BX100A and BX100V series e-Manual

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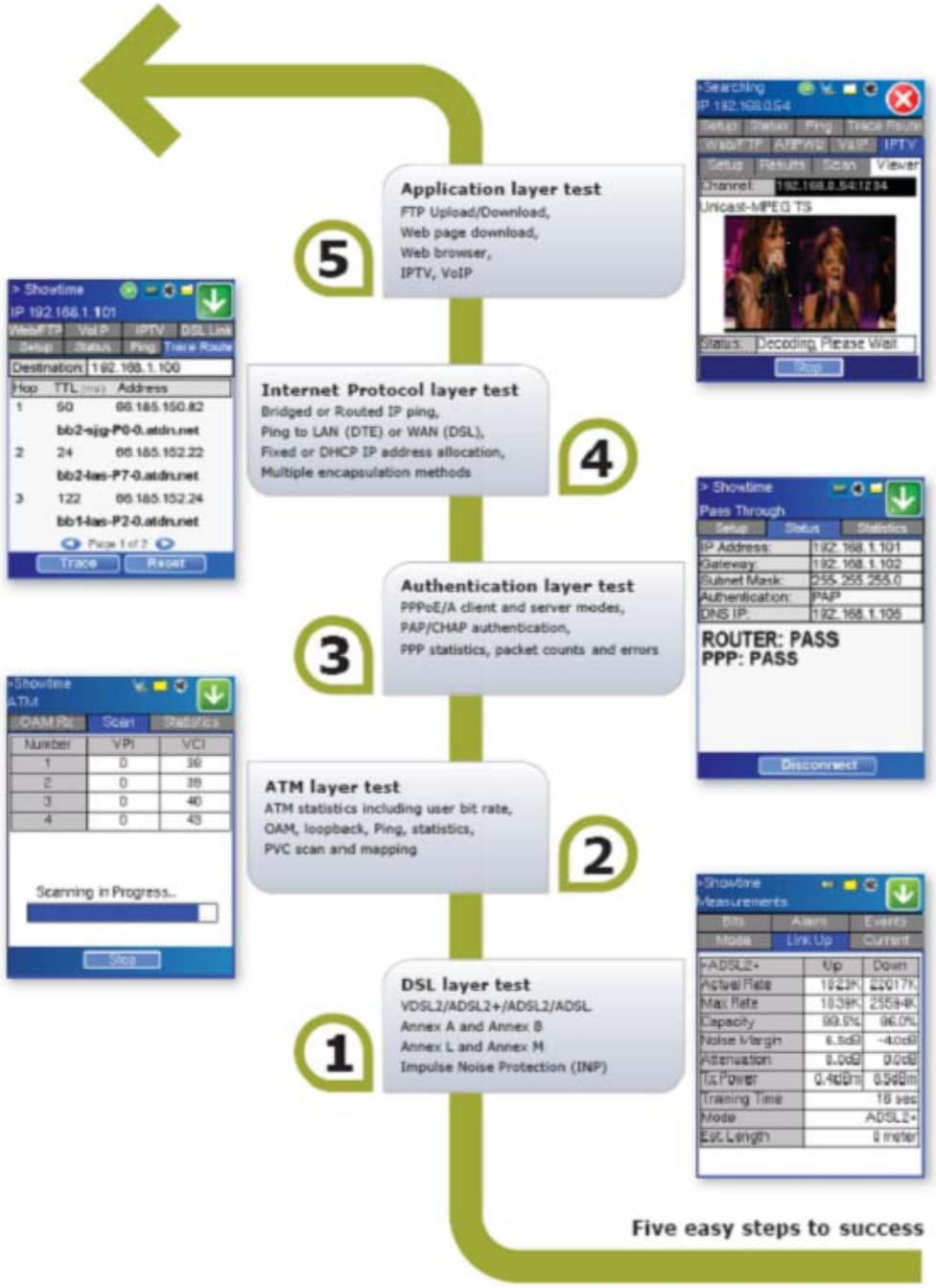
1.0 Product Introduction

VeEX™ VePAL BX instruments are next generation test solutions to install and maintain xDSL networks delivering triple play services. All BX products are lightweight, rugged and weather resistant instruments featuring advanced IP test capabilities. The BX100A models are equipped with a built in modem option to validate ADSL2+/ADSL2/ADSL based networks while the BX100V unit is equipped with a modem capable of supporting VDSL2 and ADSL2+ networks.

1.1 Test Applications

The diagram below outlines the major test capabilities of the BX100A/V products.



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2.0 About this User Manual

Every effort was made to ensure that the information contained in this user manual is accurate. Information is subject to change without notice and we accept no responsibility for any errors or omissions. In case of discrepancy, the web version takes precedence over any printed literature.

This user manual is suitable for novice, intermediate, and experienced users and is intended to help you successfully use the features and capabilities of the VePAL BX100A and BX100V analyzers. It is assumed that you have basic computer experience and skills, and are familiar with DSL and telecommunication concepts, terminology, and safety.

For more technical resources, visit VeEX Inc web site at www.veexinc.com.

If you need assistance or have questions related to the use of this product, call or email our customer care department for customer support. Before contacting our customer care department, you must have your product serial number ready. Please go to Basic Operations section for details on locating your unit serial number in the menus or locate the serial number on the back of the chassis. Please provide this number when contacting VeEX customer service.

Customer Care:

Phone: + 1 408 970 9090

Email: customers@veexinc.com

Website: www.veexinc.com

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3.0 Safety Information

Safety precautions should be observed during all phases of operation of this instrument. The instrument has been designed to ensure safe operation however please observe all safety markings and instructions. Do not operate the instrument in the presence of flammable gases or fumes or any other combustible environment. VeEX Inc. assumes no liability for the customer's failure to comply with safety precautions and requirements.

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4.0 Basic operation

4.1 Keypad

The unit is powered on and off from the red key on the keyboard area. In order to turn off the unit, press the power key for at least 2 seconds. If the unit is not responding, holding the power key down by more than 10 seconds will force the unit to power down.

The keyboard includes the following keys:

- Home key. Bring the unit to its home menu regardless of its location on the user interface.
- Print key. Performs a print of the current result or selected stored result. The print function requires a USB printer. For a list of supported printer please contact VeEX customer service.
- Store key. Performs the storage in the memory of the test set of the current results. If the result is running, it will provide a snap shot at the moment the key is pressed. The store function provides an automatic storage with automatic naming and time stamping function. To manipulate a stored file, please go to files.
- History key. The history key resets any blinking LED due to a history condition. For more details on the LED, please go to LEDs.
- Help key. The help key brings the user to the online help, regardless of the current user interface location of the unit.
- Arrow key. The arrow key moves the cursor in any of the four supported directions (left, right, up, down). The arrow key works in conjunction with the Enter and Escape keys.
- Enter key. The enter key provides an enter sequence to the user interface. It is used in non touch screen operation mode to enter menus and functions.
- Escape key. The escape key provides an escape sequence to the user interface. It is used in non touch screen operation mode to escape menus and functions.

Note: Standby Mode
By pressing Home and Help buttons simultaneoulsy, the tester switches to a sleep mode which helps to preserve battery life and makes fast boot up time at the measurement site or location possible.
To exit the sleep mode, press Home and Help simultaneously again.

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4.2 Touch Screen Display

The LCD supports touch screen operations. In order to use the unit in touch screen mode, open the transparent door covering the screen. Then take out the stylus available on the top door i.e. door protecting the connector panel. Keep the LCD cover closed when using the unit on non touch screen mode, and use the arrow, enter, and escape keys. The location of the cursor on the screen is indicated by a focus state. The focus state varies depending on the function or section of the test set. Please observe the following precautions;

- Never use excessive pressure on the touch screen as this may damage its functionality

- Never use sharp objects such as a pen, screwdriver etc. as this may damage the surface

- Clean the surface of the touch screen using a soft cloth and mild detergent only. Do not use alcohol.

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4.3 Battery

The VPAL is equipped with an intelligent Lilon rechargeable battery pack which is located in the rear of the unit. The battery will be partially charged upon delivery so it is recommended to charge the battery fully before use. It is recommended to charge the battery at room temperature to preserve its life and to obtain maximum charge. The battery can be removed during operation provided the unit is connected to the AC Main using the supplied AC adapter. Removing the battery, when not connected to the AC Main will cause the unit to shutdown. Remove the rubber cover on the left side to connect the AC Main adapter to the unit.

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4.4 Connectors and Panels

Test Ports :

To access the test connectors, please open the top cover.

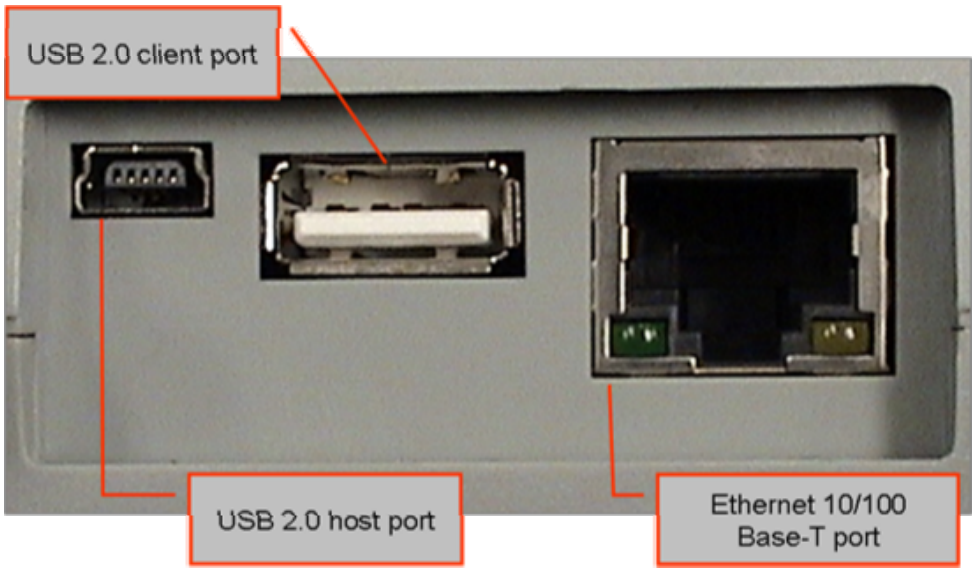
- **DSL test port:**
  One RJ11 (BX100V) or one RJ45 (BX100A) connector is located at the top of the unit. Connect the unit to the network using one of the cables supplied with the instrument.
  Note: Maximum Voltage input is 100VAC, 140VDC

- **Digital Multimeter test port** (option for BX100A models only)
  The Digital Multi-Meter (DMM) measures AC and DC voltage, current and resistance. Connect to the network using the test cables supplied with the instrument.

- **POTS test port:** (option for BX100A models only)

Utility Ports:

To access the utility ports, remove the protective rubber cover on the right hand side of the unit to expose the connectors;



- **USB 2.0 Client port:** To connect USB memory drives, WiFi or VoIP adaptors. These accessories are shown below.

- **USB 2.0 Host port:** To connect USB printer (future firmware release)
- **RJ45, 10/100Base-T port:** To connect to an Ethernet network. Applications include;
    - Transfer measurement results and test profiles between the instrument and a computer using Reveal BX software
    - Upload/download channel tables between the instrument and a computer using Reveal BX software
    - Upgrade the instrument software using Reveal BX software
    - Remote control of the instrument using Reveal BX software (optional)

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4.5 LEDs

The BX100A series are equipped with four LEDs providing the following functions;

- The **Power LED** indicates the power state of the unit. The LED is off when the unit is powered off. The LED is green when the unit is powered on. The LED is orange when the unit is connected to the AC Main and powered off.
- The **ALM/ERR LED** is linked to the alarms and errors. The LED is solid red when there is an alarm or error condition. The LED is flashing red to indicate an error or alarm that has occurred but is no longer present. This is called the history function. In order to reset the history condition on any LED press the function key on the rubber keyboard (O -> O).
- The **FRAME LED** indicates synchronization aspects of the DSL signal. The LED is green when showtime or link-up is achieved. The LED is red while the unit is training or the expected DSL signal can not be detected.
- The **SIGNAL LED** is related to the physical status of the built-in DSL Modem. A solid green LED indicates the modem has synchronized with the DSLAM and showtime is achieved.

The BX100V is equipped with three LEDs providing the following functions;

- The **Power LED** indicates the power state of the unit. The LED is off when the unit is powered off. The LED is green when the unit is powered on. The LED is orange when the unit is connected to the AC Main and powered off.
- The **SIGNAL LED** is related to the physical status of the built-in DSL Modem. A solid green LED indicates the modem has synchronized with the DSLAM and showtime is achieved.
- The **ALM/ERR LED** is linked to the alarms and errors. The LED is solid red when there is an alarm or error condition. The LED is flashing red to indicate an error or alarm that has occurred but is no longer present. This is called the history function. In order to reset the history condition on any LED press the function key on the rubber keyboard (O -> O).

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5.0 Home Menu

This menu can be reached at anytime during operation by pressing the home key, accessible on the rubber keyboard.

BX100A Home Menu

BX100V Home Menu (CPE mode)

The upper part of the menu (DSL link, ATM, IP, Passthrough, Bitstogram etc) contains items specific to the test application of the handheld test set, while the lower part of the menu contains items common to all VeEX VePAL handheld test sets.

Some test capabilities may be specific to a certain product while other features may require the purchase of a software option in order to be displayed or be enabled.

5.1 DSL Link

ADSL and VDSL technology re-uses the copper pair between the exchange or street cabinet and the customer premises. The usable bandwidth is extended from 4kHz to 2.2MHz in the case of ADSL2+ and 4kHz to 30MHz in the case of VDSL2. Extended bandwidths make the copper pair far more susceptible to faults, impairments and other degradation thus impacting the BER. Testing at this layer not only provides information about the copper's performance, but connection to the DSLAM or customer's modem can also be assessed.

The BX100A/V models offer the following test functions depending on model purchased;

- Emulate customer modem (ATU-R) to prove that synchronization or link up with DSLAM is possible.

- Emulate DSLAM (ATU-C) to prove that synchronization or link up with a customer modem (ATU-R) is possible (BX100V with xTU-C options only)
- Provide link performance statistics - Measure downstream bit rate, upstream bit rate, max bit rate, relative capacity, noise margin, transmit power and attenuation.
- Display bits per tone in both graphical and table format.
- Display SNR per tone in both graphical and table format.
- Counts FEC, HEC and CRC error frames and detects and indicates Loss of signal, Loss of cell declineation
- Modem emulation - replace the customer modem and measure data performance with live customer traffic in Pass Through mode.

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5.2 ATM Function

The ATM link proves the communication path from the customer's equipment through the Service Provider's backbone network. Testing the ATM layer verifies correct equipment setup.

- OAM F5 loopback support.
- VPI/VCI scan returns list of available VPI/VCI.
- ATM PING (end to end or segmented).
- ATM F4 and F5 OAM cells to check connectivity between various network points

	**Note: ATM versus IP DSLAMs** **ATM DSLAM:** When ADSL services first began, ATM was the main high-speed data backbone transport used in telecommunications networks. As a result, DSLAMs with an ATM uplink or backplane were developed to enable the ADSL link to connect seamlessly into the whole ATM network. The 'last mile' ATM link over the ADSL line was merely an extended part of the telco's ATM network. **IP DSLAM:** More recently, Ethernet bandwidth capabilities have increased significantly and it is becoming a cheaper and more popular transport protocol choice for Metro Area Networks. In installations where subscribers are using DSL to access a Metro Area Network, it makes sense for the DSLAMs to have Ethernet uplink ports. DSLAMs with Ethernet uplink ports are known as IP DSLAMS.The market is rapidly moving towards IP DSLAMs because they are cheaper to implement, scale better and are easier to manage than ATM DSLAMs.

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5.3 IP Function

An IP test will verify if the whole DSL system is configured properly and connected to the Internet. Depending on the IP options purchased, the following tests are possible;

- **Ping Test:** PING is a popular computer network tool used to test whether a particular host is reachable across an IP network. Sending an "echo request" or ICMP (Internet Control Message Protocol) to the target host and listening for "echo response" replies. PING estimates the round-trip time, in milliseconds, and records any packet loss. The destination address can be in IP address or URL format.
- **Trace Route:** To find the route to the destination IP or URL. Often used to identify routing problems and unreachable destinations. All the remote IP addresses and their reponse times are displayed indicating possible network congestion points.
- **FTP Test:** Using the File Transfer Protocol, verify the actual throughput of upstream or downstream data rate by sending or receiving files with known size
- **Web Test/ Web Browser:** To verify internet is properly connected by the service point. Allows user to

perform work force management related tasks.
- **VoIP:** Refer to Commmon Features manual
- **IPTV:** Refer to Commmon Features manual

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5.4 Pass Through Function

In Pass Through mode, the BX100A/V emulates a customer's modem by synchronizing with the DSLAM, making data analysis (Ping, Traceroute, HTTP/FTP), Web surfing via a PC, IPTV STB emulation, and VoIP analysis possible. The unit is connected to the DSL line via the RJ11 or RJ45 interface and to a PC via the Ethernet 10/100Base-T port. Used in this "transparent" mode, this test helps to verify;

- The customer’s modem or router is working correctly
- The IPTV quality of experience (QOE) by monitoring joins/leave request, zapping time, jitter and delay
- Sufficient bandwidth is available to deliver Triple-Play services
- VoIP call flow, jitter, and delay

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5.5 Bitstogram - Option for all BX100A/V models.

The Bitstogram feature measures the bits per tone distribution the modem transmits to deliver the provisioned data rate. The number of bits assigned per tone is displayed in both graphic and tabular formats. The Bitstogram feature is useful to troubleshoot interference problems, to monitor bit swapping and Seamless Rate Adapation (SRA) occuring over a period of time.

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5.6 Digital Multi-Meter (DMM) - Option for BX100A models only.

DMM measurements help verify that the copper pair meets specified requirements for DSL service. These tests are normally conducted during the prequalification phase or on problematic service loops.

