

User Manual

Tektronix

**NetTek[®] YBT250
Field Transmitter &
Interference Tester**

071-0856-12

This document supports firmware version 1.5xx
and above.

www.tektronix.com

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General Safety Summary

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

Only qualified personnel should perform service procedures.

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

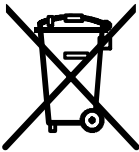
Environmental Considerations

This section provides information about the environmental impact of the product.

Product End-of-Life Handling

Observe the following guidelines when recycling an instrument or component:

Equipment Recycling. Production of this equipment required the extraction and use of natural resources. The equipment may contain substances that could be harmful to the environment or human health if improperly handled at the product's end of life. In order to avoid release of such substances into the environment and to reduce the use of natural resources, we encourage you to recycle this product in an appropriate system that will ensure that most of the materials are reused or recycled appropriately.



The symbol shown to the left indicates that this product complies with the European Union's requirements according to Directive 2002/96/EC on waste electrical and electronic equipment (WEEE). For information about recycling options, check the Support/Service section of the Tektronix Web site (www.tektronix.com).

Battery Recycling. This product may contain a lithium ion (Li-ion) rechargeable battery, which must be recycled or disposed of properly. Please properly dispose of or recycle the battery according to local government regulations.

Transporting Batteries

The lithium ion rechargeable battery pack in this product contains less than 8 grams of equivalent lithium content, with individual cells containing less than 1.5 grams of equivalent lithium, as measured by International Civil Aviation Organization (ICAO) standards. Consult your air carrier for applicability and determination of any special lithium ion battery transportation requirements.

Restriction of Hazardous Substances

This product has been classified as Monitoring and Control equipment, and is outside the scope of the 2002/95/EC RoHS Directive. This product is known to contain lead, cadmium, mercury, and hexavalent chromium.

Preface

The NetTek[®] YBT250 Field Transmitter & Interference Tester is part of the NetTek Base Transceiver Station (BTS) Field Tool family: a high performance, portable, field-ready tester optimized for fast trouble resolution and easy BTS 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 YBT250 verifies the most important RF transmit functions of cdmaOne/cdma2000/1xEV-DO, TDMA IS-136, GSM/EDGE, W-CDMA (UMTS), and Analog base stations. The YBT250 Field Transmitter & Interference Tester has powerful analysis tools to enable you to locate and identify interfering signals quickly. With its built-in spectrum analysis display, the YBT250 enables you to easily see signal problems. The spectrogram display makes it easier than ever to spot intermittent signal problems.

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 YBT250 Field Transmitter & Interference Tester.

The *Operating Basics* section shows you how to operate the YBT250.

The *Reference* section explains how to perform specific tests with the YBT250.

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

Additional Information

The YBT250 Field Transmitter & Interference Tester contains online help to enable you to quickly get explanations of how to use your YBT250. The online help is the first place you should look for information about operating the YBT250.

Important information about configuring and operating the NetTek Analyzer Platform is contained in the *Getting Started* section of this manual.

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 YBT250 Field Transmitter & Interference Testers running software version 1.5xx and greater. To verify your software version, select **Tools > Software Info** when the YBT250 is running.



Getting Started

Getting Started

This section describes the Y400 NetTek Analyzer Platform, on which the NetTek YBT250 operates.

The NetTek Analyzer Platform

Figure 1-1 shows the NetTek Analyzer Platform layout. Figure 1-2 shows the front-panel controls and indicators. Figure 1-3 shows the input and output ports.

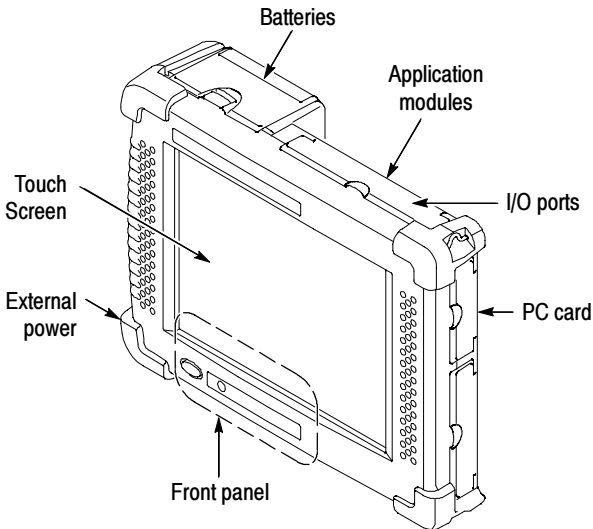


Figure 1-1: NetTek Analyzer Layout



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 because they will damage the display surface.

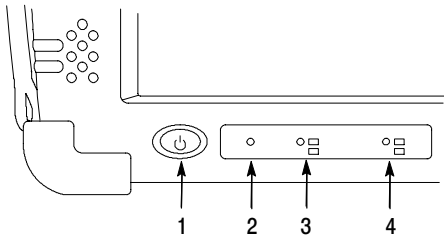


Figure 1-2: Front Panel Controls

- 1. Power/Suspend Switch.** Push on; push off. See pages 1-11 and 1-12 for additional information.
- 2. Reset Switch.** Push to perform a hardware reset if a lock-up occurs. All programs and data loaded into volatile memory since power on are lost.
- 3. Status Indicator.** Green indicates that the instrument is powered on. Amber indicates that the instrument is powered on but the display is turned off (for power conservation).
- 4. Batteries Indicator.** Green indicates that the instrument is connected to an external power source (and charging any installed batteries). Red indicates a low battery.

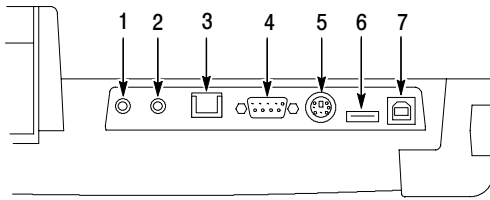


Figure 1-3: I/O ports (Y400 NetTek Analyzer Platform)

1. Microphone input
2. Headphone jack
3. Ethernet connector (RJ-45)
4. Serial port (RS-232)
5. PS/2 keyboard connector
6. USB Host connector
7. USB Slave connector

Installing and Removing a Module

If you purchased the YBT250 Application Module as a separate item, you must install the module on a NetTek Analyzer platform before you can take measurements. Refer to Figures 1-4 and 1-5 to install or remove an application module.



CAUTION. To prevent damage to the NetTek Analyzer Platform or an application module, you must power down the NetTek Analyzer Platform and remove all cables or connectors before installing any application module.

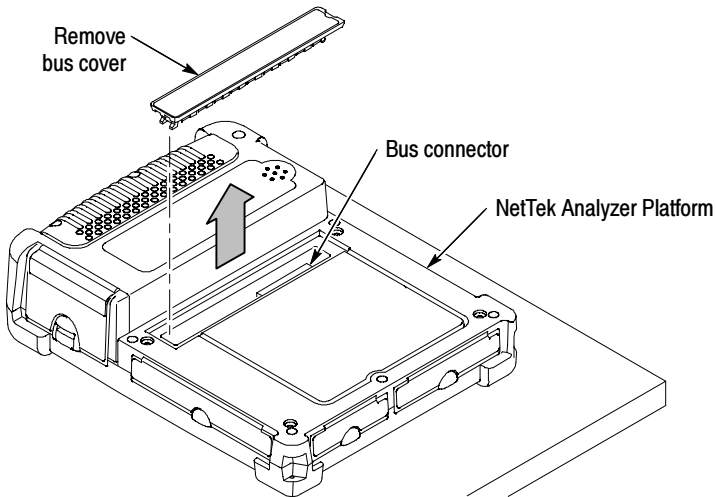


Figure 1-4: Removing the bus cover

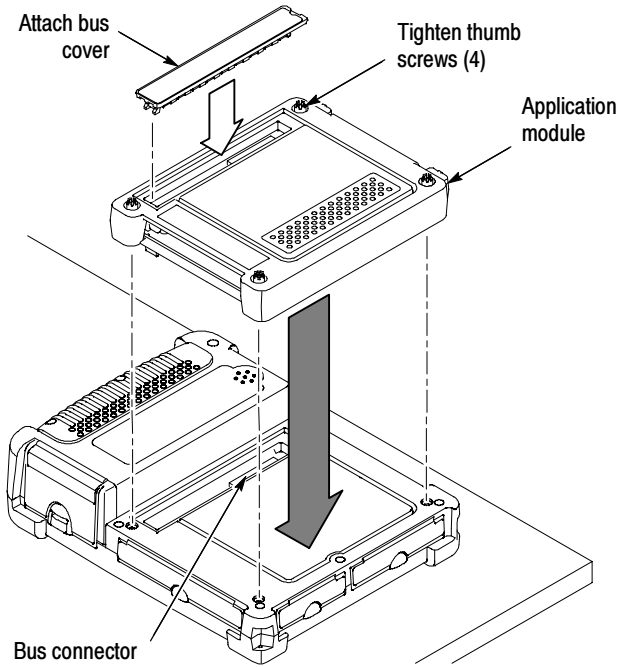


Figure 1-5: Attaching a module

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

To install additional modules (up to three), remove the bus cover from the installed module and install the additional module on top of the previously-installed module, as shown in the above figures.

To maintain the module or instrument seal integrity, reinstall the bus cover onto the outermost module, or onto the NetTek Analyzer when no module is installed.

Connecting External Power Supplies

To power the NetTek Analyzer Platform from AC mains or DC vehicle voltage, or recharge installed batteries, connect the Desktop Power Supply or the In-Vehicle Adapter to the NetTek Analyzer Platform as shown in Figure 1-6. The Desktop Power Supply operates from 100 VAC to 240 VAC mains.

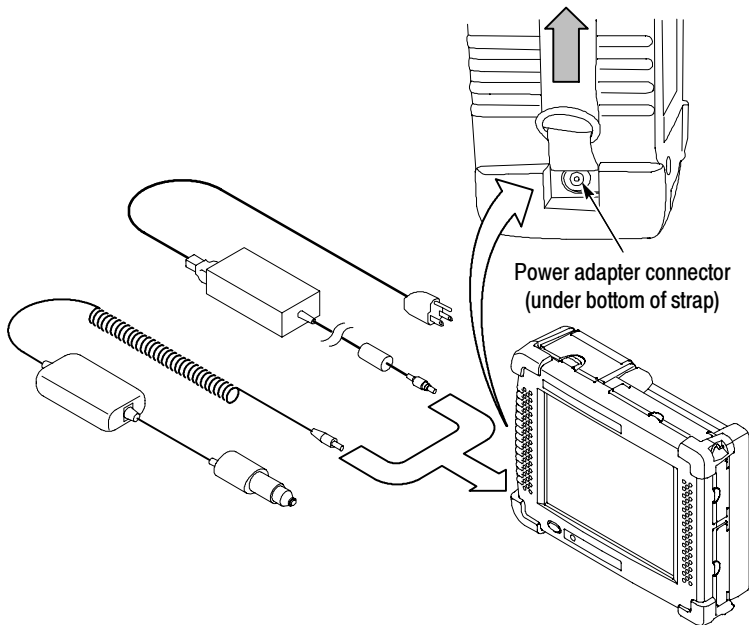


Figure 1-6: External power supplies

Batteries

Installing or Removing a Battery

The NetTek Analyzer Platform comes standard with a single battery, which is not installed when the instrument is shipped. Refer to Figures 1-7 through 1-9 for battery installation or removal steps.

NOTE. Disconnect power supply cables from the NetTek Analyzer Platform before installing or removing batteries.

New batteries, or batteries that have not been used for an extended period, must be charged before using them to power the instrument. Refer to Charging a Battery on page 1-9 for more information.

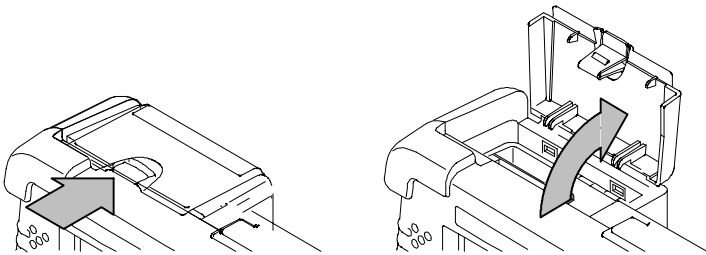


Figure 1-7: Opening the battery compartment

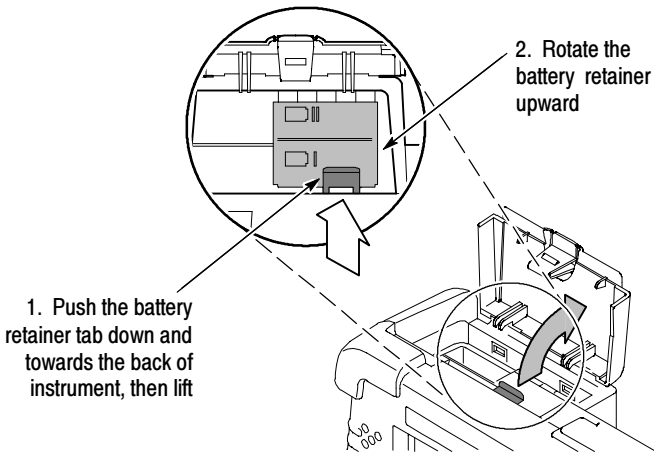


Figure 1-8: Opening the battery retainer

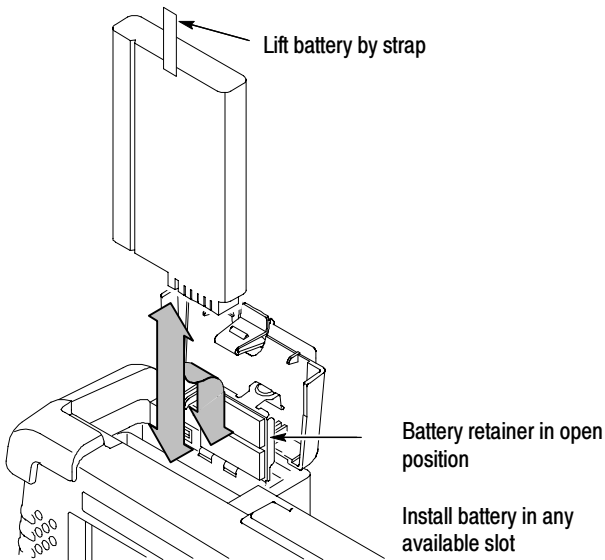


Figure 1-9: Installing/removing a battery

NOTE. *The battery electrical contacts, on the bottom of the battery, must face in the direction shown in Figure 1-9.*

Close and latch the battery retainer and battery compartment door after installing or removing batteries.

Install the battery in either slot. 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 contact your Tektronix Service Center for the correct part number.

Charging a Battery

To charge batteries, connect the instrument to an external power supply (see Figure 1-6 on page 1-6) and let the battery or batteries recharge in the instrument. Table 1-1 lists the approximate charge times for fully-discharged batteries. You can also charge batteries in the optional external battery charger.

Table 1-1: Approximate battery charge times

Number of batteries in instrument	Instrument powered on	Instrument powered off
1	8 hours	3 hours
2	16 hours	6 hours

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

Batteries are partially charged and calibrated at the factory. A calibrated battery allows the NetTek Analyzer Platform to more accurately estimate how much longer application modules can operate before the instrument automatically powers off. The NetTek Analyzer Platform always warns you before it powers off, so that you can save important test results or settings.

To verify the status of your batteries at any time:

1. Select **Start > Settings > Control Panel**.
2. Double-tap the **Power Management** icon. The Batteries tab lists the status of each battery.

If the battery charge is low, connect the NetTek Analyzer Platform to an external power source and let the battery or batteries recharge in the instrument for eight hours. For more information, select **Start > Help > Settings > Power Management > Charging Batteries**.

Maximizing Battery Operating Time

For tips on how to maximize battery operating time, select **Start > Help > Settings > Power Management > Optimizing Battery Life**.

Transporting Lithium-Ion Batteries

Regulations regarding transportation of lithium-ion batteries on passenger aircraft may subject this product to special handling restrictions. Consult your air carrier for applicability and determination of any special lithium-ion battery transportation requirements.

Each NetTek Analyzer Platform lithium-ion battery pack contains less than 8 grams of lithium, with individual cells each containing less than 1.5 grams of lithium, as measured by International Civil Aviation Organization (ICAO) standards.

Battery Recycling

The NetTek Analyzer Platform uses replaceable Lithium Ion batteries, which must be recycled or disposed of properly at the end of product life. There may be specific legal requirements in your community for battery collection and disposal. Contact your local electronics recycler, relevant legal authority, or your Tektronix representative for assistance in recycling batteries.

Powering On the Instrument

To power on the NetTek Analyzer Platform, press the large blue oval front-panel switch in the lower-left corner. The green status indicator to the right of the switch lights and the system begins its power-on process. The touch-screen display and human interface are described in the *Operating Basics* section.

How the Software Loads

When you press the power switch on the front panel, the NetTek Analyzer Platform powers on and runs its startup diagnostics (if enabled). Once the NetTek Analyzer Platform has completed its power-on sequence, installed application module 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 application module software loads into volatile memory (this happens only with user-installed modules; if your application module was purchased already installed on a NetTek Analyzer Platform the software was loaded into flash memory at the factory).

Loading the software into flash memory reduces the application module software power-on time. 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.

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 tap rate

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 to set the tap rate.
4. Double-tap the checkerboard grid 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 NetTek Analyzer Platform has separate, but related, standby and power off functions.

Suspend Mode

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

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

- Press the front-panel power switch.
- Select **Start > Programs > Shutdown**. In the Shut Down dialog box, select **Suspend**.

To cancel Suspend mode and wake up the NetTek Analyzer Platform, press the front-panel power switch. The instrument returns to the state that existed before suspend mode was invoked.

Shutdown Mode

To completely power down the NetTek Analyzer Platform, do the following:

1. Select **Start > Programs > Shutdown**.
2. In the Shut Down dialog box, select **Shutdown**.

A shutdown clears volatile memory, including the module 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:

1. Select **Start > Help**.
2. In the Help window select **Tektronix Basics**.
3. Select **Store Data in Nonvolatile Memory**.

The next time you press the front-panel power switch, the NetTek Analyzer Platform cycles through the complete power up process, taking about 30 seconds to completely power up.

Restart (Software Reset)

If the NetTek Analyzer Platform or module application stops responding correctly, try performing a restart to clear the problem.

To restart the module software, do the following:

1. Select **Start > Programs > Shutdown**.
2. In the Shut Down dialog box, select **Restart**.

The display blanks for approximately five seconds. The module software reloads and restarts. A restart does not empty volatile memory.

Front-Panel Power Switch

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

- If the NetTek Analyzer Platform is shut down: powers on the instrument.
- If the NetTek Analyzer Platform is operating: initiates Suspend mode.
- If the NetTek Analyzer Platform is in Suspend mode: cancels Suspend mode and activates the module software.
- 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.

Attaching Accessories

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.

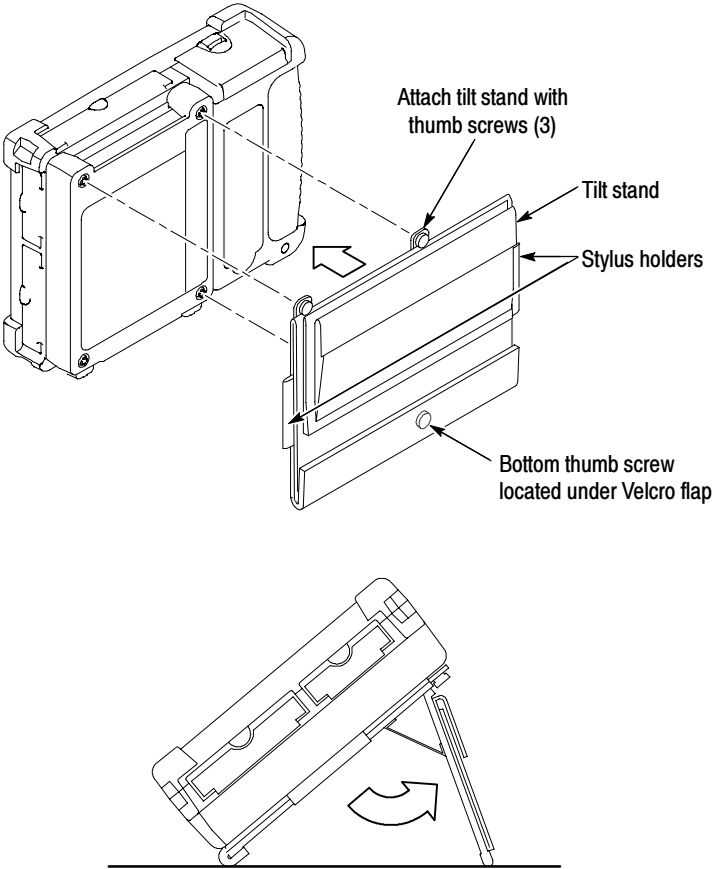


Figure 1-10: NetTek Analyzer Platform tilt stand

To install the tilt stand with two or more instrument modules attached, use the provided storage spacers as shown in Figure 1-11. You can store cables and other accessories (such as the NetTek YBGPS1 GPS Timing Reference receiver) in the spacer compartment. Each additional module installed requires a module storage spacer, which can be stacked on top of each other.

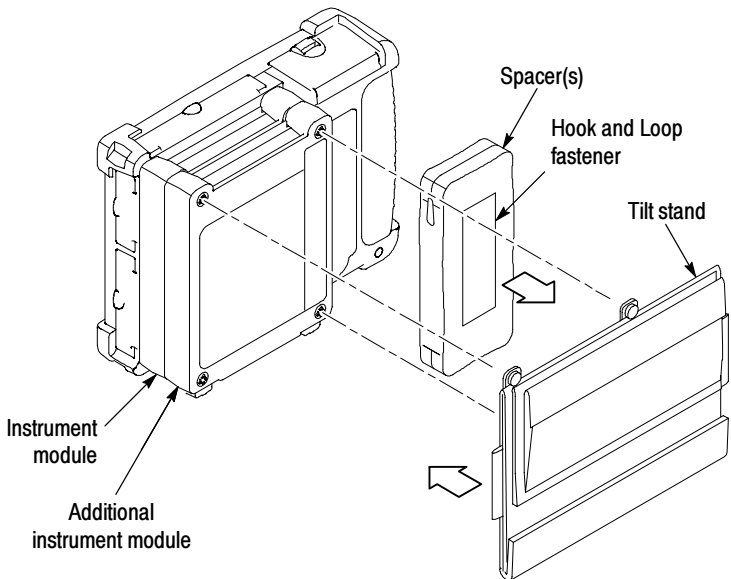


Figure 1-11: Installing the tilt stand on multiple instrument modules

Installing the Shoulder Strap and Strand Hook

Use the shoulder strap to carry the NetTek Analyzer Platform to the job site. Install the strap on the instrument as shown in Figure 1-12. You can also install the strap on the soft case.

Use the Strand hook to hang the instrument from a wire strand, ladder, or other support. Install the strand hook as shown in Figure 1-12.



CAUTION. *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 instrument from any support.*

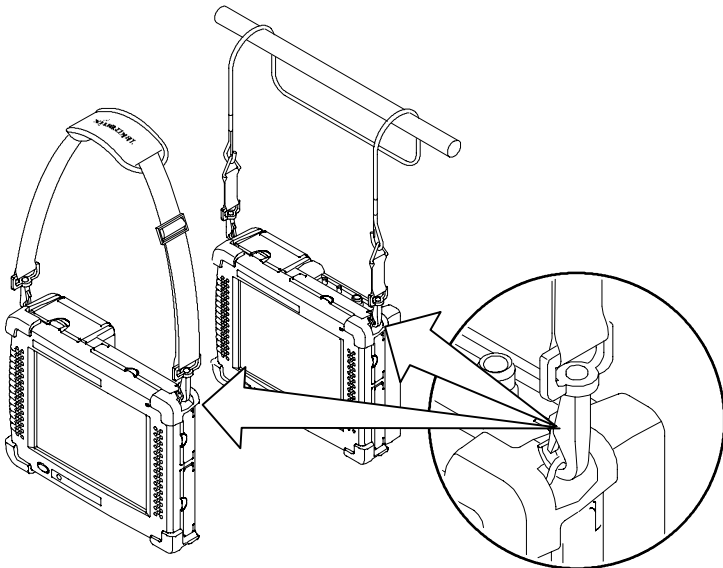


Figure 1-12: NetTek Analyzer Platform shoulder strap and strand hook



Operating Basics

Operating Basics

This section explains the essential things you need to know to operate the YBT250 Field Transmitter & Interference Tester.

Overview

The YBT250 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 YBT250 Field Transmitter & Interference Tester, 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. Each NetTek Series instrument provides the circuitry and the software necessary for signal measurement and analysis.

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.*

Getting Help

To open the Help window and obtain general information on YBT250 topics, tap **Start > Help** and select **YBT250**.





There are three ways to display Help when you are running the YBT250 software:

- Tap the  icon in the upper-right corner of the YBT250 display. This displays the top level of the YBT250 help.
- Tap underlined text on the screen. This displays the Help topic for that item.
- Display Help from some dialog boxes by tapping the **Help** button in the bottom-right corner of the dialog box.

The Help Window

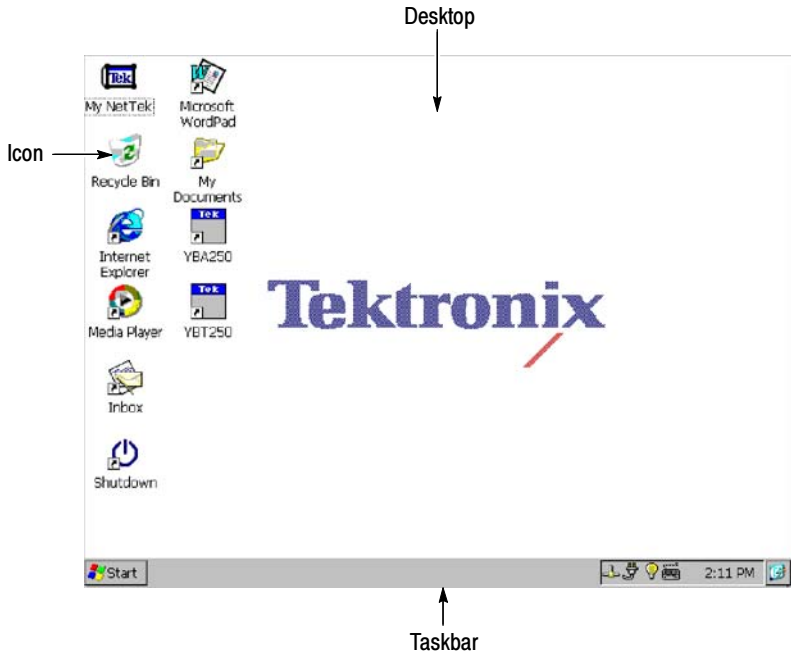
Table 2-1 describes the primary Help window buttons.

Table 2-1: Help window buttons

Tap this button	To
 All Topics	Displays the main table of contents.
 Back	Returns to the previous help screen.
 Contents	Displays the current program or local table of contents.
	Toggles between full-screen and a smaller help text 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.

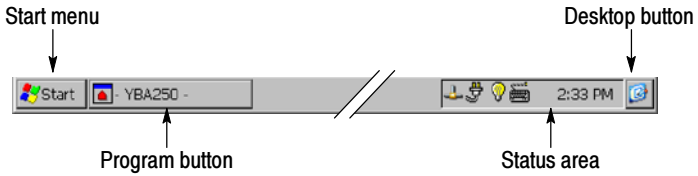


Icons

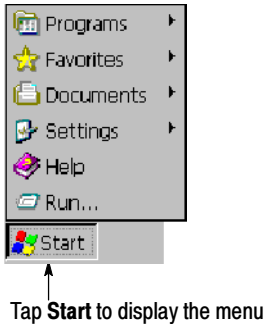
Double-tap desktop icons to open folders or to start programs.

Taskbar

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



Start Menu. 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.










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.
	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 YBT250 Software

If you purchased your YBT250 installed on NetTek Analyzer Platform, it comes from the factory set to automatically start the YBT250 software when you power on the NetTek Analyzer Platform.

If you added your YBT250 module to a NetTek Analyzer Platform you already own, see page 2-7 for instructions on how to start the YBT250 software or set the software to load at startup.

To start the YBT250 software:

- Double-tap the YBT250 icon on the desktop or select **Start > Programs > NetTek > YBT250**

When the YBT250 software starts for the first time, it displays the Spectrum display, as shown in Figure 2-1. Subsequent starts display the screen that was active prior to instrument power off.

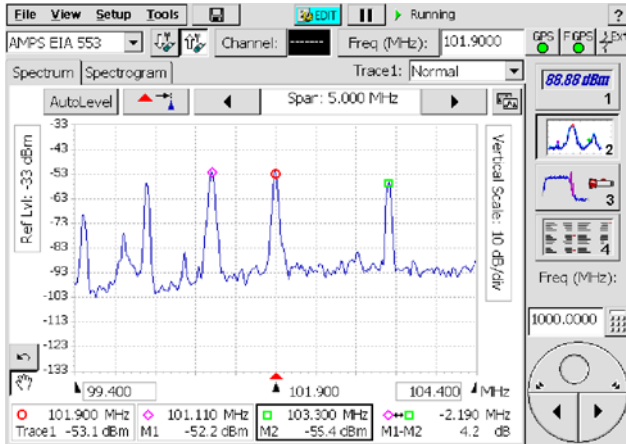


Figure 2- 1: The Spectrum display

Setting the YBT250 Software to Load at Startup

If you purchased your YBT250 as a module to use on an existing NetTek Analyzer Platform, you can set the YBT250 to load at startup.

To set the YBT250 as the startup application:

1. Select **Start > Programs > Tektronix Utilities > System Configuration**.
2. On the Software tab, select the StartUp checkbox for the YBT250. See Figure 2-2.
3. Close the System Configuration window.

The next time the NetTek Analyzer Platform is powered on, the YBT250 software starts up automatically.

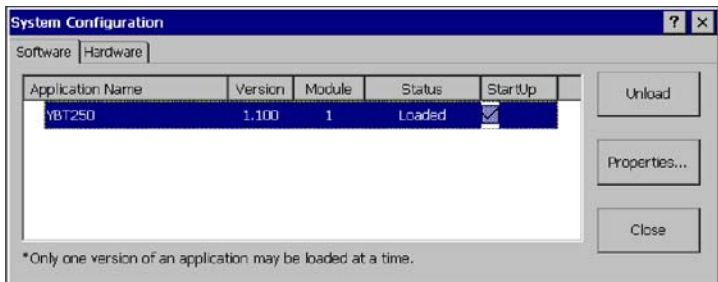


Figure 2-2: Setting the StartUp Application

Elements of the Display

Figure 2-3 shows the four key areas of the YBT250 Field Transmitter & Interference Tester display.

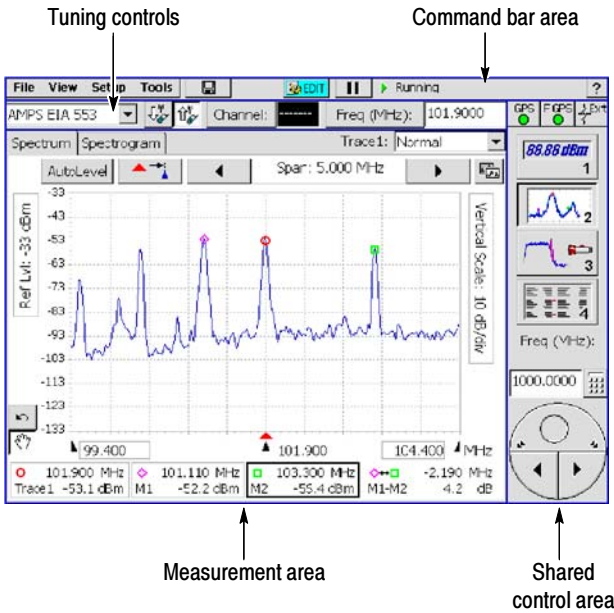


Figure 2-3: YBT250 display elements

- **Tuning Controls Area:** This area contains the controls used to specify the signal standard and measurement frequency. See page 2-11.
- **Command Bar Area:** This area contains the menu bar and some instrument control buttons. See page 2-10.

- **Shared Control Area:** This area contains GPS and reference frequency status buttons, the instrument measurement function buttons, and the control knob and associated fields. See page 2-9.
- **Measurement Area:** This area contains the measurement results and waveform displays. The appearance of this area changes depending on the selected instrument function and measurement type. See page 2-12.

Shared Control Area

Table 2-3 describes the Shared Control Area elements.

Table 2-3: Shared control area elements






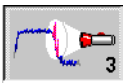

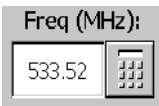


Button	Function
	<p>Indicates the overall GPS signal quality. Tapping this button opens the GPS tab for selecting GPS receiver type and other GPS-related settings.</p>
	<p>Shows the measurement frequency reference source: the internal instrument frequency reference, an external reference, or a GPS-derived timing reference from the YBGPS1 GPS Timing Reference. Tapping this button opens the Inputs tab.</p>
	<p>Shows the external attenuator or amplifier status. Tapping this button opens the Inputs tab where you can set signal amplification or attenuation values..</p>
	<p>Displays the Measure window (only if RF Measurement or Demodulation Option is installed). See page 3-67 for descriptions of Measure display buttons and icons.</p>
	<p>Displays the Spectrum window. See page 3-2 for descriptions of Spectrum display buttons and icons.</p>

Table 2-3: Shared control area elements (Cont.)

Button	Function
	Displays the Interference window if the appropriate options are installed. See page 3-34 for descriptions of Interference display buttons and icons.
	Displays the measurement Sequencer window. This window provides a way to display multiple measurement results in a single window.
	This area shows the control assigned to the knob and the value of that control.
	The Keypad button enables you to enter numbers using an on-screen numeric keypad.
	The Knob is used to change the value of the assigned control.

Command Bar Area

Table 2-4 describes the Command Bar elements.

Table 2-4: Command bar area elements










Button/Icon	Function
	The application menus.
	Saves measurement results to a file.
	Displays the Setup window, which lets you set measurement-related parameters.

Table 2-4: Command bar area elements (Cont.)

Button/Icon	Function
	Displays the Open dialog box, which enables you to select a saved setup to load. Replaces the Edit button when Hide Setup Controls is selected.
	Toggles between running and pausing (stopping) measurements.
	Shows that the YBT250 is stopped. The Timestamp Readout appears when measurements are stopped.
	Shows that the YBT250 is acquiring measurements.
	Shown when displaying recalled data.
	Opens the instrument Online Help.

Tuning Control Area

Table 2-5 describes the Tuning Control Area elements (left to right).

Table 2-5: Tuning control area elements





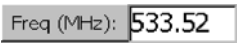
Button	Function
	This drop-down list selects the signal standard and channel table.
	This button changes the <i>Freq</i> (MHz) setting to the forward link (downlink) frequency for the selected channel, or, in the case of W-CDMA, selects the corresponding forward channel.
	This button changes the <i>Freq</i> (MHz) setting to the reverse link (uplink) frequency for the selected channel, or, in the case of W-CDMA, selects the corresponding reverse channel.

Table 2-5: Tuning control area elements (Cont.)

Button	Function
	This button is used to set the Channel number. The frequency will be set to the appropriate value for the selected channel. Tap the button to use the numeric keypad; tap the box to use the knob.
	This button is used to set the Measurement Frequency. Tap the button to use the numeric keypad; tap the box to use the knob.

Measurement Area

Icons and buttons in the Measurement Area change depending on the function selected by the Shared Control buttons:

- For descriptions of Measure display buttons and icons, see page 3-67.
- For descriptions of Spectrum display buttons and icons, see page 3-2.
- For descriptions of Interference display buttons and icons, see page 3-34.

Using the Touch Screen

To select items on the display, just touch them. For example, to display a signal spectrum, simply touch the Spectrum button at the middle right of the display (labeled with a 2).

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 left or right 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.

YBT250 Menus

The YBT250 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 commands have keyboard shortcuts.

There are three menu commands in the File menu that change depending on the displayed window. The commands are Save Trace/Results, Save Trace/Results As, and Export Trace/Results. Save Trace, Save Trace As and Export Trace commands appear when the Spectrum and Interference windows are displayed (that is, when a signal spectrum is displayed). Save Results, Save Results As and Export Results commands appear when the Measure window is displayed (that is, when measurements are displayed). See Tables 2-6 and 2-7.

Table 2-6: The File menu (Measure window)

Menu item	Control key	Description
<u>O</u> pen	Ctrl + O	Displays Open Results dialog.
<u>S</u> ave Results	Ctrl + S	Save measurement results to a file. The file is automatically named and stored in \BuiltInDisk\YBT250\App-Data\Results.
Save Results <u>A</u> s	---	Save measurement results to a file; displays Save dialog so you can name the file and specify where it is saved.
Compare Saved	---	Display two saved results for visual comparison. (Disabled)
<u>E</u> xport Results As	---	Save measurement results in a file format that can be used by word processing or spreadsheet applications.
Export <u>S</u> creen As	---	Store an image of the display that can be used by word processing or image editing applications.
<u>P</u> rint	Ctrl + P	Prints the displayed window's data.
<u>R</u> esults Properties	---	Displays a dialog that shows information saved with a results file.
<u>E</u> xit	---	Quits the YBT250 program.

Table 2-7: The File menu (Spectrum/Interference windows)

Menu item	Control key	Description
<u>O</u> pen	Ctrl + O	Displays Open Results dialog
<u>S</u> ave Trace	Ctrl + S	Saves a Trace to a file. The file is automatically named and stored in \BuiltInDisk\YBT250\AppData\Results.
Save Trace <u>A</u> s	---	Store Trace in a file; displays Save dialog to enable you to name the file and specify where it is saved.
Compare Saved	---	Display two saved results for visual comparison.
<u>E</u> xport Trace As	---	Store Trace in a file format that can be used by word processing or spreadsheet applications.
Export <u>S</u> creen As	---	Store an image of the display that can be used by word processing or image editing applications.
<u>P</u> rint	Ctrl + P	Prints the displayed window's data.
<u>R</u> esults Properties	---	Displays a dialog that shows information saved with a results file.
<u>E</u> xit	---	Quits the YBT250 program.

Table 2-8 describes the View menu elements.

Table 2-8: The View menu

Menu item	Control key	Description
<u>T</u> race 2	---	Displays/Hides second trace.
<u>R</u> otate Trace Order	---	Changes the order of traces in the graph (front versus back).
<u>D</u> efine Trace 2	---	Displays the Trace 2 & Mask tab of the Setup window, enabling you to specify the source of Trace 2.
<u>M</u> ask	---	Enables Mask Testing.
Define <u>M</u> ask	---	Displays the Trace 2 & Mask 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.
<u>M</u> arkers	Ctrl + M	Displays/Hides marker controls and readouts.
Band Edge <u>C</u> ursor	---	Displays/Hides band edge cursors.
M1 Trace 1, M2 Trace 2		Places marker M1 on Trace 1, and places marker M2 on Trace 2 (only with Trace 2 enabled).
Both on front trace		Places both markers on the front trace (only with Trace 2 enabled).
Both on Trace 1		Places both markers on Trace 1 (only with Trace 2 enabled).
Both on Trace 2		Places both markers on Trace 2 (only with Trace 2 enabled).

Table 2-9 describes the elements of the Setup menu.

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.
<u>S</u> ave...	---	Saves current setup to a file.
<u>P</u> reset	Ctrl + A	Recalls defaults except for Signal Standard, Channel and Frequency; sets the span to cover the selected Signal Standards frequency range.
<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 describes the elements of the Tools menu.

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.
<u>M</u> ask Maker	---	Displays the Mask Maker utility.
<u>F</u> requency Correction	---	Displays the utility for improving frequency measurement accuracy.
<u>F</u> actory Reset	---	Resets all YBT250 settings to original factory values; overwrites existing settings.

