AXS-200/610
Copper Test Module

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Trademarks

Units of Measurement

Units of measurement in this publication conform to SI standards and practices.

Version number: 4.0.0

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Certification Information

F.C.C. Information

Electronic test equipment is exempt from Part 15 compliance (FCC) in the United States. However, compliance verification tests are systematically performed on most EXFO equipment.

ϵ Information

Electronic test equipment is subject to the EMC Directive in the European Union. The EN61326 standard prescribes both emission and immunity requirements for laboratory, measurement, and control equipment. This unit has undergone extensive testing according to the European Union Directive and Standards.

CSA Information

This unit is certified by the CSA (certificate number 162451) and was evaluated according to applicable CSA and UL standards (as confirmed by "C-US" mark) as well as applicable IEC standards for use in Canada, the United States, and other countries.

Certification Information

EXFO $C\epsilon$ <u>**DECLARATION OF CONFORMITY**</u>

Application of Council Directive(s):   73/23/EEC - The Low Voltage Directive
                                            89/336/EEC - The EMC Directive
                                            And their amendments
Manufacturer's Name: EXFO Electro-Optical Engineering Inc.
Manufacturer's Address: 400 Godin Avenue,
                                            Quebec (Quebec)
                                            Canada G1M 2K2
                                            (418) 683-0211
Equipment Type/Environment: Test & Measurement / Industrial
Trade Name/Model No.:   AXS-200/610
                                            30 MHz Copper Test Set

<u>Standard(s) to which Conformity is Declared:</u>

EN 61010-1:2001   **Safety Requirements for Electrical Equipment for Measurement,
                               Control, and Laboratory Use, Part 1: General Requirements.**

EN 55022: 1998 +A2: 2003   **Limits and Methods of Measurement of Radio Disturbance
                               Characteristics of Information Technology Equipment.**

**EN 61326:1997 +A1:1998   Electrical Equipment for Measurement, Control and Laboratory
+A2:2001 + A3:2003   Use - EMC Requirements**

I, the undersigned, hereby declare that the equipment specified above conforms to the above Directive and Standards.

<u>Manufacturer</u>
Signature:

Full Name: Stephen Bull, E. Eng
Position: Vice-President Research and
                Development
Address: 400 Godin Avenue, Quebec (Quebec),
                Canada, G1M 2K2
Date: January 16, 2008

1 Introducing the AXS-200/610 Copper Test Module

The AXS-200/610 Copper Test Module is a handheld device designed to test basic twisted pair quality, identify and locate faults, perform advanced single-ended loop tests, and troubleshoot noise and signal issues all the way up to 30 Mhz in support of the VDSL2 standard. These measurements offer a quick and thorough method to determine if the cable is capable of supporting xDSL technology. In addition, the AXS-200/610 utilizes noise measurements, longitudinal balance tests, and power spectral density tests to assist in the installation, maintenance, and troubleshooting of copper cables.

Main Features

➤ Full 30 MHz spectrum analysis

➤ Spectral detective with auto identification of disturbers

➤ Single-ended testing – no remote device required

➤ Loop mapper – graphical loop depiction

➤ Color display with graphical analysis

➤ Fully automated testing with pass or fail analysis

➤ POTS and VF measurements for complete ADSL2+ and VDSL2 loop qualification

➤ Video and DSL rate prediction

➤ In-service pair, rectified loop, and water detection tests

Typical Applications

The AXS-200/610 can be configured to run the following series of tests to see if the cable is suitable for carrying digital subscriber line (DSL) technologies:

➤ Auto tests

➤ POTS auto test

➤ DMM tests

➤ VF tests

➤ Fault location tests

➤ Wideband tests

Cable Connections

The graphic below shows the connectors on the AXS-200/610 device.
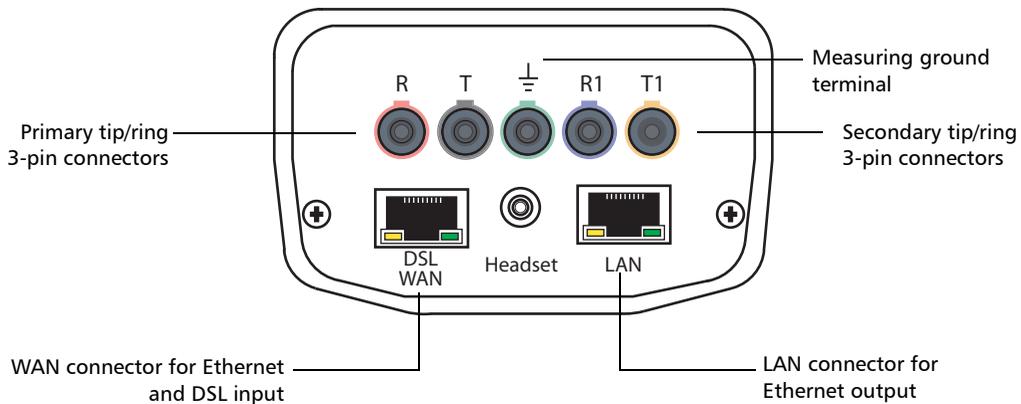
Note: *When connecting a DSL cable to the WAN port, use the RJ-45 plug end of the 26AWG cable provided with the unit. There is a 1500V maximum transient voltage on telecom ports. Basic insulation is needed for external telecom circuits.*

LED Indicators

The graphic below illustrates the LED indicators across the top of the AXS-200/610 unit.

VOLTAGE DETECTED

Red indicates that a voltage is detected on the line. This is normal if the voice switch is connected to the circuit under test. If the circuit is open, foreign voltage is present - either DC (with battery cross) or AC (induced from electrical power lines).

PASS/FAIL

Red indicates that test results have failed the thresholds.

Green indicates that test results were evaluated against the customer-defined thresholds and have passed.

Electrical Safety Information

Do not use the unit outdoors in wet locations. For information about equipment rating for temperature, environment, and power supply, refer to the *Safety Information* chapter of the AXS-200 User Guide.

VDSL2

Very high speed digital subscriber lines (VDSL) is a new standard that allows extremely high speed internet access over existing copper cables. The VDSL2 standard increases the spectrum allocation up to 30 MHz for even higher performance than its predecessor VDSL1, and allows speeds up to 100 Mbps symmetrical (both up and downstream). VDSL2 also calls for support of applications such as multi-channel high definition TV (HDTV), video on demand, video-conferencing, and VoIP using the existing copper telephone line infrastructure. Along with that it also calls for ATM, Ethernet, and IP compatibility, as well as multimode implementations to permit interoperability with existing ADSL equipment.

VDSL2 gives carriers the flexibility to start rapidly deploying VDSL2 networks and offer new broadband services including triple-play services, HDTV, VoD, high-speed data, VoIP, high-speed Internet access, video conferencing, virtual private networks (VPNs), PBX Extension, and video surveillance to compete with cable companies. VDSL2's broader spectrum combined with features like Trellis coding and multi-pair bonding allows carriers to offer full triple-play services to a large portion of their customer base.

Navigating through the AXS-200/610

Use the following general instructions to navigate through the AXS-200/610 menus and panes:

➤ To navigate through the menu items use the arrow keys.

➤ To confirm a choice or open a menu item press ✔.

 ➤ Most manual tests automatically run when they are selected from the menu.

 ➤ The rotating hour glass in the title bar indicates when a test is running.

Note: *The unit checks for an active circuit at the beginning of every manual and auto test.*

➤ To start/stop a test, press Ω.

➤ To view the contents of the panes or tabs, use the F1, F2, and F3 keys. To view any available additional tabs use the function arrow keys on either side of the F1 and F3 keys.

➤ To cancel an action or return to the previous item or pane, press ⬅.

➤ To return to the home pane, press 🏠.
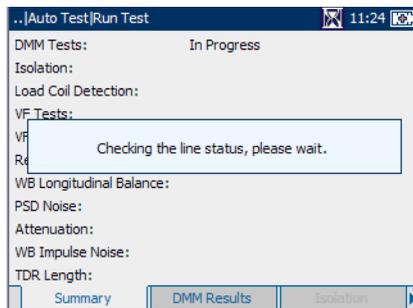
Conventions

Before using the product described in this manual, you should understand the following conventions:

WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in *death or serious injury*. Do not proceed unless you understand and meet the required conditions.

CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in *minor or moderate injury*. Do not proceed unless you understand and meet the required conditions.

CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in *component damage*. Do not proceed unless you understand and meet the required conditions.
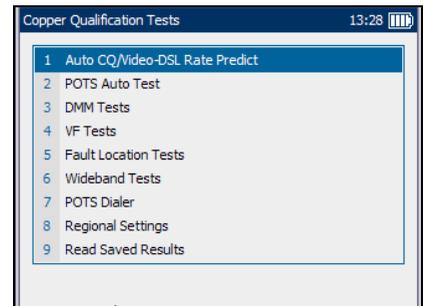

IMPORTANT

Refers to information about this product you should not overlook.

2 *Getting Started with Copper Qualification Tests*

The AXS-200/610 is designed to test basic twisted pair quality, identify and locate faults, perform advanced single-ended loop tests, and troubleshoot noise and signal issues all the way up to 30 MHz in support of the VDSL2 standard. These measurements offer a quick and thorough method to determine if the cable is capable of supporting xDSL technology. In addition, it utilizes noise measurements, longitudinal balance tests, and power spectral density tests to assist in the installation, maintenance, and troubleshooting of copper cables.

To access copper qualification tests:

1. From the **Home** pane use the up/down arrow keys to highlight **Copper Qualification Tests**, then press ✔.

2. From the **Copper Qualification Tests** pane highlight the desired menu item, and press ✔.

Copper Qualification Tests	13:28
1 Auto CQ/Video-DSL Rate Predict	
2 POTS Auto Test	
3 DMM Tests	
4 VF Tests	
5 Fault Location Tests	
6 Wideband Tests	
7 POTS Dialer	
8 Regional Settings	
9 Read Saved Results	

POTS Dialing

The **POTS Dialer** function provides a dial-up path from the AXS-200/610 to another tester (or quiet termination or silent switchman) through a switched circuit network. DTMF transmission is enabled via the AXS-200 keypad allowing you to place and receive POTS calls. The dialer can be accessed from the **Copper Qualification Tests** pane and is also integrated into individual test screens to give you quick access to the manual dialer function, speed dial and last dialed lists, without exiting the current test application.
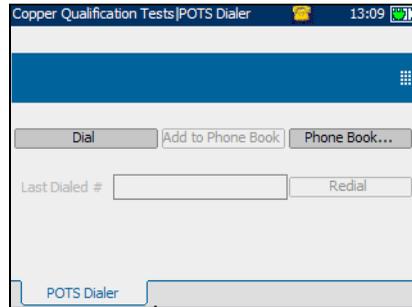
POTS Dialer

The **POTS Dialer** menu item/tab allows you to use the unit as a telephone (with a headset) and the AXS-200 keypad as a dialer keypad when the **POTS Dialer** is invoked, whether in the test results screens or through the separate dedicated **POTS Dialer** application.

Each parameter and button are described below:

➤ **NumbertoDial** edit box is the phone number you wish to dial. You can add this number to the **Phone Book** by pressing the **Add to Phone Book** button.

➤ **Dial** button is enabled whether or not there is a number present in the **NumbertoDial** edit box. If a number is present, it will be dialed. If not, pressing the **Dial** button will cause the unit to go off hook and a new *placing a call* pane appears where you can manually dial a number from the keypad.

   ➤ **Dial Status** displays the progress of dialing such as **Dial Tone Detected**, **No Dial Tone**, or **Busy Tone Detected**.

   ➤ **Volume** is used to set the headset volume to **LOW** or **HIGH**.

   ➤ **Hang Up** button terminates the call and you'll be returned to the **POTS Dialer** pane.
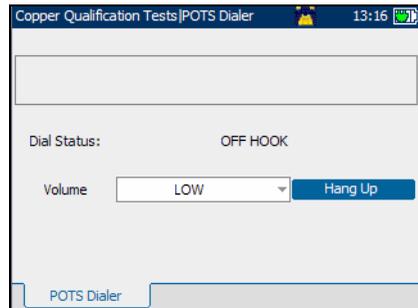
➤ **Add to Phone Book** button enters
the number dialed into the **Phone
Book** by bringing up the
edit screen where you can add the
Name for the **Number** dialed and
save it. After pressing either the
Cancel or **Update** buttons, you'll
be returned to the **POTS Dialer**
pane.
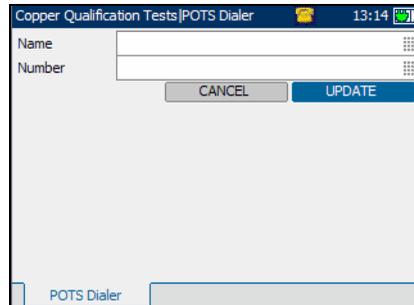
➤ **Phone Book** button invokes the list of numbers to dial and supports 15
commonly called names and numbers. Names can be up to 30
characters long and numbers up to 32 digits.

➤ **Last Dialed #** lists up to 30 last dialed numbers.

➤ **Redial** button dials a selected phone number from the
Last Dialed # list.

➤ Icon on title bar gives a live on-screen, graphical indication of on-hook
and off-hook status.

To select parameter values:

1. Press the up/down arrow keys to highlight the desired parameter.

2. Press ✔ to display the list or select the value.

3. Press the up/down arrow keys to highlight the desired value.

   OR

4. Press the left arrow key to erase the existing value, and then use the
alphanumeric keypad to enter a value. To cancel the entry, press ⬅.

5. Press ✔ to accept the value.

Regional Settings

Before performing copper qualification tests, set up the software settings and values for the cables. The AXS-200/610 allows you to save standard parameter settings to different profiles and reuse them as needed.

Select Profile

The **Select Profile** tab allows you to configure the unit with specific measurement values.

Each parameter is described below:

➤ **Distance Units** are the units of measurement for distances in **FEET** or **METER**.

➤ **Cable Gauge** is the gauge system for measuring wire sizes in **AWG** (American Wire Gauge) units or **mm** (metric wire size).

➤ **Profile Name** is either **Default** or a list of all available profile file names stored in the current directory.

➤ **Clone Profile** allows you to copy an existing profile to a new one and switch to use the new profile.
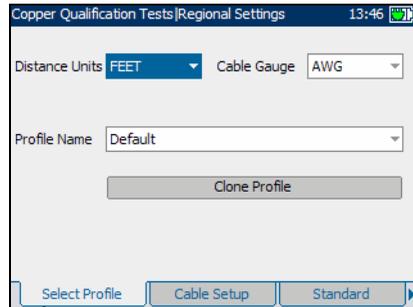
To select the parameter values:

1. Press the up/down arrow keys to highlight the desired parameter.

2. Press ✔ to display the list.

3. Use the up/down arrow keys to highlight the desired value, and press ✔ to accept the value.

When you change the selections and press ◀ or ⌂, the following actions should be performed:

1. If **ProfileName** selection is not **Default** then save modifications (if any) into the current profile file and proceed with the selected action.

2. If **ProfileName** selection is **Default** and modification to the profile has been made then enter the new name of the profile.

At power up, all settings are read from the last current profile.

➤ **Enter Profile Name** is the new name of the profile.

To save modifications made to a CustomProfile:

1. Select **Save as New Profile** and create and save a new **CustomProfile** name in the current directory.

Copper Qualification Tests|Regional Settings	15:07
Enter Profile Name   Default
Save As New Profile
Cancel Modifications

2. If the file with **CustomProfile** name already exists in the current directory, you will be prompted to overwrite it.
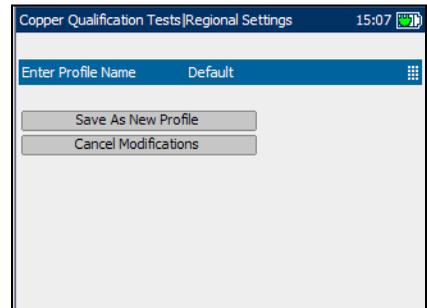
> # !IMPORTANT
> **Changes to test parameters will be lost if the unit is turned off without first saving them to a default or custom profile. The unit can also be left in suspend mode to avoid loss of test parameters.**

*To cancel modifications made to a CustomProfile:*

1. Select **Cancel Modifications** and reload the current profile with the default profile.

2. Proceed with the previously selected action (◀, ⌂, ⟳).

Cable Setup

The **Cable Setup** tab allows you to configure parameter values for the cable.

Each parameter and button is described below:

➤ **Cable Type** defines the gauge of the cable in use. If wire gauge is measured in American Wire Gauge (AWG) units, the available choices are: **AUTO**, **19 AWG**, **22 AWG**, **24 AWG**, or **26 AWG.** For mm gauge wire, the available choices are: **AUTO**, **0.32 mm**, **0.40 mm**, **0.50 mm**, **0.60 mm**, **0.65 mm**, **0.80 mm**, **0.90 mm**, or **1.20 mm**.

➤ **Cable Fill** allows you to select the type of material the cable can be filled with. Changing the selection to **AIRCORE**, **JELLY**, **PULP**, **5 PR**, or **2 PR** influences the cable capacitance per length, automatically updating the **Cap. T/R-GND** field.

➤ **Capacitance T-R (nF/km** or **nF/mi)** allows you to specify a value for the capacitance per length constant.

➤ **Cap. T/R-GND (nF/km** or **nF/mi)** allows you to specify a value for the capacitance per length to ground constant.

➤ **Resistance (Ohm/km** or **Ohm/mi)** allows you specify a value for the resistance constant of the cable.

➤ **Attenuation (dB/km** or **dB/mi)** allows you to specify a value for the reduction in signal strength or insertion loss of the cable.

➤ **VOP** allows you to set the velocity of propagation for the cable as a ratio of the speed of light. Enter a value between **0.400** and **0.999**.

➤ **Restore Defaults** allows you to reset cable parameters for the selected cable to the standard default values.
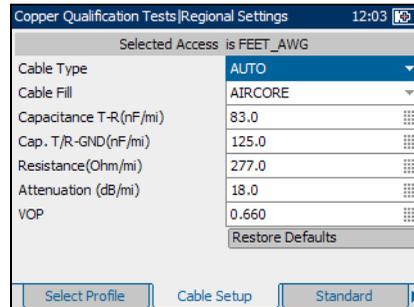
To select parameter values:

1. Press the up/down arrow keys to highlight the desired parameter.

2. Press ✔ to display the list or select the value.

3. Press the up/down arrow keys to highlight the desired value.

    OR

4. Press the left arrow key to erase the existing value, and then use the alphanumeric keypad to enter a value. To cancel the entry, press ↰.

5. Press ✔ to accept the value.
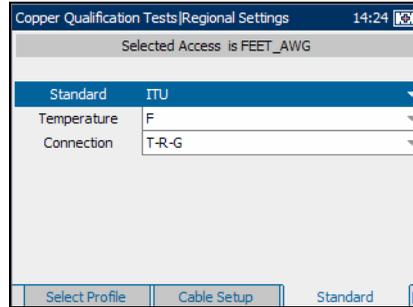
To reset default cable values:

1. Press the up/down arrow keys to highlight **Cable Type**.

2. Press ✔ to display the list.

3. Press the up/down arrow keys to highlight the desired cable type, then press ✔ to accept the selection.

4. Use the up/down arrow keys to highlight the **Restore Defaults** button, then press ✔. The selected cable's default values are restored.

Standard

The **Standard** tab allows you to set unit parameter values for the selected profile composed of current **Distance Units** and **Cable Gauge**.

> ➤ **Standard** allows you to specify if the copper qualification tests should conform to the **ITU** (International Telecommunications) or **ANSI** (American National Standards Institute) standard.

> ➤ **Temperature** allows you to specify the units of measurement for temperature in **F** (Fahrenheit) or **C** (Celsius).

> ➤ **Connection** allows you to specify the default type of cable connections as **T-R-G** or **A-B-E**.
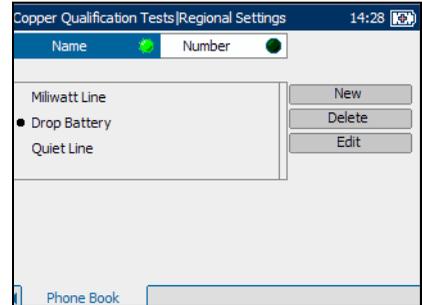
To select the parameter values:

1. Press the up/down arrow keys to highlight the desired parameter.

2. Press ✔ to display the list.

3. Use the up/down arrow keys to highlight the desired value, and press ✔ to accept the value.

Phone Book

The **Phone Book** tab provides you with a list of saved names and numbers that will be part of the **Profile**.

Each parameter and button is described below:

➤ **Name** displays the list box of names in a phone book list.

➤ **Number** displays the list box of phone numbers in a phone book list.