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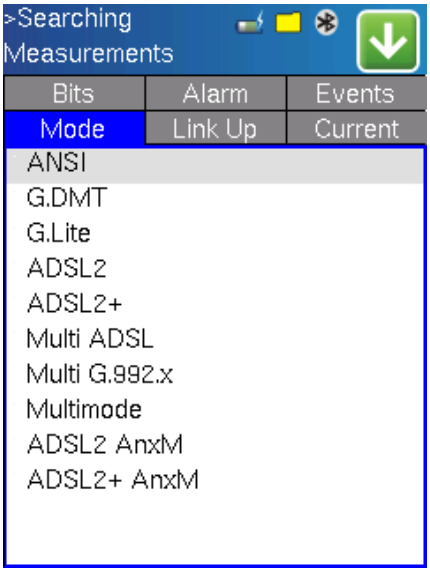
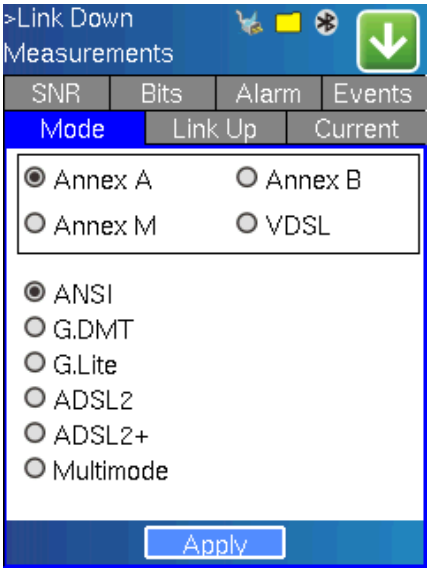
6.0 DSL Measurement Setup

Te Setup menu can be reached at anytime during operation by pressing the **Home** key, accessible on the rubber keyboard.

BX100A ADSL Setup Menu **BX100V ADSL Setup Menu - Annex A**





6.1 ADSL CPE (ATU-R) Setup:

The following ADSL test functions are available under the **Mode** tab on the BX100A and BX100V models;

ANSI: Enables ANSI mode.
Defined by the American National Standards Institute (ANSI) Telecommunications Committee, T1.413 was the first standardized ADSL specification. The underlying modulation is Discrete Multi-Tone (DMT) line code which divides the bandwidth of the standard two wire copper wire used in the PSTN into 256 separate 4.3125 kHz wide bins called sub-carriers. Even though each of these 254 sub-carriers or tones can support a modulation of up to 15 bits, the maximum achievable downstream data rate is actually 8.128 Mbit/s due to error checking and related overhead data. In the upstream direction, a maximum of 30 sub-carriers is used, each tone being modulated with up to 15 bits providing a maximum theoretical throughput of just over 1.5 Mbit/s.

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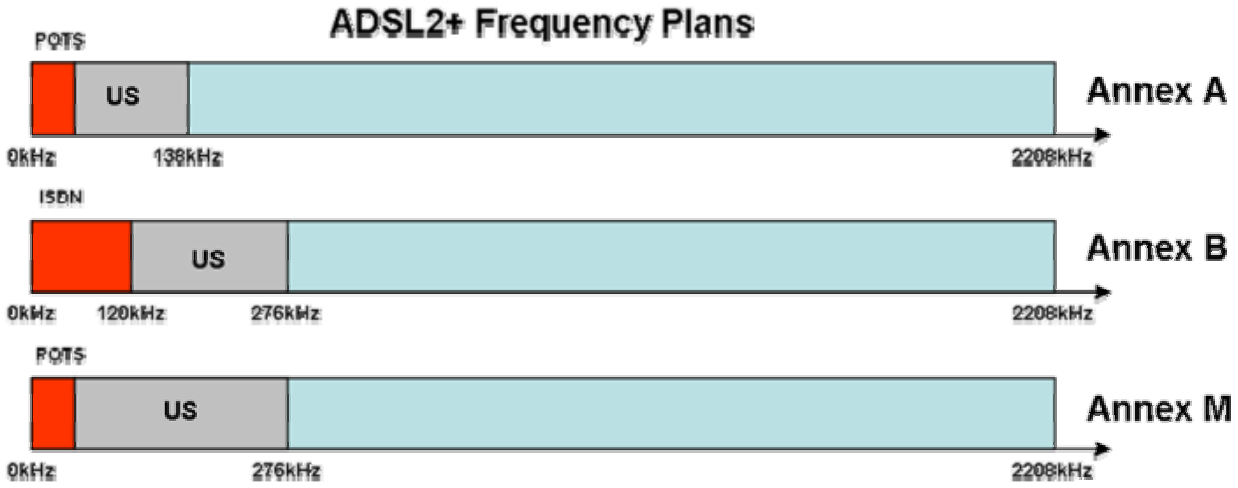
DMT: Enables DMT mode.
Also referred to as ITU G.992.1, the standard expands the usable bandwidth of existing copper telephone lines to rates up to 12 Mbit/s downstream and 1.3 Mbit/s upstream. Discrete Multi-Tone (DMT) mode, divides the ADSL signal into 255 carriers (bins) spaced in multiples of 4.3125 kHz. The DMT spectrum has 224 downstream frequency bins and up to 31 upstream bins.

In **Annex A** systems where Voice (POTS) is used on the same line, the frequency spectrum can be outlined as follows:

- 0-4 kHz is allocated to Voice traffic
- 4-25 kHz is an unused guard band
- 25-138 kHz is for Upstream data
- 138-1107 kHz is for Downstream data (ADSL)
- 138-2208 kHz is for Downstream data (ADSL2+)



ADSL2+ Frequency Plans

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G.Lite: Enables G.Lite mode.
A lower data rate version of G.DMT and T1.413 also known as Splitterless ADSL i.e. it uses the same DMT modulation scheme but eliminates the POTS splitter at the customer premises. As a result, the ADSL signal is carried over all of the house wiring which results in lower available bandwidth due to greater noise impairments. Initially deployed in 1999 to reduce truck rolls which were needed to install the splitter at the customer premises.

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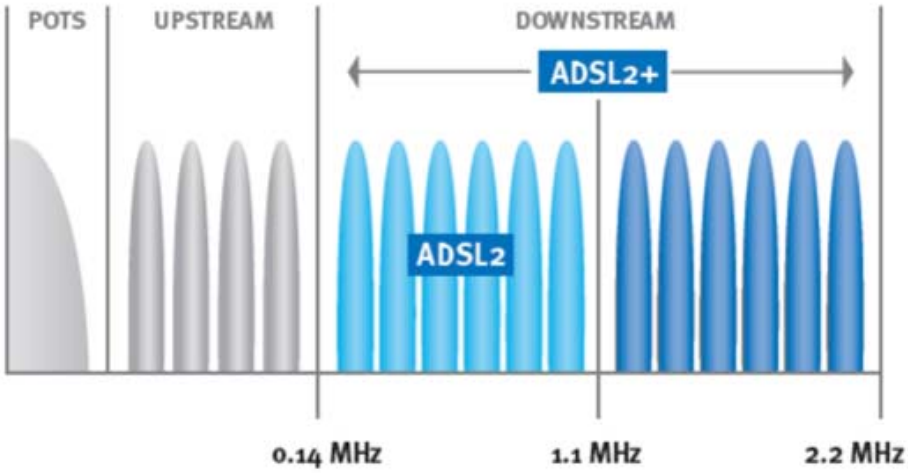
ADSL2: Enables ADSL2 mode.
Also known as ITU-T G.992.3, the standard extends basic ADSL data rates to 12 Mbit/s downstream and 3.5 Mbit/s upstream however actual speeds are dependent on line quality - the most significant factor being loop length.

ADSL2+: Enables ADSL2+ mode.
Also known as ITU-T G.992.5, the standard extends the capability of basic ADSL by doubling the number of downstream tones providing data rates as high as 24 Mbit/s downstream and 1 Mbit/s upstream depending on loop length. ADSL2+ can also be used to reduce crosstalk because it provides the capability to use only tones between 1.1 MHz and 2.2 MHz thus masking the downstream frequencies below 1.1 MHz and associated interference - this is also referred to as Spectral Masking.



ADSL2+ Frequency Spectrum

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Multi ADSL: Enables Multi ADSL mode.
The test set searches for one the signal types below and will try to synchronize in order of priority;

- G.DMT ADSL signal
- ANSI T1.413 ADSL signal
- G.Lite ADSL signal

Multi G.992.x mode: Enables Multi G.992.x mode.
The test set searches for one the signal types below and will try to synchronize in order of priority;

- G.992.5 ADSL2+ signal
- G.992.3 ADSL2 signal
- G.992.1 ADSL (DMT) signal

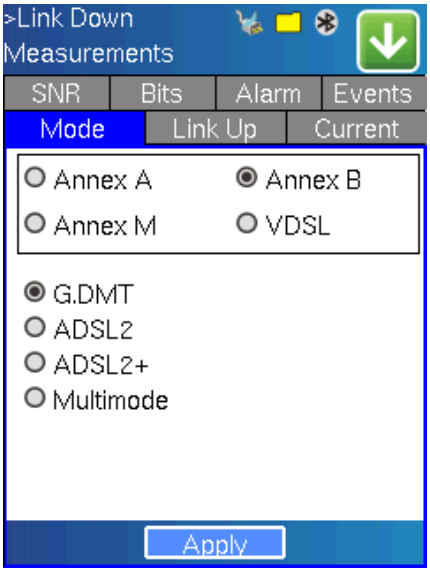
Multimode: Enables Multimode mode.
The test set searches for one the signal types below and will try to synchronize in order of priority;

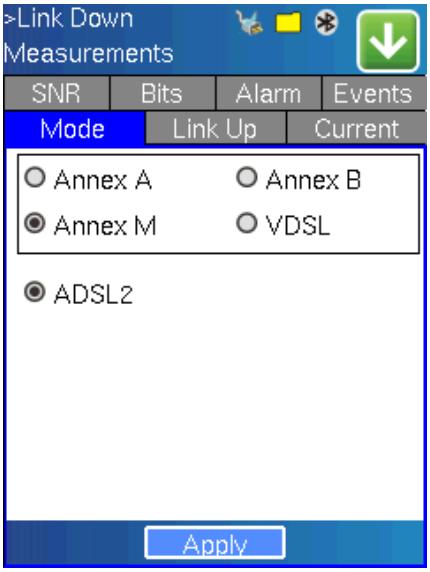
- G.992.5 ADSL2+ signal
- G.992.3 ADSL2 signal
- G.992.1 ADSL (DMT) signal
- G.DMT ADSL signal
- ANSI T1.413 ADSL signal
- G.Lite ADSL signal

ADSL/2+ Annex B: Enables Annex B mode. (Screen layout differs slightly on BX100A and BX100V models)
In Annex B systems, where voice (ISDN) is used on the same line, the frequency spectrum can be outlined as follows:

- 0-80 kHz is allocated to ISDN service (160kbps full duplex and 2B1Q line coding). For 4B3T line coding, frequency allocation is slightly different.
- 80-120 kHz is typically a guard band
- 120-276 kHz is for Upstream data
- 276-1107 kHz is for Downstream data (ADSL)
- 276-2208 kHz is for Downstream data (ADSL2+)

BX100V ADSL Setup Menu - Annex B **BX100V ADSL Setup Menu - Annex M**





ADSL2 Annex M: Enables ADSL2 Annex M mode.
Also known as ITU G.992.5 Annex M, the standard extends the capability of basic ADSL2 by doubling the number of upstream bits. Data rates can be as high as 24 Mbit/s downstream and 3.5 Mbit/s upstream depending on the distance from the DSLAM to the customer premises. The main difference between this and ITU G.992.5 (ADSL2+) specification is that the upstream/downstream frequency split has been shifted from 138kHz up to 276kHz, allowing upstream bandwidth to be increased from 1 Mbit/s to 3.5 Mbit/s, with a corresponding decrease in downstream bandwidth.

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ADSL STANDARDS			
Standard name	Common name	Downstream Rate	Upstream Rate
ANSI T1.413	ADSL	8 Mbit/s	1.0 Mbit/s
ITU G.992.1	ADSL (G.DMT)	12 Mbit/s	1.3 Mbit/s
ITU G.992.1 Annex A	ADSL over POTS	12 Mbit/s	1.3 Mbit/s
ITU G.992.1 Annex B	ADSL over ISDN	12 Mbit/s	1.8 Mbit/s
ITU G.992.2	ADSL Lite (G.Lite)	4.0 Mbit/s	0.5 Mbit/s
ITU G.992.3/4	ADSL2	12 Mbit/s	1.0 Mbit/s
ITU G.992.3/4 Annex J	ADSL2	12 Mbit/s	3.5 Mbit/s
ITU G.992.3/4 Annex L	RE-ADSL2	5 Mbit/s	0.8 Mbit/s
ITU G.992.5	ADSL2+	24 Mbit/s	1.0 Mbit/s
ITU G.992.5 Annex L	RE-ADSL2+	24 Mbit/s	1.0 Mbit/s
ITU G.992.5 Annex M	ADSL2+M	24 Mbit/s	3.5 Mbit/s

ADSL Standards Summary

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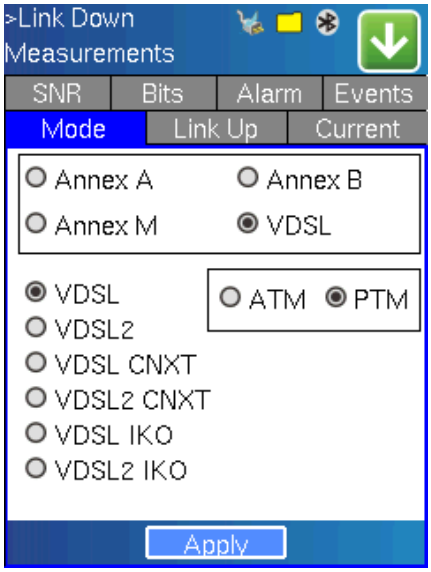
6.2 VDSL VTU-R (CPE) Mode

The BX100V offers the following VDSL/2 modes;

- CPE (VTU-R) mode to emulate a VDSL/2 modem

BX100V VDSL Menu - CPE mode



VDSL mode: Enables Infineon/Aware mode.
Efforts to standardize VDSL got underway in 1995 with the ITU, ETSI and ANSI (T1E1.4) organizations each conducting simultaneous projects. The adoption/ratification of the standard was hampered by the choice of two competing line-code technologies i.e. using quadrature amplitude modulation (QAM); and discrete multitone (DMT). As a result, proprietary implementations of VDSL-QAM and VDSL-DMT were developed and deployed in limited volumes in a few markets. VDSL1 supports a bandwidth of up to 12MHz. The physical reach of VDSL1 is limited to around 1500m on 0.4mm cable.

VDSL2 mode: Enables Infineon/Aware VDSL2 mode.
Frequency configuration options of 8.5 MHz, 12 MHz, 17.7 MHz and 30 MHz are set automatically depending on DSLAM settings.

	Note: VDSL2 backgrounder Based on inputs from the ANSI and ETSI standards, ITU drafted the VDSL2 standard (G.993.2) in 2004 and it was approved in May 2005. The underlying modulation in the VDSL2 standard is discrete multitone (DMT) and is based on both the VDSL1-DMT and ADSL2/ADSL2+ recommendations. As a result, it is spectrally compatible with existing services and enables very important multimode operability with ADSL/2/+. VDSL2 is designed to support a wide deployment of Triple Play services and permits the transmission of asymmetric and symmetric data rates up to 200 Mbit/s. The bandwidth can be extended to 30MHz however VDSL2 uses the same band plans below 12MHz to be spectrally compatible with VDSL1. The physical reach of VDSL2 can be extended to around 2400m on 0.4mm cable.

VDSL CNXT: Enables Conexant VDSL mode.
Supports and improves interoperability with Conexant chipset based VDSL1 DSLAMs using DMT modulation.

VDSL2 CNXT: Enables Conexant VDSL2 mode.
Supports Conexant based VDSL2 DSLAMs using DMT modulation. Bandplan configuration options of 8.5 MHz, 12 MHz, 17.7 MHz and 30 MHz are set automatically depending on DSLAM and operator settings.

VDSL IKO: Enables Ikanos VDSL mode.
Supports Ikanos based VDSL1 DSLAMs using DMT modulation.

VDSL2 IKO: Enables Ikanos VDSL mode.
Supports Ikanos chipset based VDSL2 DSLAMs using DMT modulation. Bandplan configuration options of 8.5 MHz, 12 MHz, 17.7 MHz and 30 MHz are set automatically depending on DSLAM and operator settings.

	Note: VDSL interoperability: Initial VDSL standards were never fully adopted by the market due to disagreements during the standardization phase regarding the modulation scheme (DTM or QAM) and packet technology

(ATM or Ethernet) to be used. Even though interoperability testing of VDSL2 is a top priority of chipset and equipment vendors, experience from working with ADSL indicates that it might take a a few years to reach full interoperability.
The first step in the process is to gain layer-1 interoperability between chipset vendors. Once that is achieved, system vendors can perform additional tests between CPE and DSLAMs. The DSL Forum is defining the framework for the VDSL2 tests in several important documents that will guide the industry forward.

For the reasons stated, above, the BX100V is equipped with different vendor profiles to deal with potential compatibility issues and customer deployments.

