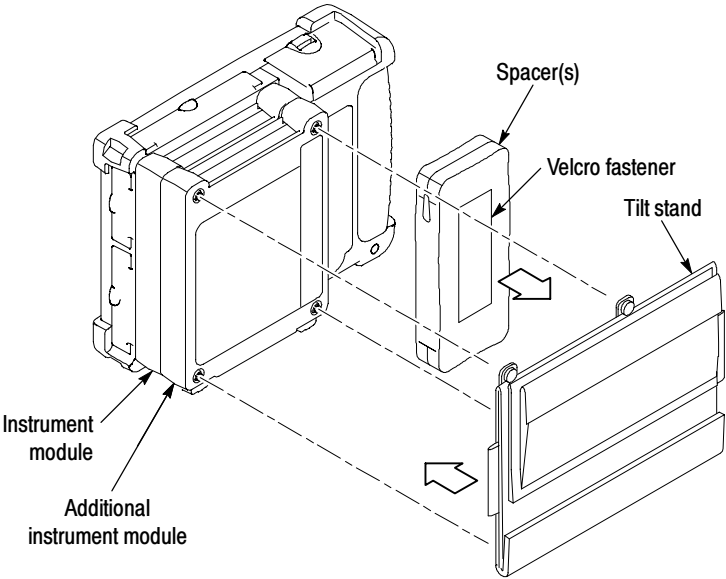
Figure 1-11: Installing the tilt stand on multiple instrument modules

Installing the Shoulder Strap

Use the shoulder strap to carry the YBA250 Antenna and Transmission Line Analyzer to the job site. Install the strap as shown in Figure 1‑12 or install it on the softcase.
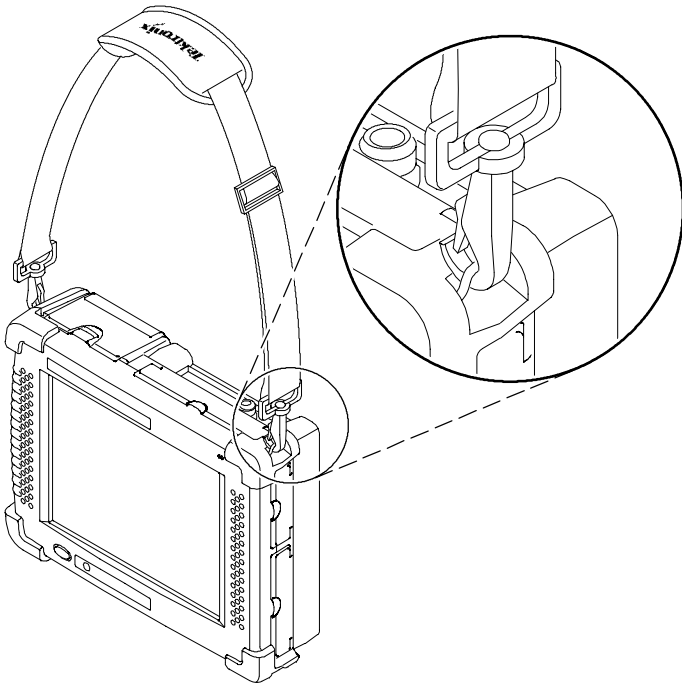
Figure 1‑12: YBA250 Antenna and Transmission Line Analyzer with shoulder strap attached

Installing the Strand Hook

Use the Strand hook to hang the YBA250 Antenna and Transmission Line Analyzer from a wire strand, ladder, or other support. Install the strand hook as shown in Figure 1-13.

⚠ *CAUTION. The YBA250, including the NetTek Analyzer Platform, can weigh in excess of 12 kg (25 lbs), depending on the number of batteries and instrument modules installed. Use caution when hanging the YBA250 from any support.*
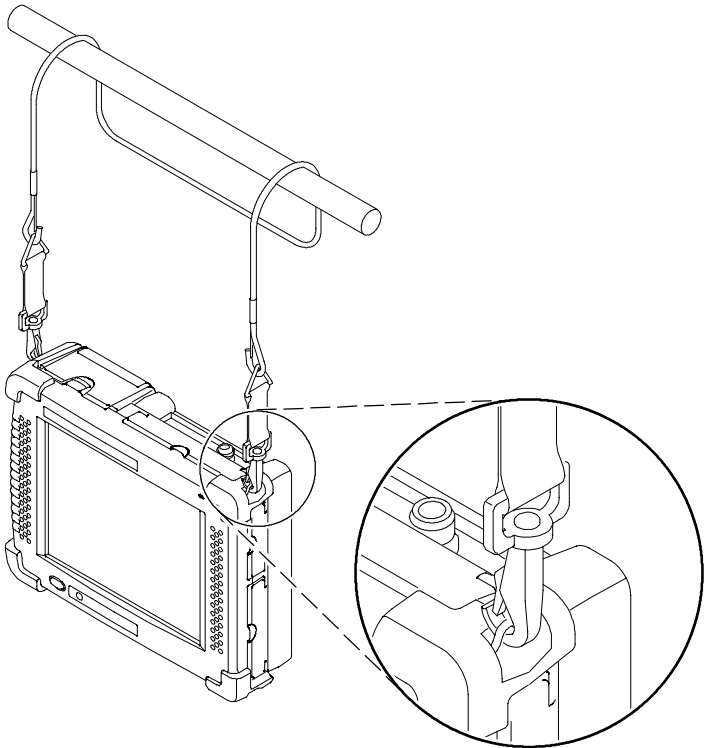
Figure 1‑13: YBA250 with strand hook attached

Powering On the Instrument

To power on the YBA250 Antenna and Transmission Line Analyzer:

■ Press the large blue oval front-panel switch in the lower-left corner.

The green status indicator to the right of the switch will light and the system will start up. The YBA250 can take up to $3\,{}^1/_2$ minutes to become fully functional depending on its state when last powered off. A typical power on takes about 2 minutes. The touch-screen display and human interface is described in the section to follow, *Operating Basics*.

How the Software Loads

When you press the power switch on the front panel, the NetTek Analyzer Platform powers up and runs its startup diagnostics (if enabled). Once the NetTek Analyzer Platform has completed its power up sequence, the YBA250 software begins to load. If there is enough flash memory available, the software loads into flash memory. If there is not enough flash memory available, then the YBA250 software loads into volatile memory (this happens only with user-installed modules; if your YBA250 was purchased already installed on a NetTek Analyzer Platform the software was loaded into flash memory at the factory). If the software is loaded into flash memory, the time required for the YBA250 to startup each time the instrument is powered on is much shorter. If the software is not loaded in flash memory, the software must be loaded into the NetTek Analyzer Platform each time the instrument is powered on, resulting in a longer start up time. Note that the software load process is automatic, there are no user decisions required or settings available that affect the software load process.

Calibrating the Touch-Screen Display

For the touch-screen display to respond correctly to your taps, you must set the stylus centering and double-tap speed.

Setting the stylus sensitivity

1. Select **Start > Settings > Control Panel**.

2. Open (double-tap) the Stylus icon.

3. In the **Double-Tap** tab, double-tap the checkerboard grid at a comfortable speed with your stylus or finger. This sets the tap rate.

4. Double-tap the clapboard to verify your settings.

Setting the stylus centering

1. Select **Start > Settings > Control Panel**.

2. Open the Stylus icon.

3. In the **Calibration** tab, select **Recalibrate**.

4. Follow the on-screen instructions to set the location and amount of pressure needed for the touch-screen to respond to your taps. Apply pressure to the touch-screen for approximately 5 seconds at each position, until the target moves.

5. Select **OK** to close the dialog box and save your settings.

Powering Off the Instrument

The YBA250 Antenna and Transmission Line Analyzer has separate, but related, standby and power off functions.

Suspend Mode

Use Suspend mode to place the YBA250 in a suspended (standby or sleep) state. This is the typical power down mode that allows the YBA250 software to remain in volatile memory. If the YBA250 remains in Suspend mode for an extended time (approximately two hours), it will automatically enter Shutdown mode.

To suspend analyzer operation, choose one of the following methods:

■ Press the front-panel power switch.

■ Select **Start > Shutdown**. In the Shut Down dialog box, select **Suspend**.

To cancel Suspend mode and wake up the YBA250, press the front-panel power switch. The YBA250 will return to the state that existed before suspend mode was invoked.

Shutdown

To completely power down the YBA250, do the following:

1. Select **Start > Shutdown**.

2. In the Shut Down dialog box, select **Shutdown**.

A shutdown clears volatile memory, including the YBA250 software if it is loaded in volatile memory, user setups, and measurement data not saved to nonvolatile memory. For information on how to save these items to nonvolatile memory, refer to the online help. Select **Start > Help**. In the Help window select **Tektronix Basics**; then select **Store Data in Nonvolatile Memory**.

The next time you press the front-panel power switch, the YBA250 will cycle through the complete power up process taking about 2 to $3\,^{1}/_{2}$ minutes to completely power up.

Restart (Software Reset)

If the YBA250 stops responding, try performing a restart to clear the problem.

To restart the YBA250, do the following:

1. Select **Start > Shutdown**.

2. In the Shut Down dialog box, select **Restart**.

The display blanks for approximately five seconds. The YBA250 software will reload and start. A Restart does not empty volatile memory.

Front-Panel Power Switch

Depending on the current state of the YBA250, pressing the front-panel power switch performs one of the following functions:

- If the YBA250 is shutdown: powers on the instrument.

- If the YBA250 is operating: initiates Suspend mode.

- If the YBA250 is in Suspend mode: cancels Suspend mode and activates the YBA250.

- If the analyzer is in PowerSaver mode (touch-screen display off): activates the display.

Preventing Personal Injury from the Effects of Lightning

⚠ **WARNING.** *To prevent personal injury from the effects of lightning, exercise the following precautions when using this product.*

Before connecting this product to any source

- Check your local weather forecast for the possibility of thunderstorms or lightning.

- If weather conditions could allow thunderstorms or lightning to develop, be sure to visually check the sky and weather conditions in your area frequently.

- If you can hear thunder or if you see lightning, do not connect this product to any source which may be exposed to the effects of lightning.

- Use your own good judgement and common sense. You must protect yourself from the effects of lightning.

- You must assume that hazardous voltages will be present on exposed surfaces of this product if it is connected to a source exposed to lightning. The insulation of this product will not protect you from these hazardous voltages.

Do not connect this product to any source which might be subject to the effects of lightning

If thunderstorms or lightning are in your vicinity:

- When weather conditions that could lead to lightning activity exist in your area, *you could be at risk of a lightning strike*

before the cloud is close enough for you to hear thunder or see lightning.

■ When lightning strikes a structure or facility, current travels through the rebar, concrete, pipes, cables, vent stacks, and electrical system.

■ Lightning can induce electric and magnetic fields into structures and portions of wiring. The length of a conductor affected by the magnetic field of a lightning strike may exceed two miles.

Be alert and aware of the effects of lightning

■ When lightning strikes a conductor, which in turn introduces the current into an area some distance from the ground strike point, *equipment can be damaged and personnel injured* if they become an indirect path in the completion of the ground circuit.

■ Conductors such as the braided shields of cables or unshielded wires will have significant transient currents flowing in them in regions exposed to the electric field effect of lightning.

■ Induced voltages may cause breakdown of insulation in wiring at connectors and in electrical components or breakdown of air.

Operating Basics

Operating Basics

This section explains the essential things you need to know to operate the YBA250 Antenna and Transmission Line Analyzer.

Overview

The YBA250 is a member of the Tektronix NetTek Series of modular instruments that are based on the NetTek Analyzer Platform. A NetTek Series instrument consists of a hardware module, application software, and the NetTek Analyzer Platform. A NetTek Series instrument, such as the YBA250 Antenna and Transmission Line Analyzer, can be purchased with or without a NetTek Analyzer Platform. Because a NetTek Analyzer Platform can support four instrument modules, it is a highly flexible instrument that can be reconfigured to meet your changing needs.

The NetTek Analyzer Platform is a specialized Windows CE-based computer. The NetTek Analyzer Platform provides the power source and display for NetTek Series instruments. The hardware module for each NetTek Series instrument provides the circuitry and the software provides the instrument interface and analysis capability.

The NetTek Analyzer Platform comes with a touchscreen and stylus. Use the stylus as you would a mouse on your desktop computer. You can select an object by tapping it, move it by dragging it or activate ("open") it by double-tapping it with your finger or a stylus.

⚠ *CAUTION. Only use soft objects, such as plastic or your finger, to tap the touch-screen display. Do not use metal or other abrasive materials, as they will damage the display surface.*

Identifying Front-Panel Controls and Indicators

The front-panel controls power the YBA250 Antenna and Transmission Line Analyzer on and off, reset the instrument, and indicate status. See Figure 2--1.
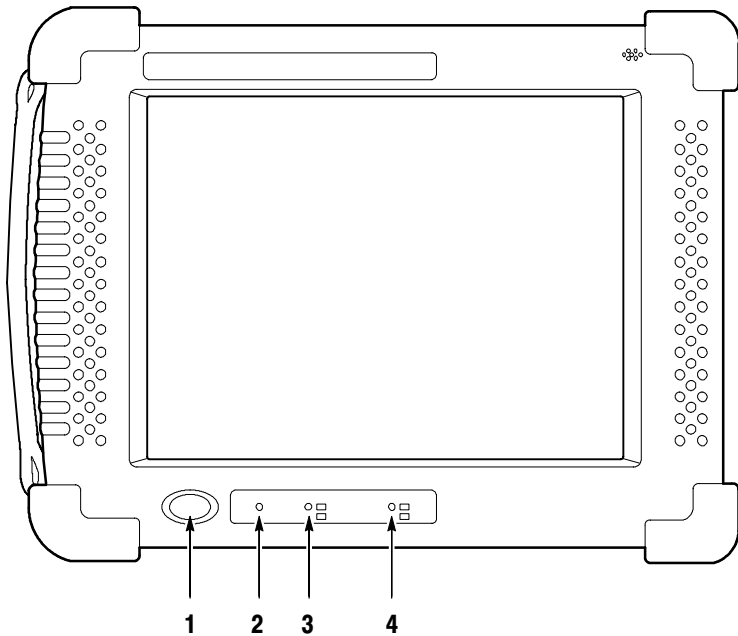
Figure 2--1: Front-panel controls and indicators

1. **Power/Suspend Switch.** Push on; push off. See pages 1--20 and 2--20 for additional information.

2. **Reset Switch.** Push to perform a hardware reset if a lock-up occurs. Programs and data loaded into volatile memory since startup will be lost.

3. **Status Indicator.** Green indicates power on. Amber indicates display off.

4. **Batteries Indicator.** Green indicates the instrument is connected to an external power source and charging an installed battery. Red indicates low battery.

YBA250 Input Connector

Figure 2‑2 identifies the location of the YBA250 input. For identification of the NetTek Analyzer Platform inputs, outputs and storage devices, please refer to the *Y350C and Y350M NetTek Analyzer Platform User Manual*.
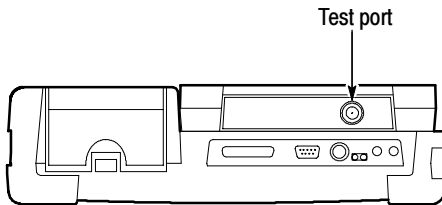
Test port

Figure 2‑2: YBA250 test port.

Getting Help

To open the Help window and obtain general information on YBA250 topics, select **Help** from the Start menu. Select **YBA250** to get help on the YBA250.

There are three ways to display Help when you are running the YBA250 software:

- First, you can tap the ⟦ **?** ⟧ icon in the upper-right corner of the YBA250 display. This displays the top level of the YBA250 help.

- Second, you can tap underlined text on the screen. This displays the Help topic for the item selected.

- Third, you can display Help from some dialog boxes by selecting the **Help** button in the bottom-right corner of the dialog box.

The Help Window

Table 2‑1 explains how to use the Help window buttons.

Table 2-1: Help window buttons

Tap this button	To
🔖 All Topics	Display the main table of contents.
📁 Back	Return to the previous help screen.
📋 Contents	Display the current program or local table of contents.
🗗	Display full-screen help text.
🗗	Display the help text in its own window. Drag the Help window title bar to move the window.
▬	Minimize the Help window. To restore the window, tap the Help button in the taskbar.
✕	Close the Help window and quit help.
▲	Display information farther up the window.
▼	Display information farther down the window.

Navigating the Desktop

The NetTek Analyzer Platform desktop is your primary workspace. Use the desktop to configure hardware and software, adjust settings, establish communications, and access built-in applications.
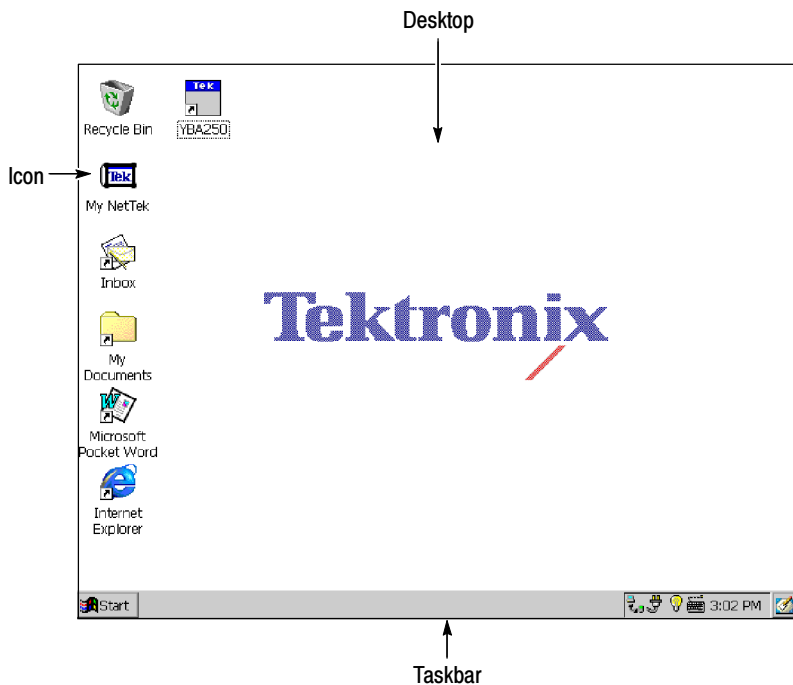
Icons

Double-tap desktop icons to open folders or to start programs.

Taskbar

The Taskbar contains the Start menu, buttons to identify the programs you are running, a status area, and a desktop icon.

Start menu   Desktop button

Program button   Status area
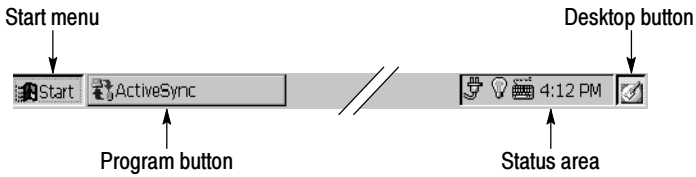
Start Menu. Use the Start menu to load and run other instrument modules and other programs, access settings, open documents, and obtain help. Select (tap) **Start** to open the menu; then select the entry you want.

For detailed information on the Start menu selections, see the *Y350C and Y350M NetTek Analyzer Platform User Manual*.

Tap **Start** to display the menu

Program Buttons. To hide a program that is running, tap its taskbar button. To restore the program, tap the button again.

Status Area. Icons and buttons appearing in this area indicate status, activate features, or open settings windows. Double-tap the icons for further information.

Table 2-2 explains the function of some common status icons. For a complete list and explanation of all status area icons, refer to the NetTek Analyzer Platform online help. Select **Start > Help**. In the Help window select **Windows CE Basics**; then select **Understanding Taskbar Icons**.

Table 2‑2: Status area icons

Tap this icon	To	Details
⚡	Double-tap to open the Power Management utility.	The analyzer is operating on external AC power.
⚡	Double-tap to open the Power Management utility.	The analyzer is charging batteries.
▯	Double-tap to open the Power Management utility.	The analyzer is operating on battery power. Also indicates charge level.
💡	Double-tap to open the Backlight utility.	Adjust the backlight brightness.
⌨	Single-tap to open the Input Panel soft keyboard.	Single-tap to close the keyboard.
4:12 PM	Double-tap to open the Date/Time utility.	Set the date and time.
🗔	Single-tap to minimize all windows and display the desktop.	Tap again to restore all windows.

Starting the YBA250 Software

If you purchased your YBA250 installed on NetTek Analyzer Platform, it comes from the factory set to automatically start the YBA250 software when the NetTek Analyzer Platform is powered up. If you added your YBA250 module to a NetTek Analyzer Platform you already own, you will need to start the YBA250 software or set the software to load at startup.

To start the YBA250 software:

- Double-tap the YBA250 icon on the desktop or select **Start > Programs > NetTek > YBA250**

When the YBA250 software starts, it displays a screen like the one shown in Figure 2–3.
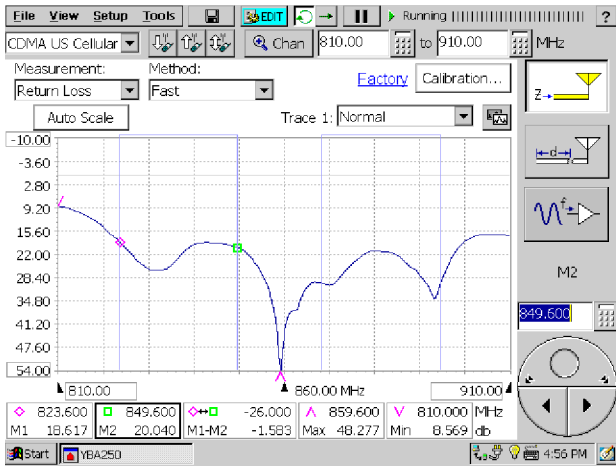
Figure 2‑3: The YBA250 display

Setting the YBA250 Software to Load at Startup

If you purchased your YBA250 as a module to use on an existing NetTek Analyzer Platform, you may want to set the YBA250 to load at startup.

To set the YBA250 as the startup application:

1. Select **Start > Programs > Tektronix Utilities > System Configuration**.

2. On the Software tab, select the StartUp checkbox for the YBA250. See Figure 2‑4.

3. Close the System Configuration window.

The next time the NetTek Analyzer Platform is powered on, the YBA250 software will start up automatically.
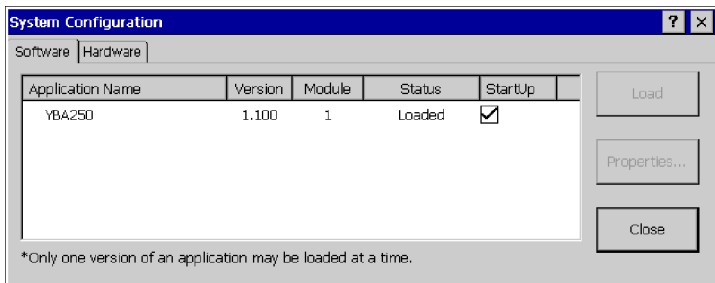
Figure 2‑4: Setting the StartUp Application

Elements of the Display

Figure 2‑5 shows an example YBA250 display. The YBA250 display is made up of four areas:

- Command Bar Area: This area contains the menu bar and some instrument control buttons. This area is always visible.