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

Menu item	Control key	Description
<u>U</u> grade Software	---	Displays the utility for enabling software options or installing a new version of the YBT250 application.
T <u>e</u> chnical Support	---	Displays technical support contact information.
<u>S</u> oftware Info	---	Displays the SW Properties window which lists, among other things, the installed options, Options key, and software version.
<u>H</u> ardware Info	---	Displays the HW Properties window which lists, among other things, serial number, hardware versions, and Global ID.

Entering Text

The Input Panel soft keyboard lets you type characters into text boxes or address fields without using an external keyboard.

To display and use the soft keyboard, tap the  icon in the toolbar status area. Figure 2-4 shows the default keyboard.

Input Panel															
Esc	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	Home	End	Prop
`	1	2	3	4	5	6	7	8	9	0	-	=	BS		
Tab	q	w	e	r	t	y	u	i	o	p	[]	\		
Caps Lock	a	s	d	f	g	h	j	k	l	;	'		return		
Shift	z	x	c	v	b	n	m	,	.	/	up		pgup		
Ctrl	win	Alt						ins	del	lt	dn	rt	pgdn		

Figure 2-4: The Soft Keyboard

To set soft keyboard properties, or switch between a large keyboard (default) and a smaller keyboard, select **Start > Settings > Control Panel**. Open the Input Panel icon, and then select **Options**.

Connecting a Signal

This section explains how to connect an RF signal, a timing reference and a frequency reference to the YBT250 Field Transmitter & Interference Tester.

YBT250 Inputs

Figure 2-5 identifies the YBT250 Field Transmitter & Interference Tester inputs.

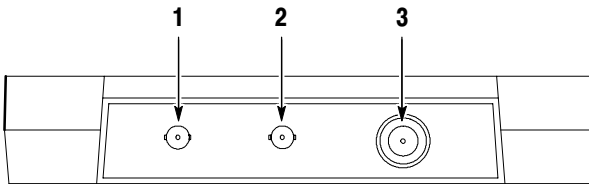


Figure 2-5: YBT250 inputs.

1. The Timing Input connects to an external timing reference signal, such as a BTS Even Second Clock signal, or the timing signal from a Tektronix YBGPS1 GPS Timing Reference.
2. The Frequency Reference Input
3. The RF Input connects to the RF signal source or measurement antenna.

RF Signal Input

The RF input characteristics are:

- The input impedance is 50 Ω .
- The input frequency range is from 30 MHz to 2500 MHz.
- The maximum continuous input power is 1 W.



CAUTION. *To prevent damage to the YBT250, continuous input signals should not exceed 1 Watt. If a signal between 1 Watt and 50 Watts is connected to the RF INPUT, the input protection circuitry displays a warning and halts operation until the input overload is corrected. Input signals over 50 Watts will damage the input circuitry.*

The input signal-level requirements for measurement accuracy depend on the selected measurement and the installed options. See Appendix A (*Specifications*) for the appropriate input signal levels for specific combinations of measurements and installed options.

To measure a signal with very high or very low power levels, you may need to connect an external attenuator or amplifier. See *Connecting an RF Signal* (below) for instructions on using an external attenuator or amplifier with the YBT250 to set appropriate signal input levels.

Connecting an RF Signal

Connect a signal from a base station transmitter test port to the YBT250 RF INPUT connector.

If there is no test port, do the following:

1. Disconnect the transmitter cable from the antenna.
2. If the transmitter output signal level is too high (refer to the specifications in Appendix A), connect the transmitter output signal to an attenuator, and then connect the output of the attenuator to the RF Input connector.



CAUTION. To prevent damage to the YBT250, continuous input signals should not exceed 1 Watt. If a signal between 1 Watt and 50 Watts is connected to the input, the input protection circuitry displays a warning and halts operation until the input overload is corrected. Input signals over 50 Watts will damage the input circuitry.

3. If the transmitter output signal level is too low (see the specifications in Appendix A), connect the transmitter output signal to an external amplifier, and then connect the output of the amplifier to the RF Input connector.
4. If you use an external attenuator or amplifier on the input signal, you need to set the YBT250 to adjust the readouts and displays to account for the use of an attenuator or amplifier.
 - a. Tap the **RF Input Signal** status button (see Figure 2-6) to display the **Inputs** tab (see Figure 2-7).

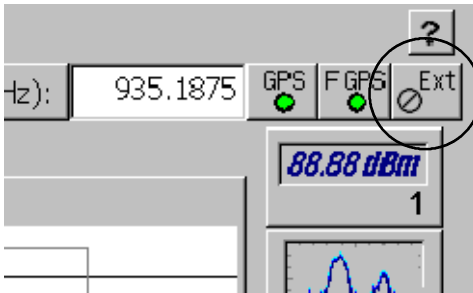


Figure 2-6: Location of RF Input Signal status button

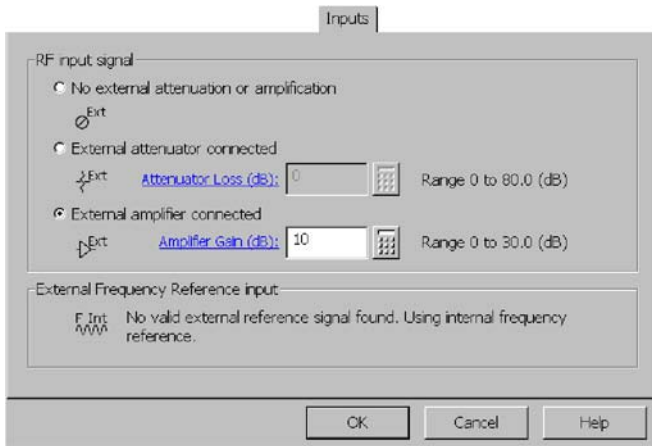


Figure 2-7: Changing RF input settings

- b. If you are not using external attenuation or amplification, verify that the **No external attenuation or amplification** setting is selected.
- c. If you are using an external attenuator, select **External attenuator connected**. Tap the numeric keypad and enter the attenuator loss value. For example, if you are using a 20 dB attenuator, tap **20** on the numeric keypad, and then tap **OK**.
- d. If you are using an external amplifier, select **External amplifier connected**. Tap the numeric keypad and enter the value of the amplifier gain. For example, if the amplifier has a 10 dB gain, tap **10** on the numeric keypad, and then tap **OK**.
- e. Once you have finished verifying the settings, tap **OK** at the bottom of the window.

Connecting a Timing Reference

To properly measure PN Offset and Tau/Pilot Time Alignment Error (requires Option CD1, CD2, or CDE), you must connect an external Even Second Clock signal to the YBT250. Figure 2-5 on page 2-21 shows the location of the timing reference input connector.

To connect an Even Second Clock signal to the YBT250, connect the BTS Even Second Clock signal, or the NetTek YBGPS1 GPS Timing Reference Timing cable to the **TIMING INPUT** connector. The signal is automatically detected by the YBT250.

The NetTek YBGPS1 GPS Timing Reference provides timing pulses that the YBT250 uses to derive an Even Second Clock. This lets the YBT250 measure CDMA PN Offset and Tau/Pilot Time Alignment without being attached to the BTS ESC signal. If Option CS1 is installed, the YBT250 can also make cdma2000 over the air (OTA) measurements.

Improving Measurement Accuracy

There are three ways to improve YBT250 measurement accuracy:

- Use an external frequency reference while taking measurements (see the following section)
- Use an external frequency reference to create and store custom frequency correction factors with the YBT250 (see page 2-28)
- Use the Tektronix YBGPS1 GPS Timing Reference to provide GPS-derived timing accuracy (GPS information starts on page 2-51)

Using an External Frequency Reference

You can improve the accuracy of Carrier Frequency and Frequency Error measurements by connecting an external frequency reference signal to the YBT250 during measurements. The external frequency reference input connector is located on the top of the YBT250 and is labeled **FREQUENCY REFERENCE INPUT**. See Figure 2-5 on page 2-21 for the location of the frequency reference input connector.

The external reference signal requirements are:

- The YBT250 locks on to signals that are within 1 ppm of an acceptable frequency.
- The external frequency reference input impedance is 50 ohms.
- The signal level is between -15 dBm and +15 dBm.

Table 2-11 lists the acceptable external frequency reference signals.

Table 2-11: Accepted external frequency reference signals

External reference frequency	Transmitter/Frequency reference
1 to 15 MHz, in 1 MHz steps	
4.8 MHz	For Nortel BTS equipment.
10 MHz	Standard frequency from WWV and other high-accuracy references.
13 MHz	For GSM systems.
15 MHz	For Lucent W-CDMA.
1 MHz, 2 MHz, 5 MHz	Along with 10 MHz, these are standard for Rubidium and other high-accuracy References.
19.6608 MHz	For Motorola, Qualcomm, and newer Nortel. Used for CDMA only.
1.2288 MHz, 2.4576 MHz, 4.9152 MHz, 9.8304 MHz	These are also multiples of the CDMA chip rate.
2.048 MHz	For Ericsson BTS equipment with E1 reference source

To connect an external frequency reference to the YBT250, connect the frequency reference signal to the **FREQUENCY REFERENCE INPUT** connector. The YBT250 automatically detects the reference signal. When a valid external frequency reference is present, it is used as the frequency (time base) reference.

To verify that the YBT250 recognizes the frequency reference signal, do the following:

1. Tap the **EDIT** button.
2. Tap the **Inputs** tab.

When the YBT250 recognizes an external frequency reference, the **External Frequency Reference Input** field displays an icon identifying the reference type, and text providing signal information. Figure 2-8 shows typical external frequency reference input displays for an external signal (upper image) and for when a NetTek YBGPS1 GPS Timing Reference is connected.

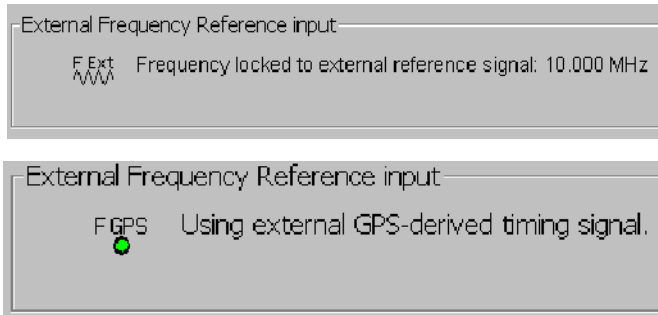


Figure 2-8: External frequency reference locked signal

If the YBT250 does not recognize the frequency reference, or cannot lock onto the signal, the **External Frequency Reference Input** box displays an icon with the letters INT and displays the text:

No valid external reference signal found. Using internal frequency reference.

Check the connections and verify that the frequency reference is within the correct frequency range and level.

Creating Frequency Correction Factors

You may be able to improve frequency measurement accuracy by creating custom frequency correction factors using the YBT250 frequency correction utility. This utility compares the YBT250 internal frequency reference to an external reference and calculates correction values to align the internal frequency reference with the external reference. You can then choose to use either the frequency correction values or the original factory-generated values when at a remote site.



CAUTION. *You should run the Frequency Correction utility only if you have a known high-quality Reference source. The Reference source frequency accuracy directly affects the accuracy of the frequency correction values. A poorly calibrated Reference source can result in correction values that degrade measurement results.*

To run the frequency correction utility:

1. Power on and run the YBT250 for at least 10 minutes before running the Frequency Correction utility.
2. Connect a frequency reference signal to the YBT250 **FREQUENCY REFERENCE INPUT** connector.
3. Select **Tools > Frequency Correction**. This displays the Frequency Correction dialog shown in Figure 2-9.

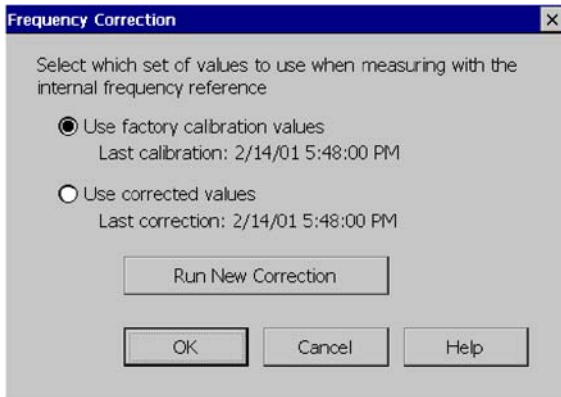


Figure 2-9: The Frequency Correction dialog

4. To calculate new frequency correction values, tap **Run New Correction**. This displays the dialog shown in Figure 2-10.

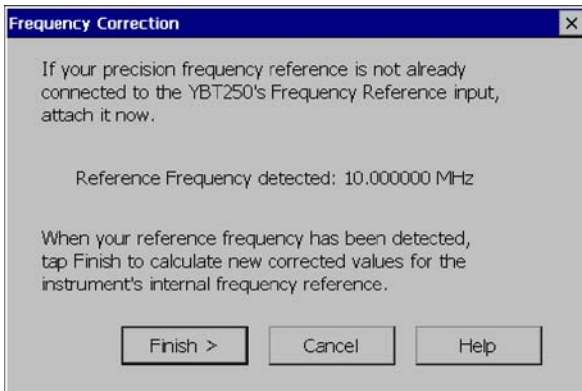


Figure 2-10: Ready to calculate new correction values

If the reference frequency is detected, the frequency is shown in the dialog box. If the reference frequency is not detected, "--" is displayed instead of a frequency. If the reference frequency is not displayed within 15 seconds, check the connection to the external frequency reference.

5. If the reference frequency is detected, tap **Finish >** to calculate new frequency correction values. If the calculation of new frequency correction values is successful, the dialog shown in Figure 2-11 appears.

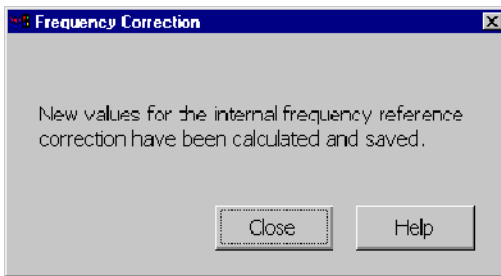


Figure 2-11: New frequency correction values calculated successfully

6. Tap **Close**. This displays the initial frequency correction dialog shown in Figure 2-12.

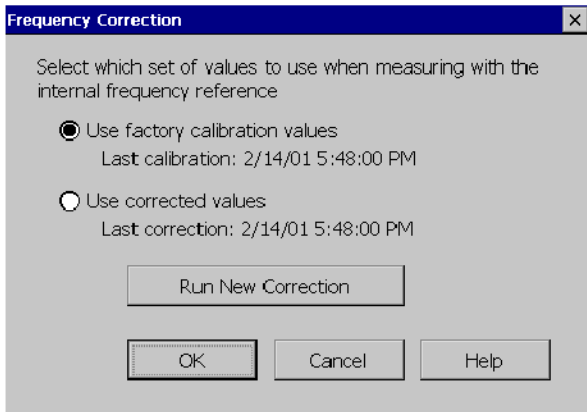


Figure 2-12: The Frequency Correction dialog

7. To use the new frequency correction values, select **Use Corrected Values**, then tap **OK**.

Changing Instrument Settings

Before you can fully utilize the YBT250 you need to set some instrument settings. For example, the YBT250 displays measurements only for enabled signal standards. If the signal standard used in your system is not enabled, you will not be able to take measurements for your system until you enable the Signal Standard.

Enabling Signal Standards

The currently selected signal standard controls the channels available for measurements and which measurements are available. Before you begin using the YBT250, you must ensure that the standard for your system has been enabled. You can only take measurements on enabled standards. Signal standards are enabled from the Options window.

To enable signal standards:

1. Select **Tools > Options**.
2. Tap the **Signal Standards** tab. See Figure 2-13.

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

NOTE. *If you need to test a standard that does not appear in the list of supported standards, you can create a custom channel table file for the standard. See page 2-40.*

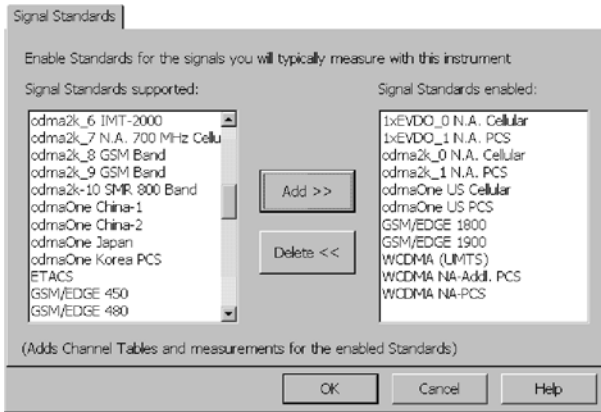


Figure 2-13: The Signal Standards tab

3. Tap the name of the standard in the left-side list that you want to enable.
4. Tap **Add>>** to add the standard to the right list field.
5. 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 measurements with the YBT250, you can only take measurements on enabled standards. You should limit the number of standards enabled to just those you test regularly to make it easier to select a standard from the Signal Standard drop-down list.

Setting Display Preferences

You can change the color scheme used in the instrument display. There are three color schemes, one monochrome scheme, and a color scheme optimized for black and white printouts. Color schemes specified in the YBT250 do not affect standard Windows CE screen items. The YBT250 color schemes affect only measurement graphs and results readouts in the YBT250 display.

To specify the color scheme used by the YBT250:

1. Select **Tools > Options**.
2. Tap the **Preferences** tab. See Figure 2-14.

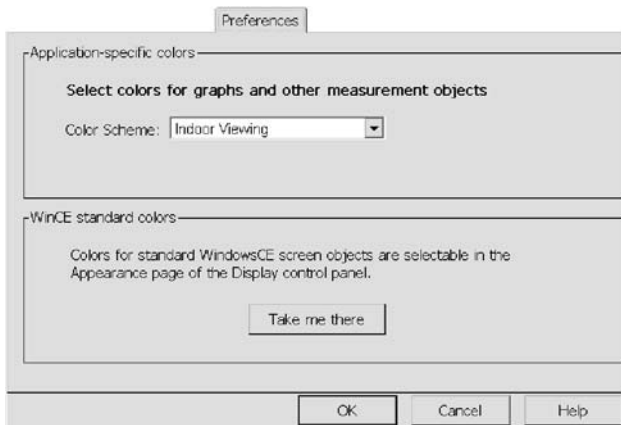


Figure 2-14: Preferences tab showing available color schemes

3. To display a list of the available color schemes, tap the **Color Scheme** list box. Available color schemes are Indoor Viewing, Outdoor Viewing, Dark on white, Monochrome grays, and Black on White for Printer.
4. To select a color scheme, tap the name of the desired color scheme.

5. Tap **OK** to save the change.
6. To view the changed color scheme, exit and restart the YBT250 program.

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.

Setting Up the Channel Table

Before taking measurements, you must set the measurement frequency. You set the measurement frequency either by entering the appropriate frequency or by selecting a channel. It is quicker to select a channel than to enter a frequency. Selecting a channel to set the measurement frequency can save you valuable time and minimizes entry errors.

A quick way to select a channel number is to use the knob. By tapping the left and right arrows on the knob, you can quickly change the selected channel and thus, the measurement frequency. The channels that are selectable using the knob are set by the Quick Select List. The channels listed in the Quick Select List are specified by the Channel Table.

You set up the Channel Table by enabling channels individually or by using the Channel Wizard. If you want to enable a large number of channels, use the Channel Wizard to save time.

To set up the Channel Table by enabling channels individually:

1. Tap the **Edit** button.
2. Tap the **Ch Table** tab. See Figure 2-15. Channels are enabled according to the signal standard. Therefore, you must select the signal standard before you enable the channels within that standard.
3. Select the desired signal standard from the **Signal Standard** list.

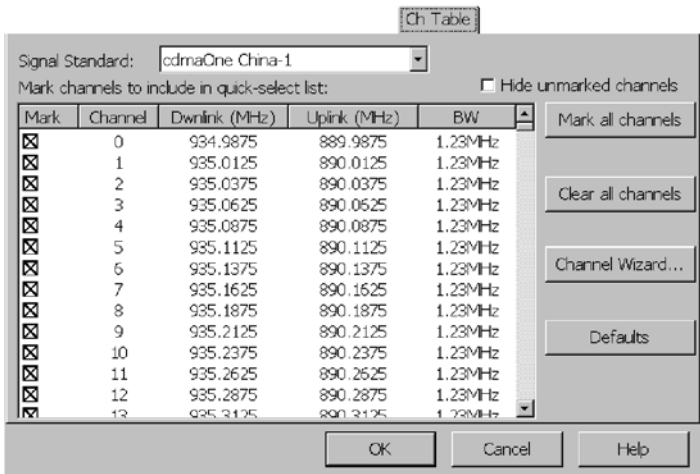


Figure 2-15: The Channel Table tab

4. To enable a channel:

- a. Tap the box in the **Mark** column next to the desired channel. Enabled channels are marked with an X.
- b. You can mark all channels by tapping the **Mark All Channels** button.

Enabled channels are added to the Quick Select List. The Quick Select List determines which channels can be selected by the knob. For example, suppose only channels 1, 2, 5, and 6 are enabled. If channel 1 is the current channel and you tap the right arrow (on the bottom half) on the knob, the next channel selected will be channel 2. If you tap the knob again, the next channel selected will be 5. Tap the right arrow once more and channel 6 will be selected. If you tap the right arrow once more, the channel selected will not change, because there are no channels enabled after 6.

5. To disable a selected channel:
 - a. Tap the box in the **Mark** column next to the enabled channel so that the box is empty.
 - b. You can disable or “unmark” all channels by tapping the **Clear All Channels** button.
6. When you have marked all the channels you wish to enable, tap **OK** to save your changes.

To set up the Channel Table using the Channel Wizard:

1. Tap the **Edit** button.
2. Tap the **Ch Table** tab.

Channels are enabled by signal standard. Thus, before you enable channels, you must specify the signal standard.
3. Select the desired signal standard from the **Signal Standard** list.
4. To enable channels using the Channel Wizard, tap the **Channel Wizard...** button. This displays the window shown in Figure 2-16.

The Channel Wizard needs three numbers to determine which channels to enable. The first number needed is the first channel that should be enabled. The second number needed is the last channel to be enabled. The third number is the interval between enabled channels.

5. To set the first channel number:
 - a. Tap the numeric keypad button next to the First Channel box.
 - b. Tap the appropriate numbers to set the first channel number.
 - c. Tap **OK** when finished.

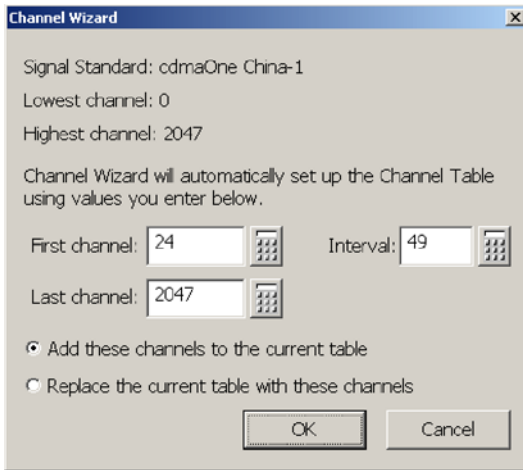


Figure 2-16: The Channel Wizard

6. To set the last channel number:
 - a. Tap the numeric keypad button next to the **Last Channel** box.
 - b. Tap the appropriate numbers to set the last channel number.
 - c. Tap **OK** when finished.

7. To set the interval between enabled channels:

- a. Tap the numeric keypad button next to the **Interval** box. Next, tap the appropriate number for the interval.

For example, to enable every channel, set the interval to 1. To enable every other channel, set the interval to 2. To enable every third channel, set the interval to 3.

- b. To add the specified channels to the existing channel table, select **Add these channels to the current table**.

- c. To replace the current channel table with the specified selections, select **Replace the current table with these channels**.
 - d. Tap **OK** when finished.
8. Tap **OK** to close the Setup window.

Customizing the Channel Table

The Channel Table is a file used by the YBT250 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.

Because the channel bandwidth is used in some measurements, if your system's channel bandwidth is non-standard and the YBT250 is using the standard Channel Table, a measurement based on the standard channel bandwidth will not be accurate for your system.

The YBT250 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\YBT250` folder. If that file is not found, a dialog box is 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\YBT250` folder or `\NetTekApps\YBT250` folder (only if the application software is loaded into volatile memory instead of flash memory).
2. Copy the `signalstandards.txt` file to the `\BuiltInDisk` folder.

The YBT250 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 2-12 lists the elements of the Channel Table file.

Table 2-12: Channel table file contents

Column heading	Description
Standard Name	<p>The text string used to identify the standard. This name is what appears in the Signal Standard list.</p> <p>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.</p>
Forward Base Frequency	<p>Forward base frequency for each signal standard. The actual frequency for each channel is calculated.</p> <p>For signal standards that specify a single frequency for each channel (for example, the UTRA/FDD scheme used by W-CDMA (UMTS)), each row in the file will describe a group of forward or a group of reverse channels. The row that describes forward channels should specify zero for the reverse base frequency. The row that describes reverse channels should specify zero for the forward base frequency.</p>

Table 2-12: Channel table file contents (Cont.)

Column heading	Description
Reverse Base Frequency	<p>Reverse base frequency for each signal standard. The actual frequency for each channel is calculated.</p> <p>For signal standards that specify a single frequency for each channel (for example, the UTRA/FDD scheme used by W-CDMA (UMTS)), each row in the file will describe a group of forward or a group of reverse channels. The row that describes forward channels should specify zero for the reverse base frequency. The row that describes reverse channels should specify zero for the forward base frequency.</p>
Signal Bandwidth	<p>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.</p>
Starting Channel Number	<p>The starting channel number for a block of channels.</p>
Ending Channel Number	<p>The ending channel number for a block of channels.</p>
Channel Increment Amount	<p>If the channels increment by 1, then a 1 goes in here. If by 2, then a 2 goes in here. If by 5...</p>
Channel Spacing	<p>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.</p>
Channel Offset	<p>Offset applied to channel number before calculating the channel frequency from the channel number.</p>
Unique Standard ID	<p>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.</p>

Table 2-12: Channel table file contents (Cont.)

Column heading	Description
Signal Type	1 = CDMAOne 2 = AMPS 3 = TDMA IS136 4 = GSM/EDGE 5 = W-CDMA (UMTS) 6 = CDMA 2000 10 = CDMA 2000 1xEV-DO 998 = NO_MEAS_ANALOG 999 = NO_MEAS_DIGITAL
Forward / Reverse frequency separation	190000000 for W-CDMA (UMTS) For signal standards that specify a single frequency for each channel (for example, the UTRA/FDD scheme used by W-CDMA (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.

Specifying the Signal Type

The Channel Table file contains a field that defines the type of signal for the named signal standard. For example, the standard named GSM 900 is designated as a Signal Type 4. The Signal Type is used by the Signal Identification function to suggest possible sources of interference.

Although the YBT250 will make measurements only on the first seven signal types listed in Table 2-12, you can define a signal standard that is based on other signal types. For example, you could create an FM signal standard of signal type 998 (Analog signal, no measurements available) and define channels within the FM radio band. This would allow you to tune to “channels” within the FM band, although you could not take measurements with the YBT250.

The reason for creating a signal standard is that the Signal Identification function uses the Channel Table to determine possible types of signals, and if you have defined a signal standard, then it will appear as a possible source in the Signal Identification function.

The signal types 998 and 999 are included in the Channel Table to enable you to create a custom signal standard for analog or digital signals that do not match the other signal types (such as an “FM” standard noted previously). Though no measurements would be made on channels of a standard based on either 998 or 999, the standard they are assigned to would be used by the Signal Identification function.

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)

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

If (Channel Offset $<$ 0)

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

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.

Changing Settings for Saved Files

The YBT250 enables you to specify the following default settings for saving files:

- Custom filename prefixes.
- The name of a technician making a test.
- User notes to be included in saved results files.
- The format of exported screens.
- The format of saved or exported results files.
- The default location to which files will be saved or exported during Spectrogram and Codogram Auto Save.

The headings that follow provide information on how to set these defaults.

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 2-17.

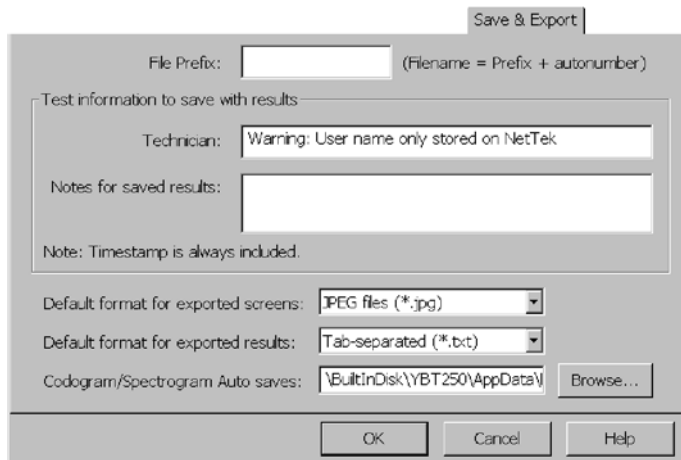


Figure 2-17: The Save & Export tab

Setting the Filename Prefix

The YBT250 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 YBT250 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 enter 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. Tap the **Edit button**.
2. Tap the **Save & Export** tab. See Figure 2-17.
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 YBT250 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. Tap the **Edit button**.
2. Tap the **Save & Export** tab. See Figure 2-17.
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.

When viewing a saved results file, you can view any saved notes, including Technician Name, by selecting **File > Results Properties**.

Entering Notes for Saved Results

The YBT250 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. Tap the **Edit button**.
2. Tap the **Save & Export** tab. See Figure 2-17.
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.

When viewing a saved results file, you can view any saved notes by selecting **File > Results Properties**.

Setting Up a GPS Receiver

Refer to page 2-51 for information about selecting and setting up a Global Positioning System (GPS) receiver so that you can save GPS coordinates with your results. The YBT250 automatically saves GPS location and platform time data when a GPS receiver is connected and working properly.

Setting Default File Type

You can set the default file type for exported screens. You can also set the default file type for saved and exported results files.

To specify default file types:

1. Tap the **Edit button**.
2. Tap the **Save & Export** tab. See Figure 2-17.
3. In the drop down box **Default format for exported screens:**, select a file extension:
 - PNG files (*.png)
 - JPEG files (*.jpg)
 - Bitmap files (*.bmp)


NOTE. An exported screen cannot be displayed by the YBT250; it can be opened only by a program that can display graphic images.

4. In the drop down box **Default format for exported results:**, select a file extension:
 - Tab-separated (*.txt)
 - Comma-separated (*.csv)

Setting Default Save Location for Automatically Saved Spectrogram and Codogram Files

You can set the default location to which you save and export screens and results files for spectrograms and codograms. This feature can be useful when, for example, you are saving many spectrograms and codograms to a PCMCIA memory card over a long period of time in an unattended mode.

To specify the location to which spectrograms and codograms are automatically saved or exported:

1. Tap the **Edit button**.
2. Tap the **Save & Export** tab. See Figure 2-17.
3. In the field **Codogram/Spectrogram Auto Saves**, look at the path. Tap the  icon to open the Input Panel to use the arrows on the Input Panel to view the whole path.
4. Enter a new path using the Input Panel, or tap the **Browse...** button to navigate to the location to which you want files saved.

NOTE. *Changes you make to the default location for auto saving and exporting spectrograms and codograms will persist when you next power-on the instrument.*

This control only sets the location of codogram and spectrogram auto saves. It does not set the default location for other saves or exports. When you start the YBT250 application, the default location for all saves and exports (except codogram and spectrogram auto save) is always \BuiltInDisk\YBT250\AppData\Results; after you have saved a file, the default location will be whatever location you used most recently.

GPS

Using a GPS (Global Positioning System) receiver with the YBT250 lets you record geographical location, time, and date information with your measurement results. The YBT250 is compatible with off-the-shelf NMEA-compliant GPS receivers (PCMCIA card type or GPS receivers with an RS232 serial output capability) to obtain and record measurement location and time.


The Tektronix YBGPS1 GPS Timing Reference, in addition to providing standard geographic location information, also provides a Timing Reference signal for taking cdma2000 (Option CS1) or 1xEV-DO (Option ES1) over-the-air (OTA) signal measurements, as well as improving carrier frequency measurement accuracy for applicable measurement options.

GPS Receiver Requirements

- You can use any GPS receiver that supports NMEA 0183 V2.0.
- The GPS receiver must output the \$GPRMC, \$GPGGA, \$GPGSV, and \$GPGSA sentences on a regular basis.
- The YBT250 reads the GPS receiver position data once per second, or at the rate the GPS receiver sends the \$GPRMC, \$GPGGA, \$GPGSV, and \$GPGSA sentences, whichever is slower.
- You can connect a GPS receiver to the NetTek Analyzer Platform using a serial (RS-232) port connection (at 4800 baud rate), or the NetTek Analyzer Platform PCMCIA slot to emulate a serial port on COM4.
- Over-the-air measurements require that you use the Tektronix YBGPS1 GPS Timing Reference, and have YBT250 option CS1 (cdma2000) or Option ES1 (1xEV-DO) installed.

YBT250 GPS Configuration

To configure your GPS receiver with the YBT250, do the following:

1. Connect your GPS receiver to the NetTek Analyzer Platform.
Refer to the GPS receiver instructions for details.
2. Tap the  status button to open the GPS tab. See Figure 2-18.

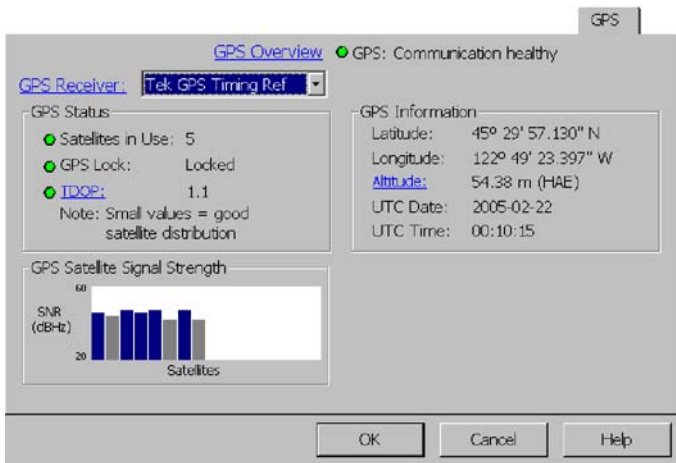


Figure 2-18: The GPS tab


3. Select the correct GPS receiver type in the GPS Receiver drop-down list. The YBT250 establishes communication with the GPS receiver and displays data in the GPS status and information fields. This may take a few moments depending on your GPS receiver, the GPS signal quality and available satellites. Signal acquisition and satellite signal lock times vary depending on the GPS receiver in use.
4. Check that the latitude and longitude information are correct for your location. If the YBT250 does not display correct GPS information within about four minutes, see *Troubleshooting GPS*

Receiver Problems on page 2-58 to resolve possible GPS receiver problems.

5. See *The GPS Setup Tab* on page 2-53 for information on the GPS tab fields.

You are now ready to use the GPS receiver to record and save measurement location data along with your measurements. If you are using the Tektronix YBGPS1 GPS Timing Reference, and have option CS1, see *Taking cdma2000 or 1xEV-DO OTA Measurements* for how to enable cdma2000 or 1xEV-DO OTA measurements.

GPS Signal Status Button

The GPS Status button , located at the upper right of the screen, indicates GPS signal usability. Tapping this button opens the GPS setup tab in the Setup window (see *YBT250 GPS Configuration* below).

- Green: Indicates that the GPS signals are of good quality and the receiver has valid location and timing data.
- Yellow: Indicates that the GPS signals were good, but are now suspect. If the signals do not return to green status within a short time, the GPS signal status changes to red. This indicator shows that measurements being taken may not be accurate and will become invalid if the GPS signal quality does not improve.
- Red: Indicates that the GPS signals are unusable. Possible reasons include loss of satellite signals, excess multipath, or the GPS antenna no longer has an unobstructed satellite view. See *Troubleshooting Your GPS Receiver* on page 2-58 for help in restoring or improving GPS signal reception.

The GPS Setup Tab

The GPS tab selects the GPS receiver type and displays GPS signal and location information. To display the GPS tab fields, tap the GPS button. The following text describes each field.

GPS Receiver Field

The GPS Receiver field selects the type of GPS receiver that is connected to the YBT250 and/or NetTek Analyzer Platform.

- **None:** Select this when there is no GPS receiver connected to the NetTek Analyzer Platform.
- **NMEA (Serial):** Select this when there is a GPS receiver connected to the NetTek Analyzer Platform serial (RS-232) port.
- **NMEA (PCMCIA):** Select this when there is a GPS receiver connected to the NetTek Analyzer Platform PCMCIA card slot.
- **Tek GPS Timing Ref:** Select this when there is a Tektronix YBGPS1 GPS Timing Reference unit connected to the YBT250 and the NetTek Analyzer Platform.

GPS Field

The GPS field shows the overall YBT250-to-GPS receiver communication status. If the YBT250 cannot establish communications with the GPS receiver, see *Troubleshooting Your GPS Receiver* on page 2-58 to resolve possible GPS receiver problems.

GPS Status Field

The GPS Status field shows satellite signal status information. See Figure 2-54.

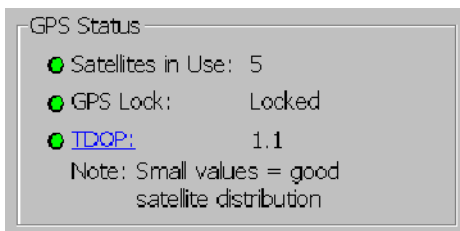


Figure 2-19: GPS Status field

Satellites In Use indicates the number of locked satellite signals, and displays an associated status icon.

- Green: The GPS receiver is locked to four or more satellites.
- Yellow: The number of locked satellites has recently dropped below four. If the GPS receiver does not detect four or more satellites in a short period, this status changes to red. This is a warning indicator to show that measurements being taken may not be accurate and will become invalid if the GPS signal quality does not improve.
- Red: The GPS receiver is locked to three or less satellites, indicating an insufficient number of satellites to provide accurate information.

GPS Lock indicates signal lock status.

- Green: The signals are adequate for the GPS receiver to synchronize with the satellite data transmissions.
- Yellow: The number of synchronized satellite data transmissions has recently dropped below four. If the GPS receiver does not resynchronize received satellite data from four or more satellites in a short period, this status changes to red. This is a warning indicator to show that measurements being taken may not be accurate and will become invalid if the GPS signal loses lock.
- Red: The GPS receiver cannot synchronize with an adequate number of satellite data transmissions.

TDOP and **HDOP** indicates GPS timing or position dilution of precision (DOP), based on the geometry of the satellite constellation. DOP is a description of the geometry of the satellites used in the time and position solutions.

- Green: The GPS TDOP/HDOP timing or position information is good (within the limits of the GPS system and receiver).
- Yellow: The GPS TDOP/HDOP timing or position information was good, but has degraded recently. If the TDOP/HDOP does not improve in a short period, this status changes to red. This is a warning indicator to show that measurement or position data

being taken may not be accurate and will become invalid if the GPS timing or position information does not improve.

- Red: The GPS TDOP/HDOP timing or position information is poor.

When the useable satellites are widely positioned in the sky (larger vertical angles between the receiver and each satellite), the DOP values are close to 1 and timing and position information is more accurate. When the useable satellites are more closely positioned together, the DOP values are higher and accuracy is degraded because of the small angles between the satellites. In general, the errors due to other sources are multiplied by the DOP value.

The four common DOP values are PDOP, HDOP, VDOP, and TDOP (3-D position, horizontal position, vertical position, and time). Timing is the major function of the Tektronix YBGPS1, so TDOP is the important DOP value for this product.