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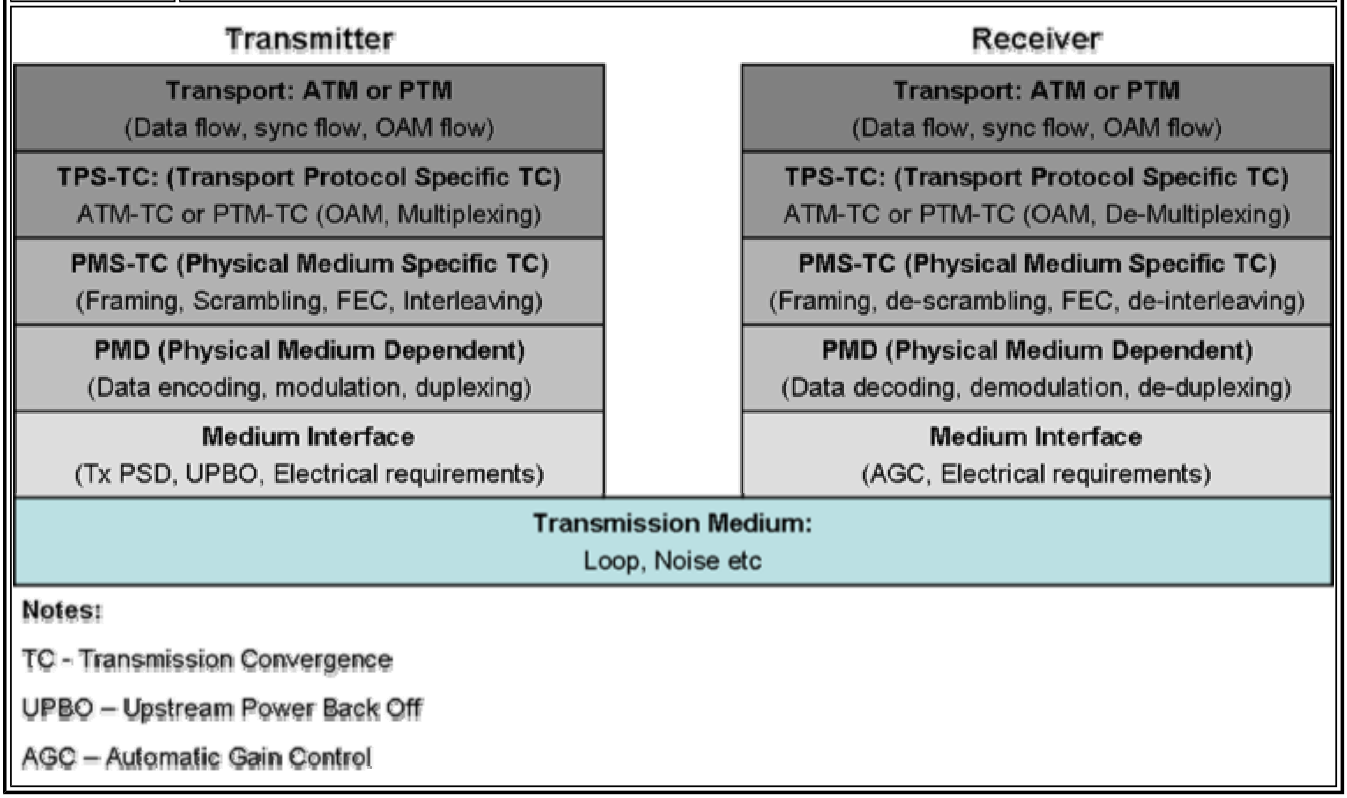
ATM mode: Enables Asynchronous Transfer Mode (ATM) encapsulation of Ethernet frames.

PTM mode: Enables Packet Transfer Mode (PTM) encapsulation of Ethernet frames.

Note:
Asynchronous Transfer Mode (ATM) versus Packet Transfer Mode (PTM)

- VDSL2 specifies a Packet Transfer Mode – Transmission Convergence (PTM-TC) function that is based on the Ethernet in the First Mile (EFM) IEEE 802.3ah standard. The PTM-TC specified in VDSL2 makes provision for Pre-emption and Short Packet Support.
- Pre-emption improves traffic management by pausing the transmission of a low-priority packet when a high-priority packet needs to be transmitted. Thus high-priority packets (e.g. voice) experience a minimum amount of packet insertion delay.
- Short Packet Support enables a VDSL2 system to transport packets that contain less than 64 bytes. While IEEE802.3 was designed exclusively for the transport of Ethernet packets greater than 64 bytes, VDSL2 transports any packet type, including IP packets which are often less than 64 bytes.
- So when introducing VDSL2, there will be a strong tendency from operators to drop ATM in the first mile, and to replace it with Ethernet (64/65 encapsulation).



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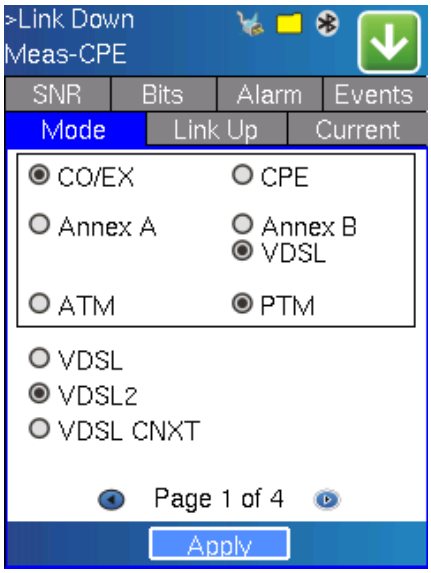
6.3 / 6.4 VDSL/ADSL CO Setup Mode

The BX100V offers various setup modes. In Page #1 of 4 the following ATU-C or VTU-C configurations are possible;

- CO (ATU-C) mode to emulate a ADSL/2/2+ DSLAM
  - Annex A ADSL/POTS
  - Annex B ADSL/ISDN
  - Annex M
- CO (VTU-C) mode to emulate a VDSL/2 DSLAM

BX100V CO Setup Menu



VDSL mode: Emulates Infineon/Aware VDSL1 based DSLAMs using DMT modulation.

VDSL2 mode: Emulates Infineon/Aware based VDSL2 DSLAMs using DMT modulation.

VDSL CNXT: Emulates Conexant based VDSL1 DSLAMs using DMT modulation.

VDSL2 CNXT: Emulates Conexant based VDSL2 DSLAMs using DMT modulation.

VDSL IKO: Emulates Ikanos based VDSL1 DSLAMs using DMT modulation.

VDSL2 IKO: Emulates Ikanos based VDSL2 DSLAMs using DMT modulation.

ATM mode: Enables Asynchronous Transfer Mode (ATM) encapsulation of Ethernet frames.

PTM mode: Enables Packet Transfer Mode (PTM) encapsulation of Ethernet frames.

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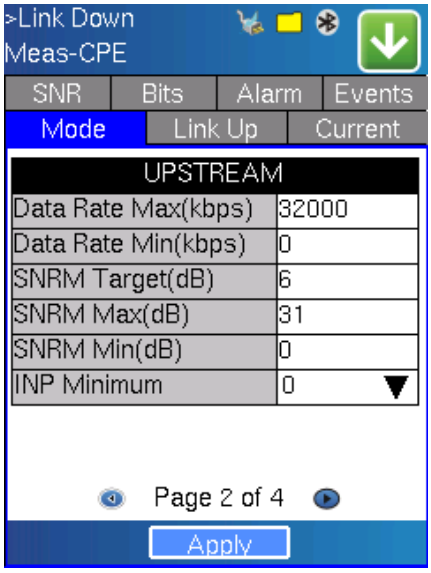
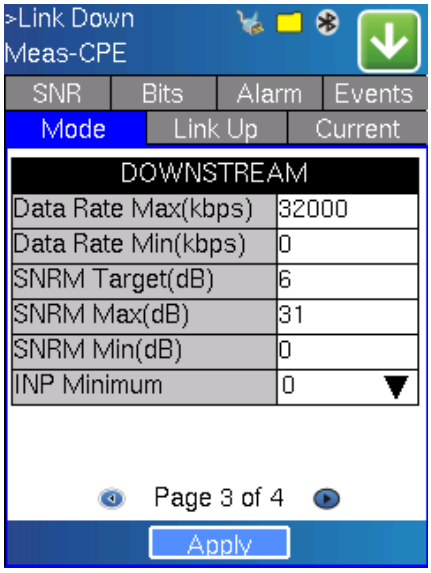
VDSL/ADSL CO Mode - Upstream and Downstream setup:

- In Page # 2 of 4, the Upstream parameters can be configured.
- In Page # 3 of 4, the Downstream parameters can be configured.

BX100V CO Setup - Upstream **BX100V CO setup - Downstream**

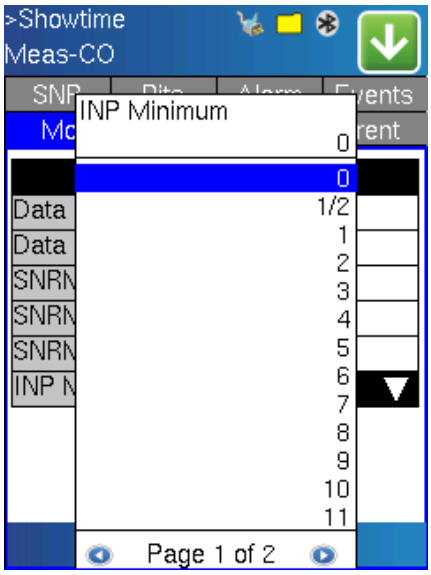




Upstream and Downstream - The following parameters are adjustable;

- Data rate (maximum)
- Data rate (minimum)
- SNR target: Signal to Noise Ratio
- SNR (maximum)
- SNR (minimum)
- INP (minimum) - Impulse Noise Protection value

BX100V CO Setup - INP editor



	Note: Impulse Noise Protection (INP): Electrical appliances and installations at customer premises often generate short bursts of noise of relatively high amplitude. These bursts, called impulse noise, are electromagnetically coupled into the digital subscriber line, degrading performance and in some cases disrupting service. The ADSL2/+ standard introduced a parameter called Impulse Noise Protection (INP), that allows operators to select the maximum impulse length that the DSL system can correct.

VDSL2 uses the same parameter and when implemented, an INP value between 2 and 16 can correct errors from noise impulses ranging from 250µs to 3.75ms in length.
INP is a key feature in most IPTV video deployments and enables better Video QOS by minimizing the effects of Impulse Noise.
The INP value for the interleaved channel can be set by the user and is expressed in symbols. For example, an INP value of 1 means that 1 symbol can be corrected i.e. a burst of noise for 1 symbol duration can be corrected without errors. One symbol equals 250 µs, therefore an INP of 1 correlates to a correction time of 250 µs.
The Impulse Noise Protection (INP) or interleave depth is defined by the S and D parameters where;

- S is the Interleave DMT symbols per FEC code word (1,2,4,8,16)
- D is the Interleave depth (1,2,4,8,16,32,64)
- Interleave delay can vary from 4.25 to 263.75 msec

The graphic below shows various Impulse Noise Sources

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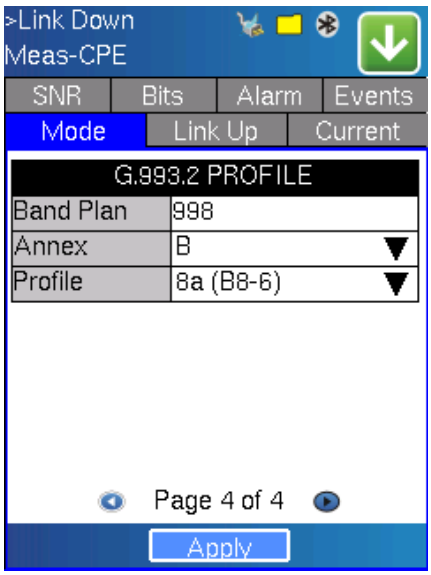
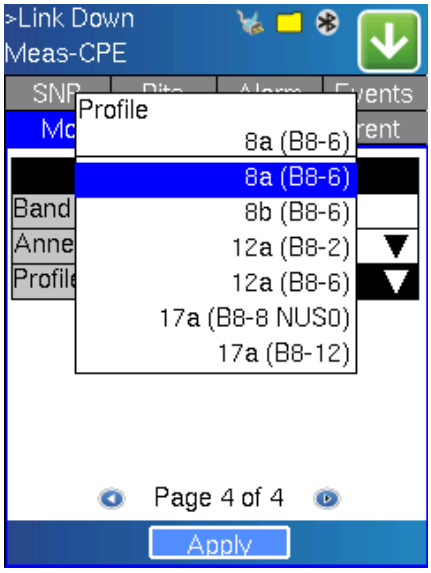
VDSL/ADSL CO Mode - Bandplan setup:

In Page # 4 of 4, Bandplans can be selected (available in VDSL2 mode only)

BX100V CO Setup - Bandplans **BX100V CO setup Bandplan selection**





Bandplans - The following parameters can be selected;

- Bandplan - 998 only. (Bandplan 997 and others may be supported in future)
- Annex - A (North America) or B (Europe)
- Profile - the following selections are available (refer to VDSL2 profile and PSD limit tables below);
  - 8a (B8-6)
  - 8b (B8-6)
  - 12a (B8-2)
  - 12a (B8-6)
  - 17a (B8-8 NUS0)
  - 17a (B8-12)

Parameter	VDSL2 Profile Values							
	8a	8b	8c	8d	12a	12b	17a	30a
Bandwidth (MHz)	8,832	8,832	8.5	8,832	12	12	17,664	30
DMT carriers (#)	2048	2048	1972	2048	2783	2783	4096	3479
DMT spacing (kHz)	4,3125	4,3125	4,3125	4,3125	4,3125	4,3125	4,3125	8,6250
Max data rate (US/DS)	50	50	50	50	68	68	100	200
Max Power DS (dBm)	+17.5	+17.5	+17.5	+17.5	+17.5	+17.5	+17.5	+17.5
Max Power US (dBm)	+14.5	+14.5	+14.5	+14.5	+14.5	+14.5	+14.5	+14.5
US0 support	Yes	Yes	Yes	Yes	Yes	No	No	No

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VDSL2 Bandplan 998 - Limit Masks			
Name	Limit Mask	US0 Type	Max Freq (MHz)
B8-1	998-M1x-A	Annex A (25-138 kHz)	12
B8-2	998-M1x-B	Annex B (120-276 kHz)	12
B8-3	998-M1x-NUS0	N/A	12
B8-4	998-M2x-A	Annex A (25-138 kHz)	12
B8-5	998-M2x-M	Annex M (25-276 kHz)	12
B8-6	998-M2x-B	Annex B (120-276 kHz)	12
B8-7	998-M2x-NUS0	N/A	12
B8-8	998E17-M2x-NUS0	N/A	17,664
B8-9	998E17-M2x-NUS0-M	N/A	17,664
B8-10	998ADE17-M2x-NUS0-M	N/A	17,664
B8-11	998ADE17-M2x-A	Annex A (25-138 kHz)	17,664
B8-12	998ADE17-M2x-B	Annex B (120-276 kHz)	17,664
B8-13	998E30-M2x-NUS0	N/A	30
B8-14	998E30-M2x-NUS0-M	N/A	30
B8-15	998ADE30- M2x-NUS0-M	N/A	30
B8-16	998ADE30- M2x-NUS0-A	N/A	30

Note:

US0 type refers to ADSL+2 recommendation (ITU-T G.992.5)

PSD limit masks highlighted in green are supported by BX100V VTU-C mode (Bandplan 998)

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Note:
Annexes: Similar to ADSL and ADSL2+, VDSL2 includes regional bandplan annexes that specify PSD Masks which are designed to coexist with other services. **Annex A** specifies bandplans for the North American and enables VDSL2 to be deployed with traditional POTS telephony. **Annex B** specifies bandplans for Europe and enables VDSL2 deployment with underlying POTS and ISDN services. **Annex C** allows VDSL2 to coexist with TCM ISDN services, found primarily in Japan.

Bandplans: VDSL2 is a true worldwide standard which has has numerous configuration profiles and bandplans to meet regional service provider requirements. The frequency bandwidth has increased from 12 MHz to 30 MHz, with options for 8.5 MHz, 12 MHz, 17.7 MHz and 30 MHz spectrums.
The standard also defines asymmetric (Plan 998) and symmetric (Plan 997) bandplans for the transmission of upstream and downstream signals.

Profiles: To simplify configuring network equipment, the standard defines profiles tailored for different regional deployment architectures. There are eight profiles which define power options, bandwidths and minimum data rates for each profile. The profiles are depicted in the table below.

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7.0 DSL Measurements Mode

The **DSL Measurements** mode and screen provides all the measurements related to the DSL layer and is displayed

automatically after achieving showtime. The BX100A/V synchronization process can be outlined as follows;

1. **Activation, Discovery or Handshaking** - Powering on the unit takes the DSL modem into activation and acknowlegment phase, also known as handshaking. The goals of this phase are to determine which tones can be used and how many bits can be assigned to each tone. Initialization typically uses two pilot tones to begin activation. Normally the modem initiates the process when it is turned on and connected to the DSL line. Messsages are sent using the pilot tones to ensure that both ends are ready for transceiver training process.
2. **Training** - DSLAM measures and adjusts the power output to equalize the circuit. Unless configured otherwise, it negotiates the fastest possible speed based on local loop conditions.
3. **Channel Analysis** - DSLAM tells the modem which options are configured and sends a predefined medley of tones so the modem can report its signal-to-noise ratio.
4. **Exchange** - DSLAM sends the minimum signal-to-noise ratio and decides on the power output per tone.
5. **Show Time** - Initialization concludes in which the line is active and higher layer protocols such as ATM can begin negotiation to transfer data over the connection.

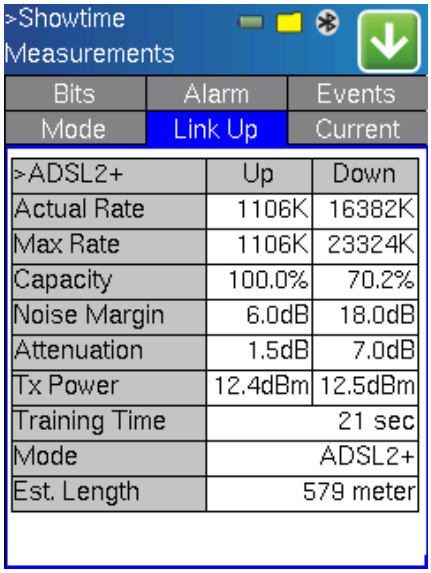
The following measurements and parameters are displayed in the various Tabs;

- **Link Up** Tab: provides a snap shot of the link at initial turn up.
- **Current** Tab: provides the current status of the link parameters and conditions.
- **SNR** Tab (BX100A fitted with TI chipset): provides a tabular and graphical display of the Signal to Noise Ratio per tone.
- **Bits** Tab: provides a tabular and graphical display of the bit allocation per tone.
- **Alarm** Tab: provides information on any alarm occurring or having occurred on the line.
- **Events** Tab: provides a log of all events that have occurred on the link since the test was started or measurement was cleared or reset.