➤ List Box can display up to 15 names/numbers. Once the list box reaches 15 entries the **New** button will be disabled. The phone book has 3 predefined entries: **Milliwatt Line**, **Drop Battery** and **Quiet Line**. These entries can be edited but not removed.

To select a name/number from the current list:

1. Press the up/down arrow keys to highlight the desired parameter.

2. Press ✔ to select the item.

This selection can be edited or removed. Once you leave this screen, the selected name/number will be used to dial. All changes are automatically saved into phone book.

➤ **New** invokes the edit screen where a new name and number can be entered then saved to the phone book list.

➤ **Edit** invokes the edit screen where a name and number can be viewed or changed.

➤ **Delete** removes the selected entry from the phone book list.

On the *edit details screen*, the following controls are shown:

➤ **Name** is the name, maximum 30 characters, assigned to the phone number entered in the phone book.

➤ **Number** is the phone number, maximum 32 digits including #,* and comma.

➤ **Cancel** button returns you to the phone book screen without saving any changes.

➤ **Update** button stores the **Name** and **Number** entered, in the phone book.
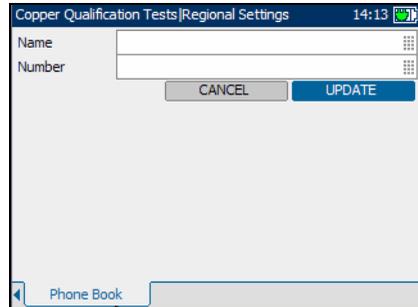
To select and edit the controls:

1. Press the up/down arrow keys to highlight the desired entry and press ✔.

2. Use the alphanumeric keypad to enter a value. To cancel the entry, press ↰.

3. Press ✔ to accept the value.

Saving Results

You can save any of your results after running and viewing a test performed with the AXS-200/610, in either text or graphical format. Each copper qualification test includes a **Save Results** tab to do so.

Press the F1, F2, or F3 key to view this tab, or use the function arrow keys on either side of the F1 and F3 keys to access it.

Save Results

The **Save Results** tab allows you to save your test results to a file or to an HTML report.

Each entry on the pane is described as follows:

➤ **Save as Type** lists the following formats to save your test results:

➤ **AXS200 format** is a binary file format with ext *.dat. This format can be opened only on an AXS200 unit. The **Available Graphs** list box will be unavailable in this case.

➤ ***.csv** saves only graphical results.Textual results must be formatted as a comma-separated values table for easy importation to Excel. Results are saved to a USB.

➤ ***.gif** stands for graphics interchange format and is one of the most common file formats for graphic images on the World Wide Web. Results are saved to a USB.

➤ ***.bmp** saves graphical results in a bitmap file format. Results are saved to a USB.

➤ ***.xml** saves your data in a common language format to share on the Web.
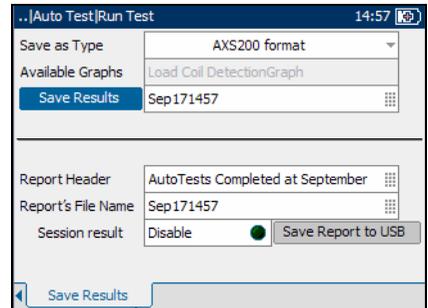
➤ **Available Graphs** is enabled only if the selected format under **Save as Type** is ***.gif**, ***.csv**, or ***.bmp**.The selection of graphs available are: **Load Coil Detection**, **VF Power Influence**, **PSD Noise**, **WB Spectral Detective**, **WB Impulse Noise Histogram**, **Attenuation**, **WB Long. Balance**, **Loop Mapper**, **TDR**, and **Auto Test**. For a test that does not have a graph, this list box is unavailable.

➤ **Save Results** button saves the test results in internal or external memory (depending on the **Save as Type** format).

➤ *Filename* is the current date and time stamp plus you can enter any name. If it already exists, you will be prompted to overwrite the existing file.

➤ **Report Header** is where you can enter any comment. The initial value is the current test followed by the date and time stamp.

➤ **Report's File Name** is where you can enter any name for the HTML filename. If the name already exists, you will be prompted to overwrite the existing file.The default extension is .html.

The default name is generated from the current time.

➤ **Session result** creates and saves the report for single test results when disabled, or appends multiple results in one report when enabled.

➤ **Save Report to USB** button saves the results to an HTML report. If a USB memory stick is not inserted, the following warning dialogue box appears: **USB device is not detected**.

➤ **Append to Report** button appears only if **Session result** is **Enable**, and creates an HTML report for the current test in internal memory.

To set parameter values and save results:

1. Press the left/right and up/down arrow keys to highlight the desired parameter.

2. Press ✔ to display the list or select the value.

3. Press the up/down arrow key to highlight the desired value.

   OR

4. Press the left arrow key to erase the existing value, and then use the alphanumeric keypad to enter a value. To cancel the entry, press ↰.

5. Press ✔ to accept the value.

Reading Saved Results

You can view any of your saved results with the Copper Test Module, by highlighting the **Read Saved Results** menu item from the **Copper Qualification Tests** pane, and pressing ✔.

Read Saved Results

The **Read Saved Results** tab allows you to select a test type and view the results of all the files previously saved.

Select Test Type provides a list of all the copper qualification test types available for you to select for viewing.

➤ **Auto Test**

➤ **Video-DSL Rate Prediction**

➤ **POTS Auto Test**

➤ **DMM Tests**

➤ **VF Receive Tone**

➤ **VF Noise**

➤ **VF Impulse Noise**

➤ **VF Power Influence**

➤ **VF Long.Balance**

➤ **VF Load Coil**

➤ **TDR**

➤ **RFL-2 Wires**

➤ **RFL-4 Wires**

➤ **Loop Mapper**

➤ **WB Receive Tone**
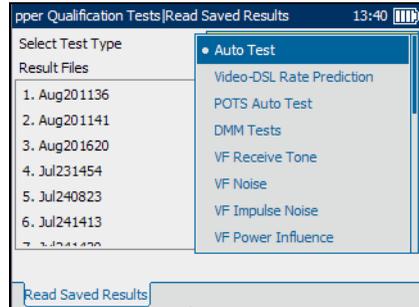
➤ **WB Impulse Noise**

➤ **WB Impulse Noise Histogram**

➤ **Spectral Detective**

➤ **PSD Noise**

➤ **Attenuation**

➤ **WB Longitudinal Balance**

➤ **WB Data Rate Prediction**

➤ **Rect. L Detection**

➤ **Resistive Balance**

To open previously saved test results:

1. Press ✔ to open the list.

2. In the list, press the up/down arrows to select the test type.

3. Press ✔ to confirm the selection.

4. Press the down arrow to activate the **Result Files** list box and press ✔ to display the list of available files.

5. Press the up/down arrows to select the desired result file.

6. Press ✔ to view the selection.

3 *Auto CQ/Video-DSL Rate Prediction*

CQ Auto Test

The cable qualification auto test function allows you to automatically run tests used in pre-qualification, installation, and maintenance of different circuit types from POTS to VDSL2. Auto tests include a range of different tests that compare measured results against stored threshold values to provide pass or fail results. The results are displayed in both text and graphical format.

The following tests can be included in the CQ auto test function:

➤ AC/DC voltage and current

➤ Resistance

➤ Capacitance

➤ Isolation

➤ Load coil detection

➤ Power influence

➤ Voice frequency (VF) longitudinal balance

➤ Voice frequency (VF) noise

➤ Voice frequency (VF) impulse noise

➤ Voice Frequency (VF) receive tone

➤ Wideband (WB) receive tone

➤ Wideband (WB) longitudinal balance

➤ Power spectral density (PSD) noise

➤ Attenuation

➤ Wideband (WB) impulse noise

➤ Time domain reflectometry (TDR)
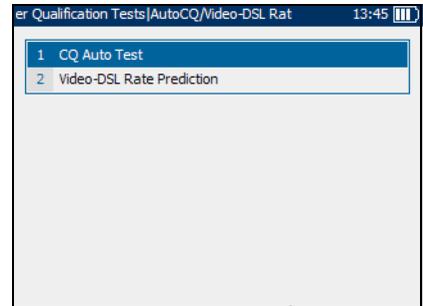
Configuring CQ Auto Tests

Parameters for auto test configuration are on the **CQ Auto Test** pane tabs.

To view auto test configuration tabs:

1. From the **CQ Auto Test** pane use the up/down arrow keys to highlight **Test Configuration**, and press ✔.

2. Press the F1, F2, or F3 key to view the various tabs. To view any available additional tabs, use the function arrow keys on either side of the F1 and F3 keys.
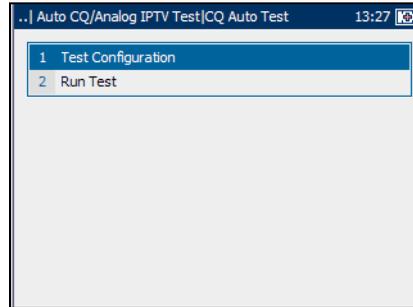
Test List 1

The **Test List 1** tab allows you to select the types of tests to include in the auto test function.

The following tests are available:

➤ **AC/DC Voltage** detects AC RMS and DC voltages in the line. Toggle between **Enable** and **Disable**.

➤ **AC/DC Current** checks for AC RMS and DC currents in the line. Toggle between **Enable** and **Disable**.

➤ **Resistance** measures isolation resistance between the wires and to ground. It is also used to identify possible faults, and to measure the resistance of the twisted pair cable for estimating loop length. Toggle between **Enable** and **Disable**.

➤ **Capacitance** measures the capacitance of the cable for estimating loop length. Toggle between **Enable** and **Disable**.
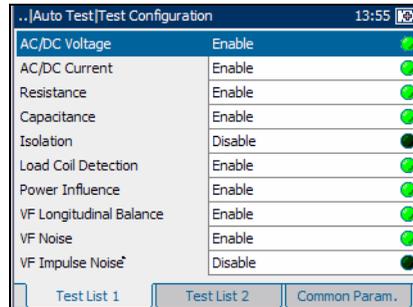
➤ **Isolation** measures the quality of insulation or sheathing for the copper pairs.

➤ **Load Coil Detection** detects the presence of load coils in the line. Toggle between **Enable** and **Disable**.

➤ **Power Influence** measures the effects that 50 Hz and 60 Hz powerline (AC Mains) interference has on the circuit under test. Toggle between **Enable** and **Disable**.

➤ **VF Longitudinal Balance** is very useful in identifying loops that will suffer from crosstalk. Toggle between **Enable** and **Disable**.

➤ **VF Noise** measures VF noise in the line. Toggle between **Enable** and **Disable**.

➤ **VF Impulse Noise** measures the random occurrences of energy spikes in the voice frequency range that have random amplitude and spectral content.

To select tests:

1. Press the up/down arrow keys to highlight a desired test.

2. Press ✔ to toggle between **Enable** and **Disable**.

3. Select other tests as required.

Test List 2

The **Test List 2** tab allows you to select additional tests to include in the auto test function.

The following additional tests are available:

➤ **VF Receive Tone** measures the level and frequency of the incoming voice signal.

➤ **WB Receive Tone** measures the level and frequency of the incoming wideband signal.
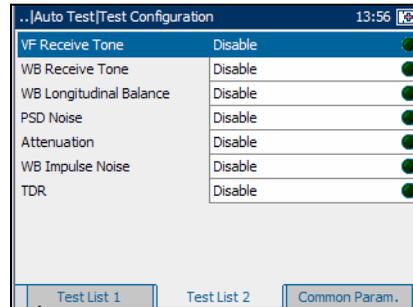
Note: *The VF and WB Receive Tone tests are mutually exclusive. When one test is enabled, the other is automatically disabled.*

➤ **WB Longitudinal Balance** verifies that the wideband longitudinal balance ratios comply with applicable standards.

➤ **PSD Noise** measures power spectral density noise.

➤ **Attenuation** measures the amount of reduction in signal strength.

➤ **WB Impulse Noise** measures the irregular occurrences of energy spikes in the wideband range that have random amplitude and spectral content.

➤ **TDR** test identifies and locates all types of faults as well as bridge taps (multiple appearances) and load coils.

To select tests:

1. Press the up/down arrow keys to highlight a desired test.

2. Press ✔ to toggle between **Enable** and **Disable**.

3. Select other tests as required.

Common Parameters

The **Common Param.** tab allows you to set up parameters common to all tests in the auto test function.

Each parameter is described below:

➤ **Cable Type** defines the gauge of the cable in use. If wire gauge is measured in AWG units, the available choices are: **AUTO**, **19 AWG**, **22 AWG**, **24 AWG**, or **26 AWG.** For mm gauge wire, the available choices are: **AUTO**, **0.32 mm**, **0.40 mm**, **0.50 mm**, **0.60 mm**, **0.80 mm**, **0.90 mm**, or **1.20 mm**.

➤ **Temperature** specifies the temperature of the cable under test in either **F** (Fahrenheit) or **C** (Celsius) units.

➤ **Isolation Test Time(sec)** specifies the duration of the isolation test.
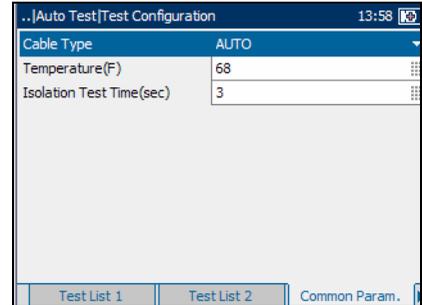
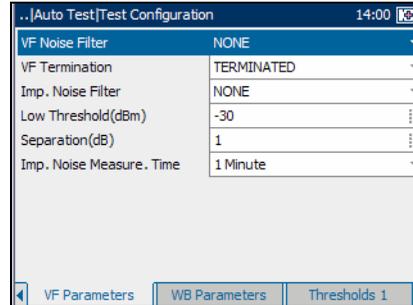***To set parameter values:***

1. Press the up/down arrow keys to highlight the desired parameter.

2. Press ✔ to display the list or select the value.

3. Press the up/down arrow keys to highlight the desired value.

OR

4. Press the left arrow key to erase the existing value, and then use the alphanumeric keypad to enter a value. To cancel the entry, press ↰.

5. Press ✔ to accept the value.

VF Test Parameters

The **VF Parameters** tab allows you to set up parameters used in the voice frequency tests.

Each parameter is described below:

➤ **VF Noise Filter** defines the level of voice frequency noise filtering. If the ANSI standard is used, the available choices are: **NONE**, **C-MESSAGE**, **C NOTCHED**, **3 kHz FLAT**, **D-FILTER** or **15 kHz**. If the ITU standard is used, the available choices are: **NONE**, **PSOPHOMETRIC**, **P-NOTCHED**, **3 kHz FLAT**, **D-FILTER** or **15 kHz**.

➤ **VF Termination** defines if the unit uses normal test impedance termination or high bridging impedance when the cable is active or terminated by other external equipment. For normal test termination select **TERMINATED**, otherwise select **BRIDGING**.

➤ **Imp. Noise Filter** defines the type of impulse noise filtering to use. If ANSI standard is used, the available choices are: **NONE**, **C-MESSAGE**, **C NOTCHED**, **3 kHz FLAT**, **D-FILTER** or **15 kHz**. For the ITU standard, the choices are: **NONE**, **PSOPHOMETRIC**, **P-NOTCHED**, **3 kHz FLAT**, **D-FILTER** or **15 kHz**.

➤ **Low Threshold(dBm)** defines the low threshold limits for impulse noise. Specify a value between -**40** and **0**.

➤ **Separation(dB)** defines the level difference (in dB) between the low, the mid and high thresholds. Specify a value between **1** and **6** dB.

➤ **Imp. Noise Measure. Time** defines the time duration to measure impulse noise. The available choices are: **1 minute**, **5 minutes**, **10 minutes**, **15 minutes**, **60 minutes**, or **24 hours**.

To set parameter values:

1. Press the up/down arrow keys to highlight the desired parameter.

2. Press ✔ to display the list or select the value.

3. Press the up/down arrow keys to highlight the desired value.

   OR

4. Press the left arrow key to erase the existing value, and then use the alphanumeric keypad to enter a value. To cancel the entry, press ↰.

5. Press ✔ to accept the value.

WB Test Parameters

The **WB Parameters** tab allows you to set up parameters used in the wideband tests.

Each parameter is described below:

➤ **WB Noise Filter** defines the level of wideband noise filtering. The available choices are: **NONE**, **50 kbit**, **ISDN-E**, **HDSL-F**, **ADSL-G**, **ADSL**, **ADSL2+**, **VDSL**, **VDSL2-8**, **VDSL2-12**, **VDSL2-17**, or **VDSL2-30**.
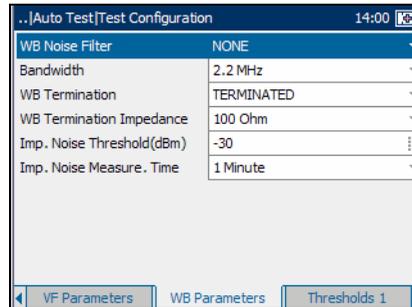
Note: *VDSL2-x filters are only available if VDSL2 is enabled in the software options.*

➤ **Bandwidth** specifies the frequency range for the test: **2.2 MHz**, **12 MHz**, **17 MHz**, or **30 MHz**.

Note: *Frequency bands in excess of 2.2 MHz are only displayed if VDSL2 is enabled in the software options.*

➤ **WB Termination** defines if the unit uses normal test impedance termination or high bridging impedance when the cable is active or terminated by other external equipment. For normal test termination select **TERMINATED**, otherwise select **BRIDGING**.

➤ **WB Termination Impedance** defines the impedance of the dummy load connected to the line. Select one of the following: **100 Ohm** or **135 Ohm**.

➤ **Imp. Noise Threshold(dBm)** is the maximum impulse noise level. Specify a value between **-50** and **0** (-40 and 0 if any filter applied).

➤ **Imp. Noise Measure. Time** defines the time duration to measure impulse noise. The available choices are: **1 minute**, **5 minutes**, **10 minutes**, **15 minutes**, **60 minutes**, or **24 hours**.

To set parameter values:

1. Press the up/down arrow keys to highlight the desired parameter.

2. Press ✔ to display the list or select the value.

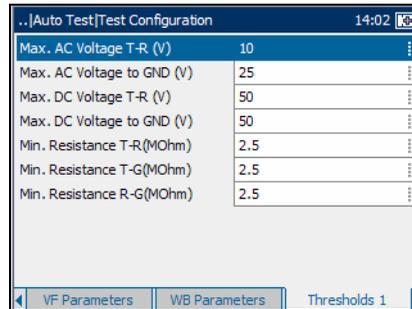3. Press the up/down arrow key to highlight the desired value.

   OR

4. Press the left arrow key to erase the existing value, and then use the alphanumeric keypad to enter a value. To cancel the entry, press ⬅.

5. Press ✔ to accept the value.

Thresholds 1

The **Thresholds 1** tab allows you to set threshold values for the auto tests.

Each parameter is described below:

➤ **Max. AC Voltage T-R (V)** defines the maximum AC threshold voltage for the T-R leg of the circuit. Specify a value between **1** and **30**.

➤ **Max. AC Voltage to GND (V)** defines the maximum AC threshold voltage to ground for the circuit. Specify a value between **1** and **30**.

➤ **Max. DC Voltage T-R (V)** defines the maximum DC threshold voltage for the T-R leg of the circuit. Specify a value between **1** and **400**.

➤ **Max. DC Voltage to GND (V)** defines the maximum DC threshold voltage to ground for the circuit. Specify a value between **1** and **400**.

➤ **Min. Resistance T-R(MOhm)**: defines the minimum threshold resistance for the T-R leg of the circuit. Specify a value between **0** and **999**.

➤ **Min. Resistance T-G(MOhm)** defines the minimum threshold resistance for the T-G leg of the circuit. Specify a value between **0** and **999**.

➤ **Min. Resistance R-G(MOhm)** defines the minimum threshold resistance for the R-G leg of the circuit. Specify a value between **0** and **999**.

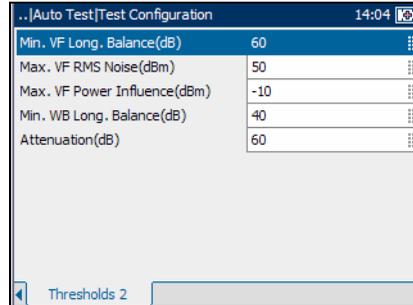***To set a threshold value:***

1. Press the up/down arrow keys to highlight the desired parameter.

2. Press ✔ to select the value.

3. Press the left arrow key to erase the existing value, and then use the alphanumeric keypad to enter a value. To cancel the entry, press ↰.