The TDOP (shown when using the Tektronix YBGPS1 GPS Timing Reference) indicates the quality of the timing reference signal. A lower TDOP value means more accurate timing information.

HDOP (shown when using GPS receivers other than the Tektronix YBGPS1 GPS Timing Reference) indicates the quality of the receiver latitude and longitude position data. A lower HDOP value means more accurate position information.

For reasonable timing accuracy, there must be at least 4 useable satellites, the TDOP value should be less than 4, the signal strength of the satellites used in the solution should be above 43 (SNR), and you should wait 30 seconds after locking onto the fourth satellite to allow the satellite time to transmit its precise position information.

For more information, search the Internet using the keywords GPS, Theory, Satellite, Geometry, and DOP.

GPS Information Field

The GPS Information field shows the GPS receiver geophysical location (latitude and longitude), altitude, time, and date (UTC - Coordinated Universal Time). Altitude information is labeled MSL (Mean Sea Level) or HAE (Height Above Ellipsoid), depending on the GPS receiver. See Figure 2-20.



Figure 2-20: The GPS Information field

NOTE. It is normal to obtain different altitude and position measurements from different GPS receivers at the same location due to different geophysical models. There are several geophysical models that describe the shape of the earth, and each model affects how both position and altitude information is calculated. For example, surveyors in the United States typically use the NAD83 model for their calculations, whereas maps printed in the United States generally use the NAD27 model to calculate position. Many GPS receivers reference their altitude calculations to mean sea level (MSL).

The Tektronix YBGPS1 GPS Timing Reference uses the WGS84 HAE altitude model, which is similar to the NAD83 model used by surveyors.

Search the Internet using the keywords GPS, Theory, Ellipsoid, and DOP for GPS theory of operation information.

GPS Satellite Signal Strength Field

The GPS Satellite Signal Strength field graphically represents the GPS satellite signal strength of each detected and locked signal. See Figure 2-21. Blue indicates a locked satellite signal that is being used for GPS calculations; grey indicates a tracked but unused satellite signal.

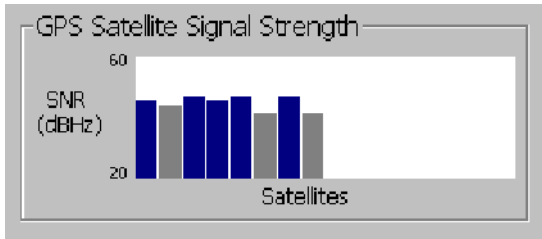


Figure 2-21: The GPS Satellite Signal Strength field

Saving GPS Data with Measurements

The YBT250 automatically saves location, time, and date information with measurements whenever the GPS receiver is active and acquiring accurate location data. For accurate measurement records, make sure to save or export your results 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.

Troubleshooting Your GPS Receiver

If the application is unable to read position information from the GPS receiver, then check or do the following:

- If the message "Invalid Position" appears, then the communication connection to the receiver has been successfully established, and the NMEA sentence is being successfully read from the receiver, but the position supplied in that sentence is not valid. An invalid position is normal while the GPS receiver is initially attempting to locate and receive data from 4 satellites. When the GPS receiver is first turned on, it typically requires about 90 seconds to lock onto satellites. If the Invalid Position message lasts longer than a few minutes, check the GPS signal strength and DOP values.

- Check that all cables from the GPS receiver to the YBT250 and/or the NetTek Analyzer Platform are attached to their correct connectors and are completely seated.
- If required, check that a GPS antenna is connected to your GPS receiver.
- Check that your GPS antenna has clear access to receive satellite signals. GPS signals do not penetrate metal or concrete structures. Trees and wooden structures can also reduce received signal strength.
- The GPS Status and GPS Satellite Signal Strength fields (on the GPS tab) are helpful for determining problems with the location of the GPS antenna. If TDOP (or HDOP) values remain high for long periods of time, this normally indicates that some satellite signals are blocked from the GPS antenna. Low GPS signal strength may also indicate that the GPS antenna is in a poor location.
- If required, check that your GPS receiver is powered on, or there is sufficient power left in the battery. Note that the Tektronix YBGPS1 GPS Timing Reference draws its power from the NetTek Analyzer Platform, and is powered on as soon as it is connected to the NetTek Analyzer Platform.
- If you are using a PCMCIA-type GPS receiver card, check that the GPS PCMCIA card is firmly seated.
- Verify that the GPS receiver is set to output NMEA sentences regularly. Refer to your GPS receiver documentation to find out how to output NMEA sentences regularly. Note that the YBGPS1 GPS Timing Reference sends binary data to the NetTek Analyzer Platform.
- Power cycle the NetTek Analyzer Platform and see if it now acquires the GPS position data.
- The NetTek Analyzer includes a 30-day evaluation version of the vxHpc High Performance Serial and Telnet Communications Software from Cambridge Computer Corporation. vxHpc provides more sophisticated and powerful communications capability than the built-in Windows CE Terminal program, and

may help you diagnose GPS to NetTek Analyzer Platform communications problems. vxHpc provides a broad range of terminal emulations, includes telnet (TCP/IP) communications capability, terminal emulation over the serial port, file transfer and scripting.

The vxHpc software is fully functional for 30 days after its first use, after which you will have to purchase a license from Cambridge Computer Corporation. For registration information, see the vxHpc online help: follow the Tips for using vxHpc link on the first Online help page or go to <http://www.cam.com>.



Reference

Displaying a Signal Spectrum

You can use the YBT250 Field Transmitter & Interference Tester to display the spectrum and the spectrogram of a signal. The spectrum display shows the signal level at different frequencies, all at once. The spectrogram displays how the signal level varies over time, providing a history of the signal. The spectrogram display is accessible only if the Interference option is installed (Option IN1, Interference Analyst).

The Spectrum Display Area

There are several buttons located in the Spectrum area display. Figure 3-1 shows a typical spectrum display (with Interference option installed).

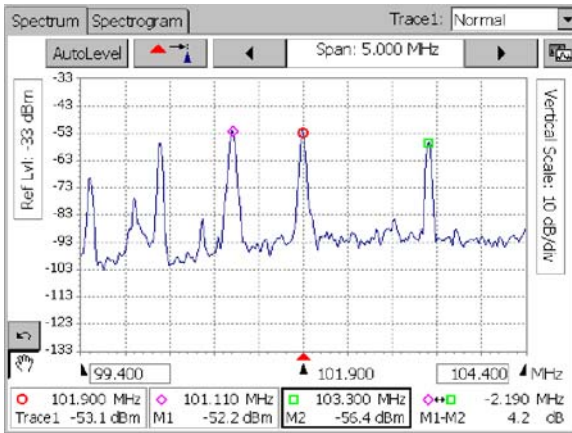


Figure 3-1: A typical Spectrum display with markers

Table 3-1 lists each of the buttons that can appear in the spectrum display and explains what each button does.

Table 3-1: Spectrum and Spectrogram buttons and icons









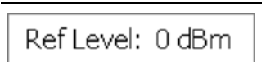
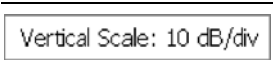
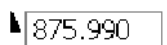


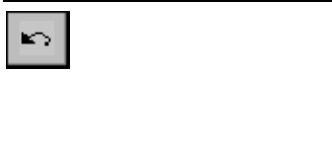

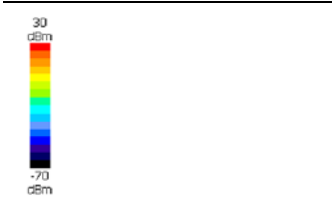
Button	Function
	This tab selects the normal spectrum display.
	This tab selects the spectrogram display (requires Option IN1, Interference Analyst).
	This drop-down list specifies the trace type. See Table 3-2.
	This button clears the trace and restarts acquisition when Trace is set to Average, Min, Max, or Min & Max Hold. Present in both the Spectrum and Spectrogram displays. This button also clears and restarts the spectrogram.
	Adjusts the internal gain and /or attenuation (Ref Level) to provide an optimized waveform display and prevent overload conditions.
	Moves the measurement frequency to the horizontal center of the display.
	Decreases or increases the span (frequency width) of the spectrum and spectrogram displays.
	Toggles the trace order: Moves the front trace to the back or enables Trace 2 if not displayed.
	Indicates the current Reference Level (top of the display in spectrum windows).
	Displays current vertical scale setting.
	Indicates the Start frequency (the lowest displayed frequency).
	Indicates the Center frequency (the middle displayed frequency).

Table 3-1: Spectrum and Spectrogram buttons and icons (Cont.)

Button	Function
	<p>Indicates the Stop frequency (the highest displayed frequency).</p>
	<p>Undo button moves the waveform in the display back to its previous position or resets the value of the last item touched in the graph. Present only when an action can be undone.</p>
	<p>Enables or disables moving the waveform or placing markers on a waveform by tapping the display graph.</p>
	<p>Indicates the power values of channel data in the Spectrogram based on the displayed color.</p>




Displaying a Trace

To display a spectrum trace:

1. Connect a signal (see page 2-22) from a test port to the YBT250 RF INPUT connector.
2. If there is no test port:
 - a. Verify the transmitter is not transmitting power to the antenna.
 - b. Disconnect the transmitter cable from the antenna.
 - c. Attach an attenuator to the cable output (to prevent overpowering the input of the YBT250).



CAUTION. *If the input of the YBT250 is accidentally overpowered, it will trip an internal protection switch. A dialog box will inform you that to continue using the YBT250, you must disconnect the input cable or reduce the input power and then press OK.*

- d. Connect the attenuator to the YBT250 input connector.
3. Select a signal standard.
4. Select a channel.
5.   Tap the **Forward Link** or **Reverse Link** button.
6.  Tap the **Spectrum** button. See Figure 3-1 for a typical spectrum display.

Setting Trace Display Options

You can change how a trace is displayed to make it easier to analyze a signal. There are five trace types you can choose from. See Table 3-2.

Table 3-2: Trace display 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 Spectrum tab of the Settings page.
Min Hold	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.
Max Hold	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 restart button. Updates displayed point only if new point > old point.
Min/Max Hold	This is a combination of Min Hold and Max Hold. 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. Draws a vertical line between Max Hold and Min Hold points.

Setting the Trace Type

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 3-2.

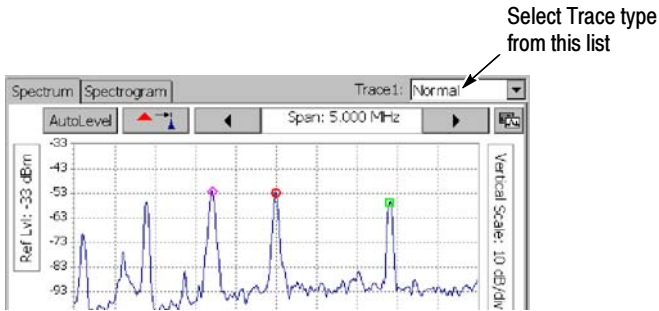


Figure 3-2: Setting the trace type

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

1. Tap the **Edit** button.
2. Tap the **Spectrum** tab. See Figure 3-3.

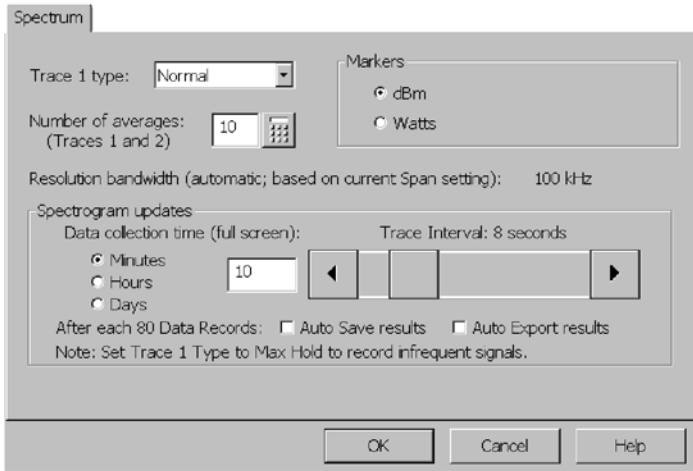


Figure 3-3: The Spectrum tab

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 5. This number applies to both Trace 1 and 2.

- a. To set the number of averages, tap the keypad next to the number of averages.
- b. Enter the number of traces to average and then tap **OK**.

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

Changing the Vertical Scale of the Spectrum Display

To change the vertical scale of the display (dB/div):

1. Tap the Vertical Scale label to assign Vertical Scale to the knob. See Figure 3-4.

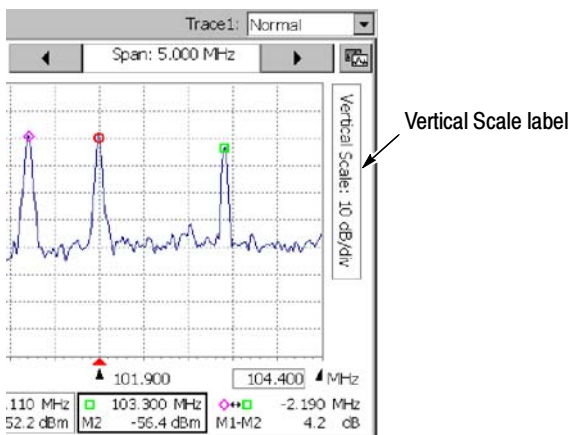


Figure 3-4: The Vertical Scale label

2. Change the vertical scale by:
 - a. Tapping the numeric entry keypad button and entering a new value, or
 - b. Tapping the left/right arrows below the knob to change the vertical scale value, or
 - c. Dragging the top portion of the knob to set the new value.

When the vertical scale is set to a value that causes the trace to expand beyond the display area, a scroll bar appears at the right side of the trace display. You can change the position of the trace by dragging the scroll bar or tapping the scroll bar's arrows.

Changing the Vertical Position of the Trace

The vertical position of the trace can be changed only when the vertical scale is <10 dB/div.

To change the vertical position of the trace:

- Drag the vertical scroll bar (only visible when the vertical scale is <10 dB/div) or tap the arrows at the ends of the scroll bar. See Figure 3-5.

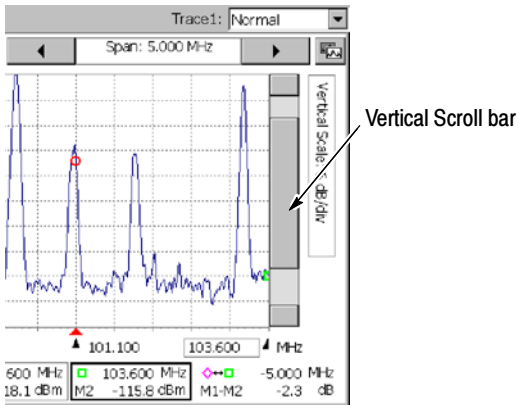


Figure 3-5: How the display appears with a small vertical scale value

Changing the Horizontal Position of the Trace

To change the horizontal position of the trace:

- Touch inside the graph, and keeping your finger on the screen, drag the trace to the desired position. You do not have to touch the trace itself.

If you just tap the waveform and remove your finger, the trace will not move. If Markers are on, the position of the selected Marker will change to the location you tapped. If Markers are off, when you tap the waveform, the measurement frequency will change to the frequency at the point you tapped.

Changing the Reference Level



The Reference Level is the level displayed at the top of spectrum windows.

To change the Reference Level:

1. Tap the **Ref Lvl** label to assign the knob to Reference Level.
2. Change the Reference Level by:
 - a. Tapping the numeric keypad button and entering a new value, or
 - b. Tap the left/right arrows on the bottom half of the knob to change the Reference Level value, or
 - c. Drag the circle on the top half of the knob to set the new value.

Disabling Tap/Drag Operation

You can prevent the accidental change of settings or movement of the trace by disabling Tap/Drag actions within the trace area of the display.

To disable tap/drag action, tap the **Tap/Drag** button . When Tap/Drag action is disabled, the icon changes to .

To enable tap/drag action again, tap the **Tap/Drag** button.

Saving Traces

You can save a trace for later recall. For example, you can save an example of a known good trace to compare with a live trace later. To save a trace with an automatically generated filename, select **File > Save Trace**.

When you start the application, traces are saved in the \BuiltIn-Disk\YBT250\AppData\Results directory by default. Refer to *Changing Settings for Saved Files* on page 2-45 for information on changing the default directory and setting other defaults for saved files.

You can also change the directory for future save operations by selecting a different path in the Save Trace As window, but the default will return to the \BuiltInDisk\YBT250\AppData\Results directory when you restart the application.

NOTE. *Only traces saved within the BuiltInDisk folder (or on a removable storage device such as a PC memory card) are stored in non-volatile memory. Traces saved outside the BuiltInDisk folder are lost when the YBT250 is shutdown.*

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

1. Select **File > Save Trace 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.*


You can also save GPS coordinates with your trace results. See page 2-51 for information about selecting and setting up a Global Positioning System Receiver with the YBT250.

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 YBT250 provides the ability for you to visually compare the current 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

- Tap 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 Settings window appears with the Trace 2 & Mask tab selected. See Figure 3-6.

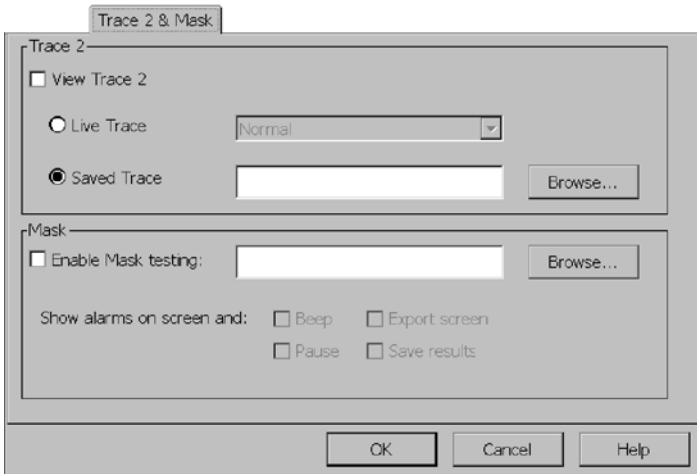


Figure 3-6: Defining Trace 2

2. To set Trace 2 to a version of the live trace, select **Live Trace** in the Trace 2 box.

You can set the trace display options for Trace 2 with the drop-down list. You can choose Normal, Average, Min Hold, Max Hold, or Min/Max Hold.

3. To set Trace 2 to a saved trace, select **Saved Trace**. Enter the path to the saved trace in the input box, or tap **Browse** to display the Open dialog box.

Comparing Two Trace Results Files

To compare two saved results:

1. Select **File > Compare Saved....** The Open dialog appears. See Figure 3-7. For the first result selected, the dialog is labeled **Select first result file to compare**.

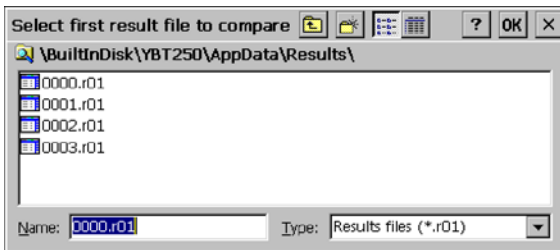


Figure 3-7: Selecting the first result file

2. Select the first result file you want to compare.
3. Tap **OK**. The trace stored in this file is displayed as Trace 1.
4. After you select the first result, use the **Select second result file to compare** dialog box (shown in Figure 3-8) to select the second trace file.

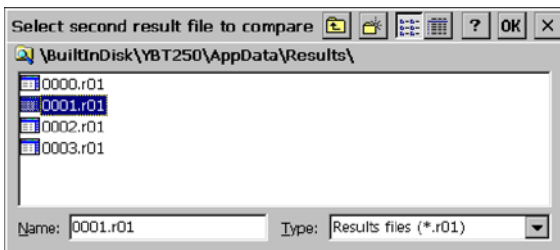


Figure 3-8: Selecting the second result file

5. Tap **OK**. The trace stored in this second file is displayed as Trace 2.

The timestamp displayed next to the Open Folder indicator on the toolbar is associated with the trace file that is displayed in the foreground.

The two traces are displayed in different colors so that they are easier to compare. You can use markers on the saved traces to compare points on the traces. See Figure 3-9.

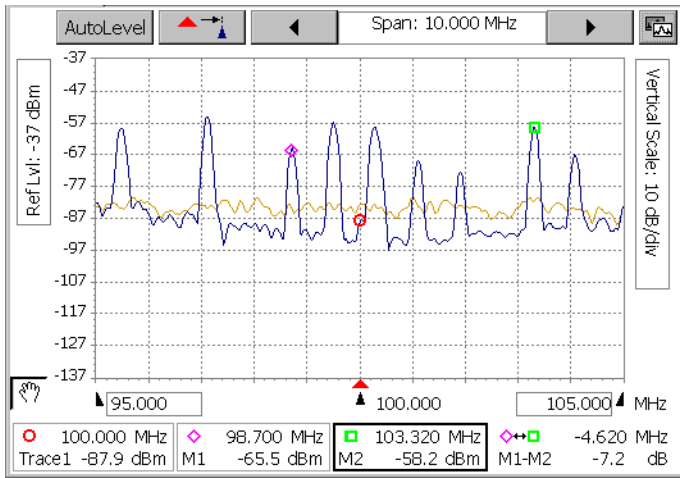


Figure 3-9: Two compared traces

Displaying Markers

The YBT250 Field Transmitter & Interference Tester uses markers to measure differences in the frequency and level of the displayed trace. You can move markers by tapping and dragging the markers on the graph.

To display the markers, select **View > Markers**. The markers are displayed as shown in Figure 3-10.

NOTE. Markers can be viewed only in the Spectrum display. Markers are not available in any of the Interference or Measure windows.

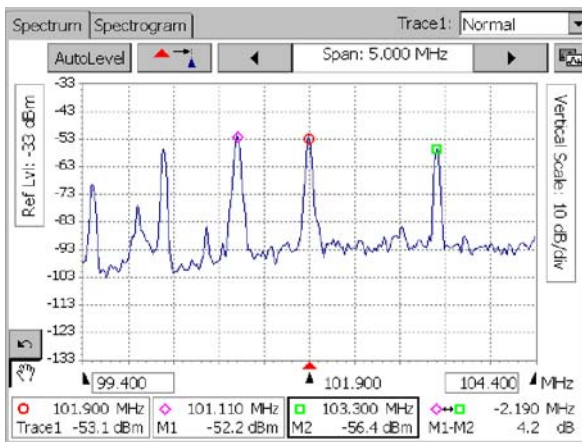


Figure 3-10: Spectrum display with markers

There are four readouts associated with markers, located at the bottom of the display. See Figure 3-11. The marker readouts are:

- Measurement Frequency level and frequency
- Marker 1 (M1) frequency and level
- Marker 2 (M2) frequency and level
- Difference in frequency and level between M1 and M2 (M1-M2) (when mask testing *is not* enabled) OR
- Difference in level between M1 and a Mask and M2 and a Mask (when mask testing *is* enabled)

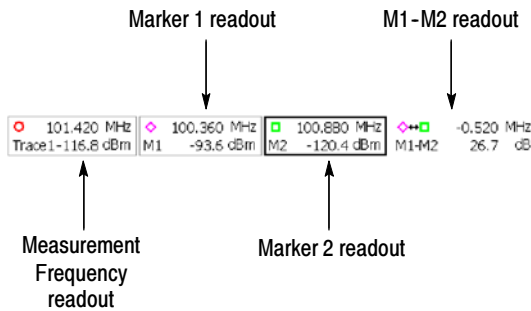


Figure 3-11: The four readouts of the Markers display

The units for the frequency and level readouts are located at the right side of each segment of the marker display (for example, MHz and dBm). The elements of each marker display are shown in Figure 3-12.

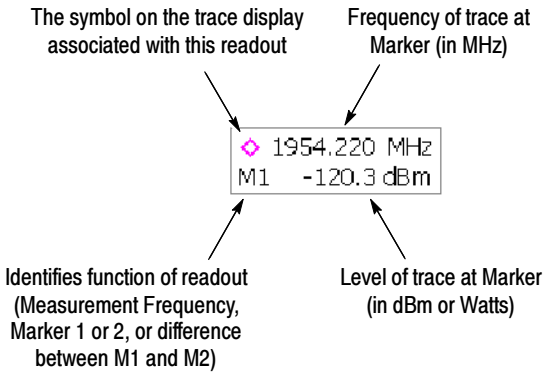


Figure 3-12: The Marker readout

Specifying Units for Marker Display

The units displayed in the marker readouts for level can be set to either dBm or Watts.

To change the marker readout units for level:

1. Tap the **Edit** button
2. Tap the **Spectrum** tab. This displays the window shown in Figure 3-13 shows the upper half of the Spectrum tab.
3. Tap **dBm** or **Watts** in the Markers box to set the marker readout units.
4. Tap **OK** after setting the units.



Figure 3-13: Changing Units for Marker Level

Using Markers on a Single Trace

To measure the difference in frequency and level 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 frequency and level at the right side of the marker display.

Using Markers with Two Traces

When Trace 2 is displayed, you can measure the difference in frequency and level 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 3-3 from the **View** menu.

Table 3-3: Marker placement

Menu selection	Location of markers
M1 Trace 1, M2 Trace 2	Assigns M1 to Trace 1 and M2 to Trace 2 (rotating the trace order does not change the marker assignment).
Both on front trace	Both markers are assigned to the front trace, which changes when the trace order changes.

Table 3-3: Marker placement (Cont.)

Menu selection	Location of markers
Both on Trace 1	Both markers remain on Trace 1 (rotating the trace order does not change the marker assignment).
Both on Trace 2	Both markers remain on Trace 2 (rotating the trace order does not change the marker assignment).

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.

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.

Refer to page 3-31 for more information about mask testing and markers.

Band Edge Cursor

The Band Edge cursors identify the start and stop frequencies for the transmit or receive bands of the selected standard. See Figure 3-14. (Transmit or receive band is selected using the Uplink and Downlink buttons.)

There are two parts to the band edge 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 3-15.

To turn on the display of Band Edge Cursors, select **View > Band Edge Cursor** so that it is checked. See Figure 3-14 on page 3-20.

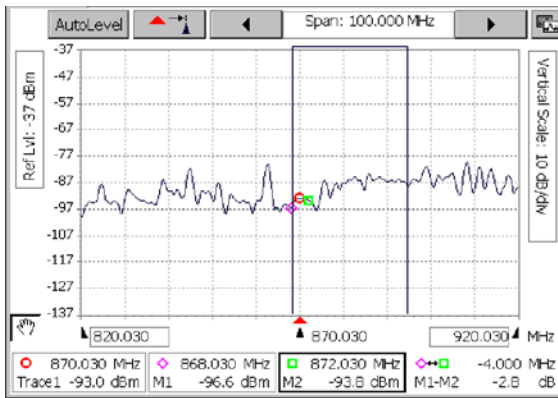


Figure 3-14: Band Edge Cursor displayed

To turn off the display of Band Edge Cursors, select **View > Band Edge Cursor** so that it is *not* checked. See Figure 3-15 on page 3-21.

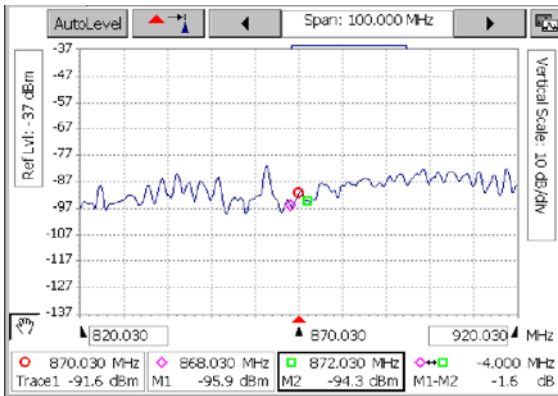



Figure 3-15: Band Edge Cursor turned off; top part visible

Displaying a Spectrogram

Requires Option IN1, Interference Analyst

A spectrogram displays the record of over time. This signal level history lets you to see changes in the signal that cannot be seen in any other way.

To display a spectrogram:

1.  Tap the **Spectrum** button.
2. Set the Frequency, Span, Reference Level and Vertical Scale to show the signal(s) of interest in the graph.
3. Select the **Spectrogram** tab. See Figure 3-16.

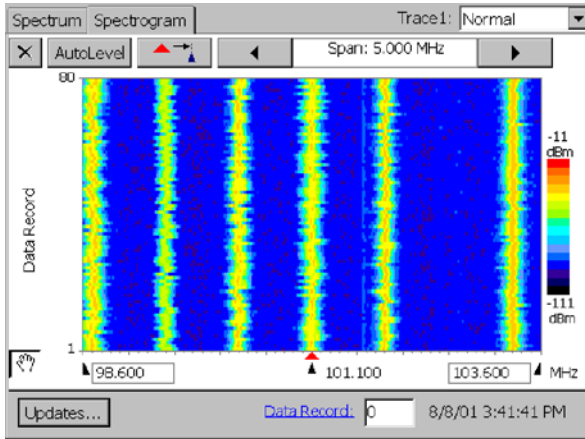



Figure 3-16: A spectrogram

Remember the following while viewing a spectrogram:

- Select the Restart icon  to clear the trace history and restart collecting data.
- Select **Updates...** to change how often the spectrogram is updated.
- You can determine when an anomaly occurred in the spectrogram by using a cursor. To display the cursor, enter the number of a data record (1-80) in the Data Record box at the bottom of the display. The cursor is a horizontal white band. Use the knob or numeric keypad to move the cursor to the data record of interest on the spectrogram. The time and date the data was recorded is displayed to the right of the Data Record box.
- To create a spectrogram that uses the full range of colors, adjust the Vertical Scale and vertical position in the spectrum display so that the trace fills at least eight vertical divisions.
- The message “Input Overrange: Reduce input signal level” appears below the spectrogram when input levels are too high. A red mark also appears to the right of a spectrogram record to

indicate that the spectrum was acquired during an Input Overrange condition. When a Spectrogram is acquired during an Input Overrange condition, the resulting trace data may still be valid, but it may also contain IM (Inter-Modulation Distortion) products that are internally generated.

The Input Overrange information is saved and exported with the results.

See *Locating Intermittent Interference* on page 3-42, for more information on using the Spectrogram window.

Setting the Spectrogram Update Rate

The YBT250 lets you set the spectrogram update rate (how often the Spectrogram display receives a new trace).

To specify the spectrogram update rate:

1. Tap the **Edit** button.
2. Tap the **Spectrum** tab. Figure 3-17 shows the Spectrogram Updates field of the Spectrum tab.

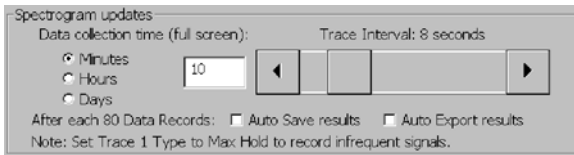


Figure 3-17: The Spectrogram Updates field.

3. Specify the full-screen data collection time by selecting either **Minutes**, **Hours** or **Days**.
4. Adjust the slider control to set the data collection time (that is, the time used to fill the spectrogram display). You change the data collection time by moving the slider, tapping the left/right arrow buttons, or typing in the number with the soft keyboard.

Automatically Saving and Exporting the Spectrogram Display


You can set YBT250 to save or export the spectrogram display each time 80 records are accumulated. Files are automatically named as they are saved, enabling unattended operation.

For a general discussion of saving and exporting, refer to *Saving, Exporting, and Recalling Results, Traces, and Settings* on page 3-137. For a general discussion of how to set defaults for saving or exporting files, refer to *Changing Settings for Saved Files* on page 2-45.

To automatically save or export the spectrogram display every 80 records:

1. Tap the **Edit** button
2. Tap the **Spectrum** tab. See Figure 3-17.
3. To automatically save and / or export, tap the check boxes next to **Auto Save** and / or **Auto Export**.
4. Tap **OK** to save your changes. The YBT250 saves or exports the spectrogram display to a new file each time 80 data records are accumulated. The time required to accumulate 80 records depends on the spectrogram update rate. The size of a full, saved spectrogram file is about 43 kilobytes. The size of a full, exported spectrogram file is about 160 kilobytes.



Mask Testing

Mask testing is used to determine if a signal exceeds specified levels. The YBT250 can perform several actions when an input signal exceeds limits defined by a mask. The default action is to display an icon (!) to the right 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.

Creating a Mask

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.  Tap the Spectrum button.
2.  Set the measurement frequency to the center of the spectrum graph by tapping the **Move to Center** icon.
3. From the **Tools** menu, select **Mask Maker**. This displays the Mask Maker utility. See Figure 3-18.

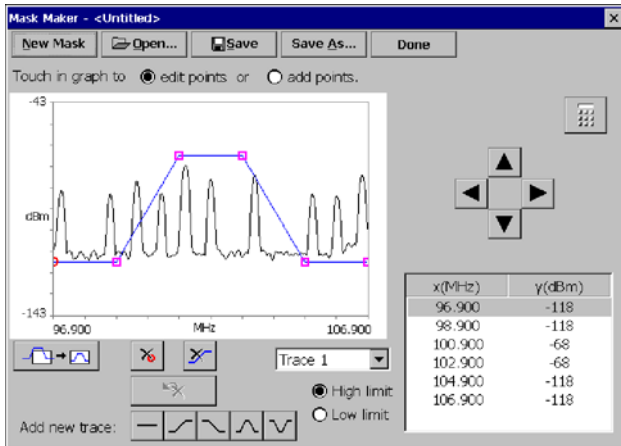
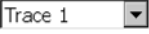



Figure 3-18: The Mask Maker utility

If Mask testing was already enabled for the Spectrum display, 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 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 on the trace selector and select the desired trace from the list.
2. Tap the **edit points** option button above the graph.
3. Tap the point to move and drag it to the new location.

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

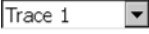

1. Tap the value in the table (the number in either the **x(MHz)** column or the **y(dBm)** column) you want to adjust.
2.  If the cursor arrows are displayed above the table, tap the keypad icon to display the keypad.
3. Use the keypad to type the new value for the point and tap **Enter** when finished.

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.

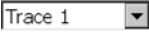
To delete a point from a trace:

1.  If more than one trace is displayed, tap the down arrow on the trace selector and select a 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.

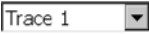
To delete a trace from a mask:

1.  Tap the down arrow 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 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.

To save a mask to a file:

1.  Tap the **Save** button to bring up the save dialog box.
2. Navigate to the location where you want to save the mask file.
3. Enter the name of the mask file.

4. Tap **OK** to save the mask.
5.  To save a mask file to a new name, tap the **Save As** button and use the save dialog box to save the mask to a new name and/or location.

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 3-4: Mask maker buttons and icons












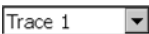






Button/Icon	Description
	Creates a new mask.
	Opens an existing mask for editing.
	Saves changes to the current mask.

Table 3-4: Mask maker buttons and icons (Cont.)

Button/Icon	Description
	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. 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.
	Delete Trace. Tap to delete the selected trace from the mask.
	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 (Loading) a Mask

Before you can perform a mask test, you must define (load) the mask to use for testing. If you have not yet created a mask, see *Creating a Mask* on page 3-25.


To define a mask:

1. Select **View > Define Mask**. This displays the **Trace 2 & Mask** tab of the Setup window.
2. In the **Mask** section of the tab, tap **Browse** and select the mask you want to use for your mask test.
3. Tap the **Enable Mask Testing** check box.
4. To have the YBT250 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 YBT250 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 YBT250 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, with the mask centered on the current Measurement Frequency.

If the signal trace exceeds the mask, the violation icon () appears on the right side of the spectrum graph and the violated mask trace changes color (the specific color depends on the selected color scheme).

A mask trace does not have to cover the entire frequency range of a graph. 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 passed test. A negative value indicates a failed test. A positive value for an upper limit means that 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 YBT250 calculates the difference between the marker and the mask using the above rule to determine the sign of the difference. The YBT250 calculates the difference between the signal level and the level of each of the traces in the mask. The YBT250 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 dBm, the signal level is -10 dBm and the lower limit mask trace level is -30 dBm. Thus, the difference between the upper limit and the signal level is 10 dB, and the difference between the signal level and the lower limit is 20 dB.

The YBT250 displays the M1 marker difference as 10 dB because the signal is closer to the upper limit than it is to the lower limit.

As another example, assume the upper limit mask trace level is 0 dBm, the signal level is -30 dBm and the lower limit mask trace level is -25 dBm. Therefore, 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 YBT250 displays 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 YBT250 displays dashes (----) for the marker difference instead of a number, it means there is no mask defined at the marker frequency.

Locating Interference

To locate interference, you need Option IN1 (Interference Analyst), Option ES1 (1xEV-DO PN Scanner), Option GS1 (GSM PN Scanner), or Option WS1 (W-CDMA Scrambling Code Analyzer), installed on the YBT250. These options provide several methods to locate and identify many types of interfering signals. The YBT250 can identify interference signals, demodulate AM or FM audio signals, assess the strength of an interfering signal, and measure the noise floor on receive channels.

The Interference Display Area

Requires Option IN1

There are several tabs, buttons and icons located in the Interference display area. Figure 3-19 shows a typical Interference strength display.

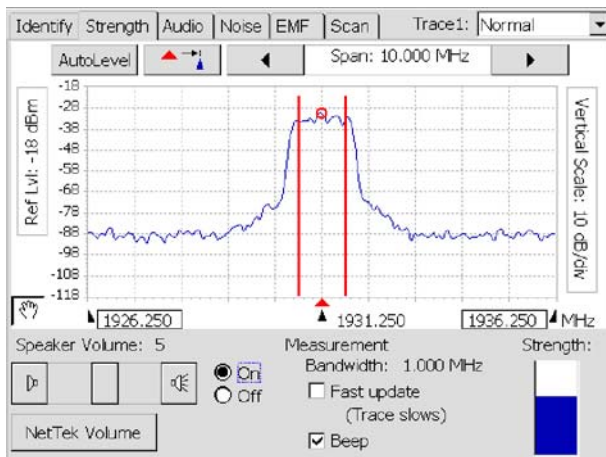



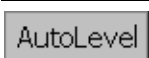
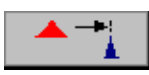





Figure 3-19: The Interference Strength display

Table 3-5 describes the function of each of the Interference window buttons and icons.

Table 3-5: Interference window buttons and icons

Buttons/Icon	Function
	This button starts the automatic identification function (Identify tab only).
	Adjusts the volume of the speaker when listening to demodulated signals (Strength and Audio tab only).
Trace1: <input type="text" value="Normal"/>	Sets the trace type: Normal, Average, Min, Max or Min/Max.
	Restarts trace acquisition when Trace is set to Average, Min, Max or Min/Max.
	Adjusts the Reference Level to provide an optimized waveform display and prevent overload conditions.
	Moves the trace so the measurement frequency is at the horizontal center of the spectrum graph.
	Decreases or increases the frequency span of the trace display.
	Undo reverses the most recent tap or drag action. Only visible after a tap or drag action. Displayed in graph area only.
	Enables or disables Tap or Drag actions on the graph.

Displaying a Spectrum Trace

To begin searching for an interfering signal, you usually begin by displaying a spectrum trace.

To display a spectrum trace:



1. Connect the signal from an antenna to the YBT250 RF INPUT.
2. Select a signal standard.
3. Select a channel.
4.  Tap the Forward or Reverse Link button.
5.  Tap the Interference button.
6. Tap the **Identify** tab. See Figure 3-20.



Figure 3-20: A spectrum trace in the Interference window

Identifying a Signal

Requires Option IN1

Once you can see a signal that you think may be interfering, you can use the automated identification function to identify the signal. The YBT250 will make an estimate of the signal type, choosing between GSM, cdmaOne/cdma2000/1xEV-DO, W-CDMA, IS-136, and analog FM signal types.

1. In the Interference display (button 3), tap the **Identify** tab if needed.
2. Look at the spectrum display to locate the suspected interfering signal. Tap the trace at the frequency of the interfering signal to set the measurement frequency. Try to set the Measurement Frequency to the center of the signal.
3. Look at the **Assignments for this Freq.** readout at the lower left of the display. See Figure 3-20.

