USER MANUAL

VePAL TX130M+

DSn/PDH, Ethernet Analyzer

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1.0 Introduction

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.

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2.0 About This Guide

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 TX130M+. It is assumed the user has basic computer experience and skills, and is generally familiar with Cable TV 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 e-mail 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.

Customer Care:

Phone: + 1 510 651 0500
E-mail: customercare@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 Operations

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.

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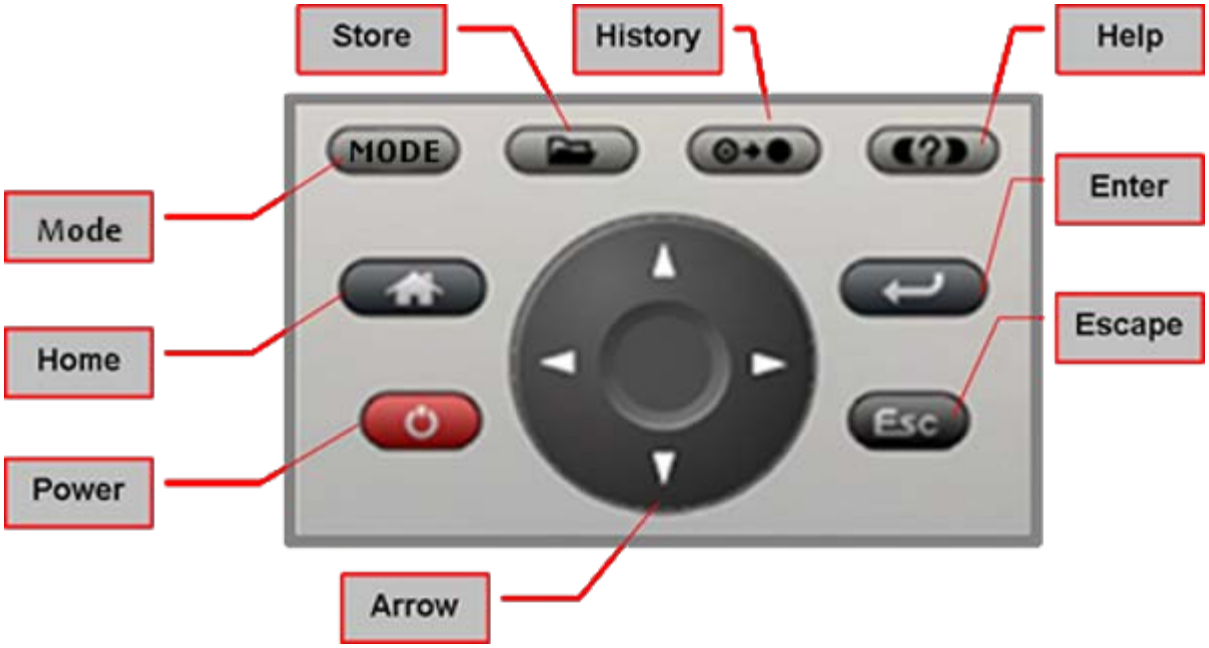
4.1 Keypad

The keyboard includes the following keys:



- Home key. Brings the unit to its home menu regardless of its location on the user interface.
- Mode key. Press the MODE key to toggle between Menu A and Menu B. Menu A features Ethernet, SyncE, 1588v2, and Common Functions. Menu B features PDH and DSn.
- Store key. Performs storage of current results in the memory of the test set. If the result is running, it will provide a snapshot at the moment the key is pressed. The Store function provides automatic storage with automatic naming and timestamping function. To manipulate a stored file, please go to 7.0 Files in the Common Functions manual.
- History key. Resets any blinking LED due to a history condition. For more details on the LED, please go to LEDs.
- Help key. Brings the user to the online help, regardless of the current user interface location of the unit.
- 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. Provides an enter sequence to the user interface. It is used in non touch-screen operation mode to enter menus and functions.
- Escape key. Provides an escape sequence to the user interface. It is used in non touch-screen operation mode to escape menus and functions.

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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.

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4.3 Battery

The VePAL is equipped with an intelligent Li-ion 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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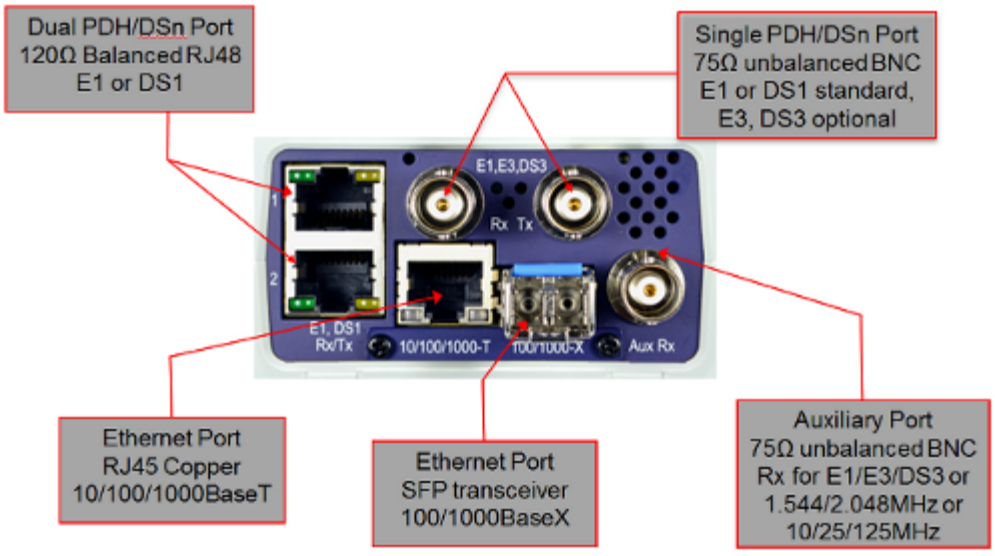
4.5 Connectors and Panels

The TX130M+ is equipped with the following physical test interfaces:



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4.5.1 BNC Interface

75 ohm unbalanced BNC for E1, DS1, E3, DS3.

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4.5.2 Ethernet Port

RJ45 Copper 10/100/1000BaseT and SFP 100/1000BaseX.

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4.5.3 Dual PDH/DSn Port

120 ohm Balanced RJ48 E1 and DS1.

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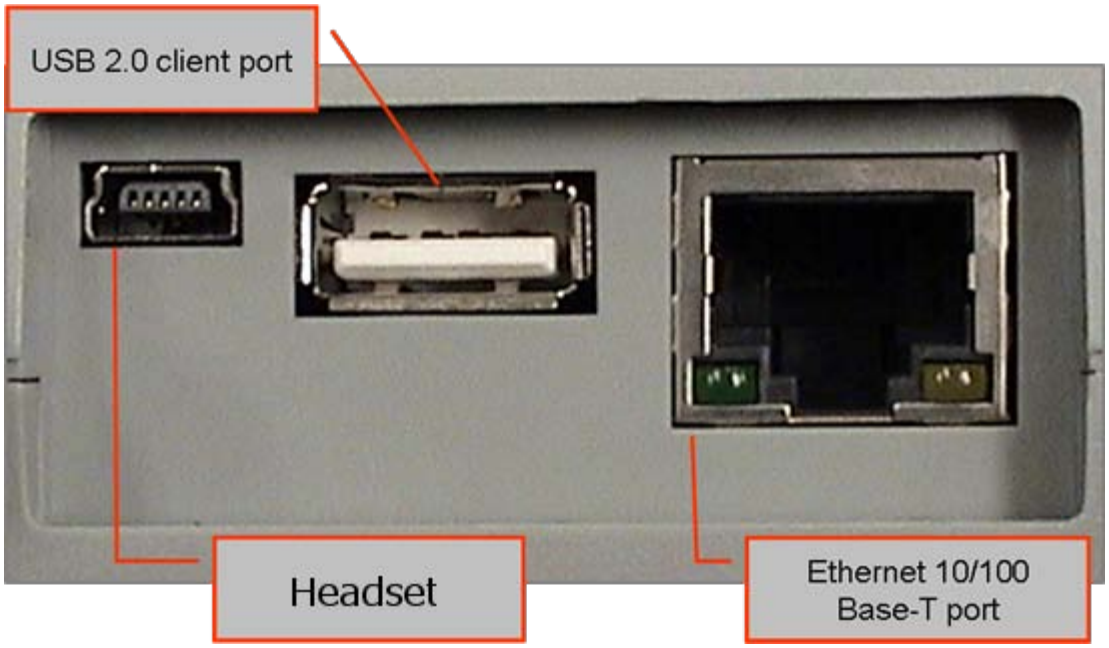
4.5.4 Utility Ports

The Ethernet and USB ports are located on the left and right side of the unit.

- RJ45, 10/100/1000Base-T port:
  - 10/100/1000Base-T Ports, RJ45 connector, IEEE 802.3 compliant
  - A green LED on the RJ45 connector flashes when there is activity on the network.
  - The green LED is On when there is a valid Ethernet link with the network and off when there is no link.

  To access the Ethernet management port, remove the protective rubber cover on the right hand side of the unit to expose the connector. Ethernet applications include:
  - IP connectivity testing
  - WiFi Wiz testing
  - Voice over IP (VoIP) testing
  - IPTV testing
  - Transfer measurement results and test profiles between the instrument and a computer using ReVeal MTX software
  - Upload/download channel tables between the instrument and a computer using ReVeal MTX software
  - Upgrade the instrument software using ReVeal MTX software
  - Remote control of the instrument using ReVeal MTX software (optional)
- USB Port:
  To access the USB port, remove the protective rubber cover on the right hand side of the unit to expose the connector. The USB port supports:
  - Memory drives
  - WiFi adaptor for WiFi testing application



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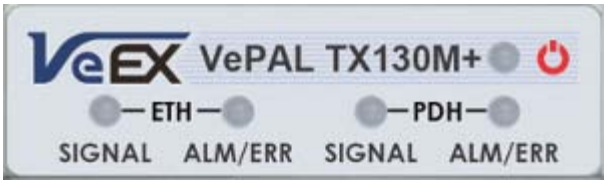
4.6 LEDs

The TX130M+ is equipped with the following LEDs:

- Power LED: A single 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.
- Signal LED - Indicates presence of a valid input signal.
- Alarm / Error LED - Indicates the presence of alarms or errors.
  - Green LED - Indicates that no alarm/error has occurred
  - Red LED - Indicates that at least one alarm/error has occurred during the test
  - Red flashing LED - Indicates any alarms/errors that have occurred
  - Grey LED - Indicates that no condition or a test that has not begun yet

Note: The Signal and Alarm/Error lights are separated according to whether the Signal or Error/Alarm refers to Ethernet (ETH) or PDH testing.



Note: Each LED is equipped with a History function.

Note: The History key on the rubber keyboard (O -> O) resets the soft LEDs on the GUI.

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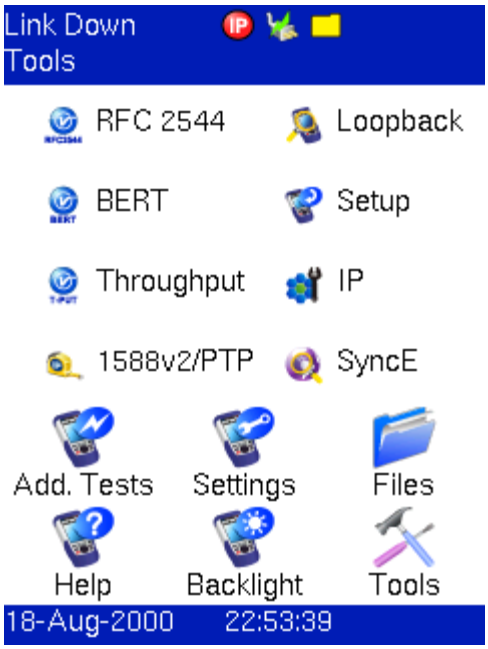
5.0 Home Menus

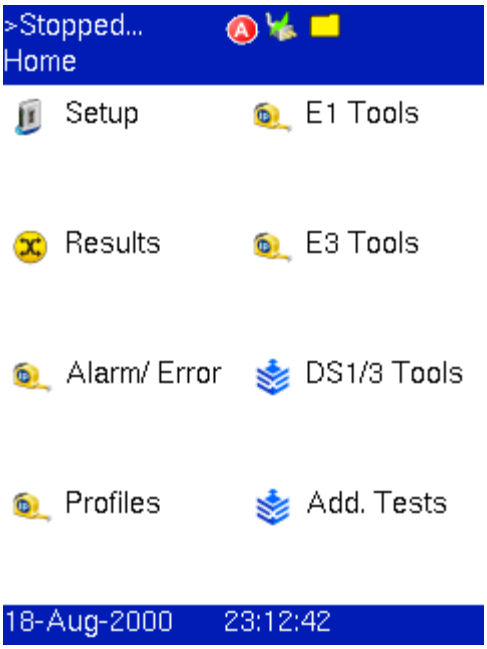
5.1 Ethernet and PDH/DSn Home Menus

The TX130M+ is able to record Ethernet and PDH/DSn measurements. The two modes are featured on separate home menus. To toggle between Ethernet and PDH/DSn modes, press the MODE key. Either Home Menu can be accessed at anytime during operation by pressing the Home key on the rubber keypad.

Menu A - Ethernet, SyncE, 1588v2, and Common Functions



Menu B - PDH and DSn



Menu A features Ethernet, SyncE, 1588v2, and Common Functions.

The upper part of Menu A 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.

Menu B features PDH and DSn test functions.