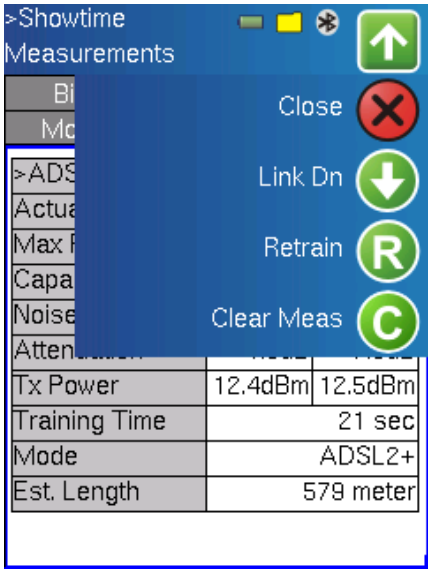
The Measurement Action Pull down menu performs the following functions;

- **Close:** Closes the Pull Down Menu
- **Link Down/Link Up -** a "Dying Gasp" signal, it sent to the DSLAM. The dying gasp message shows that the connection went down because of loss of power and not because the cable was accidentally cut between the modem and DSLAM.
- **Retrain:**
- **Clear Measurement:** Resets the measurement counter.

BX100A Link-Up results



BX100V Measurement Action Menu



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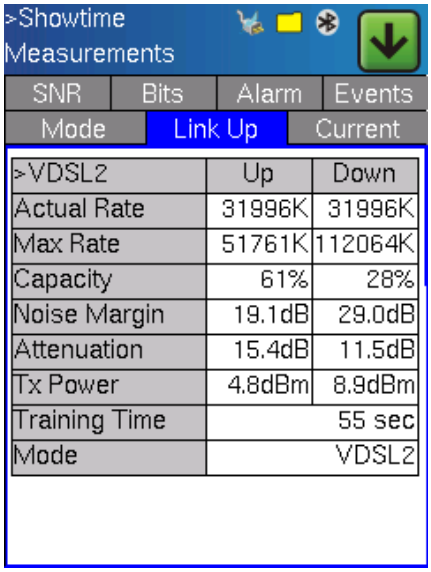
Link Up Tab: The initial showtime results are displayed. The screens may vary from BX100A to BX100V models, and from test mode to test mode, however the result information maintains and retains the same basic definition/s.

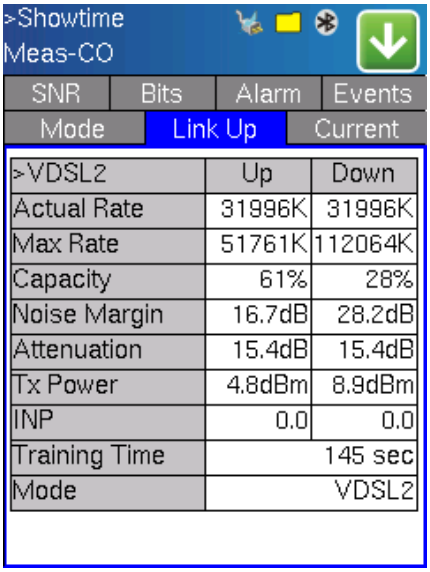
- **Actual Rate:** attained for Upstream and Downstream displayed in kbit/s
- **Maximum Rate**: attained for Upstream and Downstream displayed in kbit/s
- **Capacity:** Upstream and Downstream displayed in %. The capacity is the ratio of the actual rate versus the maximum bit rate.
- **Noise Margin:** Upstream and Downstream displayed in dB. The noise margin is the amount of noise measured relative to a noise level needed to maintain a BER of < 10EXP-7
- **Attenuation:** Upstream and Downstream (numeric in dB) is the difference in the power level transmitted at the near end and received at the far end.
- **Transmit (Tx) Power:** Upstream and Downstream (in dB) . The power output is typically the level needed to achieve the noise margin configured in the DSLAM.
- **Training Time:** Displayed in seconds. Training time is counted from the start of the test (power on, link up command, or retrain command) to the time showtime is achieved.
- **Path:** (Interleaved or Fast) displayed on BX100A models only
- **Mode:** This indication is particularly valuable when using the multimode setup.
- **Estimated Loop Length:** displayed in feet or meters based on the regional settings. BX100A models only.

BX100V Link Up Measurements - CPE mode



>VDSL2	Up	Down
Actual Rate	31996K	31996K
Max Rate	51761K	112064K
Capacity	61%	28%
Noise Margin	19.1dB	29.0dB
Attenuation	15.4dB	11.5dB
Tx Power	4.8dBm	8.9dBm
Training Time		55 sec
Mode		VDSL2

BX100V Link Up Measurements - CO mode



>VDSL2	Up	Down
Actual Rate	31996K	31996K
Max Rate	51761K	112064K
Capacity	61%	28%
Noise Margin	16.7dB	28.2dB
Attenuation	15.4dB	15.4dB
Tx Power	4.8dBm	8.9dBm
INP	0.0	0.0
Training Time		145 sec
Mode		VDSL2

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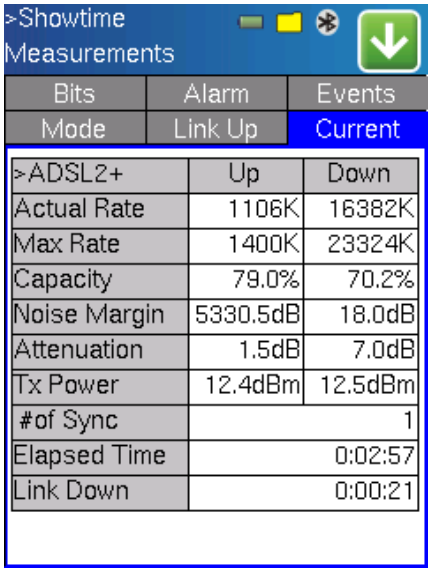
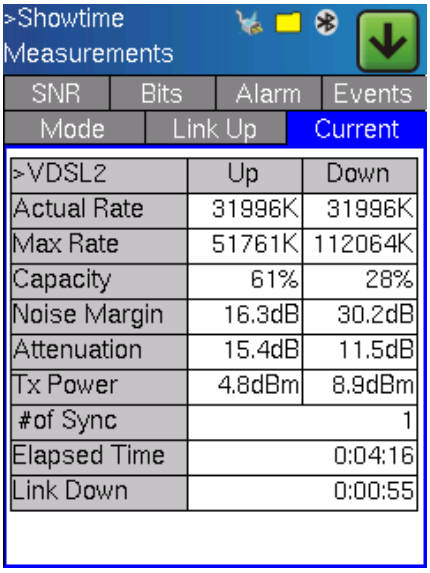
Current Tab: The most recent measurement is displayed. The definition of each measurement is the same as described for the Link up results above.

- **Actual Rate:** Upstream and Downstream (in kbit/s)
- **Maximum Rate:** Upstream and Downstream (in kbit/s)
- **Capacity:** Upstream and Downstream (in %)
- **Noise Margin:** Upstream and Downstream (in dB)
- **Attenuation:** Upstream and Downstream (in dB)
- **Transmit Power:** Upstream and Downstream (numeric in dB)
- **Number (#) of Synchronizations:** Resyncs (number)
- **Elapsed Time:** since the start of the test (in hr:min:sec)
- **Link Down:** Time the DSL link was out of service (in hr:min:sec)

BX100A ADSL current results **BX100V VDSL current results**





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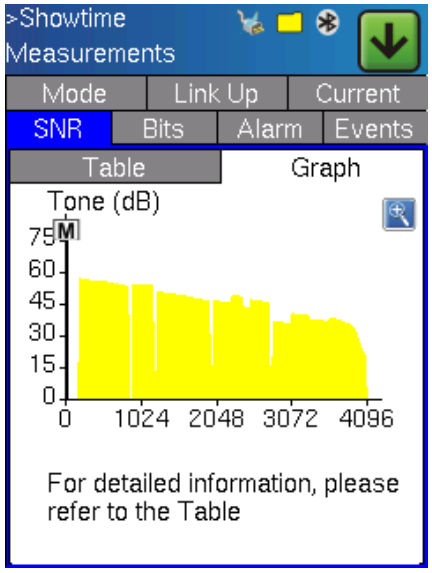
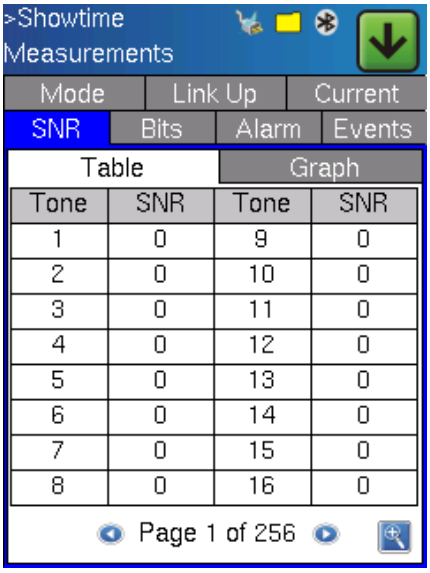
SNR Tab: Displays the SNR per tone (available on certain BX100 models only). The results can be displayed in graphical format or tabular formats.
As with all transmission lines, signal quality depends primarily on the attenuation and signal to noise ratio. The frequency of the bin can therefore determine how many bits can be encoded i.e. SNR can differ from bin to bin. Generally speaking, 1 bit can be encoded reliably for each 3 dB of available dynamic range above the noise floor e.g. a bin with a SNR of 21 dB would be able to carry 7 bits. However due to the fact that a **minimum of 2 bits** (QAM-4) are encoded per bin, the SNR of any single bin **cannot drop below 6 dB**.

BX100V SNR/Tone Graph



BX100V SNR/Tone Table



Note:
Bit Swapping: During initial modem link up, a signal to noise measurement is made for each tone and the bit distribution is optimized to deliver the desired bit rate. During showtime, modems constantly monitor the SNR/tone and the bit distribution is adjusted to optimize bandwidth based on noise, interference and cross talk. If a tone degrades in quality, a bit swap command adjusts the bit allocation for that particular tone and these bits are either re-allocated to another tone or removed completely.

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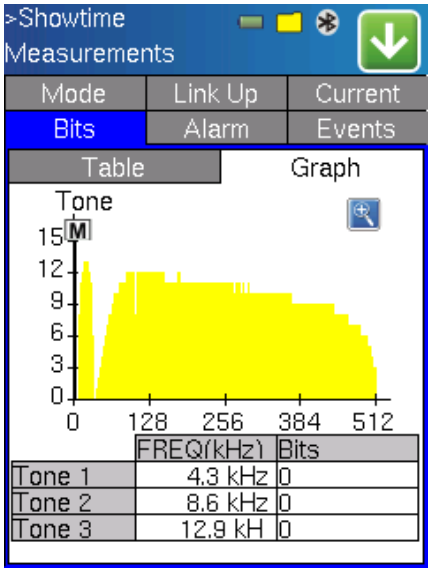
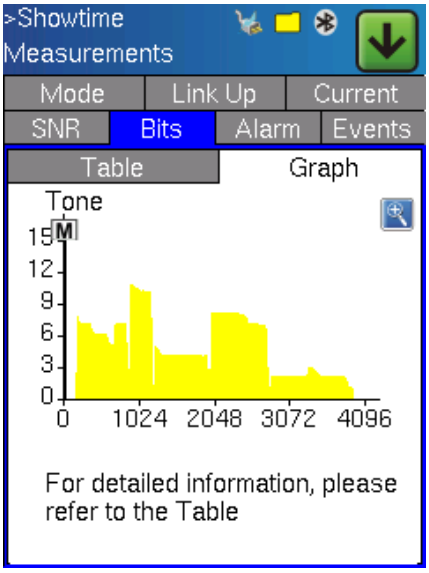
Bits Tab: Displays the bits allocated per tone. The results can be displayed in graphical format or tabular formats or modes.
In ADSL, Discrete Multi-Tone (DMT), divides the signal into multiple carriers (bins) centred in multiples of 4.3125 kHz. The spectrum of each bin overlaps with its neighbours i.e. it is not confined to a 4.3125 kHz wide channel because the orthogonality of COFDM makes this possible without interference. Up to 15 bits per symbol can be encoded on each bin on a good quality line.

BX100A Bits/Tone (graph mode)



BX100V Bits/Tone (graph mode)



Each tone (bin) represents a 4.3125 kHz bandwidth and is used to transfer up to 15 bits in a single direction. In VDSL2 Bandplan 30a, the tone bandwidth is increased to 8.625kHz.

Note: Bits/Tone
The Bits/Tone graph is a useful visual tool to quickly indentify interference or cross talk issues
The graphical mode can provide valuable insight to ADSL spectrums or VDSL2 channel plan implemented.

The table below represents the Tone Allocations in ADSL/2+

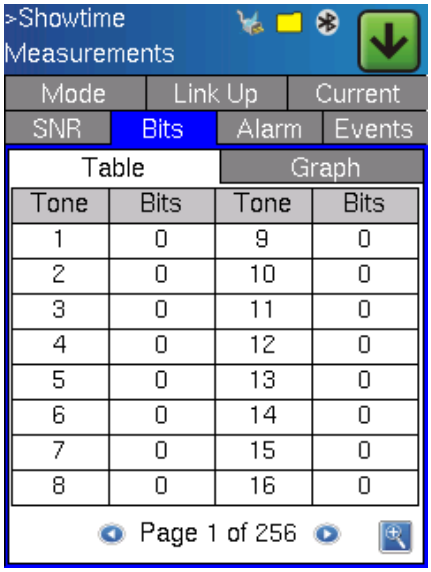
		USE OF TONES					APPLICABLE TO:		
ANNEX	ENVIRONMENT	1-5	6-31	32-64	65-255	256-512	ADSL G.992.1	ADSL2 G.992.3	ADSL2+ G.992.5
A	POTS	POTS	UP	DOWN	DOWN	DOWN*	YES	YES	YES
B	ISDN	ISDN	ISDN	UP	DOWN	DOWN*	YES	YES	YES
C	TCM-ISDN	POTS	UP	DOWN	DOWN	N/A	YES	YES	YES
I (ADSL)	TCM-ISDN	POTS	UP	DOWN	DOWN	DOWN	YES	NO	NO
I (ADSL2)	POTS	UP	UP	DOWN	DOWN	DOWN*	NO	YES	YES
J	ISDN	UP	UP	UP	DOWN	DOWN*	NO	YES	YES
L (RE-ADSL2)	POTS	POTS	UP **	DOWN **	DOWN **	N/A	NO	YES	NO
M (ADSL2+)	POTS	UP	UP	UP	DOWN	DOWN*	NO	YES	YES

* ADSL2+ only
** Not all tones are

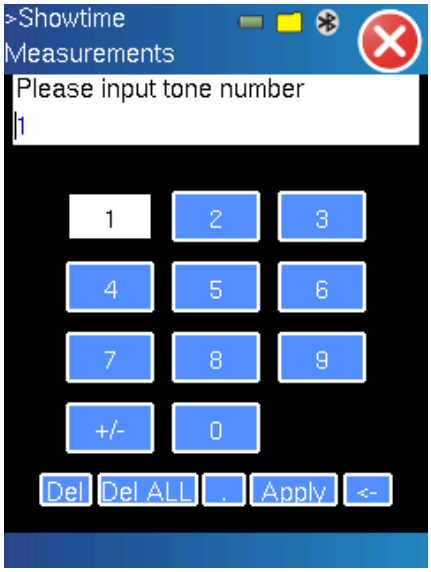
used **Note:** Applies to non-overlapped PSD masks only

To zoom in locate on any specific tone, click the zoom function and enter the tone number.

BX100V Bits/Tone (table mode)



BX100A/V Tone Zoom function



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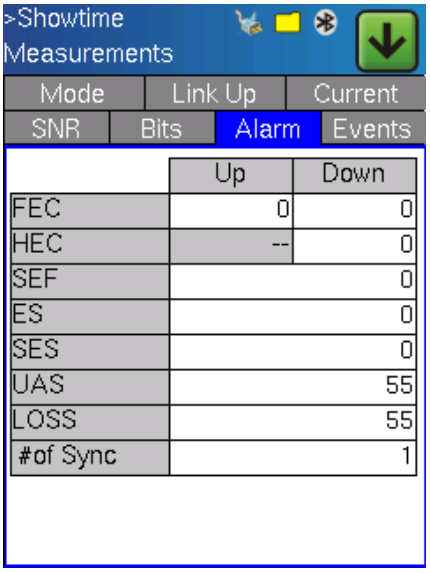
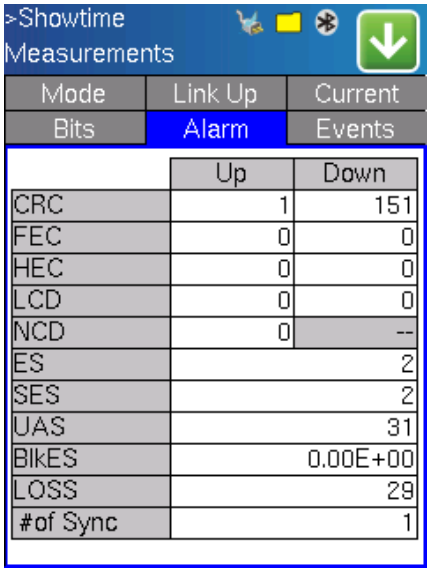
Alarm Tab: Displays the Line and Channel performance monitoring parameters (anomalies and errors). Alarm types recorded and displayed may vary between BX100A and BX100V models due to xDSL chipset differences and capabilities.