This readout displays the signal standard (more than one might be displayed) that has channels defined at the measurement frequency. The YBT250 first looks at the list of preferred signals and then looks at the global channel reference to check for a match. If the Measurement Frequency does not match with a supported standard, *Not Found* is displayed.

4. Select **Measure** to invoke the Identify function.

The YBT250 will perform a series of measurements to identify which signal standard the signal's characteristics most closely match. The results of the Identify function are displayed in the **Measurements suggest** results box. The signals are sorted by frequency, with the signal that most closely matches the measurement frequency listed first. See Figure 3-21.

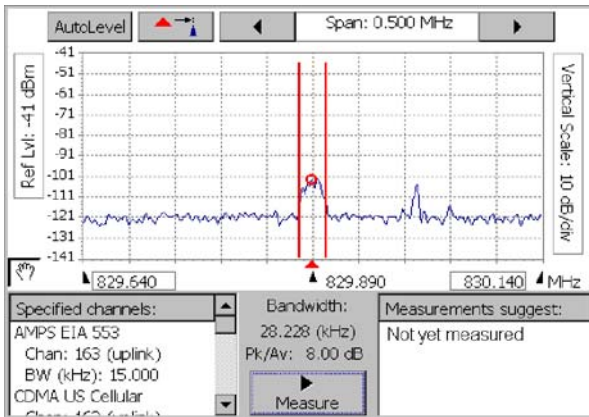



Figure 3-21: Results of an identification test

Locating an Interfering Signal

Requires Option IN1

By attaching a directional antenna to the YBT250, you can locate the source of an interfering signal by measuring the strength of the interfering signal.

To locate an interfering signal:

1. Connect a directional antenna to the YBT250 input.
2.  Tap the **Interference** button.
3. Tap the **Strength** tab.
4. Adjust the span and Measurement Frequency to the area of concern.
5. Set the Measurement Frequency to a signal of interest on the trace. Figure 3-22 shows an example of a signal strength display.

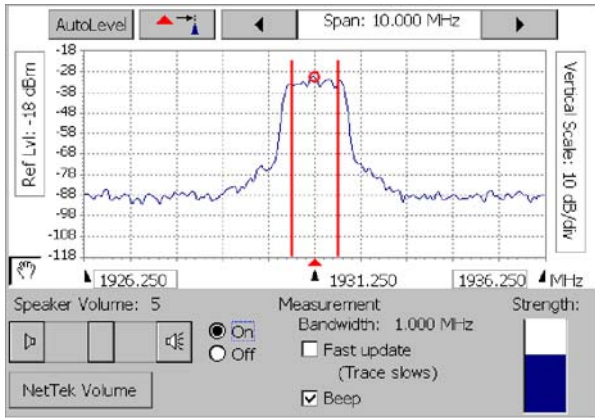


Figure 3-22: Example of a signal strength display

6. To locate an interfering signal, point the directional antenna in different directions.

As you change the direction of the antenna, you will hear a change in the audible tone and beep (if switched on) and see a change in the Strength bar. The source of the signal is located in the direction that results in the highest signal strength.

The Measurement Bandwidth, shown below the graph area in Figure 3-22, is the frequency range that fits within one horizontal division around the Measurement Frequency. You can change the span to adjust the Measurement bandwidth.

The YBT250 indicates signal strength two ways. One indicator is the **Strength** graph located at the bottom-right of the results display area. The Strength graph indicates the signal power detected within the Measurement Bandwidth. As the signal strength increases, the bar on the Strength graph rises.

The second indicator is an audible tone or beep. The audible tone changes pitch as the signal strength changes. The stronger the signal, the higher the pitch. The audible tone is switched on and off by selecting **On** or **Off**, below the trace display.

You can change the volume of the audible tone using the slider control at the bottom-left of the results display area.

The **Beep** causes the audible tone to switch on and off at a rate that varies with the signal strength. The stronger the signal, the faster the audible tone beeps. The **Beep** is activated by selecting the **Beep** checkbox located at the bottom-center of the results display area.


You can increase the rate at which the signal strength indicators are updated by selecting the **Fast Update** checkbox. When **Fast Update** is checked, the trace update rate is slowed so that the strength measurement can speed up. The variation in pitch of the audible tone (and **Beep** if it is selected) occurs much faster when **Fast Update** is enabled.

Demodulating an Interfering Signal

Requires Option IN1

One method to identify an interfering signal is to demodulate the signal. This enables you to listen for any identifying information, such as a station ID, in the signal. A station ID can be particularly helpful when the interfering signal is a radio or broadcast television station. You may also be able to discriminate between possible sources by listening to the characteristic sounds of paging, video, control signals or the harmonics of other common signals.

To demodulate the audio of an interfering signal:

1.  Tap the **Interference** button.
2. Tap the **Audio** tab.
3. Display the trace of the interfering signal.
4. Tap the trace at the peak of the suspected interfering signal to set the measurement frequency. See Figure 3-23.

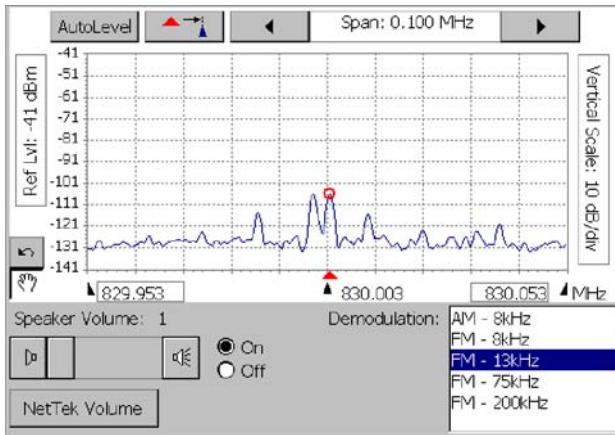


Figure 3-23: Example of an Audio Demod display

5. Select a demodulation type and bandwidth from the **Demodulation** box on the lower-right of the results area. The YBT250 will play the demodulated signal through the speaker. While the audio plays, the trace display is frozen briefly.

NOTE. To conserve power, the YBT250 does not demodulate a signal continuously, even if plugged into an external power source. The demodulation cycles on for four seconds, off for one second and then repeats the cycle.

6. If the audio doesn't sound right, select another demodulation type or bandwidth.

Measuring the Noise Floor

Requires Option IN1

Noise Floor measures all the RF Power coming into the receive antenna within the frequency band of the selected channel. The Noise Floor is the power integrated across the selected channel. To make an accurate measurement, the Noise Floor must be measured on a disabled channel (that is, a channel that is not carrying live traffic). Larger numbers indicate more noise. Figure 3-24 shows an example of a Noise Floor measurement.

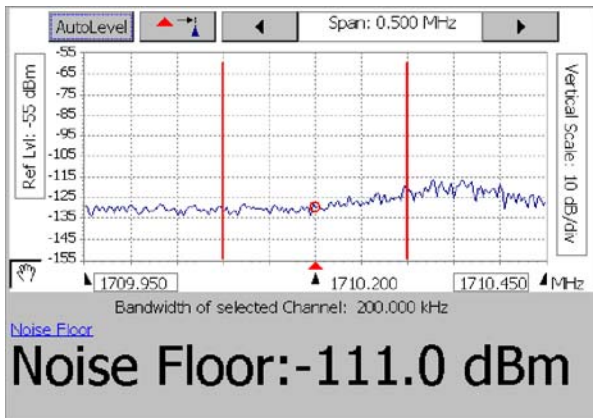




Figure 3-24: Example of a Noise Floor measurement

To measure the noise floor:

1. Connect a signal (see page 2-22) from a BTS receiver test port to the YBT250 RF INPUT connector.
2. If there is no test port:
 - a. Disconnect the receiver cable from the transmitter.
 - b. Connect the receiver cable to the RF INPUT connector.
3. Select a signal standard.

4. Select a channel.
5.  Tap the **Reverse Link** button.
6.  Tap the **Interference** button.
7. Tap the **Noise** tab.


The Noise Floor measurement is displayed below the trace display. Noise Floor is displayed in dBm, with a resolution of 0.1 dB. The two vertical lines in the trace display indicate the upper and lower frequencies of the channel being measured.

Locating Intermittent Interference

Requires Option IN1

Intermittent interference can be difficult to identify. The YBT250 Spectrogram display is ideal for spotting intermittent interference. A spectrogram displays how a signal changes over time, in addition to frequency and level. Because the spectrogram displays signals over a period of time, signals that are intermittent are easy to spot.

To locate an intermittent interference signal:

1. Connect the YBT250 RF INPUT to the signal. The signal may be from an antenna for off-the-air signals or you may need to connect to a test point on the base station.
2.  Tap the **Spectrum** button .
3. Set the Measurement Frequency and span to show the frequency range of concern.
4. Set the Vertical Scale (dB/div) so that the trace nearly fills the vertical range of the graph area.
5. Tap the **Spectrogram** tab. See Figure 3-25.

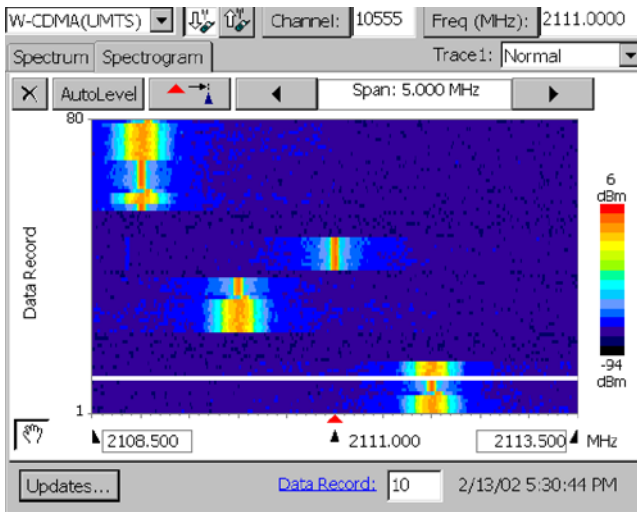


Figure 3-25: Intermittent signal Spectrogram display

6. To locate an intermittent signal, sweep the antenna along the horizon and then vertically, while looking for bursts matching the interfering signal on the spectrogram.

Time in the spectrogram display runs from the bottom to the top, with the most recent data at the bottom of the display. Continuous signals display an uninterrupted vertical line (although the signal level can vary). Intermittent signals will show up as a discontinuous vertical line. Signals of varying frequency will appear as a slanted or crooked line through the display.

To determine the date and time when an intermittent signal occurred:



1. Locate the Data Record cursor at a discontinuous point on the vertical line located at a frequency of interest.
 - a. Tap the Data Record box to assign the knob to the Data Record.

W-CDMA Scrambling Code Analyzer

Requires Option WS1

The W-CDMA Scrambling Code Analyzer detects the scrambling code and pilot power level of each received downlink signal when multiple signals are present. The scanner is intended for off-air reception using an antenna, and measures only downlink signals. The maximum number of signals that can be detected is ten.

To use the W-CDMA Scrambling Code Analyzer:

1. Connect the antenna and filter (if used) to the RF input using high quality cabling. See the note on page 3-47.
2. Select a W-CDMA signal standard.
3. Select a channel.
4.  Tap the **Forward Link** button.
5.  Tap the **Interference** button.
6. Tap the **Scan** tab. See Figure 3-26.

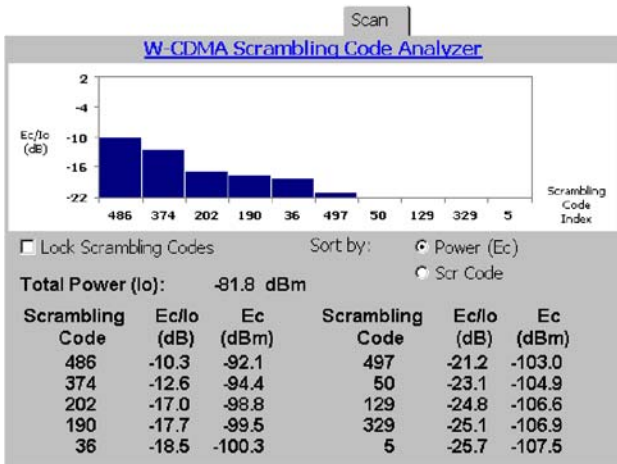


Figure 3-26: W-CDMA Scrambling Code Analyzer display

Table 3-6 describes the Scrambling code measurements.

Table 3-6: Scrambling code measurement fields

Field	Description
Total Power (I _o)	The received power in the W-CDMA signal bandwidth, in dBm. (I _o is also known as N _o or RSSI.)
Scrambling	The Primary Scrambling Code number of each detected downlink
Ec/I _o	The energy per chip in a downlink pilot channel code, normalized to the received power, in dB. Essentially, it is the ratio of the power of each detected pilot channel code to the total received power. An Ec/I _o value of -10 dB indicates that pilot code contributes one tenth of the total received power.
Ec	<p>The absolute power level of each detected pilot channel code, in dBm. (Ec is also known as RSCP.) Results are normally displayed in descending order of Ec/I_o level in the graph and table. As Ec/I_o varies, codes may change order or disappear from the display.</p> <p>In the graph, look for only one or two signals to have high Ec/I_o (>-10 dB). Any other detected signals should have Ec/I_o of 5 to 10 dB less than these to avoid interference. If there are three or more signals of high and approximately equal level, one or more of the transmitters may need adjustment to prevent excessive interference in that location.</p>

Sorting or Locking Scrambling Codes

You can sort or lock the current set of scrambling codes.

To sort the results, select one of the following choices:

- **Power (Ec)** to sort by descending Ec level. (See Figure 3-26.)
- **Scrambling Code (SC)** to sort by ascending Scrambling Code index.
- **Lock Scrambling Codes** to lock and hold the current set of detected Scrambling Codes.

NOTE. While Lock Scrambling Codes is enabled, if a new signal is detected, the YBT250 will not display the new signal until Lock Scrambling Codes is disabled.

To make accurate measurements of the forward link signals, use a receive antenna with a frequency response and bandwidth that is appropriate for the channel you are measuring. Use a high quality, low-loss Band Pass Filter (BPF) to reject signals outside the signal band. If you take measurements near a high-power transmitter, such as commercial TV or radio, a BPF may be necessary for the scanner to produce useable results.

To enter the attenuation values of the antenna, filter, and connecting cable:

1. Tap the **Edit** button.
2. Tap the **Input** tab.
3. Enter the dB attenuation loss value in the **Attenuator Loss** field.
4. Tap the **OK** button.



cdma2000 and 1xEV-DO PN Scanners

Requires Option CS1 (cdma2000 standards) or Option ES1 (1xEV-DO standards)

The cdma2000 and 1xEV-DO PN Scanners display the PN offset and pilot power level of up to ten cdma2000 or 1xEV-DO forward link signals. These scanners are intended for off-air reception using an antenna, and measure only forward link signals.

PN scanner measurements require that YBT250 option CS1 (for cdma2000 standards) and/or ES1 (for 1xEV-DO standards) is installed and that a Tektronix YBGPS1 GPS Timing Reference receiver is installed and active.

To use the cdma2000 or 1xEV-DO PN Scanner:

1. Connect the antenna and filter (if used) to the RF input using high quality cabling. See the note on page 3-51.
2. Select a cdma2000 or 1xEV-DO signal standard.
3. Select a channel.
4.  Tap the **Forward Link** button.
5.  Tap the **Interference** button.
6. Tap the **Scan** tab. Figure 3-27 shows a typical cdma2000 PN scanner display.

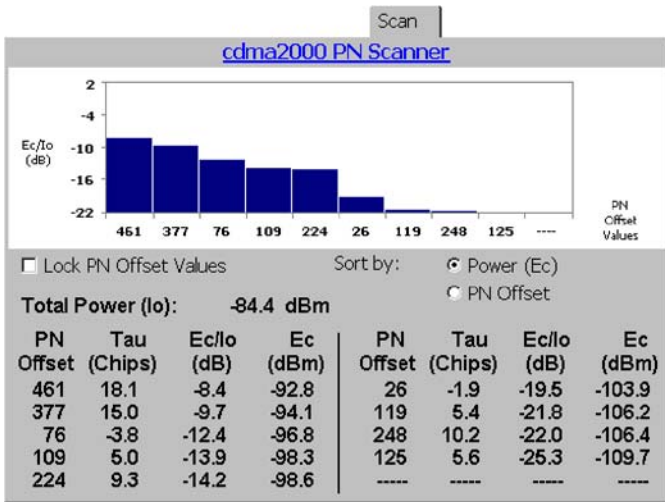


Figure 3-27: A typical cdma2000 PN Scanner display

The following tables describe the cdma2000 and 1xEV-DO PN Scanner controls and measurements.

Table 3-7: cdma2000 and 1xEV-DO PN Scanner controls

Field	Description
Lock PN Offset Values	Locks and holds the current set of PN offsets in the display. The locked PN offset values are updated, but no new PN offsets are added or removed from the display. Disable the Lock PN Offset Values feature to return the display to showing results for the currently detected signals.
Sort By: Power, PN Offset	Sorts measurements by descending Ec value or by ascending PN offset index value.

Table 3-8: cdma2000 and 1xEV-DO PN Scanner measurement fields

Field	Description
Total Power (Io)	<p>cdma2000: The received power in the signal bandwidth (1.23 MHz), in dBm.</p> <p>1xEV-DO: The total received power in the pilot intervals of the signal, in the signal bandwidth (1.23 MHz), in dBm.</p>
PN Offset	<p>The PN Offset of each detected forward link pilot, referenced to the timing input signal. Other detected pilot PN offsets are assigned relative to the highest power pilot.</p> <p>cdma2000: If no timing input signal is available, the highest-powered pilot is assigned PN offset zero.</p> <p>1xEV-DO: If the timing input signal is not detected, the instrument displays the message "ESC/TIMING Reference Not Detected" and the measurement is the Total Power (Io) value.</p>
Tau (Chips)	<p>The timing error, in PN chips, between the ideal and measured PN offset starting time.</p>
Ec/Io	<p>The relative pilot power, in dB, that is detected at the corresponding PN offset. It is the ratio of the detected pilot power at that PN Offset to the total received power. An Ec/Io value of -10 dB indicates that the pilot at this PN offset contains one tenth of the total received power.</p> <p>cdma2000: Ec/Io values less than -20 dB are usually caused by system noise, and can be disregarded.</p>
Ec	<p>The absolute power level of the detected pilot at the indicated PN Offset, in dBm.</p>

For cdma2000 standards, look for only one or two signals to have high Ec/Io (> -10 dB) values. All other detected signals should have Ec/Io values from 5 to 10 dB less than the high signal values to avoid interference. If there are three or more signals of high and

approximately equal level, one or more of the transmitters may need adjustment to prevent excessive interference in that location.

Results are normally displayed in descending order of E_c/I_o level in the graph and table. As E_c/I_o varies, PN offset values may change order or disappear from the display. The maximum number of signals that can be detected is ten.

NOTE. *To make accurate measurements of the forward link signals, use a receive antenna with a frequency response and bandwidth that is appropriate for the channel you are measuring. Use a high quality, low-loss Band Pass Filter (BPF) to reject signals outside the signal band. If you take measurements near a high-power transmitter, such as commercial TV or radio, a BPF may be necessary for the scanner to produce useable results.*

To enter the attenuation values of the antenna, filter, and connecting cable:

1. Tap the **Edit** button.
2. Tap the **Input** tab.
3. Enter the dB attenuation loss value in the **Attenuator Loss** field.
4. Tap the **OK** button.

GSM Channel Scanner

Requires Option GS1

The GSM channel scanner displays channel power and related information on a maximum of 128 GSM forward (down) link signals. The scanner is intended for off-air reception using an antenna, and measures only forward link signals.

To use the GSM channel scanner:


1. Connect the antenna and filter (if used) to the RF input using high quality cabling. See the note on page 3-56.
2. Select a GSM/EDGE signal standard.
3. Select a channel.
4.  Tap the **Interference** button.
5. Tap the **Scan** tab.
6. Tap **Start** and **Stop** to enter start and stop channel numbers.

Figure 3-28 shows a typical GSM Channel Scanner display.

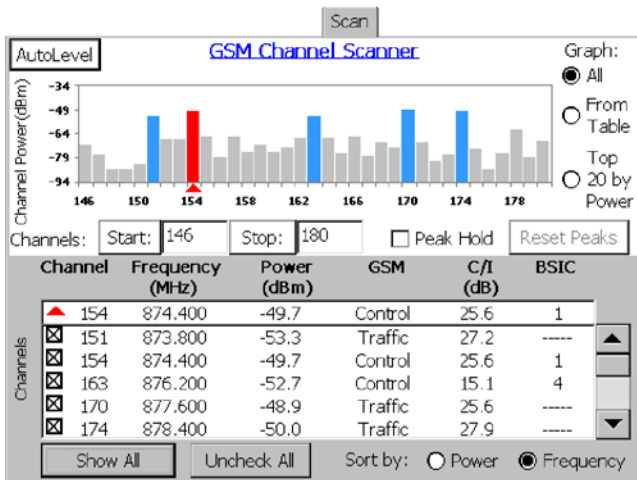


Figure 3-28: A typical GSM Channel Scanner display

The graph displays the power of the channels in the specified channel range (if Graph: All is selected), the channels as listed in the measurement table (if Graph: From Table is selected), or the top 20 channels by power (if Graph: Top 20 by Power is selected).

The following tables describe the GSM channel scanner controls and measurement fields.

Table 3-9: GSM channel scanner controls

Field	Description
Autolevel	Adjusts the graph vertical scale to provide an optimized graph display. This does not change any instrument settings.
Graph: All, From Table, Top 20 by Power	Sets the graph to display all channels in the stop/start range, up to 128 channels (default), just the channels listed in the measurement table (as set with the Show Unchecked check box), or the top 20 channels of all available channels (sorted by power in descending order).
Channels: Start, Stop	Displays and sets the start and stop channel numbers being scanned for graphing and measurement readouts. The maximum channel range is 128 channels. The stop channel must be greater than or equal to the start channel. If you specify a range of channels that is greater than 128, the instrument constrains the channel range to be within 128 channels of the last-entered channel number.
Peak Hold	Displays a horizontal bar above the top of each channel plot in the graph to indicate the channel peak power level from the start of the current measurement acquisition. Selecting Peak Hold also changes the Measurement table Power reading to Peak Power.
Reset Peaks	Clears the current peak power level marks and Measurement table peak power readings, begins acquiring new peak level readings, and displays new peak level marks.

Table 3-9: GSM channel scanner controls (Cont.)

Field	Description
Enable Demodulation check box (adjacent to each channel in the measurement table)	<p>Sets the instrument to take and display GSM, C/I and BSIC demodulation measurements for selected channels. Selecting only those channels for which you need GSM, C/I and BSIC measurements speeds up the measurement acquisition rate.</p> <p>The measurements displayed depend on the detected GSM signal type: If the GSM signal type is Traffic, only the C/I measurement is shown. If the GSM signal type is Control, both C/I and BSIC measurements are shown.</p>
Show Checked/ Show All	<p>Toggles the contents of the measurement table to show all available channels or show only those channels that have their Enable Demodulation check box selected. The default is Show Checked.</p> <p>Sets the view in the measurement table and the graph plot (if Graph From table is selected).</p>
Uncheck All	<p>Clears the Enable Demodulation check box for all listed channels in the measurement table.</p>
Sort by: Power, Frequency	<p>Sorts the displayed measurements table contents by Power (in descending order) or Frequency (in ascending order, based on channel numbers). The table label (on the left side of the table) shows Channels by Power when sorting by power, or Channels when sorting by Frequency.</p> <p>Note that some signal standards restart their channel numbers within their listed channel range.</p>

Table 3-10 describes the GSM channel scanner measurements.

Table 3-10: GSM Channel Scanner measurement table

Field	Description
Marker readout (located above the measurement table)	The measurement values at the current channel marker location (selected channel on the graph). The marker measurements include GSM, C/I and BSIC demodulation measurements, even if they are not enabled in the Measurement table. Use the touch screen or the keypad/knob to change the selected channel on the graph.
Channel	The channel number.
Frequency	The channel frequency, in MHz.
Power, Peak Power	The current channel power, or peak power for the current measurement acquisition period, in dBm. The Peak Hold radio button sets which power measurement is displayed. If the channel is selected for demodulation measurements, then the displayed power of a GSM signal is the channels highest GSM time slot power value (not the channel RF power).
GSM	The detected GSM signal type. This measurement is only displayed for those channels with the Enable Demodulation check box selected. Valid types are Non-GSM, Traffic, Control, and --- (not demodulated).

Table 3-10: GSM Channel Scanner measurement table (Cont.)

Field	Description
C/I	Carrier to Interference ratio (C/I) is the ratio of desired signal (carrier) power to undesired signal (interference) power, in dB units. The NetTek C/I value is derived from the EVM result, and gives an estimate of the power-based C/I value. This measurement is only displayed for those channels with the Enable Demodulation check box selected and when the GSM signal type is either Control or Traffic.
BSIC (Base station identity code)	The code that is broadcast on the SCH (Synchronization Channel) that identifies the NCC (Network Color Code) and the BCC (Base Station Color Code). This measurement is only displayed for those channels with the Enable Demodulation check box selected and when the GSM signal type is Control.

NOTE. *To make accurate measurements of the forward link signals, use a receive antenna with a frequency response and bandwidth that is appropriate for the channel you are measuring. Use a high quality, low-loss Band Pass Filter (BPF) to reject signals outside the signal band. If you take measurements near a high-power transmitter, such as commercial TV or radio, a BPF may be necessary for the scanner to produce useable results.*

To enter the attenuation values of the antenna, filter, and connecting cable:

1. Tap the **Edit** button.
2. Tap the **Input** tab.
3. Enter the total cable, antenna, and/or BPF dB attenuation loss value in the **Attenuator Loss** field.
4. Tap the **OK** button.

The GSM Channel Scanner Process

The following steps describe the GSM channel scanner measurement process:

1. The GSM channel scanner first measures the RF power (200KHz BW) of all specified channels, and displays the RF power values on the graph and in the Power column of the Measurement table. The Marker channel (current selected channel) is plotted in Red. Channels that are checked for demodulation are plotted in Dark Blue. Channels that are not selected for demodulation measurements are plotted in Gray. The Graph radio buttons and the Show Checked/Show All button define what channels will be plotted.
2. The GSM channel scanner then attempts a demodulation measurement on the Marker (selected channel), regardless of if it is selected for demodulation measurements in the Measurement table. If it is a successful demodulation measurement (the signal is a GSM signal), the instrument displays that channels highest GSM time slot power value (not the channel RF power) on the graph and in the Power column of the Measurement table, and shows the GSM signal type, C/I, and BSIC values if appropriate.

If the demodulation measurement is not successful, the GSM type displays Non-GSM, there are no C/I or BSIC measurements, and the Power measurement is the channel RF power.

3. The GSM channel scanner then attempts to do demodulation measurements on those channels selected in the Measurement table for demodulation measurements. If it is a successful demodulation measurement, the instrument displays that channel's highest GSM time slot power value on the graph and in the Power column of the Measurement table, and shows the C/I and BSIC values if appropriate.

If a demodulation measurement is not successful, the GSM type displays Non-GSM, there are no C/I or BSIC measurements, and the Power measurement value displayed is the channel RF power. Channels that are not selected for demodulation measurement remain plotted in Gray and display just the Frequency and channel RF Power measurements.

The scanner changes the demodulation measurement plot colors from Dark Blue to Light Blue regardless of whether the demodulation measurement was successful or not.

4. The GSM channel scanner then starts the measurement sequence over again from the first step.



NOTE. *The function of the Blue graph plots is to indicate which channels are selected for demodulation measurements. The change in color from Dark Blue to Light Blue only indicates that a demodulation measurement attempt was made, and that the graph and Measurement table were updated with the results of the measurement attempt. The color change does not indicate that the demodulation measurement was successful.*

Measuring EMF

Requires Option IN1 or WS1

EMF field strength is a measure of the absolute electromagnetic power of a signal at a particular frequency and bandwidth at the antenna. Option IN1 is required to make RF field strength measurements, and Option WS1 is required to make W-CDMA field strength measurements.

To measure EMF:

1. Connect the hand-held antenna and filter (if used) to the YBT250 RF input. See the note on page 3-63.
2. Select a signal standard.
3. Select a channel.
4.  Tap the **Downlink** button.
5.  Tap the **Interference** button.
6. Tap the **EMF** tab.

7. Select the EMF measurement type in the **Measurement** field (**RF Field Strength** or **WCDMA Field Strength**). See Figure 3-29. The display changes depending on the selected measurement type. The following sections describe each measurement field.

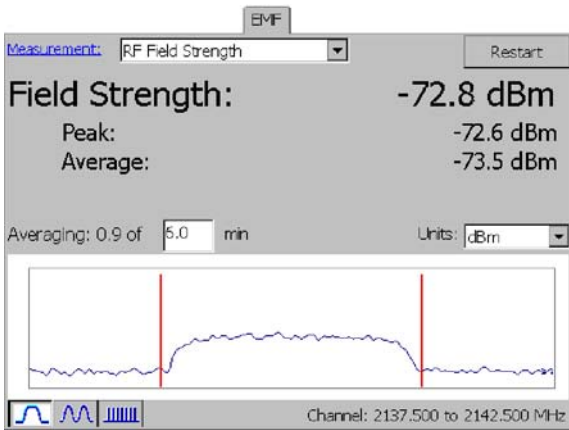


Figure 3-29: EMF RF Field Strength.

Table 3-11 describes the EMF RF Field Strength measurements.

Table 3-11: EMF RF Field Strength measurement fields

Field	Description
Restart	Clears and restarts the measurement averaging.
Field Strength	The EM power at one frequency with no reference to any modulation.
Peak	The highest power level detected during the averaging period.
Average	The average measured power level during the averaging period.

Table 3-11: EMF RF Field Strength measurement fields (Cont.)

Field	Description
Averaging n.n of x.x min	<p>The time period over which to average measurements. The range is from 0.1 to 10 minutes. The default value is six minutes.</p> <p>When the specified averaging interval is reached, the averaging period becomes a rolling memory of the most recent x.x minutes of measurements. The peak and average values are then computed from this rolling time period.</p>
Units	<p>The measurement result units. The dBuV/m, V/m, and W/m² units are only valid when an antenna factor table is being used. See <i>EMF Cable/Antenna Factors</i> on page 3-63 for more information.</p>

NOTE. *If there is no antenna factor table file, the instrument displays the message EMF antenna factor file not found - only dBm is valid.*

The graph at the bottom of the RF Field Strength screen does not have x- or y-axis labels. It is just to indicate signal activity and relative strength.

Figure 3-30 shows the W-CDMA Field Strength measurements on the EMF tab. Table 3-12 describes the EMF W-CDMA Field Strength measurements.

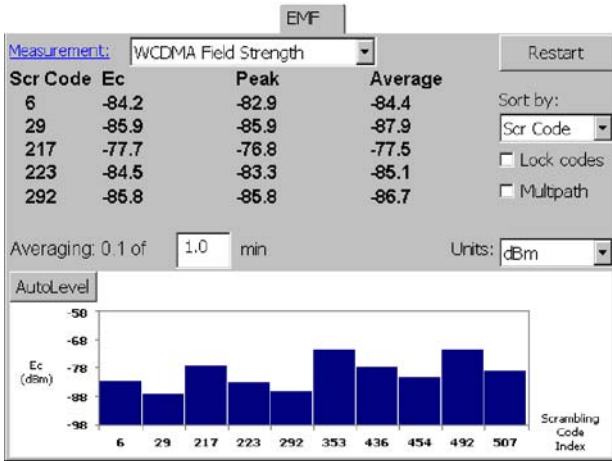


Figure 3-30: EMF WCDMA Field Strength.

Table 3-12: EMF W-CDMA Field Strength measurement fields

Field	Description
Restart	Clears and restarts the measurement averaging.
Scr Code	The Scrambling Code index.
Ec	The power of the detected pilot channel.
Peak	The highest power level detected during the averaging period.
Average	The average measured power level during the averaging period.

Table 3-12: EMF W-CDMA Field Strength measurement fields (Cont.)

Field	Description
Averaging n.n of x.x min	The time period over which to average measurements. The range is from 0.1 to 10 minutes. The default value is six minutes. When the specified averaging interval is reached, the averaging period becomes a rolling memory of the most recent x.x minutes of measurements. The peak and average values are then computed from this rolling time period.
Sort By	Sorts measurements by the selected fields.
Lock Codes	Locks (holds) the current scrambling code indices on the display.
Multipath	Sums up to five multipath components of each detected scrambling code into the Ec and Ec/Io results. When unchecked, only the highest power component is used in each result.
Units	Sets the displayed measurement units.
AutoLevel	Adjusts the graph vertical scale to provide an optimized graph display and prevent overload conditions.

NOTE. *The table is limited to 5 signals at a time while the graph can show 10 signals.*

The averaging and peak measurements apply to each individual scrambling code.

NOTE. *To make accurate measurements of the forward link signals, use a receive antenna with a frequency response and bandwidth that is appropriate for the channel you are measuring. Use a high quality, low-loss Band Pass Filter (BPF) to reject signals outside the signal band. If you take measurements near a high-power transmitter, such as commercial TV or radio, a BPF may be necessary for the scanner to produce useable results.*

To enter the attenuation values of the antenna, filter, and connecting cable:

1. Tap the **Edit** button.
2. Tap the **Input** tab.
3. Enter the total cable, antenna, and/or BPF dB attenuation loss value in the **Attenuator Loss** field.
4. Tap the **OK** button.

EMF Cable/Antenna Factors

The YBT250 requires two system-dependent numeric factors to make the correct EMF calculations; cable loss factors and antenna factors. These factors are stored in separate ASCII files.

The antenna factor represents a conversion between the field strength seen by the antenna and the power measured by the instrument, at specific measurement frequencies. Without an antenna factor defined at the measurement frequency, you can only measure power in dBm.

The cable loss is important for accurate measurements. Without accounting for cable attenuation, you will still be able to measure field strength, but the instrument warns you that the results would be more accurate with a cable loss value defined at the measurement frequency.

Of these two factors, the antenna factor table has more impact on measurement accuracy than the cable loss factor table. If you can only create one table, create the antenna factor table.

EMF Cable/Antenna Factors Tables

The cable loss and antenna factor data is stored in tab-delimited or comma-separated value (CSV) format ASCII text files in non-volatile memory. The instrument searches for these files in the following location and file names:

BuiltInDisk\YBT250 EMF Antenna Factors.txt
BuiltInDisk\YBT250 EMF Cable Loss.txt
BuiltInDisk\YBT250 EMF Antenna Factors.csv
BuiltInDisk\YBT250 EMF Cable Loss.csv

The content is the same in both formats. Use CSV if you are more likely to edit the tables in a spreadsheet program such as Microsoft Excel. Use a text format if you are more likely to edit them in Microsoft WordPad on the NetTek Analyzer Platform.

To use MS Excel to create a cable or antenna loss factors file:

1. In MS Excel, enter frequencies in column A and offsets in column B.
2. Select **File > Save As**.
3. Select **Text (Tab delimited)** or **CSV (Comma delimited)** as the file type.
4. Select **OK**.
5. Transfer the table files to the appropriate location on the NetTek Analyzer Platform (as listed above).

When you make field strength measurements in any unit other than dBm, the YBT250 automatically applies both the antenna and cable loss factors for the current frequency. If you choose a frequency between two entries in your table, the YBT250 interpolates between the two offset values. If you are outside the frequency range of your table, the YBT250 uses the offset at the nearest defined frequency, and warns you that you are outside the table range.

EMF Cable/Antenna Factors Table Format

Observe the following guidelines when editing or creating cable loss or antenna factor files:

- Each file contains an optional header row, followed by one or more rows containing a frequency and an offset value separated by a comma or tab.
- Do not supply unit designators: all frequencies are in Hz, and all offsets are in dB.
- Frequencies should be within the instrument measurement range.
- Losses are positive numbers less than 100 dB.

The following are brief examples of the cable or antenna factor file formats:

CSV format, no header:

```
800000000, 1.0  
850000000, 1.8  
900000000, 2.0
```

CSV format, with header:

```
Frequency, Offset  
800000000, 1.0  
850000000, 1.8  
900000000, 2.0
```

Tab format, no header: (< t > represents tab character)

```
800000000 < t > 1.0  
850000000 < t > 1.8  
900000000 < t > 2.0
```

Tab format, with header: (< t > represents tab character)

```
Frequency < t > Offset  
800000000 < t > 1.0  
850000000 < t > 1.8  
900000000 < t > 2.0
```


Taking Measurements





The YBT250 provides measurement capabilities to quickly and easily determine the condition of a transmitter. Measurements are available to measure power, spectral response and modulation.

The Measure Window Display

The Measure window displays measurement results for the selected measurement appear. The Measure window is dynamic, and changes depending on the selected measurement.

Table 3-13 lists some common buttons and icons that can appear in the Measure window display and it explains what each button or icon represents.

Table 3-13: Measure window buttons and icons

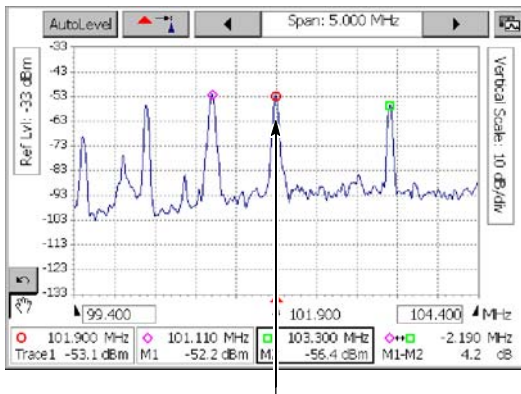
Button	Function
	Sets the horizontal range to one channel width plus half a channel on either side (Channel Power measurement only).
	Sets the horizontal range to just over five channels (Channel Power measurement only).
	Sets the horizontal range to 10 MHz or 10 channel widths, whichever is greater (Channel Power measurement only).
	This arrow is a Fail indicator. It appears when a measurement exceeds upper or lower test limits, as set in the Limits tab.

Setting the Measurement Frequency

The frequency at which measurements are made is called the Measurement Frequency. Before making a measurement, you must ensure the Measurement Frequency is properly set.

The measurement frequency is indicated on the spectrum display in two ways. One indicator is the **Freq (MHz)** readout. For example, in Figure 3-31 the Freq (MHz) readout shows a measurement frequency of 878.4900 MHz. The second measurement frequency indicator is the small triangle and circle that appears on the trace display.

Note that the Measurement Frequency can be located anywhere in the spectrum display; it does not have to be located at the center.



Measurement Frequency Indicator



Figure 3-31: Measurement Frequency indicator

There are four ways to set the measurement frequency:

- Tap the trace at the point you want to measure the frequency
- Select a channel number

- Enter the measurement frequency with the numeric keypad
- Use the knob control to set a frequency

To set the measurement frequency by tapping the display:

1. If Markers are displayed, tap the Measurement Frequency Marker box (labeled as Trace 1/2).
2. Tap the trace at the point where you wish to make a measurement.
 -  To increase the precision of where the frequency is set, tap the decrease span button  to change the horizontal scale of the display.

To set the measurement frequency using the numeric keypad:

1. Tap the **Freq (MHz)** button. This displays the input keypad. See Figure 3-32.



Figure 3-32: Entering the measurement frequency with the keypad

2. Enter the specific frequency at which you want to make measurements 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 instrument, the measurement frequency is set to the maximum or minimum, depending on the value you entered.

To set the measurement frequency using the knob:

1. Tap the box displaying the measurement frequency (*not* the Freq (MHz) button). This assigns the knob to the measurement frequency. The label above the knob display will change to **Freq (MHz)**.
2. Tap the knob to change the measurement frequency.
 - Tap the top half of the knob to make large changes to the measurement 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.