Some items are optional, and require the purchase of a software option in order to be activated. Some items have not been released, and will become available in future software releases.

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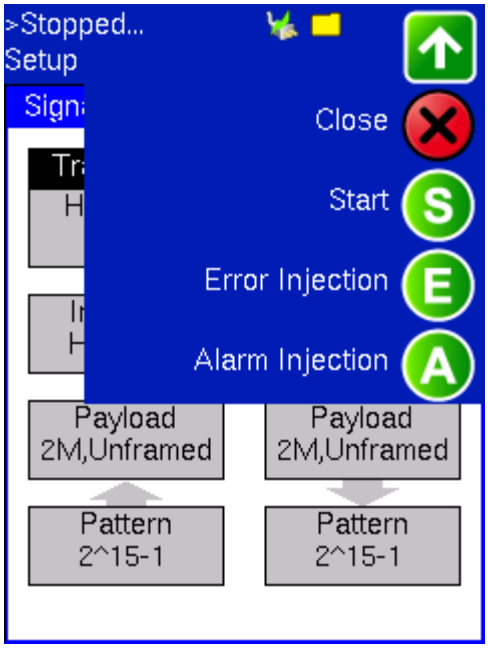
5.2 Action Menu (Menu B only)

In Menu B, tapping the green arrow access the Action Menu, which displays the following menu selections:

- Close - Closes the Actions menu
- Start - Starts measurements and brings up the Results screen.
- Stop - Stops measurements
- Error/Alarm Injection

Action Menu



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6.0 Menu A - Ethernet/SyncE/1588v2/Common Features Setup

Test ports and network settings are required prior to performing any measurements or applications.

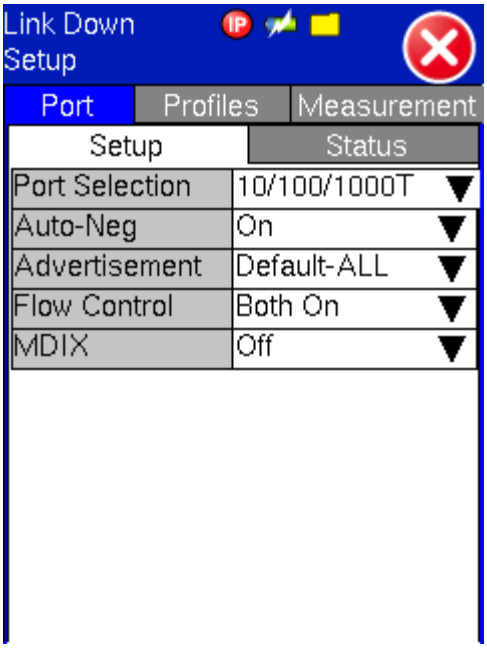
6.1 Port Setup

Port setup of the test interface configurations are accessed via the Setup menu located on the Home page. The user selects the operation mode and the interfaces that will be used to carry out tests. The available selections are as follows:

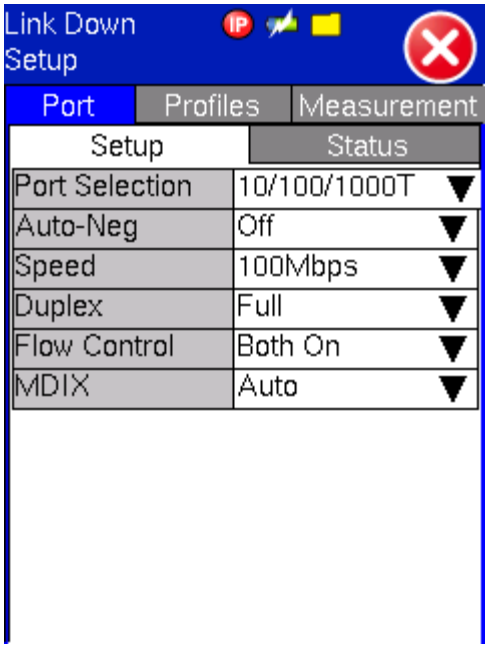
- Port Selection - 10/100/1000T or 100/1000Base-X
- Auto Neg - On or Off. Matches the test set's negotiation settings to those of the link partner.
  - Off - Enables access Speed and Duplex.
  - On - Enables Advertisement
    - Advertisement - Default-All or User Defined. Choosing User Defined brings up the Auto Neg. Advertisements screen
- Speed - Only available when auto-negotiation is off. Select from 10Mbps or 100Mbps on the 10/100/1000/T port and 100Mbps or 1000Mbps when the 100/1000Base-X port is selected.
- Duplex - Only available when auto-negotiation is off for the 10/100/1000T port. Select from half or full duplex modes. Full is chosen as default when 100/1000Base-X is selected.
- Flow control - On or Off. Once the operating mode and interfaces are selected, the user can independently configure the auto-negotiation, speed, duplex, and flow control settings for each port (where applicable).
  - When flow control is enabled, the test set will respond to pause frames received by the link partner by adjusting the transmit rate.
  - When flow control is disabled, the test set ignores all incoming pause frames from the link partner and continues transmitting at the configured transmit rate

Port Setup - 10/100/1000T - Auto-Neg ON

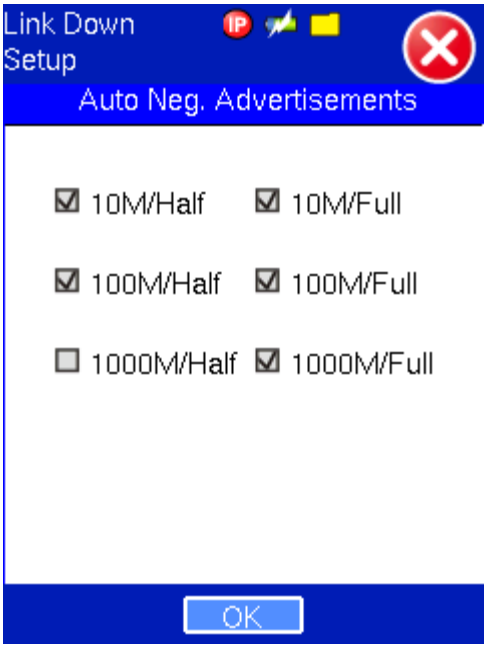
Port Setup - 10/100/1000T - Auto-Neg OFF

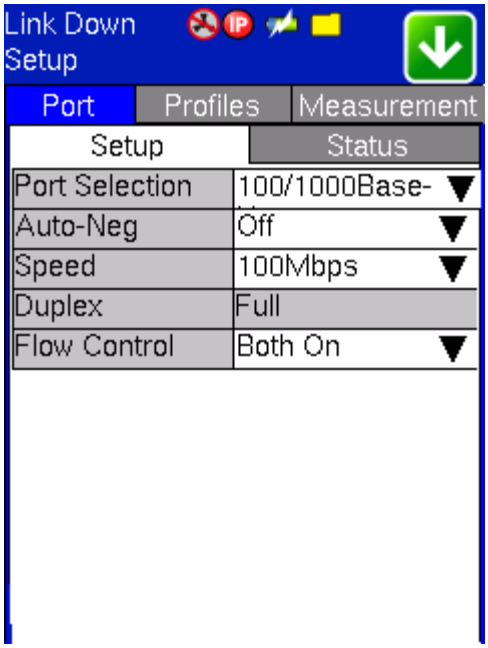


Advertisement - User Defined



Port Setup - 100/1000BaseX





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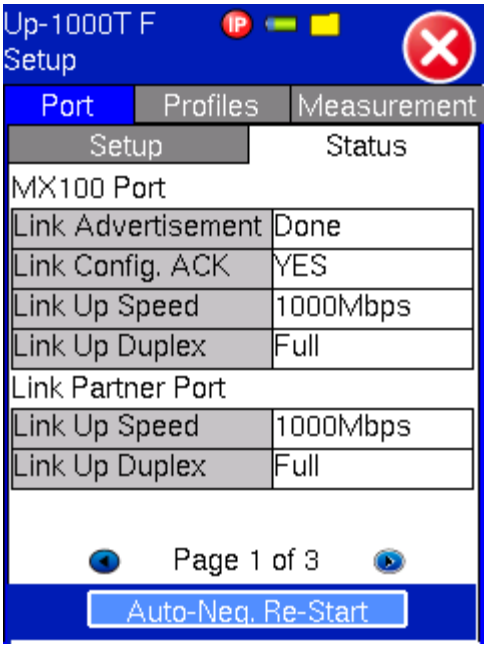
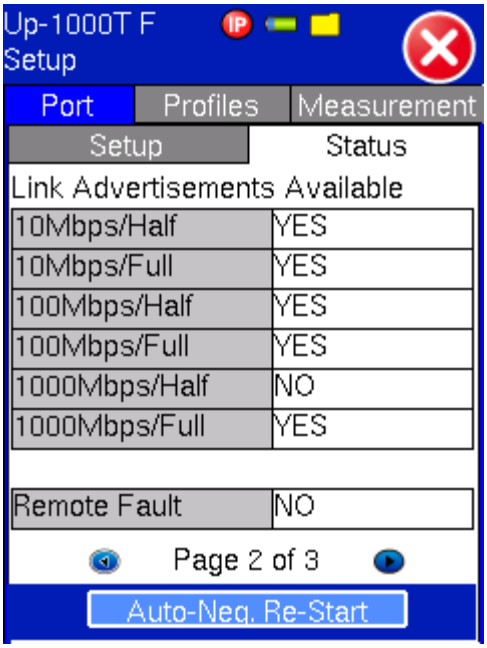
6.2 Port Status (10/100/1000T only)

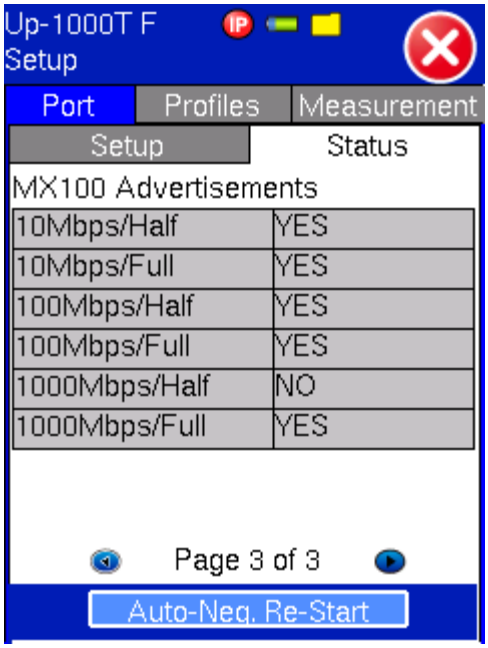
Copper Port Status (Page 1)

Copper Port Status (Page 2)

Copper Port Status (Page 3)







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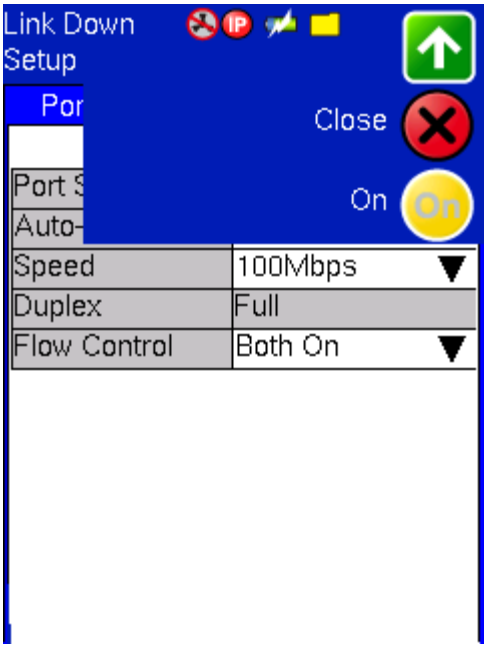
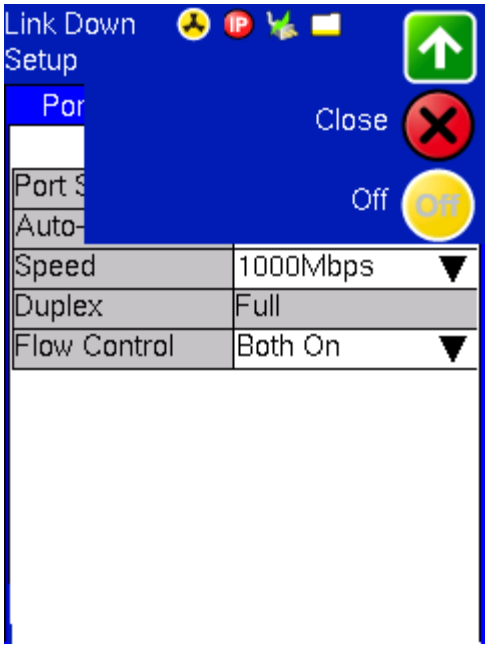
6.3 Laser Activation

- LASER On/Off Operation - When the 100/1000Base-X ports is/are selected, the top pull down menu appears in the Setup/Port screen. From this pull down menu the user is able turn the LASER on or off.
  - The LASER may also be turned on/off from any of the following application menus;
    - BERT, RFC 2544, Throughput, Loopback, and IP.