BX100V Alarms



BX100A Alarms



Alarm definitions:

Line Performance parameter definitions:

- **FEC Up and Down Stream (#)** - Count of near-end Reed-Solomon forward error correction anomalies for the interleaved or fast data-streams.
- **Errored Second (ES #)** - a count of 1-second intervals with one or more CRC-8 anomalies summed over all received channels, or one or more LOS defects, or one or more SEF defects, or one or more LPR defects.
- **Severely Errored Seconds (SES #)** - An Errored Second is any second containing one or more CRC anomaly, or one or more Los(s) or Severely Errored Frame (Sef) defect(s).
- **Unavailable Seconds (UAS #)** - a count of 1-second intervals for which the xDSL line is unavailable. The xDSL line becomes unavailable at the onset of 10 contiguous SES which are included in unavailable time. Once unavailable, the xDSL line becomes available at the onset of 10 contiguous seconds with no SES however these 10 seconds with no SES are excluded from unavailable time.
- **Loss of Signal Second (LOSS #)** - This parameter is a count of 1-second intervals containing one or more LOS defects.

Channel Performance monitoring definitions:

- **HEC Up and Down Stream (#)** - Count of near-end Header Error Control anomalies for the interleaved or fast data streams. A CRC algorithm is used for checking and correcting an error in the ATM cell header. ATM equipment checks for an error and if possible will correct it.
- **CRC Up and Down Stream (#) -** Received CRC-8 code word received does not match the code word transmitted. A count of the superframes that contained CRC
- **LCD Up and Down Stream (#)** - Count of near-end Loss of Cell Delineations for the interleaved or fast data streams. A LCD failure is reported if this counter has surpassed 127. An LCD state is declared after an OCD condition persists for 4 milliseconds. An OCD event is declared when seven consecutive ATM cells have Header Error Control (HEC) violations.
- **# of Sync** - Number of times the modem has spontaneously retrained

Note:
Alarms and Errrors detected will trigger the Alarm/Error LED. To reset the LED, press the reset key on the keypad

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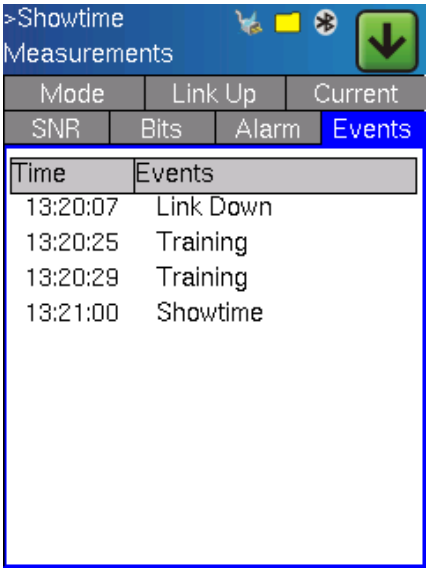
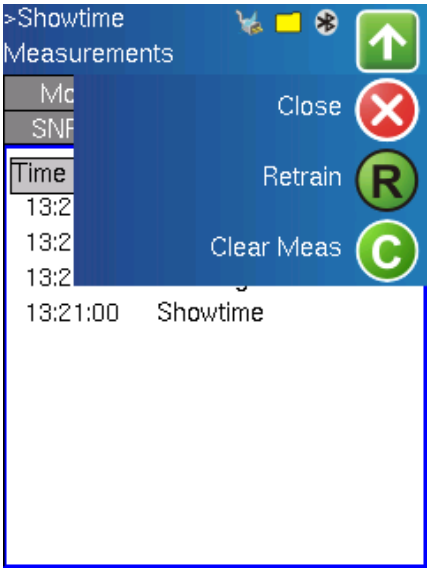
Events tab: Provides a time stamped record of all events that occur for the duration of the test.

BX100A/V Events Log Function **BX100A/V Measurement Action Menu**





Event types include Link Down, Training, Discovery, Handshake, Lost Frame, Bit Error, Showtime, FEC Error, Local CRC Error, LCD Error.

Note:
The Events function provides a time stamp of link status, alarms and error conditions.
The Events function can only be reset by closing or performing a retrain on the link under test.

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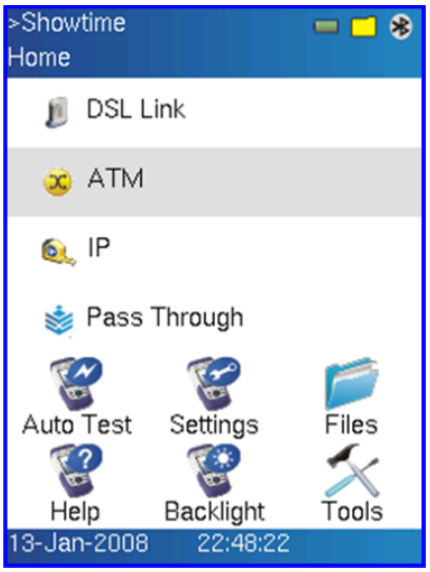
8.0 ATM Measurement Mode

Background: Asynchronous Transfer Mode (ATM) is a high speed Link Layer (Layer 2) network protocol and is used to provide access to the ADSL physical layer, for higher layer protocols such as PPP and TCP/IP.

- **ATM cells** - are transmitted as cells of equal size where each cell has 53 bytes, of which the first 5 bytes are the cell header, and the last 48 bytes are payload.
- **ATM channels** - an ATM network consists of a mesh of ATM switches that switch and direct cells according to their destination using Virtual Channels (VC). All switches along the path have information about the VC, including the direction to the next switch along the channel. Two parameters defining the VC, are logically bundled together into a virtual path.
    - **Virtual Path Identifier (VPI)** - There are fewer Virtual Paths in the network than Virtual Channels. Core switches forward cells on the basis of the VPI, looking the route up quickly in the relatively short list. There are fewer Virtual Paths in the network than Virtual Channels so switches forward cells on the basis of the VPI
    - **Virtual Channel Identifier (VCI)** - As a cell approaches its destination, switches forward it on the basis of its VCI in order to get it to its own unique destination.

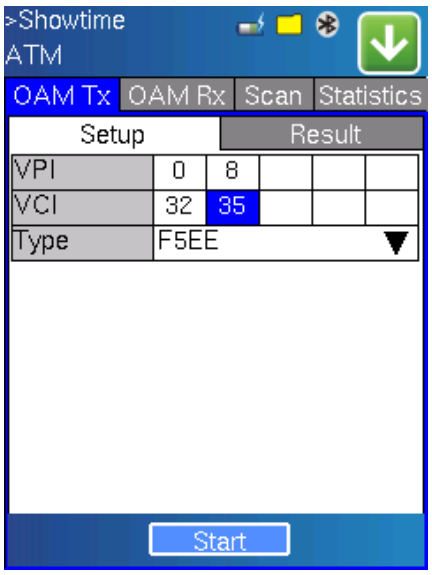
The **ATM Measurements** on the Home menu enables measurements related to the ATM layer and should be used only when showtime or DSL link-up has been achieved.

BX100A/V Home Menu - ATM

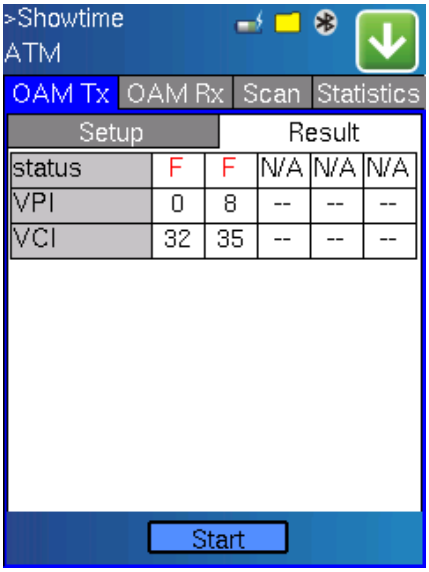


Testing is made possible provided using the Operation, Administration & Maintenance (OAM) functions of ATM networks. OAM controls the ATM alarm and circuit continuity and is important for monitoring ATM connections. OAM functions contain special cells to test and monitor different aspects of ATM network performance. Continuity Check cells are used to ensure reliable path connections while Loopback cells can be used to validate routing through a network. In an ADSL network or link, the ATM endpoints are typically the ATU-R and the BRAS.

BX100A/V - ATM OAM TX setup



BX100A/V - ATM OAM TX result



OAM Tx Setup tab - configures ATM Ping measurement based on different OAM cell types and VCC (VPI/VCI). The following OAM cell types are available;

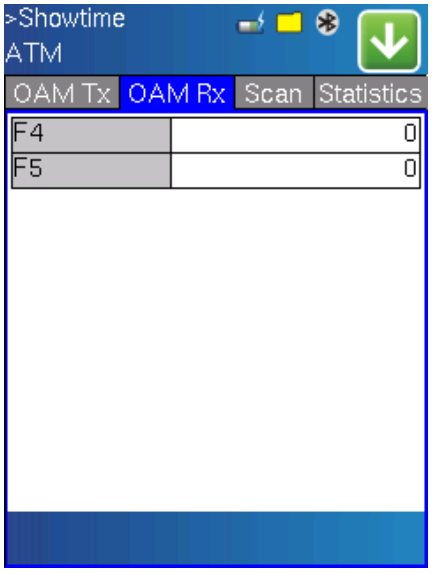
- F5EE - OAM F5 cell used to verify end-to-end connectivity from the modem (CPE) to the BRAS (Broadband Remote Access Server).
- F5SG - OAM F5 cell used for segmenting the ATM layer to isolate the location and nature of the fault.
- F4EE - OAM F4 cell used for controlling the entire connection.
- F4SG - OAM F4 cell used for controlling a single segment of the connection.

	Note: Operation, Administration, and Maintenance (OAM) OAM performs standard loopback (end-to-end or segment) and fault detection and notification

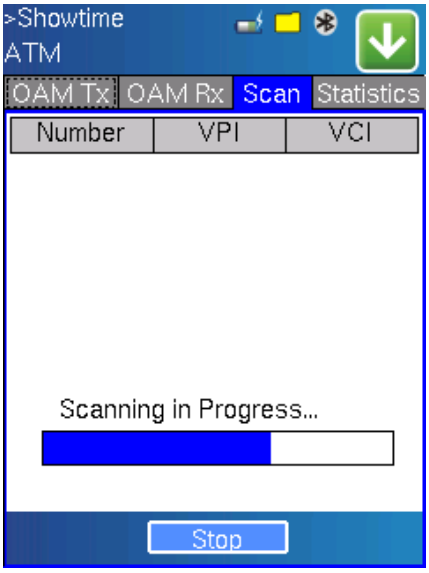
(alarm indication signal [AIS] and remote defect identification [RDI]) for each connection. In the BX100A/V, only loopback cells are used.

OAM Tx Result tab - displays the ATM Ping result for the corresponding VCC either as Pass (P) or Fail (F) in the status field.

BX100A/V - ATM OAM RX result



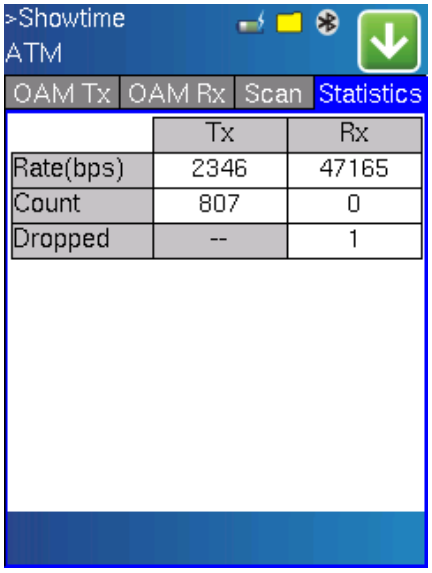
BX100A/V - ATM VCC Scan



OAM Rx tab - records the number of F4 and F5 OAM requests generated by network equipment or other test sets.

Scan Tab - performs a VCC scan at the point of connection and displays active PVCs in that section of the network. The feature helps identify missing VCCs and misconfigured switches. Both VPI and VCI values are displayed.

BX100A/V OAM Statistics



OAM Statistics tab - displays information on the traffic received and transmitted.

- Rate - rate at which ATM cells are transmitted and received
- Count - number of ATM cells transmitted and received
- Dropped - number of cells transmitted but not received

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9.0 IP Measurement Mode

The **IP** mode on the Home menu screen enables all the measurements and functions related to the IP layer on the DSL interface.

Setup tab: configures the following parameters;

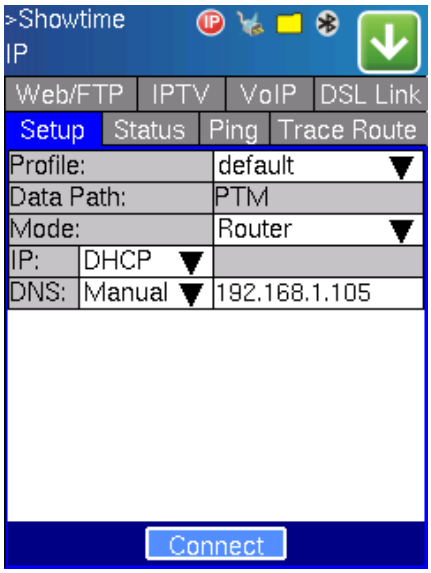
- **Profile** - option to use an existing stored setup or to create a new configuration
- **Data Path** - Preset on BX100V based on ATM or PTM selection
- **Mode** - select PPPoA, PPPoE, LLC-BRG or LLC-RTE
- **Encapsulation** - sets encapsulation type.
  - PPPoA - select between LLC or VC MUX. Complies with RFC2364.
  - PPPoE - select LLC. Comlies with RFC2516
  - LLC-BRG - select between LLC or VC based multiplexing
  - LLC-RTE - select between LLC or VC based multiplexing
- **Authentication** - select between PAP, CHAP or Auto (available in PPPoA and PPPoE modes only)
- **VPI** - Virtual Path Indicator. Enter value in the range of 0 to 255 using the pop-up keypad
- **VCI** - Virtual Channel Identifier. Enter value in the range of 32 to 65535 using the pop-up keypad
- **IP** - select Static or Dynamic. (available in PPPoA, PPPoE and LLC-BRG only)
- **IP Address and Gateway** - enter address using pop-up keypad. (available in IP Static mode only)
- **DNS** - Domain Name Server selections of Auto, On or Off.
- **User ID** - enter information using pop-up keypad
- **Password** - enter information using pop-up keypad

	Note: LLC versus VC MUX encapsulation. • **Virtual Channel Multiplexing (VCMux)** - multiple VCs are created so that different protocols can be sent over each VC. The receiver knows that all the packets arriving on a particular VC belong to a particular protocol therefore more bandwidth is available for data. • **LLC/SNAP** - only one VC is used. Extra headers are put into the front of data packets before they are passed to the AAL5 process. The main purpose of these headers is to hold a field that

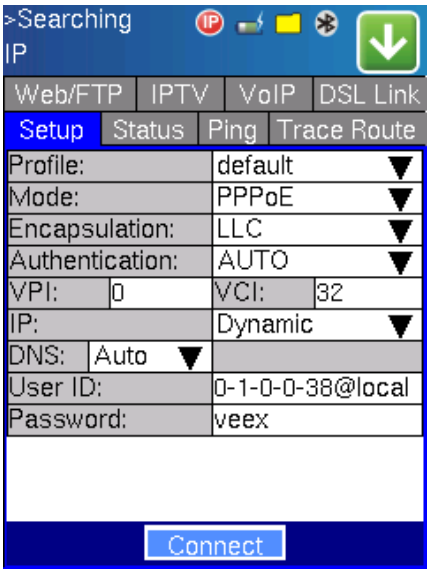
specifies the protocol type of the enclosed data packet.
RFC 1483 defines two different types of LLC/SNAP headers:

- **RFC 1483 Routed** - Only the Layer 3 protocol frame is encapsulated with an RFC 1483 header in the AAL5 frame. The modem forwards packets based on their IP addresses i.e. it routes packets.
- **RFC 1483 Bridged** - The whole Ethernet packet that arrives on the Ethernet side of the modem is encapsulated into AAL5 using the 'bridged-data' format defined in RFC 1483. The modem forwards packets based on their MAC addresses i.e. it bridges the packets.