- Tuning Controls Area: This area contains the controls used to specify the signal standard and measurement frequency. This area is always visible.

- Shared Control Area: This is where the instrument function buttons appear and the input box appears. This area is always visible.

- Instrument Area: This is where the waveforms are displayed and measurement results appear. The appearance of this area changes depending on the instrument function.
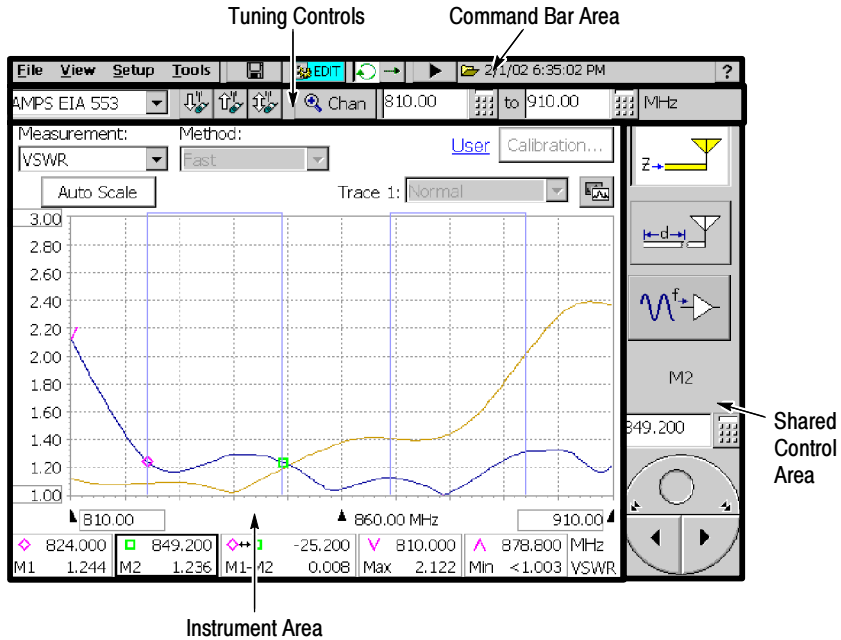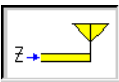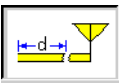
Figure 2‑5: Elements of the YBA250 display
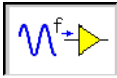
Shared Control Area

Table 2–3 describes the elements of the Shared Control Area of the display.

Table 2‑3: Shared control area buttons and icons

Button	Function
	Displays Frequency window for measuring return loss, VSWR and cable loss versus frequency.
	Displays Distance window for measuring the distance to a fault.

Table 2‑3: Shared control area buttons and icons (Cont.)

Button	Function
	Displays CW Mode window for outputting a CW signal.
	The Knob is used to change the value of the assigned control.
M2 849.200	This area shows the control assigned to the knob and the value of that control.
	The Keypad button enables you to enter numbers using a numeric keypad on screen.
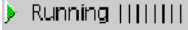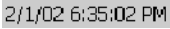
Command Bar Area

Table 2‑4 describes the elements of the Command Bar Area of the display.

Table 2‑4: Command bar area buttons and icons

Button/Icon	Function
File View Setup Tools	These are the application menus
	Pressing the Save Results button enables you to save measurement results to a file.
EDIT	Pressing the Edit button displays the Setup window, which enables you to edit the YBA250 setup.
OPEN	Pressing the Open button displays the Open dialog box, which enables you to select a saved YBA250 setup to load. Replaces Edit button when Hide Setup Controls is selected.
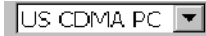
Table 2‑4: Command bar area buttons and icons (Cont.)

Button/Icon	Function
❚❚	Pressing this button pauses trace acquisition (stops measurements).
▶	Pressing this button restarts trace acquisition.
▶ Running ‖‖‖‖‖	The Running indicator shows that the YBA250 is acquiring measurements. The number of vertical bars displayed cycles to indicate measurements are in progress.
📂	The Folder icon is shown when displaying recalled data.
🛑	The Stopped icon is shown when the measurements are paused.
2/1/02 6:35:02 PM	The Timestamp Readout shows the time and date the displayed results were acquired (not present on live displays).
?	Selecting this button displays the YBA250 Online Help.

Tuning Control Area

Table 2‑5 describes the elements of the Tuning Control Area of the display.

Table 2‑5: Tuning control area buttons and icons

Button	Function
US CDMA PC ▼	This drop-down list selects the signal standard and channel table.
⬇	This button changes the start and stop frequency settings to the forward link (downlink) frequency for the selected channel.

Table 2‑5: Tuning control area buttons and icons (Cont.)

Button	Function
⬆	This button changes the start and stop frequency settings to the reverse link (uplink) frequency for the selected channel.
⬆⬇	This button changes the start and stop frequency settings to cover both the forward and reverse link frequencies for the selected channel.
🔍 Chan	This button is used to set the Channel number. The frequency will be set to the appropriate value for the selected channel.
901.01 ⊞ MHz	These number entry boxes are used to set the start and stop frequencies. Tap the button to use the numeric keypad; tap the box to use the knob.
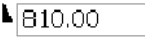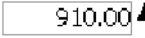
Instrument Area

Icons and buttons in the Instrument Area of the display change depending on the selected function. Table 2–6 describes the buttons and icons that appear in the instrument area.

Table 2‑6: Instrument area buttons and icons

Button	Function
Measurement: VSWR ▾	This drop-down list selects the type of measurement displayed: Return Loss, VSWR, or Cable Loss.
Auto Scale	This button automatically adjusts the vertical scale to achieve the best display.
User	This indicator shows the current Calibration status.

Table 2‑6: Instrument area buttons and icons (Cont.)

Button	Function
Calibration...	This button displays the Calibration window where you can specify the calibration set to be used.
(icon)	This button rotates the order of the traces in the display (and displays Trace 2 if it is not already displayed).
▲ 810.00	This label is used to change the start frequency or distance of the graph.
910.00 ◢	This label is used to change the stop frequency or end distance of the graph.

■ For descriptions of marker buttons and icons, see page 3‑43.

Using the Touch Screen

To select items on the display, just touch them. For example, to display the distance to fault screen, tap the Distance button
((icon)).
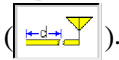
Using the Knob

To assign the knob to a control, tap the control to be changed. Change the value by:

■ tapping the left/right arrows on the bottom half of the control knob make small changes

■ tapping to the left or right of the small circle (on the top half) to make larger changes

■ placing a finger inside the "circle" and dragging it until the control is set to the desired value

Using the Numeric Keypad

To change a value using the numeric keypad:

1. Tap the control whose value is to be changed (to assign the value to the numeric keypad).

2. Tap the numeric keypad button above the control knob.

3. Type the new value, including units when present.

4. Tap **OK**, when present, to accept the new value.

YBA250 Menus

The YBA250 menu bar has four menus. These menus are File, View, Setup, and Tools. Some menu commands have keyboard shortcuts for use when an optional keyboard is attached to the NetTek Analyzer Platform, but not all menu commends have keyboard shortcuts.

Tables 2--7 through 2--10 describe the elements of the YBA250 menus.

Table 2--7: The File menu

Menu item	Control key	Description
Open	Ctrl + O	Displays Open Results dialog.
Save Results	Ctrl + S	Save measurement results to a file. The file is automatically named and stored in \BuiltInDisk\YBA250\App-Data\Results.
Save Results As	- - -	Save measurement results to a file, displays Save As dialog so you can name the file and specify where it is saved.
Compare Saved...	- - -	Display two saved results for visual comparison.

Table 2-7: The File menu (Cont.)

Menu item	Control key	Description
Export Results	- - -	Save measurement results in a file format that can used by word processing or spreadsheet applications.
Export Screen	- - -	Store an image of the display that can be used by word processing or image editing applications. The file is automatically named and stored in \BuiltInDisk\YBA250\AppData\Results.
Export Screen As	- - -	Store an image of the display that can be used by word processing or image editing applications. Displays Save As dialog so you can name the file and specify where it is saved.
Print	Ctrl + P	Prints the displayed window's data.
Results Properties	- - -	Displays a dialog that shows information saved with a results file.
Exit	- - -	Quits the YBA250 program.

Table 2-8: The View menu

Menu item	Control key	Description
Trace 2	- - -	Displays/Hides second trace.
Rotate Trace Order	- - -	Changes the order of traces in the graph (front versus back).

Table 2‑8: The View menu (Cont.)

Menu item	Control key	Description
Define Trace 2	---	Displays the Frequency or Distance tab of the Setup window (depending on the current window), enabling you to specify the source of Trace 2.
Mask	---	Enables Mask Testing.
Define Mask	---	Displays the Masks tab of the Setup window, enabling you to specify the mask file to use for mask testing and any action to perform on mask failure.
Markers	Ctrl + M	Displays/Hides marker controls and readouts.
Band Edge Cursor	---	Displays/Hides band edge cursors.
Marker 1 (T1/T2/FG)	---	Places M1 marker on Trace 1 (T1), Trace 2 (T2), or the Foreground trace (FG).
Marker 2 (T1/T2/FG)	---	Places M2 marker on Trace 1 (T1), Trace 2 (T2), or the Foreground trace (FG).
Marker Min (T1/T2/FG)	---	Places Min marker on Trace 1 (T1), Trace 2 (T2), or the Foreground trace (FG).
Marker Max (T1/T2/FG)	---	Places Max marker on Trace 1 (T1), Trace 2 (T2), or the Foreground trace (FG).

Table 2‑9: The Setup menu

Menu item	Control key	Description
<u>E</u>dit..	Ctrl + T	Displays the Setup window.
<u>O</u>pen...	---	Displays the Open Setup dialog.
Save...	---	Saves current setup to a file.
<Saved Setup 1‑N>		Name of most recently used setup files or files specified in Tools>Options>Settings Menu. Up to 10 files can be displayed.

Table 2‑10: The Tools menu

Menu item	Control key	Description
<u>O</u>ptions...	---	Displays the Options window.
<u>K</u>eyboard	Ctrl + K	Displays/Hides the soft keyboard.
<u>T</u>ouchscreen Calibration	---	Displays the Windows CE Stylus utility.
Mask Maker	---	Displays the Mask Maker utility.
Factory Reset	---	Resets all YBA250 settings to original factory values; overwrites existing settings.
<u>U</u>pgrade Software	---	Displays the utility for enabling software options or installing a new version of the YBA250 application.
Technical Support	---	Displays technical support contact information.

Table 2-10: The Tools menu (Cont.)

Menu item	Control key	Description
Software Info	---	Displays the SW Properties window which lists, among other things, the installed options, and Options key.
Hardware Info	---	Displays the HW Properties window which lists, among other things, serial number, hardware versions and Global ID.

Entering Text

Use the Input Panel soft keyboard, see Figure 2-6, to type characters into text boxes or address fields without using an external keyboard.
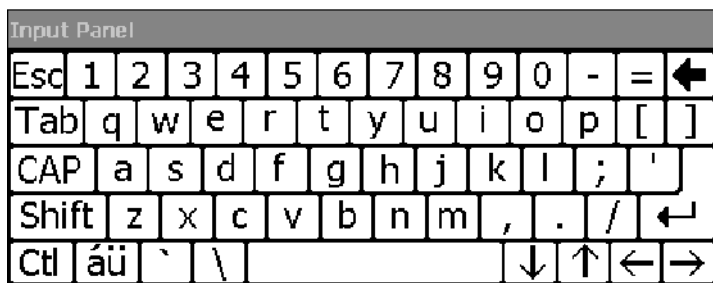
Figure 2-6: The Soft Keyboard

1. Tap the icon in the toolbar status area.

2. Tap the Input Panel keys to enter text.

3. Tap ↵ (RETURN) to wrap text or execute a command.

4. Tap the icon again to close the keyboard.

To set soft keyboard properties, select **Start > Settings > Control Panel**. Open the Input Panel icon, and then select **Options**.

Special Characters

The soft keyboard includes characters not visible on the startup keyboard.

CAP Key. Tap the **CAP** key to create all capital letters and common characters.

Shift Key. Tap the **Shift** key to create one capital letter or other common character.

$\boxed{\text{áü}}$ **Key.** Tap this key to create special characters.

Powering Off the YBA250

The YBA250 has separate but related standby and power off functions similar to a laptop PC.

Suspend Mode

Use Suspend mode to place the YBA250 in a suspended (standby or sleep) state. This is the typical power down mode that allows the YBA250 software to remain in volatile memory. If the YBA250 remains in Suspend mode for an extended time (approximately two hours), it will automatically enter Shutdown mode and the contents of volatile memory will be lost.

To suspend YBA250 operation, choose one of the following methods:

- Press the front-panel power switch.

- Select **Start > Shutdown**. In the Shut Down dialog box, select **Suspend**.

To activate the YBA250 following Suspend, press the front-panel power switch. The YBA250 will return to the software and setup state that existed before the user invoked suspend.

Shutdown

To completely power down the YBA250:

1. Select **Start > Shutdown**.

2. In the Shut Down dialog box, select **Shutdown**.

A shutdown clears volatile memory, including the YBA250 software (if it is not loaded into flash memory) and measurement data not saved to nonvolatile memory. For information on how to save these items to nonvolatile memory, refer to the NetTek Analyzer Platform online help. Select **Start > Help**. In the Help window select **Tektronix Basics**; then select **Store Data in Nonvolatile Memory**.

The next time you press the front-panel power switch following a shutdown, the YBA250 will cycle through the complete power up process taking about 2 to 3 minutes for the YBA250 to become functional.

Restart (Software Reset)

To restart the YBA250, do the following:

1. Select **Start > Shutdown**.

2. In the Shut Down dialog box, select **Restart**.

The display blanks for approximately five seconds, then the YBA250 software will reload. A Restart does not erase volatile memory.

Connecting a Signal

This section explains the importance of using precision cables and connectors, how to connect the YBA250 to an antenna, and how to calibrate the YBA250.

Use Precision Connectors and Cables

To ensure your measurements are accurate, always use precision cables and connectors. Quality of materials and construction is what separates a precision connector from a standard connector. A precision connector is manufactured with precisely machined connection surfaces and tight tolerances. Precision female center connectors often have six fingers instead of the four fingers common on less expensive connectors. Precision cables are specially constructed to have an exact 50-ohm impedance. However, the only real way to tell if a connector is a precision one is to know the VSWR and loss specifications over the frequency range to be measured. While the loss specification is important to accurate measurements, the VSWR of the cable is critical.

How cables and connectors affect measurements

Reflection measurements are usually made as a comparison of the unknown (device being measured) to a known standard. This standard is assumed to be perfect.

Any non-precision cable can dramatically affect a reflection measurement. The higher the frequency of measurement, the worse the degradation will likely be. There are two distinct types of errors introduced by a cable.

The first error is simply the reflection and loss of the cable itself. This usually causes a device being tested to seem to have a worse VSWR or Return Loss than it really does.

The second type of error is the change in reflection, phase, or loss of the cable as it is flexed or bent. This causes readings to change as the jumper is bent (particularly for measurements of antennas with good VSWR).

Any non-precision connector also affects reflection measurements. The effect non-precision connectors have is to decrease return loss by reflecting part of the signal. As with cables, the higher the frequency of measurement, the worse the degradation will likely be.

Attaching and Removing Precision Connectors

There is a correct way to attach and remove precision connectors. Precision connectors are exceptionally sensitive to mishandling.

⚠ *CAUTION. Attaching or removing a precision connector incorrectly will damage the connector. You must attach and remove precision connectors using the proper procedure to avoid damaging the connector.*

Precision connectors that have been damaged by improper handing will not provide dependable measurements.

Attaching Precision Connectors

To properly attach a precision connector to the YBA250:

1. Gently push the connector straight onto the Test Port. *DO NOT* turn the body of the connector while pushing it onto the Test Port.

2. To secure the connector, hold the body of the connector still while turning the nut until it is finger-tight. Turn *ONLY* the nut to secure the connector. See Figure 2-7.

Hold body portion of the connector
secure from turning.

Tighten connector by turning only the
bottom, knurled portion of the connector.
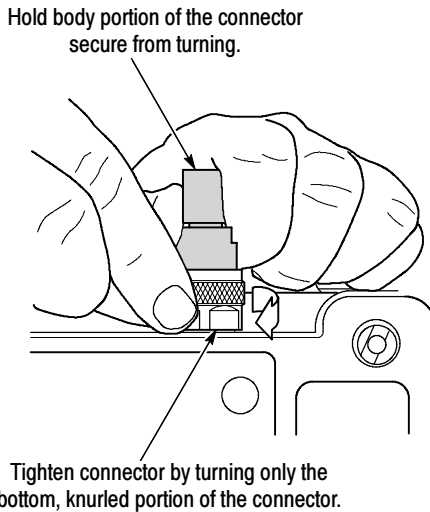
Figure 2‑7: How to attach a precision connector

Removing Precision Connectors

To properly remove a precision connector from the YBA250:

1. Hold the body of the connector still while turning the nut to loosen it. Turn *ONLY* the nut to remove the connector.

2. Gently pull the connector straight away from the RF input. *DO NOT* turn the body of the connector while pulling it off the Test Port.

Connecting an RF Signal

The YBA250 has a single, RF signal input, labeled TEST PORT. The input impedance is 50 Ω. The input frequency range is 25 MHz to 2500 MHz. Figure 2–8 shows the location of the TEST PORT.
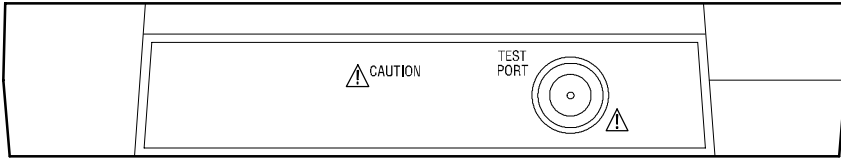
Figure 2-8: TEST PORT location

To connect an antenna to the YBA250:

⚠ **WARNING.** *To prevent personal injury from the effects of lightning, do not connect this product to any source that might be subject to the effects of lightning. Use your own good judgement and common sense. You must protect yourself from the effects of lightning.*

---

1. Following your standard practice, disconnect the antenna to be tested from the transmitter or receiver.

2. Discharge the antenna (short the center conductor to the cable ground shield).

3. Connect one end of a precision cable to the antenna.

4. Connect the other end of the precision cable to the TEST PORT on the YBA250.

Calibrating the YBA250

To get the most accurate measurements, calibrate the YBA250 each time you begin to make measurements at a site. There are two types of calibration: factory calibration and user calibration. Factory calibration provides good measurement accuracy without requiring the use of a calibration kit. When the YBA250 is calibrated during manufacture using a set of high-precision calibration standards, the calibration values generated are saved in non-volatile memory so that they can be recalled at any time. You can perform a User calibration when you want even better accuracy. A User calibration generates a set of values that the YBA250 uses to compensate for

changes in temperature, power level, and component aging, to ensure the most accurate measurements. A User calibration is a calibration performed with the YBAC1 Calibration Kit (or an equivalent calibration kit). A user calibration can be saved so that it can be recalled at another time.

The YBAC1 Calibration Kit is a set of three high-precision measurement standards. You connect each of the measurement standards in the kit to the YBA250 input and run a calibration procedure that normalizes measurements to the accuracy of the calibration kit standards.

When to Calibrate the YBA250

Calibration is most sensitive to changes in temperature. When the YBA250 senses its internal temperature has changed more than 10 °Celsius (18 °Fahrenheit) from its temperature at the last calibration, it will change the calibration status to **User Cal?** to inform you that you should perform a calibration to ensure the most accurate measurements. You can choose not to perform the calibration and still make measurements, but the results may not be as accurate as measurements performed with a valid calibration. A calibration is performed across the entire frequency range of the YBA250, so if you change the measurement frequency range or the start/stop frequencies, you *do not* need to recalibrate the YBA250.

However, if you change the power level setting from that of the current calibration set, you should perform a calibration.

What is the Current Calibration Status?

The YBA250 displays the current calibration status next to the Calibration button. There are three values of calibration status:

■ **Factory**: When this status is displayed, the YBA250 is using the Factory calibration set.

■ **User**: When this status is displayed, the YBA250 is using a User calibration set. A User calibration is listed as valid for seven days.

■ **User Cal?**: This indicates that the YBA250 is using a User Calibration set but either too much time has elapsed since the last calibration (more than seven days), the internal temperature has

changed more than 10 °Celsius (18 °Fahrenheit), or the power level doesn't match what it was at the last calibration.

Elements of the Calibration Window

The Calibration window is where you specify calibration settings. From the Calibration window you select which type of calibration to use (Factory or User), initiate a new calibration, save a calibration, or load a saved calibration set. See Figure 2-9.
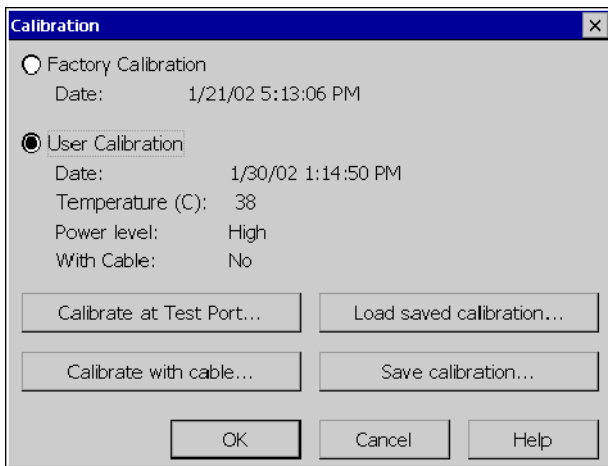
Figure 2- 9: The Calibration window

Table 2-11 explains the elements of the Calibration window.

Table 2- 11: Calibration Window Fields

Field	Description
Factory Calibration	Select this option button when you want to use the Factory Calibration set.
Date	Date the Factory Calibration was performed.

Table 2‑11: Calibration Window Fields (Cont.)

Field	Description
User Calibration	Select this option button when you want to use a calibration that you have performed.
Date	The date and time the current calibration was performed.
Temperature (C)	The internal temperature of the YBA250 at the time the current calibration was performed.
Power level	The output power setting when the current calibration was performed.
Calibrate at Test Port	Select this button to perform a new calibration when you are not using an intermediate cable to connect to the antenna.
Calibrate with cable	Select this button to perform a new calibration when you are using a cable (less than 10 feet or 3 meters long) to connect to the antenna.
Load saved calibration	Select this button to load a saved calibration set.
Save calibration	Select this button after you have performed a new calibration to save the calibration.

Using the Factory Calibration

A Factory Calibration is a special calibration performed with a set of very high-precision calibration standards at the factory. The Factory Calibration set is saved in non-volatile memory so it can be recalled at any time. The Factory Calibration set cannot be changed.