TX130M+ Laser Operation - Off



TX130M+ Laser Operation - On



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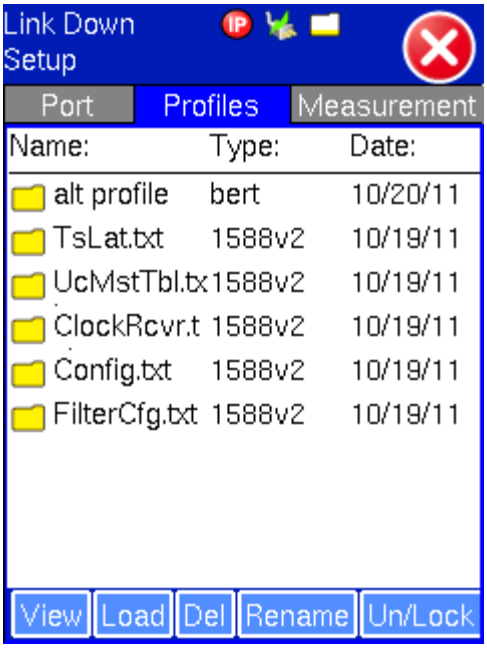
6.4 Profiles

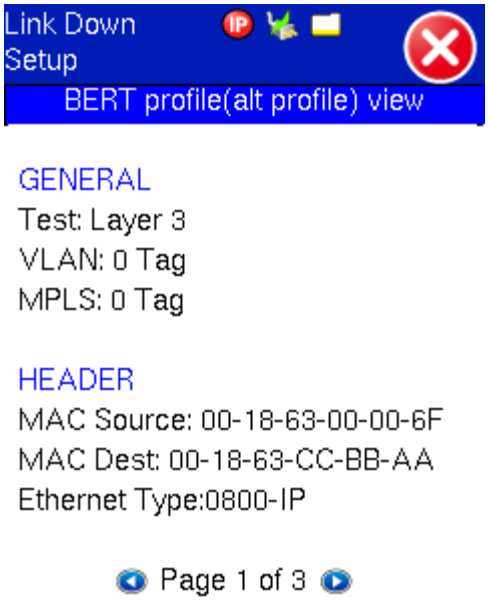
Profiles Tab:

Previously stored profiles can be viewed, deleted and loaded from this screen. When the user loads a profile, the screen will change automatically to the application that the profile corresponds to.

TX130M+ Profile Selection

Viewing a Profile





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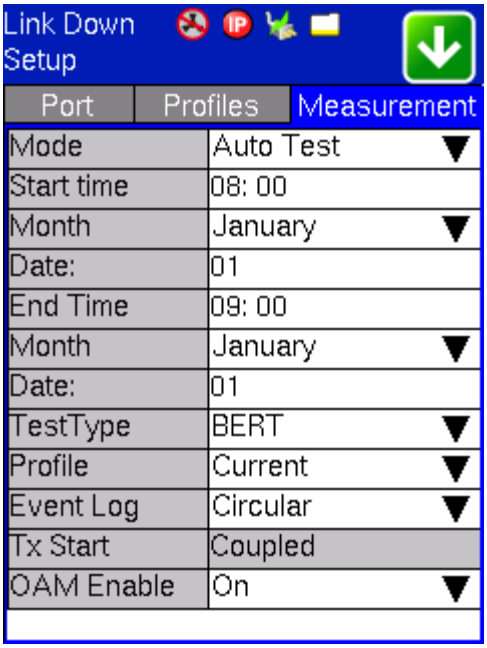
6.5 Measurement Settings

Measurement Tab:

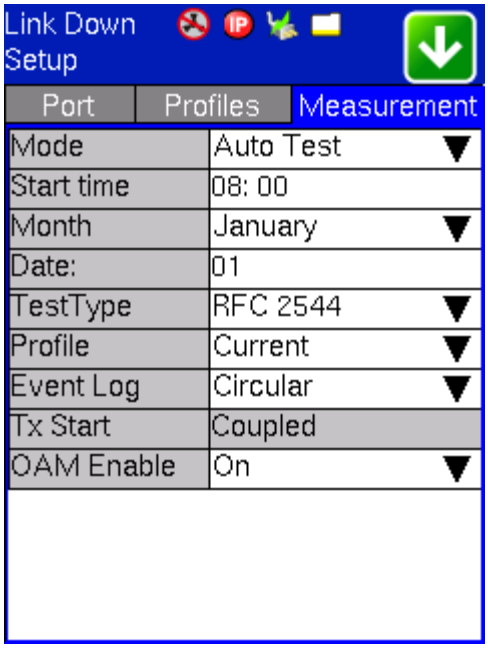
The measurement and event log settings are configured in this screen.

- Mode: Manual, timed, or auto mode are available.
  - Manual - User starts and stops the measurements manually.
  - Timed - User defines the duration of the test; after the test is started, the test will run for the configured duration and stop automatically.
  - Auto - User configures the start and end time of the test, selects the type of test to run, and a profile if one has been previously stored.
    The test set must be powered on to carry out and automatic test.
- TestType (Auto Test only) - BERT, Throughput, or RFC 2544.

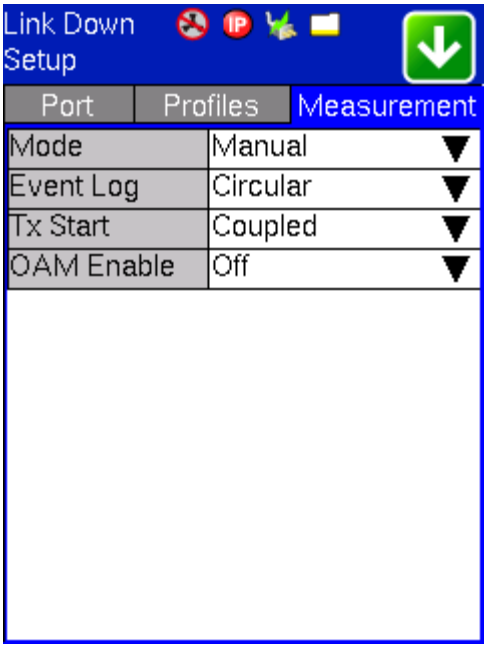
Measurement Settings -Auto Test - BERT & Throughput



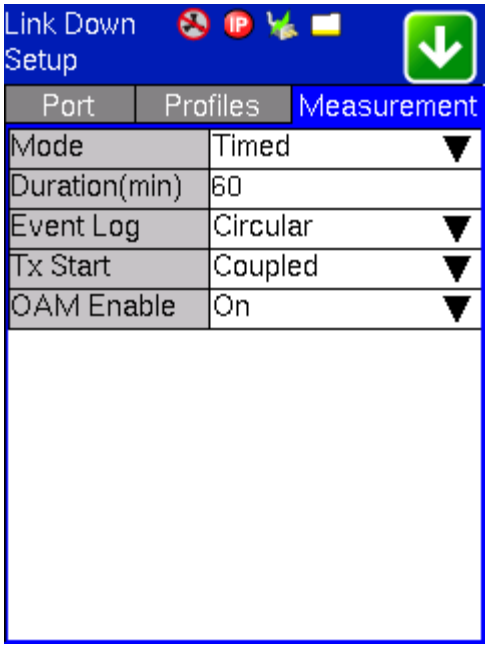
Measurement Settings - Auto Test - RFC 2544



Measurement Settings - Manual



Measurement Settings - Timed



- Event Log: Circular or Blocked. Up to 1000 event logs can be stored.
  - Circular - only the latest events will be stored if there are over 1000 event logs. The oldest event will be deleted so that the new event can be added.
  - Blocked - only the maximum number of events will be stored; any event that occurs after the 1000th event will not be stored. Event logs consist of a log of the start of test, end of test, errors, alarms, frame loss, etc. The log will have a timestamp, type of event, and count (number of errors occurring in that instant).
- Tx Start: Coupled or Separate. Configure how the measurements are started when in BERT and Multiple Streams test modes
  - Coupled - Transmitter and receiver are turned on at the same time, and the Tx and Rx measurements start at the same time at the start of the test.
  - Separate - independent control (Start/Stop) of the transmitter is enabled. At the start of the test only the receiver is turned on - the user must start the transmitter manually.
- OAM Enable: On / Off.
  - When OAM is enabled, the TX130M+ supports the IEEE 802.3ah EFM standard for discovery and loopback control of OAM-enabled devices.

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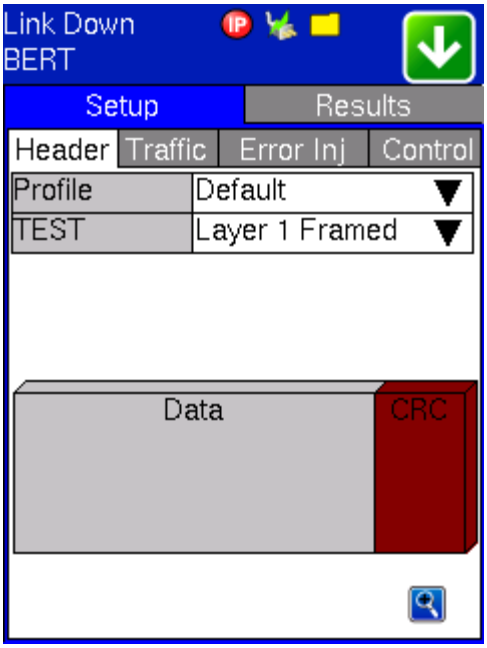
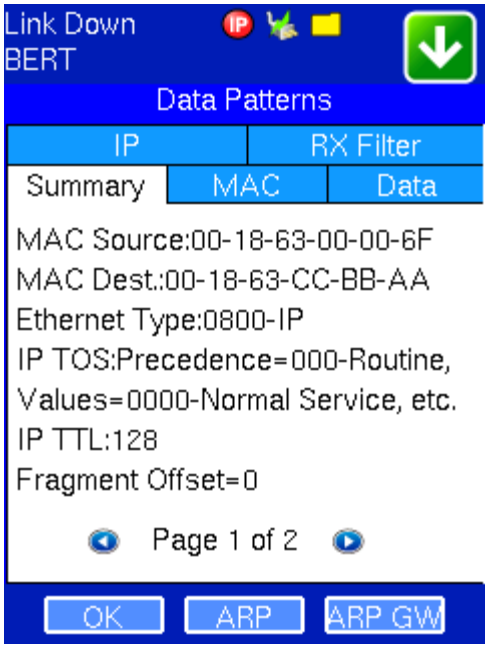
7.0 BERT

Overview:
BER testing at layer 1, 2, 3, and 4 is supported. The test can be configured to use either regular PRBS patterns, stress patterns or user defined test patterns to simulate various conditions. All patterns are encapsulated into an Ethernet frame to verify bit-per-bit performance of the circuit under test.

- Layer 1: Framed mode - Test pattern is encapsulated into a valid Ethernet frame with SOF, Preamble and CRC field.

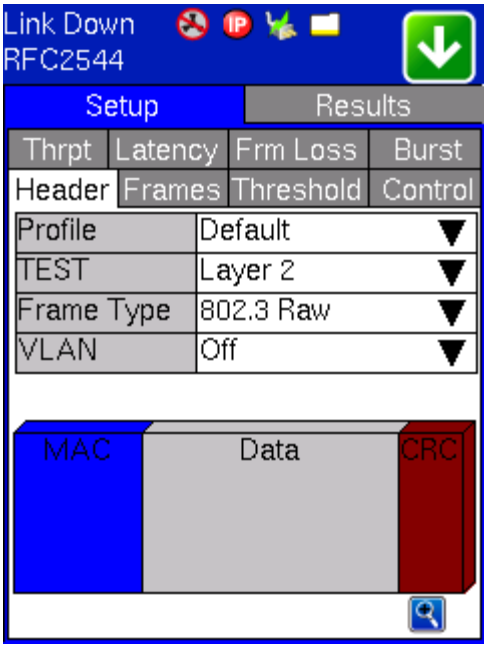
BERT Setup - Header (Layer 1 Framed) Data Patterns



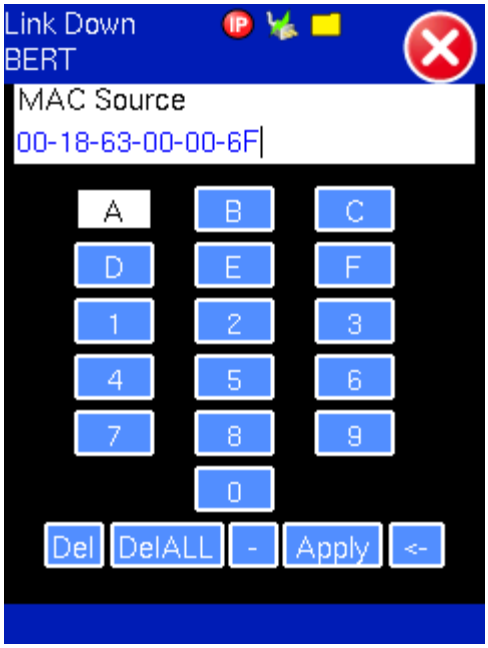


- Layer 2: Framed BERT (same as Layer 1 Framed)
  - MAC Address: A default or user configured Media Access Control (MAC) address is added to the frame. This MAC address is used as the source MAC address for all streams (Throughput Testing mode).