4. Press ✔ to accept the value.

Thresholds 2

The **Thresholds 2** tab allows you to set additional threshold values.

Each parameter is described below:

➤ **Min. VF Long. Balance(dB)** defines the minimum voice frequency threshold longitudinal balance level. Specify a value between **10** and **80**.

➤ **Max. VF RMS Noise** defines the maximum threshold RMS noise energy level. Specify a value between **-90** and **10** dBm if the ITU standard is used. Specify a value between **0** and **100** dBrn if the ANSI standard is used.

➤ **Max. VF Power Influence** defines the maximum threshold power influence level on the circuit. Specify a value between **-90** and **20** dBm if the ITU standard is used. Specify a value between **0** and **110** dBrnC if the ANSI standard is used.

➤ **Min. WB Long. Balance(dB)** defines the minimum threshold wideband longitudinal balance level. Specify a value between **10** and **80**.

➤ **Attenuation(dB)** defines the threshold wideband attenuation level. Specify a value between **0** and **80**.

### *To set a threshold value:*

1. Press the up/down arrow keys to highlight the desired parameter.

2. Press ✔ to select the value.

3. Press the left arrow key to erase the existing value, and then use the alphanumeric keypad to enter a value. To cancel the entry, press ↰.

4. Press ✔ to accept the value.

Running CQ Auto Tests and Viewing Results

Auto test results are located on the **CQ Auto Test** pane tabs.

To run auto tests and view results:

1. From the **CQ Auto Test** pane use the up/down arrow keys to highlight **Run Test**, and press ✔.

2. Press the F1, F2, or F3 key to view the various tabs. To view any available additional tabs, use the function arrow keys on either side of the F1 and F3 keys.
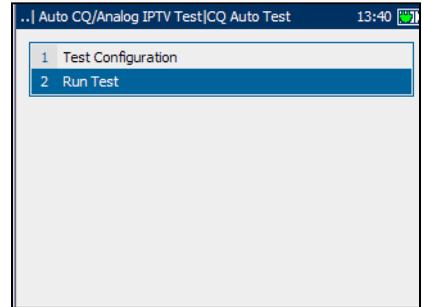
Summary

The **Summary** tab displays the overall **PASS** or **FAIL** status of all tests selected for auto testing.

DMM Results

The **DMM Results** tab displays the measured values and pass or fail status of each digital multimeter (DMM) test.
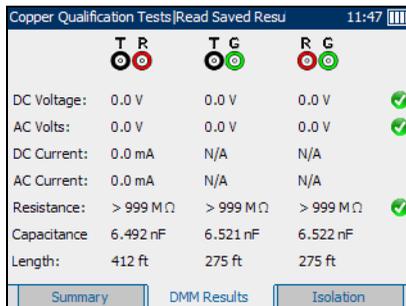
Isolation

The **Isolation** tab displays the measured **Resistance** values from the isolation test.
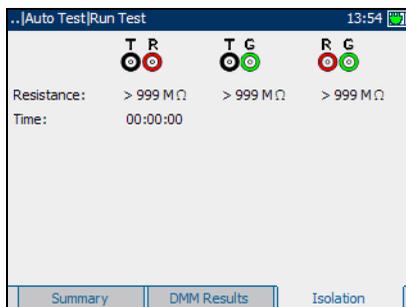
Load Coil

The **Load Coil** tab displays the number of load coils in the line, and measured values from the load coil detection test in graphical form.

To move the screen pointer:

Press the left/right arrow keys to move the screen pointer. The pointer value updates dynamically.
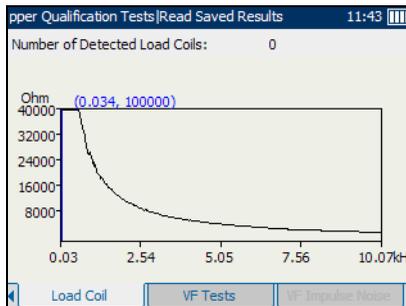
VF Tests

The **VF Tests** tab displays the measured values and **PASS** or **FAIL** status of the voice frequency tests.
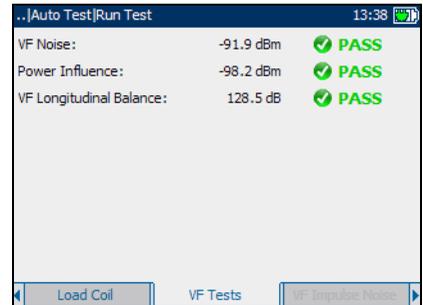
VF Impulse Noise

The **VF Impulse Noise** tab displays the measured values from the voice frequency impulse noise tests.
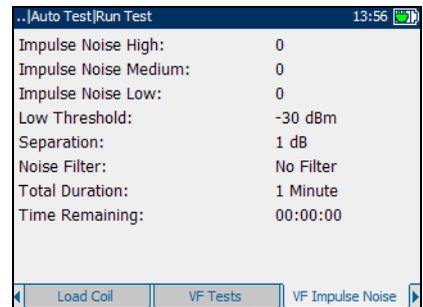
Receive Tone

The **Receive Tone** tab displays the current received frequency and level values of the received tone.

WB Longitudinal Balance

The **WB Long. Balance** tab displays in graphical form the measured values from the wideband longitudinal balance tests.

The list and buttons on the tab are described below:

➤ (Zoom function List) allows you to select the desired zoom function **Horizontal Zoom** or **Vertical Zoom**. The selected function is displayed in the box.

➤ **Zoom In** allows you to increase the level of zoom for the selected zoom function.

➤ **Zoom Out** allows you to reduce the level of zoom for the selected zoom function.

To zoom in or out:

1. Press ✔ to display a list of zoom functions.

2. Press the up/down arrow keys to highlight the desired zoom function.

3. Press ✔ to select the zoom function.

4. Use the left/right arrow keys to highlight the **Zoom In** or **Zoom Out** button as required, then press ✔.

   The graphical display zooms in or out accordingly.
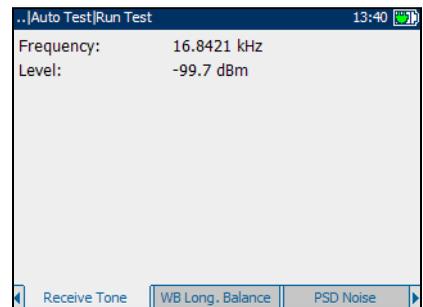
5. Press ✔ repeatedly to continue zooming.

To move the screen pointer:

Press the left/right arrow keys to move the screen pointer. The pointer value updates dynamically.

PSD Noise

The **PSD Noise** tab displays the **RMS Noise** value from the power spectral density (PSD) noise tests in text and graphical form.

The list and buttons on the tab are described below:

➤ (Zoom function List) allows you to select the desired zoom function: **Horizontal Zoom** or **Vertical Zoom**. The selected function is displayed in the box.

➤ **Zoom In** allows you to increase the level of zoom for the selected zoom function.

➤ **Zoom Out** allows you to reduce the level of zoom for the selected zoom function.

To zoom in or out:

1. Press ✔ to display a list of zoom functions.

2. Press the up/down arrow keys to highlight the desired zoom function.

3. Press ✔ to select the zoom function.

4. Use the left/right arrow keys to highlight the **Zoom In** or **Zoom Out** button as required, then press ✔.

The graphical display zooms in or out accordingly.

5. Press ✔ repeatedly to continue zooming.

To move the screen pointer:

Press the left/right arrow keys to move the screen pointer. The pointer value updates dynamically.

Attenuation

The **Attenuation** tab displays in graphical form the cable length value from attenuation tests.

The list and buttons on the tab are described below:

➤ (Zoom function List) allows you to select the desired zoom function: **Horizontal Zoom** or **Vertical Zoom**. The selected function is displayed in the box.

➤ **Zoom In** allows you to increase the level of zoom for the selected zoom function.

➤ **Zoom Out** allows you to reduce the level of zoom for the selected zoom function.

To zoom in or out:

1. Press ✔ to display a list of zoom functions.

2. Press the up/down arrow keys to highlight the desired zoom function.

3. Press ✔ to select the zoom function.

4. Use the left/right arrow keys to highlight the **Zoom In** or **Zoom Out** button as required, then press ✔.

   The graphical display zooms in or out accordingly.

5. Press ✔ repeatedly to continue zooming.
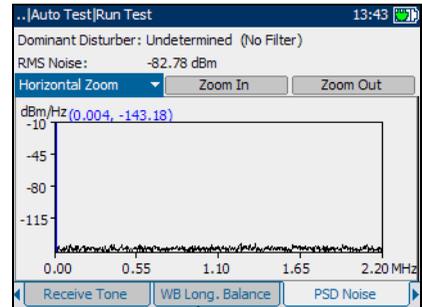
To move the screen pointer:

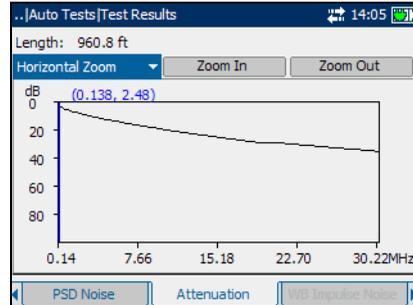Press the left/right arrow keys to move the screen pointer. The pointer value updates dynamically.

WB Impulse Noise

The **WB Impulse Noise** tab displays the measured values from the wideband impulse noise tests.

..|Auto Test|Run Test	13:45
Termination Impedance:	100 Ohm
Termination:	Terminated
Threshold:	-30 dBm
Noise Filter:	No Filter
Total Duration:	1 Minute
Time Remaining:	00:00:00
Impulse Count:	0

Attenuation | WB Impulse Noise | TDR

TDR

The **TDR** tab displays the time domain reflectometry which is on and ready to use upon completion of the **Auto Test**. **TDR** first attempts to find the length of the circuit and then searches all ranges from shortest to longest for significant events. Upon completion, the test selects the nearest major event, sets the range to match, and aligns the cursor with the event. It remains running (not in **Fault Location Tests**).

..|..|CQ Auto Test|Run Test	16:57
Pulse/Gain: 25 ns/0 dB	Loss: 9.9 dB
Length: 96.5 ft	Zoom

[Cursor-Marker] = 97 ft
(97, 0.00)

Attenuation | WB Impulse Noise | TDR

To make TDR adjustments via the keypad:

1. Press ✔ to change the mode button (top-right corner of the pane) and function of the up/down arrow keys.

2. Press ✔ repeatedly to cycle between:

    ➤ Zoom

    ➤ Gain

    ➤ Pulse Gain (Pulse Width & Gain)

    ➤ Range

    ➤ Cursor and Marker Selection

To measure the distance/duration between reflections:

1. Press ✔ to cycle the mode and change to **CursorMarker**.

2. Press the left/right arrow keys to position the blue cursor (indicated by the blue color of data above cursor).

3. Press the up arrow key to select the red marker.

4. Press the left/right arrow keys to position the marker.

5. The difference between the cursor and marker is continuously updated and is indicated with a triangle (delta symbol) above the graph.

To zoom in/out:

1. Press ✔ to select the **Zoom** function. Default mode is **Zoom**.

2. Press the up/down arrow keys to increase/decrease **Zoom** function. The graphical display zooms in or out accordingly.

Video-DSL Rate Prediction

The video-DSL rate prediction test provides an innovative way to understand the otherwise complicated output of electrical and attenuation measurements, and noise tests as they relate to the capacity to transport IPTV video over ADSL2+ circuits. This test performs a series of loop-quality measurements before predicting the ADSL2+ data rate and Video-DSL rate.

Based on current loop conditions and user-defined technology, the video-DSL rate prediction test shows you how many streams of standard broadcast (SB) and high definition (HD) IPTV video streams the tested circuit could reliably carry.
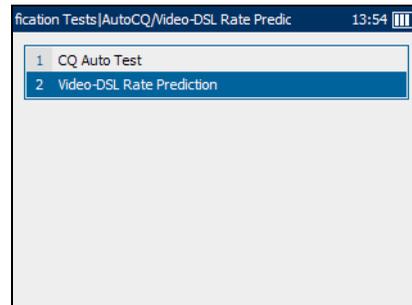
Configuring Video-DSL Rate Prediction

Parameters for auto test configuration are on the **Video-DSL Rate Prediction** pane tabs.

To view the test configuration tabs:

1. From the **Video-DSL Rate Prediction** pane use the up/down arrow keys to highlight **Test Configuration**, and press ✔.

2. Press the F1, F2, or F3 key to view the various tabs. To view any available additional tabs, use the function arrow keys on either side of the F1 and F3 keys.
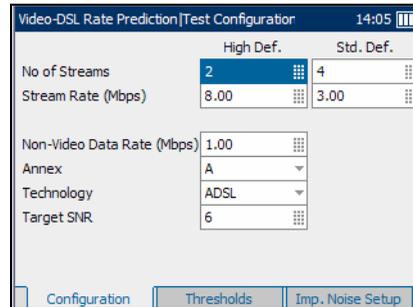
Configuration

The **Configuration** tab allows you to
define the desired number of streams
and allocated bit rate per stream
before running the test.

Video-DSL Rate Prediction	Test Configuration		14:05
	High Def.	**Std. Def.**	
No of Streams	2	4	
Stream Rate (Mbps)	8.00	3.00	
Non-Video Data Rate (Mbps)	1.00		
Annex	A		
Technology	ADSL		
Target SNR	6		
	Configuration	Thresholds	Imp. Noise Setup

Each parameter is described below:

➤ **No Of Streams** is the number of
   High Def. (definition) streams,
   ranging from 0 to 4 and **Std.**
   (standard) **Def.** streams ranging
   from 0 to 10.

➤ **Stream Rate (Mbps)** is the **High Def.** (HD) and **Std. Def.** (SD) stream
   rate before running the test, ranging from 0 to 24 Mbps. Default values
   are 8 Mbps for HD and 1 Mbps for SD.

➤ **Non-Video Data Rate (Mbps)** is a data rate of non-video data typically
   used by high-speed internet and VoIP services. Rates range from
   0 to 24 Mbps. Default value is 1 Mbps.

➤ **Annex** defines the modes of available ADSL Annexes from the
   ITU standards.

   ➤ **A** is ADSL service functioning over POTS.

   ➤ **B** activates the ADSL functionality over ISDN.

   ➤ **L Mask 1** assumes an increase in ADSL2 range/distance.

   ➤ **L Mask 2** also extends the signal reach but can show an
      improvement in the upstream data rate.

   ➤ **M** allows increased upload speeds from 1 Mbps to 3.5 Mbps.
      Available only for ADSL2 and ADSL2+.

➤ **Technology** lists the following values: **ADSL2+**, **ADSL2**, or **ADSL**. If **Annex L** is previously selected, **ADSL2** is automatically set. If **Annex M**, **ADSL** is not available.

➤ **Target SNR** is the desired signal-to-noise ratio ranging from 0 to 31 dB. Default value is 6 dB.

To set parameter values:

1. Press the up/down or left/right arrow keys to highlight the desired parameter.

2. Press ✔ to display the list or select the value.

3. Press the up/down arrow keys to highlight the desired value.

OR

4. Press the left arrow key to erase the existing value, and then use the alphanumeric keypad to enter a value. To cancel the entry, press ↰.

5. Press ✔ to accept the value.

Thresholds

The **Thresholds** tab allows you to set threshold values for the auto tests.

Each parameter is described below:

deo-DSL Rate Prediction|Test Configuration		14:06
Max AC Voltage (V)	6	
Max DC Voltage (V)	9	
Min Resistance (MOhm)	3.6	
Max Cap. Balance (%)	6	
Min Long Balance (dB)	59	

| Configuration | Thresholds | Imp. Noise Setup |

➤ **Max AC Voltage (V)** defines the maximum AC voltage, ranging from 1 to 20. Default value is 6.

➤ **Max DC Voltage (V)** defines the maximum DC voltage ranging from 1 to 20. Default value is 9.

➤ **Min Resistance (MOhm)** defines the minimum resistance ranging from 0.5 to 100. Default value is 3.6.

➤ **Max Cap. Balance (%)** defines the percentage maximum capacitance balance ranging from 0 to 20. Default value is 6.

➤ **Min Long Balance (dB)** defines the minimum longitudinal balance level ranging from 50 to 70. Default value is 59.
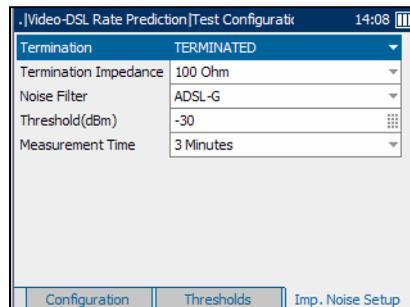
To set a threshold value:

1. Press the up/down arrow keys to highlight the desired parameter.

2. Press ✔ to select the value.

3. Press the left arrow key to erase the existing value, and then use the alphanumeric keypad to enter a value. To cancel the entry, press ↰.

4. Press ✔ to accept the value.

Impulse Noise Setup

The **Imp. Noise Setup** tab allows you to configure parameters to measure impulse noise on the circuit under test.

Each parameter on the pane is described below.

➤ **Termination** defines if the unit uses normal test impedance termination or high bridging impedance when the cable is active or terminated by other external equipment. For normal test termination select **TERMINATED**, otherwise select **BRIDGING**.

➤ **Termination Impedance** defines the impedance of the dummy load connected to the line. Select one of the following: **100** or **135 Ohm**.

➤ **Noise Filter** defines the level of wideband noise filtering. The available choices are: **NONE**, **50 kbit**, **ISDN-E**, **HDSL-F**, **ADSL-G**, **ADSL**, **ADSL2+**, **VDSL**, **VDSL2-8**, **VDSL2-12**, **VDSL2-17**, or **VDSL2-30**.

Note: *VDSL2-x filters are only available if VDSL2WB is enabled in the software options.*

➤ **Threshold(dBm)** is the maximum impulse noise level. Specify a value between **-50** and **0** (-40 and 0 if any filter applied). Default value is -30.

➤ **Measurement Time** defines the duration of the Impulse Noise test. The available choices are: **1**, **3**, **5**, **10**, **15**, or **60 Minutes**, or **24 Hours**.

To set parameter values:

1. Press the up/down arrow keys to highlight the desired parameter.

2. Press ✔ to display the list or select the value.

3. Press the up/down arrow keys to highlight the desired value.

   OR

4. Press the left arrow key to erase the existing value, and then use the alphanumeric keypad to enter a value. To cancel the entry, press ↰.

5. Press ✔ to accept the value.

Running Video-DSL Rate Prediction Tests and Viewing Results

Details of the video-data rate prediction results are located on the **Video-DSL Rate Prediction** pane tabs.

To run the tests and view results:

1. From the **Video-DSL Rate Prediction** pane use the up/down arrow keys to highlight **Run Test**, and press ✔.

2. Once the tests are completed, highlight the **Details** button from the **Test Summary** pane and press ✔ to view the results.

3. Press the F1, F2, or F3 key to view the various tabs. To view any available additional tabs, use the function arrow keys on either side of the F1 and F3 keys.
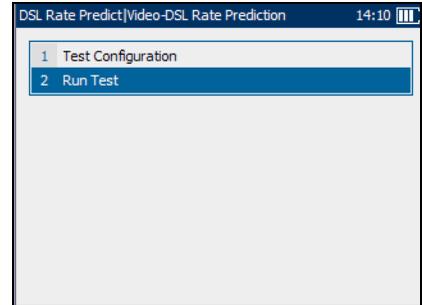
Test Summary
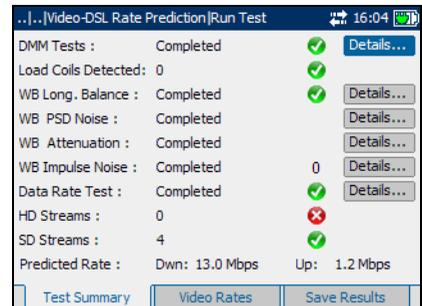
The **Test Summary** tab allows you to view the pass/fail status and **Details** of all tests configured for auto testing.

The available test results are the following:

➤ **DMM Tests** or digital multimeter tests detect AC/DC voltages, and measure frequency, resistance and capacitance for the copper wire connection.

➤ **Load Coils Detected** is the number load coals detected in the line.

➤ **WB Long. Balance** measures the wide band longitudinal balance of the broadband service.

➤ **WB PSD Noise** measures the wide band power spectral density noise on the line.

➤ **WB Attenuation** measures the cable length value from wide band attenuation tests.

➤ **WB Impulse Noise** measures values from the wideband impulse noise tests.

➤ **Data Rate Test** predicts the maximum bit rate achievable on the local loop based on **Annex**, **Technology**, and **Target SNR** selected.