To load the Factory Calibration set:

1. Tap the **Calibration...** button (Calibration...). This displays the Calibration window.

2. To load the Factory Calibration settings, select the **Factory Calibration** checkbox. See Figure 2‑10.
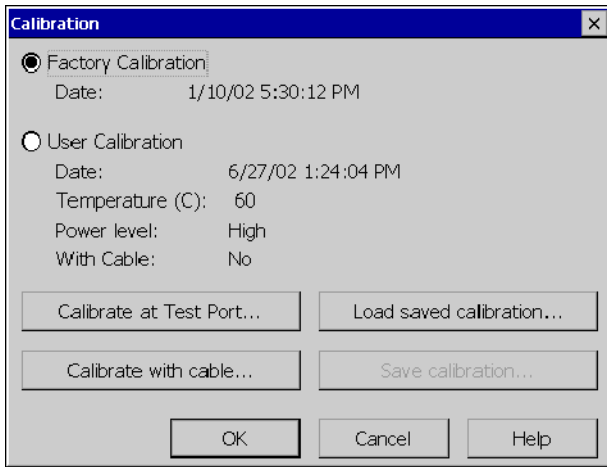
Figure 2‑10: The Calibration window

3. Tap **OK**.

This loads the calibration set stored at the factory. The Factory Calibration can be used across the entire YBA250 operating temperature range. (For details on accuracy specifications, see *Appendix A*, *Specifications*.)

Performing a User Calibration

To perform a User calibration, you must have a YBAC1 Calibration Kit (or an equivalent calibration kit). The YBAC1 is a set of precision terminations: an Open, a Short, and a Load. The terminations are calibrated and the connectors are precision connectors.

NOTE. The accuracy of the YBA250 cannot be guaranteed if you perform a new calibration with terminations that are not part of a YBAC1 Calibration Kit (or an equivalent calibration kit).

Open   Short   Load
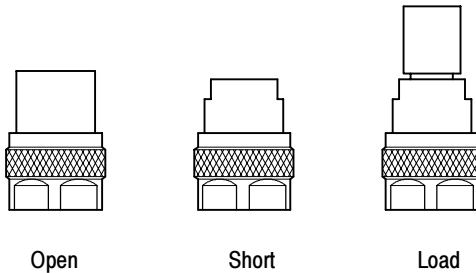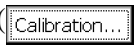
Figure 2‑11: Precision terminations from YBAC1 Calibration Kit

There are two methods of User calibration: Calibrate at Test Port and Calibrate with cable. If you are using a precision cable to connect to the antenna, you can use either method. If you are using a non-precision cable to connect to the antenna, it is important to use the Calibrate with cable method.

When using the Calibrate at Test Port method, you attach the calibration standards directly to the RF input of the YBA250. When using the Calibrate with cable method, you first connect the cable you will use to connect to the antenna to Test Port of the YBA250, and then you connect the calibration standards to the other end of the cable. In this way, the YBA250 can compensate for the loss in the cable, resulting in a more accurate measurement. Note that the Calibrate with cable method is valid only for cable lengths up to 10 feet (3 meters).

Calibrate at Test Port. To perform a calibration at the test port:

1. In the main display, tap the **Calibration...** button (Calibration...).

    This displays the **Calibration** window.

2. Tap the **Calibrate at Test Port...** button (Calibrate at Test Port...).

    This displays the **Calibration at Test Port** window. See Figure 2‑12.
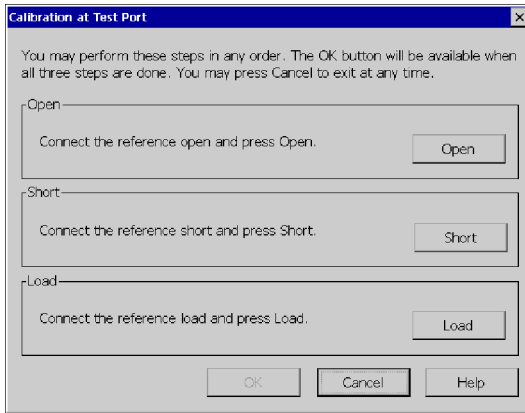
Figure 2‑12: Ready to perform calibration

3. Carefully attach the OPEN calibration standard to the TEST
PORT using the procedure described on page 2–24.

You can perform steps 4 through 8 in any order. Note that the OK
button is not selectable until all three steps have been completed.
If you accidently tap the wrong button (for example, you tap
Open while you have the Short calibration standard connected),
just repeat the step. To cancel the calibration, tap **Cancel** at any
time.

4. Tap the **Open** button in the Calibration at Test Port window.
When the calibration is completed, **Done** appears above the Open
button.

5. Carefully replace the OPEN calibration standard with the SHORT
calibration standard.

6. Tap the **Short** button in the Calibration at Test Port window.
When the calibration is completed, **Done** appears above the Short
button.

7. Carefully replace the SHORT calibration standard with the
LOAD calibration standard.

8. Tap the **Load** button. When the calibration is completed, **Done** appears above the Load button.

9. Carefully remove the LOAD calibration standard from the TEST PORT.

10. Once calibration has been completed for all three standards, tap the **OK** button. The OK button is not selectable until all three calibration standards have been marked as done. See Figure 2–13.
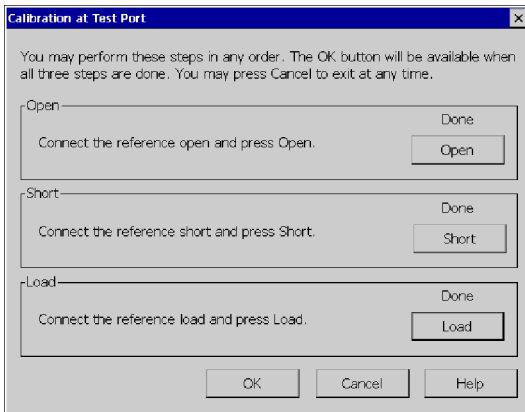
Figure 2‑13: Calibration window after calibration is done

This loads new calibration settings that remain valid until the temperature of the YBA250 changes by more than 10 °Celsius (18 °Fahrenheit) or more than seven days have elapsed since the calibration was performed.

Calibrate with Cable. To perform a calibration with a cable (10 feet (3 meters) or less in length):

1. In the main display, tap the **Calibration...** button (Calibration...).

    This displays the **Calibration** window.

2. Tap the **Calibrate with cable...** button (`Calibrate with cable...`). This displays the **Calibration with Cable** window. See Figure 2‑14.
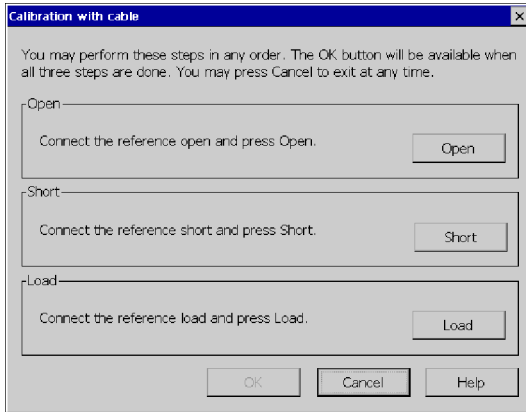
Figure 2‑14: Ready to perform calibration with cable

3. Carefully attach the cable to the TEST PORT using the procedure on page 2‑24. Note that this calibration method is valid only cables up to 10 feet (3 meters) long.

   You can perform steps 4 through 8 below in any order. Note that the OK button is not selectable until all three steps have been completed. If you accidently tap the wrong button (for example, you tap Open while you have the Short calibration standard connected), just repeat the step. To cancel the calibration, tap **Cancel** at any time.

4. Carefully attach the OPEN calibration standard to the end of the cable. You may need an adapter to connect the calibration standard to the end of the cable. If you need an adapter, be certain to use a precision adapter.

5. Tap the **Open** button in the Calibration with cable window. When the calibration is completed, **(Done)** appears above the Open button.

6. Carefully replace the OPEN calibration standard with the SHORT calibration standard.

7. Tap the **Short** button in the Calibration with cable window. When the calibration is completed, **(Done)** appears above the Short button.

8. Carefully replace the SHORT calibration standard with the LOAD calibration standard.

9. Tap the **Load** button. When the calibration is completed, **(Done)** appears above the Load button.

10. Carefully remove the LOAD calibration standard from the cable and remove the cable from the TEST PORT.

11. Once the calibration has been completed for all three standards, tap the **OK** button. The OK button is not selectable until all three calibration standards have been marked as done. See Figure 2‑15.
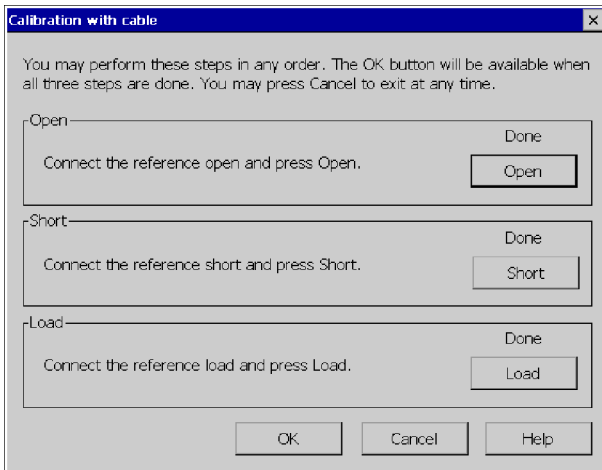
Figure 2‑15: Calibration window after calibration is done

This loads new calibration settings which remain valid (while using the cable with which the calibration was performed) until the temperature of the YBA250 changes by more than 10 °Celsius (18 °Fahrenheit) or more than seven days have elapsed since the calibration was performed.

Loading a Saved Calibration Set

If you are in the field and need to perform a calibration but do not have the YBAC1 Calibration Kit with you, you can load a saved calibration set.

 To load a saved calibration set:

1. Tap the **Calibration...** button (Calibration...). This displays the **Calibration window**.

2. To load a saved calibration set, tap the **Load saved calibration...** button. This displays the Calibration Browser window. See Figure 2-16.

Name	Cable	Valid	Power	Temp	Date
Mt. St. Helens	No	Yes	High	38	1/30/02 1:14:50 PM
Crater Lake	No	Yes	High	41	1/24/02 6:05:03 PM
Ochoco Divide	Yes	Yes	High	41	1/23/02 1:22:54 PM
Nehalem Mountain	Yes	Yes	High	38	1/21/02 5:35:07 PM

Current conditions: High 38 2/3/02 3:39:06 PM
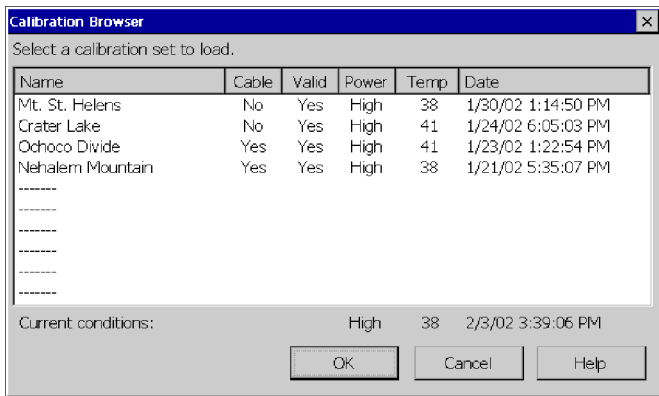
Figure 2‑16: Calibration browser window

There is a line of text that appears below the list of saved calibration sets. The line of text begins with **Current conditions:**. It displays the the power level, temperature of the YBA250, and the date. This information is provided to help you decide which calibration set to load. For details on how to use this information, see *Which Calibration Set Should You Use?* below.

3. Select the saved calibration set you wish to use and tap **OK**.

This loads the saved calibration set which will remain valid until the temperature of the YBA250 changes by more than 10 °Celsius (18 °Fahrenheit) or more than one week has elapsed since the calibration was performed.

Which Calibration Set Should You Use?

There are three factors to consider when deciding which saved calibration set you should use: temperature, power level, and length of time since the calibration was performed. Temperature (that is, the internal temperature of the module) has the greatest effect on measurement accuracy; therefore, it should be considered the most important factor when selecting among saved calibration sets. Choose the calibration set with the temperature closest to the current temperature. The next factor to consider is the power level. Always try to use a calibration set that was performed at the same power level. The next factor to consider is the time since the calibration was performed. The most recent calibration is the best choice.

Elements of the Calibration Browser Window

The Calibration Browser window is used to select a saved calibration to load. But, how do you know which calibration set to load? There are several fields of information in the browser window that can help you decide which calibration set to load.

Table 2- 12: Calibration Browser Fields

Field	Description
Name	The name given to the calibration set when it was saved.
Cable	Either Yes or No. Yes indicates the calibration was performed using **Calibrate with cable**. No indicates the calibration was performed with **Calibrate at Test Port**.
Valid	Either Yes or No. If Yes, the temperature at the time of the calibration was run is within 10 °Celsius (18 °Fahrenheit) of the current temperature, less than a week has elapsed since the calibration set was saved and the current power level is that same as that of the calibration set. If No, the temperature when the calibration set was saved is too different from the current temperature, more than one week has elapsed since the calibration set was saved (possibly both), or the current power level is different from the power level setting of the calibration set.
Power	Either High or Low. The output power setting when the calibration was performed.
Temp	The internal temperature of the YBA250 at the time the calibration was performed.
Date	The date the calibration was performed.
Current Conditions	A line below the list of saved calibration sets that lists current conditions:
	Output level: Either High or Low
	Temperature: Current temperature in degrees Celsius.
	Date: The current date set on the NetTek Analyzer Platform.
	Time: The time on the NetTek Analyzer Platform when the Calibration Browser was opened.

Saving Calibration Data Sets

Calibration data sets can be saved in non-volatile memory so that they can be loaded at another time. One reason to do this is so you do not have to carry a calibration kit with you in the field.

To save calibration sets for later recall:

1. Perform a new calibration as described starting on page 2-30.

2. To save the calibration set, tap the **Save calibration...** button in the Calibration window.

3. Name the calibration set (for example, "Nehalem Mountain" to denote the location where the calibration was performed) and tap **OK**.

This saves the calibration set in non-volatile memory so that it can be loaded at another time. Calibration data sets are stored within the module, so that if the YBA250 module is moved to another NetTek Analyzer Platform the calibration data set stays with the module.

Changing Instrument Settings

Before you can fully utilize the YBA250 you need to set some instrument settings. For example, the YBA250 measures return loss only for enabled signal standards. If the signal standard used in your system is not enabled, you will not be able to measure return loss until you enable the Signal Standard.

Enabling Signal Standards

The currently selected signal standard controls the channels available from the signal standard list. Before you begin using the YBA250, you should ensure that the standard for your system has been enabled. Signal standards are enabled from the Options window.

To enable a signal standard:

1. Select **Tools > Options**.

2. Tap the **Signal Standards** tab. This displays the window shown in Figure 2-17.
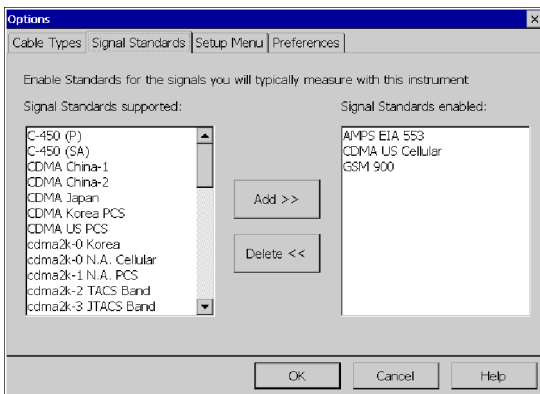
Figure 2-17: The Signal Standards tab of the Options window

The standards supported in the YBA250 are shown in the list on
the left side of the window.

3. To enable a signal standard, tap the name of the standard you
wish to enable and then tap **Add>>**.

4. When you have enabled all the standards you will be testing, tap
OK.

Only enabled standards are selectable from the signal standards
list that appears in the tuning controls area of the display. When
you take return loss measurements with the YBA250, you can
select a channel from the channel list available for that standard
to speed up frequency band allocation.

Setting the Output Power Level

You can set the output power used for Calibration, Return Loss,
Distance to Fault and Cable Loss measurements to either Low or
High power. The default setting is High. The advantage of the High
power setting is that it makes measurements more immune to
interference from other signal sources. The advantage of the Low
power setting is that it is less likely to disrupt calls on other
transmitters.

The High power setting is also a good choice when testing long
cables or cables with a high cable-loss value. If you are trying to
measure cable with an active device on it, you may need to chose the
Low power setting to avoid overdriving the active device.

To set the Output Power level:

1. Tap the Edit button (EDIT) or select **Setup > Edit** from the
menu bar.

2. Tap the **General** tab.

3. Select the option button for Low power or High Power. See
Figure 2-18.
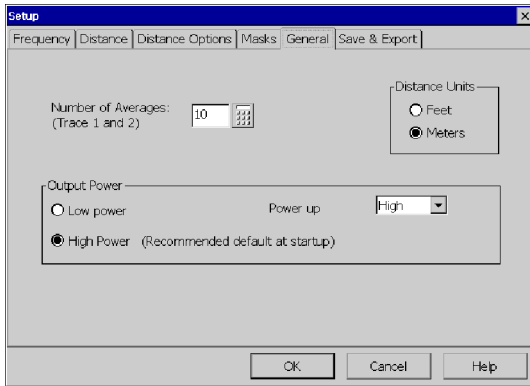
Figure 2‑18: Setting the output power level

NOTE. Each time the YBA250 is powered up, the Output Power is set to the level specified by Power up. The output power can be set to Low or High. The Low power level is approximately −20 dBm and the High power level is about +3 dBm.

To set the default Output Power level:

■ Select **Low** or **High** from the Power up drop‑down list.

NOTE. Setting the Output Power Level does not affect the CW Signal Mode output power setting.

Setting Display Preferences

The YBA250 enables you to change the color scheme used in the display. There are three color schemes optimized for color displays and one color scheme optimized for monochrome displays. There is also a color scheme optimized for black and white printouts. Color schemes specified in the YBA250 do not affect standard Windows

CE screen items. The YBA250 color schemes affect only measurement graphs in the display.

To specify the color scheme used by the YBA250:

1. Select **Tools > Options**.

2. Select the **Preferences** tab. This displays the window shown in Figure 2--19.
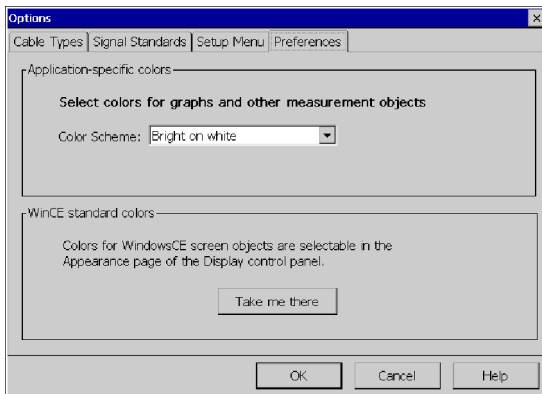
Figure 2‑19: Preferences tab showing available color schemes

3. To display a list of the available color schemes, tap the **Color Scheme** list box.

4. To select a color scheme, tap the name of the desired color scheme.

   a. To change the Windows CE display properties, tap **Take Me There**. This displays the Windows CE Display Properties window, where you can set the display background and window color scheme.

5. Tap **OK** to save the change.

6. To view the changed color scheme, quit the YBA250 program and restart it.

Table 2‑13 shows the colors assigned to screen elements by the different color schemes.

Table 2‑13: Color scheme color assignments

Display item	Bright on white	Bright on black	Dark on white	Mono‑chrome grays
Alarm indicator	Red	Red	Red	Medium Gray
Measurement Error Ribbon	Yellow	Yellow	Yellow	White
Results Flag Ribbon	Cyan	Cyan	Cyan	White
Trace background	White	Black	White	White
Trace 1	Dark Blue	Yellow	Dark Cyan	Black
Trace 2	Salmon	Cyan	Dark Red	Dark Gray
Trace 3	Periwinkle	Periwinkle	Dark Blue	Medium Gray
Frequency cursor	Red	Red	Red	Medium Gray
Marker / Cursor 1	Magenta	Magenta	Magenta	Medium Gray
Marker / Cursor 2	Green	Green	Green	Medium Gray
Graticule for Traces	Dark Gray	Dark Gray	Dark Gray	Light Gray
Online Help Links	Blue	Blue	Blue	Black

Changing Settings for Saved Files

The YBA250 enables you to specify settings for saved files such as prefixes for filenames, the name of a technician making a test, notes to be included in saved results files and the default format for exported screens.

Where to Set File Options

The **Save & Export** tab is where you specify saved file options.

To display the Save & Export tab:

1. Select **Setup > Edit**.

2. Tap the **Save & Export** tab. See Figure 2‑20.
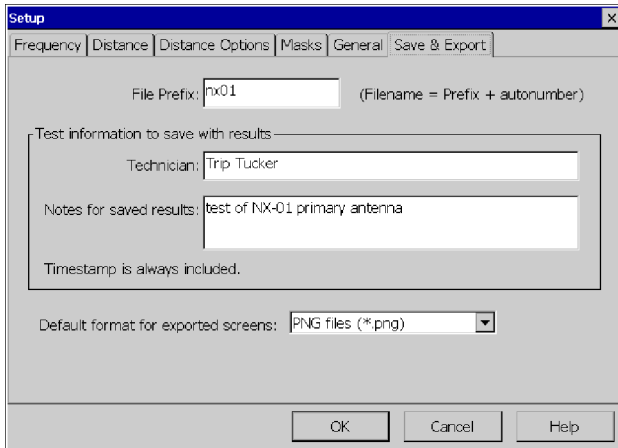
Figure 2‑20: The Save & Export tab

Setting the Filename Prefix

The YBA250 allows you to save a file, such as a results file, with a name you enter each time you save a file or you can allow the YBA250 to automatically name files for you. When files are saved without a specified prefix, the filename is simply a number, for example: 0004.r01. However, you can specify a prefix for automatically named files so that you can more easily identify saved files. Actual filenames will consist of the prefix you specify attached to a number, which is generated when the file is saved. For example, if you are testing Site 5 you could set the prefix to s5, resulting in a filename of s50004.r01.

NOTE. The length of a filename is variable, depending on the length of the path (where the file is located). The limit of the path and filename is 256 characters. The shorter the path to the file, the longer the filename can be.

To specify the filename prefix:

1. Select **Setup > Edit**. This displays the Setup window.

2. Tap the **Save & Export** tab. See Figure 2-20.

3. Tap the box after **File Prefix:.**

4. Enter text (using the soft keyboard or an external keyboard) to use as the prefix of filenames.

5. Tap **OK** to save your changes.

Setting the Technician Name

The YBA250 allows you to store the name of the technician performing a test in the results file for the test.

To specify the technician's name:

1. Select **Setup > Edit**. This displays the Setup window.

2. Tap the **Save & Export** tab. See Figure 2-20.

3. Tap the box after **Technician:.**

4. Enter text (using the soft keyboard or an external keyboard) for the technician name. Of course, you can also use this space for additional test information instead of a technician name.

5. Tap **OK** to save the technician name.

Entering Notes for Saved Results

The YBA250 allows you to enter note text to be saved in results files. Thus, if there are any special conditions about a test, you can save notes within the results file. You can enter up to 254 characters in the notes field.