BERT Setup - Header (Layer 2)

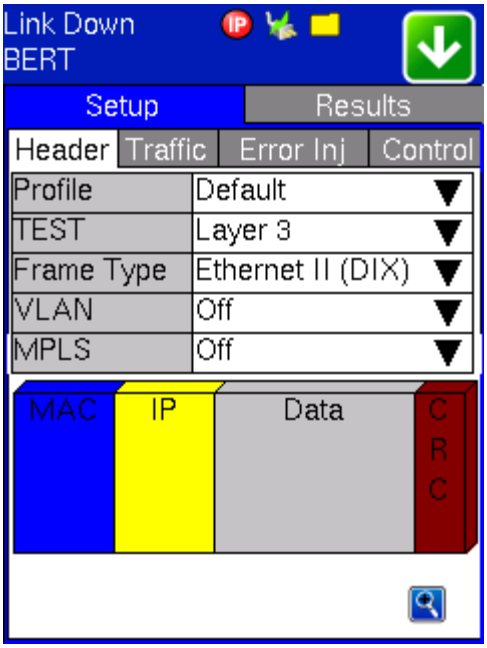


BERT Setup - MAC address editing



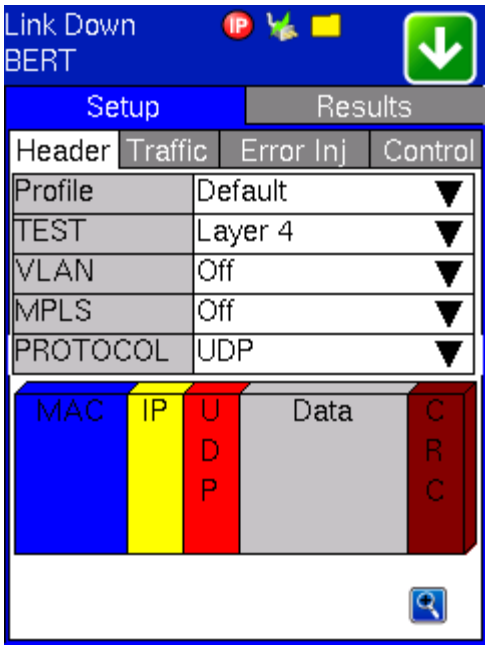
- Layer 3: Framed BERT (same as Layer 1 & 2 Framed)
  - MAC Address: A default or user configured Media Access Control (MAC) address is added to the frame. This MAC address is used as the source MAC address for all streams.
  - IP Address: A default or user configured IP address is added to the frame. This IP address is used as the source IP address for all streams.

BERT Setup - Header (Layer 3)

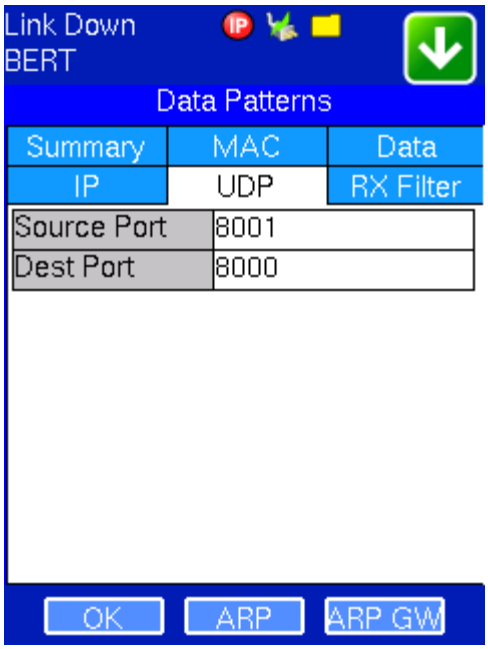


- Layer 4: Framed BERT (same as Layer 1, 2 & 3 Framed)
  - MAC Address: A default or user configured Media Access Control (MAC) address is added to the frame. This MAC address is used as the source MAC address for all streams.
  - IP Address: A default or user configured IP address is added to the frame. This IP address is used as the source IP address for all streams.
  - UDP/TCP: A user defined source and destination port address is added to the frame.

BERT Setup - Header (Layer 4)



BERT Setup - Header (Layer 4) UDP Settings



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7.1 BERT Setup

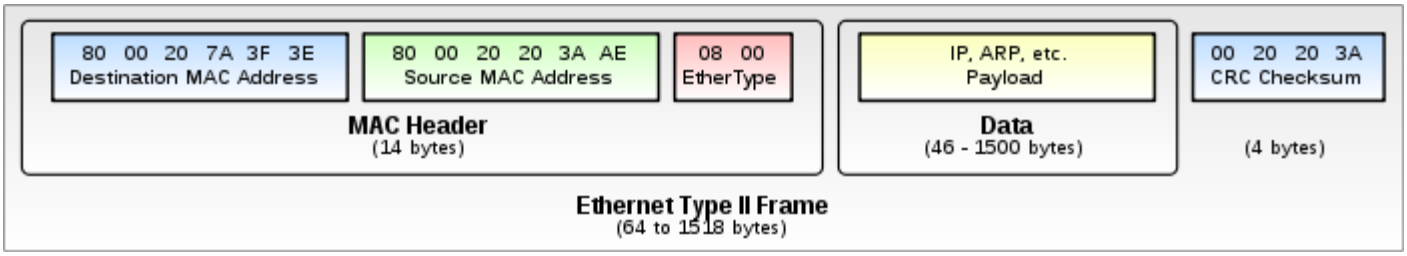
The test layer, frame header, traffic profile, error injection, and control settings of the far end device (if applicable) must be configured prior to testing.

7.1.1 Header Settings

- BERT Profile: Load a previously configured test profile or create a new profile from existing settings.
  See Profiles for more details on how to create new profiles.

- Test: Select the test layer to perform the BERT.
  - Options are Layer 1 Framed, Layer 2, Layer 3, and Layer 4.
- Frame Type: Select the Ethernet frame type for Layer 2 or Layer 3.
  - 802.3 Raw (IEEE 802.3 frame without LLC) - Not available when Layer 3 is selected
  - Ethernet II (DIX) (named after DEC, Intel, and Xerox, this is the most common frame type today)
- MAC/IP: Tap the MAC and IP blocks on the Frame image to access the setup menus
  - Set the Source and Destination MAC address for Layer 2
  - Set the Source and Destination MAC and IP addresses for Layer 3
- VLAN: Off, 1 tag, 2 tags, 3 tags.
  - The user is able to configure up to 3 VLAN tags (VLAN stacking, for Q-in-Q applications)
    Note: VLAN stacking is an option.
- MPLS: Off, 1 tag, 2 tags, 3 tags.
  - The user is able to configure up to 3 MPLS tags.
    Note: MPLS tag configuration is only available when the MPLS option is purchased.

The most common Ethernet Frame format, Type II



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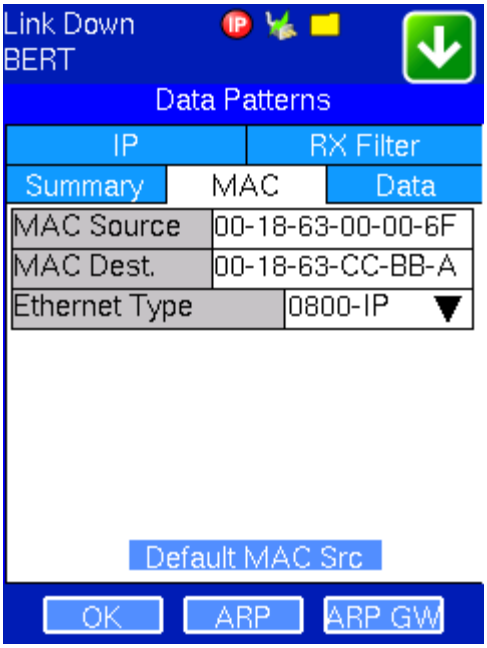
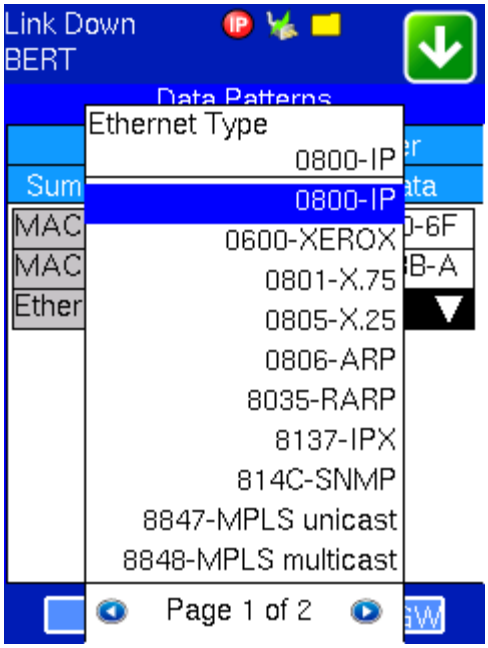
MAC, VLAN, MPLS, IP, and Test Pattern Configurations:

To configure the MAC addresses, IP addresses, VLAN tags, MPLS tags, and test pattern, tap on the frame image displayed on the screen. This brings you to the configuration screens for all the header fields. Alternately, tap on the magnifying glass at the bottom right corner to access the configuration screens.

- MAC Header Tab:
  - MAC Source - Use the default source address of the test set or configure a new or different address.
  - MAC Destination - Configure the destination MAC address of the far end partner test set.
  - Ethernet Type - For Layer 3 testing, the user can also configure the Ethernet type;
    - 0800-IP (Internet Protocol Version 4, IPv4)
    - 0600-Xerox
    - 0801-X.75 (X.75 Internet)
    - 0805-X.25 (X.25 Level 3)
    - 0806-ARP (Address Resolution Protocol (ARP))
    - 8035-RARP (Reverse Address Resolution Protocol (RARP))
    - 8137-IPX (Novell IPX)
    - 814C-SNMP
    - 8847-MPLS unicast
    - 8848-MPLS multicast
    - 86DD (Internet Protocol, Version 6 (IPv6)) - Future Release

BERT Setup - MAC Address Settings (Layer 3) BERT Setup - Ethertype Settings (Layer 3)

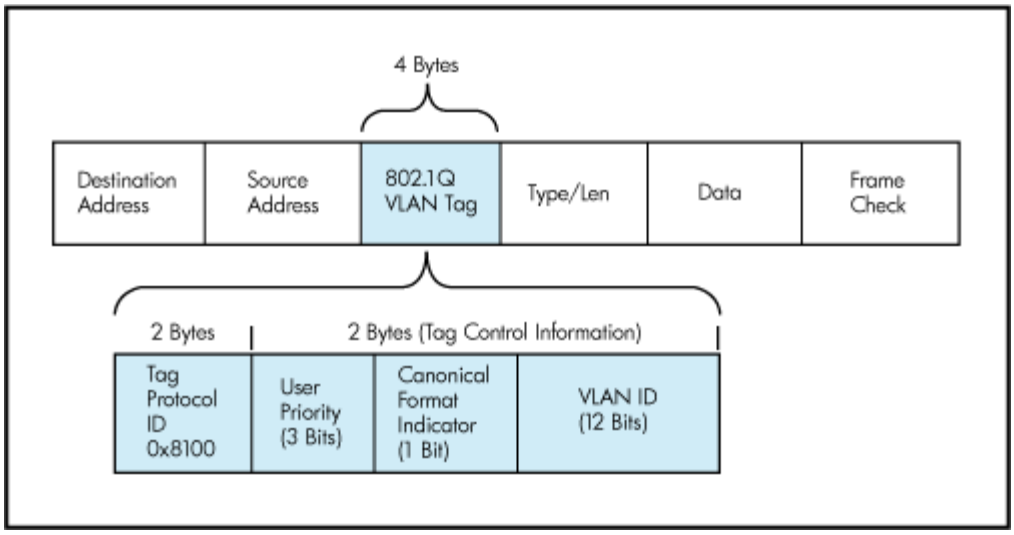




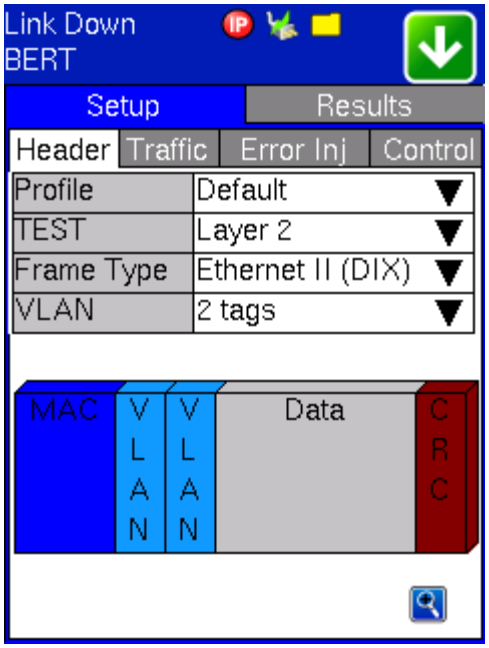
Go back to top

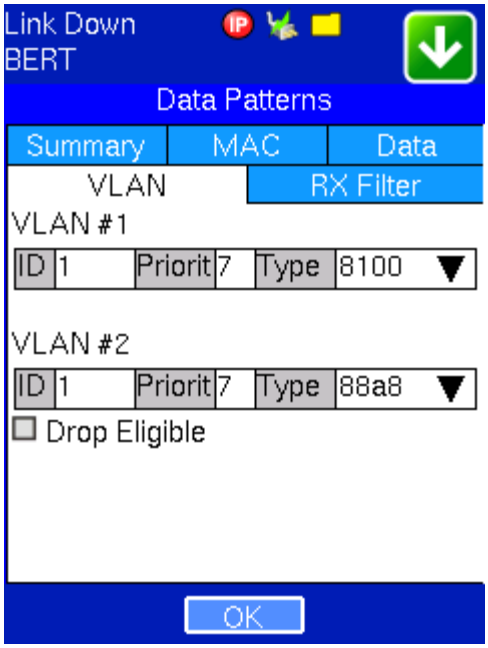
- VLAN Tab: In the VLAN tab the following parameters are configured;
  - VLAN ID: Can be configured in the range 1 to 4094
    - VLAN ID is the identification of the VLAN, which is basically used by the standard 802.1Q.
    - It has 12 bits which allows the identification of 4096 (2^12) VLANs.
    - Of the 4096 possible VIDs, a VID of 0 is used to identify priority frames and value 4095 (FFF) is reserved
    - Maximum possible VLAN configurations are therefore set to 4094
  - VLAN Priority: Can be configured in the range 0 to 7
    - Set by the Priority Code Point (PCP), a 3-bit field which refers to the IEEE 802.1p priority.
    - It indicates the frame priority level from 0 (lowest) to 7 (highest), which can be used to prioritize different classes of traffic (voice, video, data, etc)
  - Type: The following selections are possible;
    - 8100 (IEEE 802.1Q tagged frame)
    - 88a8 (IEEE 802.1ad Provider Bridging)