➤ **HD Streams** is the number of high definition streams carried on the local loop. Again, the pass indicator is displayed only if the analyzed number of HD streams matches the number set on the **Configuration** tab. Otherwise the status is fail.

➤ **SD Streams** is the number of standard definition streams carried on the local loop. Here, the pass indicator is displayed only if the analyzed number of SD streams matches the number set on the **Configuration** tab. Otherwise the status is fail.

➤ **Predicted Rate** displays the downstream and upstream predicted data rates.

➤ The **Details** button navigates you to the applicable results tab which provides more information about a particular test.

To view more information about each available test result:

1. Press the up/down arrows to highlight the **Details** button alongside the desired test result.

2. Press ✔ to select the desired **Details** button.

3. To return to the **Test Summary** pane, press ↰.

Video Rates

The **Video Rates** tab allows you to view the pass/fail status, details and predicted data rate of the high and standard definition streams carried on the local loop.

Configurable parameters include:

➤ **No of Streams** is the number of **High Def.** (definition) streams, ranging from 0 to 4 and **Std.** (standard) **Def.** streams ranging from 0 to 10.

➤ **Stream Rate (Mbps)** is the **High Def.** (HD) and **Std. Def.** (SD) stream rate before running the test, ranging from 0 to 24 Mbps. Default values are 8 Mbps for HD and 1 Mbps for SD.

➤ **Technology** lists the following values: **ADSL2+**, **ADSL2**, or **ADSL**. If **Annex L** is previously selected, **ADSL2** is automatically set. If **Annex M**, **ADSL** is not available.

➤ **Annex** defines the modes of available ADSL Annexes from the ITU standards.

➤ **A** is ADSL service functioning over POTS.

➤ **B** activates the ADSL functionality over ISDN.

➤ **L Mask 1** assumes an increase in ADSL2 range/distance.

➤ **L Mask 2** also extends the signal reach but can show an improvement in the upstream data rate.

➤ **M** allows increased upload speeds from 1 Mbps to 3.5 Mbps. Available only for ADSL2 and ADSL2+.

➤ **Target SNR** is the desired signal-to-noise ratio ranging from 0 to 31 dB. Default value is 6 dB.

➤ **Recalculate** button allows you to change the setup and re-evaluate the rates.

To re-set parameters to view different results:

1. Press the up/down or left/right arrow keys to highlight the desired parameter.

2. Press ✔ to display the list or select the value.

3. Press the up/down arrow keys to highlight the desired value.

OR

4. Press the left arrow key to erase the existing value, and then use the alphanumeric keypad to enter a value. To cancel the entry, press ⬅.

5. Press ✔ to accept the value.

6. Press the up/down arrow keys to highlight the **Recalculate** button.

7. Press ✔ to recalculate rates for the new setup.

DMM Tests

The DMM tests results pane displays the measured values on tip, ring, and ground, and the pass/fail status of each digital multimeter test.
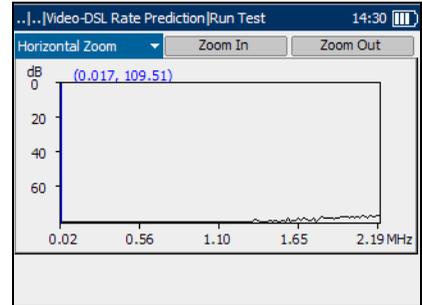
WB Longitudinal Balance

The WB Long. Balance pane displays the results of the wideband longitudinal balance test in graphical form.

The buttons on the tab are described below:

➤ (Zoom function List) allows you to select the desired zoom function: **Horizontal Zoom** or **Vertical Zoom**. The selected function is displayed in the box.

➤ **Zoom In** allows you to increase the level of zoom for the selected zoom function.

➤ **Zoom Out** allows you to reduce the level of zoom for the selected zoom function.

To zoom in/out:

1. Press ✔ to display a list of zoom functions.

2. Press the up/down arrow key to highlight the desired zoom function.

3. Press ✔ to select the zoom function.

4. Use the left/right arrow key to highlight the **Zoom In** or **Zoom Out** button as required, then press ✔.

5. The graphical display zooms in or out accordingly. Press ✔ repeatedly to continue zooming.

To move the screen pointer:

Press the left/right arrow key to move the screen pointer. The pointer value updates dynamically.

WB PSD Noise

The WB PSD Noise pane displays the **RMS Noise** value from the power spectral density (PSD) noise tests in text and graphical form. RMS noise voltage measures the signal-to-noise ratio of the circuit.

The list and buttons on the tab are described below:

➤ (Zoom function List) allows you to select the desired zoom function: **Horizontal Zoom** or **Vertical Zoom**. The selected function is displayed in the box.

➤ **Zoom In** allows you to increase the level of zoom for the selected zoom function.

➤ **Zoom Out** allows you to reduce the level of zoom for the selected zoom function.

To zoom in or out:

1. Press ✔ to display a list of zoom functions.

2. Press the up/down arrow keys to highlight the desired zoom function.

3. Press ✔ to select the zoom function.

4. Use the left/right arrow keys to highlight the **Zoom In** or **Zoom Out** button as required, then press ✔ .

The graphical display zooms in or out accordingly.

5. Press ✔ repeatedly to continue zooming.

To move the screen pointer:

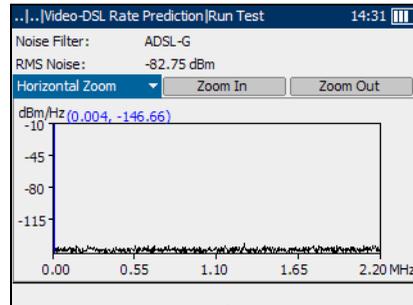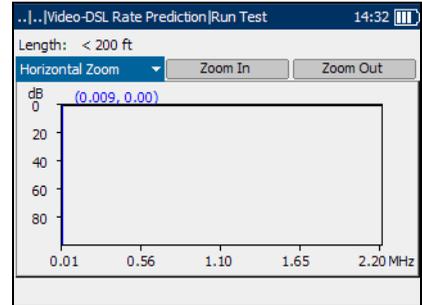Press the left/right arrow keys to move the screen pointer. The pointer value updates dynamically.

WB Attenuation

The WB Attenuation pane displays the wideband attenuation test results in graphical form.

The list and buttons on the tab are described below:

➤ (Zoom function List) allows you to select the desired zoom function: **Horizontal Zoom** or **Vertical Zoom**. The selected function is displayed in the box.

➤ **Zoom In** allows you to increase the level of zoom for the selected zoom function.

➤ **Zoom Out** allows you to reduce the level of zoom for the selected zoom function.

To zoom in/out:

1. Press ✔ to display a list of zoom functions.

2. Press the up/down arrow key to highlight the desired zoom function.

3. Press ✔ to select the zoom function.

4. Use the left/right arrow key to highlight the **Zoom In** or **Zoom Out** button as required, then press ✔.

5. The graphical display zooms in or out accordingly. Press ✔ repeatedly to continue zooming.

To move the screen pointer:

Press the left/right arrow key to move the screen pointer. The pointer value updates dynamically.

WB Impulse Noise

The WB Impulse Noise pane displays the measured values from the wideband impulse noise tests.

DSL Rate Tests

The **DSL Rate** tab allows you to view the down/up stream **Predicted Rate** based on measurements of PSD noise and attenuation.

Configurable parameters include:

➤ **Annex** lists the modes of available ADSL Annexes from the ITU standards.

    ➤ **A** is ADSL service functioning over POTS.

    ➤ **B** activates the ADSL functionality over ISDN.

    ➤ **L Mask 1** assumes an increase in ADSL2 range/distance.

    ➤ **L Mask 2** also extends the signal reach but can show an improvement in the upstream data rate.

    ➤ **M** allows increased upload speeds from 1 Mbps to 3.5 Mbps. Available only for ADSL2 and ADSL2+.

➤ **Target SNR** is the desired signal-to-noise ratio ranging from 0 to 31 dB. Default value is 6 dB.

➤ **Technology** lists the following values: **ADSL2+**, **ADSL2**, or **ADSL**. If **Annex L** is previously selected, **ADSL2** is automatically set. If **Annex M**, **ADSL** is not available.

➤ **Recalculate** button allows you to change the setup and re-evaluate the rates.

To re-set parameters to view different results:

1. Press the up/down or left/right arrow keys to highlight the desired parameter.

2. Press ✔ to display the list or select the value.

3. Press the up/down arrow keys to highlight the desired value.

   OR

4. Press the left arrow key to erase the existing value, and then use the alphanumeric keypad to enter a value. To cancel the entry, press ↰.

5. Press ✔ to accept the value.

6. Press the up/down arrow keys to highlight the **Recalculate** button.

7. Press ✔ to recalculate rates for the new setup.

Signal-to-Noise Ratio

The **SNR** tab displays the signal-to-noise ratio per tone in graphical form.

The list and buttons on the tab are described below:

➤ (Zoom function List) allows you to select the desired zoom function: **Horizontal Zoom** or **Vertical Zoom**. The selected function is displayed in the box.

➤ **Zoom In** allows you to increase the level of zoom for the selected zoom function.

➤ **Zoom Out** allows you to reduce the level of zoom for the selected zoom function.

To zoom in or out:

1. Press ✔ to display a list of zoom functions.

2. Press the up/down arrow keys to highlight the desired zoom function.

3. Press ✔ to select the zoom function.

4. Use the left/right arrow keys to highlight the **Zoom In** or **Zoom Out** button as required, then press ✔.

   The graphical display zooms in or out accordingly.

5. Press ✔ repeatedly to continue zooming.

To move the screen pointer:

Press the left/right arrow keys to move the screen pointer. The pointer value updates dynamically.

Bits per Bin

The **Bits per Bin** tab displays in graphical form the number of bits that can be transmitted on a particular bin representing a certain tone.

➤ **Zoom In** allows you to increase the level of zoom for the selected zoom function.

➤ **Zoom Out** allows you to reduce the level of zoom for the selected zoom function.

To zoom in or out:

1. Press the up or down arrow key to highlight the desired zoom function.

2. Press ✔ to select the zoom function.

3. Use the left or right arrow key to highlight the **Zoom In** or **Zoom Out** button as required, then press ✔.

The graphical display zooms in or out accordingly.
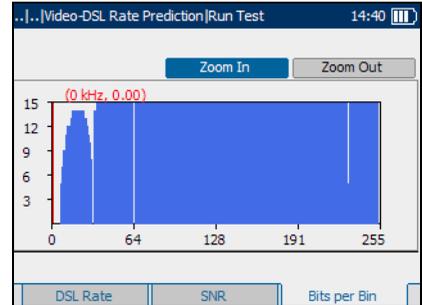
4. Press ✔ repeatedly to continue zooming.

To move the screen pointer:

Press the left/right arrow keys to move the screen pointer. The pointer value updates dynamically.

4   *POTS Auto Test*

The purpose of the POTS Auto Test function is to detect the DC current and measure the voice frequency in a copper telephone loop. This test allows you to compare measured results against stored threshold values to provide pass or fail status results of the POTS circuit type.

To view POTS Auto Test tabs:

From the **POTS Auto Test** pane use the F1, F2, or F3 key to view the various tabs.

Thresholds

The **Thresholds** tab allows you to set threshold values for the POTS auto test.

Each parameter is described below:

➤ **Min DC Current (mA)** is a value ranging from 10 to 100. Default is 23.

➤ **Max Loss (dB)** is a value ranging from 0 to 50. Default is 8.

➤ **Max VF Power Influence** is a value ranging from -90 to 10 dBm with a default of -10, if the ITU Standard is used. If ANSI Standard, the range is from 0 to 100 dBrn with a default value of 80.

➤ **Max VF Noise** is a value ranging from -90 to 10 dBm with a default of -70, if the ITU Standard is used. If ANSI Standard, the range is from 0 to 100 dBrn with a default value of 20.

➤ **Min Long Balance (dB)** is a value ranging from 0 to 100. Default is 60.

To set a threshold value and start/stop the test:

1. Press the up/down arrow keys to highlight the desired parameter.

2. Press ✔ to select the value.

3. Press the left arrow key to erase the existing value, and then use the alphanumeric keypad to enter a value. To cancel the entry, press ↰.

4. Press ✔ to accept the value.

5. Select other parameters as required.

6. Press ⋂ to start/stop the test.

Result

The **Result** tab allows you to view detailed results of the **DC Current**, voice frequency measurement values and Pass/Fail status of the POTS Auto Test.

Copper Qualification Tests|POTS Auto Test		11:34
Dialer Status:	ON HOOK	
DC Current:	0.0 mA	< 23.0 mA ✖
Loss:	N/A	
VF Power Influence:	N/A	
VF Noise:	N/A	
VF Longitudinal Balance:	N/A	

Thresholds	Result	Save Results

5 *DMM Tests*

The purpose of the digital multimeter (DMM) tests function is to detect AC/DC voltages and currents, and measure resistance and capacitance in a loop. These tests allow you to make basic electrical safety checks (AC volts), check from "crossed" or coupled battery voltages, assess basic loop continuity and quality with resistance measurements, and measure total electrical length with capacitance.

The DMM Tests menu includes the following tests:

➤ DMM

➤ In-service pair, rectified loop, and water detection

➤ Resistive balance

Copper Qualification Tests|DMM Tests	15:48
1 DMM	
2 In Service Pair Detection Test	
3 Rectified Loop Detection Test	
4 Water Detection Test	
5 Resistive Balance	
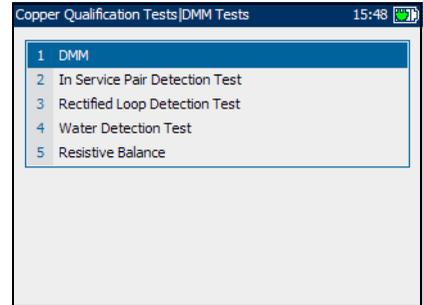
DMM

The DMM function allows you to perform the following tests:

➤ Voltage

➤ Resistance (also known as shorts meter)

➤ Isolation (also known as stress/leakage)

➤ Capacitance (also known as opens meter)

➤ Current

➤ VF Noise

➤ Longitudinal Balance

➤ POTS Dialer

To view DMM test tabs:

From the **DMM** pane use the F1, F2, or F3 key to view the various tabs. To view any available additional tabs, use the function arrow keys on either side of the F1 and F3 keys.

Voltage

The **Voltage** tab shows measured volts for each lead combination and allows you to measure AC/DC voltages and **Frequency** on tip, ring, and ground (A/B/Earth).

Each parameter is described below.

➤ **Input Imp.** displays the input impedance in the loop. The available choices are: **>1 MOhm**, **100 KOhm**.

➤ **Connection** defines the type of connection to be tested. The available choices are: **Tip-Ring**, **Tip-Gnd**, **Ring-Gnd**.
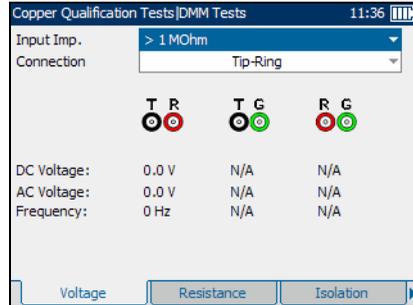
To start/stop the test:

1. Press the up/down arrow keys to highlight the desired test parameter.

2. Press ✔ to open the list.

3. Press the up/down arrow keys to highlight the desired value, then press ✔ to select it.

4. Select other parameters as required.

5. Press ⭘ to start/stop the test.

   Test results are displayed on the screen as they are completed.

Resistance

The **Resistance** tab allows you to measure the current resistance value and cable length for the cable connection.

Note: *If the ANSI standard is used, the tab name **Resistance** changes to **Shorts Meter**.*

Each parameter is described below.

➤ **Cable Type** defines the gauge of the cable in use. If wire gauge is measured in AWG units, the available choices are: **AUTO**, **19 AWG**, **22 AWG**, **24 AWG**, or **26 AWG.** For mm gauge wire, the available choices are: **AUTO**, **0.32 mm**, **0.40 mm**, **0.50 mm**, **0.60 mm**, **0.65 mm**, **0.80 mm**, **0.90 mm**, or **1.20 mm**.

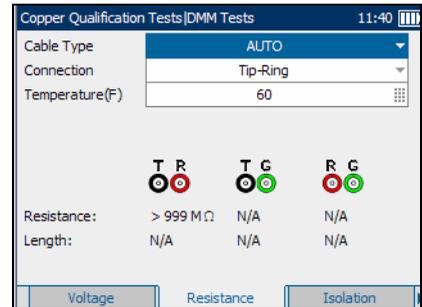➤ **Connection** defines the type of connection to be tested. The available choices are: **Tip-Ring**, **Tip-Gnd**, **Ring-Gnd**, **All**.

➤ **Temperature**(F) is the temperature of the cable.

To start/stop the test:

1. Press the up/down arrow keys to highlight the desired test parameter.

2. Press ✔ to open the list or specify a value.

3. Press the up/down arrow keys to highlight the desired value.

   OR

4. Press the left/right arrow keys to erase the existing value, and then use the alphanumeric keypad to enter a value. To cancel the entry, press ↰.

5. Press ✔ to accept the value.

6. Select other parameters as required.

7. Press ⟳ to start/stop the test.

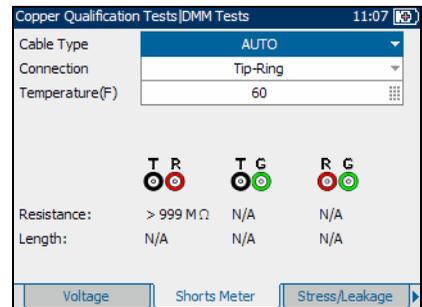   Test results are displayed on the screen as they are completed.

Isolation

The **Isolation** tab allows you to run a resistance test over a period of time to look for high-resistive faults. This method may also reveal poor wire insulation. Select the type of **Connection** to be tested. The available choices are: **Tip-Ring**, **Tip-Gnd**, **Ring-Gnd**.

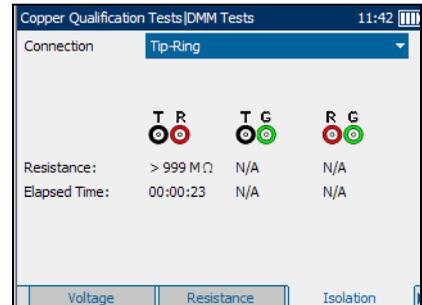**Note:** *If the ANSI standard is used, the tab name* **Isolation** *changes to* **Stress/Leakage**.

To start/stop the test:

1. Press the up/down arrow keys to highlight the desired test parameter.

2. Press ✔ to open the list.

3. Press the up/down arrow keys to highlight the desired value, then press ✔ to select it.

4. Press Ω to start/stop the test.

   Test results are displayed on the screen as they are completed.
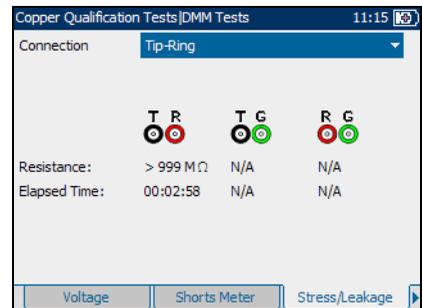
Capacitance

The **Capacitance** tab allows you to measure the capacitance of the loop and capacitance length.

> If no contact fault, check the **Fault Location** test and trace for characteristic reflection of water.

> Also check the **Long. Balance** tab for <55 dB which could indicate a split if no other faults detected.
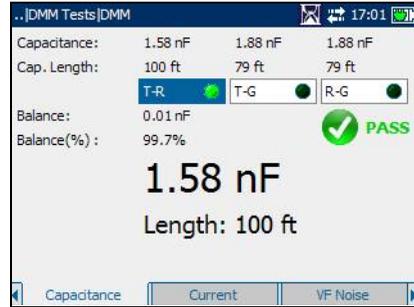
Note: *If the ANSI standard is used, the tab name **Capacitance** changes to **Opens Meter**.*

> ➤ **Cable Fill** allows you to select the type of material the cable can be filled with.

> ➤ **Connection** defines the type of connection to be tested.

> ➤ **Cap bal. thr. (nF)** is the capacitance balance threshold ranging from 0.1 to 20 nF. If the measured capacitive balance in nF is greater than this threshold, **FAIL** is displayed. Otherwise, **PASS** is displayed.

> ➤ **Cap bal. thr. (%)** is the capacitance balance threshold ranging from 50 to 100%. If the measured capacitance balance in percentage is greater than this threshold, **PASS** is displayed. Otherwise, **FAIL** is displayed.