To specify notes for saved results:

1. Select **Setup > Edit**. This displays the Setup window.

2. Tap the **Save & Export** tab. See Figure 2-20.

3. Tap the box after **Notes for saved results:.**

4. Enter text (using the soft keyboard or an external keyboard) for the note.

5. Tap **OK** to save the notes you entered.

Saving GPS Coordinates with your Results

You can connect a GPS receiver to your NetTek Analyzer Platform to collect location coordinates that are saved with your measurement results when you save or export the results. At the time that you save or export your results, the most recent position read from the GPS receiver is included with your results.

NOTE. For correct coordinates when using the GPS function, save or export your results while the GPS receiver is at the location where you made the test. If you make a measurement, move the instrument, and then save your results, you will not be saving the coordinates of where you took the test. You will be saving the coordinates of your new location.

Selecting a Compatible GPS Receiver

You can use any GPS receiver that supports NMEA 0183 V2.0. Specifically, the GPS must output the $GPRMC sentence on a regular basis.

The YBA250 application reads the GPS position from the GPS receiver once per second, or at the rate the GPS receiver sends the $GPRMC sentence, whichever is slower.

Connecting through the Serial Port. The GPS receiver can connect to the serial port (4800 baud rate). The Garmin GPS III and Garmin GPS III Plus have been tested with the YBA250 application.

Connecting through the PCMCIA Slot. The GPS receiver can connect through the PCMCIA slot and emulate a serial port on COM4. The

Teletype GPS WorldNavigator (product #1351) has been tested with the YBA250 application.

Enabling Your GPS Receiver

To enable the GPS feature:

1. Set your GPS receiver to output NMEA sentences regularly.

2. Connect the GPS receiver (by serial cable or through the PCMCIA slot) to the Y350C platform.

3. In the YBA250 application, tap the **Edit** button and then the **Save & Export** tab.

4. From the drop down list box, select the correct GPS receiver interface type (Serial or PCMCIA) for your GPS. See Figure 2-21.
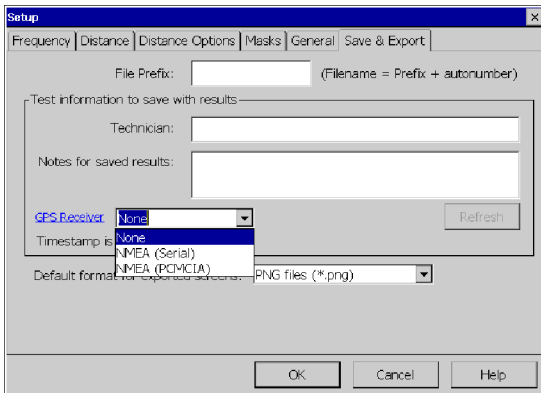
Figure 2-21: Selecting the GPS receiver interface type

The YBA250 will display the latitude and longitude just to the right of the drop-down list box a short time after the GPS receiver sends the $GPRMC sentence. Tap the **Refresh** button to update the displayed coordinates.

You can also view the latest GPS position in the Results Properties dialog box (**File > Results Properties**). When you open a saved results file, the Results Properties will show information about the results file, including the GPS position at the time the results file was saved.

Troubleshooting Your GPS Receiver

After you have selected the GPS receiver type in the Save & Export dialog box, a position should appear immediately to the right of the list box.

Error Message: Invalid Position. If, after you select the GPS receiver type in the Save & Export dialog, the message "Invalid Position" appears, then the communication connection to the receiver has been successfully established, and the $GPRMC sentence is being successfully read from the receiver, but the position supplied in that sentence is not valid. In this case, check your GPS receiver to see if it does have a valid position, and, if not, refer to the GPS receiver documentation to resolve this problem.

Error Message: Unable to Read Position Information If, after you select the GPS receiver type in the Save & Export dialog, an error dialog box appears indicating that the application was unable to read position information from the GPS receiver, then do the following:

■ Make sure the cable from the receiver to the serial port is connected or that the PCMCIA card is firmly seated.

■ Ensure that the receiver is set to output NMEA sentences regularly.

  If you have purchased the vxHpc terminal emulator, you can view the NMEA sentences being sent.

  Open the vxHpc terminal emulator by tapping **Start > Programs > Communication > vxHpc**. Refer to the Y350C documentation for general information on how to use the vxHpc terminal emulator.

  To view the NMEA sentences being sent, you need to set up vxHpc to connect to the correct port:

  ■ For a serial port GPS receiver, set up vxHpc to connect to COM1.

- For the Teletype WorldNavigator, set up vxHpc to connect to Teletype_1358.

Configure the port the as follows:

- 4800 baud

- 8 data bits

- No parity

- 1 stop bit

- No flow control

If you then open the session, you should see NMEA sentences being sent the GPS receiver.

If you do not see NMEA sentences, either the GPS receiver is not sending the sentences or the connection to the GPS receiver is not passing them (check the cables again). Refer to your GPS receiver documentation to find out how to output NMEA sentences regularly.

Reference

Measuring Return Loss and VSWR

The YBA250 provides measurement capabilities to quickly and easily determine the condition of an antenna by measuring its return loss or VSWR.

The Return Loss Display
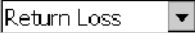
The Return Loss display is where return loss and VSWR measurements appear. Figure 3‑1 shows a typical display.
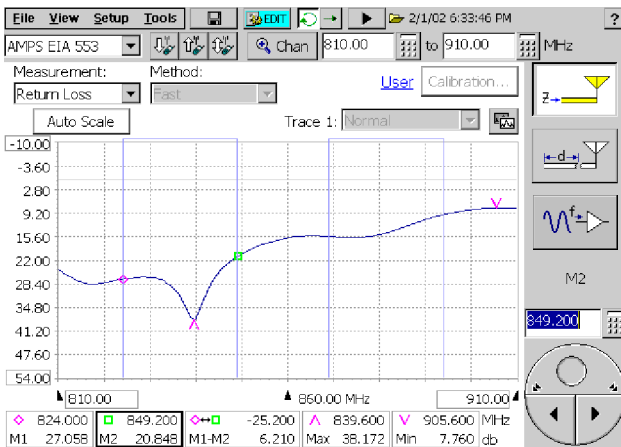
Figure 3‑1: The Return Loss display

Table 3‑1 lists the buttons and icons that are specific to the Return Loss/VSWR display and it explains what each button or icon represents.

Table 3‑1: Return loss display buttons and icons

Button	Function
Measurement: Return Loss ▼	Set the units of the vertical scale. Return Loss units are dB; VSWR has no units – it is a ratio.
Auto Scale	Adjusts the scale of the display for optimum waveform display.
Method: Fast ▼	Sets the method used to make the measurement. Fewer data points display faster, more data points have better resolution.
Trace 1: Average ▼	Sets the trace type for the specified trace.
⬇	Sets the test frequency range to the forward frequency range of the selected signal standard.
⬆	Sets the test frequency range to the reverse frequency range of the selected signal standard.
⬍	Sets the test frequency range to cover both the forward and reverse frequency ranges of the selected signal standard.
✕	The Restart button appears with all trace types except Normal. Tapping the Restart button restarts trace acquisitions.

Setting the Test Frequency Range

Return Loss and VSWR measurements are made across a frequency range, which is referred to as the test frequency range. Before making a return loss or VSWR measurement, you must set the test frequency range. The test frequency range is the difference between the start and stop frequencies. The start frequency is the frequency

displayed at the left edge of the graph and the stop frequency is the frequency displayed at the right edge of the graph.

The easiest way to find the test frequency range is to look at the numbers located along the bottom of the frequency display. There are three numbers located along the bottom edge of the display representing the start, center, and stop frequencies. The start and stop frequencies can be set, but the center frequency cannot be set.

Another place to look at the test frequency range is the pair of boxes located at the top right-edge of the graph. See Figure 3-2. These two boxes display the start and stop frequencies on the frequency display. The left box indicates the start frequency and the right box indicates the stop frequency.
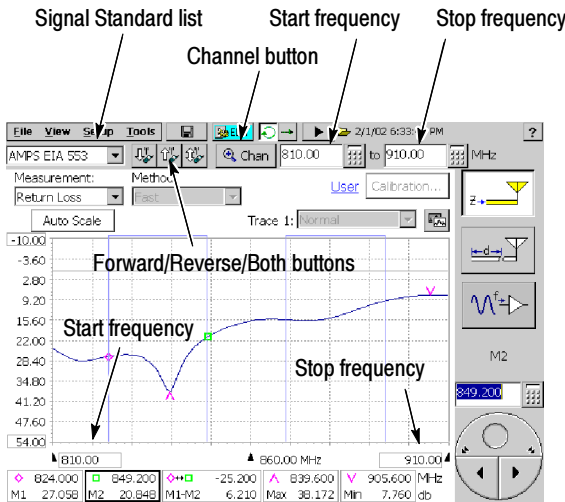
Figure 3-2: Frequency range controls

There are two ways to set the test frequency range:

■ Select the signal standard and direction (forward/reverse/both)

■ Set the start and stop frequencies individually

The easiest way to set the test frequency range is to select the signal standard and direction. This way you don't have to remember the specific frequencies for a signal standard. Setting the signal standard and direction sets the test frequency range so that it covers the span for the selected standard plus 10% of the total span above and below.

Setting the Test Frequency Range by Standard and Direction

To set the test frequency range by selecting the signal standard and direction:

1. Select the signal standard from the drop-down list. See Figure 3-2.

Only "enabled" signal standards are listed in the drop-down list. If a supported signal standard is not listed, you can add it by selecting **More..** from the drop-down list. For more information on enabling signal standards, see page 2-41.

2. To set the bandwidth, tap one of the Forward (⬆️), Reverse

(⬆️), or Both (⬆️) buttons.

Setting the Test Frequency Range by Channel

If you need to test a specific channel within a signal standard, you tune the YBA250 to the desired channel using the **Channel** button. When you set the test frequency range using the Channel button, the center of the frequency display is set to the center frequency of the specified channel. The test frequency range is set at twice the channel bandwidth (with a minimum test frequency range of 1.5 MHz). The start frequency is set one channel bandwidth below the channel center frequency and the stop frequency is set one channel bandwidth above the channel center frequency.

To set the test frequency range by selecting the Channel:

1. Select the signal standard from the drop-down list.

2. Tap the Channel button (🔍 Chan). This displays the **Select Channel** dialog box. See Figure 3-3.

Note that both uplink and downlink frequencies are listed. Be sure to select the desired direction when selecting a channel
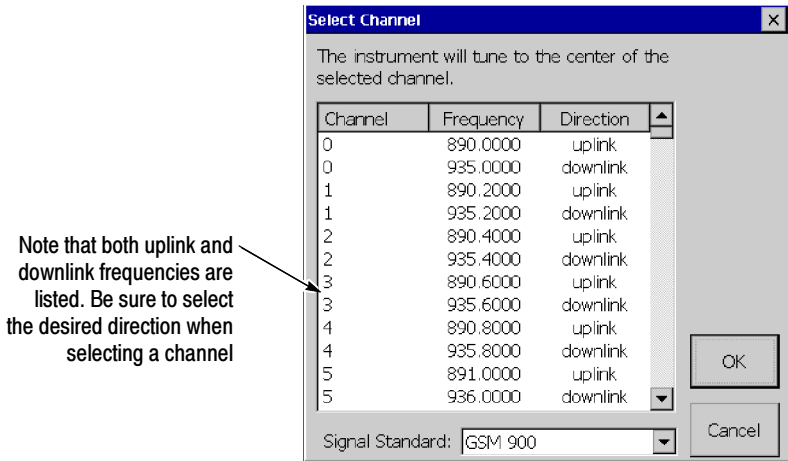
Figure 3‑3: Select Channel dialog box

3. Scroll through the list until you find the channel which you wish to test and tap the desired channel number.

Note that the list shows both the uplink and downlink frequencies. Be sure to tap the appropriate direction when selecting a channel.

4. After selecting the desired channel, tap **OK**.

Setting the Test Frequency Range by Start and Stop Frequency

To set the test frequency range by specifying the start and stop frequencies:

1. Tap the numeric keypad next to the Start frequency entry box (see Figure 3‑2) or the Stop frequency box. This displays the **Enter Frequency** dialog shown in Figure 3‑4.
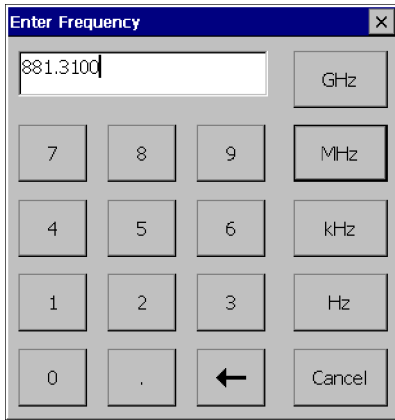
Figure 3- 4: Entering the frequency with the keypad

2. Enter the desired frequency by tapping the keypad.

You enter a frequency by tapping a number followed by a multiplier. You must include the multiplier (GHz, MHz, KHz, or Hz) to complete your input.

- For example, to enter a frequency of 370 MHz, tap 3 7 0 MHz.

- To enter a frequency of 370.330 MHz, tap 3 7 0 . 3 3 0 MHz.

To correct a mistyped number, tap the backspace button (←).

If you enter a number that is outside the frequency range of the YBA250, the frequency is set to the maximum or minimum, depending on the value you entered.

To set the start and stop frequencies using the knob:

1. Tap the box at the bottom of the frequency display containing the Start or Stop frequency. This assigns the knob to the selected frequency. The label above the knob display will change to either **Start (MHz)** or **Stop (MHz)** .

2. Tap the knob to change the frequency.

■ Tap the top half of the knob to make large changes to the specified frequency. Tapping the knob to the right of the circle increases the frequency. Tapping the knob to the left of the circle decreases the frequency.

■ Tapping the arrow buttons on the lower half of the knob makes smaller changes than tapping the top half.

Customizing the Channel Table

The Channel Table is a file used by the YBA250 to specify the characteristics of the channels assigned to a signal standard. You can customize the Channel Table to suit the specific needs of your system. For example, if you have set the bandwidth of your channels to be wider than the standard bandwidth, you can specify the wider bandwidth in a customized Channel Table. If your system's channel bandwidth is non-standard and the YBA250 is using the standard Channel Table, the test frequency range based on the standard channel bandwidth will not be accurate for your system.

The YBA250 looks for a file named UserStandards.txt in the \BuiltInDisk folder when it starts up. If it does not find the file, the YBT250 then looks for the standard channel table file, SignalStandards.txt, in the NetTekApps\YBA250 folder. If that file is not found, a dialog box will be displayed informing you that no standards file was found, so a new channel table will be generated using internal default values.

Creating a Custom Channel Table

To create a custom channel table:

1. Locate the existing **SignalStandards.txt** file in either the **\BuiltInDisk\NetTekApps\YBA250** folder or **\NetTekApps\YBA250** folder (only if the application software loaded into volatile memory instead of flash memory).

2. Copy the **SignalStandards.txt** file to the **\BuiltInDisk** folder.

   The YBA250 will look only in the \BuiltInDisk folder for a custom channel table.

3. Rename **SignalStandards.txt** to **UserStandards.txt**.

4. Edit the contents of the file to suit your systems settings.

When editing your UserStandards.txt file, it is safer to copy a row and then edit the copied row to meet your requirements than to modify an existing row.

Table 3-2 lists the elements of the Channel Table file.

Table 3-2: Channel table file contents

Column heading	Description
Standard Name	The text string used to identify the standard. This name is what appears in the Signal Standard list.
	Each line in the channel table should describe a single group of channels for a standard. If a standard is made up of multiple groups or blocks of channels then you should make an entry for each group. When multiple groups are required, they should be ordered in channel number sequence and contiguous. To tie the groups together, the Unique Standard ID must be the same for each group.
Forward Base Frequency	Forward base frequency for each signal standard. The actual frequency for each channel is calculated.
	For signal standards that specify a single frequency for each channel (for example, the UTRA/FDD scheme used by WCDM(UMTS)), each row in the file will describe a group of forward *or* reverse channels. The row that describes forward channels should specify zero for the reverse base frequency.
Reverse Base Frequency	Reverse base frequency for each signal standard. The actual frequency for each channel is calculated.
	For signal standards that specify a single frequency for each channel (for example, the UTRA/FDD scheme used by WCDM(UMTS)), each row in the file will describe a group of forward *or* reverse channels. The row that describes reverse channels should specify zero for the forward base frequency.

Table 3-2: Channel table file contents (Cont.)

Column heading	Description
Signal Bandwidth	The signal bandwidth. If the signal to be measured is 100 kHz wide but the channels are spaced 200 kHz apart then this field should contain 100000.
Starting Channel Number	The starting channel number for a block of channels.
Ending Channel Number	The ending channel number for a block of channels.
Channel Increment Amount	If the channels increment by 1, then a 1 goes in here. If by 2, then a 2 goes in here. If by 5...
Channel Spacing	Sets the spacing between channels. For instance, if you have a standard that has signals that are 100 kHz wide but the channels in you system are spaced 200 kHz apart, then this field should contain 200000.
Channel Offset	Offset applied to channel number before calculating the channel frequency from the channel number.
Unique Standard ID	Must be between 0 and 400. It is used to tie multiple blocks of channels together into a single standard. A block of channels is a single row in the channel table file.
Signal Type	1 = CDMAOne 2 = AMPS 3 = TDMA IS136 4 = GSM 5 = W-CDMA (UMTS) 6 = CDMA 2000 998 = NO_MEAS_ANALOG 999 = NO_MEAS_DIGITAL
Forward / Reverse frequency separation	For signal standards that specify a single frequency for each channel (for example, the UTRA/FDD scheme used by WCDM(UMTS)), this entry specifies the difference in frequency between a forward channel and its corresponding reverse channel. For signal standards that specify forward and reverse frequencies for each channel (most standards), this entry is left blank.

How Channel Frequencies are Calculated

The frequency for a specific channel is calculated with a formula based on the current channel number, the base frequency, the channel spacing and the channel offset:

If (Channel Offset $\geq$ 0)

  Chan Freq = ((Chan Num - Channel Offset) $\times$ Channel Spacing) + Base Frequency

If (Channel Offset $<$ 0)

  Chan Freq= Base Frequency - ((-Channel Offset - Chan Num) $\times$ Channel Spacing)

Where:

Base Frequency: Either forward or reverse base frequency depending on current user selection, from the Channel Table file (UserStandards.txt when present or SignalStandards.txt).

Chan Num: The current user selected channel number.

Chan Freq: The frequency associated with the Chan Num.

Channel Spacing: The distance between channels, from the Channel Table file.

Channel Offset: From the Channel Table file.

How to Measure Return Loss/VSWR

One way to measure the condition of an antenna system is to measure its Return Loss or VSWR. The YBA250 makes it easy to measure the Return Loss or VSWR of an antenna.

Return Loss is a ratio of the power sent to the antenna versus the power reflected by the antenna. A larger Return Loss is better because less power is reflected.

VSWR (Voltage Standing Wave Ratio) is a measure of the difference (ratio) of impedance between a transmission line and the attached load. For VSWR, the lower the number, the better. The best possible VSWR is 1.0, which means the impedance of a transmission line and its load match perfectly.

To measure Return Loss or VSWR:

1. To ensure accurate measurements, calibrate the YBA250 according to the procedures beginning on page 2–26. If possible, use the Calibrate with cable procedure to achieve the best results.

2. Connect the antenna to be tested to the Test Port.

3. Set the Output Power level, if needed.

4. Select the signal standard from the drop-down list located below the menu bar.

5. Set the measurement mode:

   a. To make a single measurement, tap the measurement mode button so it displays the single-shot mode icon (![single-shot icon]). See Figure 3–5.

   b. To make continuous measurements, tap the measurement mode button so it displays the continuous mode icon (![continuous icon]).
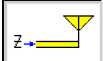
NOTE. *Continuous measurements consume more battery power than single-shot measurements. To extend battery-based operation, use single-shot mode whenever possible.*

Measurement mode button
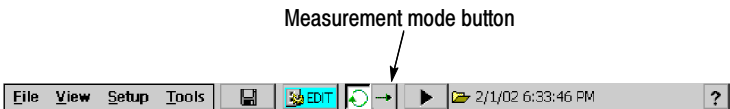
Figure 3‑5: Location of the measurement mode button

6. Tap the **Impedance** button (![impedance icon]). See Figures 3–6 and 3–7.

7. Select either **Return Loss** or **VSWR** from the Measurement drop-down list as desired.

8. If desired, change the test frequency range using the procedures described in *Setting the Test Frequency Range* on page 3-2.

■ When you first select the signal standard, the Start and Stop frequencies are set so that the displayed frequency span covers the selected standard plus 10% of the total span above and below. If a Forward/Reverse/Both button is selected, it is taken into account when the Start and Stop frequencies are set.

■ You can change the Start and Stop frequencies by selecting the channel or set each frequency separately by using the numeric keypads or the knob.

■ To measure Return Loss or VSWR across just the forward or reverse bands, select the Forward ( ) or Reverse ( ) button. To measure the return loss across both the Forward and Reverse bands, select the Both ( ) button.

■ To set the frequency span to a specific channel, tap the channel button (Chan) and select the channel you wish to measure. The YBA250 will center the display at the center frequency of the selected channel and the span will be set to twice the bandwidth specified by the signal standard or 1.5 MHz, whichever is greater. After you have selected a channel, tap OK.
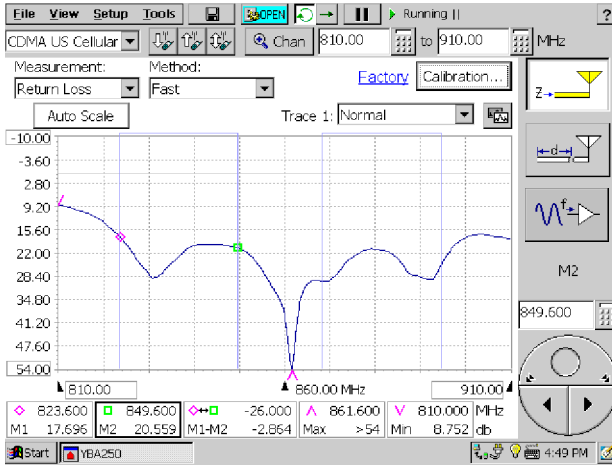
Figure 3-6: Example of a Return Loss measurement
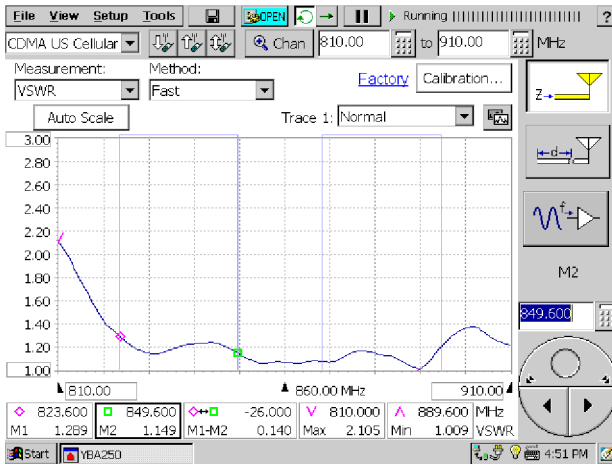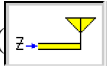
Figure 3-7: Example of a VSWR measurement

Measuring Cable Loss

The YBA250 can measure the loss of a cable. When measuring the loss of a cable, you must terminate the cable with either a short or an open termination. Cable loss measurements are not valid if the cable is connected to a load.