IEEE 802.1Q VLAN Tag in an Ethernet Frame



BERT Setup - VLAN Tag Configuration BERT Setup - VLAN Tag Summary





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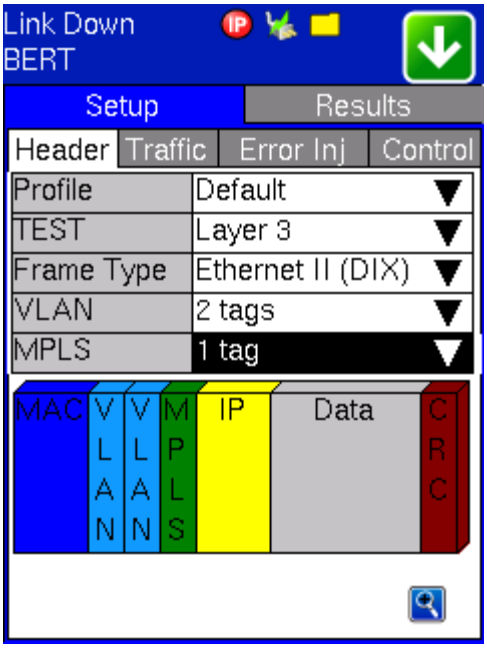
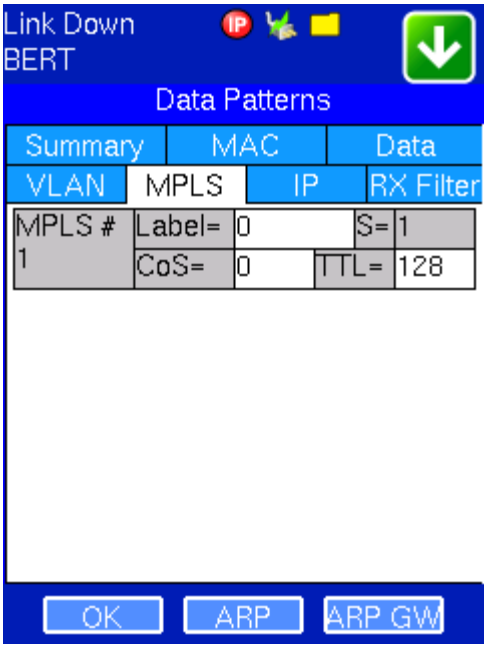
- MPLS Tab: In the MPLS tab the following parameters are configured;
  - MPLS label: Can be configured in the range 16 through 1,048,575 (labels 0 to 15 are reserved)
    Note: Composed of 20 bits which allows for the creation of over one million labels.
  - CoS: Can be configured in the range 0 to 7
    Note: This field is three bits in length and maps directly to IP Precedence TOS bits to provide Class of Service (COS).
  - S-bit: Can be configured 0 or 1
    Note; The S field is one bit in length and is used for stacking labels. This is important as it is used to indicate the last label in the label stack.
  - TTL: Can be configured in the range 0 to 255. The default setting is 128 hops
    Note: Used to decrement the time-to-live counter.

BERT Setup - Header with MPLS Label



BERT Setup - MPLS Label Summary



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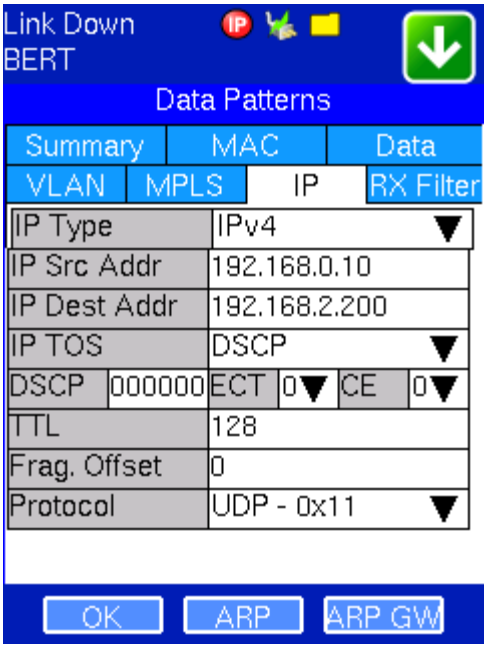
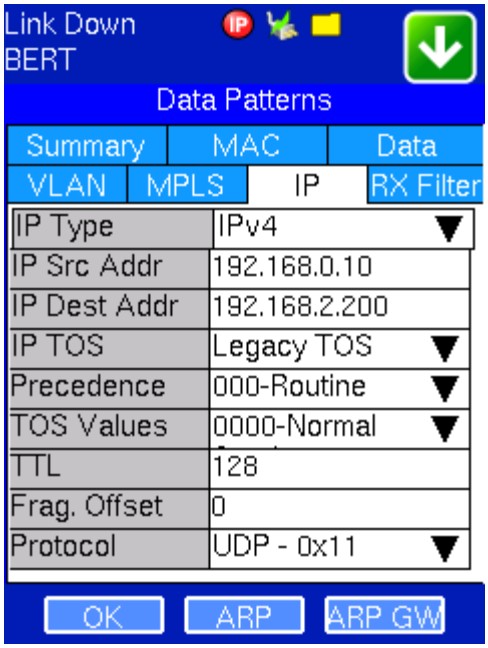
- IP Tab: In the IP tab the user must configure the destination IP address and source address. The user may also configure the following IP header fields:
  - IP TOS (for Quality of Service testing):

- Legacy TOS (Precedence) - The first three bits of the IP TOS field can be edited;
  000 - Routine
  001 - Priority
  010 - Immediate
  011 - Flash
  100 - Flash Override
  101 - Critical
  110 - Internetwork Control
  111 - Network Control
- DSCP (Differentiated Services Code Point) - The first six bits of the IP TOS can be edited to provide more granular service classification.
  For more information on the definition of DSCP field in IPv4 and IPv6 headers, refer to RFC2474
- Time To Live (TTL): Can be configured in the range 0 to 255
- Fragment offset byte: Can be configured in the range 0 to 65.528
  Note: The fragment offset field, measured in units of eight-byte blocks, is 13 bits long and specifies the offset of a particular fragment relative to the beginning of the original unfragmented IP datagram.
- Protocol: UDP (0x11), TCP (0x06), or User defined

BERT Setup - IP Settings (DSCP)



BERT Setup - IP Settings (Legacy TOS)



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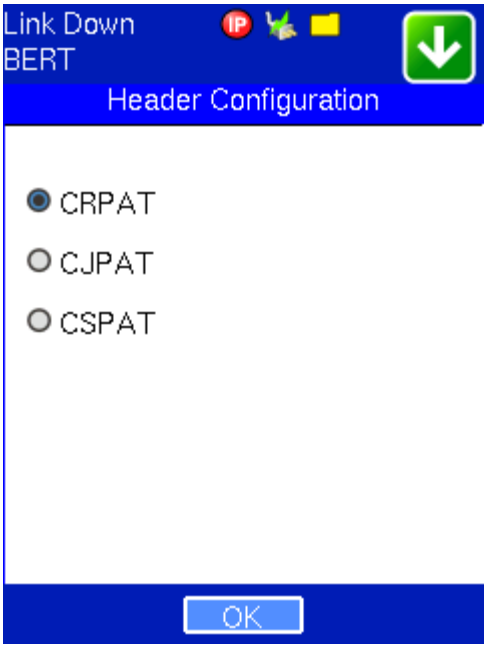
- Data Tab: User selects a test pattern that will be encapsulated in the Ethernet frame payload (for framed mode). Depending on the test layer, different test pattern options are available;
  - Layer 1 test patterns
    - CRPAT - Compliant Random Pattern provides broad spectral content and minimal peaking for the measurement of jitter at component or system level.
    - CJTPAT - Compliant Jitter Test Pattern is a Jitter Tolerance Pattern that stresses a receiver by exposing it to extreme phase jumps thereby stressing the Clock Data Recovery (CDR) circuitry. The pattern alternates between repeating low transition density patterns and repeating high transition density patterns.
    - CSPAT

BERT Setup - Test Pattern (Layer 1 Framed)



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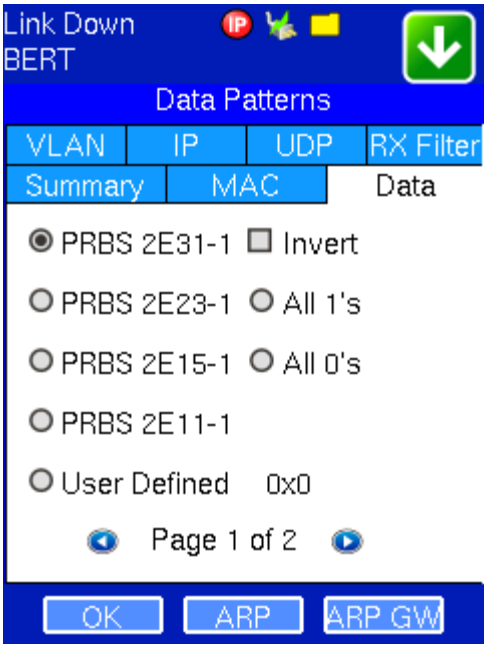
- Layer 2 & 3 test patterns
  - PRBS:
    - 2^31 -1 (147 483 647-bit pattern used for special measurement tasks, e.g. delay measurements at higher bit rates)
    - 2^23 -1 (8 388 607-bit pattern primarily intended for error and jitter measurements at bit rates of 34 368 and 139 264kbit/s)
    - 2^15 -1 (32 767-bit pattern primarily intended for error and jitter measurements at bit rates of 1544, 2048, 6312, 8448, 32 064 and 44 736kbit/s
    - 2^11 -1 (2047-bit pattern primarily intended for error and jitter measurements on circuits operating at bit rates of 64kbit/s and N 64kbit/s)
  - Fixed: All 0s or All 1s
  - User Defined pattern: Length depends on size of frame
  - Inversion: Normal or inverted

BERT Setup - PRBS Patterns



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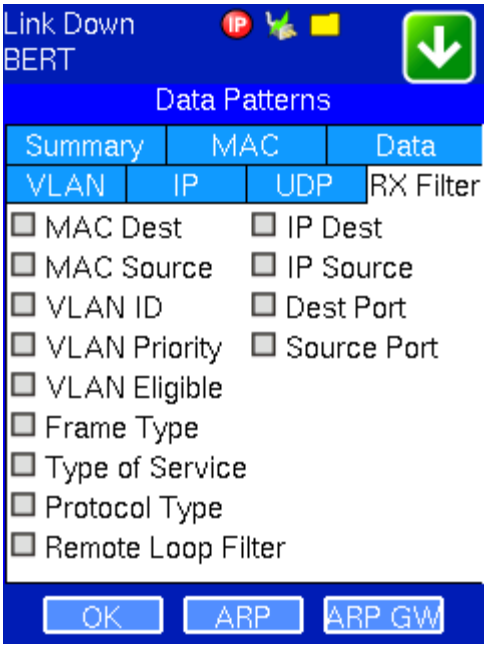
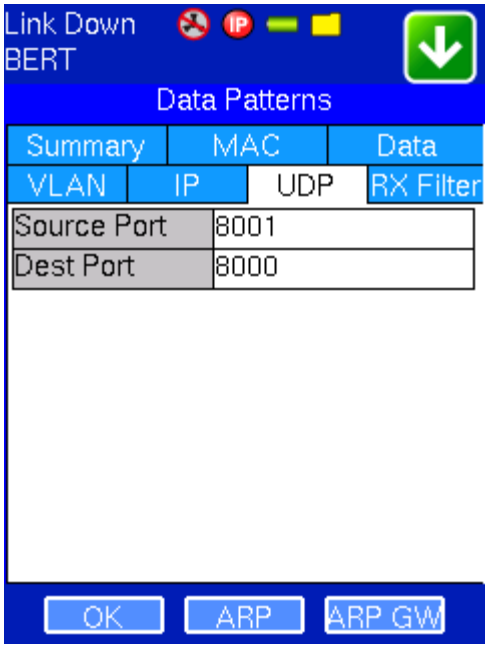
- RX Filter Tab: Allows the user to filter incoming streams by:

- MAC Destination address
- MAC Source address
- VLAN ID
- IP Destination address
- IP Source address

BERT Setup - RX Filter Selection



BERT Setup - UDP/TCP



- UDP/TCP: Input Source Port and Destination Port.