> ➤ **Low cap value(nF)** defines which of the above thresholds will be used to determine pass or fail. The range is 0.1 to 500 nF. If the loop capacitance is less than the **Low cap value**, the threshold in **Cap bal. thr. (nF)** will be used. Otherwise, the threshold in **Cap bal. thr. (%)** is used.
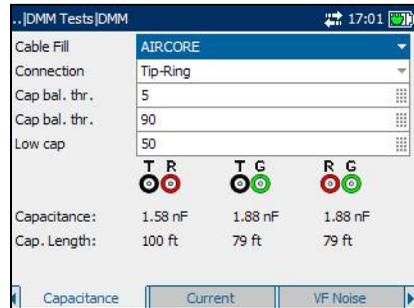
To start/stop the test:

1. Press the up/down arrow keys to highlight the desired test parameter.

2. Press ✔ to open the list.

3. Press the up/down arrow keys to highlight the desired value, then press ✔ to select it.

4. Select other parameters as required.

5. Press Ω to start/stop the test.

   Test results are displayed on the screen as they are completed.

Current

The **Current** tab allows you to measure the AC/DC currents and frequency in the loop.

To start/stop the test:

Press Ω to start/stop the test.

Test results are displayed on the screen as they are completed.
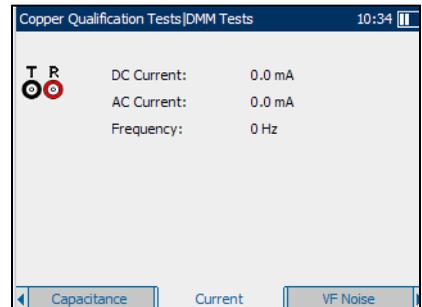
VF Noise

The **VF Noise** test allows you to measure the amount of unwanted or disturbing energy introduced into a loop from man-made and natural sources.

Copper Qualification Tests|DMM Tests   10:39

Termination   TERMINATED

Noise Filter   PSOPHOMETRIC

-106.1 dBm

Capacitance   Current   VF Noise

Each parameter is described below.

➤ **Termination** is either **BRIDGING** if the unit uses high bridging impedance when the cable is active or terminated by other external equipment, or **TERMINATED** if the unit uses normal test impedance termination.

➤ **Noise Filter** is either **PSOPHOMETRIC** for ITU standard or **C-MESSAGE** for ANSI standard.

To start/stop the test:

1. Press the up/down arrow keys to highlight the desired test parameter.

2. Press ✔ to open the list.

3. Press the up/down arrow keys to highlight the desired value, then press ✔ to select it.

4. Select other parameters as required.

5. Press Ω to start/stop the test.

Test results are displayed on the screen as they are completed.
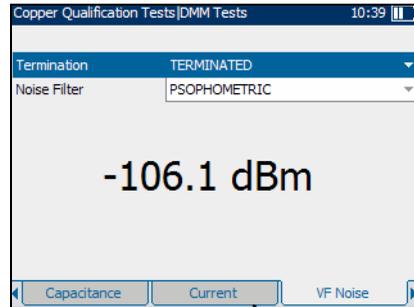
Longitudinal Balance

The **Long. Balance** test allows you to check that the longitudinal balance ratio for the twisted pair complies with applicable standards so as to reduce the effects of common-mode voltage to ground. The better the longitudinal balance of the cable pair, the higher the dB reading.

To start/stop the test:

Press ↻ to start/stop the test.

Test results are displayed on the screen as they are completed.
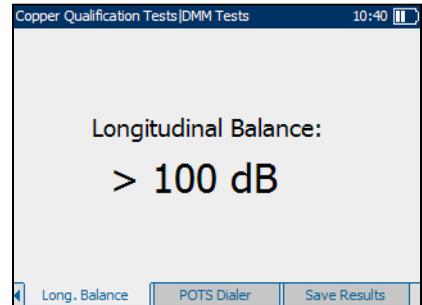
In Service Pair Detection Test

At the start of the In Service Pair Detection test, the unit will check for the presence of dangerous voltage and an active circuit. If dangerous voltage is detected, a dialog box will be displayed to inform you and the test will stop. If an active circuit is detected, a dialog box will be displayed to ask the you whether or not to proceed with the test.

In Service

The **In Service Pair Detection Test** uses the black and green (ground) leads to quickly check if wire pairs are **in service** or available for usage. This test checks for the following:

➤ dangerous voltages

➤ high voltages

➤ POTS battery (>45 V)

➤ digital service signals

➤ a bad ground connection

Note: *Test beeps or warns when ground is NOT present or very poor.*

Rectified Loop (Corrosion) Detection Test

The **Rect. L Detection** tab displays a rectified loop state which often indicates the presence of corrosion on a circuit. Rectified loops can disrupt balance and make the circuit unsuitable for Broadband and other digital services.
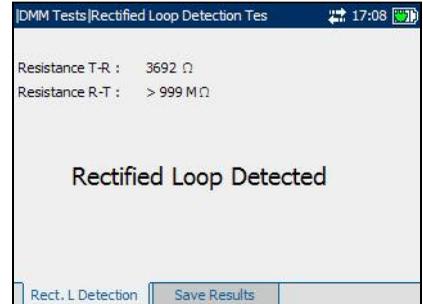
Water Detection Test

The **Water Detection Test** detects the presence of water in the circuit. Use the TDR to locate.
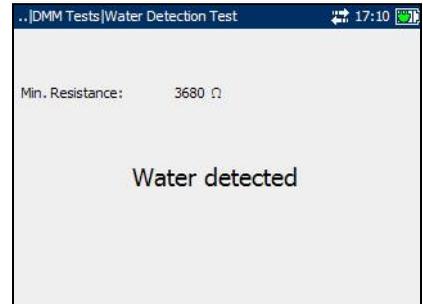
Resistive Balance

At the start of the Resistive Balance test, the unit will check for the presence of dangerous voltage and an active circuit. If dangerous voltage is detected, a dialog box will be displayed to inform you and the test will stop. If an active circuit is detected, a dialog box will be displayed to ask you whether or not to proceed with the test.

Test Setup

The Test Setup tab allows you to configure parameters for the resistive balance test.

Each parameter is described below:

➤ **Res. Bal. Thr. (ohm)** is the resistive balance threshold ranging from 0.1 to 20 ohms. If the measured resistive balance in ohms is greater than this threshold, the fail icon is displayed. Otherwise, the pass icon is displayed.

➤ **Res. Bal. Thr. (%)** is the resistive balance threshold ranging from 50 to 100%. If the measured resistive balance in percentage is greater than this threshold, the pass icon is displayed. Otherwise, the fail icon is displayed.

➤ **Low Resistance Value (ohm)** defines which of the above thresholds will be used to determine pass or fail. The range is 0.1 to 999.9 ohm. If the loop resistance is less than the **Low Resistance Value**, the threshold in **Res. Bal. Thr. (ohm)** will be used. Otherwise, the threshold in **Res. Bal. Thr. (%)** is used.
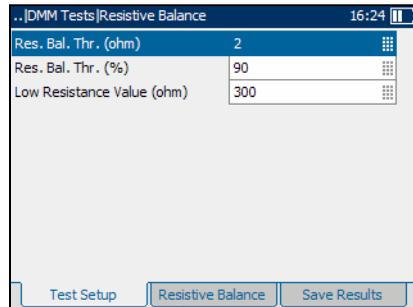
To set parameter values and start/stop the test:

1. Press the up/down arrow keys to highlight the desired parameter.

2. Press ✔ to select the value.

3. Press the left arrow key to erase the existing value, and then use the alphanumeric keypad to enter a value. To cancel the entry, press ↰.

4. Press ✔ to accept the value.

5. Select other parameters as required.

6. Press Ω to start/stop the test.

Resistive Balance

The **Resistive Balance** test measures and compares the resistance of each leg. This tests requires the Tip and Ring wires to be shorted to earth/ground at the far end of the circuit for a valid measurement.

..|DMM Tests|Resistive Balance		17:14
	Loop	T Leg	R Leg
Resistance:	7 Ω	3 Ω	4 Ω
Earth Resistance:	2 Ω		
Balance:	1 Ohm		✔ PASS
Balance(%):	63.9%		
Test Setup	Resistive Balance	Save Results	

6 *Fault Location Tests*

Fault location tests are used to locate faults in the loop. The AXS-200/610 uses the following types of fault location tests:

➤ TDR

➤ RFL Single Pair (2 wire)

➤ RFL Separate Good Pair (4 wire)

➤ Loop Mapper

To view fault location test panes or tabs:

1. From the **Fault Location** pane use the up or down arrow key to highlight the desired test, then press ✔.

2. Press the F1, F2, or F3 key to view available tabs. To view any available additional tabs, use the function arrow keys on either side of the F1 and F3 keys.

TDR Test

The time domain reflectometry (TDR) test allows you to easily locate bridge taps (multiple appearances), the end of the cable, open ends, shorted ends, splices, split pairs, and wet sections in a cable. It also allows you to estimate cable lengths.

A TDR test transmits a fast pulse along the cable, then measures the resulting reflected pulse as a function of time, and displays the results as a function of the cable length or time.

Test Setup

The **Test Setup** tab allows you to configure parameters for the TDR test. **VOP** sets the velocity of propagation for the cable as a ratio of the speed of light.

Note: *The default VOP is good for most cables; only change it when you know the correct VOP for the cable you are measuring. An incorrect VOP will cause distance errors.*
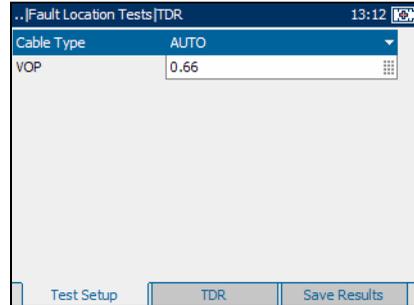
TDR

The **TDR** test first attempts to find the length of the circuit and then searches all ranges from shortest to longest for significant events. Upon completion, the test selects the nearest major event, sets the range to match, and aligns the cursor with the event.

Est is the estimated length of the circuit.
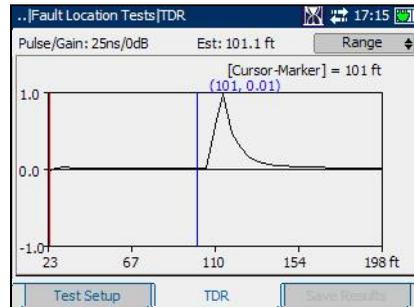
To make TDR adjustments via the keypad:

1. Press ✔ to change the mode and function of the up/down arrow keys.

2. Press ✔ repeatedly to cycle between:

   ➤ Zoom

   ➤ Gain

   ➤ Pulse Gain (Pulse Width & Gain)

   ➤ Range

   ➤ Cursor and Marker Selection

To measure the distance/duration between reflections:

1. Press ✔ to cycle the mode and change to **CursorMarker**.

2. Press the left/right arrow keys to position the blue cursor (indicated by the blue color of data above cursor).

3. Press the up arrow key to select the red marker.

4. Press the left/right arrow keys to position the marker.

5. The difference between the cursor and marker is continuously updated and is indicated with a triangle (delta symbol) above the graph.

To zoom in/out:

1. Press ✔ to select the **Zoom** function. Default mode is **Zoom**.

2. Press the up/down arrow keys to increase/decrease **Zoom** function. The graphical display zooms in or out accordingly.

RFL Single Pair (2 wire) Test

Resistance fault locator (RFL) testing is a powerful means to locate shorts between tip to ring, tip to ground, or ring to ground. The RFL-2 wire test, also known as RFL single pair test, allows you to locate resistive faults between tip to ring, tip or ring to ground, or the adjacent live pair.

Note: *Before performing RFL tests install a strap at the other end of the cable.*

Test Setup

The **Test Setup** tab allows you to configure parameters for the RFL test.

Each parameter on the pane is described below.

➤ **Sect.** denotes the section number in the cable. Select to enable or disable that section of the cable.

➤ **Cable Type** defines the gauge of the cable in use. If wire gauge is measured in AWG units, the available choices are: **AUTO**, **19 AWG**, **22 AWG**, **24 AWG**, or **26 AWG.** For mm gauge wire, the available choices are: **AUTO**, **0.32 mm**, **0.40 mm**, **0.50 mm**, **0.60 mm**, **0.65 mm**, **0.80 mm**, **0.90 mm**, or **1.20 mm**.

➤ **Ohm/mi** or **Ohm/km** is the resistance constant of the cable per unit length.

➤ **Len.** is the length of the cable under test. Specify a maximum of four characters.

➤ **Temp.** is the temperature of the cable under test. Specify a maximum of three characters. Default is 60F or 20C.

➤ **L.Coil** specifies the presence or absence of load coil in the cable section. Select **YES** or **NO**.

To set parameter values:

1. To configure a section of cable for the test, press the up/down arrow keys to highlight the section icon then press ✔ to enable the section.

To disable a section, highlight the section icon then press ✔.

2. Use the left/right arrow keys to highlight each parameter and press ✔ to open the list or select the value.

3. Press the up/down arrow key to highlight the desired value.

OR

Press the left arrow key to erase the existing value, and then use the alphanumeric keypad to enter a value. To cancel the entry, press ↰.

4. Press ✔ to accept the value.

5. Set other parameters as necessary.

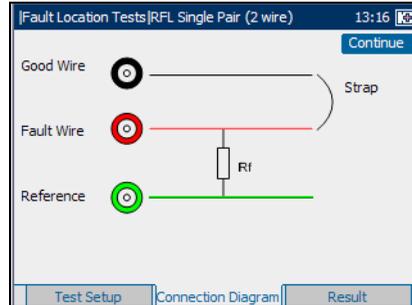*6.* Configure other sections of the cable as required.

7. Press Ω to start/stop the test.

Connection Diagram

The **Connection Diagram** tab displays how to connect the cables to the unit.

The green lead is used as reference.

Continue button allows you to resume the test once the cables have been connected.

Result

The **Result** tab allows you to view detailed results of the RFL test.

RFL Separate Good Pair (4 wire) Test

The RFL separate good pair test, allows you to determine the distance to a short, ground, or battery cross in a faulty cable pair using a separate good cable pair.

Note: *Before performing RFL tests install a strap at the other end of the cable.*

Test Setup

The **Test Setup** tab allows you to configure parameters for the RFL test.

Each parameter on the pane is described below.

➤ **Sect.** denotes the section number in the cable. Select to enable or disable that section of the cable.

➤ **Cable Type** defines the gauge of the cable in use. If wire gauge is measured in AWG units, the available choices are: **AUTO**, **19 AWG**, **22 AWG**, **24 AWG**, or **26 AWG.** For mm gauge wire, the available choices are: **AUTO**, **0.32 mm**, **0.40 mm**, **0.50 mm**, **0.60 mm**, **0.65 mm**, **0.80 mm**, **0.90 mm**, or **1.20 mm**.

➤ **Ohm/mi** or **Ohm/km** is the resistance constant of the cable per unit length. Specify maximum of five characters.

➤ **Len.** is the length of the cable under test. Specify a maximum of four characters.

➤ **Temp.** is a temperature of the cable under test. Specify a maximum of three characters. Default is 60F or 20C.

➤ **L.Coil** specifies the presence or absence of load coil in the cable section. The choices are **YES** or **NO**.

To set parameter values:

1. To configure a section of cable for the test, press the up/down arrow keys to highlight the section icon then press ✔ to enable the section.

   To disable a section, highlight the section icon then press ✔.

2. Use the left/right arrow keys to highlight each parameter and press ✔ to open the list or select the value.

3. Press the up/down arrow key to highlight the desired value.

   OR

   Press the left arrow key to erase the existing value, and then use the alphanumeric keypad to enter a value. To cancel the entry, press ↰.

4. Press ✔ to accept the value.

5. Set other parameters as necessary.

6. Configure other sections of the cable as required.

7. Press Ω to start/stop the test.

Connection Diagram

The **Connection Diagram** tab displays how to connect the cables to the unit.

Continue button allows you to resume the test once the cables have been connected.

Result

The **Result** tab allows you to view detailed results of the RFL test.

Loop Mapper Test

The LoopMapper test allows you to easily identify faults in the cable with increased resolution using time domain reflectometry (TDR) and frequency domain reflectometry (FDR). This test is extremely useful in locating bridge taps and the end of the cable. Faults such as open ends and shorted ends can be easily found using the enhanced resolution of the FDR test.

Note: *This test is only available if LoopMapper is enabled in the software options.*

Test Setup

The **Test Setup** tab allows you to configure parameters for the Loop Mapper test.

Define the **Cable Type** by selecting the gauge of the cable in use. If wire gauge is measured in AWG units, the available choices are: **AUTO**, **19 AWG**, **22 AWG**, **24 AWG**, or **26 AWG.** For mm gauge wire, the available choices are: **AUTO**, **0.32 mm**, **0.40 mm**, **0.50 mm**, **0.60 mm**, **0.65 mm**, **0.80 mm**, **0.90 mm**, or **1.20 mm**.
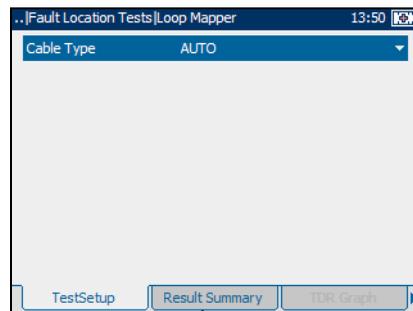
To set parameter values and start/stop the test:

1. Press ✔ to display the list.

2. Use the up/down arrow key to highlight the desired value, and press ✔ to accept the value.

3. Press ⟳ to start/stop the test.

Result Summary

The **Result Summary** tab allows you to view results of the Loop Mapper test in graphical and text form.
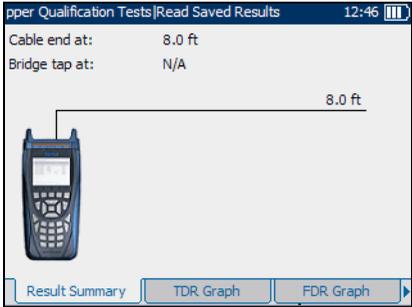
TDR Graph

The **TDR Graph** tab allows you to view results of the high resolution TDR test methodology used in the Loop Mapper test. **TDR** first attempts to find the length of the circuit and then searches all ranges from shortest to longest for significant events. Upon completion, the test selects the nearest major event, sets the range to match, and aligns the cursor with the event.

To make TDR adjustments via the keypad:

1. Press ✔ to change the mode button (top-right corner of the pane) and function of the up/down arrow keys.

2. Press ✔ repeatedly to cycle between:

   ➤ Zoom

   ➤ Gain

   ➤ Pulse Gain (Pulse Width & Gain)

   ➤ Range

   ➤ Cursor and Marker Selection

To measure the distance/duration between reflections:

1. Press ✔ to cycle the mode and change to **CursorMarker**.

2. Press the left/right arrow keys to position the blue cursor (indicated by the blue color of data above cursor).

3. Press the up arrow key to select the red marker.

4. Press the left/right arrow keys to position the marker.

5. The difference between the cursor and marker is continuously updated and is indicated with a triangle (delta symbol) above the graph.

To zoom in/out:

1. Press ✔ to select the **Zoom** function. Default mode is **Zoom**.

2. Press the up/down arrow keys to increase/decrease **Zoom** function. The graphical display zooms in or out accordingly.

FDR Graph

The **FDR Graph** tab allows you to view results of the high resolution FDR test methodology used in the Loop Mapper test.

The list and buttons on the tab are described below:

➤ (Zoom function List) allows you to select the desired zoom function: **Horizontal Zoom** or **Vertical Zoom**. The selected function is displayed in the box.

➤ **Zoom In** allows you to increase the level of zoom for the selected zoom function.

➤ **Zoom Out** allows you to reduce the level of zoom for the selected zoom function.

To zoom in/out:

1. Press ✔ to display a list of zoom functions.

2. Press the up/down arrow key to highlight the desired zoom function.

3. Press ✔ to select the zoom function.

4. Use the left/right arrow key to highlight the **Zoom In** or **Zoom Out** button as required, then press ✔.

5. The graphical display zooms in or out accordingly. Press ✔ repeatedly to continue zooming.

To move the screen pointer:

Press the left/right arrow key to move the screen pointer. The pointer value updates dynamically.

7   *VF Tests*

The purpose of the voice frequency (VF) tests is to perform VF band noise and level measurements, and count load coils. The AXS-200/610 uses the following types of VF tests:

➤ Receive tone (RX)

➤ Send tone (TX)

➤ Tracing tone

➤ VF noise

➤ Impulse noise

➤ Power influence

➤ Longitudinal balance

➤ Load coil detection

To view VF test panes or tabs:

1. From the **VF Tests** pane use the up or down arrow key to highlight the desired test, then press ✔.

2. Press the F1, F2, or F3 key to view available tabs. To view any available additional tabs, use the function arrow keys on either side of the F1 and F3 keys.