BX100V IP Setup (PTM) mode



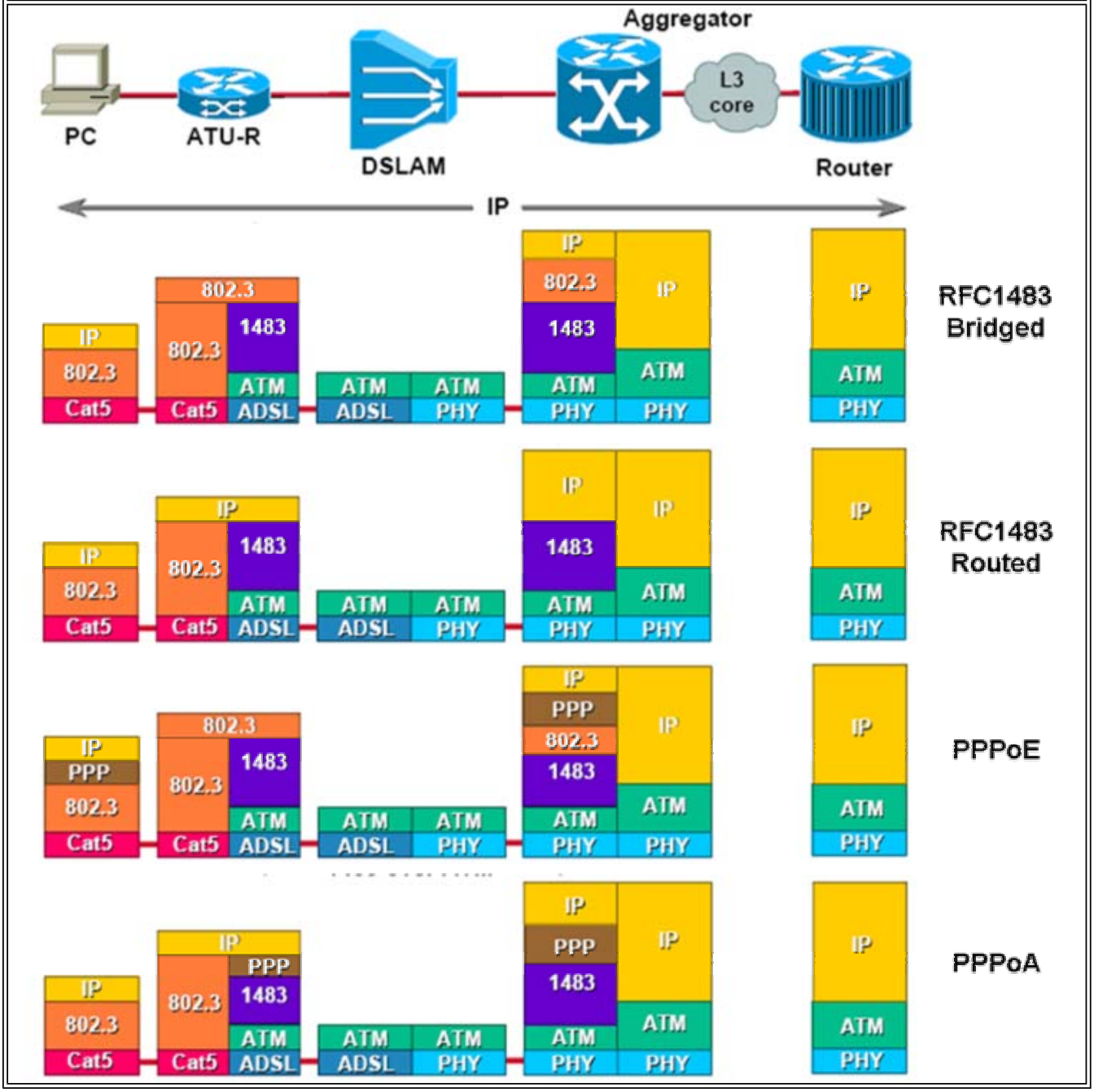
BX100A IP Setup (ATM) mode



Note: RFC Descriptions applying to DSL Protocols and Encapsulations

- **RFC2684, Multiprotocol Encapsulation over ATM LLC/SNAP** - two encapsulation methods for carrying network interconnect traffic over AAL type 5 over ATM. The first method allows multiplexing of multiple protocols over a single ATM virtual connection whereas the second method assumes that each protocol is carried over a separate ATM virtual connection.
- **RFC2516, Point-to-Point Protocol over Ethernet PPPoE** - provides the ability to connect a network of hosts over a simple bridging access device to a remote Access Concentrator by encapsulating PPP packets over Ethernet.
- **RFC2364, Point-to-Point Protocol over ATM PPPoA** - provides the ability to establish a point-to-point relationship between peers using ATM Adaptation Layer 5 (AAL5) for framing PPP encapsulated packets.
- **RFC2153, Point-to-Point Protocol** - provides a standard method for transporting multi-protocol datagrams over point-to-point links. PPP defines an extensible Link Control Protocol (LCP) for establishing, configuring, and testing the data-link connection; and a family of Network Control Protocols (NCPs) for establishing and configuring different network-layer protocols.
- **RFC1994, Challenge Handshake Authentication Protocol (CHAP)** - the next best password scheme over PAP—a three-way handshake using a public domain encryption algorithm to securely pass user information across the link to authenticate a user with the server.
- **RFC1994, Password Authentication Protocol (PAP)** - the basic internet password scheme—sends the user name and password in the clear to the server.

Common DSL Encapsulation Schemes



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10.0 Pass Through Mode

The **Pass Through** mode on the Home menu allows you to use the test set to emulate Customer Premise Equipment i.e. DSL modem. After configuring both the WAN (DSL) and LAN (Ethernet) interfaces and establishing valid connections on each interface, your PC will have connection to the Internet thus allowing you to perform a variety of data tests.

Setup: Configures the following parameters;

Function: Bridge or Router. When "Router" is selected, you are able to set additional WAN and LAN access parameters

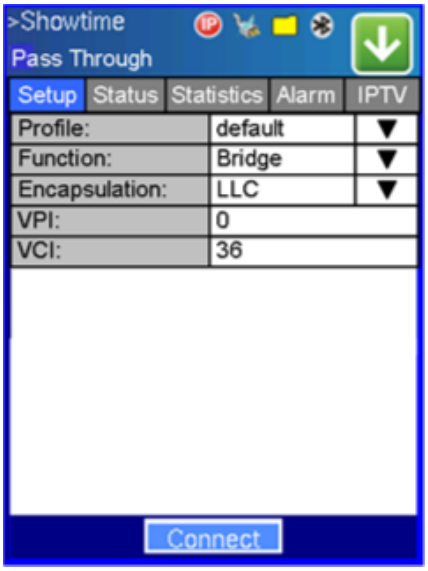
Bridge mode (ATM data path mode):

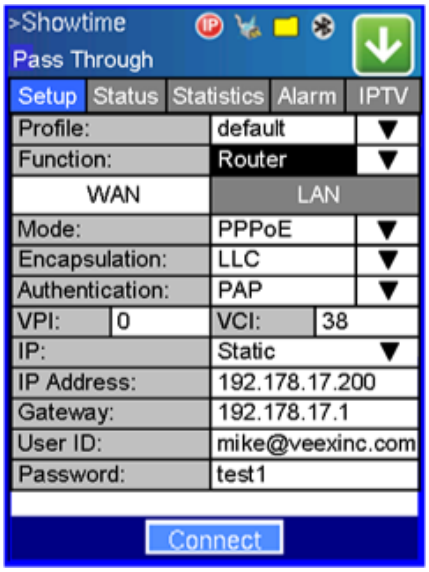
- **Encapsulation**:LLC-SNAP (logical link control-sub network address protocol) or VC-MUX (virtual channel multiplexed).
- **VPI:** Virtual Path Indicator. Enter value in the range of 0 to 255 using the pop-up keypad
- **VCI:** Virtual Channel Identifier. Enter value in the range of 32 to 65535 using the pop-up keypad

Router mode (ATM data path mode):
WAN settings:

- **Mode:** PPPoE, PPPoA or LLC Routed
- **Encapsulation:** LLC or VC MUX (available in LLC mode only)
- **Authentication:** PAP, CHAP or Auto (available in PPPoE and PPPoA modes only)
- **VPI:** Virtual Path Indicator. Enter value in the range of 0 to 255 using the pop-up keypad (available in ATM data path mode only)
- **VCI:** Virtual Channel Identifier. Enter value in the range of 32 to 65535 using the pop-up keypad (available in ATM data path mode only)
- **IP method**: Static or Dynamic.
  - In Static mode, you enter an IP address of the unit.
  - In Dynamic mode, the access concentrator or broadband remote access server assigns a temporary IP address to the unit
- **User ID:** Enter your username using the pop-up keypad
- **Password:** Enter your password using the pop-up keypad

BX100A Pass Through - Bridge mode **BX100A Pass Through - Router mode**





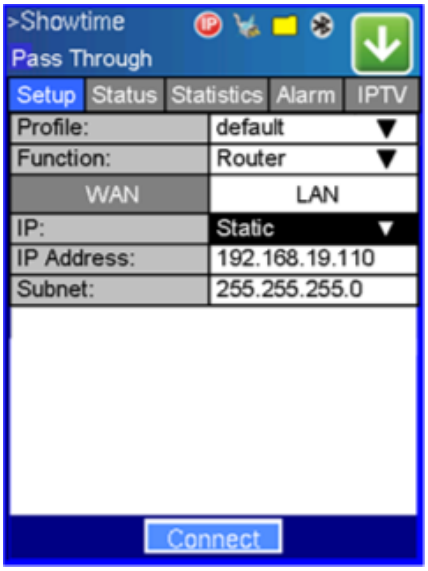
Note:
In the Settings menu on the Main menu, you are able to configure the test set to hide your **User name** and **Password** if needed.

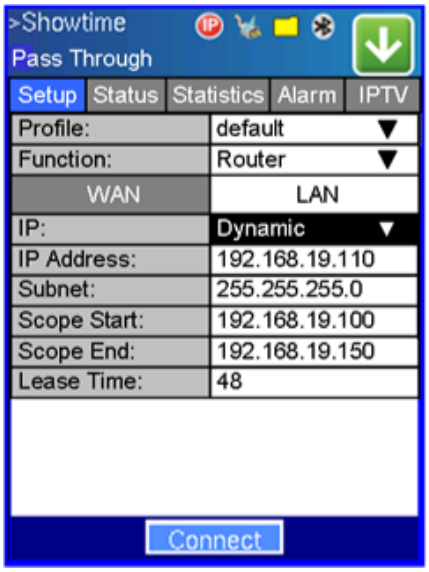
Router mode (ATM data path mode):
LAN settings: Allows you to configure the LAN parameters when connected to the tester's ethernet interface. Available only when the WAN interface is set to Router.

- **IP method:** Static or DHCP
  - DHCP enables the dynamic host configuration protocol (DHCP) mode
- **IP address:** Enter a value using the pop-up keypad
- **Subnet:** Network address to identify if the IP address falls within the local area network.
- **Scope start:** DHCP mode only. Starting range for IP address allocation. Enter a value using the pop-up keypad
- **Scope end:** DHCP mode only. Stopping range for IP address allocation. Enter a value using the pop-up keypad
- **Lease time:** DHCP mode only. Enter a "Hour" value using the pop-up keypad

Pass Through Setup - Router (LAN)

Pass Through Setup - Router (LAN)





Note:
The Pass-Through setup screen will vary based on the data path setting in the DSL link setup mode. ATM mode applies mostly to ADSL type connections while PTM mode applies mostly to VDSL2 network architecture.

Status: Displays the following results depending on IP method selected;

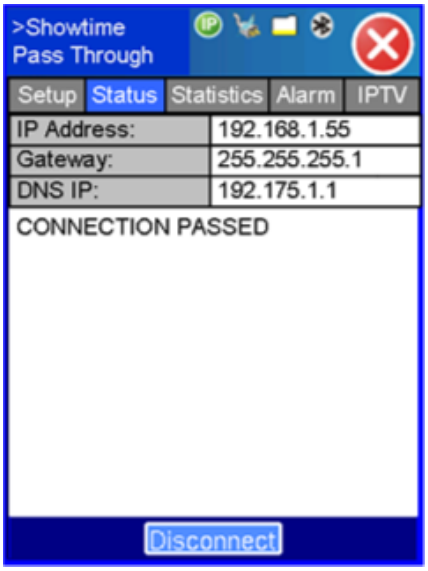
Static IP mode:

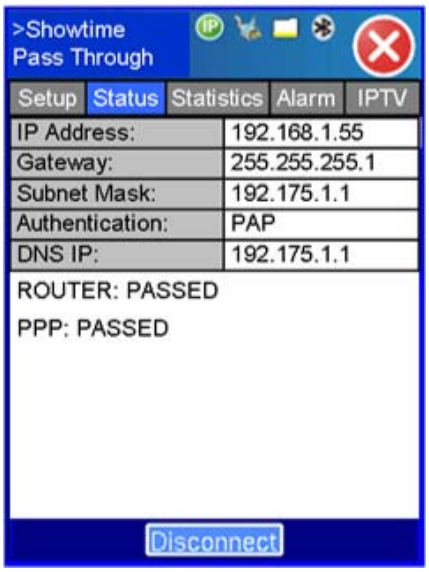
- **IP address:** Address of the network device or PC connected to the LAN port
- **Gateway:** IP address of default gateway
- **DNS IP:** Address of the Domain Name Server to be used by the tester
- **Result:** Connection Passed or Failed.

Dynamic IP mode:

- **IP address:** Address of the network device or PC connected to the LAN port
- **Gateway:** Address of Gateway
- **Subnet Mask:** Address of sub-net
- **DNS IP:** Domain Name Server address
- **Authentication:** PAP or CHAP (PPPoE or PPPoA only)
- **Result:**
  - Router connection status: Passed or Failed.
  - PPP session status: Passed or Failed

Pass Through Status - Router (Static) **Pass Through Status - Router (Dynamic)**





Statistics:: displays results associated with the DSL link (WAN connection) and IP packets and Ethernet frames from the PC connected to the LAN side of the tester which is acting as a modem.

DSL link statistics (page #1)

- **Connection status:** Connected or Not connected
- **Up Rate (bps):** attained rate for Upstream displayed in bit/s
- **Down Rate (bps):** attained rate for Downstream displayed in bit/s
- **Up Margin (dB):** Upstream noise margin expressed in dB (amount of noise measured on all active sub-channels in the upstream and relative to a noise level needed to maintain a BER of < 10EXP-7)
- **Down margin (dB):** Downstream noise margin expressed in dB (amount of noise measured on all active sub-channels in the downstream relative to a noise level needed to maintain a BER of < 10EXP-7)
- **Trained Modulation:** Operational mode achieved during negotiation and showtime.
- **LOS errors**: Error rate based on any Loss of Signal or Loss of Synchronization condition since the start of the test.
- **Up Attenuation (dB):** Upstream attenuation expressed in dB. Difference in the power level transmitted at the near end (modem) and received at the far end (DSLAM)
- **Down Attenuation (dB):** Downstream attenuation expressed in dB. Difference in the power level transmitted at the near end (modem) and received at the far end (DSLAM)

IP statistics (page #2) BX100A models only

- **Bytes:** number of bytes associated with the IP packets
- **Packets:** IP packets transmitted and received
- **Bad packets:** IP packets in error

IP statistics (page #2) BX100V model only

- **Packets:** IP packets transmitted and received
- **Errors:** IP packets in error
- **Dropped:** IP packets dropped
- **Bytes:** number of bytes associated with the IP packets

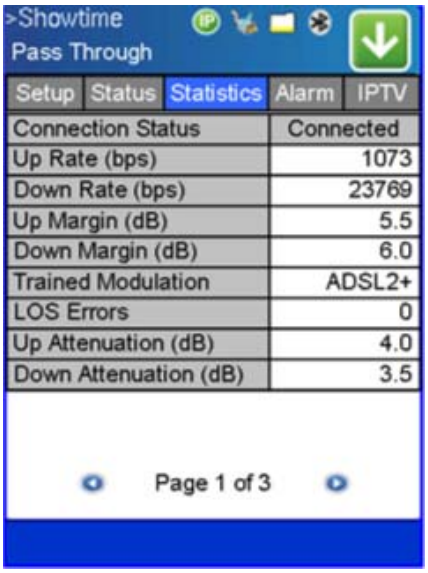
Cell statistics: (page #3) - BX100A models only

- Cells: Number of ATM cells transmitted and received
- Dropped cells: Number of ATM cells dropped by the receiver

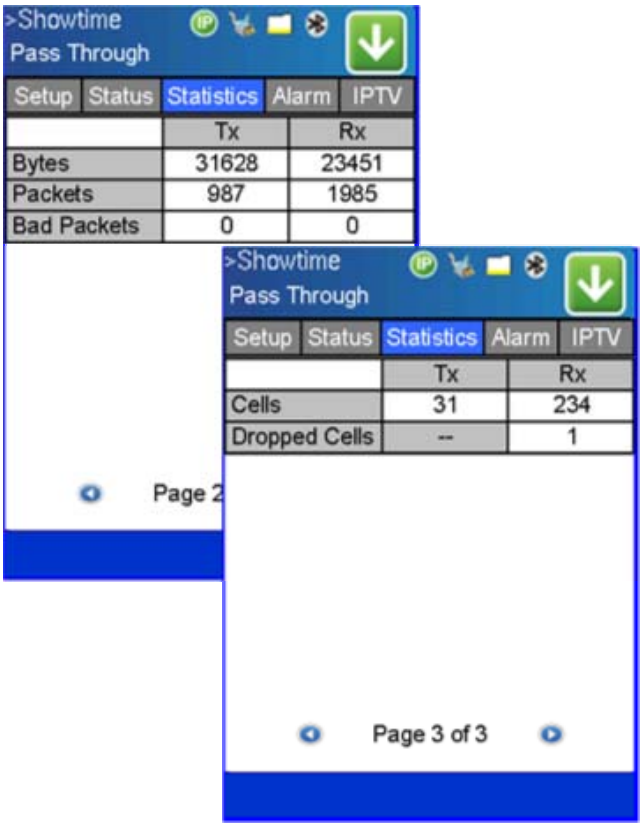
Frame statistics: (page #3) - BX100V models only

- Frames: Ethernet frames transmitted and received
- Errors: Ethernet frames in error (FCS or CRC)
- Dropped: Number of ethernet frames dropped by the receiver

Pass Through mode - DSL link statistics

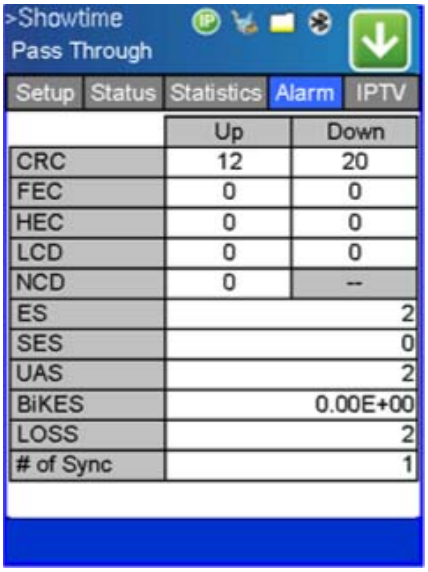


Pass Through mode - ATM & IP statistics



Alarm: displays the anomalies associated with the DSL link or line connection conditions. (Alarm types may vary from BX100A and BX100V models).

Pass Through - Alarms



- **CRC:** Count of the superframes that contained CRC
- **FEC:** Count of near-end Reed-Solomon forward error correction anomalies for the interleaved or fast data-streams.
- **HEC:** Count of near-end Header Error Control anomalies for the interleaved or fast data streams.
- **LCD:** Count of near-end Loss of Cell Delineations for the interleaved or fast data streams.
- **NCD:** Declared when a No Cell Delineation (NCD) anomaly persists for more than 2.5 ± 0.5 s after the start of SHOWTIME.
- **ES:** Count of errored seconds which are 1-second intervals containing one or more CRC-8 anomalies summed over all received sub-channels, or one or more LOS defects, or one or more SEF defects, or one or more LPR defects.
- **SES**: Count of severely errored seconds. An SES is declared when, during a 1-second interval, there are 18 or more CRC-8 anomalies in one or more of the received sub-channels, or one or more LOS defects, or one or more SEF defects, or one or more LPR defects.
- **UAS:** Count of Un-Available Seconds whihc are 1-second intervals for which the xDSL line is unavailable. The xDSL line becomes unavailable at the onset of 10 contiguous SES which are included in unavailable time.
- **BlKES:** Count of the Block Error Rate
- **LOSS:** Count of 1-second intervals containing one or more LOS defects.
- **# of Sync:** Number of times the modem spontaneously retrained

IPTV: The tab allows you to configure the following parameters;

Setup:

- **Channel Table** - Select the IPTV channel table to test. The IPTV channel table can be configured manually on the test set or defined using the Editor function. Alternatively, the IPTV channel table can be created using the Reveal BX software an downloaded onto the test set.
- **Channel #** - Select and configure the channel to be analyzed. Up to three channels or streams (Multicast or Unicast) can be analyzed simultaneously. The channel can be in IP address or URL format.