To measure the loss of a cable:

1. Connect the cable to be tested to the TEST PORT.

2. Connect either a short or an open termination to the other end of the cable.

3. Set the Output Power level, if needed.

4. Select the signal standard from the drop-down list located below the menu bar.

5. Tap the **Impedance** button ( ).

6. Select **Cable Loss** from the Measurement: drop‑down list. See Figure 3‑8.
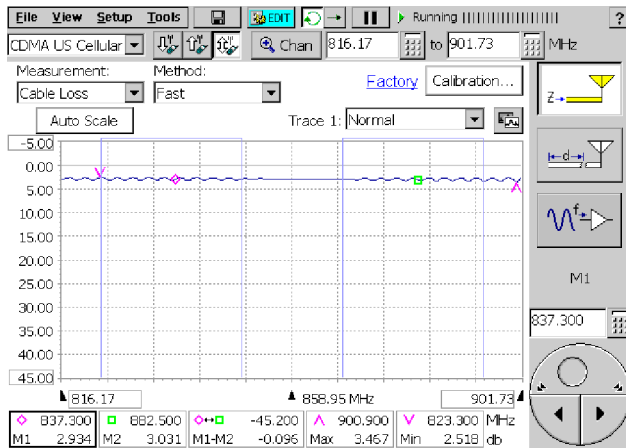
Figure 3‑8: Example of a cable loss measurement

■ When you first select the signal standard, the Start and Stop frequencies are set so that the displayed frequency span covers the selected standard plus 10% of the total span above and below. If a Forward/Reverse/Both button is selected, it is taken into account when the Start and Stop frequencies are set.

■ You can change the Start and Stop frequencies by selecting the channel or set each frequency separately by using the numeric keypads or the knob.

■ To measure cable loss across just the forward or reverse bands, select the Forward (⬇) or Reverse (⬆) button. To measure the cable loss across both the Forward and Reverse bands, select the Both (⬍) button.

■ To set the frequency span to a specific channel, tap the channel button (🔍 Chan) and select the channel you wish to measure. The YBA250 will center the display at the center frequency of the selected channel and the span will be set to twice the bandwidth specified by the signal standard or 1.5 MHz, whichever is greater. After you have selected a channel, tap **OK**.

Resolution versus Performance

The Method setting allows you to choose between a faster measurement with fewer data points or a slower measurement that contains more data points. The more data points in the measurement, the higher the resolution of the measurement. Table 3‐3 shows how the performance setting affects the resolution.

Table 3‐3: Performance versus Resolution

Performance Setting	Maximum Resolution[1] (Number of Data Points)
Fast	256
Normal	1024

Table 3‑3: Performance versus Resolution (Cont.)

Performance Setting	Maximum Resolution[1] (Number of Data Points)
High Resolution	4096

[1] **The actual number of data points depends on several interacting factors. The number of data points in the display may be less than the maximum.**

To change the method setting:

- Select the desired setting from the **Method** drop-down list. See Figure 3‑9.

Method drop-down list
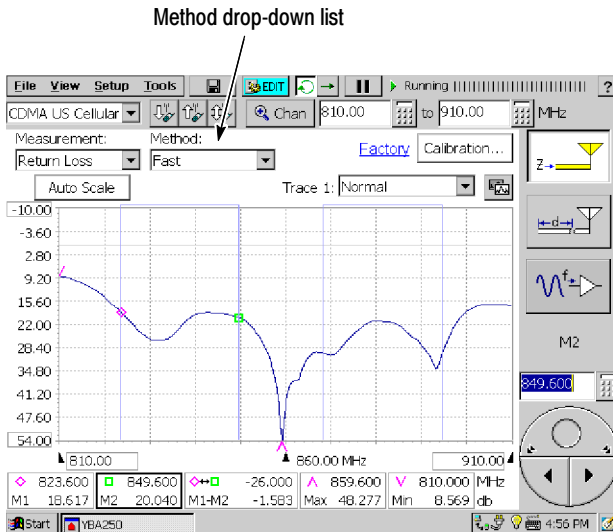
Figure 3‑9: Location of Method drop-down list

Measuring the Distance to a Fault

The YBA250 can measure the distance to a fault, enabling you to quickly locate faults on your antenna.

The Distance to Fault Display
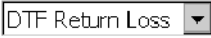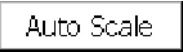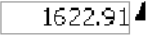
The Distance to fault display is where the distance to fault results appear. Figure 3‑10 shows a typical display.
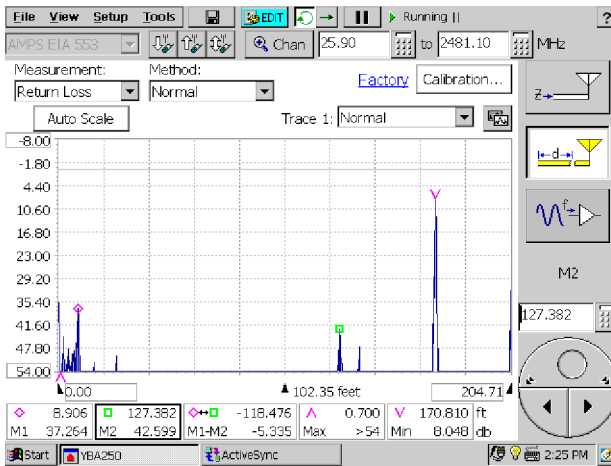
Figure 3‑10: The Distance to Fault display

Table 3‑4 lists the buttons and icons located in the Distance to Fault display and it explains what each button or icon represents.

Table 3‑4: Distance to Fault display buttons and icons

Button	Function
Measurement: DTF Return Loss ▼	Set the units of the vertical scale. Return Loss units are dB; VSWR has no units.
Auto Scale	Adjusts the scale of the display for optimum waveform display.
Method: Fast ▼	Sets the method used to make the measurement. Fast contains fewer data points but displays faster; High Resolution contains more data points but takes longer for measurements.
Trace 1: Average ▼	Sets the trace type for the specified trace.
▲0.00	Indicates the displayed Start point of the Distance to Fault measurement.
1622.91◢	Indicates the displayed End point of the Distance to Fault measurement.
✕	The Restart button appears with all trace types except Normal. Tapping the Restart button restarts trace acquisitions.

Setting Cable Types

It is essential to specify the cable type being tested to achieve accurate measurements. It is impossible to determine the true distance to a fault if the wrong cable type (propagation velocity and loss) is specified.

To enable the cable types you will be testing in your system:

1. Select **Tools > Options** menu item. The **Cable Types** tab will be selected. See Figure 3–11.
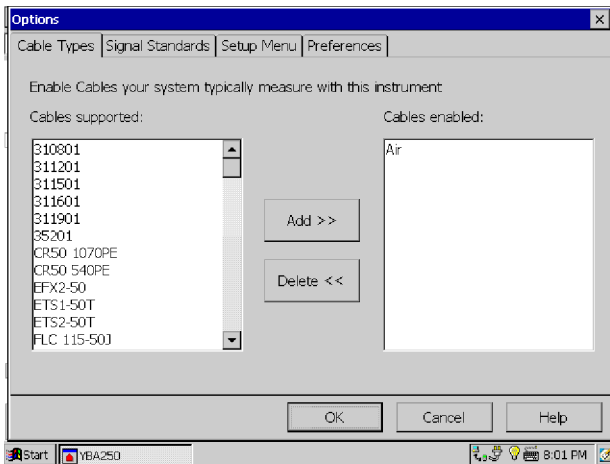
Figure 3-11: The Cable Types tab

2. Select a cable type you use in your system from the **Cables supported** list.

3. Tap **Add>>** to add the selected cable to the list of enabled cables.

4. Continue to add cables to the **Cables enabled** list until you have enabled all the cables which you use in your system.

When you are ready to perform a distance to fault measurement, you must specify the cable type you will be testing.

To specify the cable type to be tested:

1. Tap the Edit button ( ) to display the Setup window.

2. Tap the **Distance Options** tab.

3. Select the cable type to be tested from the drop-down list next to **Type:**. See Figure 3-12.
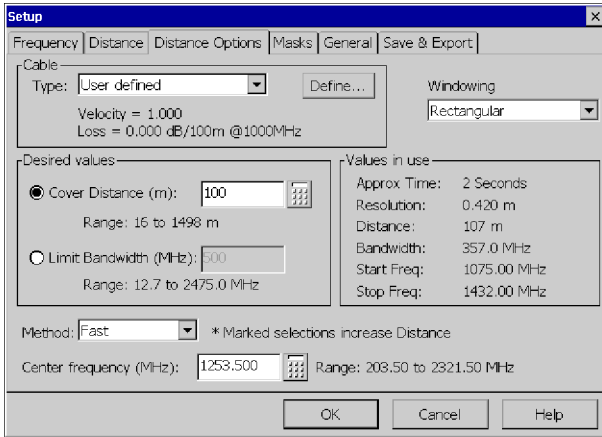
Figure 3‑12: The Distance Options tab

The specifications for the selected cable type are shown below the Type drop-down list.

NOTE. The cables listed in the Type drop-down list are limited to the cable type listed on the Cable Types table of the Options window.

If your system uses a cable type not listed in the Cable Type drop-down list, you can define your own cable type. To create a user-defined cable type, you will need to know two characteristics of the cable: Velocity of propagation and cable loss.

To create a user-defined cable type:

1. On the Distance Options tab, select **User defined** from the drop-down list next to Type:.

2. Tap the **Define...** button. This displays the User Defined Cable dialog. See Figure 3‑13.
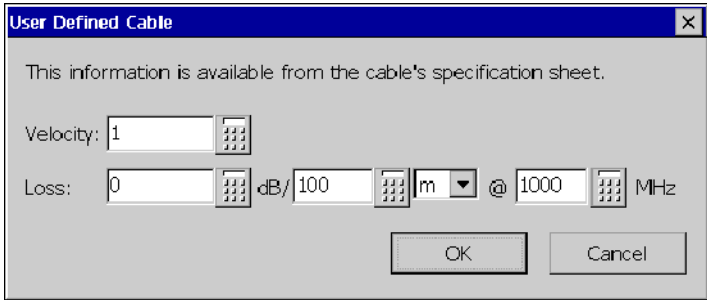
Figure 3-13: User Defined Cable window

3. To specify the velocity of propagation, tap the numeric keypad button next to the **Velocity** entry box. Enter a number between 0.1 and 1. Tap **OK** when you have entered the number.

4. To specify the cable loss, first tap the numeric keypad button next to the **Loss:** entry box. Enter a number between 0 and 100. Fractional values are acceptable. Tap **OK** when you have entered the number.

5. To specify the distance at which the cable loss is specified, tap the numeric keypad button to the right of "**dB**/". Enter a number for the distance. Tap **OK** when you have entered the number.

6. Tap the drop-down list (there is only one) to specify the unit distance, either **ft** (feet) or **m** (meters).

7. To specify the frequency at which the cable loss is specified, tap the numeric keypad button next to **MHz**. Enter a number between 1 and 10000. Tap **OK** when you have entered the number.

8. Tap **OK** when you have entered all the necessary numbers.

The specifications you entered for your cable type are shown below the Type drop-down list. These are the values that will be used for distance to fault measurements.

Customizing the Cable Standards Table

The Cable Standards Table is a plain text file used by the YBA250 to
specify the characteristics of the cable types that are tested. You can
customize the Cable Standards Table to suit the specific needs of
your system. For example, if there are cable types in your system
that are not included in the default list of cable types, you could add
them to the cable standards table. This allows you to select your
cable types from the Type drop-down list whenever you wish to
make a distance to fault measurement. You can also shorten the Type
drop-down list by deleting cables from the cable standards list if you
never test those cable types.

The YBA250 looks for a file named CableStandards.txt in the
\BuiltInDisk\NetTekApps\YBA250 folder when it starts up. You can
edit this file to include cable types not originally included in the file
from the factory.

Customizing the Cable Standards Table

To customize the cable standards table:

1. Locate the existing **CableStandards.txt** file in either the
   \BuiltInDisk\NetTekApps\YBA250 folder or
   \NetTekApps\YBA250 folder (only if the application software
   loaded into volatile memory instead of flash memory).

2. Make a copy of the original file and store the copy in another
   location within the BuiltInDisk folder as a backup.

3. Use Pocket Word to edit the contents of the file to suit your
   systems settings. When saving the file, be certain to save the file
   as a TEXT file (txt), not as a Pocket Word file (pwd).

When editing your CableStandards.txt file, it is safer to copy a row
and then edit the copied row to meet your requirements than to
modify an existing row.

Table 3--5 lists the elements of the CableStandards.txt file.

Table 3-5: Channel table file contents

Column heading	Description
Cable ID	An identification number assigned to the cable.
Cable Name	This is the name of the cable that appears in the Type drop-down list.
Velocity	The cable's velocity of propagation.
Loss	The loss of the cable per the loss distance, in dB.
Loss Distance	The distance over which the cable loss is specified.
Loss Frequency	The frequency at which the cable loss is specified.
Metric T/F	Indicates whether the Loss distance is metric on not. If True, the loss distance is in meters.

```
cable id   cable name   velocity   loss    Loss Distance   Loss Frequency   metric T/F
1          Air          1          0       100             1000             TRUE
2          None         1          0       100             1000             TRUE
3          RG8          0.659      0.262   1               1000             TRUE
4          RG8A         0.659      0.262   1               1000             TRUE
5          RG9          0.659      0.289   1               1000             TRUE
6          RG9A         0.659      0.289   1               1000             TRUE
7          RG17         0.659      0.18    1               1000             TRUE
8          RG17A        0.659      0.18    1               1000             TRUE
9          RG55         0.659      0.541   1               1000             TRUE
10         RG55A        0.659      0.541   1               1000             TRUE
11         RG55B        0.659      0.541   1               1000             TRUE
12         RG58         0.659      0.558   1               1000             TRUE
13         RG58B        0.659      0.558   1               1000             TRUE...
```

Figure 3-14: A portion of the cablestandards text file

Measuring the Distance to a Fault

The YBA250 can help you locate faults on a transmission line by measuring the distance to a fault.

To measure the distance to a fault:

1. Connect the antenna to be tested to the RF input.

2. Set the Output Power level, if needed.

3. Tap the Distance button ( ). See Figure 3–15.
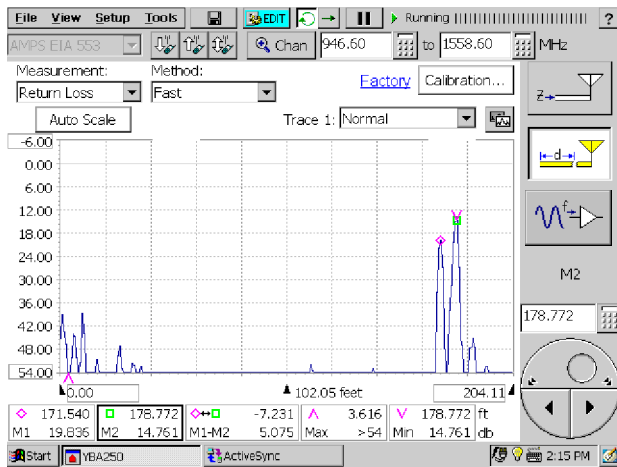
Figure 3‑15: An example of a distance to fault measurement

Changing the Vertical Scale Units

The default setting for Vertical Scale Units is dB. You can also display faults using VSWR as the vertical scale unit.

To change the vertical scale unit to VSWR:

■ Select **VSWR** from the **Measurement** drop-down list.

Improving the Display of Distance Measurements

The Distance to fault display will show a large main lobe at a fault location, surrounded by series of side lobes of decreasing amplitude. The YBA250 provides a choice of windowing functions that enable you to make a tradeoff between resolution of the fault location and suppression of waveform "noise" (side lobe magnitude).

There are two choices for Windowing: **Rectangular** and **Blackman**. See Figure 3-16. The Rectangular window produces a display with a narrow main lobe and relatively higher side lobes (possibly making the main lobe more difficult to spot), resulting in better distance resolution but a "noisier" waveform. The Blackman window produces a display with a wider main lobe and relatively smaller side lobes, which emphasizes the main lobe (making it easier to spot) but reduces distance resolution.
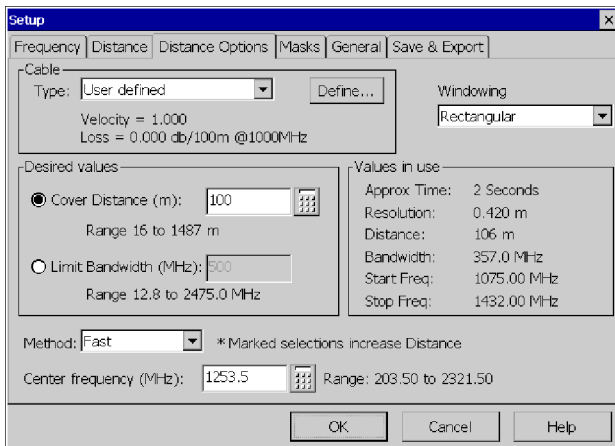
Figure 3-16: The Distance Options tab

To change the Windowing:

■ Select **Rectangular** or **Blackman** from the **Windowing** drop-down list.

Resolution of Distance to Fault Measurement

The resolution (distance between data points) shown in the Distance display is based on several interacting factors. Resolution is important because it limits how accurately you can locate a fault. The resolution varies with the Method, the bandwidth used, and the maximum distance setting. The maximum distance, bandwidth and Method settings can be changed. Normally, the only settings you need to adjust are the maximum distance and the Method. However, if your antenna has a bandpass filter installed, you will need to limit the bandwidth on the YBA250 to make distance-to-fault measure-ments. Limiting the bandwidth used by the YBA250 may limit the distance and resolution of the measurement.

To increase the resolution:

1. Tap the **Edit** (EDIT) button. This displays the Setup window.

2. Tap the **Distance Options** tab. See Figure 3-16.

3. Tap the **Cover Distance** option button if it is not selected.

4. Tap the numeric keypad next to the Cover Distance box.

5. Enter the distance from the receiver to the antenna.

Review the displayed value for **Resolution** in the **Values in use** box. Note that as you shorten the **Cover Distance** sufficiently (without changing the Method), the Resolution will improve, that is, the distance between data points will shorten. When you change the method to **Normal** or **High Resolution** (without changing the Cover Distance), the **Approx Time** will increase as will the Resolution.

Limiting the Bandwidth for a Bandpass Filter

The YBA250 automatically adjusts the frequencies it uses to make the distance-to-fault measurement depending on the Method and Cover Distance settings. If your antenna uses a bandpass filter to minimize interference from other sources, you will need to limit the bandwidth used by the YBA250 so its measurement signal can pass through the filter.

To set the bandwidth for the distance-to-fault measurement:

1. Tap the **Edit** ( ) button. This displays the Setup window.

2. Tap the **Distance Options** tab. See Figure 3--16.

3. Select the **Limit Bandwidth** option button.

4. Tap the numeric keypad next to the **Limit Bandwidth** box.

5. Enter the bandwidth of the filter.

6. Tap the numeric keypad next to the **Center frequency** box.

7. Enter the center frequency of the bandpass filter.

8. Tap **OK** to save your changes.

Note that values in the **Values in use** box will change as you change values for the Limit Bandwidth or the Center Frequency. Most importantly, by limiting the range of frequencies available for the distance to fault measurement, the maximum distance that can be measured will be limited. The exact distance will depend on the Limit Bandwidth and method selected.

Outputting a CW Signal

A continuous wave (CW) signal source, used in combination with a test receiver such as the Tektronix YBT250, can test a variety of two-port devices. The YBA250 can provide a CW signal which is adjustable across the entire YBA250 frequency band and over power levels from +3 dBm to −60 dBm.

To output a CW signal:

1. Connect the cable from the device to be tested to the Test Port.

2. Tap the CW Signal Mode button ( ).

3. Select the signal standard from the drop-down list located below the menu bar.

4. Set the desired frequency using the frequency controls or the knob. A quick way to do this is to use the channel button

    ( ) to set the frequency to a channel.

5. Tap the appropriate Output Power option button to set the output level. See Figure 3-17.

NOTE. *The CW Signal Mode Output Power setting does not affect the Output Power setting on the General tab of the Setup window.*
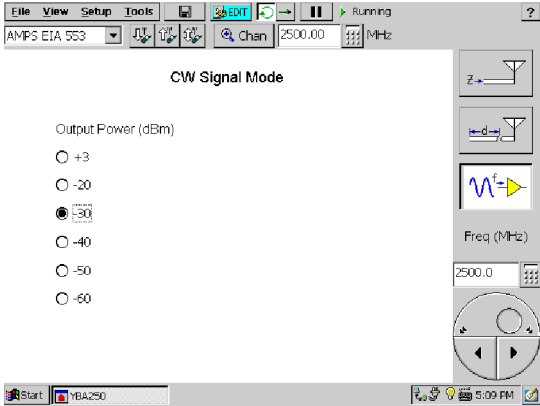
Figure 3-17: Setting output power for CW signal mode

Working with Traces

The YBA250 enables you to control the display of traces several ways. You can set the type of trace display, whether or not a second trace is displayed, display a saved traces and compare traces.

Setting the Trace Type

You can change how a trace is displayed to make it easier to analyze. There are five trace types you can choose from. See Table 3-6.

Table 3-6: Trace type options

Trace type	Description
Normal	Each point in the trace represents a single acquisition. Updates display with each new acquisition.
Average	Each point in the trace represents an average of a number of acquisitions. The number of acquisitions averaged is set on the General tab of the Setup window.
Min	Each point in the trace represents the minimum amplitude measured at that frequency since the acquisition was started. Acquisition can be restarted by tapping the restart button. Updates displayed point only if new point < old point.

Table 3‑6: Trace type options (Cont.)

Trace type	Description
Max	Each point in the trace represents the maximum amplitude measured at that frequency since the acquisition was started. Acquisition can be restarted by tapping the the restart button. Updates displayed point only if new point > old point.
Min/Max	This is a combination of Min and Max. Each point in the trace has both a minimum and maximum value that correspond, respectively, to the minimum and maximum values measured at that frequency since the acquisition was started. Acquisition can be restarted by tapping the restart button. Displays a bar between Max and Min points.

The usual trace type is Normal. However, you can set the trace type to any of the other four trace types.

To specify the trace type:

- Select the desired trace type from the drop-down list. See Figure 3‑18.