Copper Qualification Tests|VF Tests	11:59
1 Receive Tone (RX)	
2 Send Tone (TX)	
3 Tracing Tone	
4 VF Noise	
5 Impulse Noise	
6 Power Influence	
7 Longitudinal Balance	
8 Load Coil Detection	
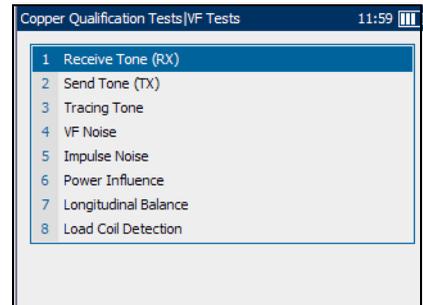
Receive Tone (RX)

The **Receive Tone (RX)** tab allows you to configure and run a receive tone test, which measures the frequency and level of incoming signals.

Select the type of **Termination,** either **BRIDGING** if the unit uses high bridging impedance when the cable is active or terminated by other external equipment, or **TERMINATED** if the unit uses normal test impedance termination.

To start/stop the test:

1. Press ✔ to open the list.

2. Press the up/down arrow keys to highlight the desired value, then press ✔ to select it.

3. Press ⍉ to start/stop the test.

   Test results are displayed on the screen as they are completed.
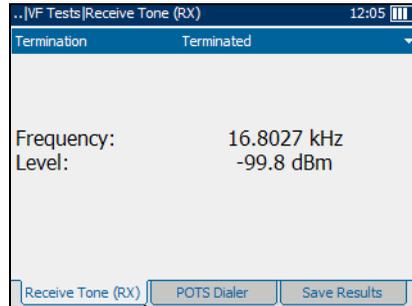
Send Tone (TX)

The VF **Send Tone (TX)** pane allows you to configure and transmit a tone to a downstream device in the loop.

Each parameter and button on the pane is described below.

➤ **Frequency (Hz)** is the frequency of the transmitting tone. Specify a value between **200** and **20000**. Default value is 1004 Hz.

➤ **Level (dBm)** is the tone level. Specify a value between **-20** and **10**.

➤ **Apply** is used to confirm any changes to parameter values which can be changed while the test is running.
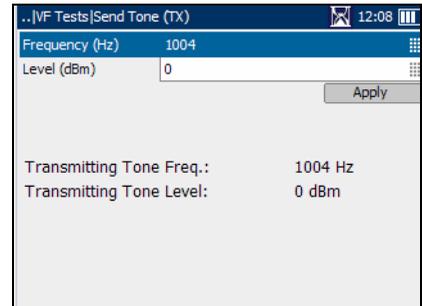
To start/stop the test:

1. Press the up/down arrow keys to highlight the desired test parameter.

2. Press ✔ to specify a value.

3. Press the left/right arrow keys to erase the existing value, and then use the alphanumeric keypad to enter a value. To cancel the entry, press ↩.

4. Press ✔ to accept the value.

5. Select other parameters as required.

6. Press Ω to start/stop the test.

Test results are displayed on the screen as they are completed.

Tracing Tone

The **Tracing Tone** pane allows you to configure and place a pulsed tone on the line to trace a cable pair at the far end. When **Tracing Tone** is selected from the **VF Tests** menu, the tracer tone sends a 577 Hz signal for the first 80 ms, then the signal is turned off for 80 ms, turned on for another 80 ms, and off again for another 320 ms. The sequence of this tone is repeated continuously until you stop the test. Sinusoidal waveform is used to generate the 577 Hz signal.

Each parameter and button on the pane is described below.

➤ **Frequency (Hz)** value is set to 577 Hz.

➤ **Level (dBm)** is the tone level. Specify a value between **-20** and **10**.

➤ **Apply** is used to confirm any changes to the parameter value.

To start/stop the test:

1. Press ✔ to specify a value.

2. Press the left/right arrow keys to erase the existing value, and then use the alphanumeric keypad to enter a value. To cancel the entry, press ↩.

3. Press ✔ to accept the value.

4. Press ⌲ to start/stop the test.

   Test results are displayed on the screen as they are completed.

VF Noise

The **VF Noise** pane allows you to configure and run a VF noise test. It measures the amount of unwanted or disturbing energy introduced into a loop from man-made and natural sources.

Each parameter is described below.

➤ **Termination** defines if the unit uses normal test impedance termination or high bridging impedance when the cable is active or terminated by other external equipment. For normal test termination select **TERMINATED**, otherwise select **BRIDGING**.

➤ **Noise Filter** defines the type of noise filtering to use. If ANSI standard is used, the available choices are: **NONE**, **C-MESSAGE**, **C-NOTCHED**, **3 kHz Flat**, **D-FILTER** or **15 kHz**. For the ITU standard, the choices are: **NONE**, **PSOPHOMETRIC**, **P-NOTCHED**, **3 kHz Flat**, **D-FILTER** or **15 kHz**.
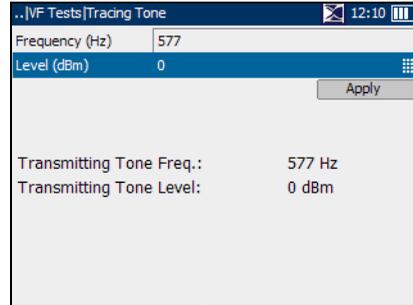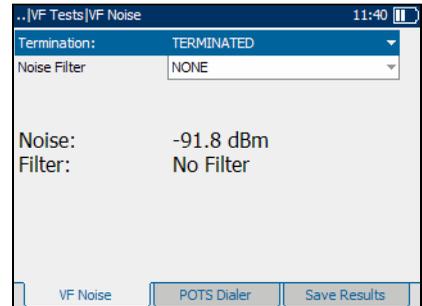
To start/stop the test:

1. Press the up/down arrow keys to highlight the desired test parameter.

2. Press ✔ to open the list.

3. Press the up/down arrow keys to highlight the desired value, then press ✔ to select it.

4. Select other parameters as required.

5. Press ↻ to start/stop the test.

   Test results are displayed on the screen as they are completed.

Impulse Noise

The impulse noise test allows you to measure impulse noise on the circuit under test.

Test Setup

The **Test Setup** tab allows you to configure parameters for the impulse noise test.

Each parameter on the pane is described below.

➤ **Termination** defines if the unit uses normal test impedance termination or high bridging impedance when the cable is active or terminated by other external equipment. For normal test termination select **TERMINATED**, otherwise select **BRIDGING**.

➤ **Noise Filter** defines the type of noise filtering in use. If ANSI standard is used, the available choices are: **NONE**, **C-MESSAGE**, **C NOTCHED**, or **D-FILTER**. For the ITU standard, the choices are: **NONE**, **PSOPHOMETRIC**, **P-NOTCHED**, or **D-FILTER**

➤ **Low Threshold (dBm)** defines the low threshold limits for the impulse noise test. Specify a value between **-40** and **0**.

➤ **Separation (dB)** defines the level difference between the low, mid and high thresholds. Specify a value between **1** and **6** dB.

➤ **Imp. Noise Measure. Time** defines the duration of the impulse noise test. The available choices are: **1**, **5**, **10**, **15**, **60 Minutes**, or **24 Hours**.
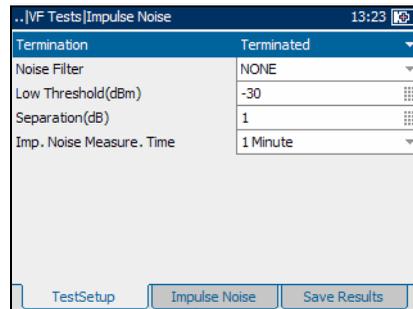
To set parameter values and start/stop the test:

1. Press the up/down arrow keys to highlight the desired parameter.

2. Press ✔ to display the list or specify the value.

3. Press the up/down arrow keys to highlight the desired value.

   OR

4. Press the left arrow key to erase the existing value, and then use the alphanumeric keypad to enter a value. To cancel the entry, press ↰.

5. Press ✔ to accept the value.

6. Select other parameters as required.

7. Press Ω to start/stop the test.

Impulse Noise

The **Impulse Noise** tab allows you to view results of the VF impulse noise test.

..|VF Tests|Impulse Noise	13:25
Impulse Noise High:	0
Impulse Noise Medium:	0
Impulse Noise Low:	0
Low Threshold:	-30 dBm
Separation:	1 dB
Noise Filter:	No Filter
Total Duration:	1 Minute
Time Remaining:	00:00:43

| TestSetup | Impulse Noise | Save Results |
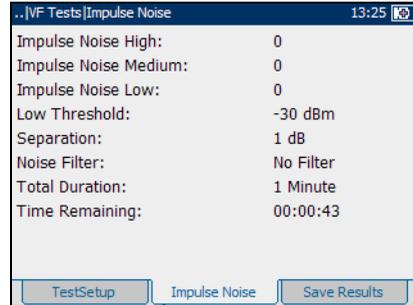
Power Influence

The **Power Influence** tab allows you to view the effects of interference from a 50 Hz or 60 Hz power line (AC mains) on the circuit under test. The results of the power influence test are in graphical form.

To move the screen pointer:

Press the left/right arrow keys to move the screen pointer. The pointer value updates dynamically.

pper Qualification Tests|Read Saved Results	12:25
Power Influence:	-76.2 dBm (C - Message)
Level at 60Hz:	-55.9 dBm, 0.0 V

(graph: dBm vs Hz, (60, -55.9), axis 10, -10, -30, -50; 60, 960, 1860, 2760, 3660Hz)

| Power Influence | Save Results |
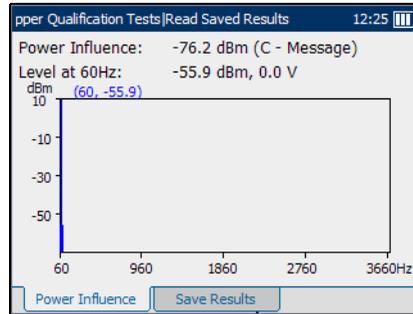
Longitudinal Balance

The **Long. Balance** test allows you to check that the VF longitudinal balance ratio for the twisted pair complies with applicable standards so as to reduce the effects of common-mode voltage to ground. The better the longitudinal balance of the cable pair, the higher the dB reading.

To start/stop the test:

Press ⟳ to start/stop the test.

Test results are displayed on the screen as they are completed.
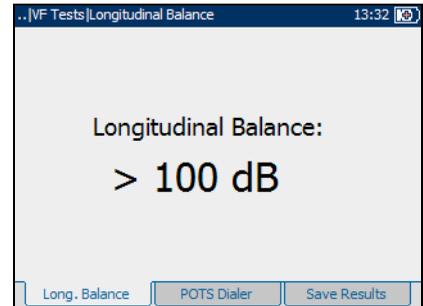
Load Coil Detection

The **Load Coil** detection test allows you to detect the presence of load coils, which are detrimental to the use of DSL technologies on the line. If a load coil is detected, use the time domain reflectometry (TDR) test to quickly locate and remove it from the cable.Test results are displayed in graphical form.

To move the screen pointer:

Press the left/right arrow key to move the screen pointer. The pointer value updates dynamically.
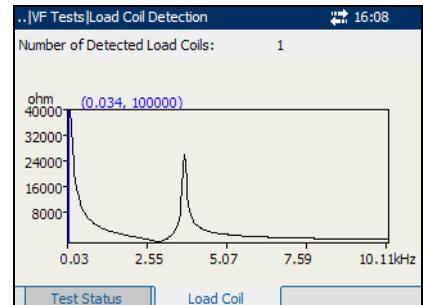
8 *Wideband Tests*

Wideband tests allow you to perform cable qualification checks on the circuit in the frequency range above 20 kHz. Wideband tests include the following:

➤ Receive tone (RX)

➤ Send tone (TX)

➤ PSD noise

➤ Spectral detective

➤ Impulse noise

➤ Impulse noise histogram

➤ Attenuation

➤ Longitudinal balance

➤ Data rate prediction

Note: *Tests above 2.2 MHz are only available if VDSL2WB option is installed.*

To view the wideband test tabs:

1. From the **Wideband Tests** pane use the up or down arrow key to highlight the desired test, then press ✔.

2. Press the F1, F2, or F3 key to view available tabs. To view any available additional tabs, use the function arrow keys on either side of the F1 and F3 keys.
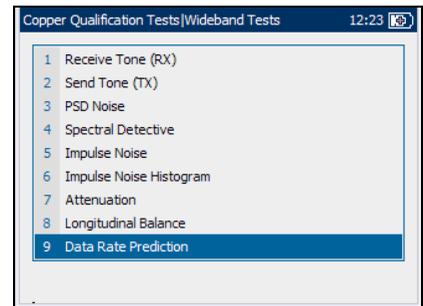
Receive Tone (RX)

The wideband **Receive Tone (RX)** test allows you to configure and measure the level and frequency of incoming signals.

Each parameter is described below.

➤ **Termination** defines if the unit uses normal test impedance termination or high bridging impedance when the cable is active or terminated by other external equipment. For normal test termination select **TERMINATED**, otherwise select **BRIDGING**.

➤ **Termination Impedance** defines the impedance of the dummy load connected to the line. Select either **100 Ohms** or **135 Ohms**.

To start/stop the test:

1. Press the up/down arrow keys to highlight the desired test parameter.

2. Press ✔ to open the list.

3. Press the up/down arrow keys to highlight the desired value, then press ✔ to select it.

4. Select other parameters as required.

5. Press ⟳ to start/stop the test.

Test results are displayed on the screen as they are completed.
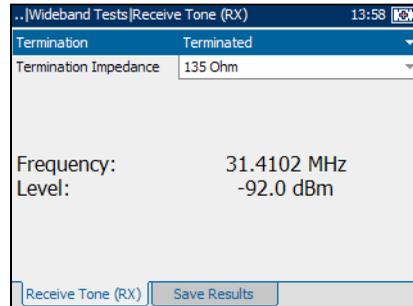
Send Tone (TX)

The wideband **Send Tone (TX)** test allows you to configure and transmit a tone to a downstream device in the loop.

Each parameter and button on the pane is described below.

➤ **Frequency (kHz)** is the frequency of the transmitting tone. Specify a value between **20** and **30000**.

➤ **Level (dBm)** is the tone level. Specify a value between **-10** and **10**.

➤ **Termination Impedance** defines the impedance of the dummy load connected to the line. Select either **100** or **135 Ohms**.

➤ **Apply** is used to confirm any changes to parameter values.
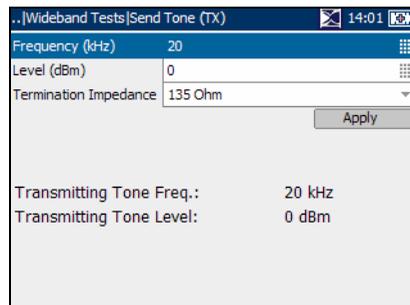
To start/stop test:

1. Press the up/down arrow keys to highlight the desired test parameter.

2. Press ✔ to select the value.

3. Press the left arrow key to erase the existing value, and then use the alphanumeric keypad to enter a value. To cancel the entry, press ⬅.

4. Press ✔ to accept the value.

5. Change other parameter values as required.

6. Press the right arrow key, then use the up/down arrow key to highlight the **Apply** button. Press ✔ to confirm any changes.

7. Press 𝛀 to start/stop the test.

Test results are displayed on the screen as they are completed.

PSD Noise

The wideband power spectral density (PSD) noise test measures the noise energy at a point in a noise spectrum. It is expressed as power per hertz at a point in a noise spectrum.

Test Setup

The **Test Setup** tab allows you to configure the parameters for the wideband PSD noise test.

Each parameter on the pane is described below.

➤ **Bandwidth** specifies the frequency range for the test. Select **2.2 MHz**, **12 MHz**, **17 MHz**, or **30 MHz**.

Note: *Frequency bands in excess of 2.2 MHz are only displayed if VDSL2WB is enabled in the software options.*

➤ **Termination** defines if the unit uses normal test impedance termination or high bridging impedance when the cable is active or terminated by other external equipment. For normal test termination select **TERMINATED**, otherwise select **BRIDGING**.

➤ **Termination Impedance** defines the impedance of the dummy load connected to the line. Select either **100** or **135 Ohm**.

➤ **Noise Filter** defines the level of wideband noise filtering. The available choices are: **NONE**, **50 kbit**, **ISDN-E**, **HDSL-F**, **ADSL-G**, **ADSL**, **ADSL2+**, **VDSL**, **VDSL2-8**, **VDSL2-12**, **VDSL2-17**, or **VDSL2-30**.

Note: *VDSL2-x filters are only available if VDSL2WB is enabled in the software options.*

To start/stop the test:

1. Press the up/down arrow keys to highlight the desired test parameter.

2. Press ✔ to open the list.

3. Press the up/down arrow keys to highlight the desired value, then press ✔ to select it.

4. Press ⋂ to start/stop the test.

PSD Noise

The **PSD Noise** tab allows you to view results of the wideband PSD noise test in graphical and text form.

The list and buttons on the pane are described below:

➤ (Zoom function List) allows you to select the desired zoom function: **Horizontal Zoom** or **Vertical Zoom**. The selected function is displayed in the box.

➤ **Zoom In** allows you to increase the level of zoom for the selected zoom function.

➤ **Zoom Out** allows you to reduce the level of zoom for the selected zoom function.

➤ **Peak** allows you to measure the peak PSD noise value, compare it against the previous value, and display the maximum value. This button is only available when the test is running. Toggle between **Peak** and **Normal**.
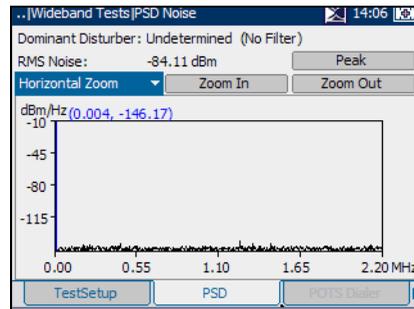
To zoom in/out:

1. Press ✔ to display a list of zoom functions.

2. Press the up/down arrow key to highlight the desired zoom function.

3. Press ✔ to select the zoom function.

4. Use the left/right arrow key to highlight the **Zoom In** or **Zoom Out** button as required, then press ✔ .

5. The graphical display zooms in or out accordingly. Press ✔ repeatedly to continue zooming.

To move the screen pointer:

Press the left/right arrow key to move the screen pointer. The pointer value updates dynamically.

Spectral Detective Test

The wideband spectral detective test allows you to bridge onto a live circuit to measure the PSD noise of the line. The spectral detective test measures up to 2.2 MHz (optionally up to 30 MHz with VDSL2WB option) so you can determine the xDSL technology that is being transmitted over the line, and the power associated with the transmitted technology to ensure it is not disruptive to adjacent cables and technologies.

Test Setup

The **Test Setup** tab allows you to configure parameters for the wideband spectral detective test.

Each parameter on the pane is described below.

➤ **Bandwidth** specifies the frequency range for the test. Select **2.2 MHz**, **12 MHz**, **17 MHz**, or **30 MHz**.

Note: *Frequency bands in excess of 2.2 MHz are only displayed if VDSL2WB is enabled in the software options.*
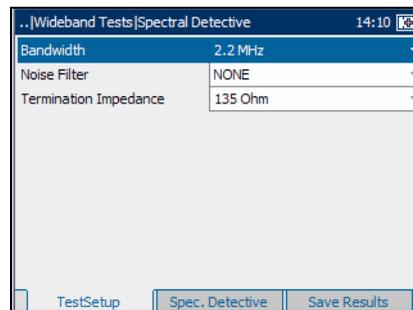
➤ **Noise Filter** defines the level of wideband noise filtering. The available choices are: **NONE**, **50 kbit**, **ISDN-E**, **HDSL-F**, **ADSL-G**, **ADSL**, **ADSL2+**, **VDSL**, **VDSL2-8**, **VDSL2-12**, **VDSL2-17**, or **VDSL2-30**.

Note: *VDSL2-x filters are only available if VDSL2WB is enabled in the software options.*

➤ **Termination Impedance** defines the resistive impedance of the dummy load connected to the line. Select one of the following: **100** or **135 Ohm**.

To start/stop the test:

1. Press the up/down arrow keys to highlight the desired test parameter.

2. Press ✔ to open the list.

3. Press the up/down arrow keys to highlight the desired value, then press ✔ to select it.

4. Press ⍜ to start/stop the test.

Spectral Detective

The **Spectral Detective** tab allows you to view results of the wideband spectral detective test in graphical and text form.

The list and buttons on the tab are described below:

➤ (Zoom function List) allows you to select the desired zoom function: **Horizontal Zoom** or **Vertical Zoom**. The selected function is displayed in the box.