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7.1.2 Traffic Settings

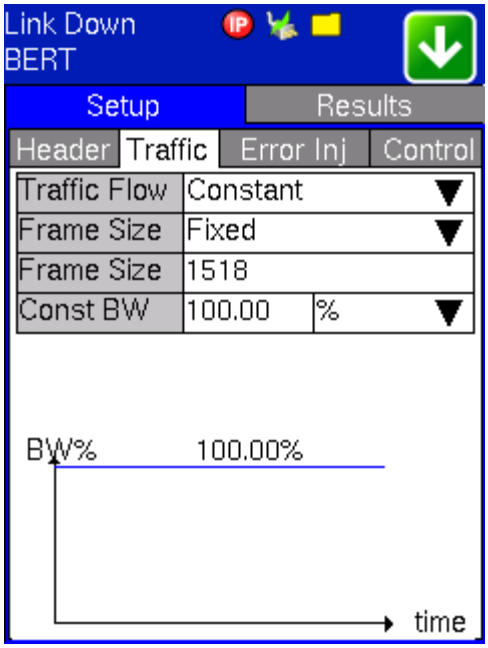
Traffic tab:

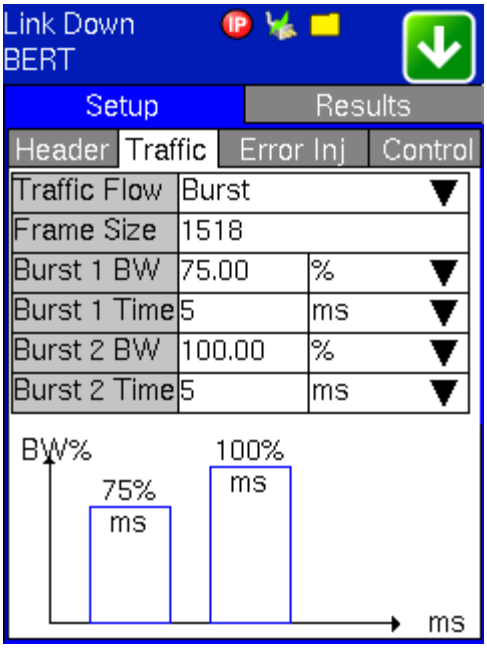
The user configures the traffic profile for the stream, including traffic flow, frame size, frame type, and transmit rate.

- Traffic Flow: Select from the following traffic flows:
  - Constant - the selected frame is transmitted continuously according to the selected bandwidth %.
  - Ramp - the selected frame is transmitted at maximum bandwidth according to the selected duty cycle and burst period.
  - Burst - the selected frame is transmitted in a stair case profile according to user selectable step time, number of steps, and maximum bandwidth
  - Single Burst
- Frame Size: Enter the frame size when a Layer 2 or Layer 3 BERT is selected.
  - Frame size configuration is not available for Layer 1 BERT.
  - Frame sizes can be from 64 bytes to 1518 bytes, in addition to jumbo frames up to 9000 bytes.
- BW (Transmit Bandwidth): Configure the transmit rate for the test.
  - When traffic flow is equal to Burst, two burst bandwidths are configured with burst time.
  - When traffic flow is equal to Ramp, starting and an ending bandwidth are configured along with the bandwidth step size and duration.

BERT Setup - Layer 1 Constant Traffic

BERT Setup - Layer 2 & 3 Burst Traffic





Frame Size Limitations

Layer 1 framed mode - Frame size configuration is not available.
Layer 1 unframed mode - Traffic profile is constant at 100% bandwidth.

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7.1.3 Error Injection

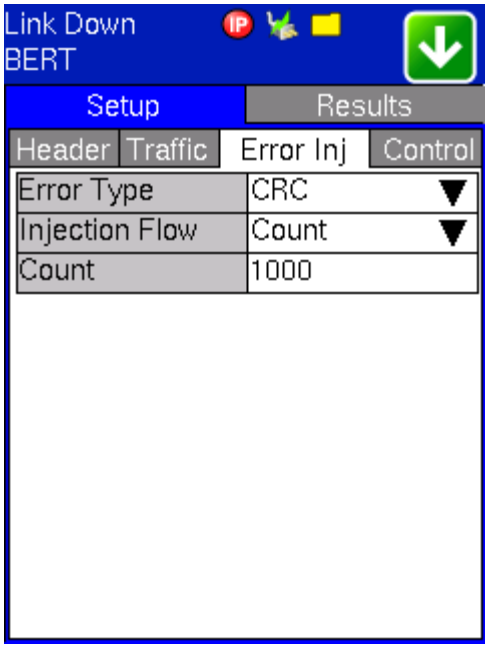
Error injection can only be performed during testing. The error type and injection rate are configured in the Error Injection tab.

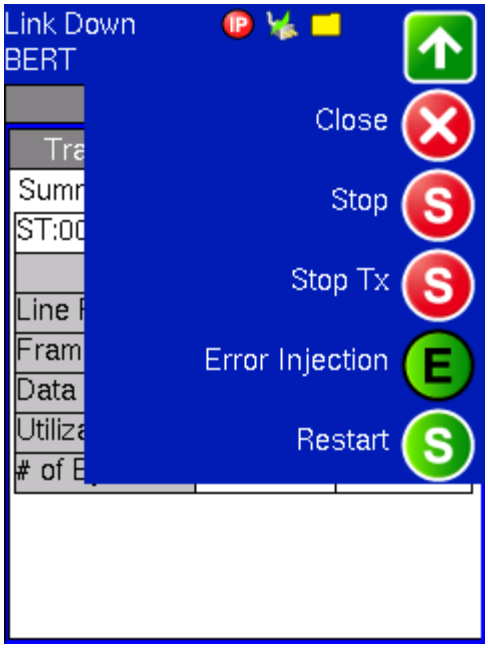
- Error type: Select from Bit, CRC, Bit and CRC, IP Checksum (layer 3 only), TCP/UDP Checksum (layer 4 only), or Pause.
- Injection Flow: Determines how the selected errors will be injected.
  - Select a single error injection, specific count, or error rate.
- Rate and Count: Configures the error rate and error count via the numeric pop-up keypad

Once the test is running, error injection is enabled by selecting the “Error Injection ” icon from the action pull down menu at the top of the screen. Press the “error inject” button to injecting error at the predetermined settings.

BERT - Error Injection Setup

BERT - Error Injection Action Menu





Error Injection

Once a test is running, error injection can be enabled by selecting the "Error Injection" icon from the action pull-down menu at the top of the screen. Press the "Error Injection" button to start injecting errors.

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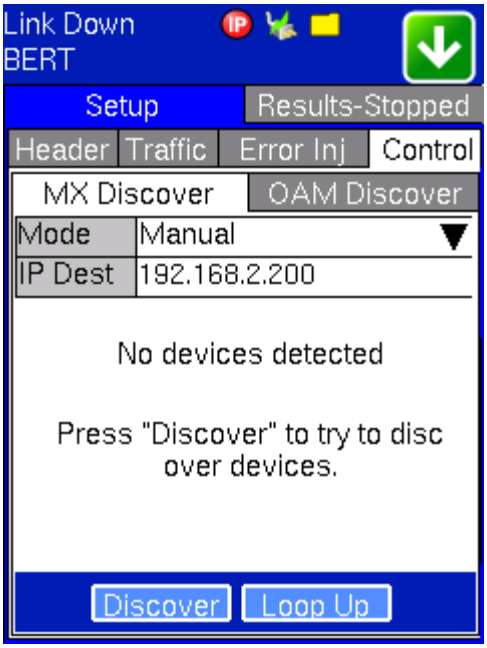
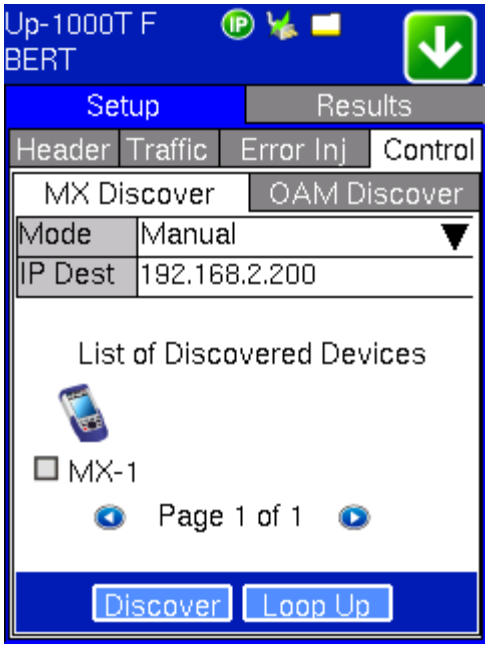
7.1.4 Control Settings

In the Control settings tab, the user configures the loop-up and loop-down commands necessary to control a far end unit. Looping back test traffic is possible as follows:

- Layer 1: All incoming traffic is looped back unchanged.
- Layer 2: All incoming unicast traffic is looped back with the MAC source and destination addresses swapped.
- Layer 3: All incoming unicast traffic is looped back with MAC and IP source and destination addresses swapped.
- Mode - Manual or Asymmetric
  - Manual: User must input the destination MAC/IP address of the far end device along with the type of command.
    - IP Destination: Enter the IP address of the far end test set that is to be looped up/down.
    - Prior to starting the test, manually send the loop up command by pressing the Loop Up button
    - A "Loop-up successful" message will appear
    - After completing the test, manually send a loop down command by pressing the Loop Down button

BERT - Control Setup (Manual) BERT - Device Discovery





MX Discover Feature

- If the local and remote test sets are on the same IP subnet, the MX Discover feature can be used
- Automatically discover the far end test unit by pressing the Discover button
- Once discovered, select the remote unit and send a loop up command
- No manual configuration of the IP address is needed, since these are populated automatically

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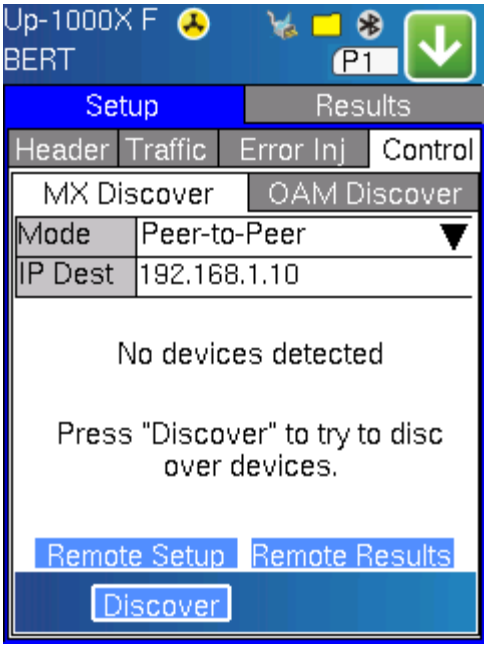
- Asymmetric Mode: No configuration is necessary.

BERT - Control Setup (Asymmetric)



OAM Devices

If OAM is enabled, any link partner that supports the IEEE 802.3ah protocol, will be discovered automatically and be displayed under the "OAM Discover" tab.

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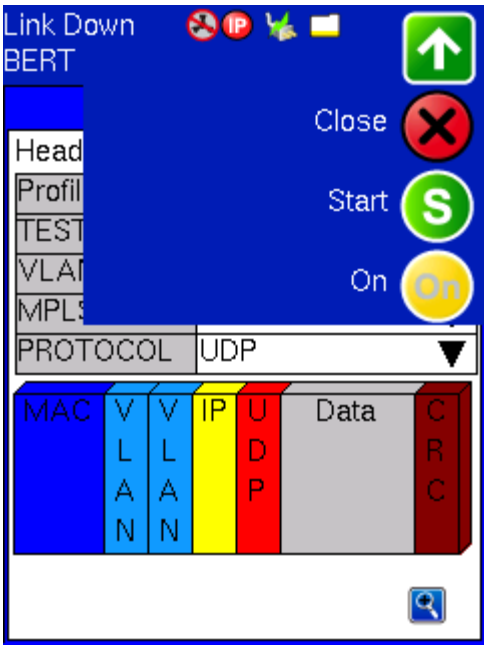
7.1.5 Starting/Stopping a BERT

Once all the necessary configurations have been completed, the user can start the test by selecting Start from the top right corner action pull-down menu (green arrow pointing down). Once selected, the test will start immediately and the icon will change to a Stop indication. To stop the test, simply tap the Stop icon. If testing on any of the fiber ports, ensure the LASER is switched ON before starting the test.