What Measurements are Available


The measurements available depend on the selected signal standard and which options are installed. Some measurements, such as cdmaOne Code Domain Power, are not available for all standards. All measurements require options to be installed. The option required depends on the type of measurement and signal standard. For information on the available measurement options, see Appendix C.

Measuring RF Power

Requires option AR1, IR1, CR1, or WR1

RF Power can be measured by itself and/or compared to a specified Reference Channel.

To measure RF Power:

1.  Tap the **Measurement** button.
2. Select a signal standard.
3. Tap **Select Measurement**.
4. Tap **RF Power**. See Figure 3-33.

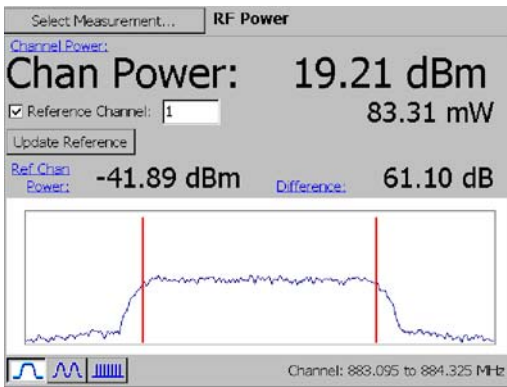






Figure 3-33: RF Power measurement for CDMA

5.  Tap the **Forward Link** button.
6. Select a channel:
 - a. Tap the Channel box. This assigns the knob and numeric keypad to Channel.
 - b. Tap the numeric keypad to enter the channel number directly or use the knob to change the channel number.

The vertical bars in the display represent the upper and lower frequency limits of the specified channel. You can change horizontal range (span) of the display by selecting one of the three buttons in the lower-left corner of the display:

- Select  to change the horizontal range to one channel width plus half a channel or either side.
- Select  to change the horizontal range to just over five channels.
- Select  to set the horizontal range to 10 MHz or 10 channel widths, whichever is greater.

To compare the power level against another channel (only for non-bursted signal types), such as a reference channel:

1. Tap the Reference Channel box.
 - Use the numeric keypad or the knob to set the Reference Channel number.
2. Tap the Update Reference button any time you want to remeasure the Reference Channel's power.

NOTE. *Ref Chan Power* is the power of the Reference Channel measured when you tap the Update Reference button. The reference power is the power at the forward frequency of the reference channel (unless you are using W-CDMA, in which case it is the power at the reference channel).


Difference is the measured difference in power between the selected channel and the reference channel.

When GSM is the selected signal standard for RF Channel Power measurements, the YBT250 attempts to locate and measure an RF power burst during the active burst. If no burst is found, the measurement defaults to a continuous power measurement on the selected channel, and displays a dialog stating that no RF burst was found.

Multiple Channel RF Power Measurements (Option CR1)

The Multiple Channel RF power measurement lets you measure total RF power within a user-settable bandwidth for cdmaOne and cdma2000 signals. The measurement band is centered on the measurement frequency.

To measure Multiple Channel RF Power:

-  Tap the **Measurement** button.
- Select a cdmaOne or cdma2000 signal standard.
- Tap **Select Measurement..**
- Tap **RF Power**.
- Tap the Single-Channel list.
- Select **Multi-Channel**.
- Tap the **Channel** or **Freq (MHz)** field and enter the center channel or frequency to measure.
- Tap the **Measurement BW (MHz)** field.
- Use the knob or keypad to enter the measurement bandwidth. The minimum bandwidth is a single channel of the selected standard; the maximum bandwidth is 10 MHz.

Tap the online help link to display more information about a measurement.

Measuring GSM/EDGE RF Power


Requires option EM1

The GSM/EDGE RF Power measurement measures the average RF power transmitted during the useful part of a GSM time slot.

The measurement can, at your option, use a specified BCCH channel to acquire time slot frame sync, enabling identification and measurement of individual GSM frame time slots (0-7).

You can measure and display each RF time slot power independent of other levels. If BCCH frame sync is available, you can also display the RF power as a difference value, relative to the BCCH Slot 0 power level.

To measure GSM/EDGE RF Channel Power:

1.  Tap the **Measurement** button.
2. Tap **Select Measurement...**
3. Select a GSM/EDGE signal standard.
4. Tap **RF Power**. See Figure 3-34.

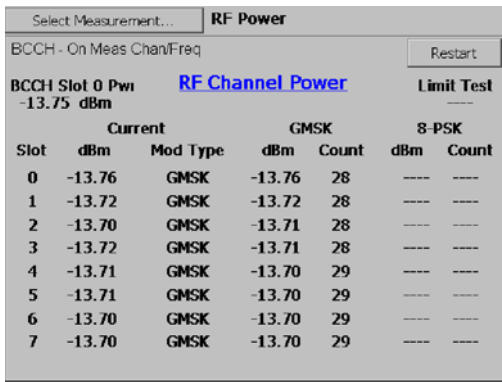


Figure 3-34: GSM/EDGE RF Power measurement


5.  Select Forward Link.
6. Tap the Channel box and enter a valid channel number for the current standard.

Table 3-14 describes the GSM/EDGE RF Power measurement fields.

Table 3-14: GSM/EDGE Power vs. Time fields

Field	Description
BCCH	The slot 0 signal source. Valid signal sources are None, On Meas Chan/Freq, On Channel xxx, and On Freq xx.xxx, where xxx and xx.xxx are the numeric values for a channel or frequency, respectively. See page 3-76 for information on setting the BCCH signal source (frame sync mode).
BCCH Slot 0 Pwr	The BCCH slot 0 average power value. The BCCH slot 0 power measurement value is always in dBm (absolute). Note that the BCCH Slot 0 Power value is displayed only if the BCCH Frame Sync control is not set to OFF, a valid BCCH channel is present, and frame sync is acquired.
Restart	Clears all multi-slot averaged measurement and count values and then restarts the averaging process.
Limit Test	Shows whether any measurements are outside the defined limit test values. See page 3-134 for information on enabling limit testing.
Current column	The current power value and modulation type for each slot.
GMSK column	The average power reading and number of acquisitions averaged (count) for GMSK signals for each slot. See page 3-78 for information on setting the number of acquisitions to average.
8-PSK column	The average power reading and count (number of acquisitions) averaged (count) for 8-PSK signals for each slot. See page 3-78 for information on setting the number of acquisitions to average.

Setting GSM/EDGE BCCH Frame Sync Modes

To set the GSM/EDGE RF Channel Power BCCH Frame Sync mode:

1. Tap the **Edit** button.
2. Tap the **Meter** tab.
3. Select a GSM/EDGE signal standard from the list at the top of the window. See Figure 3-35.

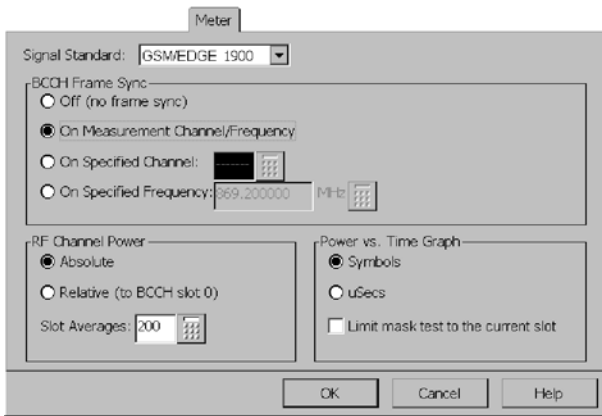


Figure 3-35: GSM/EDGE RF Power measurement parameters

4. Select a BCCH Frame Sync mode:
 - **Off (no frame sync):** Turns off BCCH frame sync, causing the YBT250 to attempt to acquire slot sync by using the power envelope ramps (edges) of the received signal. The YBT250 then measures one randomly-chosen slot. Figure 3-36 shows a typical RF Power measurement with BCCH set to Off.
 - **On Measurement Channel/Frequency:** Sets the YBT250 to frame sync on slot 0 of the currently measured channel/frequency, which is displayed in the Channel and Freq (MHz) fields at the top of the measurement display.

- **On Specified Channel:** Sets the YBT250 to frame sync on slot 0 of the specified channel. Tap the keypad icon to enter a channel number.
- **On Specified Frequency:** Sets the YBT250 to frame sync on slot 0 of the specified frequency. Tap the keypad icon to enter a frequency value.

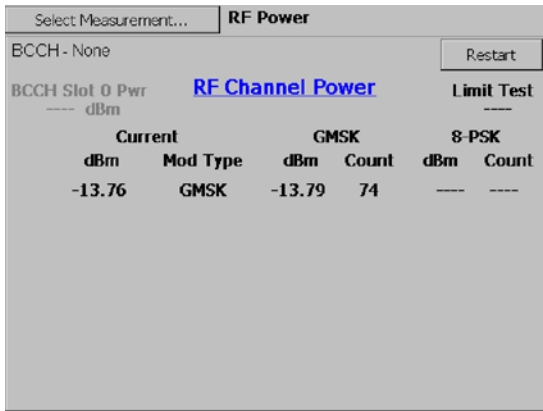


Figure 3-36: GSM/EDGE RF Power with BCCH turned off

5. Tap **OK** to accept the selections, close the Setup window, and return to the **RF Power** display. Tap **Cancel** to close the Setup window without taking any action.

When any of the BCCH Frame Sync **On** modes are selected, the YBT250 attempts to detect the FCCH and SCH bursts on the specified Frame Sync channel. If it detects the bursts, the YBT250 establishes frame timing and can then measure any of the slots (0..7) within the frame.

If the YBT250 does not detect the sync bursts, it attempts to find slot timing by using the power envelope ramp edges of the signal on the measurement frequency or channel.

Channel and Frequency Setting Interactions

When you enter a value in the On Specified Channel field, the value in On Specified Frequency updates to reflect the frequency associated with the channel number for the current measurement standard.

When you enter a value in the On Specified Frequency field, the value in the On Specified Channel field also updates as follows:

- If the specified frequency has an associated channel number for the current measurement standard, then the On Specified Channel field displays the channel number.
- If the specified frequency is within the range of a channel of the current measurement standard, but does not align exactly with a channel number, then the On Specified Channel field displays the nearest channel number in reverse video (white/gray text on a black background).
- If the specified frequency is outside the range of a channel of the current measurement standard, then the On Specified Channel field displays dashes in reverse video (white/gray text on a black background).
- When On Specified Channel is selected, changing to a different GSM measurement standard can cause the channel number to change to a valid channel number in the new standard. The On Specified Frequency value also changes to display the frequency for the new channel and standard.

Setting GSM/EDGE RF Channel Power Modes

To set the GSM/EDGE RF Channel Power mode:

1. Tap the **Edit** button.
2. Tap the **Meter** tab.
3. Select a GSM/EDGE signal standard from the list at the top of the window.

4. Select an RF Channel Power mode:
 - Absolute: displays all slot power measurement values as absolute, in dBm units. See Figure 3-37.
 - Relative (to BCCH slot 0): displays all slot power measurement values relative to the BCCH Slot 0 power measurements, in dB units. See Figure 3-38.
 - Slot Averages: Sets the number of acquisitions over which to average slot power measurements. Tap the keypad icon to enter a value from 1 to 200 (the default is 200).

Select Measurement...		RF Power					
BCCH - On Channel: 606							Restart
BCCH Slot 0 Pwr		RF Channel Power				Limit Test	
-13.78 dBm						---	
		Current		GMSK		8-PSK	
Slot	dBm	Mod Type	dBm	Count	dBm	Count	
0	-13.81	GMSK	-13.81	45	---	---	
1	-14.90	8-PSK	---	---	-14.88	45	
2	-71.91	Idle	---	---	-15.86	6	
3	-70.17	Idle	---	---	---	---	
4	-70.72	Idle	-17.77	2	---	---	
5	-71.82	Idle	-18.77	17	---	---	
6	-72.14	Idle	---	---	---	---	
7	-71.46	Idle	---	---	-20.90	2	

Figure 3-37: GSM/EDGE Absolute RF Power measurement

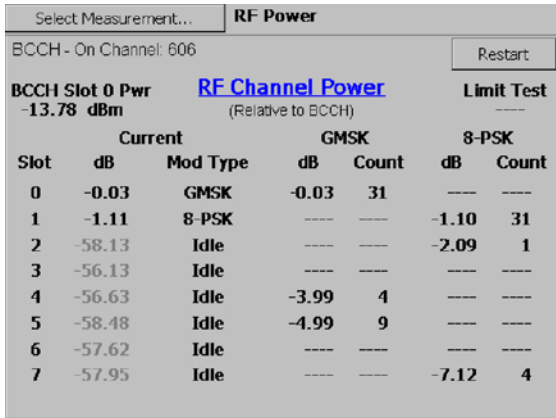


Figure 3-38: GSM/EDGE Relative RF Power measurement

5. Tap **OK** to accept the selections, close the Setup window, and return to the RF Power display. Tap **Cancel** to close the Setup window without taking any action.



Measuring 1xEV-DO RF Power

Requires option CRE

You can measure the RF Power of a 1xEV-DO signal within a selected forward channel. A basestation using 1xEV-DO signals can transmit at idle and non-idle power levels depending on the use of the individual slots for carrying data at that time. The YBT250 distinguishes between idle and non-idle slots and performs power measurements on each type of slot.

Look at the graph to see whether the waveform power remains within the green lines of the mask. Look at the readouts to see the average power.

To measure 1xEV-DO RF Power:

1.  Tap the **Measurement** button.
2. Tap **Select Measurement...**
3. Select a 1xEV-DO standard.
4. Tap **RF Power**.
5.  Tap the Forward Link button.
6. Tap the Channel box and enter a valid channel number for the current standard.
7. Tap the **Idle** or **Non-Idle** button. See Figure 3-39. Table 3-15 describes the 1x-EVDO measurement fields.

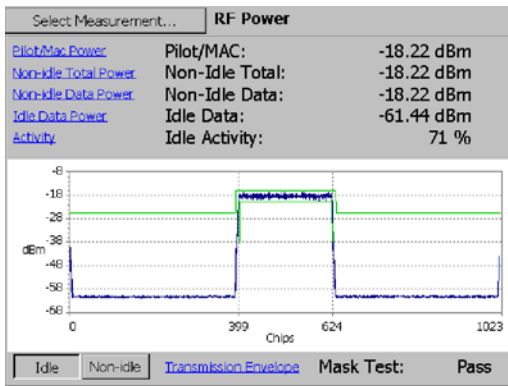


Figure 3-39: 1xEV-DO RF power measurement

Table 3-15: 1x-EVDO RF Power measurement fields

Measurement	Description
Pilot/MAC Power	Average power of Pilot/MAC intervals of all half-slots
Non-Idle Total	Average power of entire half-slot of non-idle half-slots

Table 3-15: 1x-EVDO RF Power measurement fields (Cont.)

Measurement	Description
Non-Idle Data	Average power of data intervals of non-idle half-slots
Idle Data	Average power of data intervals of idle half-slots
Activity	Percentage of acquired half-slots which are of the selected type (idle or non-idle)

Setting 1xEV-DO RF Power Averaging

This function lets you set the number of half-slots over which to average RF power measurements. Earlier 1xEV-DO standards required averaging RF power measurements over 100 half-slots. Newer standards require averaging RF power measurements over 512 half-slots. To set the 1xEV-DO half-slot power averaging mode:

1. Tap the **Edit** button.
2. Tap the **Meter** tab.
3. Select a 1xEV-DO standard.

Figure 3-40 shows a 1xEV-DO partial Meter tab with the RF Power Averaging area marked.

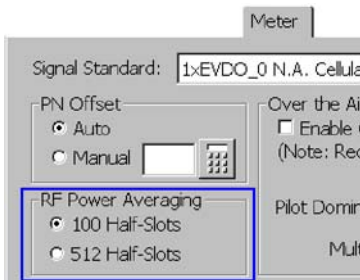


Figure 3-40: Setting 1xEV-DO RF Power Averaging

4. Tap **100 Half-Slots** or **512 Half-Slots** to select the number of half slots over which to average RF power measurements.
5. Tap **OK** to accept the setting change.

1xEV-DO Transmission Envelopes on the RF Power Screen

The YBT250 draws a waveform representing the averages of either the idle (not transmitting power in data interval) slots or the non-idle (transmitting power in data interval) slots. The averaging smooths out the more extreme bumps in the waveforms. Idle slots and non-idle slots are averaged separately.

The horizontal axis of the graph is in chips, and the first and last chip of each data interval is marked.

If the waveform strays outside the green lines of the mask, the mask test result will display Fail, and the section(s) of the mask where the failure occurred will turn from green to red. There are mask sections for each data interval, each mac interval, and for the pilot interval.

You can enable or disable the Mask test by tapping View > Mask. To set alarm actions (such as beeping), select **Setup > Edit > Limits**.

Mask for Idle Slots. Select the **Idle** button. In the graph area, you will see a time-domain mask represented by green lines within which you want to see a square waveform representing the Pilot/MAC signal. If the waveform strays outside the mask, the Mask Test results will display Fail.

Mask for Non-Idle Slots. Select the **Non-idle** button. In the graph area, you will see a time-domain mask represented by green lines within which you want to see a long, relatively flat waveform representing the data-interval part of the signal. If the waveform strays outside the mask, the Mask Test results will say Fail.

Troubleshooting. The YBT250 attempts to collect 100 or 512 half slots of the selected slot type (idle or non-idle) before displaying a result. If the YBT250 cannot collect enough half-slots of the selected type to make the measurement after collecting 1000 total half-slots, the instrument displays the average waveform for as many half-slots as could be collected, and displays the message “* Waveform not fully averaged *”. If no half-slots of the requested type could be

collected during the attempt, the instrument displays “* No non-idle (idle) half slots found *”.

To speed up the measurement rate, switch to the other slot type by pressing the appropriate button (Idle or Non-Idle) at the bottom of the screen. This increases the measurement update rate, and the numeric power results are still valid.



A test may take a long time to run if the basestation is not currently transmitting very many of the type of slot you are trying to measure.

Measuring GSM/EDGE Power vs. Time

Requires option EM1

The Power vs. Time measurement (GSM/EDGE signals) compares the RF power burst envelope for the specified slot against a mask defined by the selected signal standard and measured modulation type. The comparison determines whether the burst envelope power and timing constraints are within the mask constraints for that slot and modulation type. This test verifies that the transmitter ramps up, maintains RF power, and turns off completely within the time envelope defined for the standard and modulation type.

To measure GSM/EDGE Power vs. Time:

1.  Tap the **Measurement** button.
2. Tap **Select Measurement...**
3. Select a GSM/EDGE Signal Standard.
4. Tap **Power vs. Time**. See Figure 3-41.
5.  Tap the Forward Link button.
6. Tap the Channel or Frequency box and enter a valid channel or frequency value.
7. Tap the **Slot** field and select a slot number to measure. Or select **Any** to display the first detected slot using the specified modulation type (8-PSK or GSMK).
8. Tap the **Modulation** field to select the modulation type to detect.

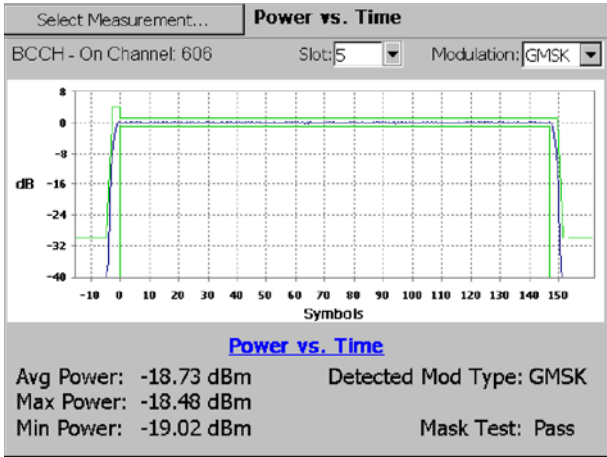


Figure 3-41: GSM/EDGE Power vs. Time measurement

Table 3-16 describes the GSM/EDGE Power vs. Time measurement fields.

Table 3-16: GSM/EDGE Power vs. Time fields

Field	Description
BCCH	The slot 0 signal source. Valid signal sources are None, On Meas Chan/Freq, On Channel xxx, and On Freq xx.xxx, where xxx and xx.xxx are the numeric values for a channel or frequency, respectively. See page 3-76 for information on setting the BCCH signal source (frame sync mode).
Slot	The specified slot to measure.

Table 3-16: GSM/EDGE Power vs. Time fields (Cont.)

Field	Description
Graph	<p>The specified slot signal and the mask limits against which the signal is compared. The graph vertical units are the measured slot power, in dB, relative to the computed average power. The graph horizontal units can be either symbols or time. See page 3-87 for information on setting the graph units.</p> <p>The mask used for testing is determined by the GSM/EDGE standard and the detected modulation type.</p>
Avg Power, Max Power, and Min Power	The slot average, maximum, and minimum power values, in dBm. The Avg, Max and Min power values are computed only for the useful part of the burst.
Detected Mod Type	The actual measured signal modulation type. The YBT250 first searches for a valid signal for the modulation type selected in the Modulation list. If that modulation type is not detected, the YBT250 then searches for the other modulation type. If neither modulation type is detected, this field shows dashes (----).
Mask Test	The pass or fail status of the mask test. The mask used for testing is based on the GSM standard and the detected modulation type. Figure 3-42 shows a failed Power vs. Time mask test.

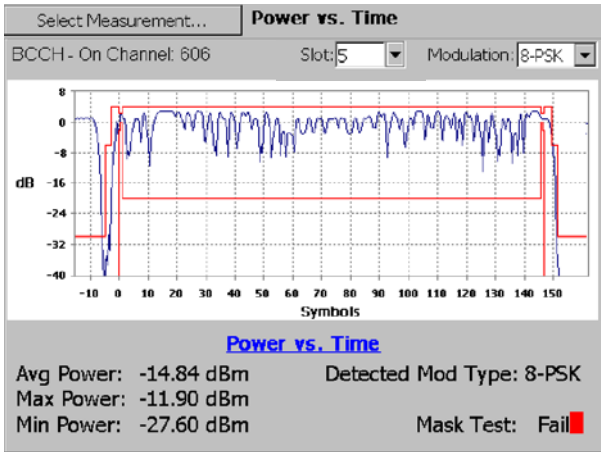


Figure 3-42: GSM/EDGE Power vs. Time mask fail example

NOTE. To search for the modulation type in all slots, instead of only the specified slot, set the BCCH Frame Sync control to Off.

Setting GSM/EDGE Power vs. Time parameters

To set the GSM/EDGE Power vs. Time graph horizontal units:

1. Tap the **Edit** button.
2. Tap the **Meter** tab.
3. Select a GSM signal standard.
4. Select the Power vs. Time Graph parameters:
 - Symbols: Sets the graph horizontal units to symbols.
 - μ Secs: Sets the graph horizontal units to microsecond time units.



- Limit mask test to the current slot: Enables use of a truncated version of the mask (the horizontal portions are omitted from the beginning and ending of the mask) to allow signals that contain active slots adjacent to the slot being tested to pass the mask test. The default value is not enabled (not checked), which corresponds to using the complete mask as defined by the current standard and modulation type.
5. Tap **OK** to accept the selections, close the Setup window, and return to the Power vs. Time display. Tap **Cancel** to close the Setup window without taking any action.

Measuring Peak to Average Power Ratio

Requires option AR1, IR1, CR1, or WR1

The YBT250 enables you to check transmitter headroom by measuring the Peak to Average Power Ratio.

To measure the Peak to Average Power Ratio:

1.  Tap the **Measurement** button.
2. Tap **Select Measurement...**
3. Tap **Peak/Average**. See Figure 3-43.
4.  Tap the Forward Link button.
5. Select a signal standard.
6. Select a channel.

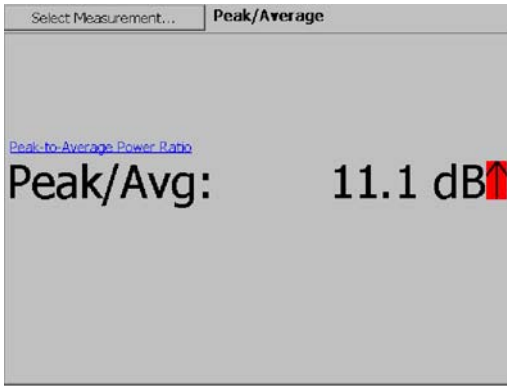


Figure 3-43: A typical Peak to Average Power Ratio display


Measuring Carrier Frequency


Requires option AR1, IR1, CR1, or WR1

The Carrier Frequency measurement actually displays three measurements: carrier frequency and frequency error expressed in frequency and parts per million (ppm). cdma2000 and 1xEV-DO measurements also display the signal PN offset value.

NOTE. To improve carrier frequency measurement accuracy, connect a cable from the BTS transmitter External Frequency Reference signal (see page 2-25 for a list of acceptable frequencies) to the FREQUENCY REFERENCE INPUT on the YBT250. You can also use a Tektronix YBGPS1 GPS Timing Reference to improve carrier frequency measurement accuracy.

To measure the carrier frequency:

1.  Tap the **Measurement** button.
2. Select a signal standard.
3. Tap **Select Measurement....**

4. Tap **Carrier Frequency**. See Figure 3-44.
5.  Tap the **Forward Link** button.
6. Select a channel.

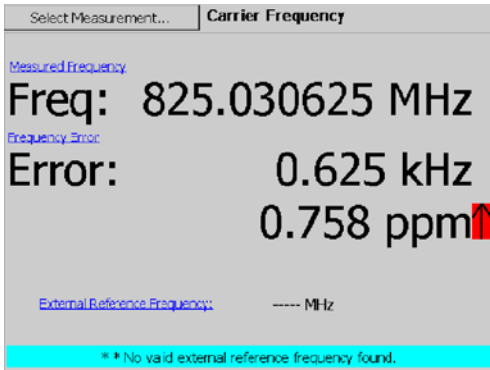


Figure 3-44: A Carrier Frequency display

The Carrier Frequency is the actual measured frequency for the selected channel. If the measurement frequency is not within the selected channel (indicated by a black background in the Channel box), a warning is displayed.

Frequency Error is the difference in frequency between the measured frequency of the selected channel and the frequency assigned to the channel in the Channel Table file. Excessive frequency error can prevent demodulation of the received signal. The Frequency Error measurement can only be made on channels in the current Channel Table. If a carrier is not detected close to the Measurement Frequency, the measurement cannot be made and an error message is displayed.

If a valid external reference frequency (see page 2-25) or YBGPS1 GPS Timing Reference is connected to the instrument, the frequency (or timing pulse rate for the YBGPS1 Timing Reference) of the external reference is displayed at the bottom of the screen. If the instrument is using the internal timing reference signal, then the external reference readout shows --- (dashes).

NOTE. *If the YBT250 indicates there is no signal when the signal standard is set to W-CDMA, verify that the Scrambling Code setting is correct. If it is set to Manual and the wrong value is entered for the scrambling code, the YBT250 will not find a signal. The YBT250 does not show signals with other scrambling codes when the scrambling code is set to Manual.*

cdma2000 and 1xEV-DO measurements also display the signal PN offset value.


Measuring Occupied Bandwidth

Requires option AR1, IR1, CR1, or WR1

One way to check the spectral response of the transmitter is to measure the Occupied Bandwidth. The YBT250 enables you to check the signal width of the selected signal using the Occupied Bandwidth measurement.

The Occupied Bandwidth is the frequency range where 99% of the power transmitted in a single channel lies. This measurement can be properly made only if the channel being measured has no active channels adjacent to it. If there is a signal in either channel adjacent to the selected channel, the signal adds power to the measurement, thus resulting in an inaccurate measurement.

To measure the occupied bandwidth:

1.  Tap the **Measurement** button.
2. Tap **Select Measurement...**

3. Tap **Occupied Bandwidth**. See Figure 3-45.

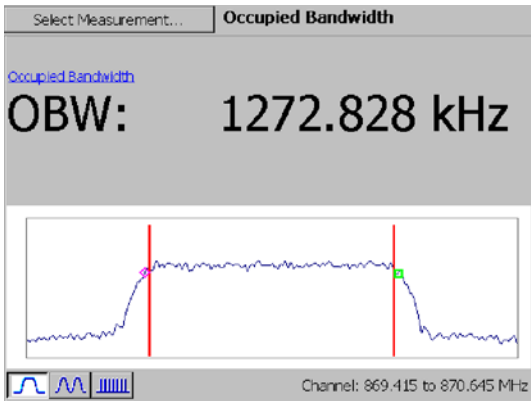






Figure 3-45: A typical Occupied Bandwidth display

4.  Tap the **Forward Link** button.
5. Select a signal standard.
6. Select a channel.

The vertical bars in the display represent the upper and lower limits of the specified channel. You can change the horizontal range of the display by selecting one of the three buttons in the lower-left corner of the display:

- Select  to change the horizontal range to one channel width plus half a channel or either side.
- Select  to change the horizontal range to just over five channels.
- Select  to set the horizontal range to 10 MHz or 10 channel widths, whichever is greater.


The two markers on the waveform indicate the left and right edges of the measurement.

Measuring cdmaOne and cdma2000 Signal Quality

Requires option CD1 or CD2

For cdmaOne and cdma2000 signal quality, the measurements performed are: Waveform Quality (Rho), Error Vector Magnitude, Pilot time Alignment, PN Offset and Carrier Feedthrough.

To measure signal quality:

1. Select the appropriate CDMA Signal Standard.
2. If available, connect the BTS Even Second Clock to the TIMING INPUT connector on the YBT250. Alternatively, you can use the Tektronix YBGPS1 GPS Timing Reference to provide a CDMA measurement timing reference. See *GPS Overview* on page 2-51 for more information.
3.  Tap the **Measurement** button.
4. Tap **Select Measurement...**
5. Tap **Signal Quality**. See Figure 3-46.

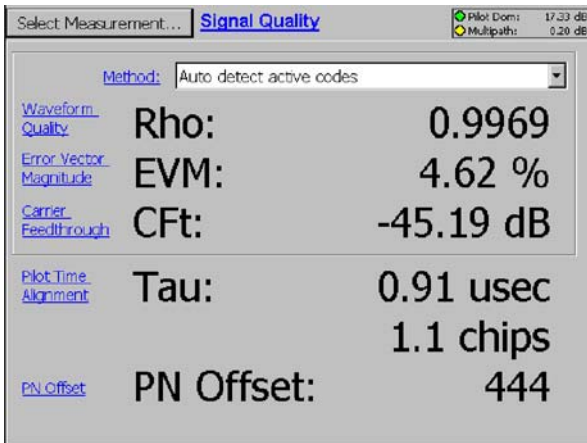



Figure 3-46: A Signal Quality display

6. Select the Method to use for measuring Signal Quality:
 - Select **Pilot only, no other codes active** on input signal for Pilot-only signals.
 - Select **Auto detect active codes** for an in-service signal quality measurement.
7.  Tap the **Forward Link** button.
8. Select a channel.

NOTE. True signal quality, *Rho*, should be measured only on a pilot-only signal. If the YBT250 detects active codes in the signal and Autodetect Active codes is selected, it will make the Estimated *Rho* measurement.

OTA Signal Quality Icon 

When over the air (OTA) measurements are enabled, the OTA Signal Quality icon provides a way to easily monitor the quality of the received signal to optimize cdma2000 or 1xEV-DO OTA measurement accuracy.

The most accurate OTA measurements are made when the Pilot Dominance (PD) value is high and Multipath Power (MP) value is low (indicated by green indicators on the icon) for the selected channel. The signal quality indicator thresholds (red/yellow/green) are set on the Meter tab (**Edit > Meter**), and can be configured to your location needs.

The OTA Signal Quality icon is shown only if option CS1 (cdma2000) or ES1 (1xEV-DO) is installed. The icon displays valid results when the YBGPS1 GPS Timing Reference is connected and satellite signals are locked, a cdm2000 or 1xEV-DO signal standard is selected, OTA measurements are enabled on the Meter tab, and an applicable measurement is selected (Pilot Power, Code Power, Codogram, or Signal Quality).

Measuring W-CDMA Signal Quality



Requires Option WD1 or WD2

For W-CDMA signal quality, the measurements performed are:

Option WD1: Error Vector Magnitude (EVM), Carrier Feedthrough (Cft), and Scrambling Code.

Option WD2: The WD1 measurements plus EVM16QAM and PCDE (Peak Code Domain Error).

To measure signal quality:

1.  Tap the **Measurement** button.
2. Tap **Select Measurement...**
3. Tap **Signal Quality**. See Figure 3-47.
4. Select the appropriate W-CDMA signal standard.
5.  Tap the **Forward Link** button.
6. Select a channel.

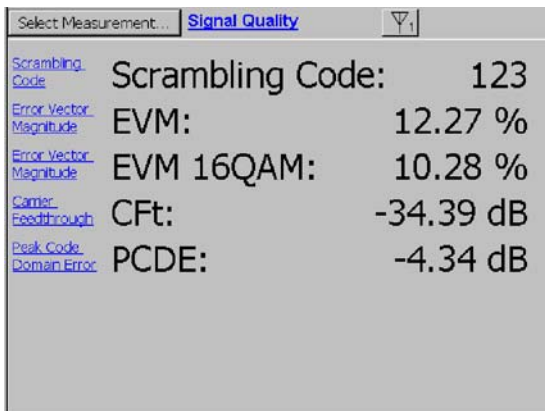


Figure 3-47: A W-CDMA Signal Quality display (option WD2)

Tap the online help link to display more information about a measurement.

The EVM measurement is most accurate when using the conformance test model for EVM, Test Model 4. Test Model 4 specifies that the only active channels are the P-CCPCH and SCH channels, with the P-CPICH channel present as an option. The P-CPICH must be present for the YBT250 to make an EVM measurement.

The EVM measurement can be made on signals other than Test Model 4, but the result is an estimate of the true EVM value. The YBT250 attempts to determine the spreading factor of all active codes and the power levels during one time slot. Changing power levels or codes with low power levels decreases the accuracy of the EVM estimate.

The EVM measurement is an average of the last ten data points. When you change a setting, the queue of the last ten data points is flushed. While the queue is filling, the help link text includes “***” and the message “***EVM result being averaged - please wait” is shown. This message goes away after ten data points are available to average (this might require several seconds). Until this averaging is completed, the EVM result will exhibit more variation.

Transmit Diversity

Some W-CDMA systems use Transmit Diversity to increase signal robustness between the Node B and mobile. When enabled in the downlink signal, Transmit Diversity uses two antennas, referred to as Antenna 1 and Antenna 2, to transmit two differently-encoded versions of the same data.

The YBT250 lets you select which antenna signal to measure for W-CDMA Carrier Frequency, Signal Quality, Code Power, Codogram, and Pilot Power measurements. To select the transmit diversity antenna, open the **Edit > Meter** tab.

The YBT250 displays an antenna button above the measurement display to indicate which antenna signal is the source for measurements. (see Figure 3-47.) Tap the button to open the **Edit > Meter** tab.

Measuring 1xEV-DO Signal Quality



Requires Option CDE

Option CDE provides the following 1xEV-DO signal quality measurements:

- Waveform Quality (Rho)
- Error Vector Magnitude (EVM)
- Data Constellation Type
- PN Offset (PNOS)
- Pilot Time Alignment Error (Tau)

You must have an appropriate Timing Reference input (Even Second Clock from a BTS, or the Timing signal from a NetTek YBGPS1 GPS Timing Reference) to measure PNOS and Tau.

To measure signal quality:

1. Select a 1xEV-DO Signal Standard.
2.  Tap the **Measurement** button.
3. Tap **Select Measurement...**
4. Tap **Signal Quality**. See Figure 3-48.
5.  Tap the **Forward Link** button.
6. Select a channel.

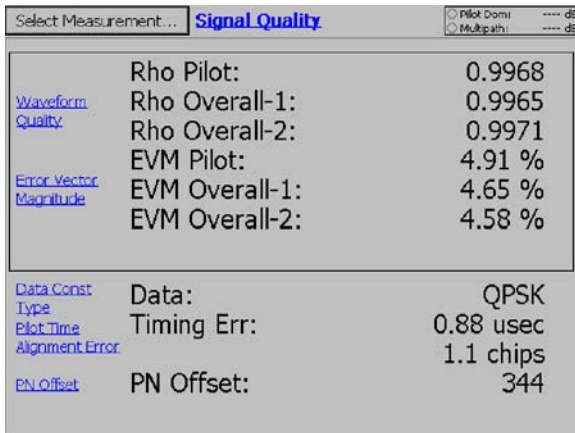


Figure 3-48: 1xEV-DO Signal Quality measurements

Table 3-17 describes the 1xEV-DO Signal Quality measurements.

Table 3-17: 1xEV-DO Signal Quality measurement fields

Field	Description
Rho Pilot	Indicates the similarity between the transmitted signal and a perfect signal. Rho can vary between 0.0 and 1.0, where 1.0 represents a perfect signal. Rho Pilot is only computed on chips in the Pilot intervals of the waveform, similar to Pilot-only Rho of cdmaOne and cdma2000.
Rho Overall-1	Rho Overall-1 is computed on all chips of one non-idle (active data) slot waveform, including pilot, MAC, and data intervals. Overall-1 Rho is only computed when a non-idle slot is detected in the input signal. If a non-idle slot cannot be found in the acquired signal, the Overall-1 measurements are not made, and will be marked "----" for that result update.

Table 3-17: 1xEV-DO Signal Quality measurement fields (Cont.)

Field	Description
Rho Overall-2	<p>Rho Overall-2 is computed on all chips of one non-idle (active data) slot waveform, including pilot, MAC, and data intervals, starting at an offset of one-quarter slot into the slot waveform. Rho Overall-2 is only computed when two consecutive non-idle slots are detected in the input signal.</p> <p>If two consecutive non-idles slot cannot be found in the acquired signal, the Overall-2 measurements are not made, and are marked "---" for that result update.</p>
EVM (general definition)	<p>The RMS value of all the vectors that extend from the ideal constellation points to the received signal constellation points in a record of demodulated CDMA symbols, divided by the RMS value of the signal. This result is multiplied by 100 to give a final value in percent. An EVM value of 0.0% represents a perfect signal.</p>
EVM Pilot	<p>The EVM Pilot is the EVM value computed on chips in the Pilot intervals of the waveform.</p>
EVM Overall-1	<p>The EVM Overall-1 value is the EVM value computed when a non-idle slot is detected in the input signal.</p> <p>If a non-idle slot cannot be found in the acquired signal, the Overall-1 measurements are not made, and will be marked "---" for that result update. The EVM Overall-1 is computed on all chips of one non-idle (active data) slot waveform, including pilot, MAC, and data intervals.</p>
EVM Overall-2	<p>EVM Overall-2 is computed on all chips of one non-idle (active data) slot waveform, including pilot, MAC, and data intervals, starting at an offset of one-quarter slot into the slot waveform. EVM Overall-2 is only computed when two consecutive non-idle slots are detected in the input signal.</p> <p>If two consecutive non-idle slots cannot be found in the acquired signal, the Overall-2 measurements are not made, and are marked "---" for that result update.</p>

Table 3-17: 1xEV-DO Signal Quality measurement fields (Cont.)



Field	Description
Data Constellation Type	The constellation type used to encode the user data bits in the data interval of a non-idle slot. Constellation type can be QPSK, 8PSK or 16QAM.
Timing Err (Tau)	The difference between an ideal signal with PN timing exactly aligned to a PN Offset location, and the received signal as observed at the module RF input port. The difference is the residual timing error of the received signal from the nearest legal PN Offset. The error is expressed in both microseconds and equivalent number of chips.
PN Offset	The time difference, measured in 64 PN-chip intervals, between the Even Second Clock pulse and the first chip of the next complete short-code PN spreading sequence in the signal, as observed at the module RF input port. PN Offset values are integer numbers with a range of 0 to 511.

Measuring GSM/EDGE Signal Quality

Requires Option EM1

For GSM/EDGE signal quality, the measurements performed are: Phase Error, Error Vector Magnitude, Origin Offset, and Carrier to Interference ratio (C/I).