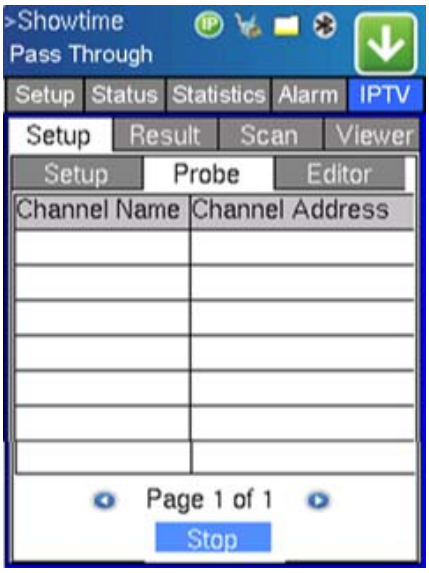
Note:

Probe:

- Channel Name
- Channel Address

Pass Through - IPTV Setup

Pass Through - IPTV Probe



Editor:

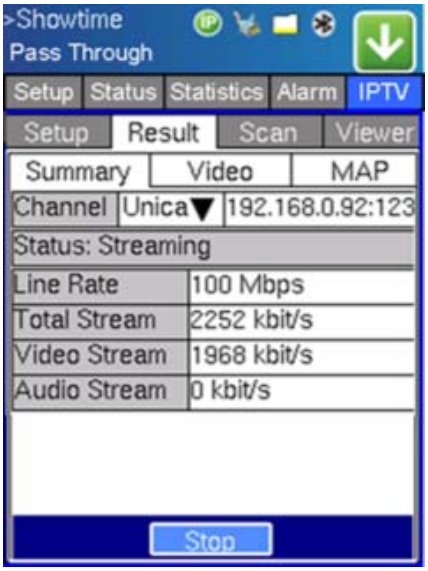
IPTV Summary tab: displays the following results - Status should indicate Streaming.

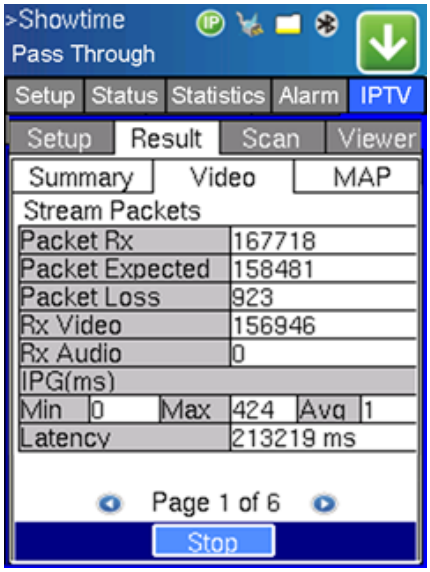
- Line rate is either the Ethernet line rate or the DSL link-up rate if in DSL terminated mode.
- Total stream are the packets associated with the video and audio content of the TS stream
- Video stream are the packets associated with the video content
- Audio stream are the packets associated with the audio content

	Note: IPTV Stream Analysis Up to three streams can be analyzed and the bandwidth associated with the whole TS is displayed. Video streams typically consume more bandwidth than audio streams, which in turn use more bandwidth than data streams. In this document, MPEG-2 refers to the video transport stream defined in IEC13818 standard and not any compression technology used in the payload or transport packet. The MPEG-2 Transport stream contains seven packets of 188bytes each which transports either the MPEG-2, MPEG-4 or VC-1 encoded video.

Pass Through - IPTV Summary

Pass Through - IPTV Results (1)





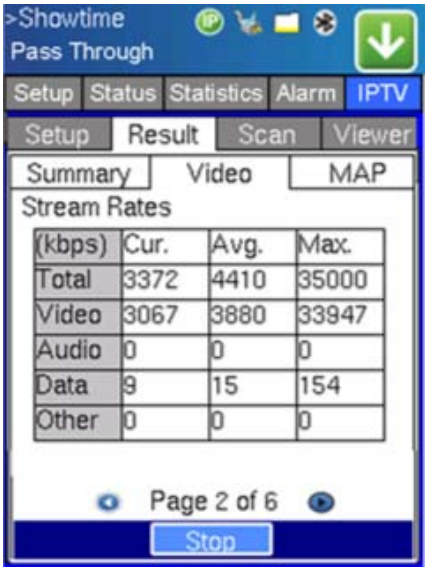
IPTV Result Video (Page #1) displays the following results;

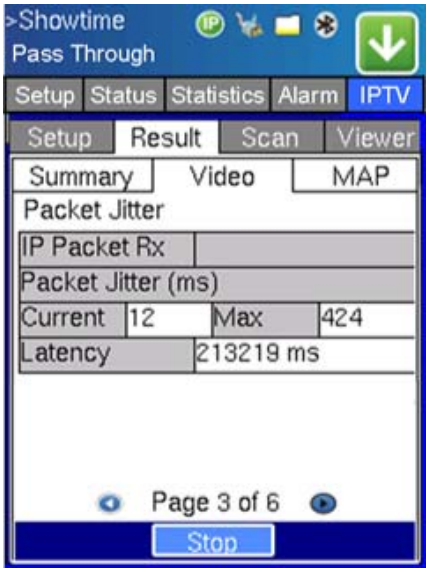
- **Packet Rx** - is the (total number of packets received) - Packet loss (total number of packets lost)
- **Packet loss** - measured by analyzing video packet flows and determining the presence of a continuity error event. Because each video packet carries a sequence number, continuity errors can be determined easily. Missing, OOS and duplicate packets are counted as errors. Packet loss is typically seen on all channels arriving at the customer, because they are not source or content related problems. Analysis of the DSL or Ethernet physical layer normally determines the problem area. Packet loss impacts video quality and leads to highly visible errors. When lost packets contain I-frames, the impact will be more pronounced because the STB has to wait for the next Iframe to "reset" itself. H.264 encoding which uses a longer Group of Pictures (GOP) structure aggravates problems because higher compression contains more information. Consequently, the loss of a single H.264 frame will likely have a greater impact on picture quality.

	Note: IPTV Network Performance Due to the real-time nature of IPTV, MPEG-2 is transported over UDP (IPv4/UDP), hence retransmission or re-ordering of packets is not intended. Video quality is largely determined by network performance parameters including Packet loss, Packet jitter and IGMP latency.

Pass Through - IPTV Results (2)

Pass Through - IPTV Results (3)





IPTV Result Video (Page #2) - displays the **Stream Rate** results;

- Table provides individual bit rate statistics for each stream;
  - Total is the total number of bytes related to the Video, Audio and Data payloads
  - Video is the number of packets classified as video packets
  - Audio is the number of packets classified as audio packets
  - Data is the number of packets classified as data packets
  - Other is the number of packets classified as unknown packets

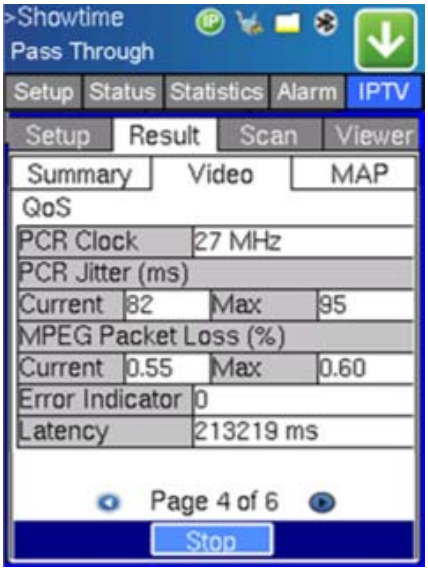
IPTV Result Video (Page #3) - displays the **Packet Jitter** results;

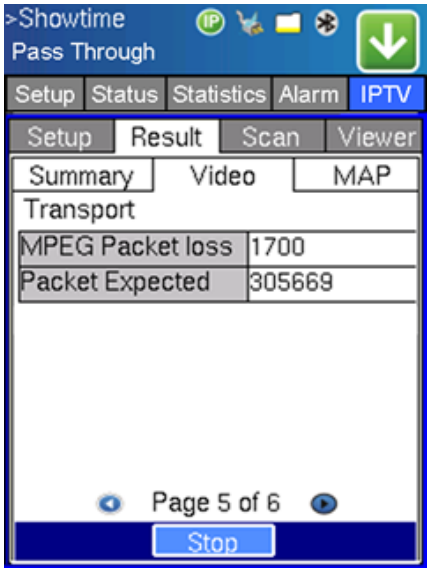
- Packet Jitter displayed in milliseconds.
- Current is the current jitter value
- Max is the maximum jitter value

	Note: Packet Jitter This measurement is based on the data packet inter-arrival time which is a measure of packet arrival variance. Packet jitter affects packet arrival throughout the network. Variations lead to buffer under / overflows at the receiving equipment e.g. STB. Jitter impacts the way packets are handled at various net work elements i.e. If the jitter is too high, packet loss will increase as queuing software tries to load balance traffic at network elements. Packet jitter should not be confused with PCR jitter (described below). When Packet jitter is present, the cause is normally related to the Ethernet physical layer. When PCR jitter is present, then the cause is most likely related to the program flow and could be related to an encoder not performing to specification.

Pass Through - IPTV Results (4)

Pass Through - IPTV Results (5)





IPTV Result Video (Page #4) - displays the **Quality of Service (QOS)** results;

- **PCR Clock** - Presence of 27MHz Program Clock Reference
- **PCR Jitter** - PCR deviation in (ms)
- **MPEG Packet Loss** - continuity error (%)
- **Latency** - the time to complete a program change measured in milliseconds (ms)

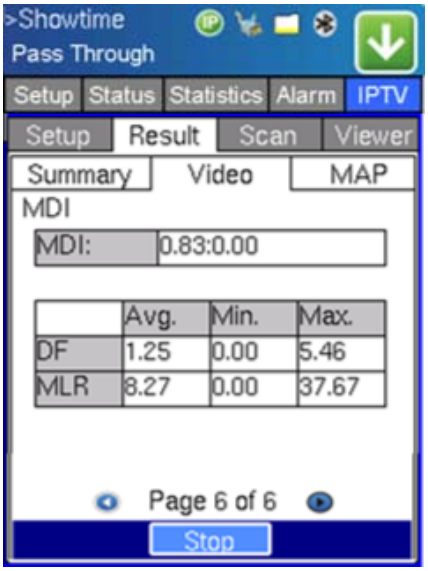
Note: Program Clock Reference (PCR)
MPEG TS normally contain a built-in timing packet known as the Program Clock Reference (PCR). Recovering the 27 MHz clock at the decoder end of the transmission system is necessary to re-create the video signal. The PCR values need to be correct at the signal origin and should not be distorted along the transmission path to a point where decoding the compressed signal becomes problematic. Measuring the interval between the arrival of PCR values, the accuracy of the expected values and also the jitter accumulated on those PCR values transmitted is necessary to assure that streams can be decoded. PCR jitter is a good indication of timing distortions due to poor encoding. Excessive PCR jitter results in visual impairments such as frame freezes, color loss and pixelization. The amount of PCR jitter that is considered excessive varies, and depends on various factors including STB buffer sizes and software architecture. However, in today's packetized video networks, PCR jitter should not exceed 10 ms. If PCR jitter is not constant, then a momentary problem from inserting local programming may be the cause.

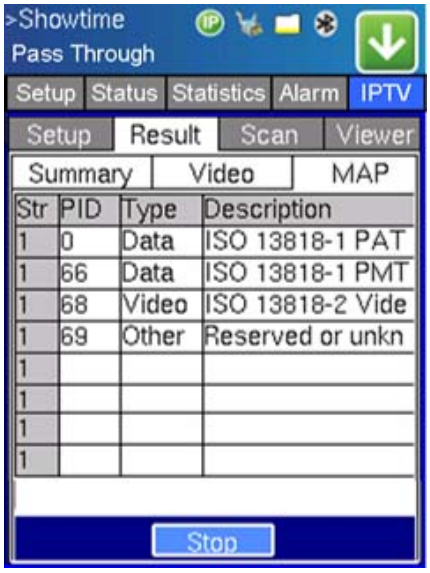
IPTV Result Video (Page #5) - displays the **Transport** results;

- MPEG Packet Loss
- Packets expected

Pass Through - IPTV Results (6)

Pass Through - IPTV Results (MAP)





IPTV Result Video (Page #6) - displays the **Media Delivery Index (MDI)** results;

- **MDI (Media Delivery Index)** - value in a ratio
- **DF (Delay Factor)** - Average, Minimum and Maximum values. Also defined as cumulative IP jitter, it represents the time it would take to drain an output buffer and ensure good video playback.
- **MLR (Media Loss Rate)** - Average, Minimum and Maximum values. Alos defined as the packet loss rate due to dropped packets, bad/corrupted packets, or out-of-sequence packets.

	Note: Media Delivery Index (MDI) Defined by RFC4445 is the only standardized video quality metric available today. MDI quantifies two IP transport impairments, namely Packet Jitter or Delay and Packet Loss. These test parameters are defined as Media Delay Factor (MDI-DF) and Media Loss Rate (MDI-MLR). The Delay Factor (DF) indicates how long a data stream must be buffered at its nominal bit rate to prevent packet loss. It gives a general idea of network jitter using the DF measurement. The MDI-DF can give a measure of congestion in a network, by showing utilization level, and detect if queuing is happening in network components, but it does not indicate how much of this is due to video packet bunching. The Media Loss Rate (MLR) is the number of packets lost during a 1 second period. MDI is expressed as a ratio namely; Delay Factor : Media Loss Rate, e.g. 70:15 The above ratio shows a delay factor of 70ms and 15 packets lost per second. MDI and MPEG packet loss together provides a good indication of IP transmission and non related IP issues.

IPTV Result MAP:

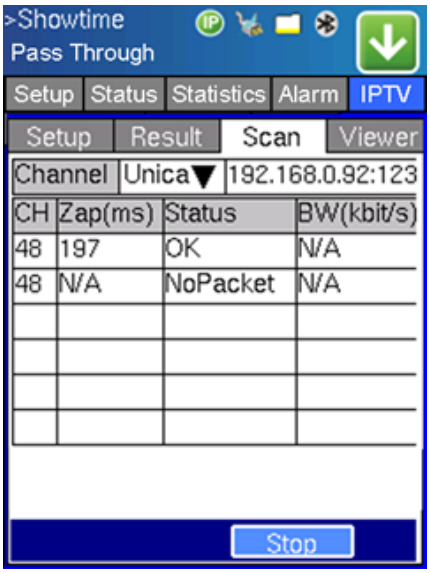
The MAP table provides a summary of the stream composition and the programming present.

- **Str** - Indicates stream number
- **PID** - Packet Identifier is a unique channel address identifier. PID enables identification and reconstruction of the programme and is used in conjunction with the Programme Service Identifier (PSI) packets. The decoder uses the PID and PSI to identify the Programme Association tables (PAT). PAT contain Program Map tables (PMT) that point the decoder to the packets associated with the channel or programme such as video, audio and data content in the transport stream.
- **Type:** Payload description
- **Description:** PID description on a per stream basis

	Note: MPEG-2 Transport Stream (TS) A Packetized elementary stream (PES) is a continuous traffic stream of 188-byte packets carrying the digital signal. Since single/multiple programs can be carried per stream, a reference point from which the STB can synchronize and start the actual decoding from, must be provided. Each 188-byte packet consists of a 4-byte header containing this reference point which is a PAT table and a PID value equal to 0. The Packet Identifier

(PID) contained within the 4-byte header, is a unique channel address identifier allowing identification and reconstruction of the program. The PID is used in conjunction with the Program Service Identifier (PSI) to identify Program Association Tables (PAT) which in turn hold Program Map Tables (PMT). The PAT table is also the table containing all program information ensuring the consumer receives updated program changes. The PAT table lists all the programs in the transport stream and associates each program with another PID, that holds a program map table (PMT) as its payload. PMT lists the Video, audio and eventual encryption information. The Payload Structure Identifier (PSI) table needs to be consistent with the PID table. PAT and PMT are inserted into the stream so that the decoder performs correctly. These two items should always be present.