Select Trace type from this list
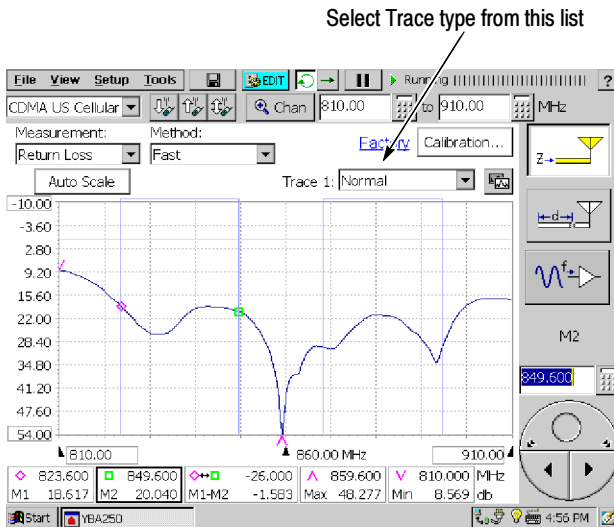
Figure 3-18: Setting the trace type

You can also set the trace type in the Setup window:

1. Select **Setup > Edit**. This displays the Setup window.

2. Tap the **Frequency** tab to set the trace type for the Return Loss display or tap the **Distance** tab to set the trace type for the Distance to Fault display. See Figure 3-19.
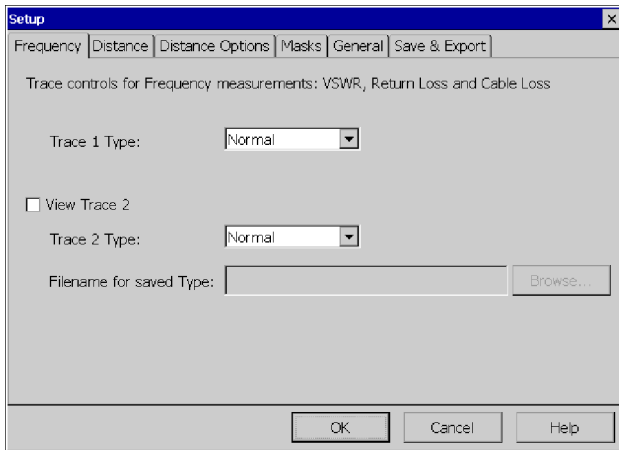
Figure 3‑19: The Frequency tab

3. Select the desired trace type from the drop‑down list.

If you select Average, you can also set the number of traces averaged together to create the trace display. The default number of averages is 10. This number applies to both Trace 1 and 2.

   a. To set the number of averages, tap the **General** tab. Then tap the keypad next to **Number of Averages**.

   b. Enter the number of traces to average and then tap **OK**.

4. Tap **OK** to save your changes.

Changing the Units of the Distance to Fault Display

The units of distance in the Distance to Fault display can be set to either feet or meters.

To change the distance units of the Distance to Fault display:

1. Tap the Edit button (EDIT) or select **Setup > Edit**. This displays the Setup window.

2. Tap the **General** tab. See Figure 3‑20.
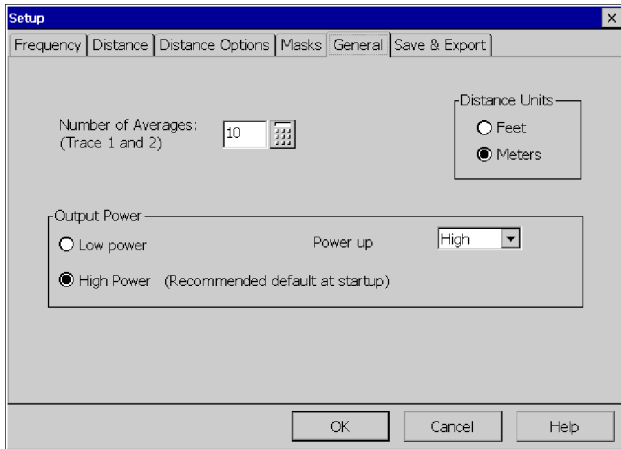
Figure 3‑20: Setting the distance units

3. Change the distance units by tapping the appropriate option button.

Saving Results

You can save a trace for later recall. For example, you can save an example of a good trace for comparison with a live trace later.

To save a trace with an automatically generated filename:

- Select **File > Save Results**.

Traces are saved in the \BuiltInDisk\YBA250\AppData\Results directory by default, but that can be changed for future save operations by selecting a different path in the Save Results As window. Remember that only traces saved within the BuiltInDisk folder (or removable storage such as a PC memory card) are stored in non-volatile memory. Traces saved outside the BuiltInDisk folder are lost when the YBA250 is shutdown.

To save a trace with a name and location you specify:

1. Select **File > Save Results As...**. The Save As dialog box appears.

2. Enter a name and location for the file and tap **OK**.

NOTE. *Traces are saved with the settings in effect at the time the trace is saved.*

Displaying a Saved Trace

You can display a previously saved trace for review or comparison with another trace.

To display a saved trace:

1. Select **File > Open**. The Open dialog box appears.

2. Locate the saved trace, tap the name of the trace and then tap **OK**.

NOTE. *Traces are saved with the settings in effect at the time the trace is saved. When a saved trace is displayed, the stored settings values will be shown for reference, though no actual instrument settings will change. As soon as you press ▶ to return to making new acquisitions, the settings will be restored to what they were before the saved trace was opened.*

Comparing Traces

The YBA250 enables you to compare traces two ways. The first allows you to compare a live trace to a reference trace. The second way compares two saved traces.

Comparing a Live Trace to a Reference Trace

The YBA250 provides the ability for you to visually compare the current live trace against a reference trace. The reference trace, called Trace 2, can be another current trace or a saved trace.

To display a second trace:

■ Select **View>Trace 2**.

or

■ Select the Rotate Traces icon ( ).

If Trace 2 is not enabled, selecting the Rotate Trace icon enables the Trace 2 display.

Defining Trace 2

Trace 2 can be a live trace (for example, an averaged display of the latest acquisitions) or a saved trace.

To define Trace 2:

1. Select **View>Define Trace 2...**. The Setup window appears with either the **Frequency** tab or **Distance** tab selected. See Figure 3-21.
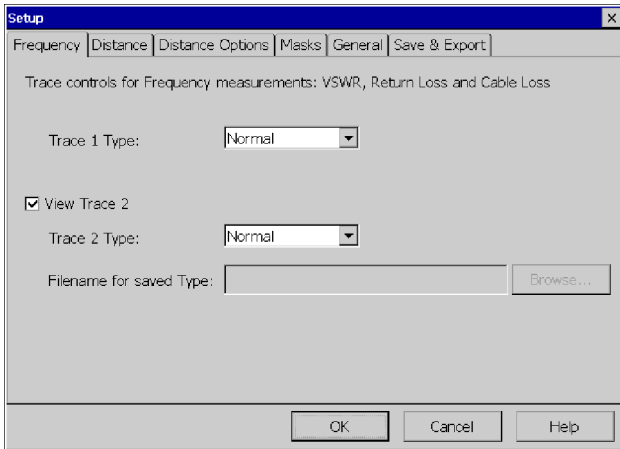
Figure 3‑21: Defining Trace 2

2. By default, Trace 2 is a live trace. You can set the trace type for a live trace.

- Set the trace type for Trace 2 with the drop-down list. You can choose Normal, Average, Min, Max, or Min/Max.

3. To set Trace 2 to a saved trace, select **Saved:** from the drop-down list. Enter the path to the saved trace in the input box, or tap **Browse**. Select the desired results file from the **Select Saved Result** dialog box and tap **OK**.

4. Tap **OK** to save your changes and close the Setup window.

Comparing Two Results Files

The YBA250 provides the ability for you to compare two saved results to each other. This would be useful in comparing previous antenna test results.

To compare two saved results:

1. Select **File > Compare Saved...**. The Open dialog appears. See Figure 3‑22. For the first result selected, the dialog is labeled **Select first result file to compare**.
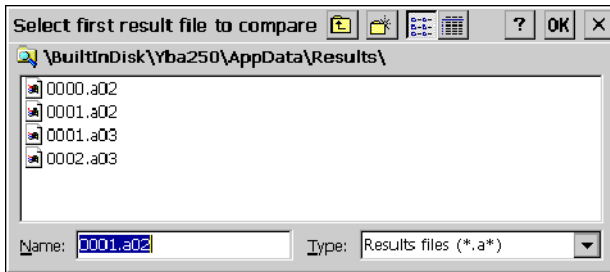
Figure 3- 22: Selecting the first result file

There are two types of results files, Return Loss and Distance to Fault. Return Loss results files have a file extension of "a02". Distance to fault results files have a file extension of "a03". Note that both results file types are displayed for the first file selection.

2. Select the first result file you wish to compare. Tap **OK**.

After you select the first result, the Open dialog is displayed again for you to select the second result file. See Figure 3–23. Note the label **Select second result file to compare**.

Note that the only file type available to select are those that match the results file you selected first. If you selected a Return Loss results file in the first dialog (a02 file extension), only Return Loss results files are displayed for you to select as the second file to compare.
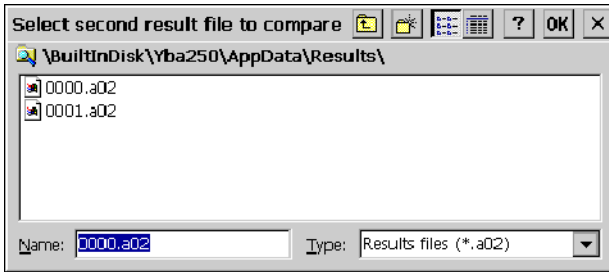
Figure 3- 23: Selecting the second result file

Once you have selected both traces, they are displayed. The two traces are displayed in different colors so that they are easier to compare. See Figure 3–24.
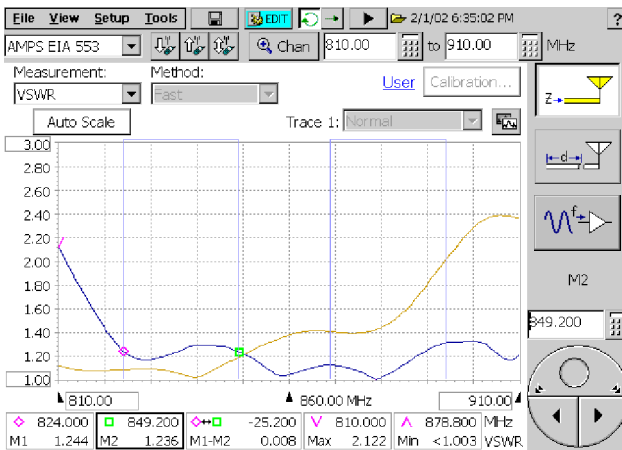
Figure 3- 24: Two compared traces

You can use markers on the saved traces to compare points on the traces.

Using Markers, Band Edge Cursors, and Mask Testing

The YBA250 provides a function named Markers that enable you to easily make measurements on a displayed trace. Markers can be used to identify the maximum and minimum value on a trace as well as the differences between two points on a trace. Another feature, known as Band Edge Cursors, can be displayed to make it easier to locate the frequency band for the selected signal standard. Using Mask Testing enables you have the YBA250 continually test a signal and perform an action when the signal exceeds the limits defined by the mask.

Displaying Markers

The YBA250 provides markers to enable you to easily measure Return Loss and VSWR differences between two points of the displayed trace or between two traces.

To display the markers:

■ Select **View>Markers**.

The markers will be displayed as shown in Figure 3-25.
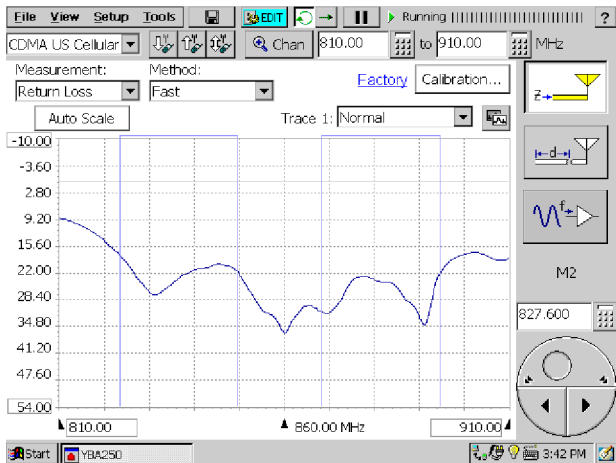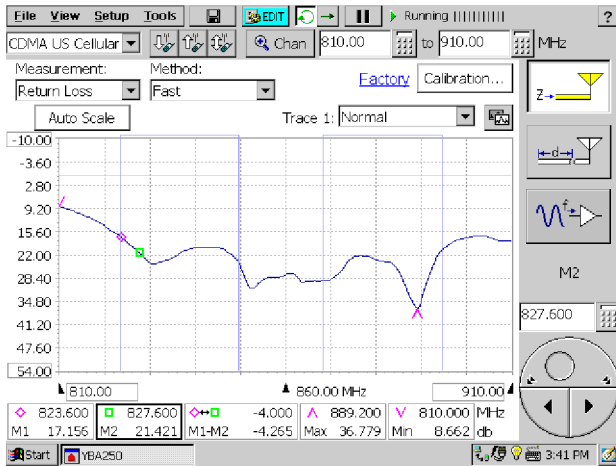
Figure 3‑25: Display with and without markers

Markers are used to display frequency, Return Loss, and VSWR at specific points on traces. There are five marker readouts: M1, M2, M1‑M2, Max, and Min. At the right end of the marker readouts the

units for the numeric values are shown (f = frequency, dB = return loss in decibels, VSWR = Voltage Standing Wave Ratio).

The elements of the marker readouts are described in Table 3-7. Refer to the following sample marker readout when reading the table.

| ◇ 824.000 | □ 849.200 | ◇↔□ -25.200 | ∧ 839.600 | ∨ 905.600 | MHz |
| M1 27.058 | M2 20.848 | M1-M2 6.210 | Max 38.172 | Min 7.760 | db |

Table 3-7: Elements of Marker Readouts

Element	Location in Readout	Function
Symbol	Top-left	The symbol (diamond, square, arrowhead pointing up or down) on the display associated with the readout.
Name	Bottom-left	The name of the readout: M1, M2, M1-M2, Max or Min.
Frequency	Top-right	The frequency at which the marker is located. On the M1-M2 readout, it is the difference in frequency between M1 and M2.
Measurement	Bottom-right	The measured value at the marker position. If the Measurement is Return Loss or Cable Loss, the readout is in dB. If the Measurement is VSWR, the readout is in VSWR units.

The M1 and M2 markers can be placed on the same trace or on different traces (with Trace 2 enabled). The Max marker (∧ or ∨) indicates the maximum signal level on any trace and the VSWR at frequency of the maximum signal level. The Min marker (∧ or ∨) indicates the minimum signal level on its assigned trace and the VSWR at that frequency. The direction of the indicator for Max and Min can point in either direction depending on settings, so be sure to look at the indicator in the marker display to determine which marker indicator you are looking at. The M1-M2 readout (◇↔□)

displays the difference in frequency, Return Loss, and VSWR between M1 and M2.

To display the Return Loss or VSWR at a specific frequency:

1. Select **View > Markers** if Markers are not already visible.

2. Select the measurement, **Return Loss**, **VSWR** or **Cable Loss**.

3. To place Marker 1:

   a. Tap the **M1** box. This assigns the knob to Marker 1. Note the readout above the knob changes to **M1**.

   b. Tap the point on the waveform where you want the marker placed. You can also tap the numeric keypad, next to the knob, to enter the frequency where the marker should be placed or use the knob to change the location of the marker.

   c. Read the M1 frequency, Return Loss, and VSWR in the M1 readout.

4. To place Marker 2:

   a. Tap the **M2** box. This assigns the knob to Marker 2. Note the readout above the knob changes to **M2**.

   b. Tap the point on the waveform where you want the marker placed. You can also tap the numeric keypad, next to the knob, to enter the frequency where the marker should be placed or use the knob to change the location of the marker.

   c. Read the M2 frequency, Return Loss, and VSWR in the M2 readout.

To place markers on two traces:

1. If it is not already selected, select **Trace 2** from the **View** menu.

   This displays Trace 2 as defined on the Loss tab.

2. From the View menu, select the desired location for the markers. See Figure 3-26.

Figure 3‑26: Assigning markers to a trace

When Trace 2 is enabled, markers can be located as follows:

Table 3‑8: Marker placement

Menu selection	Location of markers
Marker 1	Assigns M1 to Trace 1, Trace 2 (rotating the trace order does not change the marker assignment), or to the trace assigned to the foreground.
Marker 2	Assigns M2 to Trace 1, Trace 2 (rotating the trace order does not change the marker assignment), or to the trace assigned to the foreground.
Marker Min	Assigns Min to Trace 1, Trace 2 (rotating the trace order does not change the marker assignment), or to the trace assigned to the foreground.
Marker Max	Assigns Min to Trace 1, Trace 2 (rotating the trace order does not change the marker assignment), or to the trace assigned to the foreground.

If Trace 2 is not enabled, all markers are placed on Trace 1.

Measuring Return Loss and VSWR Between Points on a Single Trace

To measure the difference in Return Loss and VSWR between two points on a single trace:

1. Display the markers by selecting **View>Markers**.

2. Tap the **M1** readout. This assigns the marker to the knob and to the touch screen in the display area.

3. Tap the display where you want to place the marker. You can also use the knob to position the marker.

4. Tap the **M2** readout. This assigns the marker to the knob and to the touch screen in the display area.

5. Tap the display where you want to place the marker. You can also use the knob to position the marker.

6. Read the difference in Return Loss and VSWR in the M1–M2 marker display.

Measuring Return Loss and VSWR Differences Between Two Traces

When Trace 2 is displayed, you can measure the difference in Return Loss and VSWR between points on two traces:

1. If Trace 2 is not displayed, select **View > Trace 2**.

2. Display the markers by selecting **View > Markers**.

3. Specify the location of the markers by choosing one of the menu selections shown in Table 3-8 from the **View** menu.

4. Tap the **M1** readout. This assigns the marker to the control knob and to the touch screen in the display area.

5. Tap the display where you want to place the marker. You can also use the knob to position the marker.

6. Tap the **M2** readout. This assigns the marker to the knob and to the touch screen in the display area.

7. Tap the display where you want to place the marker. You can also use the knob to position the marker.

8. Read the difference in frequency and level at the right side of the marker display.

Band Edge Cursor

The Band Edge cursors identify the start and stop frequencies for the transmit and receive bands of the selected standard. See Figure 3–27. There are two parts to the cursors, the main part appears in the main trace display and the second part appears along the top edge of the graph. The portion in the main display can be switched off, but the part along the top edge of the graph is always visible. See Figure 3–28.
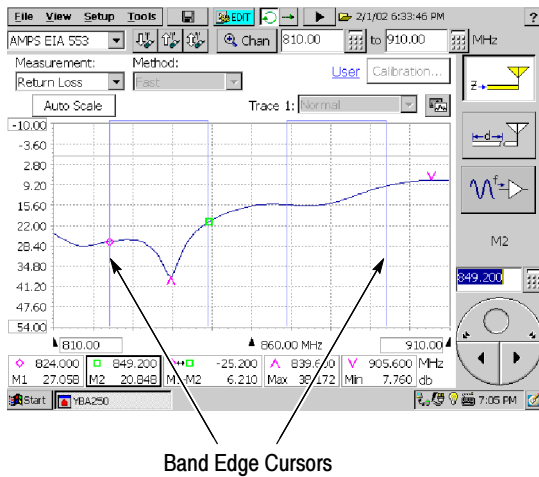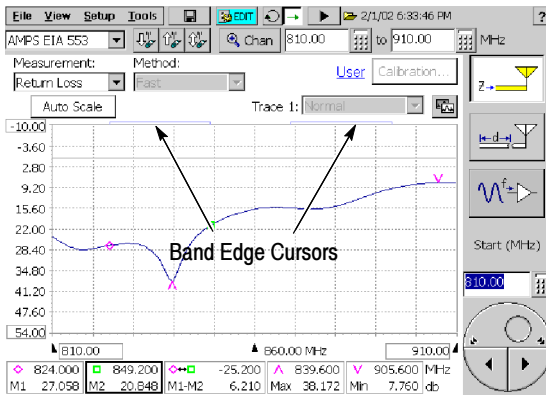

Band Edge Cursors

Figure 3‑27: Band Edge Cursor displayed

Figure 3‑28: Band Edge Cursor is always visible

To turn on the display of Band Edge Cursors:

- Select **View > Band Edge Cursor** so that it is checked.

To turn off the display of Band Edge Cursors:

- Select **View > Band Edge Cursor** so that it is *not* checked.

Markers and Mask Testing

Markers are available when mask testing is enabled. There are two things to note about markers when mask testing is enabled:

- Markers cannot be placed on a mask.

- When mask testing is enabled, the marker difference readout displays the difference between the marker and the mask.

Creating a Mask

Mask testing is used to determine if Return Loss or VSWR exceeds specified levels. The YBA250 can perform several actions when an input signal exceeds limits defined by a mask. The default action is

to display an icon (![icon]) to the left of the graph (which cannot be switched off) and sound a beep (which can be switched off). A trace that exceeds limits can trigger additional actions such as pausing the display, exporting a screen and saving results to a file.

Masks are created with the Mask Maker utility. A mask consists of one or more traces. Each trace consists of at least one point.

To create a mask:

1. Select the Impedance display by tapping the Impedance button (![button]).

2. Select the measurement for which you want to create a mask from the **Measurement** drop-down list.

3. Set the frequency range of the display by selecting the band (Forward/Reverse/Both), selecting the channel or by setting the Changing the Start and Stop frequencies.

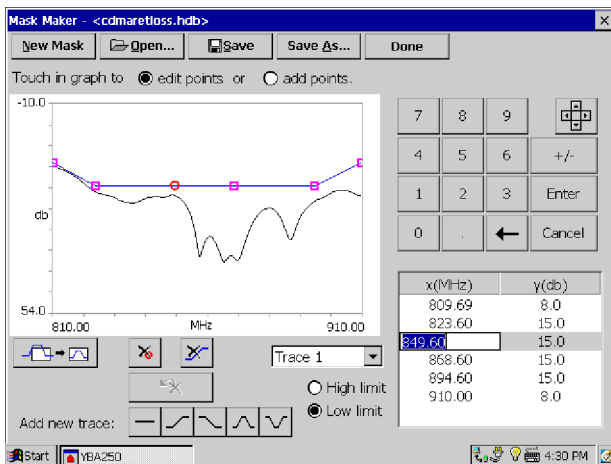4. From the **Tools** menu, select **Mask Maker**. This displays the Mask Maker utility. See Figure 3--29.

Figure 3--29: The Mask Maker utility

If Mask testing was already enabled, the selected mask is displayed in the Mask Maker window. If Mask testing was not enabled, a new default mask (the pulse-shaped trace) is displayed.

To add a point to a trace:

1. If more than one trace is displayed, select the desired trace by tapping on it or tap the down arrow (Trace 1 ▼) on the trace selector and select the desired trace from the list.

2. Tap the **add points** option button above the graph.

3. Tap the graph at the desired point.

To move a trace point:

1. If more than one trace is displayed, select the desired trace by tapping on it or tap the down arrow (Trace 1 ▼) on the trace selector and select the desired trace from the list.