To measure signal quality:

1. Select the appropriate GSM standard.
2.  Tap the **Measurement** button.
3. Tap **Select Measurement...**
4. Tap **Signal Quality**. See Figure 3-49.
5.  Tap the **Forward Link** button.
6. Select a channel.

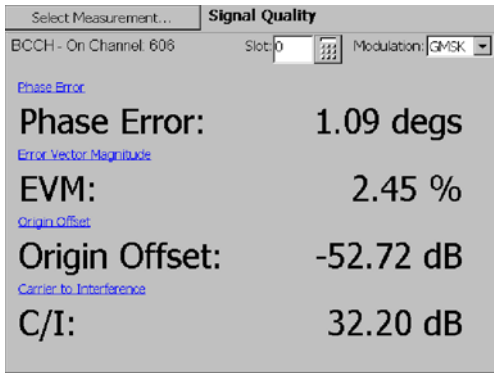


Figure 3-49: GSM/EDGE Signal Quality measurement

7. Tap the **Slot** field and select a slot number to measure. Or select **Any** to display the first detected slot using the specified modulation type.
8. Tap the Modulation field to select the modulation type to detect (8-PSK or GSMK).

NOTE. To search for the modulation type in all slots, instead of only the specified slot, set the *BCCH Frame Sync control* to *Off*.

Table 3-18 describes the GSM/EDGE Signal Quality measurements.

Table 3-18: GSM/EDGE Signal Quality measurement fields

Field	Description
Phase Error	The RMS value of the differences (in degrees) between the phase angles of the received signal and those of an ideal reconstructed reference signal of the specified slot.
EVM	The RMS value (in percent) of all the vectors that extend from the ideal constellation points to the received signal constellation points in a record of demodulated GSM/EDGE symbols, divided by the RMS value of the signal. An EVM value of 0.0% represents a perfect signal.
Origin Offset	The ratio (in dBs) of unmodulated signal power to modulated signal power. The measurement name refers to the offset of the signal constellation center that is caused by the unmodulated signal component.
C/I (Carrier to Interference Ratio)	The ratio of desired signal (carrier) power to undesired signal (interference) power, in dB units. The NetTek C/I value is derived from the EVM result, and gives an estimate of the power-based C/I value.

Setting cdma2000 or 1xEV-DO PN Offset

To set the PN offset to use for cdma2000 or 1xEV-DO signal detection and measurements:

1. Tap the **Edit** button.
2. Tap the **Meter** tab.

Figure 3-50 shows a cdma2000 partial Meter tab with the PN Offset area marked.

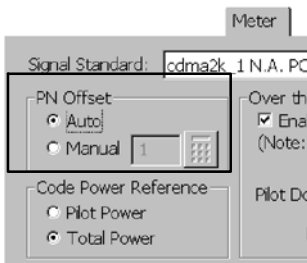


Figure 3-50: Setting the PN Offset

3. Select a cdma2000 or 1xEV-DO signal standard.
4. Tap **Auto** or **Manual** in the PN Offset field to change the setting.
 Auto selects the highest-powered pilot. Tap Manual and enter a numeric value to specify a particular PN offset. This setting applies to Carrier Frequency, Signal Quality, Codogram, Pilot Power (cdma2000 only), and Code power measurements.
5. Tap **OK** to accept the setting change.

Using PN Offset requires an Even Second Clock signal or the NetTek YBGPS1 GPS Timing Reference.

Measuring 1xEV-DO Code Power


Requires Option CDE

The Code Domain Power measurement for 1xEV-DO displays a graph showing the power in each of the 64 MAC code channels, relative to the total power of the signal. The display shows the MAC index number in the horizontal axis, and the power of each code channel level by the height of the corresponding bar.

In addition to the MAC Code Domain Power graph, numeric readouts of the minimum and maximum Data interval Code Domain Power values are displayed when a slot with non-idle data content is detected in the acquired signal. Data CDP minimum and maximum levels can be compared to limits to detect signal errors.

If no non-idle half-slots are detected in an acquisition, Data Code Power results are displayed as dashes (----).

To measure 1xEV-DO Code Power:

1.  Tap the **Measurement** button.
2. Select a 1xEV-DO signal standard.
3. Select a channel.
4. Tap **Select Measurement...**
5. Tap **Code Power**. See Figure 3-51.
6. To select which MAC Channel Code to measure:
 - Tap the entry field next to the MAC Index readout. Then use the knob or the numeric keypad to enter a MAC channel code.
 - Tap the graph to assign the knob or the numeric keypad to enter a MAC channel code.

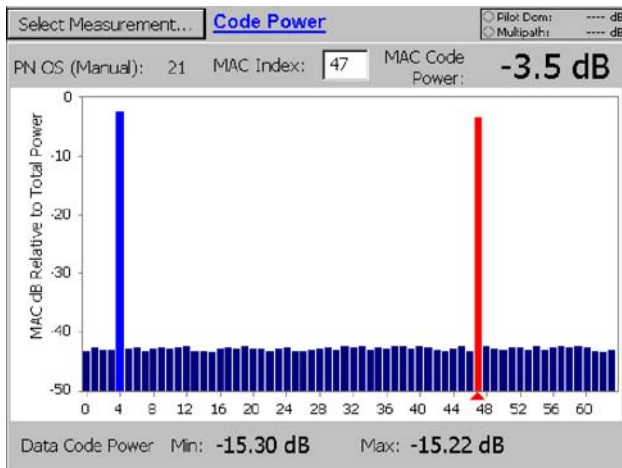


Figure 3-51: 1xEV-DO Code Domain Power display

Table 3-19 describes the 1xEV-DO Code Domain measurements.

Table 3-19: 1xEV-DO Code Domain measurement fields

Field	Description
PN Offset	The coarse timing difference between the pilot channel and the Even Second Clock.
MAC Index	The MAC index number of the selected code.
MAC Code Power	The measured power for the selected code with 0.1 dB resolution.
Data Code Power Min and Max	The minimum and maximum code domain power values (of both real and imaginary components, relative to total signal power) in the set of 16 Walsh codes used in the data portions of non-idle half slots.

NOTE. *To display the power for a specific code, you may find it easier to tap the Code box and select a code by using the knob rather than tapping the graph.*


Measuring cdma2000 Code Power

Requires Option CD2

The cdma2000 Code Power measurement displays signal and code power measurements in numerical and graphical formats. Code Power is displayed on a Bit-reversed graph.

The YBT250 displays the exact power on any specified code relative to the Total Power or the Pilot Power (as set on the Meter tab of the Setup window).

To measure cdma2000 Code Power:

1.  Tap the **Measurement** button.
2. Select a cdma2000 signal standard.
3. Select a channel.
4. Tap **Select Measurement...**
5. Tap **Code Power**. See Figure 3-52.

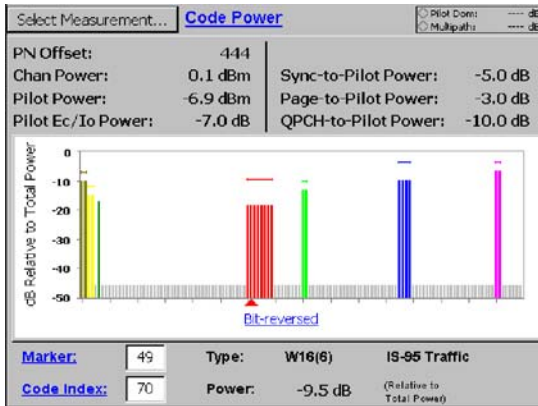


Figure 3-52: cdma2000 Code Power display

6. To select which marker to measure, do either of the following:
 - Tap the entry field next to the Marker readout. Then use the knob or the numeric keypad to enter a marker number.
 - Tap the graph to assign the knob or the numeric keypad to enter a marker number.

Table 3-20 describes the cdma2000 Code Domain measurements.

Table 3-20: cdma2000 Code Domain measurement fields

Field	Description
PN Offset	The coarse timing difference, in chips, between the pilot channel and the even second clock.
Chan Power	The total RF power in the selected channel.
Pilot Power	The absolute power of the CDMA signal's pilot code.
Pilot Ec/Io Power	The Pilot Power minus the Channel Power.
Sync-to-Pilot Power	The Sync Channel Power minus the Pilot Power.
Page-to-Pilot Power	The Page Channel Power minus the Pilot Power.
QPCH-to-Pilot Power	The peak Quick Page Channel Power minus the Pilot Power.
Marker	The bit-reversed index for the value on the graph.
Code Index	The Walsh Code which corresponds to the value of the bit-reversed index on the graph.
Power	The measured power of the selected code
Type	The detected spreading factor and base code for the selected Walsh code and indicates the purpose of the selected code. See Table 3-21.

Table 3-21 describes the cdma2000 channel types.

Table 3-21: cdma2000 channel types

Displayed type	Spreading factor	Codes(s)	Description
Forward Pilot	64	0	Common Pilot channel
Sync	64	32	Common Synchronization channel
Paging	64	1-7	Common Paging channels

Table 3-21: cdma2000 channel types (Cont.)


Displayed type	Spreading factor	Codes(s)	Description
Quick Page	128	48, 80, 112	Quick Page channel
IS-95 or cdma2000 Traffic	4-128	0-127	Any active code that does not match the above spreading factors or code numbers
Inactive	128	0-127	Power is below threshold

Measuring cdmaOne Code Power

Requires Option CD1

The cdmaOne Code Domain Power displays a graph showing the power in each of the 64 code channels, relative to the total power of the signal. The display shows the code index number in the horizontal axis, and the power of each code channel level by the height of the corresponding bar.

To measure cdmaOne Code Power:

1.  Tap the **Measurement** button.
2. Select a cdmaOne signal standard.
3. Select a channel.
4. Tap **Select Measurement...**
5. Tap **Code Power**. See Figure 3-53.
6. To select which Code to measure:
 - Tap the entry field next to the Code readout. Then use the knob or the numeric keypad to enter a code.
 - Tap the graph to assign the knob or the numeric keypad to enter a code.

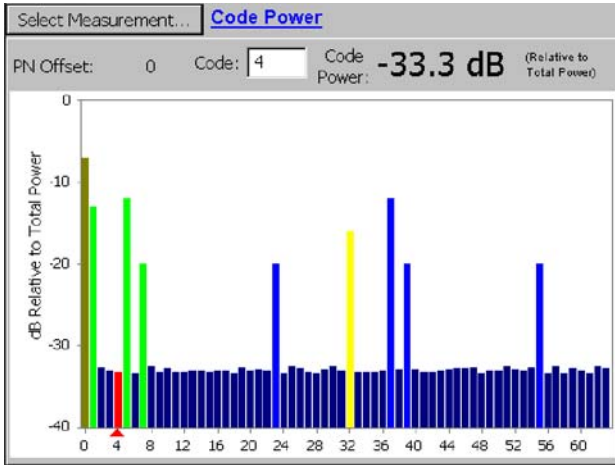


Figure 3-53: cdmaOne Code Power display

Table 3-22 describes the cdmaOne Code Power measurements.

Table 3-22: cdmaOne Code Power measurement fields

Field	Description
PN Offset	The coarse timing difference between the pilot channel and the even second clock.
Code	The selected code to measure.
Code Power	The measured power for the selected code with 0.1 dB resolution.


Measuring W-CDMA Code Power

Requires Option WD1

The W-CDMA Code Power displays graphs that indicate the power on each Orthogonal Variable Spreading Factor (OVSF) code in the signal. The bottom graph shows the Code Domain Power in all OVSF codes; the top graph shows a zoomed-in display of one fourth of the OVSF codes.

The YBT250 displays the exact power on any specified code relative to the Total Power or the Pilot Power (power in the P-CPICH channel). You specify which signal to use as a reference for the Code Power on the Meter tab of the Setup window. The spreading factor is automatically set to 512.

To measure W-CDMA Code Power:

1.  Tap the **Measurement** button.
2. Select a W-CDMA signal standard.
3. Select a channel.
4. Tap **Select Measurement...**
5. Tap **Code Power**.

See Figure 3-53. The upper graph shows a magnified section of the lower graph. Use the scroll bar at the bottom of the window to scroll the upper graph.

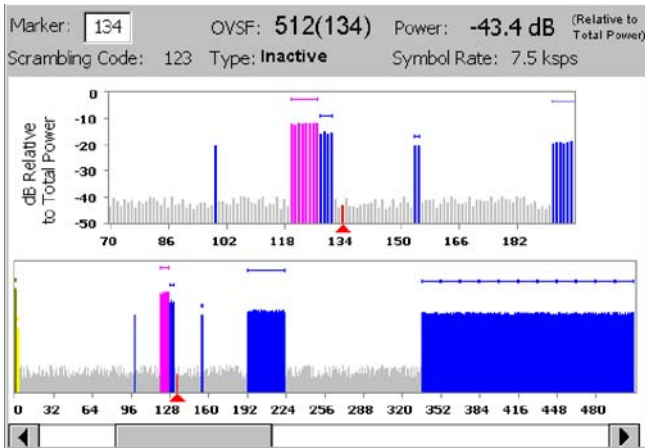


Figure 3-54: W-CDMA Code Power display

6. To select which Marker to measure, do one of the following:
 - Tap the graph at the marker to measure.
 - Tap the entry field next to the Marker readout. Then use the knob or the numeric keypad to enter a marker.
 - Tap the graph to assign the knob or the numeric keypad to enter a marker. You can tap either graph.

Table 3-23 describes the W-CDMA Code Power measurements.

Table 3-23: W-CDMA Code Power measurement fields

Field	Description
Marker	The Orthogonal Variable Spreading Factor (OVSF) code number indicates and controls the selected code number marker in the graphs.
OVSF	The detected spreading factor and code index for the OVSF code selected by the marker.

Table 3-23: W-CDMA Code Power measurement fields (Cont.)

Field	Description
Power	The measured power for the selected code based on the detected spreading factor, with 0.1 dB resolution.
Scrambling Code	The detected primary scrambling code number or the specified manual scrambling code.
Type	The purpose of the selected code. See Table 3-24.
Symbol Rate	The calculated number equal to the chip rate divided by the spreading factor

Table 3-24 describes the W-CDMA channel types.

Table 3-24: W-CDMA channel types

Displayed type	Spreading factor	Codes(s)	Description
P-CPICH	256	0	Primary Pilot channel
P-CCPCH	256	1	Primary Control channel
QPSK Traffic	4-512	1-511	Active code channel using QPSK symbol modulation
16QAM Traffic	16	1-15	Active HS code channel using 16QAM symbol modulation
Inactive	512	2-511	Unused code channels

Setting the W-CDMA Scrambling Code Detection

The YBT250 enables you to specify how it detects the scrambling code of a W-CDMA signal for demodulated measurements. There are two settings for the scrambling code control: **Auto** and **Manual**. The default setting is **Auto**.

Changing the Scrambling Code Setting

To change the scrambling code setting:

1. Select a W-CDMA signal standard.
2. Tap the **Edit** button to display the Setup window.
3. Tap the **Meter** tab. See Figure 3-55.

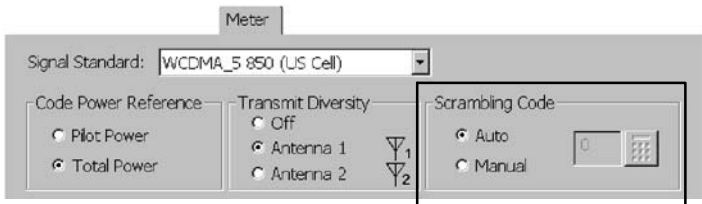


Figure 3-55: Setting the scrambling code

4. Tap **Auto** or **Manual** in the Scrambling Code field to change the setting.
 - In **Auto** mode, the YBT250 automatically detects the scrambling code by using the P-SCH and S-SCH codes to determine the code group, then searches only for the scrambling codes within that code group. If multiple signals are present, the scrambling code of the signal with the highest power P-SCH and S-SCH will be detected.
 - In **Manual** mode, the YBT250 bypasses the SCH codes and searches only for the signal with the specified scrambling code. Tap the numeric keypad and enter the scrambling code. The acceptable range for codes is 0-511.

5. Tap **OK** to accept the setting change.

The Manual setting is primarily used in off-air testing in areas where there are multiple transmitters and there is a need to make measurements on a specific transmitter.

NOTE. *If you receive an error message stating CDMA Sync Not Found, check that the Scrambling Code setting is properly set. If it is set to Manual and the code is set wrong, the YBT250 indicates that it cannot find a signal. This is because it is looking only for a signal with the specified scrambling code. Signals with different scrambling codes are ignored.*

This error message can occur with the following measurements: Carrier Frequency, Signal Quality, Code Power, Codogram, and Pilot Power.

How the Scrambling Code Setting is Indicated in Displays


The way the scrambling code is displayed changes depending on the scrambling code setting. When the scrambling code setting is Auto, the words **Scrambling Code** are used in the display. When the scrambling code setting is Manual, the words **Scr Code (Manual)** are used in the display.

Displaying a cdmaOne Codogram

Requires Option CD1

A codogram displays how code levels change over time, making it easier to spot faults, monitor traffic, and observe hand-off activity over time.

To display a cdmaOne codogram:

1.  Tap the **Measurement** button.
2. Set a CDMA signal standard.
3. Tap **Select Measurement....**

4. Select a channel.
5. Tap **Codogram**. See Figure 3-56.

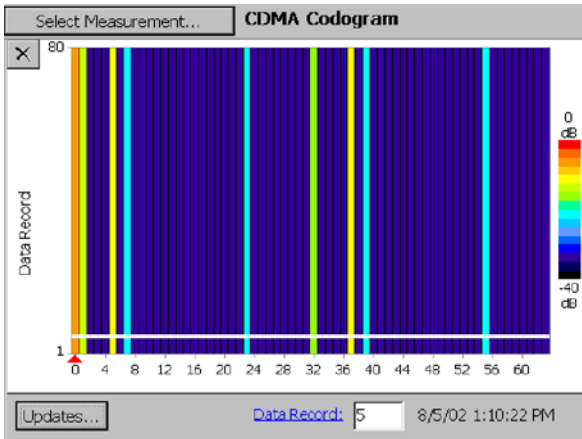



Figure 3-56: cdmaOne Codogram display

Hints


-  Tap the Restart icon to clear the trace history and restart collecting data.
- Select **Updates...** to change how often the codogram is updated.
- To find the timestamp (displayed next to the Data Record box) for a specific data record in the Codogram, tap the **Data Record** box. The cursor is the horizontal white band. Use the knob or numeric keypad to move the cursor to the data record of interest. The time and date the selected data was recorded is displayed to the right of the Data Record box.
- You can save a Codogram to a file every 80 records, by setting the option on the Meter tab of the Setup window.

Displaying a cdma2000 Codogram

Requires Option CD2

A Codogram displays how code levels change over time. The Codogram makes it easier to spot faults and interference. For cdma2000 standards, the YBT250 displays data by bit-reversed code.

To display a cdma2000 Codogram:

1.  Tap the **Measurement** button.
2. Select a cdma2000 signal standard.
3. Tap **Select Measurement...**
4. Tap **Codogram**. See Figure 3-57.

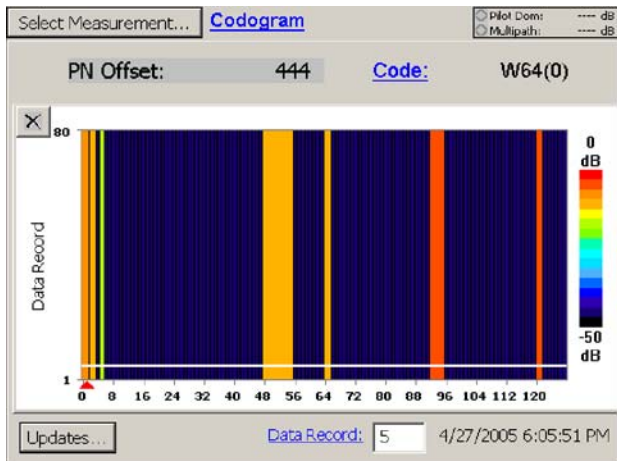



Figure 3-57: cdma2000 Codogram display

Hints

-  Tap the Restart icon to clear the trace history and restart collecting data.
- Select **Updates...** to change how often the codogram is updated.
- To find the timestamp (displayed next to the Data Record box) for a specific data record in the Codogram, tap the **Data Record** box. The cursor is the horizontal white band. Use the knob or numeric keypad to move the cursor to the data record of interest. The time and date the selected data was recorded is displayed to the right of the Data Record box.
- You can save a Codogram to a file every 80 records, by setting the option on the Meter tab of the Setup window.

cdma2000 Codogram Results Export File Format

A cdma2000 Codogram result file contains three major blocks of Codogram data, each of which is 128 rows by 80 columns. In each block, each column is a data set from a single Code Power (CP) measurement result. The row above the first row of data in each block contains the timestamp for the CP data in that column. The 128 rows per block correspond to the CP results from analyzing the signal at a Spreading Factor (SF) of 128.

Block 1 (file rows 23-150) lists the linear order Code Power for codes analyzed at only the Spreading Factor of 128. This information shows the daughter code levels of any active codes, along with the noise code levels of inactive codes. Only codes that are SF of 128 show their correct CP in this block. Active codes with lower Spreading factors show their power spread out among the corresponding multiple daughter codes at this level.

Block 2 (rows 154-281) lists the detected (parent) code Code Power values, in bit-reversed order. The detected parent code Code Power level is copied to all of the 128/SF bit-reversed daughter code indices that comprise the active parent code (these are consecutive codes in the bit reverse display). This level is used for the flying bar in the Code Power display, and also determines the Codogram level color.


Block 3 (rows 285-412) lists the parent code Spreading Factor indicators in bit reverse order, corresponding to the information in Block 2. The same SF number is repeated 128/SF consecutive times for each code of detected Spreading Factor SF.

Displaying a W-CDMA Codogram

Requires Option WD1

The Codogram display shows changes in code power levels over time. You can use it to monitor activity and spot faults and interference during time intervals that you define. The YBT250 displays two codograms, one of all the OVSF codes (lower graph) and one zoomed in showing one-fourth of the possible codes (upper graph) for more detailed viewing.

To display a W-CDMA codogram:

1.  Tap the **Measurement** button.
2. Select a cdma2000 signal standard.
3. Tap **Select Measurement...**
4. Tap **Codogram**. See Figure 3-58.
5. Select a channel.

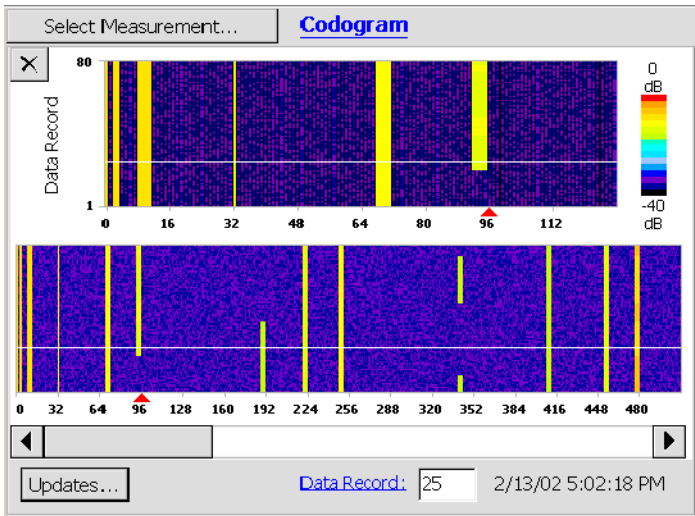



Figure 3-58: W-CDMA Codogram display

The horizontal scroll bar below the lower graph indicates the zoom range of the upper graph. Move the horizontal scroll bar to change the data displayed in the upper graph. Also, you can tap a point in either graph to move the marker to that point. If that point is not shown in the zoom range, the zoom range recenters around the selected point.

Hints

-  Tap the Restart icon to clear the trace history and restart collecting data.
- Select **Updates...** to change how often the codogram is updated.
- You can save a codogram to a file every 80 records, by setting the option on the Meter tab of the Setup window.
- To find the timestamp (displayed next to the Data Record box) for a specific data record in the Codogram, tap the **Data Record** box. The cursor is the horizontal white band. Use the knob or numeric keypad to move the cursor to the data record of interest.

The time and date the selected data was recorded is displayed to the right of the Data Record box.

Displaying a 1xEV-DO Codogram

Requires Option CDE

A Codogram displays changes in code levels over time, making it easier to spot and record intermittent faults and interference. For 1xEV-DO signals, the YBT250 displays a codogram of the MAC channel codes.

To display a 1xEV-DO codogram:

1. Tap the **Measurement** button.
2. Select a 1xEV-DO signal standard.
3. Tap **Select Measurement...**
4. Tap **Codogram**. See Figure 3-59.
5. Select a channel.

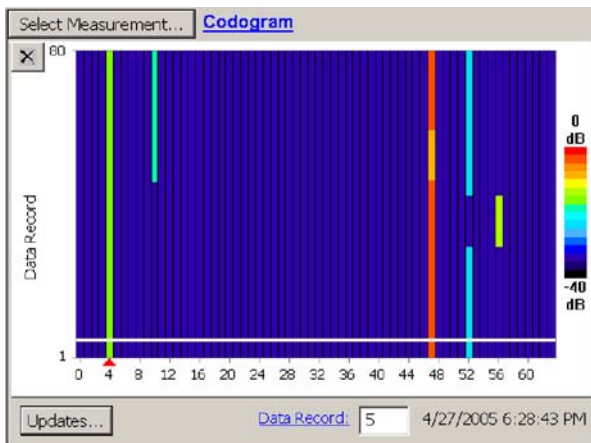



Figure 3-59: 1xEV-DO codogram display

Hints

-  Tap the Restart icon to clear the trace history and restart collecting data.
- Select **Updates...** to change how often the codogram is updated.
- To find the timestamp (displayed next to the Data Record box) for a specific data record in the Codogram, tap the **Data Record** box. The cursor is a white band of the same height as a data record. Use the knob or numeric keypad to move the cursor to the data record of interest. The time and date the data was recorded is displayed to the right of the Data Record box.
- You can save a codogram to a file every 80 records, by setting the option on the Meter tab of the Setup window.

Automatically Saving Codogram Displays

You can set the YBT250 to automatically save the cdmaOne, cdma2000, 1xEV-DO, and W-CDMA codogram displays each time 80 records are accumulated. Files are automatically named as they are saved, enabling unattended operation.

To automatically save the codogram display every 80 records:

1. Tap the **Edit** button.
2. Tap the **Meter** tab.
3. To automatically save or export after you've taken 80 records, tap the check box next to **Auto Save** or **Auto Export**. See Figure 3-60.

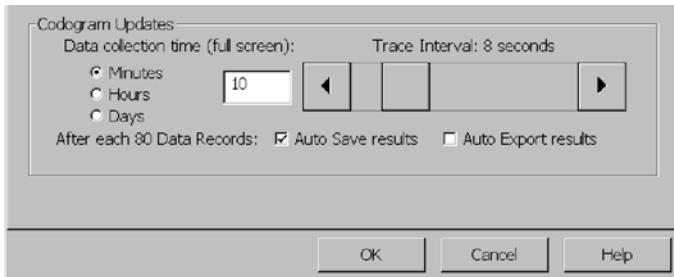


Figure 3-60: Meter tab of the setup window

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

The YBT250 will save the codogram display to a new file each time 80 data records are accumulated. The time required to accumulate depends on the codogram update rate. Refer to Table 3-25 for the approximate file sizes for codograms.

Table 3-25: Typical codogram file sizes

Signal standard	Typical saved file size	Typical exported file size
cdmaOne 1xEV-DO	8.5 kilobytes	25 kilobytes
cdma2000	40 kilobytes	124 kilobytes
W-CDMA ¹	92 kilobytes	317 kilobytes

¹ These are typical file sizes for a maximum spreading factor of 512, the highest possible setting.

Printing Trace Screens

While the **Outdoor Viewing** or **Indoor Viewing** color schemes are well suited for viewing a trace screen on a color display, if you want to print a trace screen on a black and white printer (for example, a laser printer), you should select either the **Monochrome grays** or **Black on White for printer** color scheme (**Tools > Options > Preferences**) for a better printout. When the **Monochrome grays** or **Black on White for printer** color scheme is used, a trace screen will appear with colors that are optimized for printing on black and white printers.



After you have set the color scheme for **Monochrome grays** or **Black on White for printer**, the trace screen will appear with altered colors. In the **Monochrome grays** color scheme, the highest signal level is the lightest color. But in the **Dark on white** color scheme, the lightest color is *not* the highest signal level.

Measuring cdmaOne and cdma2000 Pilot Power

Requires Option CD1 or Option CD2

The Pilot Power measurement displays the amount of transmitted power in the CDMA pilot code (Walsh code 0). It can be measured on signals with any combination of active codes. The YBT250 displays the Pilot Power, Channel Power and the difference between pilot and total.

To measure Pilot Power:

1.  Tap the **Measurement** button.
2. Select a CDMA signal standard.
3. Tap **Select Measurement...**
4. Tap **Pilot Power**. See Figure 3-61.
5.  Tap the **Forward Link** button.
6. Select a channel.

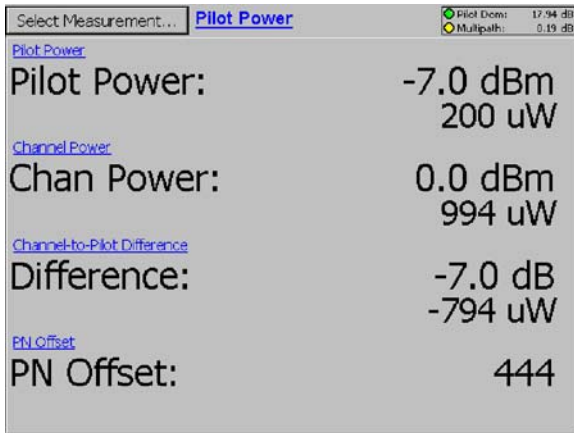



Figure 3-61: A typical cdmaOne/cdma2000 Pilot Power display

Measuring W-CDMA Pilot Power and Sync Power

Pilot power is the power in the P-CPICH channel. Sync power is power in the P-SCH and S-SCH channels.

To measure Pilot Power and Sync Powers:

1.  Tap the **Measurement** button.
2. Select a W-CDMA signal standard.
3. Tap **Select Measurement...**
4. Tap **Pilot Power**. See Figure 3-62 (option WD1) or Figure 3-63 (option WD2).
5. Select a channel.

Option WD1 Measurements

Figure 3-62 shows the Pilot Power measurements available with option WD1. Tap the online help link to display more information about a measurement.

Select Measurement...	Pilot Power
P-CPICH Power	
P-CPICH Power:	-17.0 dBm 20.0 uW
P-SCH Power	
P-SCH Power:	-20.0 dBm 10.0 uW
S-SCH Power	
S-SCH Power:	-30.0 dBm 1000 nW
Channel Power	
Chan Power:	-10.0 dBm 100 uW
Scrambling Code	
Scr Code(Manual):	123

Figure 3-62: A typical W-CDMA Pilot Power display (option WD1)

Option WD2 Measurements

Figure 3-63 shows the Pilot Power measurements available with option WD2. Tap the online help link to display more information about a measurement.

Select Measurement...	Pilot Power	
Scrambling Code	Scrambling Code:	42
Channel Power	Chan Power:	-10.0 dBm 100 uW
P-CPICH Power	P-CPICH Power Ec:	-16.9 dBm 20.4 uW
	P-CPICH Power Ec/Io:	-7.0 dB
P-CCPCH to Pilot	P-CCPCH to Pilot Power:	-2.6 dB
P-SCH to Pilot	P-SCH to Pilot Power:	-3.1 dB
S-SCH to Pilot	S-SCH to Pilot Power:	-13.1 dB


Figure 3-63: A typical W-CDMA Pilot Power display (option WD2)

Measuring W-CDMA Adjacent Channel Leakage Ratio (ACLR)

Requires Option WR1

Adjacent Channel Leakage Ratio (ACLR) is the ratio of the mean signal power in the assigned channel (5 MHz bandwidth) to the mean power in an adjacent channel of equal bandwidth. To simulate the filter response of a receiver, a Root Raised Cosine (RRC) filter response with an equivalent noise bandwidth of 3.84 MHz is applied before computing the mean power of each channel.

To measure ACLR:

1.  Tap the **Measurement** button.
2. Select a W-CDMA signal standard.
3. Tap **Select Measurement**.
4. Tap **ACLR**. See Figure 3-64.

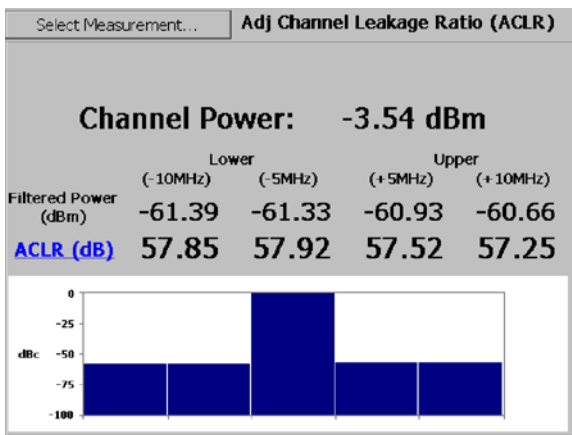


Figure 3-64: A typical ACLR display

Four adjacent channels, the two closest on either side of the assigned channel, are measured: the Upper1/Lower1 adjacent channels are centered 5 MHz above and below the assigned channel center, and the Upper2/ Lower2 channels are 10 MHz above and below the assigned channel center.

Each ACLR result is computed by subtracting the corresponding adjacent channel filtered power value from the assigned channel filtered power. The ACLR measurement page displays the four ACLR results for the Lower and Upper adjacent channels, as well as the filtered channel power for the assigned channel and the adjacent channels. ACLR values increase with improved signal leakage suppression, so larger positive values are better.


Measuring cdmaOne, cdma2000, or 1xEV-DO Adjacent Channel Power Ratio (ACPR)

Requires Option CR1

The Adjacent Channel Power Ratio (ACPR) measures the relative amount of CDMA signal power leaking into nearby narrowband channels. ACPR is the ratio of the mean power in the selected channel (1.23 MHz bandwidth) to the mean power detected in an adjacent channel of 30 kHz bandwidth.

Four adjacent channels are measured (two above and two below the selected channel), and an ACPR value result is calculated for each. The ACPR value is computed as the difference between the corresponding adjacent channel power and the center channel power. This measurement provides a simplified test to detect excessive out-of-band emissions from a CDMA transmitter.

To measure ACPR:

1. Select a cdmaOne, cdma2000, or 1xEV-DO signal standard.
2. Select a channel.
3.  Tap the **Measurement** button.
4. Tap **Select Measurement...**
5. Tap **ACPR**.

The window displays the four ACPR measurements for the Lower and Upper adjacent channels, as well as the channel power for the selected channel and the adjacent channels. Larger negative values of ACPR indicate better suppression of signal leakage. See Figure 3-65.

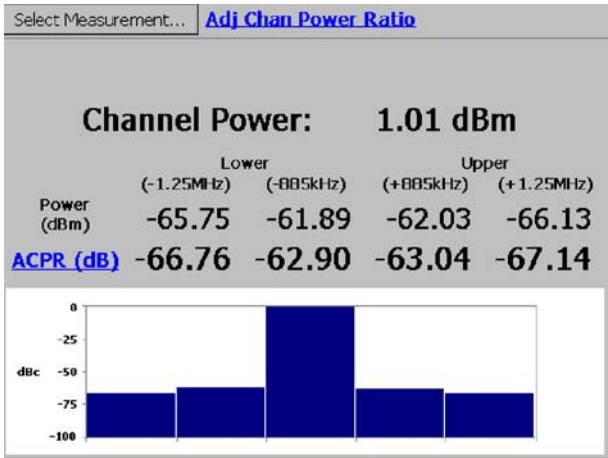


Figure 3-65: A typical Adjacent Channel Power Ratio display

The 30 kHz adjacent channels are centered at frequency offsets above and below the selected center channel. The frequency offset values in use are shown on the display, and depend on the band class of the selected standard:

- Band class 0, 2, 3, 5, 7, 9, 10; ± 750 kHz and ± 1.98 MHz
- Band class 1, 4, 6, 8; ± 885 kHz and ± 1.25 MHz

These pairs of frequency offsets correspond to corner points of the cdmaOne, cdma2000, or 1xEV-DO spectral emission limit mask.

cdma2000 or 1xEV-DO Over-The-Air (OTA) Measurements

Requires Option CS1 (cdma2000) or Option ES1 (1xEV-DO)

OTA measurements let you take cdma2000 Signal Quality, Code Power, Codogram, or Pilot Power measurements, or 1xEV-DO Signal Quality, Code Power, or Codogram measurements. OTA measurements require a NetTek YBGPS1 GPS Timing Reference in addition to option CS1 or option ES1.

NOTE. *The YBGPS1 GPS Timing Reference must be connected and active before taking OTA measurements.*

To take OTA measurements:

1. Connect the antenna and filter (if used) to the YBT250 RF input.
2. Select a cdma2000 or 1xEV-DO signal standard.
3. Select a channel.
4. Tap the **Edit** button.
5. Tap the **Meter** tab.
6. Tap the **Enable OTA Measurements** checkbox. See Figure 3-66.

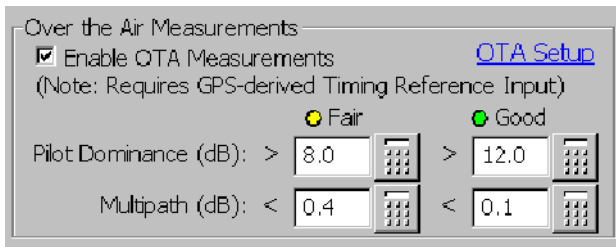
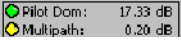


Figure 3-66: The Over the Air Measurements field

7. Change the Pilot Dominance (PD) and Multipath Power (MP) thresholds if required. See the following section for a discussion of these items.
8. Tap **OK**.
9. Select an applicable cdma2000 measurement (Signal Quality, Code Power, Codogram, or Pilot Power) or 1xEV-DO measurement (Signal Quality, Code Power, or Codogram).

10.  Watch the OTA Signal Quality icon, changing your position if required, until both indicators show green. It may be necessary to walk or drive around the measurement site until both indicators are green.
11. When both indicators are green, take the cdma2000 or 1xEV-DO OTA measurements.

NOTE. *Enabling OTA measurements requires the YBT250 to measure and calculate the Pilot Dominance and Multipath Power levels of the selected channel. These calculations slow down the OTA measurement update rate. If you are not actually taking OTA measurements, uncheck the Enable OTA Measurements checkbox to improve the measurement speed.*

Pilot Dominance and Multipath Power

Selecting a cdma2000 or 1xEV-DO standard in the Meter tab displays the Over the Air Measurements field (assuming the applicable options are installed). This field lets you enable OTA measurements and set the Pilot Dominance (PD) and Multipath Power (MP) thresholds levels.

Pilot Dominance (PD) is the ratio of the selected pilot power signal to the sum of the next two highest detected pilot power levels. A more positive PD value is good, indicating that the selected pilot is the dominant pilot in the received signal; this means that the other received pilot signals have less impact on measurement results. A value above 15 dB is desirable, although measurements can be made below this level. PD values below 10 dB indicate that the signal quality is not adequate for accurate OTA measurements.

Multipath Power (MP) is the ratio of the pilot power of the strongest multipath path component of the selected signal, to the total pilot power of all multipath components of that signal. MP measures the interference that is due to multiple versions (reflections) of the signal arriving at the antenna at different times. A low MP value is desirable, with 0.0 dB meaning there is no multipath interference (all received pilot power is in a single component). An MP value below


0.1 dB is desirable, although measurements can be made above this level. MP values above 0.4 dB indicate that the signal quality is not adequate for accurate OTA measurements.