➤ **Zoom In** allows you to increase the level of zoom for the selected zoom function.

➤ **Zoom Out** allows you to reduce the level of zoom for the selected zoom function.

To zoom in/out:

1. Press ✔ to display a list of zoom functions.

2. Press the up/down arrow key to highlight the desired zoom function.

3. Press ✔ to select the zoom function.

4. Use the left/right arrow key to highlight the **Zoom In** or **Zoom Out** button as required, then press ✔.

5. The graphical display zooms in or out accordingly. Press ✔ repeatedly to continue zooming.

To move the screen pointer:

Press the left/right arrow key to move the screen pointer. The pointer value updates dynamically.

Impulse Noise Test

The wideband impulse noise test allows you to measure impulse noise on the circuit under test.

Test Setup

The **Test Setup** tab allows you to configure parameters for the wideband impulse noise test.

Each parameter on the pane is described below.

➤ **Termination** defines if the unit uses normal test impedance termination or high bridging impedance when the cable is active or terminated by other external equipment. For normal test termination select **TERMINATED**, otherwise select **BRIDGING**.

➤ **Termination Impedance** defines the impedance of the dummy load connected to the line. Select one of the following: **100** or **135 Ohm**.

➤ **Noise Filter** defines the level of wideband noise filtering. The available choices are: **NONE**, **50 kbit**, **ISDN-E**, **HDSL-F**, **ADSL-G**, **ADSL**, **ADSL2+**, **VDSL**, **VDSL2-8**, **VDSL2-12**, **VDSL2-17**, or **VDSL2-30**.

Note: *VDSL2-x filters are only available if VDSL2WB is enabled in the software options.*

➤ **Threshold(dBm)** is the maximum impulse noise level. Specify a value between **-50** and **0** (-40 and 0 if any filter applied).

➤ **Measurement Time** defines the duration of the Impulse Noise test. The available choices are: **1**, **5**, **15**, or **60 Minutes**, or **24 Hours**.
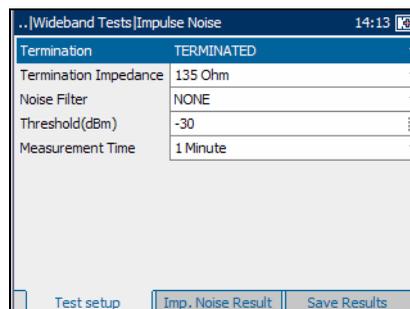
To start/stop the test:

1. Press the up/down arrow keys to highlight the desired test parameter.

2. Press ✔ to open the list or specify a value.

3. Press the up/down arrow keys to highlight the desired value.

    OR

4. Press the left/right arrow keys to erase the existing value, and then use the alphanumeric keypad to enter a value. To cancel the entry, press ↰.

5. Press ✔ to accept the value.

6. Select other parameters as required.

7. Press ⟳ to start/stop the test.

Impulse Noise Result

The **Imp. Noise Result** tab allows you to view results of the wideband impulse noise test in text form.
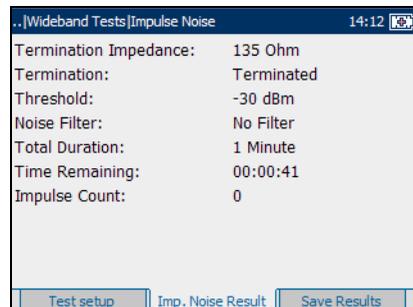
..|Wideband Tests|Impulse Noise	14:12
Termination Impedance:	135 Ohm
Termination:	Terminated
Threshold:	-30 dBm
Noise Filter:	No Filter
Total Duration:	1 Minute
Time Remaining:	00:00:41
Impulse Count:	0

Test setup	Imp. Noise Result	Save Results

Impulse Noise Histogram

The wideband impulse noise histogram test displays a plot of the impulse noise spikes over a user-defined time period.

Test Setup

The **Test Setup** tab allows you to configure parameters for the wideband impulse noise histogram test.

Each parameter on the pane is described below.

➤ **Termination** defines if the unit uses normal test impedance termination or high bridging impedance when the cable is active or terminated by other external equipment. For normal test termination select **TERMINATED**, otherwise select **BRIDGING**.

➤ **Termination Impedance** defines the impedance of the dummy load connected to the line. Select either **100** or **135 Ohm**.

➤ **Noise Filter** defines the level of wideband noise filtering. The available choices are: **NONE**, **15 kHz**, **50 kbit**, **ISDN-E**, **HDSL-F**, **ADSL-G**, **ADSL**, **ADSL2+**, **VDSL**, **VDSL2-8**, **VDSL2-12**, **VDSL2-17**, or **VDSL2-30**.

Note: *VDSL2-x filters are only available if VDSL2WB is enabled in the software options.*

➤ **Threshold(dBm)** is the maximum impulse noise level. Specify a value between **-50** and **0** (-40 and 0 if any filter applied).
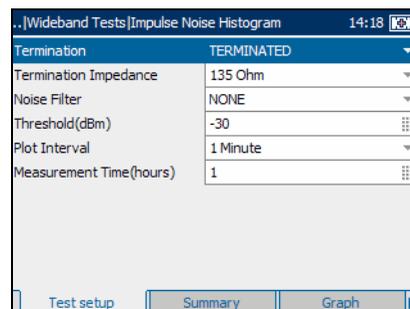
➤ **Plot Interval** defines the baseline time duration for measuring impulse noise spikes, and represents the resolution of the plot. Select one of the following: **1**, **5**, **15**, or **60 Minutes**.

➤ **Measurement Time (hours)** defines the duration of the Impulse Noise Histogram test. Specify a value between **1** and **360** hours.

To start/stop the test:

1. Press the up/down arrow keys to highlight the desired test parameter.

2. Press ✔ to open the list or specify a value.

3. Press the up/down arrow keys to highlight the desired value.

   OR

4. Press the left/right arrow keys to erase the existing value, and then use the alphanumeric keypad to enter a value. To cancel the entry, press ↰.

5. Press ✔ to accept the value.

6. Select other parameters as required.

7. Press ⟳ to start/stop the test.

Summary

The **Summary** tab allows you to view results of the wideband impulse noise histogram test in text form.

..|Wideband Tests|Impulse Noise Histogram	14:16
Time Remaining:	00:59:21
Interval Remaining:	00:00:21
Test Duration:	1 hours
Plot Interval:	1 Minute
Noise Filter:	No Filter
Threshold:	-30 dBm
Impulse Count:	0
Start Date and Time:	10/15/2008 2:14 PM

| Test setup | Summary | Graph |
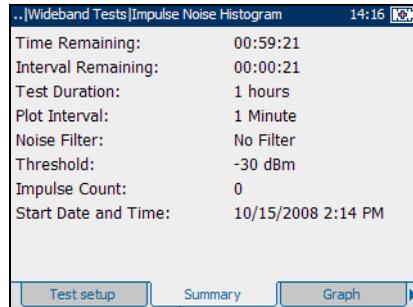
Graph

The **Graph** tab allows you to view results of the wideband impulse noise histogram test in graphical form.

The buttons on the pane are described below:

➤ **Zoom In** allows you to increase the level of zoom for the selected zoom function.

➤ **Zoom Out** allows you to reduce the level of zoom for the selected zoom function.
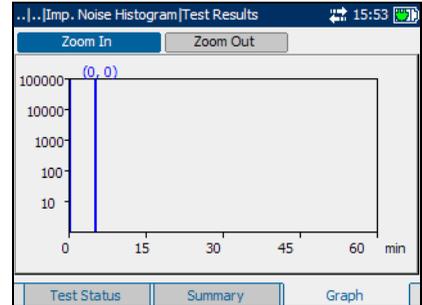
To zoom in or out:

1. Use the left or right arrow key to highlight the **Zoom In** or **Zoom Out** button as required, then press ✔.

2. The graphical display zooms in or out accordingly. Press ✔ repeatedly to continue zooming.

To move the screen pointer:

Press the left/right arrow key to move the screen pointer. The pointer value updates dynamically.

Attenuation Test

The wideband attenuation test allows you to measure the dissipation of power of a transmitted signal as it travels over the copper line.

Test Setup

The **Test Setup** tab allows you to configure parameters for the wideband attenuation test.

Select the **Bandwidth** of the frequency range for the test: **2.2**, **12**, **17**, or **30 MHz**.

Note: *Frequency bands in excess of 2.2 MHz are only displayed if VDSL2WB is enabled in the software options.*

To start/stop the test:

1. Press ✔ to open the list.

2. Press the up/down arrow keys to highlight the desired value, then press ✔ to select it.

3. Press ⟳ to start/stop the test.
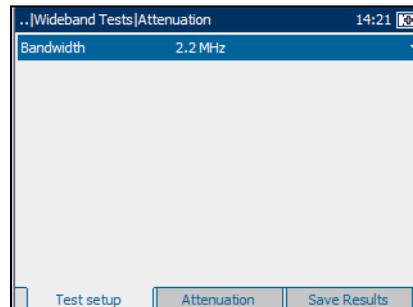
Attenuation

The **Attenuation** tab allows you to view results of the wideband attenuation test in graphical form.

The list and buttons on the tab are described below:

➤ (Zoom function List) allows you to select the desired zoom function: **Horizontal Zoom** or **Vertical Zoom**. The selected function is displayed in the box.

➤ **Zoom In** allows you to increase the level of zoom for the selected zoom function.

➤ **Zoom Out** allows you to reduce the level of zoom for the selected zoom function.

To zoom in/out:

1. Press ✔ to display a list of zoom functions.

2. Press the up/down arrow key to highlight the desired zoom function.

3. Press ✔ to select the zoom function.

4. Use the left/right arrow key to highlight the **Zoom In** or **Zoom Out** button as required, then press ✔.

5. The graphical display zooms in or out accordingly. Press ✔ repeatedly to continue zooming.

To move the screen pointer:

Press the left/right arrow key to move the screen pointer. The pointer value updates dynamically.

Longitudinal Balance

The wideband longitudinal balance test ensures that the longitudinal balance ratio for the twisted pair complies with applicable standards so as to reduce the effects of common-mode voltage to ground. The better the longitudinal balance of the cable pair, the higher the dB reading.

Test Setup

The **Test Setup** tab allows you to configure parameters for the wideband longitudinal balance test.

Each parameter on the pane is described below.

➤ **Bandwidth** specifies the frequency range for the test. Select **2.2 MHz**, **12 MHz**, **17 MHz**, or **30 MHz**.

Note: *Frequency bands in excess of 2.2 MHz are only displayed if VDSL2WB is enabled in the software options.*
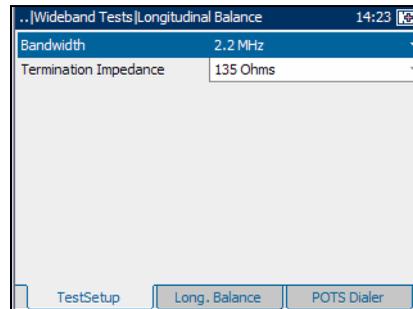
➤ **Termination Impedance** defines the impedance of the dummy load connected to the line. Select one of the following: **100 Ohms** or **135 Ohms**.

To start/stop the test:

1. Press the up/down arrow keys to highlight the desired test parameter.

2. Press ✔ to open the list.

3. Press the up/down arrow keys to highlight the desired value, then press ✔ to select it.
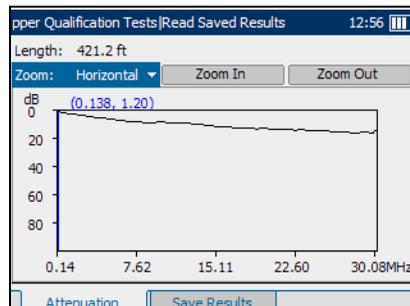
4. Press ⟳ to start/stop the test.

Longitudinal Balance

The **Long. Balance** tab allows you to view results of the wideband longitudinal balance test in graphical form.

The buttons on the tab are described below:

➤ (Zoom function List) allows you to select the desired zoom function: **Horizontal Zoom** or **Vertical Zoom**. The selected function is displayed in the box.

➤ **Zoom In** allows you to increase the level of zoom for the selected zoom function.

➤ **Zoom Out** allows you to reduce the level of zoom for the selected zoom function.

To zoom in/out:

1. Press ✔ to display a list of zoom functions.

2. Press the up/down arrow key to highlight the desired zoom function.

3. Press ✔ to select the zoom function.

4. Use the left/right arrow key to highlight the **Zoom In** or **Zoom Out** button as required, then press ✔.

5. The graphical display zooms in or out accordingly. Press ✔ repeatedly to continue zooming.

To move the screen pointer:

Press the left/right arrow key to move the screen pointer. The pointer value updates dynamically.

Data Rate Prediction

The data rate prediction test is based on measurements of PSD noise and attenuation. Considering the fact that all estimates are done from the single end of the loop, the created report will be presented as a prediction with reasonable probability.

DSL Rate

The **DSL Rate** tab allows you to configure parameters and view results for the current loop topology. The data rate prediction (DRP) test displays the calculated downstream and upstream rates.

Each parameter on the pane is described below.

➤ **Annex** defines the modes of available ADSL Annexes from the ITU standards.

   ➤ **A** is ADSL service functioning over POTS.

   ➤ **B** activates the ADSL functionality over ISDN.

   ➤ **L Mask 1** assumes an increase in ADSL2 range/distance.

   ➤ **L Mask 2** also extends the signal reach but can show an improvement in the upstream data rate.

   ➤ **M** allows increased upload speeds from 1 Mbps to 3.5 Mbps. Available only for ADSL2 and ADSL2+.

➤ **Technology** lists the following values: **ADSL**, **ADSL2**, or **ADSL2+**. If **Annex L** is previously selected, **ADSL2** is automatically set. If **Annex M**, **ADSL** is not available.

➤ **Reference Point** is either **CO** or **CPE**, allowing you to select from which end of the circuit you are running the DRP test. **CO** is located at the CO/Exchange side and you are testing towards the subscriber. **CPE** is the subscriber side and you are testing towards the CO/Exchange.

➤ **Target SNR** is the desired signal-to-noise ratio ranging from 0 to 31 dB. Default value is 6 dB.

➤ **Recalculate** button allows you to change the setup and re-evaluate the rates.

To re-set parameters to view different results:

1. Press the up/down or left/right arrow keys to highlight the desired parameter.

2. Press ✔ to display the list or select the value.

3. Press the up/down arrow keys to highlight the desired value.

   OR

4. Press the left arrow key to erase the existing value, and then use the alphanumeric keypad to enter a value. To cancel the entry, press ↰.

5. Press ✔ to accept the value.

6. Press the up/down arrow keys to highlight the **Recalculate** button.

7. Press ✔ to recalculate rates for the new setup.

Summary

The **Summary** tab allows you to view results, change some of the variables and **Recalculate** the results.

Each parameter on the pane is described below.

➤ **Annex** defines the modes of available ADSL Annexes from the ITU standards.

➤ **A** is ADSL service functioning over POTS.

➤ **B** activates the ADSL functionality over ISDN.

➤ **L Mask 1** assumes an increase in ADSL2 range/distance.

➤ **L Mask 2** also extends the signal reach but can show an improvement in the upstream data rate.

➤ **M** allows increased upload speeds from 1 Mbps to 3.5 Mbps. Available only for ADSL2 and ADSL2+.

➤ **Technology** lists the following values: **ADSL**, **ADSL2**, or **ADSL2+**. If **Annex L** is previously selected, **ADSL2** is automatically set. If **Annex M**, **ADSL** is not available.

➤ **Reference Point** is either **CO** or **CPE**, allowing you to select from which end of the circuit you are running the DRP test. **CO** is located at the CO/Exchange side and you are testing towards the subscriber. **CPE** is the subscriber side and you are testing towards the CO/Exchange.

➤ **Target SNR** is the desired signal-to-noise ratio ranging from 0 to 31 dB. Default value is 6 dB.

➤ **Recalculate** button allows you to change the setup and re-evaluate the rates.

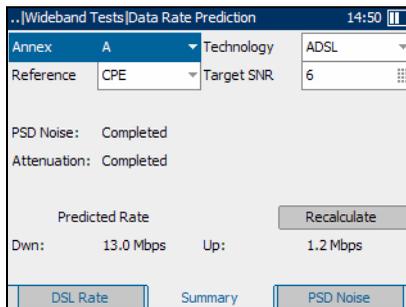***To re-set parameters to view different results:***

1. Press the up/down or left/right arrow keys to highlight the desired parameter.

2. Press ✔ to display the list or select the value.

3. Press the up/down arrow keys to highlight the desired value.

OR

4. Press the left arrow key to erase the existing value, and then use the alphanumeric keypad to enter a value. To cancel the entry, press ↰.

5. Press ✔ to accept the value.

6. Press the up/down arrow keys to highlight the **Recalculate** button.

7. Press ✔ to recalculate rates for the new setup.

PSD Noise

The **PSD Noise** tab identifies the presence of disturber signals when no filter is selected as **Dominant Disturber** and the **RMS Noise** value from the power spectral density (PSD) noise tests in text and graphical form. RMS noise voltage measures the signal-to-noise ratio of the circuit.

The list and buttons on the tab are described below:

➤ (Zoom function List) allows you to select the desired zoom function: **Horizontal Zoom** or **Vertical Zoom**. The selected function is displayed in the box.

➤ **Zoom In** allows you to increase the level of zoom for the selected zoom function.

➤ **Zoom Out** allows you to reduce the level of zoom for the selected zoom function.

To zoom in or out:

1. Press ✔ to display a list of zoom functions.

2. Press the up/down arrow keys to highlight the desired zoom function.

3. Press ✔ to select the zoom function.

4. Use the left/right arrow keys to highlight the **Zoom In** or **Zoom Out** button as required, then press ✔ .

The graphical display zooms in or out accordingly.

5. Press ✔ repeatedly to continue zooming.

To move the screen pointer:

Press the left/right arrow keys to move the screen pointer. The pointer value updates dynamically.

Attenuation

The **Attenuation** tab displays the wideband attenuation test results in graphical form.

The list and buttons on the tab are described below:

➤ (Zoom function List) allows you to select the desired zoom function: **Horizontal Zoom** or **Vertical Zoom**. The selected function is displayed in the box.

➤ **Zoom In** allows you to increase the level of zoom for the selected zoom function.

➤ **Zoom Out** allows you to reduce the level of zoom for the selected zoom function.

To zoom in/out:

1. Press ✔ to display a list of zoom functions.

2. Press the up/down arrow key to highlight the desired zoom function.

3. Press ✔ to select the zoom function.

4. Use the left/right arrow key to highlight the **Zoom In** or **Zoom Out** button as required, then press ✔.

5. The graphical display zooms in or out accordingly. Press ✔ repeatedly to continue zooming.

To move the screen pointer:

Press the left/right arrow key to move the screen pointer. The pointer value updates dynamically.

Signal-to-Noise Ratio

The **SNR** tab displays the signal-to-noise ratio per tone in graphical form.

The list and buttons on the tab are described below:

➤ (Zoom function List) allows you to select the desired zoom function: **Horizontal Zoom** or **Vertical Zoom**. The selected function is displayed in the box.

➤ **Zoom In** allows you to increase the level of zoom for the selected zoom function.

➤ **Zoom Out** allows you to reduce the level of zoom for the selected zoom function.

To zoom in or out:

1. Press ✔ to display a list of zoom functions.

2. Press the up/down arrow keys to highlight the desired zoom function.

3. Press ✔ to select the zoom function.

4. Use the left/right arrow keys to highlight the **Zoom In** or **Zoom Out** button as required, then press ✔.

The graphical display zooms in or out accordingly.

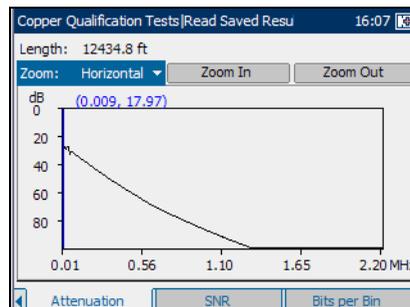*5.* Press ✔ repeatedly to continue zooming.

To move the screen pointer:

Press the left/right arrow keys to move the screen pointer. The pointer value updates dynamically.

Bits per Bin

The **Bits per Bin** tab displays in graphical form the number of bits that can be transmitted on a particular bin representing a certain tone.

➤ **Zoom In** allows you to increase the level of zoom for the selected zoom function.

➤ **Zoom Out** allows you to reduce the level of zoom for the selected zoom function.

To zoom in or out:

1. Press the up or down arrow key to highlight the desired zoom function.

2. Press ✔ to select the zoom function.

3. Use the left or right arrow key to highlight the **Zoom In** or **Zoom Out** button as required, then press ✔.

The graphical display zooms in or out accordingly.