BERT Start



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7.2 BERT Results

7.2.1 Summary

Summary tab: The following results including the Start (ST) and Elapsed (ET) times are displayed:

- Line rate
- Framed rate
- Data rate
- Utilization
- Number of bytes
- Optical power - Optical level measured by the SFP or XFP transceiver

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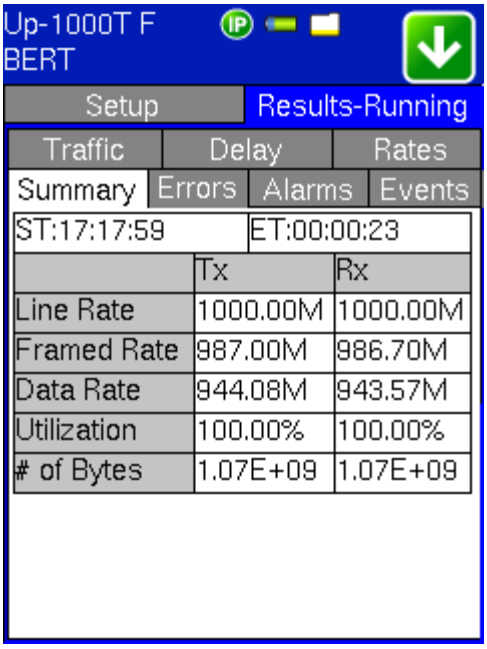
7.2.2 Errors

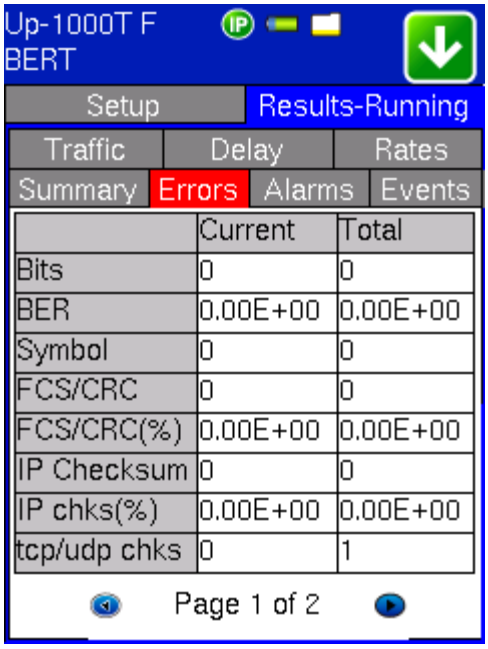
Errors tab: The following Errors (Current and Total) are displayed:

- Bits - Indicates errors related to test pattern (Bit Error or LSS (Pattern Loss)).
- BER - Bit Error Ratio
- Symbol - Declared when an invalid code-group in the transmission code is detected
- FCS/CRC - Number of received frames with an invalid FCS
- IP Checksum (Layer 3 only)
- Jabber frames - Number of received frames larger than 1518 bytes containing an invalid FCS.
- Runt frames - Number of received frames smaller than 64 bytes containing an invalid FCS.
- Giant frames - Number of received frames larger than 1522 bytes containing an invalid FCS.

BERT Results - Summary



BERT Results - Errors



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7.2.3 Events

Events tab: A time stamped record or log of anomalies, alarms, test status (start/stop) and test application are displayed.

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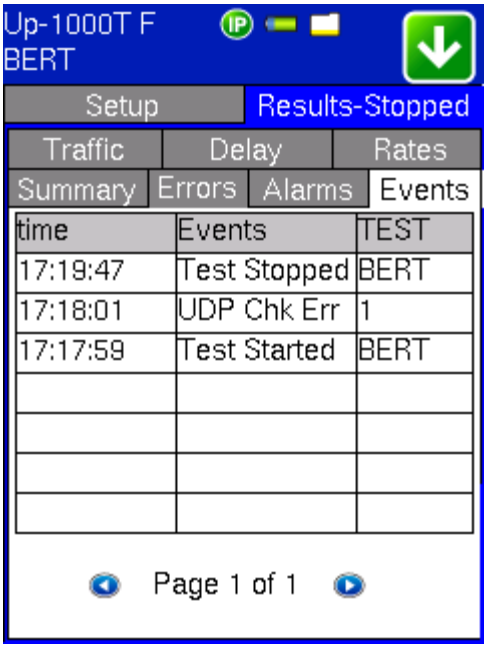
7.2.4 Alarms

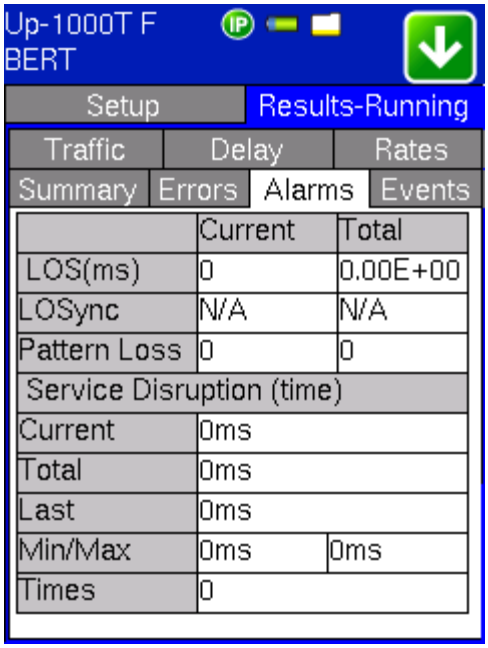
Alarms tab: The following Alarms (Current and Total) are displayed:

- LOS - Loss of Signal
- LOS Sync
- Pattern Loss - Indicates errors related to test pattern
- Service Disruption:
  - Current
  - Total
  - Min/Max
  - Times

BERT Results - Events

BERT Results - Alarms





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7.2.5 Traffic

Traffic tab: The following Traffic statistics are displayed:

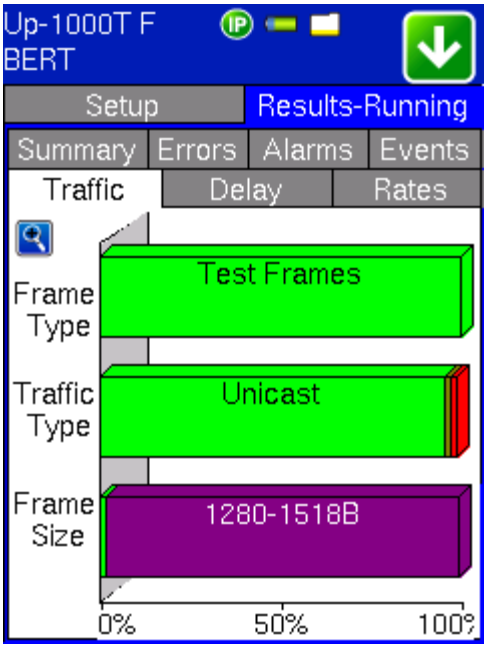
- Frame Type - Test and non-test frames
- Traffic type - Layer 2 and Layer 3 Unicast, Broadcast and Multicast frame percentage
- Frame size distribution
- Pause frames

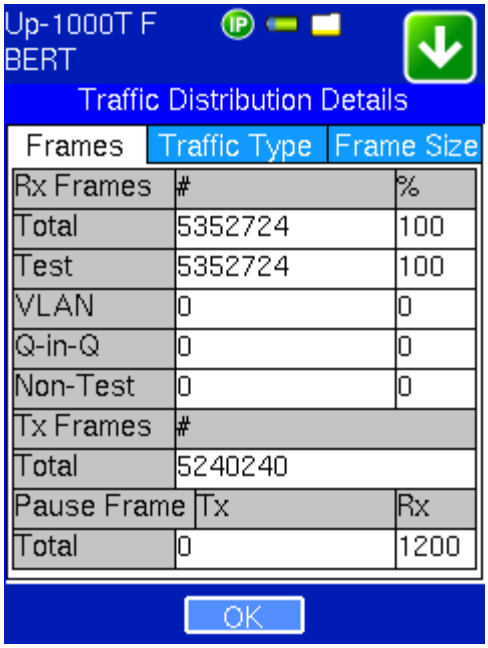
Frames tab: The following Frame distribution statistics are displayed in count (#) and percentage (%):

- Received (RX) frames:
  - Total frames
  - Test frames
  - VLAN tagged frames
  - VLAN stacked frames
  - MPLS labeled frames
  - MPLS stacked frames
  - Non-test frame
- Transmitted (TX) frames:
  - Total frame
- Paused frames: Transmitted and Received

BERT Results - Traffic Graph

BERT Results - Traffic / Frames





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Traffic Type tab: The following Traffic distribution statistics are displayed in Count (#) and Percentage (%):

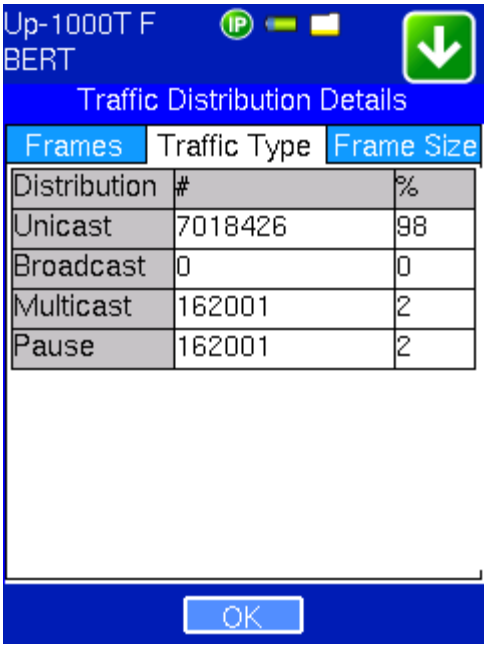
- Layer 2 Unicast frames - Number of Unicast frames received without FCS errors.
- Layer 2 Broadcast frames - Number of Broadcast frames received without FCS errors. Broadcast frames have a MAC address equal to FF-FF-FF-FF-FF-FF.
- Layer 2 Multicast frames - Number of Multicast frames received without FCS errors.
- Pause frames - Number of valid flow-control frames received. Frames having a type/length field equal to 8808h are counted as pause frames.
- Layer 3 Unicast frames - Number of Unicast frames received without FCS errors.
- Layer 3 Broadcast frames - Number of Broadcast frames received without FCS errors. Broadcast frames have a MAC address equal to FF-FF-FF-FF-FF-FF.
- Layer 3 Multicast frames - Number of Multicast frames received without FCS errors.

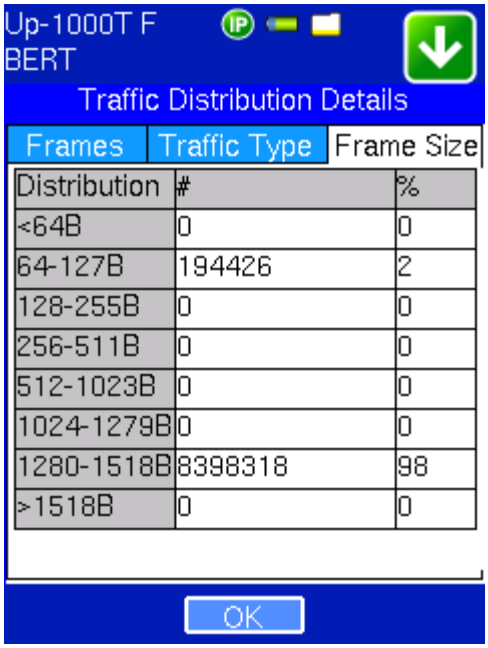
Frame Size tab: The following Frame distribution statistics are displayed in count (#) and percentage (%):

- < 64 byte frames
- 64-127 byte frames
- 128-255 byte frames
- 256-511 byte frames
- 512-1023 byte frames
- 1024-1279 byte frames
- 1280-1518 byte frames
- > 1518 byte frames - Jumbo frames

BERT Results - Traffic Type

BERT Results - Traffic Frame Size





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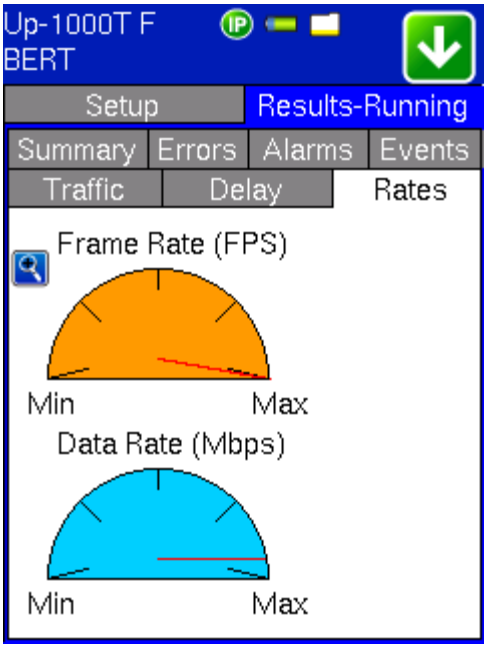
7.2.6 Rates

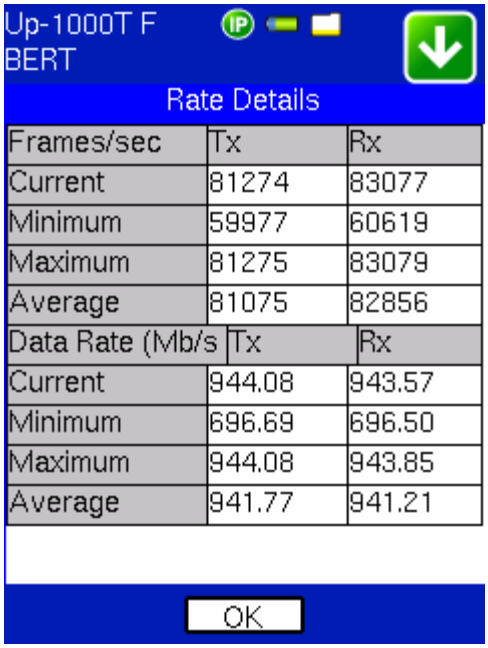
Rates tab: Rate statistics are displayed graphically and in tabular format:

- Frame rate in Frames per second (FPS) - Number of received frames (including bad frames, Broadcast frames and Multicast frames)
- Data rate in Mbps - Received data rate expressed in Mbps.