2. Tap the **edit points** option button above the graph.

3. Touch the desired point and drag it to the new location.

Alternately, you can move points by using the keypad or the cursor keys:

1. Tap the value in the table (the number in either the **x** column or the **y** column) you want to adjust.

2. If the cursor arrows are displayed above the table, tap the keypad icon (▦) to display the keypad.

3. Use the keypad to type the new value for the point and tap **Enter** when finished.

***

NOTE. *If you want to adjust a vertical value, you can tap the desired point in the graph and its vertical value will be selected in the table.*
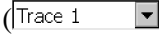
***

or:

4. Tap the point to be moved so it is selected (point indicator changes to a circle).

5. If the keypad is displayed above the table, tap the cursor arrows icon (⊞) to display the cursor arrows. Tap one of the cursor arrows to move the selected point in the desired direction.

To delete a point from a trace:

1. If more than one trace is displayed, tap the down arrow (Trace 1 ▼) on the trace selector. Select the desired trace from the list.

2. Tap the point to be deleted so it is selected (point indicator changes to a circle).

3. Tap the delete point button (✕).

To add a trace to the mask:

■ Tap one of the **Add new trace** buttons. A trace of the selected shape will appear on the graph.
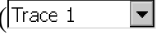
To delete a trace from a mask:

1. Tap the down arrow (Trace 1 ▼) on the trace selector.

2. Select the trace to delete from the list.

   If the **edit points** option button is selected, you can also select a trace by touching it near one of its points.
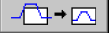
3. Tap the delete trace button (✕).

To specify how a mask violation is determined:

1. Tap the down arrow (Trace 1 ▼) on the trace selector.

2. Select the desired trace from the list.

3. Tap **High limit** to indicate a violation when a signal trace has a value higher than the mask trace.

4. Tap **Low limit** to indicate a violation when a signal trace has a value lower than the mask trace.

Hints
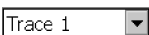
■ The selected point on a mask trace is indicated by a circle. Other points are indicated by a square.

- You can add as many points as you want to a mask trace.

- You can place as many traces on a mask as you want.

- If you place points outside the visible area of the graph, tap the rescale button (◁△▸◁) to bring all points into view.

- If you accidentally delete a point or a trace, you can undo the last delete action by tapping the Undo Delete button (↰✗)

- Tap the numeric keypad (⊞) to switch to the numeric keypad from the cursor keys.

- Tap the cursors keys button (⊞) to switch to the cursor keys from the numeric keypad.

Table 3‑9: Mask maker buttons and icons

Button/Icon	Description
New Mask	Creates a new mask.
Open...	Opens an existing mask for editing.
Save	Saves changes to the current mask.
Save As...	Save changes to the current mask with a different name or to a different location.
⊞	Cursor arrows button. Tap to display the cursor arrows.
▲	Cursor arrow. Tap to move the selected point in the desired direction.
⊞	Keypad button. Tap to display the numeric keypad.
Done	Done. Tap to exit the Mask Maker utility.
◁△▸◁	Rescale button. Tap to scale the current mask so all points are visible in the graph.
✗	Delete Point. Tap to delete the selected point from the mask.

Table 3‑9: Mask maker buttons and icons (Cont.)

Button/Icon	Description
✗	Delete Trace. Tap to delete the selected trace from the mask.
Trace 1 ▼	Trace Select list box. Tap to select which trace to edit.
✗	Undo Delete. Tap to undo the last Delete Point or Delete Trace action.
—	Flat Trace button. Tap to add a 2-point trace to the mask.
╱	Rising Trace button. Tap to add a 4-point trace to the mask.
╲	Falling Trace button. Tap to add a 4-point trace to the mask.
⋀	Positive Pulse button. Tap to add a 6-point trace to the mask.
⋁	Negative Trace button. Tap to add a 6-point trace to the mask.

Defining a Mask

Before you can perform a mask test, you must define the mask to be used. Defining a mask specifies the mask to used for mask testing. If you have not yet created a mask, see *Creating a Mask* on page 3‑48.

To define a mask:

1. Select **View > Define Mask**. This displays the **Masks** tab of the Setup window.

2. Decide which type of mask you wish to define: Return Loss, VSWR or Cable Loss, and tap appropriate **Browse** button and select the mask you want to use for your mask test.

3. Tap the **Enable Mask Testing** check box.

4. To have the YBA250 perform an action (in addition to displaying the violation icon) when a mask violation occurs, tap the appropriate check box.

- Tap **Beep** to sound an alarm when a violation occurs (this is selected by default).

- Tap **Pause** to cause the YBA250 to pause when a violation occurs.

- Tap **Export Screen** to save the screen as a graphics file when a violation occurs.

- Tap **Save Results** to cause the YBA250 to save the measurements results to a file when a violation occurs.

5. Tap **OK** to accept your changes.

Mask testing is enabled with the defined mask displayed.

Performing a Mask Test

To perform a mask test:

- Select **View > Mask** so that there is a check mark next to **Mask**.

The defined mask is displayed.

The defined mask is displayed. If the trace exceeds the mask, the violation icon (![violation icon]) will appear on the left side of the spectrum graph and the violated mask trace will change color (the specific color depends on the selected color scheme.

A mask trace does not have to cover the entire test frequency range. Signal points at frequencies that don't have associated mask points are not tested for violations. This allows you to check only those parts of the signal that are critical to your specific measurement, for example the attenuation in adjacent channels.

Mask Testing and Markers

When Mask testing is enabled, the marker difference readout displays the difference between the marker and the mask. A positive value indicates a "pass." A negative value indicates a "fail." A

positive value for an upper limit means the signal level is lower than the mask level at the marker frequency. A negative value means the signal level is higher than the mask level, thus violating the mask. For a lower limit mask, a positive difference means the signal level is higher than the mask level and a negative difference means the signal level is lower than the mask level.

The YBA250 calculates the difference between the marker and the mask using the above rule to determine the sign of the difference. The YBA250 calculates the difference between the signal level and the level of each of the traces in the mask. The YBA250 then displays the worst case difference between the signal level and all the traces in the mask.

For example, suppose there are two traces in a mask, one is an upper limit and the other is a lower limit. The upper limit mask trace level at the marker frequency is 0 dB, the signal level is –10 dB and the lower limit mask trace level is –30 dB. Thus, the difference between the upper limit and the signal is 10 dB and the difference between the signal level and the lower limit is 20 dB. The YBA250 will display the M1 marker difference as 10 dB because the signal is closer to the upper limit than it is to the lower limit. Alternately, assume the upper limit mask trace level is 0 dB, the signal level is –30 dB and the lower limit mask trace level is –25 dB. Thus, the difference between the upper limit and the signal is 30 dB and the difference between the signal level and the lower limit is –5 dB. The YBA250 will display the M1 marker difference as –5 dB because the signal is closer to the lower limit than it is to the upper limit. And because the signal is lower than the lower limit, the signal fails the mask test.

If the YBA250 displays dashes (----) for the marker difference instead of a number, it means there is no mask defined at the marker frequency.

Saving and Recalling Results, Screens, and Setups

The YBA250 can save measurement results and screens (screen captures) for later recall or for transfer to a PC. You can also set up the YBA250 for specific tests and save the setup to a file for later recall, saving you time when making measurements in the field.

When saving files, it is important to save the files in the correct location. There are two types of memory in the YBA250. Volatile memory is memory that loses data when power is removed. Non-volatile memory retains data when power is removed. When the YBA250 is powered down, any data stored in volatile memory is lost. Only data stored in non-volatile memory is retained when the YBA250 is powered down. On the YBA250, the **BuiltInDisk** folder is the only folder maintained in non-volatile memory.

When saving results, screens, or setups, be sure to save them in a folder located within the BuiltInDisk folder. The default folder for saved results is \BuiltInDisk\YBA250\AppData\Results. The default folder for saved screens is \BuiltInDisk\YBA250\AppData\Results. The default folder for saved setups is \BuiltInDisk\YBA250\AppData\Settings. Because these locations are all located within the BuiltInDisk directory, any data saved there is maintained after the YBA250 is powered down.

Saving Measurement Results

The YBA250 enables you to save a measurement result to a file for later recall. Saving measurement results is meant for use in reproducing a *display* at a later time. When results are recalled, they appear in the display just as they did when saved. To use measurement *data* results in another program for analysis or generating a report, use the **Export Results** function; see page 3--59.

To save measurement results:

1. Take the measurement you want to save.

2. Select **File > Save Results** (Save Results appears only when the Measure window is selected; Save Trace appears when the Spectrum and Interference windows are selected.).

3. Select the folder where you want to save the results.

4. Type a name for the file. Tap 🖮, in the taskbar, to display the soft keyboard. Tap 🖮 again to hide the keyboard when you are finished.

5. Tap **OK** to save the file.

What is Saved in a Measurement Results File

The following information is saved in the results file for each included measurement:

- Name of the measurement

- Measurement results and units

- Time and date of the measurement

Additional information saved in a results file includes:

- Technician name

- User notes

- Setup information that is visible in the results display

- Error information (if errors were present)

Recalling Measurement Results

You can recall saved measurement results for display. When saved measurement results are displayed, the display appears just as it did when the measurement was saved except for the status area of the control bar.

To recall measurement results for display:

1. Select **File > Open**.

2. Locate the directory that contains the measurement results file (the default is \BuiltInDisk\YBA250\AppData\Results).

3. Select the results file to recall and tap **OK**. See Figure 3‑30.

4. To restart measurements, tap the Play button (▶).

Saved Data icon indicates recalled
results are displayed

To restart acquisition,   Date and time
tap the Start button   result was saved
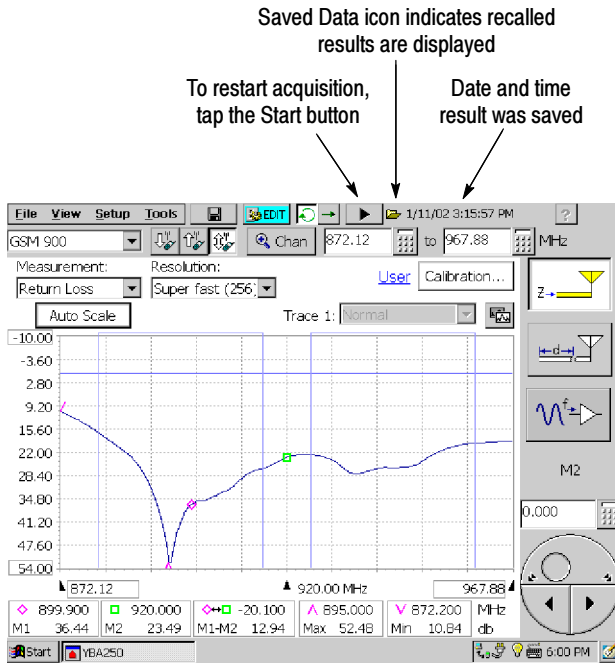
Figure 3‑30: Example of a recalled results display

When a recalled results file is displayed, the Saved Data icon is
displayed at the top of the screen, next to the time and date the file
was saved.

Exporting Measurement Results

The YBA250 can save measurement results in a file for use in other
applications, such as Microsoft Excel. The YBA250 exports files as
tab-separated or comma-separated files. Files that use tabs to

separate data fields are saved with a "txt" extension. Files that use commas to separate data fields are saved with a "csv" extension.

To export measurement results:

1. Select **File > Export Results**.

2. Select a file format from the Type list.

3. Type a name for the file. Tap ⌨, in the taskbar, to display the soft keyboard. Tap ⌨ again to hide the keyboard when you are finished.

4. Choose the location where the file should be saved.

5. Tap **OK** to save the file.

Figure 3-31 shows an exported results file.

```
Name                     Value           Units          Pass/Fail
Measurement Name         Frequency
Timestamp                10/3/02 7:20:31 PM
Calibration in use       Factory
Cal set name             Factory cal set
Calibration timestamp    1/10/02 5:30:12 PM
Technician               Trip Tucker
Note for saved results   test of NX-01 primary antenna
Message
Output power             High
Start Freq (Hz)          25000000
Stop Freq (Hz)           2500000000
Vert Scale Min (dB)      -10
Vert Scale Max (dB)      40
Trace 1 mode             Normal
Trace 2 on               False
Trace 2 mode             Normal
Mask test enabled        False
Mask Filename            \BuiltInDisk\YBA250\AppData\Results\rlmask1.hdb
Mask Limit Test          Pass
Measurement              Return Loss
Method                   Fast
```

```
Trace 1 return loss data Trace 1 VSWR data
0.014                    99.010
0.023                    99.010
0.029                    99.010...
```

Figure 3-31: Sample Exported Results file

NOTE. The Technician name and User notes are entered from the Save & Export page of the Setup dialog; see page 2-45.

Exporting a Screen

The YBA250 can export an image of the screen for use in other programs such as Microsoft Word. An exported screen is a graphic image of the YBA250 display. A screen can be saved in three formats: BMP, JPEG and PNG. An exported screen cannot be displayed by the YBA250, it can be viewed only by a program that can display graphic images.

To export a screen image:

1. Select **File>Export Screen As...**.

2. Select the image format from the **Type** list.

3. Type a name for the file. Tap ⌨, in the taskbar, to display the soft keyboard. Tap ⌨ again to hide the keyboard when you are finished.

4. Choose the location where the file should be saved.

5. Tap **OK** to save the file.

Differences Between Exported Screens and Results

Though an exported screen and an exported results file might seem as though they are the same thing, they are significantly different. You can think of an exported screen as a kind of photograph of the

YBA250 display. A saved or exported results file contains information about the displayed signal. Table 3-10 shows the differences between an exported screen and a trace.

Table 3-10: Differences between exported screens and traces

File type	Menu command	Read by other programs	File format
Exported Screen	Export Screen	Yes	BMP, JPEG PNG
	Export Screen As...	Yes	BMP, JPEG PNG
Saved Results	Save Results	No	binary[1]
	Save Results As...	No	binary[1]
Exported Results	Export Results As...	Yes	tab or comma-separated text

[1]Binary files can be read only by the YBA250

Exported Screen File Formats

BMP is an uncompressed format and uses a lot of space, but maintains sharp images. JPEG is a compressed format and uses far less space than BMP, but can blur lines and text. PNG is a compressed format and maintains sharp lines and text. Table 3-11 compares the relative features of each of the export file formats.

Table 3-11: Comparison of file formats for exporting screens

Format	Export speed	File Size	Quality
BMP	Medium	Large	Very Good
JPEG	Very Slow	Medium	Medium/Poor
PNG	Fast	Small	Good

An exported results file contains information about the YBA250 settings and data that represents the trace. Figure 3‑32 shows an example of an exported trace saved as a tab-separated text file. The numbers at the end (following "Trace 1 data") represent the data points of the trace on the display. To save space, only a few numbers are shown in this example.

```
Name                      Value         Units       Pass/Fail
Measurement Name          Frequency
Timestamp                 10/3/02 7:20:31 PM
Calibration in use        Factory
Cal set name              Factory cal set
Calibration timestamp     1/10/02 5:30:12 PM
Technician                Trip Tucker
Note for saved results    test of NX-01 primary antenna
Message
Output power              High
Start Freq (Hz)           25000000
Stop Freq (Hz)            2500000000
Vert Scale Min (dB)       -10
Vert Scale Max (dB)       40
Trace 1 mode              Normal
Trace 2 on                False
Trace 2 mode              Normal
Mask test enabled         False
Mask Filename             \BuiltInDisk\YBA250\AppData\Results\rlmask1.hdb
Mask Limit Test           Pass
Measurement               Return Loss
Method                    Fast


Trace 1 return loss data  Trace 1 VSWR data
0.014                     99.010
0.023                     99.010
0.029                     99.010...
```

Figure 3‑32: Example of an Exported Results file

Saving Setups

The YBA250 can save its settings in Setup files for later recall. Recalling a saved setup changes the YBA250 settings to match those in the saved setup. Using saved setups minimizes your setup time in the field and helps to ensure more consistent measurement results. For example, you could save a setup for measuring return loss on a specific frequency band. The saved setup will contain the measurement settings as well as all other instrument control settings. Once

the setup is saved, it can be copied to other YBA250's to save setup time in the field.

To save YBA250 setups:

1. Set all the YBA250 settings the way you want them.

2. Select **Setup > Save...**.

3. Type a name for the file. Tap ⌨, in the taskbar, to display the soft keyboard. Tap ⌨ again to hide the keyboard when you are finished.

4. Choose the location where the file should be saved (the default is \BuiltInDisk\YBA250\AppData\Settings).

5. Tap **OK** to save the setup file.

Recalling Setups

Recalling a saved setup changes the YBA250 settings to match those in the saved setup file.

To recall setups:

1. To recall a setup, select **Setup > Open..**.

2. Locate the directory that contains the setup file (the default is \BuiltInDisk\YBA250\AppData\Settings).

3. Select the setup file to recall and tap **OK**.

Customizing the Setup menu

The YBA250 allows you to customize the Setup menu to include a list of standard setups and to prevent accidental changes to existing setup files.

Preventing Changes to Saved Setups

The YBA250 enables you to hide setup controls so that accidental changes to saved setups cannot occur.

To hide setup controls:

1. Select **Tools>Options...** .

2. Select the **Setup Menu** tab. See Figure 3--33.
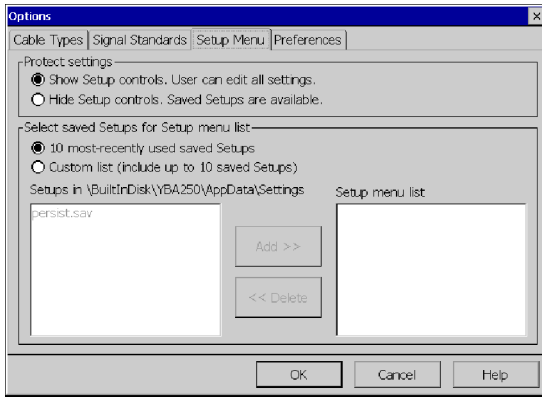
Figure 3-- 33: Setup menu controls

3. To prevent a user from changing saved setups, select **Hide Setup controls**.

4. Tap **OK** to save the **Setup Menu** changes.

When **Hide Setup controls** is selected, the Edit button changes to the Open button. Tapping the **Open** button ( ) displays the Open dialog box instead of the Setup window. This allows the user to select a saved setup for recall, but not to edit any settings or save any setups. Additionally, when **Hide Setup controls** is selected, the **Setup > Edit** and **Setup > Save** menu items are disabled.

Enabling Changes to Saved Setups

If setup controls have been hidden, you cannot create new setup files. You must show setup controls so you can create new setup files.

To show setup controls:

1. Select **Tools>Options...** .

2. Select the **Setup Menu** tab. See Figure 3-33.

3. Select **Show Setup Controls**.

Once setup controls are visible, you can create new setup files.

Specifying the List of Saved Setups

The YBA250 enables you to specify the list of saved setups that appears in the Setup menu. You can choose to list either the 10 most recently used saved setups or display a custom list of setups. A custom list of saved setups provides consistent and quick access to a standard group of setup files.

To specify the list of setups in the Setup menu:

1. Copy or move all the setup files you want to list in the Setup menu to the \BuiltInDisk\YBA250\AppData\Settings folder. The YBA250 will allow you to select only setups located in the \BuiltInDisk\YBA250\AppData\Settings folder for display in the Setup menu.

2. Select **Tools > Options...** .

3. Select the **Setup Menu** tab. See Figure 3-34.

4. To display the 10 most recently used saved setups in the Setup menu, select **10 most-recently used saved Setups**.
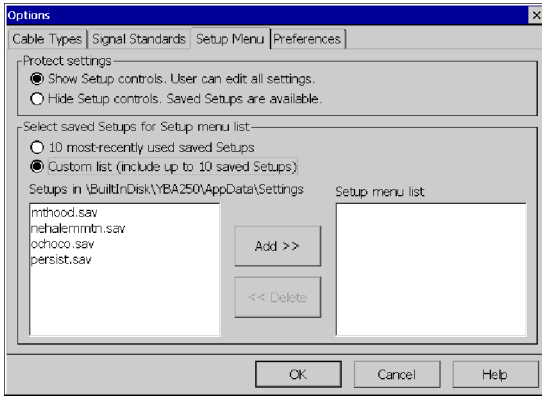
Figure 3- 34: Specifying the List of Setups

5. To display only a selected list of saved setups, select **Custom List**.

    a. Select a setup from the list on the left and tap **Add>>** to add the selected setup to the Setup menu.

    b. Select additional setups until you have selected all the setups you want in the Setup menu. (You can select up to 10 setups to appear in the Setup menu.)

    To remove a setup from the Setup menu list, select the setup to remove from the Setup menu List window and tap **<<Remove**.

6. Once you have selected all the setups you want listed in the Setup menu, tap **OK**.

Appendices

Appendix A: Specifications

This section lists the electrical, environmental, and physical specifications of the YBA250 Antenna and Transmission Line Analyzer. All specifications are guaranteed unless labeled "typical". Typical specifications are provided for your convenience and are not guaranteed.

The specifications in this section apply to the YBA250 module, unless otherwise specified. For NetTek Analyzer Platform specifications, please refer to the NetTek Analyzer Platform User Manual.

Table A-1: Measurement characteristics

Frequency Characteristic	Description
Frequency Range	25 MHz - 2500 MHz
Frequency Accuracy	± 75 ppm
	Accuracy specifications guaranteed after 5 minute warm-up period.
Frequency Resolution	100 kHz
Return Loss Characteristics	**Description**
Return Loss Measurement	Return loss is defined as:
	$\qquad$ 20 log (| Reflection Coefficient |)
	Where:
	$$Reflection\ Coefficient \ = \ \frac{(Z - Z_0)}{(Z + Z_0)}$$
	and:
	$\qquad$ Z is the measured impedance
	$\qquad$ Z_0 is the YBA250 characteristic impedance
Return Loss Display Range	0 to 54.00 dB
Return Loss Resolution	0.01 dB

Table A‑1: Measurement characteristics (Cont.)

Return Loss Characteristics	Description
Return Loss Accuracy with Factory Calibration	≤ 1 dB typical (from 0 to 40 °C up to 2 GHz, measuring a 17 dB return loss).
Return Loss Accuracy with User Calibration	$$< \ 0.05 \ + \ \mid 20 \ \log \ (\ 1 \ \pm \ 10^{\left(\frac{RL_{REL}}{20}\right)}) \mid dB$$ Where RL_{REL} is defined as: (measured return loss value – calibration standard return loss value) Return loss is dependent on the quality of the calibration standards used. Tektronix recommends the use of the YBAC1 Calibration Kit for the most accurate results.
Voltage Standing Wave Ratio (VSWR) Characteristics	**Description**
Voltage Standing Wave Ratio (VSWR) Measurement	VSWR is defined as: $$\frac{1 + \mid Reflection\ Coefficient \mid}{1 - \mid Reflection\ Coefficient \mid}$$
VSWR Display Range	1.00 to 65.00
VSWR Display Resolution	0.01
Cable Insertion Loss (One Port) Characteristics	**Description**
Cable Insertion Loss Measurement Method	An estimation of the cable's insertion loss is made by measuring its Return Loss with the cable's other terminals open or shorted. The estimated Cable Insertion Loss is one-half of the Return Loss at any given frequency.
Cable Insertion Loss Resolution	0.01 dB
Cable Insertion Loss Display Range	0.0 to 27.00 dB

Table A-1: Measurement characteristics (Cont.)