Pass Through - IPTV Scan

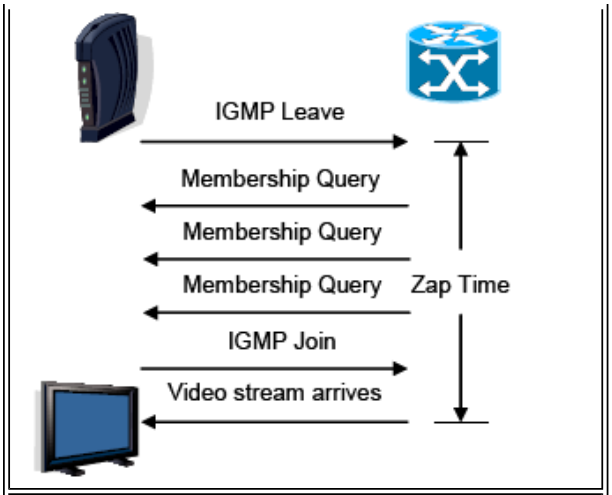


Pass Through - IPTV Viewer

IPTV Scan - displays the **Scan** results;

- **Channel** - Channel number being scanned
- **Zap time (ms)** - Also known as inter-channel change delay. Time between a channel leave request is sent and the receipt of the first byte of data from the new multicast channel. It is the IGMP Join Latency + Channel Switch Delay (STB dependent). Channel zapping should be < 700ms.
- **Status** - OK, no packet, Fail
- **Bandwidth** - bandwith associated with the stream

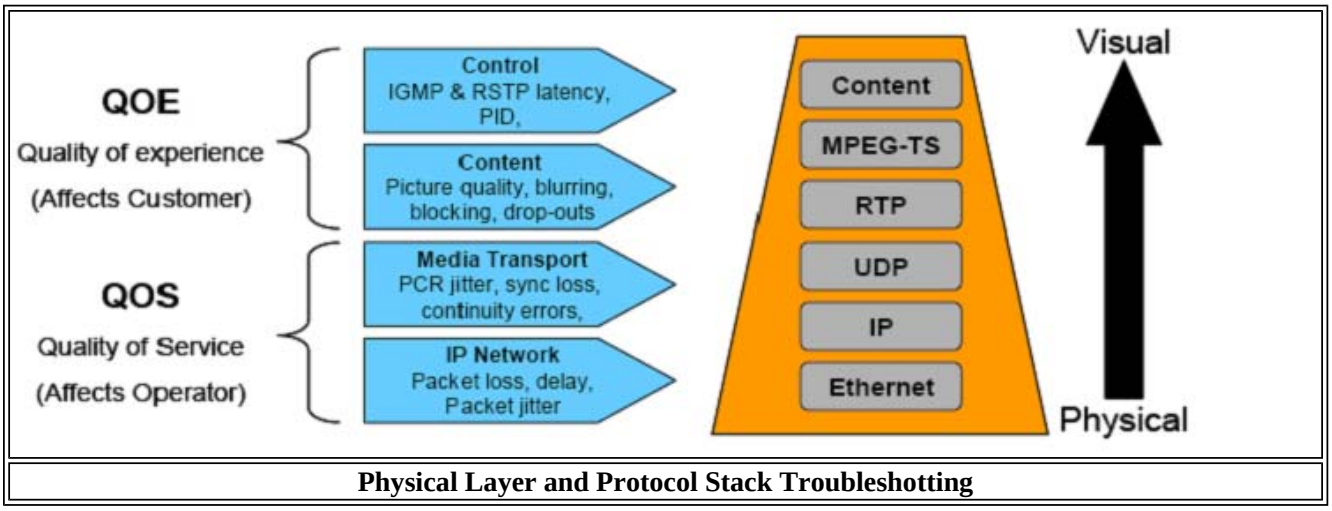
Note: IGMP and Channel Zapping
A signaling protocol that enables each STB to obtain only the programming that the viewer is interested in watching, thereby conserving bandwidth in the access network as a result. STBs use IGMP to change channels, by leaving and joining multicast groups representing channels. Key to IPTV QoE, is how fast and reliably end users can change TV channels, also known as "channel zapping". Essentially it is calculated as the time taken between sending a channel leave request and receiving the first video data of the new video stream.
Refer to DSL Forum TR-126 Triple Play Quality of Experience (QoE) requirements



IPTV Zapping Overview

IPTV Viewer - displays the Picture and is useful as a channel identifier.

- Channel - Unicast or Multicast including IP address and UDP port #
- Status – Decoding please wait. Please allow 20-30 seconds for buffering and decoding to occur.



Physical Layer and Protocol Stack Troubleshotting

	Note: Video Stream QoE comprises; - Quality of the Network Delivery System - Quality of the Encoding Components to the Network - Quality of the Decoder from the Network - Human Factors - per unit time

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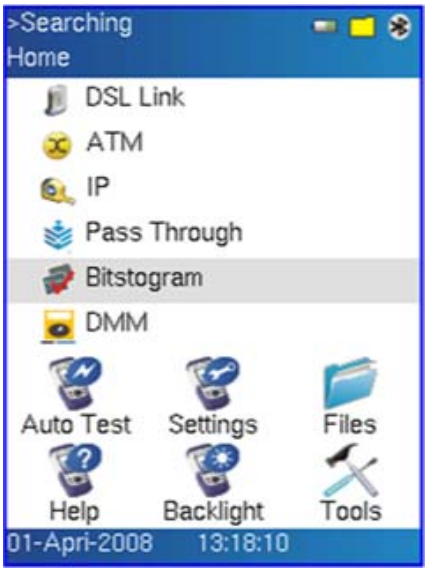
11.0 Bitstogram Measurement Mode

The Bitstogram software option is available for both BX100A and BX100V models. The Bitstogram function can be

accessed via the Home menu. The Bitstogram option is similar to the Bits/Tone mode in terms of capability, except that a Histogram function has been added allowing the user to view and analyze DMT bit swapping occuring over a period of time as a result of noise, interference and cross-talk conditions.

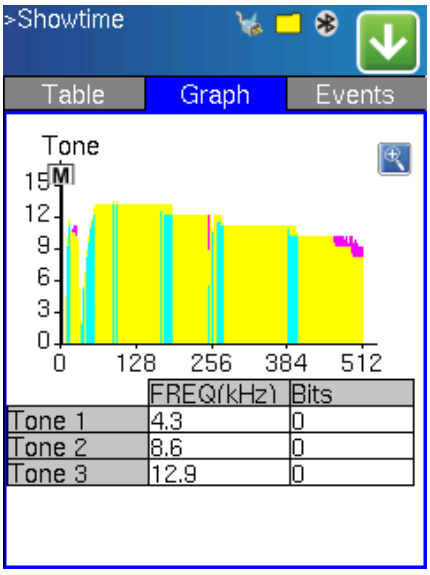


Bitstogram Graph Tab - Displays Bits/Tone assignment of the various DMT sub-carriers. The graph mode is color coded as follows;

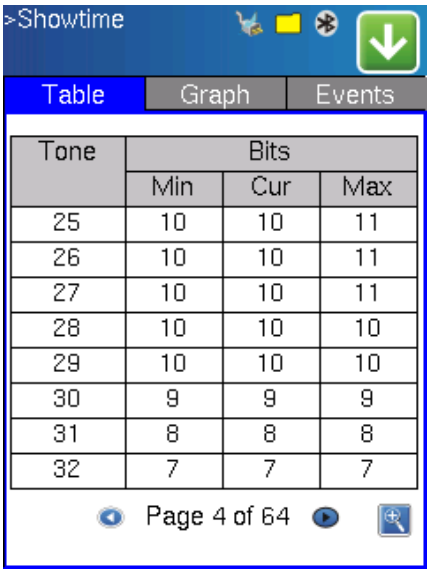
- Yellow - Tones where no bit swapping has occurred
- Tourquoise - Tones where bit swapping has occured with new lower value
- Magenta - Tones where bit swapping has occured with new maximum value

Bitstogram Table Tab - Displays Bits/Tone assignment of the various DMT sub-carriers in a tabular format. A zoom function allows fast and easy access to known tones.

BX100A/V Bitstogram Graph Mode



BX100A/V Bitstogram Table Mode

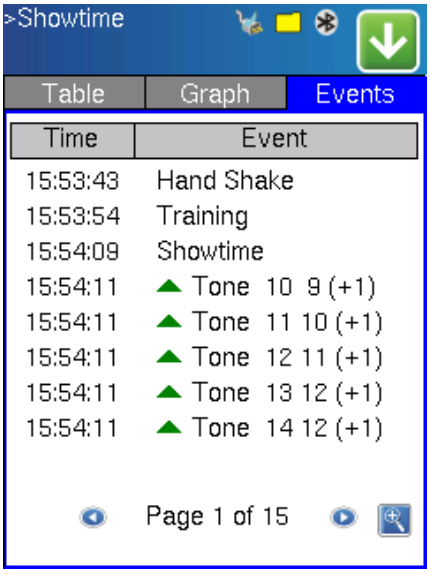


Bitstogram Events Tab - Displays bit swapping associated with DMT sub-carriers affected by noise, crosstalk and interference only. Tones not affected by bit swapping are not recorded. To simplify viewing and analysis, green and red color coded arrows are provided;

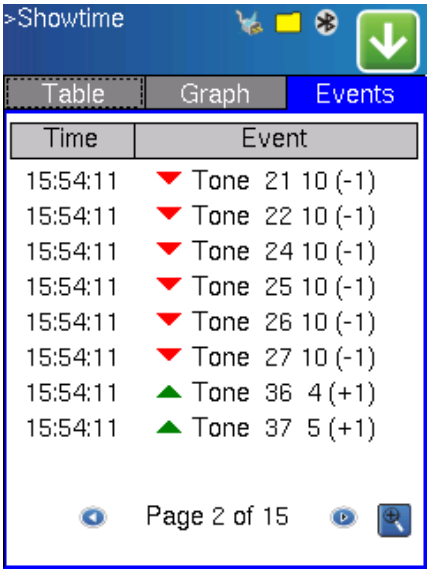
- Green arrow - indicates increased bit loading value and time bit swap occurred
- Red arrow - indicates decreased bit loading value and time bit swap occurred

A bit swapping history of all affected tones is possible using paging function or zoom function.

BX100A/V Bitstogram Events Mode



BX100A/V Bitstogram Events Mode



Note: Discrete Multi-Tone (DMT) and Bit Swapping:
Dividing the available bandwidth into independent, orthogonal subchannels is the key to DMT performance. By measuring the SNR of each subchannel and assigning bits based on its quality, data will be transmitted on subcarriers with good SNRs, while regions of the frequency spectrum that are too noisy or severely attenuated will be avoided. DMT allocates from 2 to 15 bits per channel (bin). As line conditions change, bit swapping allows the modem to swap bits to different channels without retraining.

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12.0 DR.DSL Loop Diagnostics (future option)

VDSL2 has a loop diagnostic mode and Dual Ended Line Test (DELT) funstion similar to that defined for ADSL2/+ systems. VDSL2 transceivers can measure line noise, loop attenuation, and signal-to-noise ratio (SNR) at each end of the line. Measurements can be obtained even when line conditions are so bad that a connection isn't even possible. If a connection isn't possible, the modem goes through each step of initialization but with improved robustness in order to exchange the test parameters.

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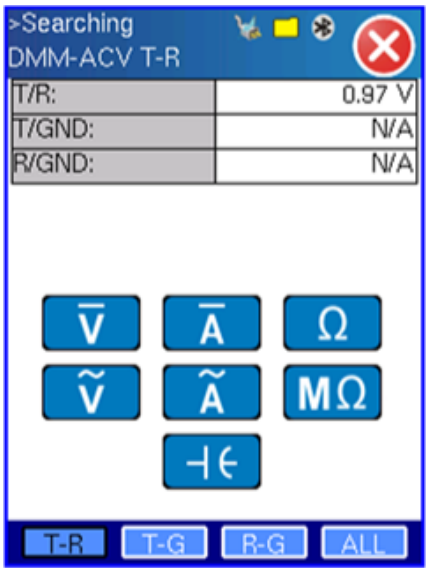
13.0 Digital Multi-Meter (DMM) (Option for BX100A models only)

The following Voltage measurements are supported by the BX100A DMM option;

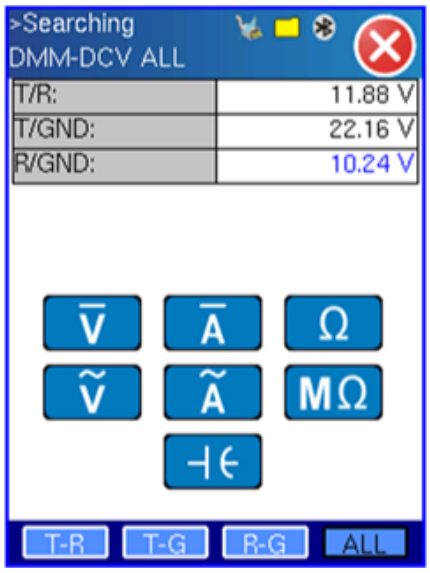
- **AC Voltage** - check for unwanted power influence which is generally caused by induction from power lines running in close promixity to the copper pair or by poor grounding. The power influence test measures the voltage and noise levels related to either 50Hz or 60 Hz interference.
- **DC Voltage** - verify the presence of POTS or ISDN voltages. An Annex A (ADSL over POTS) circuit is

powered by 48-VDC while an Annex B (ADSL over ISDN) loop is powered by 90-VDC or higher voltages depending on various regulations. Running a DCV measurement verifies that the cable pair is connected and properly powered by the POTS switch or ISDN Line Termination (LT).

DMM - AC Voltage measurement



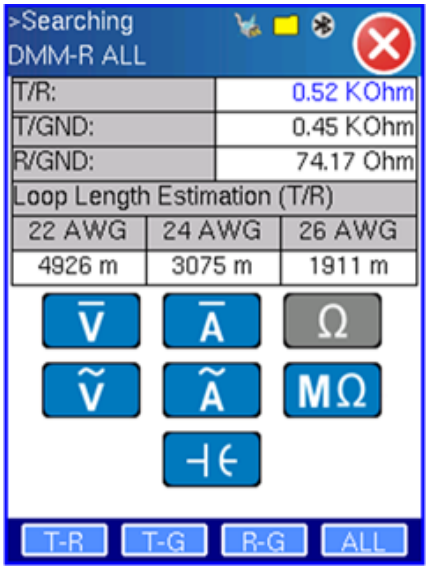
DMM - DC Voltage measurement



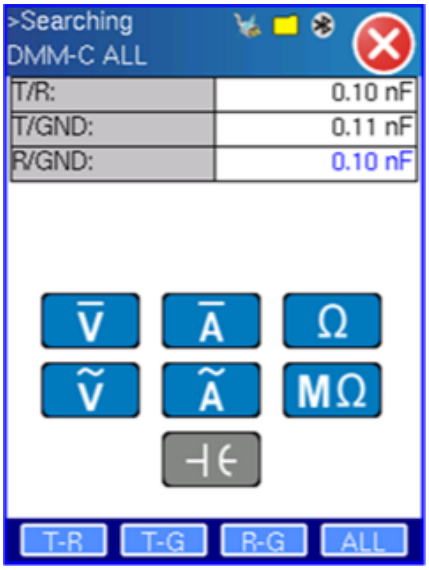
The following Resistance and Capacitance measurements are supported by the BX100A DMM option;

- **Resistance - v**erify that adequate isolation resistance exists between Tip-Ground (T-G) and Ring-Ground (R-G) when the pair has an open at the far end. A loop resistance measurement can provide an estimate loop length if the pair is shorted at the far end. ADSL loop resistance (tip-ring with a short at the far end) should not exceed 600 Ohms.
- **Capacitance** - a measurement will verify that a copper pair is balanced i.e. both the Tip and Ring leads are of equal length. If one of the leads is longer than the other, this is indicative of a split pair which is common MDF wiring mistake.

DMM - Resistance measurement



DMM - Capacitance measurement



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14.0 Common Functions

The following common functions are described in the Common Functions E-Manual

14.1 Auto Test

The Auto Test function is not implemented and is reserved for future test capability.

14.2 Settings

14.3 File

14.4 Help

14.5 Backlight

14.6 Tools

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15.0 Warranty and Software

Warranty Period: The warranty period for hardware, software and firmware are three (3) years from the date of shipment to the customer. The warranty period for battery pack, LCD, LCD touch panel, LCD protective cover, and accessories (including but not limited to patch cords, AC adaptor, SFP, USB adaptors, carrying case, carrying pouch) is limited to one (1) year.

Hardware Coverage: VeEX Inc warrants hardware products against defects in materials and workmanship. During the warranty period, VeEX will, at its sole discretion, either

- Repair the products
- Replace the hardware which prove to be defective

provided that the products that the customer elects to replace is returned to VeEX Inc by the customer along with proof of purchase within thirty (30) days of the request by the customer, freight prepaid.

Software Coverage: VeEX Inc warrants software and firmware materials against defects in materials and workmanship. During the warranty period, VeEX will, at its sole discretion, either

- Repair the products
- Replace the software and/or firmware which prove to be defective

provided that the products that the customer elects to replace is returned to VeEX Inc by the customer along with proof of purchase within thirty (30) days of the request by the customer, freight prepaid.

Additionally, during the warranty period, VeEX Inc will provide, without charge to the customer, all fixes, patches and enhancements to the purchased software, firmware and software options. VeEX Inc does not warrant that all software or firmware defects will be corrected. New enhancements attached to a software option require the option to be purchased (at the time of order or the time of upgrade) in order to benefit from such enhancements.

Limitations: The warranty is only for the benefit of the customer and not for the benefit of any subsequent purchaser or licensee of any merchandise (hardware, software, firmware and/or accessories)

Revoking the warranty: VeEX Inc does not guaranty or warrant that the operation of the hardware, software or firmware will be uninterrupted or error-free. The warranty will not apply in any of the following cases:

- Improper or inadequate maintenance by the customer
- Damage due to software installed by the customer on the unit without prior authorization (written) from VeEX

Inc.
- Unauthorized alteration or misusage
- Damage occurred from operating the unit from outside of the environmental specifications for the product
- Improper installation by the customer

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16.0 Product Specifications

BX100A Models - Click here

BX100V Model - Click here

Note: Product Specifications
The most recent product specifications can be downloaded from the VeEX website.
For the most recent version, click here

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17.0 Certifications and Declarations

What is CE?

The CE marking is a mandatory European marking for certain product groups to indicate conformity with the essential health and safety requirements set out in European Directives. To permit the use of a CE mark on a product, proof that the item meets the relevant requirements must be documented.
Use of this logo implies that the the unit conforms to requirements of European Union and European Free Trade Association (EFTA). EN61010-1

Click here for CE Declaration of Conformity relating to VeEX products

ROHS Statement

What is RoHS?

RoHS is the acronym for Restriction of Hazardous Substances. Also known as Directive 2002/95/EC, it originated in the European Union and restricts the use of specific hazardous materials found in electrical and electronic products. All applicable products imported into the EU market after **July 1, 2006** must pass RoHS compliance.

Click here for ROHS Statement relating to VeEX products

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18.0 About VeEX

VeEx Inc, the Verification EXperts, is an innovative designer and manufacturer of test and measurement solutions addressing numerous technologies. Global presence through a worldwide distribution channel provides uncompromised product support.

Visit us online at www.veexinc.com for latest updates and additional documentation.

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