When making cdma2000 or 1xEV-DO OTA measurements, the goal is to find a location that provides both high PD values and low MP values. It may be necessary to walk or drive around the measurement site, monitoring the OTA Signal Quality icon until both PD and MP indicators are green. Once a good location is found, you can take cdma2000 or 1xEV-DO OTA measurements.

Multiple Measurements Sequencer

On the Sequencer screen (tap button 4), you can view the current readouts for multiple measurements at the same time. These measurements include the numeric results that you could otherwise view one at a time on the Measurement screen (button 1). The YBT250 application sequences through each of the measurements that you designate and it summarizes the results on the Sequencer screen.

To select which measurements to take and display on the Sequencer screen:

1. Select a signal standard.
2.  Tap the Sequencer button.
3. Tap the **Select Measurements...** button. The Select Measurements dialog box appears. The list of available measurements depends on the standard you selected.
4. Select or clear the measurements in the list to display only the measurements of interest to you.
5. Tap **OK**. See Figure 3-67.

The Sequencer screen shows each measurement type you selected (such as RF Power and Carrier Frequency) in a gray bar. Beneath each measurement type, the measurement readouts are displayed. As each measurement type is updated, the measurement type heading is highlighted in reverse video.

Any out-of-limit conditions are indicated by a red block with an up or down arrow. Messages may appear in the gray bar indicating any abnormal conditions.

You can save different sets of selected measurements for each standard and then recall these sequences later for reuse. To save a measurement sequence, tap **Setup > Save...**, enter a name, and tap **OK**.

RF Power	
RF Channel Power:	-58.9 dBm
Ref Channel Power:	----- dBm
Carrier Frequency	
Carrier Freq:	1962.949999 MHz
Error (in ppm):	----- ppm
Peak/Average	
Peak/Average:	4.9 dB
Occupied Bandwidth	
OBW:	8045.083 kHz
Signal Quality	
Carrier Feedthrough:	-34.34 dB
PCDE:	-4.37 dB
Scrambling Code:	123
Pilot Power	
Channel Power:	-10.0 dBm
Channel Power:	100 uW
P-CPICH Power Ec:	-17.1 dBm
RF Channel Power:	1.28 nW
Difference:	----- dB
Error:	----- kHz
EVM:	12.28 %
EVM 16QAM:	10.28 %
P-CPICH Power Ec/Io:	-7.1 dB
P-CCPCH to Pilot Pwr:	-2.4 dB
P-SCH to Pilot Power:	-2.9 dB

Figure 3-67: Sequencer display

You can save different sets of selected measurements for each standard and then recall these sequences later for reuse. To save a measurement sequence, tap **Setup > Save...**, enter a name, and tap **OK**.

You can use the file menu to save, export, or print the numeric Sequencer data, including error information and the timestamp (the time of the last individual measurement taken). Note that if you export a screen, a picture of only what shows on the screen will be exported. If there is a scroll bar visible, then some measurement results are hidden and are not exported. To avoid this problem, choose **Export Results As...**, or scroll down and export a second view of the screen.

Limit Testing

The YBT250 can be set to display indicators or perform an action when a measurement exceeds specified limits. The available limit tests depends on the selected standard.

To enable limit testing:

1. Tap the **Edit** button at the top of the display. This displays the Setup window.
2. Tap the **Limits** tab. See Figure 3-68.
3. Select the signal standard from the list at the top of the window.
4. Tap the appropriate box in the **Enable** column at the left side of the window to enable or disable a limit test.
 - a. To enable limit testing for a specific measurement, tap the box in the **Enable** column so that an **X** appears in the box.
 - b. To disable limit testing for a specific measurement, tap the box so that there is no **X** in the box.
 - c. To enable limit testing for all the measurements, tap the **Enable All** button.
 - d. To disable limit testing for all the measurements, tap the **Disable All** button.

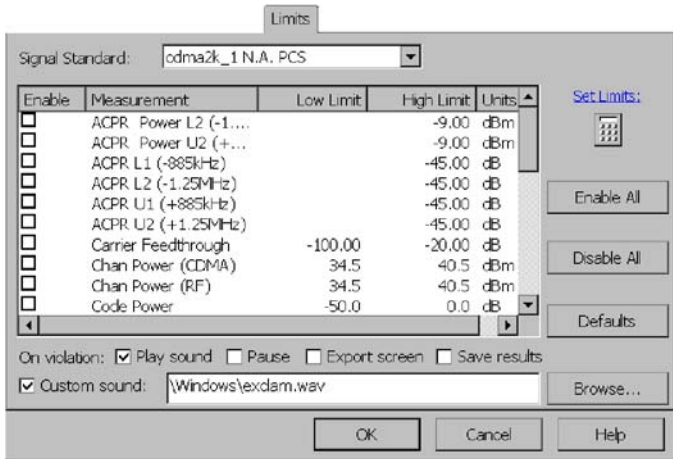


Figure 3-68: Enabling limit testing

5. To change the limits for a measurement:
 - a. Tap the limit you want to change. This highlights the limit value of the measurement.
 - b. Tap the numeric keypad to enter a new value for the limit. Tap **OK** to complete the change.
 - c. You can disable either the Low Limit or High Limit test for a measurement by clearing the contents of the cell. Disabling one test limit does not disable the other test limit.

For example, suppose you wish to test the High Limit for RF Power, but are not interested in testing the Low Limit. To enable testing for the High Limit, you must enable the limit test for RF Power. To disable the Low Limit test for RF Power, tap the Low Limit cell for RF Power and clear the contents of the cell (using the backspace key on the numeric keypad).

- d. To reset the limits for all measurements to factory default values, tap **Defaults**.

6. To specify what the YBT250 should do when a limit is exceeded, select one or more items in the **On Violation** area:
 - a. Tap the check box for **Play Sound** to cause the YBT250 to play a default sound when a limit is exceeded.

To play a specific sound file, tap the **Custom sound** check box, tap the **Browse** button, and navigate to and select a .wav sound file to play when a limit violation occurs. Operating system sound files are located in the \Windows folder.
 - b. Tap the check box for **Pause** to cause the YBT250 to pause and display a message box when a limit is exceeded.
 - c. Tap the check box for **Export Screen** to cause the YBT250 to export the screen display when a limit is exceeded. (The name for the exported screen will be automatically generated.)
 - d. Tap the check box for **Save Results** to cause the YBT250 to save the measurement results to a file when a limit is exceeded. The name for the saved file is automatically generated when the file is created.
7. When you are finished setting up the measurement limits, tap **OK**.

NOTE. *The YBT250 automatically optimizes the reference level, span and bandwidth filters to provide the most accurate results when making measurements.*

Saving, Exporting, and Recalling Results, Traces, and Settings

The YBT250 Field Transmitter & Interference Tester can save measurement results and trace displays for later recall or for transfer to a PC. You can also set up the YBT250 for specific tests and save the setup to a file for later recall, saving you time when making measurements in the field.

Volatile memory is memory that loses data when power is removed. Non-volatile memory retains data when power is removed. When the YBT250 is powered off, any data stored in volatile memory is lost. Only data stored in non-volatile memory is retained when the YBT250 is powered off. On the YBT250, the **BuiltInDisk** folder is the only folder maintained in non-volatile memory. You can also use optional PCMCIA memory cards as non-volatile storage memory.

When saving results, traces, or setups, be sure to save them in a folder located in the **BuiltInDisk** folder or optional PCMCIA memory card. When you start the application, the default folders for saving are as follows:

- Saved results: \BuiltInDisk\YBT250\AppData\Results.
- Saved traces: \BuiltInDisk\YBT250\AppData\Results.
- Saved setups: \BuiltInDisk\YBT250\AppData\Settings.

These locations are all located within the **BuiltInDisk** directory and so any data saved there is maintained after the YBT250 is powered down. Saving a file to somewhere other than the default location resets the default location to that location.



For auto saving spectrograms and codograms, you can change the default location only by selecting **Setup > Edit > Save & Export** tab and then changing the path in the **Codogram/Spectrogram Auto saves:** field. Your changes to this setting will persist when you next power-on the instrument.

NOTE. *You should use an optional PCMCIA memory card if you plan to save a lot of measurement data to memory (test measurement results, signal traces, auto saved spectrogram or codogram results, and so on). Using an optional PCMCIA memory card for measurement data keeps the BuiltInDisk memory available for application use.*

Saving Measurement Results

The YBT250 enables you to save a measurement result to a file for later recall. Saving measurement results is meant for use in reproducing a Measure *display* on the YBT250 at a later time. Recalling a saved file allows you to use markers (if available for the measurement) to further analyze the result. 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 3-141.

To save measurement results:

1. Take the measurement you want to save.
2. Select **File > Save Results As** (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
- Pass/fail status of the measurement (if limit testing is enabled)
- 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)
- GPS coordinates (Refer to page 2-51 for GPS set up information.)

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\YBT250\AppData\Results).
3. Select the results file to recall and tap **OK**. The Cammand bar shows results information. See Figure 3-69.
4. To restart measurements, tap the Run button .

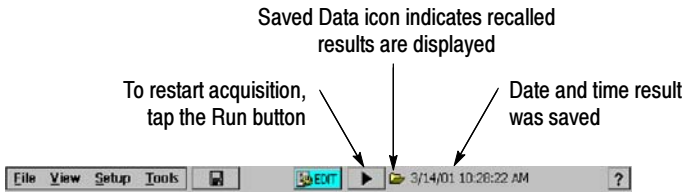


Figure 3-69: Example of a Recalled Result display

When a recalled measurements 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.

You can view the various properties of the trace file by selecting File > Results Properties (see Figure 3-70).

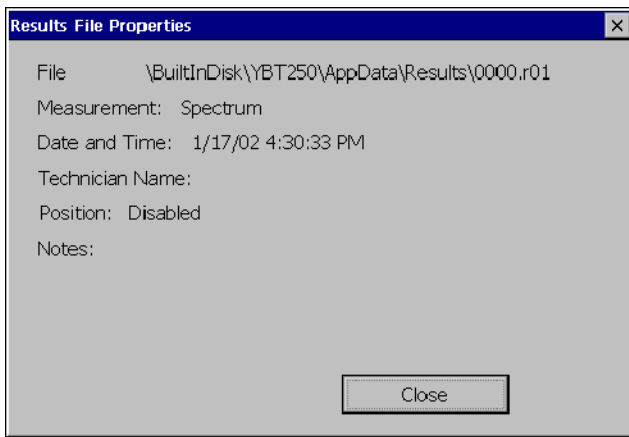


Figure 3-70: Results File Properties dialog box

Exporting Measurement Results

The YBT250 can save measurement results in a file for use in other applications, such as Microsoft Excel. The YBT250 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 3-71 shows an exported results file.

Name	Value	Units	Pass/Fail
Screen Name	RF Power		
Signal Standard	CDMA US Cellular		
Timestamp	8/6/02 12:39:46 PM		
Channel	1		
Channel Forward/Reverse	Forward		
Frequency (Hz)	870030000		
Technician	Chiana		
Notes for saved results	Main Array		
Freq Ref	Internal		
External Reference Frequency:	----	Hz	
Message			
GPS Position	42 50 33.5S, 147 18 30.5E		
Reference Channel	3		
Mask Test Enable (idle) :		False	
RF Channel Power:	-13.1	dBm	

RF Channel Power: 0.000049200 W
Ref Channel Power: -13.3 dBm
Difference: 0.2 dB
Message



Figure 3-71: 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 YBT250 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 YBT250 display. A screen can be saved in three formats: BMP, JPEG and PNG. An exported screen cannot be displayed by the YBT250, 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.



Saving a Trace

A saved trace contains an array of numbers that represent a displayed spectral graph. Saved traces are useful for sending to someone through email, recalling for later display, or printing a hardcopy at a later time. Saving a trace is identical to saving results, except that a trace or traces are included as part of the result.

To save a trace using an automatically generated filename:

- Select **File>Save Trace**.

To save a trace with a filename you enter:

1. Select **File>Save Trace As.....**
2. 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.
3. Choose the location where the file should be saved (the default is \BuiltInDisk\YBT250\AppData\Results).
4. Tap **OK** to save the trace.

Recalling a Trace

To recall a trace for display:

1. Select **File > Open**.
2. Locate the directory that contains the saved trace file (the default is \BuiltInDisk\YBT250\AppData\Results).
3. Select the trace file to recall and tap **OK**.

When a recalled trace is displayed, the Saved Data icon appears at the top of the display and the time and date the file was saved is also displayed. See Figure 3-72.

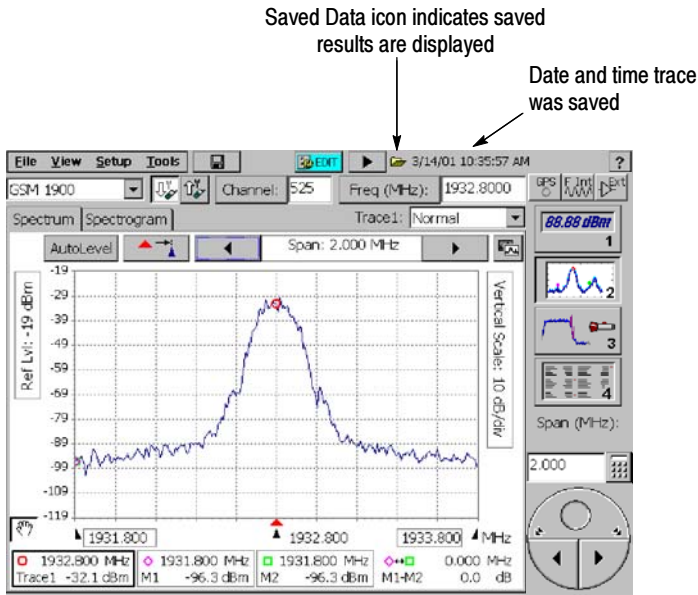




Figure 3-72: Example of a Recalled Trace display

Exporting a Trace

An exported trace is a text file that contains an array of numbers that represent a displayed trace. Exported traces are useful for analyzing with a spreadsheet program. Exported Traces can be saved with either tabs separating the data fields or commas separating the data fields. Exporting a trace is identical to exporting results, except that a trace or traces are included as part of the result.

To export a trace:

1. Select **File>Export Trace As.....**
2. 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.

3. Select the **Type** of file format, either tab-separated or comma-separated.
4. Choose the location where the file should be saved (the default is \BuiltInDisk\YBT250\AppData\Results).
5. Tap **OK** to save the trace.

Differences Between Exported Screens and Traces

Though an exported screen and an exported trace or 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 YBT250 display. A saved or exported trace or results file contains information about the displayed signal.

When you restore and view a saved results or trace file, you can then export that result or trace file. Also, just as if the data were live, you can extract additional data from saved results or trace file on the YBT250 by using the measurement markers and cursors.

Table 3-26 shows the differences between an exported screen and a trace.

Table 3-26: Differences between exported screens and traces

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

¹Binary files can be read only by the YBT250

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 3-27 compares the relative features of each of the export file formats.

Table 3-27: 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 trace file contains information about the YBT250 settings and data that represents the trace. Figure 3-73 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 Figure 3-73.

Name	Value	Units	Pass/Fail
Screen Name	Spectrum		
Signal Standard	CDMA US Cellular		
Timestamp	8/6/02 12:41:13 PM		
Channel	1		
Channel Forward/Reverse	Forward		
Frequency (Hz)	870030000		
Technician	Aeryn Sun		
Notes for saved results			
Freq Ref	Internal		
External Reference Frequency:	-----	Hz	
Message			
GPS Position	Disabled		
Span (Hz)	100000000		
Start Freq (Hz)	820030000		
Stop Freq (Hz)	920030000		
Reference Level (dBm)	1		
dB/div	10		
Trace 1 mode	Normal		
Trace 2 On	True		
Trace 2 Source	Live		
Trace 2 Live mode	Normal		
Mask Test Enabled	False		
Mask Filename			
Mask Limit Test	Pass		
Trace 1 data	Trace 2 data		
-75.1	-75.1		
-85.5	-85.5		
-75.9	-75.9		
-74.6	-74.6		
.....			
-75.1	-75.1		

Figure 3-73: Example of an Exported Trace file



Saving Setups

The YBT250 can save its settings in Setup files for later recall. Recalling a saved setup changes the YBT250 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 taking a Channel Power measurement versus a specific Reference Channel. The saved setup will contain the channel numbers and limits as well as all other instrument control settings. Once the setup is saved, it can be copied to other YBT250 modules to save setup time in the field.

Saved setups contain all the settings included on the Setup pages (Setup > Edit or Edit button). Saved setups do not contain settings made under the Tools menu (such as Tools > Options). Options settings are persistent, but are not part of Saved Setups.

To save YBT250 setups:

1. Set all the YBT250 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\YBT250\AppData\Settings).
5. Tap **OK** to save the setup file.

Recalling Setups

Recalling a saved setup changes the YBT250 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\YBT250\AppData\Settings).
3. Select the setup file to recall and tap **OK**.

Customizing the Setup menu

The YBT250 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 YBT250 enables you to hide setup controls so that accidental changes to saved setups cannot occur.

To hide setup controls:

1. Select **Tools > Options...**
2. Tap the **Setup Menu** tab. See Figure 3-74.

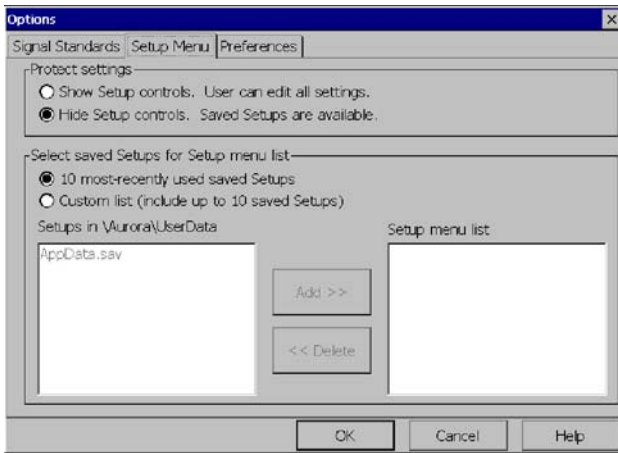


Figure 3-74: Protecting Setup Controls

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, tapping the **Edit** 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 3-74.
3. Select **Show Setup Controls**.

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

Specifying the List of Saved Setups

The YBT250 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 listed in the Setup menu to the `\BuiltInDisk\YBT250\AppData\Settings` folder. The YBT250 will allow you to select only setups located in the `\BuiltInDisk\YBT250\AppData\Settings` folder for display in the Setup menu.
2. Select **Tools > Options...** .
3. Select the **Setup Menu** tab. See Figure 3-75.

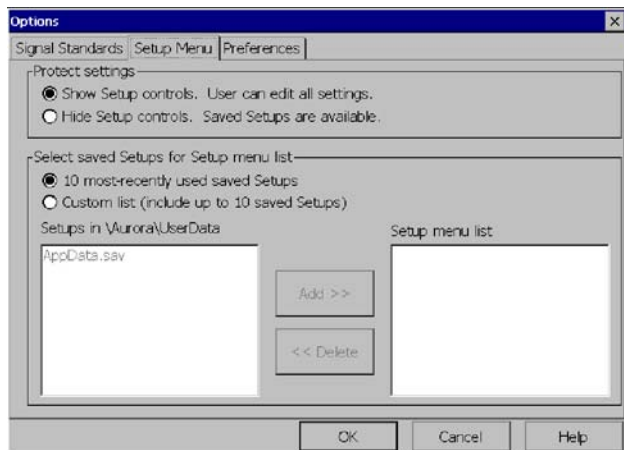


Figure 3-75: Specifying the List of Setups

4. To display the 10 most recently used saved setups in the Setup menu, select **10 most-recently used saved 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 YBT250 Field Transmitter & Interference Tester. 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 YBT250 module, unless otherwise specified. For NetTek Analyzer Platform specifications, please refer to the NetTek Analyzer Platform User Manual.

Table A-1: General characteristics

RF input characteristics	Description
Input Frequency Range	30 MHz - 2500 MHz
Input Impedance	50 ohms (nominal)
Signal Amplitude for Modulation Measurements	-50 dBm to +30 dBm for CW-like or peak envelope power Measurements may be outside this range but accuracy is not guaranteed.
Signal Amplitude for Spectral Display	CW or peak envelope power
Standard	-114 dBm to +30 dBm, 30 MHz to 2500 MHz
Option IN1	-134 dBm to +30 dBm, 200 MHz to 2000 MHz -132 dBm to +30 dBm, 2000 MHz to 2200 MHz -129 dBm to +30 dBm, 2200 MHz to 2500 MHz, typical Levels apply only when using 100 kHz span (1 kHz resolution bandwidth)
Input Overload Detect	>1 W (+30 dBm) CW or peak envelope power
Maximum Input Power without Damaging Instrument	50 W CW or peak envelope power
Coupling	AC for all measurements and spectral display modes

Table A-1: General characteristics (Cont.)

RF input characteristics	Description
Working Voltage	≥ 15 V (DC + peak AC)
Spurious Input Signals	To meet modulation measurement specifications: (Total power of interest - Total power in spurious) > 35 dB or (Center frequency of signal of interest - center frequency of spurious signal) > 1.4 MHz and (Total power of interest - Total power in all spurious) ≥ -3 dB
External Reference Input Characteristics	Description
Impedance	50 ohms (nominal)
Frequency Range	Any multiple of 1 MHz up to 15 MHz inclusive, ± 1 ppm Any multiple of 1.2288 MHz up to 19.6608 MHz inclusive, ± 1 ppm 2.048 MHz ± 1 ppm 4.8 MHz ± 1 ppm
Level Range	-15 dBm to +15 dBm
Maximum Input Level without Damage Instrument	± 3 V peak continuous
Coupling	AC
Working Voltage	3 V (DC + pk. AC)
Lock Time	< 15 seconds
Timing Input Characteristics	Description
Impedance	10 k Ω
Minimum High Threshold	2.0 V

Table A-1: General characteristics (Cont.)

Timing Input Characteristics	Description
Maximum Low Threshold	0.8 V
Minimum High Time	10 ns
Minimum Low Time	10 ns
Maximum Input Level without Damage	± 5 V peak continuous
Coupling	DC
Frequency Lock Range	± 10 ppm
Internal Time Base Characteristics	Description
Error	<p>± 0.5 ppm drift from 0 °C to 50 °C</p> <p>± 1.0 ppm aging/year</p> <p>Ten minute warm-up period required to meet accuracy specification.</p> <p>Users can connect the External Reference input to a frequency source and obtain a user correction value. This value will be used to correct time base errors in measurements to the accuracy of the external reference. The internal time base will continue to drift with temperature and age as specified above.</p>
Signal Path Characteristics	Description
Phase Noise	≤ -70 dBc/Hz @ 20 kHz carrier offset

Table A-2: Measurement characteristics

Measurement	Description
Standards Supported	See Table F-1 on page F-1.
External Attenuation	User Selectable ON/OFF Attenuation = -30 dB to +80 dB

Table A-2: Measurement characteristics (Cont.)

Measurement	Description
RF Channel Power	Measures the average RF power in a user-defined channel. The default value of channel bandwidth is taken from the selected standard. The acceptable values for channel numbers are taken from the selected standard. The user can input channel center frequency instead of channel number.
Units	Watts (W) dBm
Resolution	3 significant digits for W 0.1 dB for dBm units
Accuracy	± 0.75 dB: -20 dBm to +30 dBm, ± 0.5 dB typical ± 1.25 dB: -80 dBm to -20 dBm, ± 1.0 dB typical Reference Information: Accuracy is guaranteed for input signals between -80 and +30 dBm total power (CW or peak envelope). Accuracy specification is typical down to -120 dBm total power.
RF Power (GSM/EDGE)	Measures the average RF power of the useful part of a GSM or EDGE burst (GMSK or 8-PSK modulation), as determined by the location of the burst Training Sequence.
Units	dBm
Resolution	0.01 dB for dBm units
Accuracy	For GSM or EDGE (GMSK or 8-PSK modulation) burst signals, the RF power shall be measured with an accuracy as follows: ± 1.0 dB: -20 dBm to +30 dBm, ± 0.75 dB typical ± 1.5 dB: -80 dBm to -20 dBm, ± 1.25 dB typical

Table A-2: Measurement characteristics (Cont.)

Measurement	Description
	Reference Information: Burst timing is determined from the location of the burst Training Sequence. If Burst timing cannot be found, the power measurement will be done on an arbitrarily selected segment of the signal equal to the useful part of a slot.
RF Power (1xEV-DO)	Measures the RF power in the Pilot, MAC, and Data intervals of a 1xEV-DO timeslot.
Units	dBm
Resolution	0.01 for dBm units
Accuracy	For burst signals, the RF power shall be measured with an accuracy as set forth in the following list: ± 1.0 dB: -20 dBm to +30 dBm, ± 0.75 dB typical ± 1.5 dB: -80 dBm to -20 dBm, ± 1.25 dB typical
RF Channel Carrier Frequency	Measures the frequency of the carrier in the user selected channel. The user can enter either a channel number or frequency.
Units	MegaHertz (MHz)
Resolution	1 Hz
Accuracy	± (10 Hz + Time Base Error), 99% confidence interval W-CDMA: ± (12 Hz + Time Base Error), 99% confidence interval Note: Carrier frequency must be within 10 kHz of expected value, except: W-CDMA, 1xEV-DO, and GSM/EDGE: within 5 kHz IS-136: within 1.5 kHz W-CDMA 3GPP Test Model 4

Table A-2: Measurement characteristics (Cont.)

Measurement	Description
Accuracy using YBGPS1 GPS Timing Reference	<p>± (10 Hz + 0.015 ppm), typical</p> <p>Note: Carrier frequency must be within 10 kHz of the expected value, except:</p> <p>W-CDMA, 1xEV-DO, and GSM/EDGE: within 5 kHz</p> <p>IS-136: within 1.5 kHz</p> <p>The GPS antenna and the YBT250 antenna should be stationary for specified accuracy. Doppler shift of BST frequency is +/- 0.09 ppm when the YBT250 antenna is moving at 60 mph (100 km/hr).</p>
FM Deviation	Measures the maximum one-side frequency deviation of the analog FM cellular carrier selected by the user after demodulation. The user can enter a channel number or frequency.
Units	kiloHertz (kHz)
Resolution	0.1 kHz
Accuracy	<p>± 10% for 2 kHz ≤ Deviation ≤ 10 kHz</p> <p>Maximum measurable deviation is 15 kHz peak.</p> <p>Maximum modulation frequency is 3 kHz.</p>
PN Offset	Measures the PN Offset of the cdmaOne or cdma2000-1x signal. The user can select the CDMA signal of interest by a channel number or frequency.
Units	PN Index
Resolution	<p>1 PN Index</p> <p>Each PN Index is 64 chips</p>
Accuracy	Displayed PN Index must match PN Offset of CDMA signal.

Table A-2: Measurement characteristics (Cont.)

Measurement	Description
Pilot Time Alignment Error (Tau)	Measures the time offset between the PN sequence of the input signal and the External Even Second Clock (on Timing Input connector).
Units	Microsecond (μs) Chips
Resolution	0.1 μs 1 chip
Accuracy	± 250 ns typical
Waveform Quality (Rho, ρ)	Measures waveform quality as defined by IS-97-D using a "pilot-only" CDMA (or cdma2000-1x) signal.
Units	None
Resolution	0.0001
Accuracy	± 0.005 , $0.9 \leq \rho \leq 1.0$ Usable range $0.5 \leq \rho \leq 1.0$ Degradation due to adjacent channel CDMA carriers (having equivalent power): add ± 0.015 .
	Reference Information: The Rho measurement is only specified for a "pilot-only" CDMA signal. The accuracy specification given here applies only to measurements made on a "pilot-only" CDMA signal, and with the instrument set to use the pilot only method. For measurements on signals that are not "pilot-only", see the Estimated Waveform Quality measurement.

Table A-2: Measurement characteristics (Cont.)

Measurement	Description
1xEV-DO Waveform Quality (Overall Rho, Rho Overall-1, Rho Overall-2)	<p>Rho (ρ) for 1xEV-DO signals provides an indication of the signal to distortion ratio for the transmitted signal. This quality measure is an indication of how similar the transmitted signal is to a perfect signal. Rho can vary between 0.0 and 1.0, where 1.0 represents a perfect signal</p> <p>Pilot Rho is only computed on chips in the Pilot intervals. Pilot Rho is measured on the pilot interval of 20 half-slots.</p> <p>Rho Overall-1 is computed on all chips of one non-idle (active data) slot waveform, including pilot, MAC, and data intervals. Overall-1 Rho is only computed when a non-idle slot is detected in the input signal.</p> <p>Rho Overall-2 is computed on all chips of one non-idle (active data) slot waveform, including pilot, MAC, and data intervals, starting at an offset of one-quarter slot into the slot waveform. Rho Overall-2 is only computed when two consecutive non-idle slots are detected in the input signal</p>
Units	None
Resolution	0.0001
Accuracy, pilot only	<p>$\pm 0.005, 0.9 \leq \rho \leq 1.0$</p> <p>Usable range $0.5 \leq \rho \leq 1.0$</p> <p>Degradation due to adjacent channel CDMA carriers (having equivalent power): add ± 0.015.</p>
Estimated Waveform Quality	Measures waveform quality as defined by IS-97-D using any CDMA signal.
Units	None
Resolution	0.0001
Accuracy	± 0.01 for $\rho \geq 0.9$, typical

Table A-2: Measurement characteristics (Cont.)

Measurement	Description
	<p>Reference Information:</p> <p>The Rho measurement as given in IS-97-D is only specified for a “pilot-only” CDMA signal. This measurement makes an estimate of the Rho value on any CDMA signal.</p>
Error Vector Magnitude (EVM) (cdmaOne & cdma2000)	The normalized RMS of all of the vectors that extend from the intended constellation points to the actual symbol points in a record of symbols.
Resolution	0.01%
Accuracy	<p>Degradation due to adjacent channel CDMA carriers (having equivalent power): add 10%.</p> <p>$\pm 1\%$; $EVM \leq 31\%$</p> <p>Residual error: 5% < 1000 MHz 7% < 2000 MHz</p> <p>Reference Information:</p> <p>These measurements are accurate for both pilot-only and in-service CDMA signals.</p>

Table A-2: Measurement characteristics (Cont.)

Measurement	Description
Error Vector Magnitude (EVM) (W-CDMA)	The normalized RMS of all of the vectors that extend from the intended constellation points to the actual symbol points in a record of symbols.
Resolution	0.01%
Accuracy (W-CDMA composite)	<p>$\pm 2.5\%$; $12.5\% \leq \text{EVM} \leq 22.5\%$</p> <p>Residual error: 6% < 1000 MHz 8% < 2500 MHz</p> <p>Reference Information:</p> <p>W-CDMA composite refers to a signal with one or more channels using QPSK modulation or a combination of QPSK and 16QAM modulation. The EVM measurement readout displays the EVM for the composite signal.</p> <p>W-CDMA 3GPP Test Model 4</p>
Accuracy (W-CDMA EVM16QAM)	<p>$\pm 1.5\%$; $6.5\% \leq \text{EVM}_{16\text{QAM}} \leq 22.5\%$, typical</p> <p>Residual error: 4%</p> <p>Reference Information:</p> <p>The EVM_{16QAM} measurement readout displays the symbol EVM for the code channels using 16QAM modulation.</p>
Code Domain Power (cdmaOne, cdma2000, W-CDMA)	<p>Measures the power in each of the Walsh codes (64 in cdmaOne, 128 in cdma2000) used in a CDMA signal.</p> <p>Measures the power in each of (up to 512) OVSF codes used in a W-CDMA signal.</p>
Units	<p>dB relative to Pilot Power</p> <p>dB relative to Total Power</p>
Resolution	0.1 dB

Table A-2: Measurement characteristics (Cont.)

Measurement	Description
Accuracy	<p>cdmaOne and cdma2000: ± 1 dB code domain power level > -20 dB relative to total power, using the recommended TIA/EIA-IS-97-D pilot level of -7.0 dB (20%) relative to total power.</p> <p>W-CDMA: ± 1 dB Code domain power level > -20 dB relative to total power, using W-CDMA 3GPP Test Model 3.</p> <p>Reference Information: ± 2.5 dB for -27 dB $< CDP < -20$ dB relative to total power in band classes 0-6 (cdmaOne, cdma2000). ± 2.5 dB for -27 dB $< CDP < -20$ dB relative to total power (W-CDMA).</p>
Peak Code Domain Error (PCDE) (W-CDMA)	Measures the code domain error of all codes and displays the maximum measured code domain error.
Units	dB
Resolution	0.1 dB
W-CDMA Synchronization Channel Power	Measures the Primary Synchronization Channel (P-SCH) and Secondary Synchronization Channel (S-SCH) power.
Units	dBm, W
Resolution	0.1 dBm
1xEV-DO Code Domain Power	<p>Measures the power in each code in the MAC interval.</p> <p>The data code domain power measurement gives an indication of the overall minimum and maximum power for codes in the data interval of active slots.</p>
Units	dB relative to Total Power
Resolution	0.1 dB MAC 0.01 dB data
Accuracy	± 1 dB for code domain power level > -20 dB relative to total power for MAC.

Table A-2: Measurement characteristics (Cont.)

Measurement	Description
	<p>Reference Information:</p> <p>± 2.5 dB for -27 dB < CDP < -20 dB relative to total transmit power for MAC.</p> <p>± 0.5 dB codes from active slots for data.</p> <p>This measurement is accurate for QPSK data with pilot and 2 MAC channels.</p>
Carrier Feedthrough	Measures the offset of the constellation from zero power.
Units	dB relative to full carrier power
Resolution	0.1 dB
Accuracy	<p>cdmaOne and cdma2000: ± 2 dB</p> <p>Residual floor: -50 dBc</p> <p>Reference Information:</p> <p>For cdmaOne and cdma2000, the carrier feedthrough measurement is valid only for a pilot-only signal.</p>
Pilot Power	Measures the absolute power of the pilot. It is made without regard to whether other codes are present. (P-CPICH for W-CDMA.)
Units	dBm, Watts (W)
Resolution	0.1 dB
Accuracy	<p>± 1 dB, -20 dBm to $+30$ dBm</p> <p>± 1.5 dB, -50 dBm to -20 dBm</p> <p>Reference Information:</p> <p>W-CDMA 3GPP Test Model 2</p>
Sync Power	Measures the absolute power of the W-CDMA sync channel (SCH). It is made without regard to whether other codes are present.
Units and Resolution	dBm, Watts (W): 0.1 dB

Table A-2: Measurement characteristics (Cont.)

Measurement	Description
Occupied Bandwidth	The occupied bandwidth measurement gives the frequency bandwidth within which 99% of the power transmitted on a single channel lies. This measurement can be properly made only if the channel being measured has no channels adjacent to it.
Units	Hertz (Hz)
Resolution	Three significant digits
Accuracy	5% of the reading, typical
Adjacent Channel Leakage power Ratio (ACLR) (W-CDMA)	Measures the ratios of the mean RRC filtered power in the 5 MHz BW assigned channel to the mean RRC filtered power in each of the nearest 5 MHz BW 1st and 2nd adjacent upper and lower channels. Adjacent channel centers are offset in multiples of 5 MHz from the assigned channel center. User can input channel center frequency instead of channel number.
Units and Resolution	dB: 0.01 dB
Accuracy	± 1.5 dB, $20 \leq \text{ACLR} < 48$ dB, typical ± 2.5 dB, $48 \leq \text{ACLR} < 53$ dB, typical -30 dBm to +20 dBm (power in assigned channel)
	Reference Information: WCDMA Test Model 1 signal (3G PP TS25.141). Filter response is Root-Raised Cosine (RRC), $\alpha=0.22$, 3.84 MHz noise BW (3GPP TS25.104).
GSM/EDGE Error Vector Magnitude (EVM)	Error Vector Magnitude is the normalized RMS value of all of the vectors that extend from the intended constellation points to the actual symbol points in a record of symbols. The EVM measurement is made over one GSM or EDGE burst.
Units	Percent
Resolution	0.01%
Accuracy (8-PSK only)	$\pm 1.5\%$, $4\% \leq \text{EVM} < 10\%$ Residual error: 4.0%

Table A-2: Measurement characteristics (Cont.)

Measurement	Description
GSM/EDGE Phase Error	Phase Error is the RMS value of the differences between the phase angles of the received signal and those of an ideal reconstructed signal. The Phase Error measurement is made over one GSM or EDGE burst.
Units	Degrees
Resolution	0.01°
Accuracy (GMSK only)	± 1.0°, 2° ≤ Phase Error < 12° Residual error: 2.0°
GSM/EDGE Origin Offset	Origin Offset is the ratio of unmodulated signal power to modulated signal power. The unmodulated signal component causes the signal constellation center to be offset from the ideal location. The Origin Offset measurement is made over one GSM or EDGE burst.
Units	dB
Resolution	0.01 dB
Range	-15 dB to -60 dB
GSM/EDGE Carrier to Interference (C/I)	Carrier to Interference (C/I) is the ratio of desired signal (carrier) to undesired signal (interference). The C/I measurement is derived from the EVM result and gives an estimate of the power-based C/I value. The C/I measurement is made over one GSM or EDGE burst.
Units	dB
Resolution	0.01 dB
Range	0 dB to 50 dB
	Reference Information: C/I is derived from EVM using the following equation: $C/I = -20 * \log_{10}(EVM/100)$
GSM/EDGE RF Power vs Time	Power vs Time displays the normalized signal envelope power over one GSM or EDGE burst.
Units	Time Axis: Symbols Microseconds

Table A-2: Measurement characteristics (Cont.)

Measurement	Description
Resolution	Time Axis: 1 symbol 1 microsecond
Time uncertainty	±0.2 symbol ±0.8 microsecond
	Reference Information: Burst to mask alignment is derived from the location of the Training Sequence in the useful part of the burst.

Table A-3: Spectral analysis characteristics

Characteristic	Description
Measurement Frequency	Sets the measurement frequency of the display. The measurement frequency can be set by either entering a specific frequency or by selecting a channel number.
Units	MegaHertz (MHz) Channel Number
Resolution	1 kHz 1 channel
Range	30 MHz to 2500 MHz
Frequency Span	Sets the frequency range covered by the spectral display.
Units	kiloHertz (kHz) MegaHertz (MHz)
Resolution	1 kHz
Range	10 kHz to 2470 MHz, continuously variable or 1-2-5 steps
Resolution Bandwidth (RBW)	Width of the resolution bandwidth filter

Table A-3: Spectral analysis characteristics (Cont.)

Characteristic	Description
Units	Hertz (Hz) kiloHertz (kHz) MegaHertz (MHz)
Resolution	Uses 1-3 steps to cover the range
Range	100 Hz to 6 MHz Instrument automatically sets RBW. The RBW is set as a combination of 1-3 steps at the 1, 2, 5 span settings, and a linear range between 1, 2, 5 span settings, for a nominal value of approximately Span/125.
Reference Level	The power level indicated by the top line of the spectral display
Units	dBm
Resolution	1 dB
Range	-100 dBm to +30 dBm
Spectral Display Amplitude	
Units	dB relative to Reference Level
Resolution	0.1 dB
Range	100 Hz to 1 MHz
Accuracy	
Standard	± 1.25 dB, -20 dBm to +30 dBm ± 2.0 dB, -80 dBm to -20 dBm ± 2.75 dB, -104 dBm to -80 dBm
Option IN1	± 1.25 dB, -20 dBm to +30 dBm ± 2.0 dB, -80 dBm to -20 dBm ± 2.75 dB, -120 dBm to -80 dBm ± 5 dB -134 dBm < Input < -120 dBm, typical

Table A-3: Spectral analysis characteristics (Cont.)