Distance to Fault Character-istics	Description
Distance to Fault Measurement	The YBA250 displays Return Loss versus distance or VSWR versus distance.
Distance to Fault Range	Coaxial lines up to 1486•V_{rel} meters in length can be tested. V_{rel} is the relative signal velocity in the coaxial line with respect to the speed of light.
Distance to Fault Resolution	Incremental distances of ≤ 6.1•V_{rel} centimeters at a distance of 200•V_{rel} meters can be resolved. This resolution is available only in situations where the YBA250's entire frequency range can be used to make the measurement. If a device with a narrow bandwidth limits the system under test, the distance resolution is limited by physics to: $$1.5 \; \left(10^8\right) \left[\frac{V_{REL}}{\Delta F}\right]$$ where ΔF is the frequency range the measurements are made over. V_{rel} is the relative signal velocity in the coaxial line with respect to the speed of light.
Distance to Fault Amplitude Correction	The measured value of a broad band discontinuity is corrected using information based on the known characteristics of the cable being tested.

Table A-2: Measurement port characteristics

Impedance Test Port	Description
Connector	Type-N Female.
Nominal Impedance	50 Ω

Table A-2: Measurement port characteristics (Cont.)

Impedance Test Port	Description
Impedance Port Match	$\geq$ 9.5 dB return loss
Output signal Amplitude	+3 dBm, -20 dBm
Maximum Applied Signal Amplitude	$\leq$ +20 dBm without damage
Maximum Interfering Signal Amplitude	+11 dBm
Working Voltage	40 V (DC + peak AC)

Table A-3: Calibration characteristics

Characteristic	Description
Maximum Cable Length for Calibration	10.0 feet (3.05 meters)
Calibration Temperature Range	User calibration is accurate within $\pm$ 10 $^\circ$C (18 $^\circ$F) from the temperature at which the calibration was performed.
Warm-up time	All specifications are valid after a 5 minute warm-up period.

Table A‑4: Environmental characteristics

Characteristic	Description
Temperature Range	
Operating	0 °C to +50 °C
Nonoperating	−40 °C to +60 °C
	Test method per Military Standard MIL‑PRF‑28800F (Class 2), excluding the +23 °C procedure in Test <c> and using the test limits indicated above.
Humidity	
Operating	5% to 95% Relative Humidity (RH), noncondensing: up to +30 °C
	5% to 45% Relative Humidity (RH), noncondensing: +30 °C up to +50 °C
Nonoperating	5% to 95% Relative Humidity (RH), noncondensing: up to +30 °C
	5% to 45% Relative Humidity (RH), noncondensing: +30 °C up to +50 °C
	Test method per Military Standard MIL‑PRF‑28800F (Class 2), excluding Test Level <b>, dwelling for 11 hours minimum at Test Levels <a> and <c>, and using the test limits indicated above.
Altitude	
Operating	Up to 4,600 m (15,092 ft.)
Nonoperating	Up to 15,240 m (50,000 ft.)

Table A‑5: Physical characteristics

Characteristic	Description
Dimensions	Height: 24.1 cm. (9.50 in) Width: 18.75 cm. (7.38 in) Depth: 3.18 cm. (1.25 in)
Weight	$\leq$1 kg (2.2 lbs) YBA250 module only 4.1 kg (9 lbs), NetTek Analyzer Platform only, with one battery

Table A‑6: Miscellaneous characteristics

Characteristic	Description
Battery Life	
One battery installed	2 hours with measurements active 4 hours in suspend mode
Two batteries installed	4 hours with measurements active 8 hours in suspend mode
Recommended Calibration Interval	1 year

Table A‑7: Safety compliance

Category	Standards or description
Safety Compliance	ISA S82.02.01 Safety Standard for Electrical and Electronic Test, Measuring, Controlling, and Related Equipment. CAN/CSA C22.2 No. 1010.1 Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use. EN 61010-1 Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use. IEC61010-1 Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use. UL3111-1 Standard for Electrical Measuring and Test Equipment.

Table A‑8: Electromagnetic compatibility (EMC)

Category	Standards or description
EC Declaration of Conformity – EMC	Meets the intent of Directive 89/336/EEC for Electromagnetic Compatibility. Compliances were demonstrated using EN 61326:1997 EMC Product Family Standard for Electrical Equipment for Measurement, Control and Laboratory use. **Emissions[1]** EN 61326 — Class A Radiated and Conducted Emissions EN 61000-3-2 (A14) — Conducted Power Line Harmonic Current **Immunity[1, 2]** IEC 61000-4-2 — Electrostatic Discharge Immunity, Performance Criterion "B" IEC 61000-4-3[3] — Radiated RF Electromagnetic Field Immunity, Performance Criterion "A" IEC 61000-4-4 — Electrical Fast Transient/Burst Immunity Performance Criterion "B" IEC 61000-4-5 — Power Line Surge Immunity, Performance Criterion "B" IEC 61000-4-6[4] — Conducted RF Immunity, Performance Criterion "A" IEC 61000-4-11 — Voltage Dips and Short Interruptions Immunity, Performance Criterion "B"

Table A‑8: Electromagnetic compatibility (EMC) (cont.)

Category	Standards or description
Australia/New Zealand Declaration of Conformity – EMC	Complies with EMC Framework and demonstrated per Emission standard: AS/NZS 2064 Industrial, Scientific, and Medical Equipment

[1] **Compliance demonstrated using high quality, shielded interface cables.**

[2] **Minimum immunity test requirement.**

[3] **No degradation of a displayed return loss of 20 dB when exposed to a 3 V/m field over the frequency range of 80 MHz - 1 GHz. Test port connected to a high quality 3 meter coaxial cable (Tektronix part number 012‑1619‑00) and a high quality 10 - 12 dB attenuator terminated in a microwave short.**

[4] **No degradation of a displayed return loss of 20 dB when a 3 Vrms signal is injected into the AC power lines of the External Power Supply over the frequency range of 150 kHz - 80 MHz. Test port connected to a high quality 10 - 12 dB attenuator terminated in a microwave short.**

Appendix B: Accessories

This section lists the YBA250 Antenna and Transmission Line Analyzer standard and optional accessories.

Standard Accessories

Table B--1 lists the accessories that come standard with your YBA250 Antenna and Transmission Line Analyzer.

Table B--1: Standard accessories

Quantity	Part number	Description
1 each	016--1868--00	Accessory Pouch
1 each	200--4728--00	Connector Dust Cover
1 each	071--1047--00	YBA250 Antenna and Transmission Line Analyzer User manual, English
1 each	063--3554--00	CD-ROM containing YBA250 software and User Manual in PDF format.

Optional Accessories

Table B‑2 lists optional accessories you can purchase for your YBA250. Contact your Tektronix representative or distributor for ordering information. See page xiii for further information on contacting Tektronix.

Table B‑2: Optional accessories

Part number	Description
012‑1619‑00	Precision cable assembly, 120.0 inches (3.05 meters)
103‑0429‑00	Adapter: Type N Female to Type N Female, 50 ohms, DC‑18 GHz
103‑0430‑00	Adapter: Type N Male to Type N Male, DC‑18 GHz
103‑0431‑00	Adapter: Type 7‑16 Female to Type N Female, DC‑7.5 GHz
103‑0432‑00	Adapter: Type 7‑16 Male to Type N Female, DC‑7.5 GHz
119‑6598‑00	DC Blocks; Type N to Type N, 0.01 TO 12.4 GHz, Audio Interference Suppressors
436‑0416‑00	Shelf, Utility; Magnetic, 11.5 H X 15.0 W X 0.25 D, Safety Controlled
YBAC1	Calibration Kit

For the most current list of accessories, please see the Tektronix website: www.tektronix.com.

Appendix C: Options

Table C-1 lists the configuration option available for the YBA250.

Table C-1: Configuration option

Option	Description
Option 88	Add NetTek Analyzer Platform

Appendix D: Upgrading/Reinstalling Software

To upgrade or reinstall software for your YBA250, you will need a Windows PC. On-screen installation instructions will guide you through connecting to the NetTek Analyzer Platform and upgrading or reinstalling the YBA250 software.

To upgrade or reinstall software for your YBA250:

1. Insert the YBA250 Installation SW CD-ROM (Tektronix part number, 063-3554-XX) into your PC and follow the on-screen instructions that appear.

2. If no instructions appear after you insert the CD-ROM, use Windows Explorer to display the contents of the CD-ROM and double-click the setup.exe file to begin the installation. Follow the on-screen instructions.

3. If you received new software as part of an upgrade kit, place the label supplied in the kit on the bottom edge of your YBA250 module.

Appendix E: Functional Verification Procedure

This appendix provides a functional verification procedure. The procedure verifies the basic functionality of the YBA250. The functional verification procedure can be used for incoming inspection purposes.

NOTE. *The functional verification procedure in this appendix does* not *confirm that the YBA250 meets or exceeds the performance requirements for the specifications listed in Appendix A.*

There are two parts to this procedure:

■ Self Tests: provides instructions for performing the internal diagnostic self-tests.

■ Functional Tests: provides instructions for verifying capabilities not completely covered by the diagnostic self-tests. Requires the use of a signal generator.

Self Tests

Equipment Required

■ None.

Prerequisite

■ None.

To run the internal diagnostics self-tests:

1. Power up the NetTek Analyzer Platform.

2. Press **File>Exit** to quit the YBA250 application, if it is running.

3. Press **Start>Programs>Tektronix Utilities>Diagnostics** in the taskbar.

4. Tap the **+** box next to **All Modules, All Tests** to expand the selection tree.

5. Tap the check box next to **Platform** to deselect the platform diagnostics.

6. Verify that **Module 1: Digital** and **Module 1: Analog** are selected. See Figure E‑1.
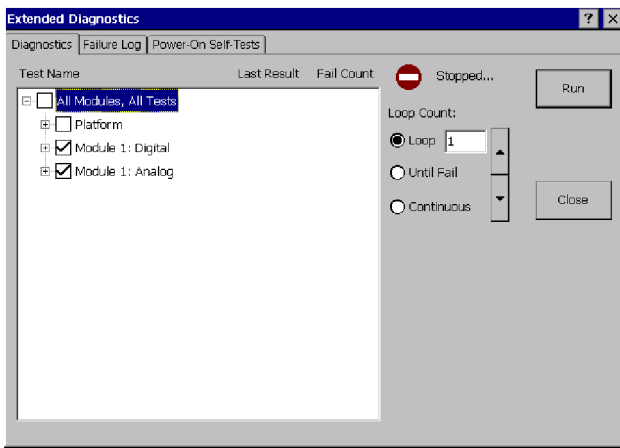
Figure E‑1: Settings to run diagnostics

7. Select **LOOP**, set the loop count to 1.

8. Tap **Run**.

9. Verify that each test executes and passes.

NOTE. *If you encounter any errors, you can tap the Failure Log tab to display more information. If the YBA250 fails any of its diagnostic tests, contact your local Tektronix service representative.*

---

10. Tap **Close** to exit the diagnostic system.

Functional Tests

In the following test, you will perform a User calibration and then measure the return loss of a 50 Ω load from a calibration kit.

Equipment Required

- Calibration Kit (Tektronix YBAC1 or equivalent)

Prerequisite
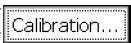
- None

NOTE. These procedures verify only that the YBA250 is operating correctly. They do not verify that the YBA250 meets warranted specifications.

To perform the functional test:

1. Power up the NetTek Analyzer Platform.

2. If necessary, launch the YBA250 application by double-tapping the **YBA250** icon on the desktop or selecting **Start>Programs>NetTek>YBA250** from the Taskbar.

3. Select **Return Loss** from the **Measurement** drop-down list.

4. Tap the Continuous mode button ( ).

5. Allow the NetTek Analyzer Platform to run for five to ten minutes to warm up.

6. In the main display, tap the **Calibration...** button (Calibration...).

   This displays the **Calibration** window. See Figure E–2.
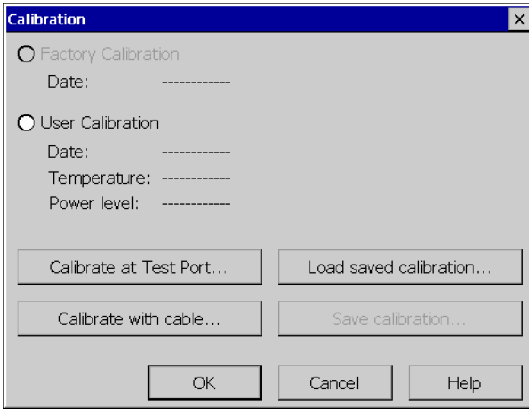
Figure E‑2: Calibration window prior to calibration

7. Tap the **Calibrate at Test Port...** button (Calibrate at Test Port...).
   This displays the **Calibration at Test Port** window. See
   Figure E‑3.
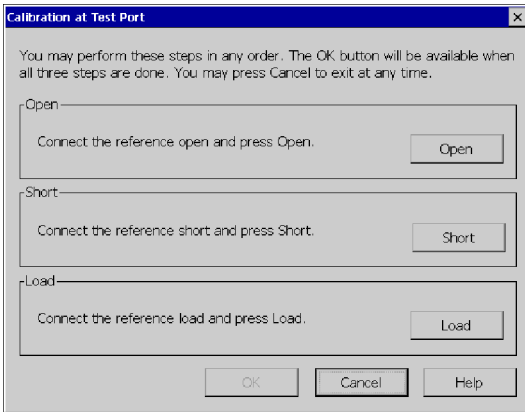
Figure E‑3: Ready to perform calibration

8. Carefully attach the OPEN calibration standard to the RF Input using the procedure described on page 2--24.

You can perform steps 9 through 13 below in any order. Note that the OK button is not selectable until all three steps have been completed. To cancel the calibration, tap **Cancel** at any time.

9. Tap the **Open** button in the Calibration at Test Port window. When the calibration is completed, **Done** appears above the Open button.

10. Carefully replace the OPEN calibration standard with the SHORT calibration standard.

11. Tap the **Short** button in the New Calibration window. When the calibration is completed, **Done** appears above the Short button.

12. Carefully replace the SHORT calibration standard with the LOAD calibration standard.

13. Tap the **Load** button. When the calibration is completed, **Done** appears above the Load button.

14. Carefully remove the LOAD calibration standard from the RF input.

15. Once calibration has been completed for all three standards, tap the **OK** button. The OK button is not selectable until all three calibration standards have been marked as done. See Figure E--4.
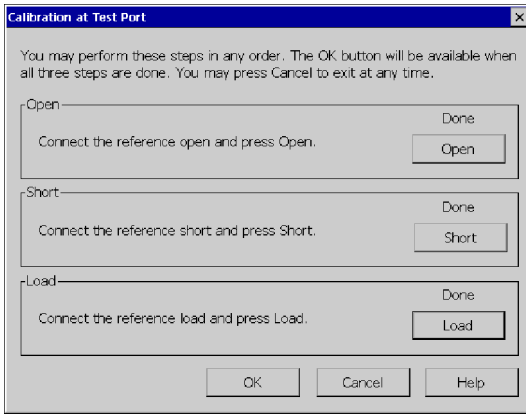
Figure E‑4: Calibration window after calibration is done

16. Tap **OK** to accept the new calibration.

17. Attach the 50 Ω load from the calibration kit to the Test Port.

18. Tap the Impedance button so you can measure return loss.

19. If necessary, tap the Start frequency label and set the start frequency to 25 MHz.

20. If necessary, tap the Stop frequency label and set the stop frequency to 2500 MHz.

21. If necessary, select **View > Markers** to display the marker readout.

22. Verify that the **Min** marker readout is greater than 45 dB.

This completes the Incoming Inspection procedure. If your YBA250 did not complete the procedure without errors, contact your local Tektronix service representative.

Appendix F: Supported Signal Standards

This appendix lists the signal standards on which measurements can be made by the YBA250.

Table F-1: Cellular standards supported

Standard	Channel numbers
US CDMA-Cellular	1≤N≤799
TIA/EIA-95	990≤N≤1023
TIA/EIA-97C	
US CDMA-PCS	1≤N≤1199
TIA/EIA-95	
TIA/EIA-97C	
CDMA Korea-PCS	1≤N≤599
CDMA Japan/ARIB	1≤N≤799
	801≤N≤1039
	1041≤N≤1199
CDMA China-1	0≤N≤1000
	1329≤N≤2047
CDMA China-2	0≤N≤1000 plus 1329≤N≤2047
CDMA2000 Class 0, Korea Cellular	1≤N≤799
	990≤N≤1023
CDMA2000 Class 0, N. A. Cellular	1≤N≤799
	990≤N≤1023
CDMA2000 Class 1, N. A. PCS	0≤N≤1199
CDMA2000 Class 2 (TACS Band)	0≤N≤1000
	1329≤N≤2047

Table F-1: Cellular standards supported (Cont.)

Standard	Channel numbers
CDMA2000 Class 3 (JTACS Band)	$1 \leq N \leq 799$
	$801 \leq N \leq 1039$
	$1041 \leq N \leq 1199$
CDMA2000 Class 4, Korea PCS	$0 \leq N \leq 599$
CDMA2000 Class 5, (NMT-450W 25 kHz)	$1 \leq N \leq 300$
	$539 \leq N \leq 871$
CDMA2000 Class 5, (NMT-450N 20 kHz)	$1039 \leq N \leq 1473$
	$1792 \leq N \leq 2016$
CDMA2000 Class 6, IMT-2000	$0 \leq N \leq 1199$
CDMA2000 Class 7, N. A. 700 MHz Cell Band	$0 \leq N \leq 359$
W-CDMA (UMTS)	$9601 \leq N \leq 9899$
	$10551 \leq N \leq 10849$
NADC IS-136 Cellular	$1 \leq N \leq 799$
	$990 \leq N \leq 1023$
NADC-PCS / IS-136	$1 \leq N \leq 1999$
GSM 900	$0 \leq N \leq 124$
	$975 \leq N \leq 1023$
GSM 1800	$512 \leq N \leq 885$
GSM 1900	$512 \leq N \leq 810$
AMPS / EIA 553	$1 \leq N \leq 799$
	$990 \leq N \leq 1023$
N-AMPS / IS-88	$1 \leq N_M \leq 799$
	$990 \leq N_M \leq 1023$
	$1 \leq N_L \leq 799$
	$990 \leq N_L \leq 1023$

Table F‑1: Cellular standards supported (Cont.)

Standard	Channel numbers
	$1 \leq N_U \leq 799$
	$990 \leq N_U \leq 1023$
TACS	$1 \leq N \leq 1000$
ETACS	$0 \leq N \leq 1000$
	$1329 \leq N \leq 2047$
NTACS	$1 \leq N \leq 799$
	$800 \leq N \leq 1039$
	$1040 \leq N \leq 1199$
JTACS	$0 \leq N \leq 798$ (even chan. only)
	$800 \leq N \leq 1038$ (even chan. only)
	$1040 \leq N \leq 1198$ (even chan. only)
NMT-411-25 kHz	$539 \leq N \leq 871$
NMT-450-25 kHz	$1 \leq N \leq 300$
NMT-450-20 kHz	$1039 \leq N \leq 1473$
NMT-470-20 kHz	$1792 \leq N \leq 2016$
NMT-900	$1 \leq N \leq 1000$
NMT-900 (offset)	$1025 \leq N \leq 2023$
MATS-E	$1 \leq N \leq 1000$
C-450 (SA)	$1 \leq N \leq 247$
C-450 (P)	$1 \leq N \leq 800$
1xEVDO-10 SMR 800 Band	$0 \leq N \leq 919$

Table F-1: Cellular standards supported (Cont.)

Standard	Channel numbers
CDMA2000 1xEVDO Class 0 NA Cellular	1≤N≤799
	990≤N≤1023
CDMA2000 1xEVDO Class 0 Korea	1≤N≤799
	990≤N≤1023
CDMA2000 1xEVDO Class 1 N.A. PCS	0≤N≤1199
CDMA2000 1xEVDO Class 2 TACS Band	0≤N≤1000
	1329≤N≤2047
CDMA2000 1xEVDO Class 3 JTACS Band	1≤N≤799
	801≤N≤1039
	1041≤N≤1199
	1201≤N≤1600
CDMA2000 1xEVDO Class 4 Korea PCS	0≤N≤599
CDMA2000 1xEVDO Class 5 NMT-25k-450	1≤N≤300
	539≤N≤871
CDMA2000 1xEVDO Class 5 NMT-20k-450	1039≤N≤1473
	1792≤N≤2016
CDMA2000 1xEVDO Class 6 IMT-2000	0≤N≤1199
CDMA2000 1xEVDO Class 7 N.A. 700 MHz Cellular	0≤N≤359
CDMA2000 1xEVDO Class 8 GSM Band	0≤N≤1499
CDMA2000 1xEVDO Class 9 GSM Band	0≤N≤699

Glossary

Glossary

BMP - Graphics File Format. BMP is one of the file formats available for saving screen captures. BMP is the standard Windows graphic image format. The filename extension is "bmp".

BTS. Acronym for Base Transceiver Station.

Cable Loss. As a signal travels down a cable, some of its energy is lost due to losses in the conductors and dielectrics. This reduction in signal level is called cable loss. Cable loss is specified in decibels per distance at a specified frequency. For example, the cable loss for RG58 cable is 0.558 dB/1 m @ 1,000 MHz.

Flash Memory. Flash memory is a form of non-volatile memory. When the YBT250 software is stored in flash memory, the YBT250 loads more quickly at power on.

Forward Frequency. The frequency the base station uses to transmit to the mobile unit. Also called Downlink Frequency.

JPEG - Graphics File Format. JPEG, an acronym for Joint Photographic Experts Group, is one of the file formats available for saving screen captures. Files saved in JPEG format can be much smaller in size than files saved in BMP format. The filename extension is "jpg".

PNG - Graphics File Format. PNG, an acronym for Portable Network Graphics, is one of the file formats available for saving screen captures. PNG is a new format developed primarily for use on the World Wide Web. PNG files are usually much smaller than BMP files. The filename extension is "png".

Reference Level. The power level at the top of the display.

Return Loss. Return Loss is a ratio of the power sent to the antenna versus the power reflected by the antenna. A larger Return Loss is better because less power is reflected.

Reverse Frequency. The frequency the mobile unit uses to transmit to the base station. Also called uplink frequency, reverse channel or uplink channel.

Span. The frequency range covered by the display graph.

Velocity of Propagation. The Velocity of Propagation is the velocity at which a signal travels through the cable. Velocity of propagation is expressed as a fraction of the speed of light. A Velocity of Propagation equal to 1 means the signal is traveling down the cable at the speed of light. A Velocity of Propagation equal to 0.5 means the signal is traveling down the cable at half the speed of light.

VSWR. VSWR (Voltage Standing Wave Ratio) is a measure of the ratio of the maximum resultant voltage to the minimum resultant voltage along a transmission line. It represents the amount of impedance mismatch between the transmission line and the load. For VSWR, the lower the number, the better. The best possible VSWR is 1.0, which means the impedance of a transmission line and its load match perfectly.

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