4. Press ✔ repeatedly to continue zooming.
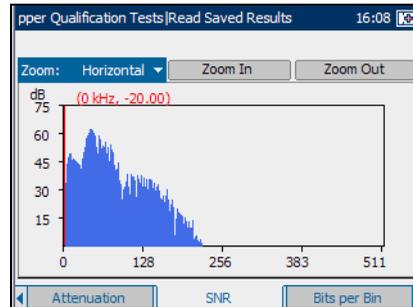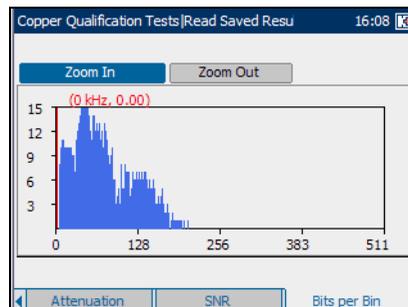
To move the screen pointer:

Press the left/right arrow keys to move the screen pointer. The pointer value updates dynamically.

9   *Maintenance*

General Maintenance

To help ensure long, trouble-free operation:

➤ Keep the unit free of dust.

➤ Clean the unit casing and front panel with a cloth slightly dampened with water.

➤ Store unit at room temperature in a clean and dry area. Keep the unit out of direct sunlight.

➤ Avoid high humidity or significant temperature fluctuations.

➤ Avoid unnecessary shocks and vibrations.

➤ If any liquids are spilled on or into the unit, turn off the power immediately and let the unit dry completely.

WARNING

Use of controls, adjustments, and procedures for operation and maintenance other than those specified herein may result in hazardous radiation exposure.

Battery Charging and Replacing

Charging the AXS-200/610 battery can take up to 1.5 hours. This battery was custom made for your unit; replacement batteries must be ordered from EXFO.

For more information about the battery, refer to the *Maintenance* chapter of the AXS-200 User Guide.

Recycling and Disposal (Applies to European Union Only)

Recycle or dispose of your product (including electric and electronic accessories) properly, in accordance with local regulations. Do not dispose of it in ordinary garbage receptacles.

This equipment was sold after August 13, 2005 (as identified by the black rectangle).

➤ Unless otherwise noted in a separate agreement between EXFO and a customer, distributor, or commercial partner, EXFO will cover costs related to the collection, treatment, recovery, and disposal of end-of-lifecycle waste generated by electronic equipment introduced after August 13, 2005 to an European Union member state with legislation regarding Directive 2002/96/EC.

➤ Except for reasons of safety or environmental benefit, equipment manufactured by EXFO, under its brand name, is generally designed to facilitate dismantling and reclamation.

For complete recycling/disposal procedures and contact information, visit the EXFO Web site at www.exfo.com/recycle.

10 Troubleshooting

Solving Common Problems

The table below presents common problems and their solution.

Problem	Possible Cause	Solution
Impossible to turn on unit.	➤ You did not press ⏻ long enough. ➤ Main batteries discharged. ➤ Battery compartment door is open. ➤ One of the two batteries is missing. ➤ Weather too cold.	➤ Press ⏻ for 2 seconds. ➤ Charge batteries by connecting the AC adapter/charger. ➤ Close battery compartment door. ➤ Insert 2 batteries and replace battery compartment door.
The display is almost blank when you turn on the unit.	Brightness may need some adjustment.	Press ☀ to adjust brightness properly.
Batteries do not charge as expected.	➤ Temperature is too high. ➤ Battery is incorrectly connected.	➤ Ensure temperature is within specifications. ➤ Ensure battery is connected properly.
A battery status LED is yellow.	Battery is defective.	Contact EXFO or replace the battery.
The unit is not responding.		Shut down the unit by pressing ⏻ and holding it down. You will hear a first beep; release the key after you hear a second beep. Turn the unit on again to reset it.

Contacting the Technical Support Group

To obtain after-sales service or technical support for this product, contact EXFO at one of the following numbers. The Technical Support Group is available to take your calls from Monday to Friday, 8:00 a.m. to 7:00 p.m. (Eastern Time in North America).

For detailed information about technical support, visit the EXFO Web site at www.exfo.com.

Technical Support Group

400 Godin Avenue	1 866 683-0155 (USA and Canada)
Quebec (Quebec) G1M 2K2	Tel.: 1 418 683-5498
CANADA	Fax: 1 418 683-9224
	support@exfo.com

To accelerate the process, please have information such as the name and the serial number (see the product identification label—an example is shown below), as well as a description of your problem, close at hand.

AXS-610-XX

Software option
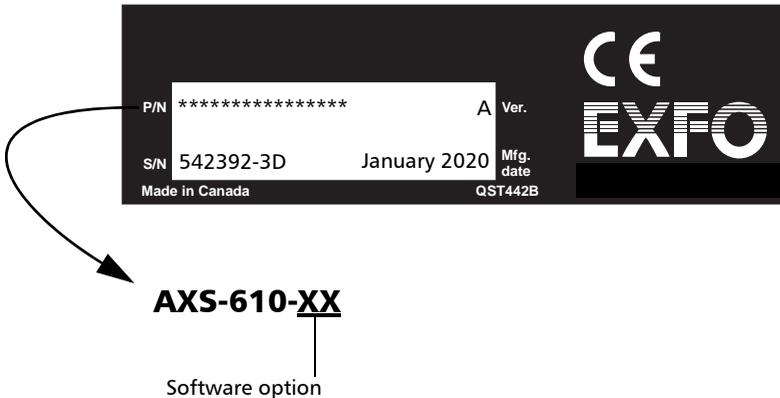
Transportation

Maintain a temperature range within specifications when transporting the unit. Transportation damage can occur from improper handling. The following steps are recommended to minimize the possibility of damage:

➤ Pack the unit in its original packing material when shipping.

➤ Avoid high humidity or large temperature fluctuations.

➤ Keep the unit out of direct sunlight.

➤ Avoid unnecessary shocks and vibrations.

11 *Warranty*

General Information

EXFO Electro-Optical Engineering Inc. (EXFO) warrants this equipment against defects in material and workmanship for a period of one year from the date of original shipment. EXFO also warrants that this equipment will meet applicable specifications under normal use.

During the warranty period, EXFO will, at its discretion, repair, replace, or issue credit for any defective product, as well as verify and adjust the product free of charge should the equipment need to be repaired or if the original calibration is erroneous. If the equipment is sent back for verification of calibration during the warranty period and found to meet all published specifications, EXFO will charge standard calibration fees.

IMPORTANT

The warranty can become null and void if:

➤ **unit has been tampered with, repaired, or worked upon by unauthorized individuals or non-EXFO personnel.**

➤ **warranty sticker has been removed.**

➤ **case screws, other than those specified in this guide, have been removed.**

➤ **case has been opened, other than as explained in this guide.**

➤ **unit serial number has been altered, erased, or removed.**

➤ **unit has been misused, neglected, or damaged by accident.**

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT SHALL EXFO BE LIABLE FOR SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

Liability

EXFO shall not be liable for damages resulting from the use of the product, nor shall be responsible for any failure in the performance of other items to which the product is connected or the operation of any system of which the product may be a part.

EXFO shall not be liable for damages resulting from improper usage or unauthorized modification of the product, its accompanying accessories and software.

Exclusions

EXFO reserves the right to make changes in the design or construction of any of its products at any time without incurring obligation to make any changes whatsoever on units purchased. Accessories, including but not limited to fuses, pilot lamps, batteries and universal interfaces (EUI) used with EXFO products are not covered by this warranty.

This warranty excludes failure resulting from: improper use or installation, normal wear and tear, accident, abuse, neglect, fire, water, lightning or other acts of nature, causes external to the product or other factors beyond the control of EXFO.

IMPORTANT

EXFO will charge a fee for replacing optical connectors that were damaged due to misuse or bad cleaning.

Certification

EXFO certifies that this equipment met its published specifications at the time of shipment from the factory.

Service and Repairs

EXFO commits to providing product service and repair for five years following the date of purchase.

To send any equipment for service or repair:

1. Call one of EXFO's authorized service centers (see *EXFO Service Centers Worldwide* on page 138). Support personnel will determine if the equipment requires service, repair, or calibration.

2. If equipment must be returned to EXFO or an authorized service center, support personnel will issue a Return Merchandise Authorization (RMA) number and provide an address for return.

3. If possible, back up your data before sending the unit for repair.

4. Pack the equipment in its original shipping material. Be sure to include a statement or report fully detailing the defect and the conditions under which it was observed.

5. Return the equipment, prepaid, to the address given to you by support personnel. Be sure to write the RMA number on the shipping slip. *EXFO will refuse and return any package that does not bear an RMA number.*

Note: *A test setup fee will apply to any returned unit that, after test, is found to meet the applicable specifications.*

After repair, the equipment will be returned with a repair report. If the equipment is not under warranty, you will be invoiced for the cost appearing on this report. EXFO will pay return-to-customer shipping costs for equipment under warranty. Shipping insurance is at your expense.

Routine recalibration is not included in any of the warranty plans. Since calibrations/verifications are not covered by the basic or extended warranties, you may elect to purchase FlexCare Calibration/Verification Packages for a definite period of time. Contact an authorized service center (see *EXFO Service Centers Worldwide* on page 138).

EXFO Service Centers Worldwide

If your product requires servicing, contact your nearest authorized service center.

EXFO Headquarters Service Center

400 Godin Avenue	1 866 683-0155 (USA and Canada)
Quebec (Quebec) G1M 2K2	Tel.: 1 418 683-5498
CANADA	Fax: 1 418 683-9224
	quebec.service@exfo.com

EXFO Europe Service Center

Omega Enterprise Park, Electron Way	Tel.: +44 2380 246810
Chandlers Ford, Hampshire S053 4SE	Fax: +44 2380 246801
ENGLAND	europe.service@exfo.com

**EXFO China Service Center/
Beijing OSIC**

Beijing New Century Hotel	Tel.: +86 (10) 6849 2738
Office Tower, Room 1754-1755	Fax: +86 (10) 6849 2662
No. 6 Southern Capital Gym Road	beijing.service@exfo.com
Beijing 100044	
P. R. CHINA	

A *Technical Specifications*

IMPORTANT

The following technical specifications can change without notice. The information presented in this section is provided as a reference only. To obtain this product's most recent technical specifications, visit the EXFO Web site at *www.exfo.com*.

SPECIFICATIONS

RECEIVER CHARACTERISTICS [a]

Receive frequency	200 Hz to 10 kHz, resolution 1 Hz
Receive frequency	10 kHz to 20 kHz, resolution 10 Hz
Receive frequency	20 kHz to 30 MHz, resolution 1 kHz
Frequency uncertainty (accuracy)	±0.1%
Receive level (dBm)	−90 to +10 at 100 Ω or 135 Ω, resolution 0.1 dB
	−100 to +10 at 600 Ω, resolution 0.1 dB
Level uncertainty (accuracy)	±1.0 dB for 200 Hz to 20 kHz at 0 dBm
	±1.0 dB for 20 kHz to 30 MHz at 0 dBm
Impedance (Ω)	100, 135, 600 and bridging (100 kΩ)

TRANSMITTER CHARACTERISTICS

Transmit frequency	200 Hz to 20 kHz, resolution 1 Hz steps	
Transmit frequency	20 kHz to 30 MHz, resolution 1 kHz steps	
Transmit level (dBm)	−10 to +10 at 100 or 135	
	−20 to +10 at 600	
Frequency accuracy	The better of ±50 ppm or ±0.5 Hz	
Level uncertainty (accuracy)	±0.6 dB	200 Hz to 1 MHz
	±1 dB	1 MHz to 2.2 MHz
	±2 dB	2.2 MHz to 17 MHz
	±3 dB	17 MHz to 30 MHz
Impedance (Ω)	100, 135 and 600	

VF NOISE MEASUREMENT

Range (dBm)	0 to −90, subject to instrument noise floor
Uncertainty (accuracy) (dB)	±1
Filters	None, 3 kHz flat, C-message, psophometric, notched and D filter (IEEE 743-1995)
Graphic results	Delay distribution and jitter histogram

VF IMPULSE NOISE

Low threshold (dBm)	0 to −40, in 1 dB steps
Mid threshold	Low threshold plus separation
High threshold	Mid threshold plus separation
Separation (dB)	1 to 6, in 1 dB steps
Dead time (ms)	125
Filters	None, 3 kHz flat, C-message, psophometric, notched and D filter (IEEE 743-1995)
Counter	Maximum 999 for each threshold
Timer	1 minute to 24 hours, default is 15 minutes

POWER INFLUENCE (NOISE TO GROUND)

Noise range (dBm)	−60 to +10
Accuracy (dB)	±1.0
Level uncertainty (accuracy) (dB)	±1.0 at −60 dBm

VF LONGITUDINAL BALANCE

Frequency (Hz)	1004
Frequency uncertainty (accuracy)(ppm)	±50
Level range (dB)	0 to 80
Level uncertainty (accuracy)(dB)	±1

TIME-DOMAIN REFLECTOMETRY (TDR)

Mode	One shot, continuous (auto-repeat) with cursor and zoom
Distance range (m)	3 to 6000 (10 ft up to 20 000 ft)
Pulse width	15 ns to 20 µs (auto-selected in auto TDR test)
Test signals	Sine wave, compensated sine wave, half-sine wave and square wave
Amplitude	7.5 V p-p on cable, 9 V p-p open circuit
V.O.P.	0.400 to 0.999 or 120 to 299 m/µs
Distance uncertainty [b] (accuracy) (m)	±(0.3 + 1 % x distance) or ±(1 ft + 1 % x distance)
Units	Feet, meters and nanoseconds
Horizontal scale (m)	Automatic or 30 (100 ft), 300 (1000 ft), 600 (2000 ft), 1500 (5000 ft), 3000 (10 000 ft), 6000 (20 000 ft), 13 500 (45 000 ft) and 15 000 (50 000 ft)

LOAD COIL DETECTION

Count	Five
Plot (kHz)	Up to 10
Distance range (m)	Up to 8000 (up to 27 000 ft)

SINGLE-END FREQUENCY RESPONSE

Distance range (m)	10 to 5000 (30 ft to 16 000 ft)
Frequency range (MHz)	Up to 30
Frequency uncertainty (accuracy)(ppm)	±50
Uncertainty (accuracy) (dB)	±1.0 typical
Resolution (dB)	0.1
Horizontal scale (MHz)	ADSL2+ = 2.208, VDSL2-12 = 12, VDSL2-17 = 17.66, VDSL2-30 = 30
Vertical scale	0 to +90

NOTE a. Characteristics are subject to instrument noise floor (approx −70 dBm). Levels below −70 dBm can be measured using the PSD noise test.
b. Does not include the uncertainty due to VOP.

Technical Specifications

PSD NOISE MEASUREMENT

Test type	Continuous or peak-hold
Vertical scale	−10 dBm/Hz to −145 dBm/Hz or +20 dBm to −110 dBm
Horizontal scale	4.3125 kHz to 17 MHz, in 4.3125 kHz steps or 8.625 kHz to 30 MHz, in 8.625 kHz steps
Noise filters	None or E, F, G, VDSL2-8, VDSL2-12, VDSL2-17 and VDSL2-30

DSL IMPULSE NOISE MEASUREMENT

Threshold	−50 dBm (40 dBrn) to 0 dBm (90 dBrn) in 1 dB steps
Counter	Maximum 65 000
Test duration	1, 5, 10, 15 and 60 min, 24 h or continuous (up to 360 h)
Histogram plot interval	1, 5, 10, 15 or 60 min
Uncertainty (accuracy) (dB)	±2

SWEPT LONGITUDINAL BALANCE TEST

Frequency accuracy (ppm)	±50
Uncertainty (accuracy)(dB)	±2.0
Vertical scale (dB)	0 to 80.0 up to 2.2 MHz
	0 to 60.0 up to 30 MHz
Horizontal scale	ADSL/2+: 26 kHz to 2.2 MHz
	SHDSL: 26 kHz to 1 MHz
	VDSL/VDSL2-12: 26 kHz to 12 MHz
	VDSL2-17: 26 kHz to 17.66 MHz
	VDSL2-30: 26 kHz to 30 MHz

DMM (DIGITAL MULTIMETER)

Measurement	Range	Resolution	Accuracy
DC voltage	0 to 200 V	1 V	the better of ±2 % or ±1 V
AC voltage	0 to 140 Vrms	1 V	the better of ±2 % or ±1 V
Resistance	0 to 999 MΩ	3 digits	
	0 to 999 Ω		the better of ±2 % or ±5 Ω
	1 kΩ to 99 MΩ		the better of ±2 % or ±1 digit
	100 MΩ to 999 MΩ		the better of ±5 % or ±1 digit
	Distance up to 30 000 m (100 000 ft)		
Capacitance	1 nF to 10 μF	3 digits	the better of ±2 % or ±1 digit
	Distance up to 30 000 m (100 000 ft)		
DC current	0 to 110 mA	1 mA	the better of ±2 % or ±1 digit
AC current	0 to 77 mA	1 mA	the better of ±2 % or ±1 digit

SPECTRAL DETECTIVE

Allows the AXS-200/625 to bridge (high-impedance) onto a live circuit to display a plot of transmitted levels and spectrum (PSD). The Spectral Detective test can be referenced to any user-selected impedance. The impedance reference setting is required to display proper readings in dBm/Hz or dBm.

Test type	Continuous or peak-hold
Bridging impedance (kΩ)	15 kΩ
Vertical scale	−10 to −145 dBm/Hz or +20 to −110 dBm
Horizontal scale	4.3125 kHz to 17 MHz, in 4.3125 kHz steps or 8.625 kHz to 30 MHz, in 8.625 kHz steps
Noise filters	None or E, F, G, VDSL2-8, VDSL2-12, VDSL2-17 and VDSL2-30

STRESS/LEAKAGE (ISOLATION RESISTANCE)

Source	100 VDC, current safely limited to < 1.0 mA
Range (MΩ)	0 to 999 auto-ranging
Resolution	3 significant digits
Uncertainty (accuracy)	0 to 999 Ω, the better of ±1 % or ±5 Ω
	1 kΩ to 99 MΩ, the better of ±1 % or ±1 digit
	100 MΩ to 999 MΩ, the better of ±5 % or ±1 digit
Soak timer (s)	1 to 99

RFL

Test type	Single pair and separate good pair
Fault detection (MΩ)	0 to 20
Resolution	3 digits
Loop resistance (kΩ)	7 maximum
Multiple cable sections	Five (includes gauge and temperature setting)
Fault location	*Total resistance, near-end to fault resistance, fault to strap resistance (four significant digits)
	*Total length, distance to fault, distance from fault to strap (3 ft/1 m resolution)
Uncertainty (accuracy) (Ω	The better of 0.2 Ω or ±2 %

Index

NOTICE
通告

CHINESE REGULATION ON RESTRICTION OF HAZARDOUS SUBSTANCES
中国关于危害物质限制的规定

NAMES AND CONTENTS OF THE TOXIC OR HAZARDOUS SUBSTANCES OR ELEMENTS CONTAINED IN THIS EXFO PRODUCT
包含在本 **EXFO** 产品中的有毒有害物质或元素的名称和含量

O	Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in SJ/T11363-2006 表示该有毒有害物质在该部件所有均质材料中的含量均在 SJ/T11363-2006 标准规定的限量要求以下。
X	Indicates that this toxic or hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement in SJ/T11363-2006 表示该有毒有害物质至少在该部件的某一均质材料中的含量超出 SJ/T11363-2006 标准规定的限量要求。

Part Name 部件名称	Toxic or hazardous Substances and Elements 有毒有害物质和元素					
	Lead 铅 (Pb)	Mercury 汞 (Hg)	Cadmium 隔 (Cd)	Hexavalent Chromium 六价铬 (Cr VI)	Polybrominated biphenyls 多溴联苯 (PBB)	Polybrominated diphenyl ethers 多溴二苯醚 (PBDE)
Enclosure 外壳	O	O	O	O	O	O
Electronic and electrical sub-assembly 电子和电子组件	X	O	X	O	X	X
Optical sub-assembly[a] 光学组件 [a]	X	O	O	O	O	O
Mechanical sub-assembly[a] 机械组件 [a]	O	O	O	O	O	O

a. If applicable.
閿磌骀钐裲塞粒粒。

MARKING REQUIREMENTS
标注要求

Product 产品	Environmental protection use period (years) 环境保护使用期限（年）	Logo 标志
This Exfo product 本 EXFO 产品	10	
Battery[a] 电池 [a]	5	

a. If applicable.
    閏稙骀钐翃塞粒。

P/N: 1056399

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TOLL-FREE	(USA and Canada)	1 800 663-3936

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