Characteristic	Description
	<p>Reference Information (applies to Standard and Option IN1 Accuracy):</p> <p>Accuracy specs apply only for spans less than 1000 MHz, and to CW-like signals</p> <p>The amplitude accuracy for Noise-like signals is degraded when averaging is turned on. This is approximately a 2.5 dB degradation due to the averaging being done after the logging instead of before. Any accuracy for noise-like signals using a marker will be impacted greatly by the user not necessarily knowing the effective IF noise bandwidth, and less so by this error. Therefore it is recommended that the user utilize power measurement routines instead of markers for any noise-like signals.</p>
Vertical Scale Factor	
Units	1 dB to 10 dB in 1 dB increments
Display Modes	<p>Normal - updates display with each new result</p> <p>Max Hold - updates displayed point only if new point > old point</p> <p>Min Hold - updates displayed point only if new point < old point</p> <p>Max/Min Hold - displays a bar between Max Hold and Min Hold</p> <p>Average - displays average of N (specified by user) results</p> <p>Reference Information:</p> <p>Average is calculated as follows - The last N values are saved in memory; when a new result is available, the earliest result of the N stored values is discarded, the new average is calculated from the stored values. If the number of results is less than N, then all of the results are averaged together.</p>
Number of Averages	$1 \leq N \leq 99$

Table A-3: Spectral analysis characteristics (Cont.)

Characteristic	Description
Spurious Free Dynamic Range (external signal related)	> 70 dB, except 2 nd harmonic > 60 dB typical
Residual Spurious Signals	<p>-125 dBm at BTS Rx frequencies (776-794, 806-849, 872-940, 1453-1465, 1525-1549, 1710-1785, 1840-1910, 1920-1980) MHz and GPS frequencies (L1 1570.3 - 1580.5, L2 1222.5-1232.8, L5 1171.4-1181.6) MHz</p> <p>-115 dBm at BTS Tx frequencies (746-764, 832-834, 840-960, 1477-1513, 1805-1880, 1930-1990, 2110-2170) MHz</p> <p>-95 dBm at frequencies not listed above, except from 1155 to 1168 MHz: -20 dBm in spans above 10 MHz, 1155 MHz to 1175 MHz</p>

Table A-4: Interference analysis characteristics

Characteristic	Description
Modulation Identification	Attempts to display the type of modulation present on a signal identified by the user.
Input Signal Level	<p>-114 dBm minimum for all signal types</p> <p>+30 dBm maximum for CW or peak envelope power</p>
Carrier Frequency	See RF Carrier Frequency on page A-5 for specifications
Power in Bandwidth	See RF Channel Power on page A-4 for specifications
Modulation Type	<p>The types of modulation identified are those listed in Appendix <i>Supported Signal Standards</i>.</p> <p>For signals to be properly identified, they should have a minimum S/N of 30dB.</p>

Table A-4: Interference analysis characteristics (Cont.)

Characteristic	Description
Noise Floor Measurement	Measures the interference power that is coming into the receiver antenna for any standard. Measurement defaults to uplink channel when specified by channel number.
Units	dBm
Resolution	0.1 dB
Accuracy	± 3 dB typical
AM Demodulation	Provides an audio output signal after AM demodulation of the user-selected signal
Measurement Frequency	30 MHz to 2500 MHz with 1 kHz resolution
Input Signal Level	-100 dBm minimum
Measurement Bandwidth	8 kHz
Audio Output Bandwidth	4 kHz
Run Time	4 seconds per activation
FM Demodulation	Provides an audio output signal after FM demodulation of the user-selected signal
Measurement Frequency	30 MHz to 2500 MHz with 1 kHz resolution
Input Signal Level	-100 dBm minimum
Maximum Signal Deviation	Up to 100 kHz
Measurement Bandwidth	8 kHz, 15 kHz, 75 kHz, 200 kHz; Selected by user
Audio Output Bandwidth	4 kHz for Measurement BW = 8 kHz, 15 kHz 15 kHz for Measurement BW = 75 kHz, 200 kHz
Run Time	4 seconds per activation
Signal Strength Indicator	Provides an audio tone and a visual display that vary with the strength of the selected signal
Input Signal Level	-110 dBm minimum
Measurement Frequency	30 MHz to 2500 MHz with 1 kHz resolution
Measurement Bandwidth	Up to 10 MHz, dependent on span setting

Table A-4: Interference analysis characteristics (Cont.)

Characteristic	Description
Tone Type	Variable Beep Rate, based on signal strength Variable Frequency, based on signal strength
RF Field Strength (EMF)	Measures the absolute electromagnetic power of a signal at a particular frequency and bandwidth as it strikes an antenna.
Units and resolution	dBm: 0.1 dB μ V/m: 0.1 V/m: 0.000001 (6 digits) W/m ² : 0.000000001 (9 digits)
Accuracy	± 0.75 dB: -20 dBm to +30 dBm, ± 0.5 dB typical ± 1.25 dB: -80 dBm to -20 dBm, ± 1.0 dB typical Accuracy is guaranteed for input signals between -80 dBm and +30 dBm total power (CW or peak envelope). Accuracy specification is typical down to -120 dBm total power.
W-CDMA Field Strength (EMF)	Measures field strength for a series of W-CDMA Scrambling Codes (options IN1 and WS1)
Units and resolution	dBm: 0.1 dB μ V/m: 0.1 V/m: 0.000001 (6 digits) W/m ² : 0.000000001 (9 digits)
Accuracy, typical	Ec: ± 2.0 dB for Ec \geq -102 dBm and Ec/I ₀ \geq -12dB ± 3.0 dB for Ec \geq -112 dBm and Ec/I ₀ \geq -14dB

Table A-5: Scanner characteristics

Characteristic	Description
W-CDMA Scrambling Code Analyzer	Detects scrambling codes and pilot channel power levels of received co-channel W-CDMA downlink signals
Input Signal Range	-117 to +30 dBm, typical
Units	Io, Ec: dBm Ec/Io: dB
Resolution	0.1 dB
Accuracy	Ec: ±2 dB for $E_c \geq -102$ dBm and Ec/Io ≥ -12 dB, typical ±3 dB for $E_c \geq -112$ dBm and Ec/Io ≥ -14 dB, typical
Display Controls	Sort by Power (descending Ec value) Sort by Scrambling Code (ascending SC index) Lock (set) current Scrambling Code set
cdma2000 PN Scanner	Detects PN Offset, Tau (Timing Error) and Pilot Channel power levels of multiple co-channel cdmaOne and/or cdma2000 forward link signals.
Input Signal Range	-120 to +30 dBm, typical
Units	Io, Ec: dBm Ec/Io: dB PN Offset: PN index (0 to 511) Tau: chips
Resolution	Ec, Io, Ec/Io: 0.1 dB PN Offset: 1 PN index Tau: 0.1 chip

Table A-5: Scanner characteristics (Cont.)

Characteristic	Description
Accuracy	<p>Ec: ± 2 dB for $E_c \geq -95$ dBm and $E_c/I_o \geq -8$ dB, typical</p> <p>± 3 dB for $E_c \geq -110$ dBm and $E_c/I_o \geq -12$ dB, typical</p> <p>Tau: 0.5 chip, of highest power multipath component of each detected PNOS, relative to input timing reference (ESC or YBGPS1), typical.</p>
Display Controls	<p>Sort by Power (descending E_c value)</p> <p>Sort by PN offset (ascending offset values)</p> <p>Lock (set) current PN Offset values</p>
1xEV-DO PN Scanner	<p>Detects PN Offset, Tau (Timing Error) and Pilot Channel power levels of multiple co-channel 1xEV-DO forward link signals. Up to 10 PN offsets are displayed.</p> <p>I_o: The total received power in the pilot intervals of the signal, within the signal bandwidth (1.23 MHz).</p> <p>E_c: The absolute power level of the detected pilot at the indicated PN Offset, in dBm.</p>
Input Signal Range	<p>-120 to +30 dBm, typical</p>
Units	<p>I_o, E_c: dBm</p> <p>E_c/I_o: dB</p> <p>PN Offset: PN index (0 to 511)</p> <p>Tau: chips</p>
Resolution	<p>E_c, I_o, E_c/I_o: 0.1 dB</p> <p>PN Offset: 1 PN index</p> <p>Tau: 0.1 chip</p>

Table A-5: Scanner characteristics (Cont.)

Characteristic	Description
Display Controls	Sort by Power (descending Ec value) Sort by PN offset (ascending offset values) Lock (set) current PN Offset values
GSM Channel Scanner	The GSM channel scanner displays channel power and related information on a maximum of 128 GSM forward link signals. Displays Channel, Frequency, Peak Power, Traffic Type, C/I, and BSIC. The scanner is intended for off-air reception using an antenna, and measures only forward (down) link signals. This measurement requires that YBT250 option GS1 is installed.
Input Signal Range	-120 to +30 dBm, typical
Units	Frequency: MHz Peak Power: dBm C/I: dB
Resolution	Frequency: 0.001 MHz Peak Power: 0.1 dBm C/I: 0.1 dB
Display Controls	AutoLevel (graph) Sort table by power or frequency Start and stop channel select Peak hold

Table A-6: Environmental characteristics

Characteristic	Description
Temperature Range	
Operating	0 °C to +50 °C specified performance, -10 °C to +50 °C typical
Nonoperating	-40 °C to +60 °C
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
Altitude	
Operating	Up to 4,600 m (15,092 ft.)
Nonoperating	Up to 15,240 m (50,000 ft.)

Table A-7: Physical characteristics

Characteristic	Description
Dimensions	Height: 25 cm. (9.75 in) Width: 33 cm. (13 in) Depth: 9 cm. (3.5 in)
Weight	1.42 kg (3.125 lbs), YBT250 module only 4.10 kg (9 lbs), NetTek Analyzer Platform only, with one battery

Table A-8: 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	2 years

Table A-9: Safety compliance

Category	Standards or description
Safety Compliance	ANSI/UL61010-1:2004 Electrical Equipment for Measurement, Control, and Laboratory Use. CSA C22.2 No. 61010.1:2004 Electrical Equipment for Measurement, Control, and Laboratory Use. EN 61010-1:2001 Electrical Equipment for Measurement, Control, and Laboratory Use. IEC61010-1:2001 Electrical Equipment for Measurement, Control, and Laboratory Use. ISA 82.02.01 Electrical Equipment for Measurement, Control, and Laboratory Use.

Table A-10: Electromagnetic compatibility (EMC)

Category	Standards or description																		
EC Declaration of Conformity - EMC	<p>Meets the intent of Directive 89/336/EEC for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Union:</p> <table border="0"> <tr> <td data-bbox="314 483 410 508">EN 61326</td> <td data-bbox="508 483 886 570">Annex D, EMC requirements for Class A electrical equipment for measurement, control, and laboratory use^{1,2,3}</td> </tr> <tr> <td data-bbox="314 570 463 594">IEC 61000-4-2</td> <td data-bbox="508 570 809 594">Electrostatic discharge immunity</td> </tr> <tr> <td data-bbox="314 594 463 618">IEC 61000-4-3⁴</td> <td data-bbox="508 594 916 618">Radiated RF electromagnetic field immunity</td> </tr> <tr> <td data-bbox="314 618 463 643">IEC 61000-4-4</td> <td data-bbox="508 618 862 643">Electrical fast transient/burst immunity</td> </tr> <tr> <td data-bbox="314 643 463 667">IEC 61000-4-5</td> <td data-bbox="508 643 756 667">Power line surge immunity</td> </tr> <tr> <td data-bbox="314 667 463 691">IEC 61000-4-6⁴</td> <td data-bbox="508 667 682 691">Conducted RF immunity</td> </tr> <tr> <td data-bbox="314 691 463 716">IEC 61000-4-11</td> <td data-bbox="508 691 873 716">Voltage dips and interruptions immunity</td> </tr> <tr> <td data-bbox="314 716 463 740">EN 61000-3-2</td> <td data-bbox="508 716 873 740">Conducted power line harmonic current</td> </tr> <tr> <td data-bbox="314 740 463 764">EN 61000-3-3</td> <td data-bbox="508 740 886 764">Voltage changes, fluctuations, and flicker</td> </tr> </table>	EN 61326	Annex D, EMC requirements for Class A electrical equipment for measurement, control, and laboratory use ^{1,2,3}	IEC 61000-4-2	Electrostatic discharge immunity	IEC 61000-4-3 ⁴	Radiated RF electromagnetic field immunity	IEC 61000-4-4	Electrical fast transient/burst immunity	IEC 61000-4-5	Power line surge immunity	IEC 61000-4-6 ⁴	Conducted RF immunity	IEC 61000-4-11	Voltage dips and interruptions immunity	EN 61000-3-2	Conducted power line harmonic current	EN 61000-3-3	Voltage changes, fluctuations, and flicker
EN 61326	Annex D, EMC requirements for Class A electrical equipment for measurement, control, and laboratory use ^{1,2,3}																		
IEC 61000-4-2	Electrostatic discharge immunity																		
IEC 61000-4-3 ⁴	Radiated RF electromagnetic field immunity																		
IEC 61000-4-4	Electrical fast transient/burst immunity																		
IEC 61000-4-5	Power line surge immunity																		
IEC 61000-4-6 ⁴	Conducted RF immunity																		
IEC 61000-4-11	Voltage dips and interruptions immunity																		
EN 61000-3-2	Conducted power line harmonic current																		
EN 61000-3-3	Voltage changes, fluctuations, and flicker																		
Australia/New Zealand Declaration of Conformity - EMC	<p>Complies with EMC provision of Radiocommunications Act per the following standard(s):^{1,2}</p> <table border="0"> <tr> <td data-bbox="314 902 479 927">AS/NZS 2064.1/2</td> <td data-bbox="508 902 926 951">Industrial, Scientific, and Medical Equipment: 1992</td> </tr> </table>	AS/NZS 2064.1/2	Industrial, Scientific, and Medical Equipment: 1992																
AS/NZS 2064.1/2	Industrial, Scientific, and Medical Equipment: 1992																		

- ¹ EMC compliance was demonstrated using high-quality shielded interface cables.
- ² Emissions that exceed the limits of this standard may occur when the instrument is connected to a test object.
- ³ Minimum immunity test requirement.
- ⁴ Residual spurious signals can increase to -70 dBm with exposure to the disturbance levels of this test.

Appendix B: Accessories

This section lists the YBT250 Field Transmitter & Interference Tester standard and optional accessories.

Standard Accessories

Table B-1 lists the accessories that come standard with your YBT250 Field Transmitter & Interference Tester.

Table B-1: Standard accessories

Quantity	Part number	Description
2	200-0678-00	BNC Connector Cover
1	200-4696-00	N Connector Cover
1	016-1868-00	Spacer
1	020-2464-XX	User manual, English, with CD-ROM containing YBT250 Field Transmitter & Interference Tester software

Optional Accessories

Table B-2 lists optional accessories for your NetTek YBT250 Field Transmitter & Interference Tester. Contact your Tektronix representative or distributor for ordering information.

Table B-2: Optional accessories

Part number	Description
YBGPS1	YBGPS1 GPS Timing Reference receiver. Required for taking cdma2000 (with option CS1) or 1xEVDO (with option ES1) over-the-air (OTA) measurements
119-7114-00	YBGPS1 GPS Antenna, Active, Magnetic Mount
174-5192-00	YBGPS1 to Y400/Y350C NetTek Adapter cable
174-5193-00	YBGPS1 SMA (M) to BNC (F) Adapter cable
012-0114-00	Low-precision N 6 foot cable (1.83 m)
012-0482-00	RF Coaxial Cable, 50 Ohm, 36 inch (91 cm), BNC Male to BNC Male
012-1619-00	Calibrated precision N 10 Foot Cable
103-0045-00	N Male to BNC Female Adapter
103-0429-00	Barrell N Female
103-0430-00	N Male to N Male Adapter, DC-18 GHz
103-0431-00	7-16(F) to N(F) Adapter
103-0432-00	7-16(M) to N(F) Adapter
119-6594-00	Beam Antenna 824 MHz - 896 MHz
119-6595-00	Beam Antenna 896 MHz - 960 MHz
119-6596-00	Beam Antenna 1710 MHz - 1880 MHz
119-6597-00	Beam Antenna 1850 MHz - 1990 MHz
119-6598-00	DC Block Type N
119-6599-00	N(F) to N(M) Attenuator 50 W, 20 dB
119-6600-00	Calibrated Coupler "N" 500 MHz - 1000 MHz

Table B-2: Optional accessories (Cont.)

Part number	Description
119-6601-00	Directional Coupler "N" 920 MHz -2200 MHz
119-6602-00	Universal Adapter Kit, 30 pcs
119-6609-00	Sniffer Antenna
174-3578-00	SMB Female to BNC Male
200-4727-00	BNC Connector Cap
200-4728-00	N Connector Cap

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

Appendix C: Measurement Options

This section lists the configuration and measurement options available for the YBT250. To take RF measurements, interference measurements or modulation measurements, a measurement option must be installed in the YBT250. You can order any combination of options. You can add a measurement option to your YBT250 without returning it to Tektronix. For information on installing a measurement option on your YBT250, see Appendix D.

Table C-1 lists the measurement options available for the YBT250 Field Transmitter & Interference Tester.

Table C-1: Measurement options

Option	Description
AR1	Add RF measurements for Analog standards
CD1	Add demodulation measurements for cdmaOne standards
CD2	Add demodulation measurements for cdma2000 standards
CDE	Add demodulation measurements for cdma2000 and 1xEV-DO standards
CR1	Add RF measurements for cdmaOne/cdma2000 standards
CRE	Add RF measurements for CDMA2000 and 1xEV-DO standards
CS1	Add cdma2000 over-the-air measurements. Requires option CD2 (Demodulation for cdma2000) for operation
EM1	Add RF measurements for GSM/EDGE standards
ES1	Add PN Scanner and over-the-air measurements for 1xEV-DO standards
GR1	Add RF measurements for GSM standards
GS1	Add Channel Scanner for GSM standards
IN1	Add interference measurements standards

Table C-1: Measurement options (Cont.)

Option	Description
IR1	Add RF measurements for IS-136 standards
WD1	Add demodulation measurements for W-CDMA
WD2	Add HSDPA measurements for W-CDMA
WR1	Add RF measurements for W-CDMA
WS1	Adds analysis of W-CDMA scrambling code, including a scrambling code display and E_c/I_o and E_c data

Appendix D: Installing Options and Upgrading Software

The YBT250 Field Transmitter & Interference Tester is a highly-configurable instrument. You can buy the YBT250 with only the measurement capability you need and then add measurement capabilities as your needs expand. Additional measurement capability is added by enabling or installing software options. The available measurement options are shown in Table C-1 on page C-1.

Measurement options are enabled by entering an Options key. An Options key is a coded text string that is tied to the serial number and Global ID of the instrument module. An Options key works only on the YBT250 for which it is purchased. To purchase an Options key, contact your local Tektronix representative.

Before Installing Options

You can install the measurement options listed in Table C-1 without returning the YBT250 to Tektronix. First, you will need to purchase a new Options key from Tektronix. To purchase a new Options key you will need to provide the serial number and Global ID for your YBT250 module (not the NetTek Analyzer Platform).

To display the YBT250 serial number:

- From the YBT250 application menu bar, select **Tools > Hardware info.**

The serial number is displayed near the top of the window. The serial number is also printed on a tag located on the bottom of the module.

To display the YBT250 Global ID:

- From the YBT250 application menu bar, select **Tools > Hardware info.**

The Global ID is displayed at the bottom of the scrolling window.

To reinstall the original application software or install a free upgrade on the YBT250, you will need the current Options key for your YBT250.

To display the YBT250's current Options key:

- From the YBT250 application menu bar, select **Tools > Software info**.

The Options key is displayed near the bottom of the scrolling window.

Installing Options

To install an option once you have an Options key:

1. Power on the NetTek Analyzer Platform.
2. From the YBT250 application menu bar, select **Tools > Upgrade Software**. The dialog box shown in Figure D-1 appears.

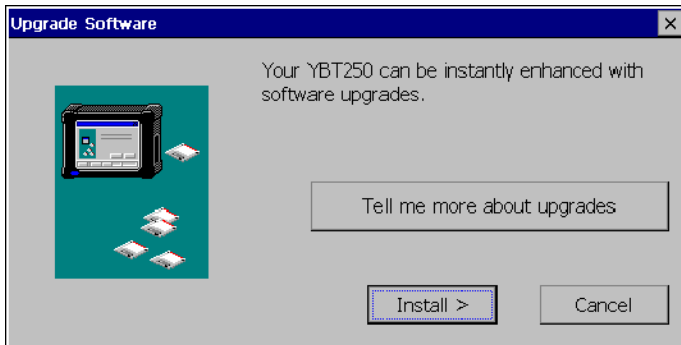


Figure D-1: The dialog displayed by selecting Tools>Upgrade Software

- a. To see which upgrades are installed or which upgrades are available, select **Tell me more about upgrades**. This displays the dialog shown in Figure D-2.

4. Select **Install with only a key** and then select **Next >** to continue with the upgrade.
5. Enter the Options key into the dialog box as shown in Figure D-4. To display the soft keyboard, tap the keyboard button to the right of the text entry box. After you enter the Options key, select **Next >**.

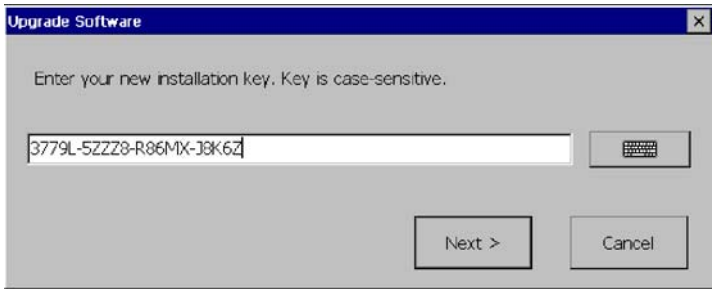


Figure D-4: Entering the Options key

After you select **Next >**, the software installation proceeds. When the installation is completed, the dialog box shown in Figure D-5 appears.

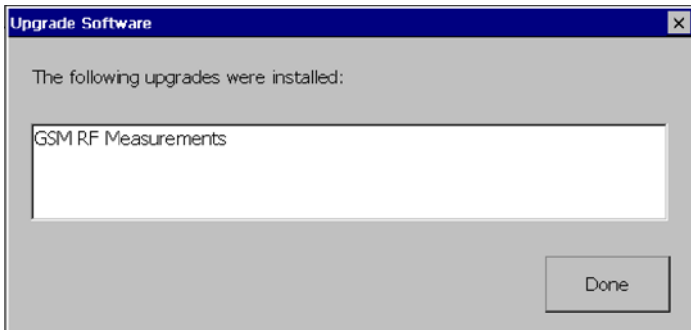


Figure D-5: Software installation is complete

6. Select **Done** to complete the software upgrade process.
7. If you received new software as part of an upgrade kit, place the label supplied in the kit on the bottom edge of your YBT250 module.

Upgrading/Reinstalling the YBT250 Software

On-screen installation instructions will guide you through upgrading or reinstalling the YBT250 software:

1. Insert the YBT250 Installation SW CD-ROM (Tektronix part number, 063-3476-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 YBT250 module.

Appendix E: Functional Verification Procedure

This appendix provides a functional verification procedure. The procedure verifies the basic functionality of the YBT250. The functional verification procedure can be used for incoming inspection purposes.

NOTE. *The functional verification procedure in this appendix does not confirm that the YBT250 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 YBT250 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.

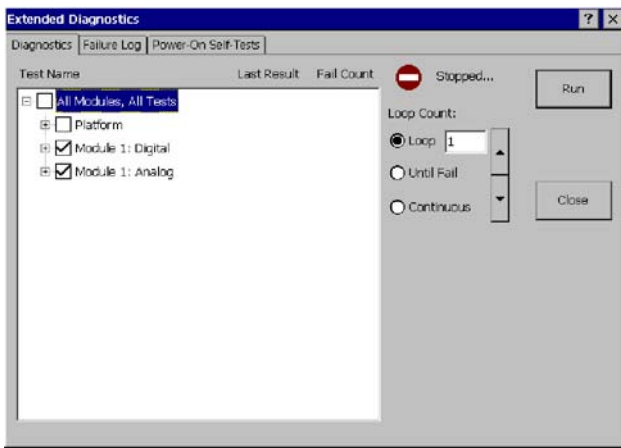


Figure E- 1: Settings to run diagnostics

7. Select **LOOP**, set the loop count to 1.
8. Tap **Run**.
9. Verify that each test executes and passes. *You will need to verify the audio tone output diagnostic by tapping the screen. The test will fail if you do not respond.*

NOTE. *If you encounter any errors, you can tap the Failure Log tab to display more information. If the YBT250 fails any of its diagnostic tests, contact your local Tektronix service representative.*

10. Tap **Close** to exit the diagnostic system.

Functional Tests

To perform the following tests, you must have an RF signal source.

Equipment Required

- One 50 Ω BNC cable, such as Tektronix part number 012-0057-01
- One BNC-female to N-male connector adapter, such as Tektronix part number 103-0045-00
- An RF signal generator with a 10MHz reference output, capable of generating a 100 MHz RF signal

Prerequisite

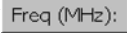

- None

NOTE. *These procedures verify only that the YBT250 is operating correctly. They do not verify that the YBT250 meets warranted specifications.*

Section 1: Check RF attenuation



To check the RF attenuation:

1. Power up the NetTek Analyzer Platform.
2. If necessary, launch the YBT250 application by double-tapping the **YBT250** icon on the desktop or selecting **Start>Programs>NetTek>YBT250** from the Taskbar.
3. Power on the RF signal generator.
4. Set the RF signal generator to a 100 MHz, -30 dBm output level.
5. Connect the BNC female-N male adapter to the YBT250 RF INPUT connector.

6. Connect the BNC cable between the adapter on the RF INPUT connector and the signal generator output.
7. In the YBT250 application menubar, select **Tools>Factory Reset**. Tap **Reset All** in the pop-up dialog box.
8. Tap the **Freq (MHz)** button (). Using the numeric keypad, set the measurement frequency to 100 MHz.
9. Tap the **AutoLevel** button (). Verify that the signal appears on the center of the screen, with approximately -30 dBm amplitude.
10. Select **AMPS EIA 553** from the signal standard drop down list. (If AMPS EIA 553 doesn't appear in the list, select **More...** and then enable AMPS EIA 553.)
11. Tap the **Measure (1)** button to display the Measurements window. If the displayed measurement is not Channel Power, tap **Select Measurement**, then select the **RF Power** measurement.
12. Verify that the Channel Power is approximately -30 dBm.
13. Change the signal amplitude on the Signal Generator to 0 dBm.
14. Verify that the Channel Power measurement is approximately 0 dBm.
15. Change the signal amplitude on the Signal Generator to -70dBm
16. Verify that the Channel Power measurement is approximately -70dBm.
17. Disconnect the Signal Generator output from the YBT250.

Section 2: External Reference

To check the External Reference function:

1. Tap the **Measure** button ().
2. Tap **Select Measurement**. Tap **Carrier Freq** to display the Carrier Frequency measurement.
3. Verify the frequency reference icon (upper-right portion of the display) appears as  (F INT).

4. Verify that the External Reference Frequency measurement readout indicates “no signal” by displaying “-----”.
5. On your RF signal generator, set the external frequency to 10 MHz at 0 dBm.
6. Connect the external reference output of the signal generator to a 50 Ω BNC cable. Connect the cable to the FREQUENCY REFERENCE INPUT of the YBT250.

Upon connection, the YBT250 should display a window indicating it is acquiring the external reference. The window should disappear within 15 seconds.

7. Verify that the External Reference Frequency is 10.00000 MHz (bottom measurement on the screen).
8. Disconnect the Signal Generator output from the YBT250 Frequency Reference input.

This completes the Incoming Inspection procedure. If any errors occurred during this procedure, contact your local Tektronix service representative.

Appendix F: Supported Signal Standards

This appendix lists the signal standards that the YBT250 supports.

Table F-1: Cellular standards supported

Standard	Channel numbers
CDMAOne US Cellular	1-799
TIA/EIA-95	990-1023
TIA/EIA-97C	
CDMAOne US PCS	1-1199
TIA/EIA-95	
TIA/EIA-97C	
CDMAOne Korea PCS	1-599
CDMAOne Japan	1-799
	801-1039
	1041-1199
CDMAOne China-1	0-1000
	1329-2047
CDMAOne China-2	0-1000
	1329-2047
CDMA2000 Class 0, Korea Cellular	1-799
	990-1023
CDMA2000 Class 0, N. A. Cellular	1-799
	990-1023
CDMA2000 Class 1, N. A. PCS	0-1199
CDMA2000 Class 2 (TACS Band)	0-1000
	1329-2047
CDMA2000 Class 3 (JTACS Band)	1-799

Table F-1: Cellular standards supported (Cont.)

Standard	Channel numbers
	801-1039
	1041-1199
	1201-1600
CDMA2000 Class 4, Korea PCS	0-599
CDMA2000 Class 5, (NMT-450W 25 kHz)	1-300
	539-871
CDMA2000 Class 5, (NMT-450N 20 kHz)	1039-1473
	1792-2016
CDMA2000 Class 6, IMT-2000	0-1199
CDMA2000 Class 7, N. A. 700 MHz Cell Band	0-359
WCDMA Class 1 UMTS	9612-9888
	10562-10838
WCDMA Class 2 NA-PCS	9262-9538
	9662-9938
WCDMA Class 2 NA-Addl PCS	12-287
	412-687
WCDMA Class 3 DCS 1800	8562-8913
	9037-9388
WCDMA Class 4 UMTS-1700	8562-8763
	10562-10763
WCDMA Class 4 UMTS-1700 Addl	1162-1362
	1462-1662
WCDMA Class 5 Cellular 850	4132-4233
	4357-4458
WCDMA Class 5 Cellular 850 Addl	782-862
	1007-1087

Table F-1: Cellular standards supported (Cont.)

Standard	Channel numbers
NADC IS-136 Cellular	1-799
	990-1023
NADC-PCS / IS-136	1-1999
GSM/EDGE 450	259-293
GSM/EDGE 480	306-340
GSM/EDGE 850	128-251
GSM-E/EDGE 900	0-124
	975-1023
GSM-P/EDGE 900	1-124
GSM-R/EDGE 900	0-124
	955-1023
GSM/EDGE 1800	512-885
GSM/EDGE 1900	512-810
AMPS / EIA 553	1-799
	990-1023
N-AMPS / IS-88	1-799 (lower, middle and upper subchannels)
	990-1023 (lower, middle and upper subchannels)
TACS	1-1000
ETACS	0-1000
	1329-2047
NTACS	1-799
	800-1039
	1040-1199

Table F-1: Cellular standards supported (Cont.)

Standard	Channel numbers
JTACS	0-798 (even channels only)
	800-1038 (even channels only)
	1040-1198 (even channels only)
NMT-411-25 kHz	539-871
NMT-450-25 kHz	1-300
NMT-450-20 kHz	1039-1473
NMT-470-20 kHz	1792-2016
NMT-900	1-1000
NMT-900 (offset)	1025-2023
MATS-E	1-1000
C-450 (SA)	1-247
C-450 (P)	1-800
CDMA2000 1xEVDO Class 0 NA Cellular	1-799
	990-1023
CDMA2000 1xEVDO Class 0 Korea	1-799
	990-1023
CDMA2000 1xEVDO Class 1 N.A. PCS	0-1199
CDMA2000 1xEVDO Class 2 TACS Band	0-1000
	1329-2047
CDMA2000 1xEVDO Class 3 JTACS Band	1-799
	801-1039
	1041-1199
	1201-1600
CDMA2000 1xEVDO Class 4 Korea PCS	0-599
CDMA2000 1xEVDO Class 5 NMT-25k-450	1-300
	539-871

Table F- 1: Cellular standards supported (Cont.)

Standard	Channel numbers
CDMA2000 1xEVDO Class 5 NMT-20k-450	1039-1473
	1792-2016
CDMA2000 1xEVDO Class 6 IMT-2000	0-1199
CDMA2000 1xEVDO Class 7 N.A. 700 MHz Cellular	0-359
CDMA2000 1xEVDO Class 8 GSM Band	0-1499
CDMA2000 1xEVDO Class 9 GSM Band	0-699

Appendix G: Channel Table Definition File

The default location of the standard Channel Table definition file is:

`\BuiltInDisk\NetTekApps\YBT250\SignalStandards.txt`

However, if the application is not loaded into the BuiltInDisk directory due to lack of space, you can also find the standard Channel Table file at:

`\NetTekApps\YBT250\SignalStandards.txt`

You can open this file as a text file (with Pocket Word); however, for the easiest viewing, copy the file to a PC and use Excel to view it.

For instructions on how to create a custom version of the channel table, see page 2-40.

About the Signal Type

The Channel Table file contains a field that defines the type of signal for the named signal standard. For example, the standard named GSM 900 is designated as a Signal Type 4. The Signal Type is used by the Signal Identification function to suggest possible sources of interference.

Although the YBT250 will make measurements only on the first six signal types listed in Table 2-12, you can define a signal standard that is based on other signal types. For example, you could create an FM signal standard of signal type 998 (Analog signal, no measurements available) and define channels within the FM radio band. This would allow you to tune to “channels” within the FM band, although you could not take measurements with the YBT250.

The reason for creating a signal standard is that the Signal Identification function uses the Channel Table to determine possible types of signals, and if you have defined a signal standard, then it will appear as a possible source in the signal Identification function.

The signal types 998 and 999 are included in the Channel Table to enable you to create a custom signal standard for analog or digital signals that do not match the other signal types (such as an “FM” standard noted previously). Though no measurements would be made on channels of a standard based on either 998 or 999, the standard they are assigned to would be used by the Signal Identification function.

Appendix H: Saved Measurement File Extensions

Table H- 1: Measurement data file extensions

Measurement type	File extension
Spectrum	.r01
Spectrogram	.r02
Audio Demod	.r14
Signal Strength	.r15
Signal Identity	.r16
Noise Floor	.r17
Scrambling Code	.r18
EMF	.r19
Scanner	.r1b
RF Power	.r64
GSM RF Burst Power	.r65
Carrier Frequency	.r66
Peak Average	.r67
Occupied BW	.r68
Adjacent Channel	.r69
CDMA Signal Quality	.r6a
CDMA Code Domain Power	.r6b
CDMA Code Domain Timing	.r6c
FM Deviation	.r6d
Total Power	.r6e
CDMA Codegram	.r6f
CDMA Pilot Power	.r70

Table H- 1: Measurement data file extensions (Cont.)

Measurement type	File extension
WCDMA ACLR	.r71
GSM RF Power	.r72
PVT	.r73
Signal Quality	.r74
CDMA ACPR	.r75



Glossary

Glossary

ACLR. Adjacent Channel Leakage power Ratio (ACLR) is the ratio of the RRC (Root Raised Cosine) filtered mean power centered on the assigned channel frequency to the RRC filtered mean power centered on an adjacent channel frequency.

ACPR. Adjacent Channel Power Ratio (ACPR) is the ratio of the mean power in the selected channel (1.23 MHz bandwidth) to the mean power detected in an adjacent channel of 30 kHz bandwidth. Four adjacent channels are measured (two above and two below the selected channel), and an ACPR value result is calculated for each adjacent channel. The ACPR value is computed as the difference between the corresponding adjacent channel power and the center channel power.

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.

Burst Power. Burst Power is a measurement of the average power in a burst of RF power on a GSM signal.

Carrier Feedthrough. Carrier Feedthrough is the offset of the constellation from zero power. It is measured relative to the full power carrier.

Channel Power. Channel Power is the RF Power measured on the selected channel.

Codogram. The Power Codogram displays a series of sequential code domain power measurements where color represents amplitude and the vertical axis represents time.

Code Domain Power. Code Domain Power is a measurement of the power in each Walsh code.

Difference. Difference is the power difference between Channel Power and the Ref Power.

Error Vector Magnitude (EVM). Error Vector Magnitude is the RMS value of all the vectors that extend from the ideal constellation points to the received signal constellation points in a record of demodulated CDMA symbols, divided by the RMS value of the signal. This result is multiplied by 100 to give a final value in percent.

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.

FM Deviation. FM Deviation is the maximum one-sided frequency deviation of the carrier due to modulation. The measurement displays whichever is greatest of either the positive or negative deviation.

Forward Frequency. The frequency the base station uses to transmit to the mobile unit. Also called Downlink Frequency.

Frequency Marker. The frequency marker indicates the Measurement Frequency setting. The Measurement Frequency is the frequency at which measurements are made. The frequency marker appears on the display as a small triangle at the bottom of a trace display and a circle on the trace itself. Changing the frequency marker location, by tapping a new location on the display or entering a new Channel number or frequency, changes the Measurement Frequency.

Frequency Error. Frequency Error is the difference in frequency between the measured frequency of the selected channel and the frequency assigned to the channel in the channel table.

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”.

Measurement Frequency. The Measurement Frequency is the frequency at which measurements are made. The Measurement Frequency is always shown in the Frequency box. The Measurement Frequency is indicated in the spectrum displays by the frequency marker.

Measured Frequency. The actual frequency measured for the selected channel.

Multipath Power. Multipath Power (MP) is the ratio of the pilot power of the strongest multipath path component of the selected signal to the total pilot power of all multipath components of that signal. MP measures the interference that is due to multiple versions (reflections) of the desired signal arriving at the antenna at different times.

Noise Floor. Noise Floor measures the interference coming into the receiver antenna. The Noise Floor is an integrated power measurement for the selected standard. Larger numbers indicate more noise.

Occupied Bandwidth. The Occupied Bandwidth is the frequency range where 99% of the power transmitted in a single channel lies. If there is a signal in either channel adjacent to the selected channel, the signal will add power to the measurement, thus resulting in an inaccurate measurement.

Peak-to-Average Power. The Peak-to-Average Power measurement is the ratio of the peak envelope power in the transmitted signal to the average power in the transmitted signal. The ratio is expressed in dB.

Pilot Dominance. The Pilot Dominance (PD) is the ratio of the selected pilot power signal to the sum of the next two highest detected pilot power levels. A more positive PD value is good, indicating that the selected pilot is the dominant pilot in the received signal; this means that the other received pilot signals have less impact on measurement results. A value above 15 dB is desirable, although measurements can be made below this level. PD values below 10 dB indicate that the signal quality is not adequate for accurate OTA measurements.

Pilot Power. The Pilot Power is the absolute power of the pilot channel (Walsh Code 0) in a CDMA channel. For W-CDMA, the Pilot Power is the absolute power of the Primary Common Pilot Channel (P-CPICH). The primary common pilot channel is used as a phase reference for many channels and to identify the primary scrambling code.

Pilot Time Alignment Error (Tau). The Pilot Time Alignment Error is the difference in timing between the pseudo noise (PN) sequences and the CDMA system time.

PN Offset. PN Offset is the coarse timing difference between the pilot channel and the even-second clock.

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.

RF Channel Power. RF Channel Power is the total RF power in the selected channel. This measurement assumes a 50 ohm nominal impedance.

Reference Level. The power level at the top of a spectrum window.

Reverse Frequency. The frequency the mobile unit uses to transmit to the base station. Also called uplink frequency, reverse channel or uplink channel.

Scrambling Code. There are 512 primary scrambling codes available in a W-CDMA system, numbered from 0 to 511, which are used to uniquely identify each downlink signal. All code channels in a downlink signal, with the exception of the primary (P-SCH) and secondary (S-SCH) synchronization channels, are scrambled by either the primary scrambling code, or one of the 15 secondary scrambling codes associated with each primary scrambling code. The YBT250 decodes only the primary scrambling code of each signal, not the secondary scrambling codes.

Span. Sets the frequency range covered by the spectral display graph. The YBT250's resolution bandwidth (RBW) is automatically adjusted based on the span setting.

Waveform Quality (Rho). The Waveform Quality measurement is an indication of the quality of the transmitted signal. Rho can vary between 0.0 and 1.0, where 1.0 represents a perfect signal. True Waveform Quality is defined as an out-of-service measurement where the base station is transmitting only a pilot signal. If additional channels are active, an Estimated Rho is displayed.



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