BERT Results - Rates Graph



BERT Results - Rates Details



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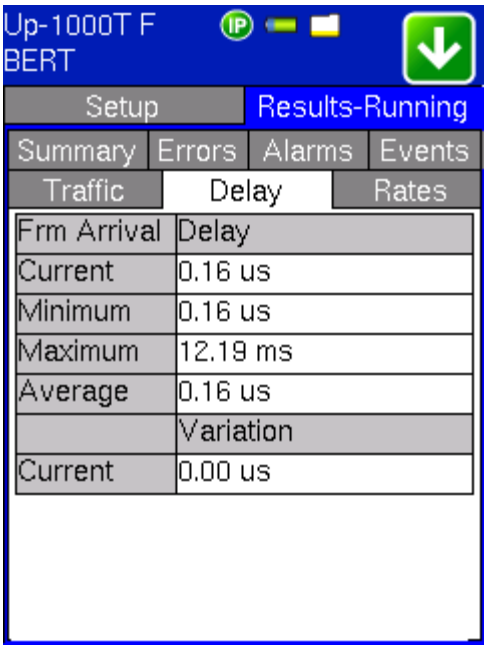
7.2.7 Delay

Delay tab: Frame arrival statistics are displayed in tabular format:

- Current
- Minimum

Maximum
- Variation (Current)

BERT Results - Delay



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7.2.8 Saving BERT Results

Once the test is completed, results can be saved by pressing the save function key on the keypad. The results will be saved and named automatically. Once saved, the user can view or rename the files by going to the results folder of the files menu.

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8.0 RFC 2544 Conformance Testing

Overview:

Service providers often need to test the end to end performance of the link when deploying Ethernet services to customers. The Internet Engineering Task Force (IETF) RFC 2544 “Benchmarking Methodology for Network Interconnect Devices” defines tests that describe the performance characteristics of a network interconnecting device.
RFC 2544 recommendations are well accepted in the test and measurement industry for network performance testing. The RFC 2544 test suite consists of and performs a set of four automated tests (throughput, latency, frame loss, and burst or back-to-back) to qualify the performance of a network link under test. The tests are especially popular for the verification of network links with certain service level agreements (SLA).

The following settings must be configured prior to RFC 2544 testing;

- Test layer (Layer 1/2/3/4)
- Frame header (MAC, VLAN, MPLS, IP, UDP, and Data)
- Test frames selection
- Pass/fail thresholds (optional)
- Far end unit loop control
- Throughput
- Latency
- Frame loss
- Burst (back-to-back)

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8.1 Setup

Unless otherwise noted, the Header and related setups are identical to the setups described in the BERT Test Application above. A summary of the RFC 2544 setup options are outlined below.

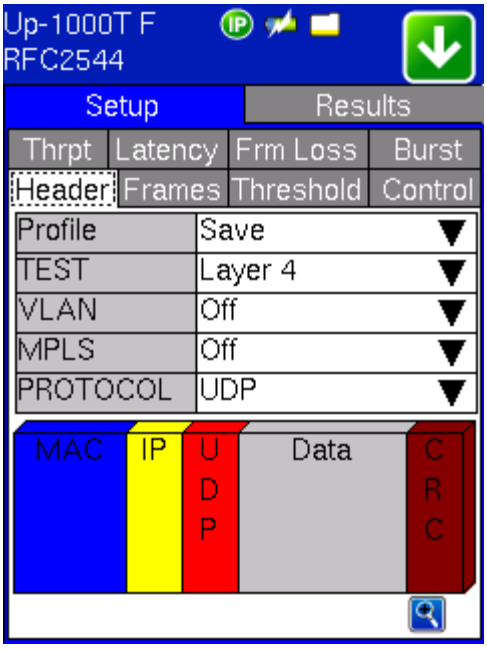
8.1.1 Header Settings

- BERT Profile: Load a previously configured test profile or create a new profile from existing settings. See Profiles for more details on how to create new profiles.
- Test: Select the test layer to perform the BERT.
  - Options are Layer 1 Unframed, Layer 1 Framed, Layer 2, and Layer 3.
- Frame Type: Select the Ethernet frame type for Layer 2 or Layer 3.
  - 802.3 Raw (IEEE 802.3 frame without LLC) - Not available when Layer 3 is selected
  - 802.3 LLC (IEEE 802.3 frame with LLC header)
  - 802.3 SNAP (IEEE 802.3 frame with SNAP header)
  - Ethernet II (DIX) (named after DEC, Intel, and Xerox, this is the most common frame type today)
- MAC/IP: Tap the MAC and IP blocks on the Frame image to access the setup menus
  - Set the Source and Destination MAC address for Layer 2
  - Set the Source and Destination MAC and IP addresses for Layer 3
- VLAN: Off, 1 tag, 2 tags, 3 tags.
  - The user is able to configure up to 3 VLAN tags (VLAN stacking, for Q-in-Q applications)
    Note: VLAN stacking is an option.
- MPLS: Off, 1 tag, 2 tags, 3 tags.
  - The user is able to configure up to 3 MPLS tags.
    Note: MPLS tag configuration is only available when the MPLS option is purchased.

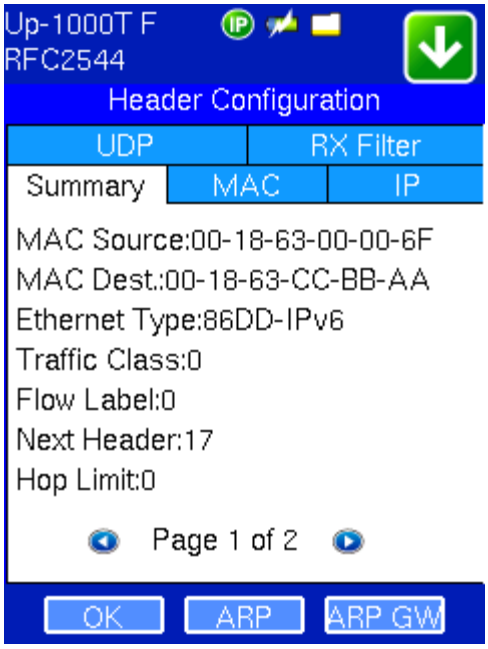
- MAC, VLAN, MPLS, IP, and Test Pattern Configurations:

  Tap on the Frame image displayed on the screen to configure the MAC addresses, IP addresses, VLAN tags, MPLS tags, and test pattern. This brings you to the configuration screens for all the header fields.

RFC Setup Overview



RFC Setup Summary



RFC 2544 Parameter Summary

Once setup parameters are completed, tapping the zoom function at the bottom right hand side of the screen displays a summary of all settings

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- MAC Header Tab:
  - MAC Source - Use the default source address of the test set or configure a new or different address. See MAC address editing screen shot below.
  - MAC Destination - Configure the destination MAC address of the far end partner test set. See MAC address editing screen shot below.
  - Ethernet Type - For Layer 3 testing, the user can also configure the Ethertype:
    - 0800-IP (Internet Protocol Version 4, IPv4)
    - 0600-Xerox
    - 0801-X.75 (X.75 Internet)
    - 0805-X.25 (X.25 Level 3)
    - 0806-ARP (Address Resolution Protocol (ARP))
    - 8035-RARP (Reverse Address Resolution Protocol (RARP))
    - 8137-IPX (Novell IPX)
    - 814C-SNMP
    - 8847-MPLS unicast
    - 8848-MPLS multicast
    - 86DD (Internet Protocol, Version 6 (IPv6)) - Future Release
- Data Tab: No payload selection is possible.
  The payload area is populated with a VeEX signature field and other proprietary data.
- RX Filter Tab: Depending on test layer, allows the user to filter streams by;
  - MAC Destination address
  - MAC Source address
  - VLAN ID
  - IP Destination address
  - IP Source address
- VLAN Tab: VLAN ID, priority, and Tag Type (Ethernet Type) can be configured. Please refer to the BERT application for more details.
- MPLS Tab: MPLS label, CoS priority settings, TTL, and S-bit fields are configured for available MPLS tags. Please refer to the BERT application for more details.
- IP Tab: User configures the source and destination IP addresses
  The user can also configure the following IP header fields; IP TOS (for quality of service testing), TTL, fragment offset byte, and the protocol field. Please refer to the BERT application for more details.

RFC 2544 Header Setups

The MAC, VLAN, MPLS, and IP configuration procedures are the same as in BERT mode
Please refer to the BERT Application section for details.

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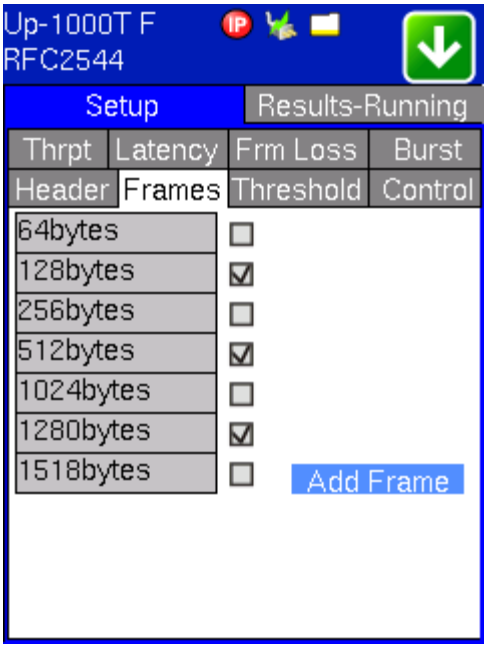
8.1.2 Frame Settings

Frames tab: User Configures;

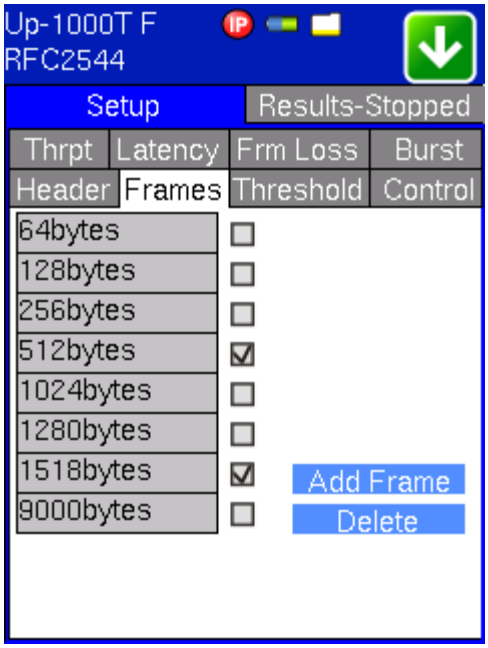
- Preset Frames: User selects from a list of recommended test frame sizes defined in RFC 2544:
  - Test frames are 64, 128, 256, 512, 1024, 1280, and 1518 bytes.
  - The default selected frames are 64 and 1518 bytes.
  - To select/deselect any of the recommended test frames, check the box to the right of the desired frame.
- Add frame: The user can add two additional user configurable test frames of any size ranging from 64 bytes to 9000 bytes.
  - To add additional test frames, tap the 'Add Frame' button.

- Enter the frame size using the numeric keypad and click apply.
- Press the back button to return to the frames screen.
- The new custom frame size is displayed - it can be enabled or disabled as needed.

RFC 2544 Setup - Frame Settings



RFC 2544 Setup - Jumbo Frame



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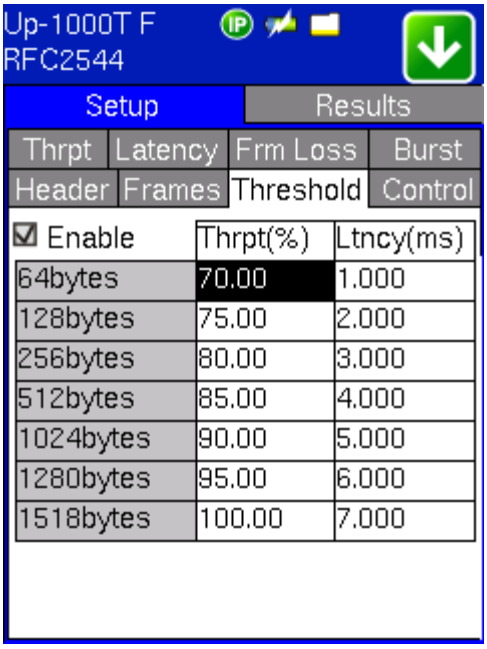
8.1.3 Threshold Settings

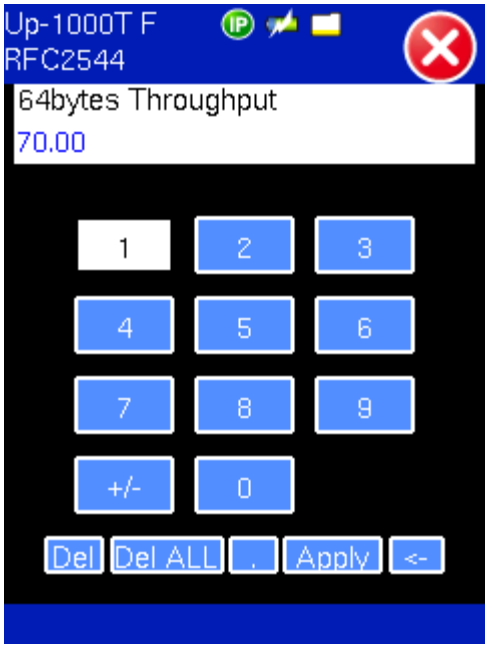
Threshold tab:

- User enables or disables threshold settings for the throughput and latency tests.
  - When enabled, threshold settings can be configured for all of the test frames selected in the frame settings tab.
- A Pass/Fail criteria will be applied when the threshold settings are enabled.
  - For example - If the throughput threshold value for a 64 byte frame is configured for 80%, then a Pass criteria is assigned if the throughput rate is 80% or better
  - The threshold values for Throughput and Latency can be customized per user requirements. Tap on the selected value to edit.

RFC 2544 Setup - Thresholds



RFC 2544 Threshold Editing



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8.1.4 Throughput, Latency, Frame Loss, and Burst Settings

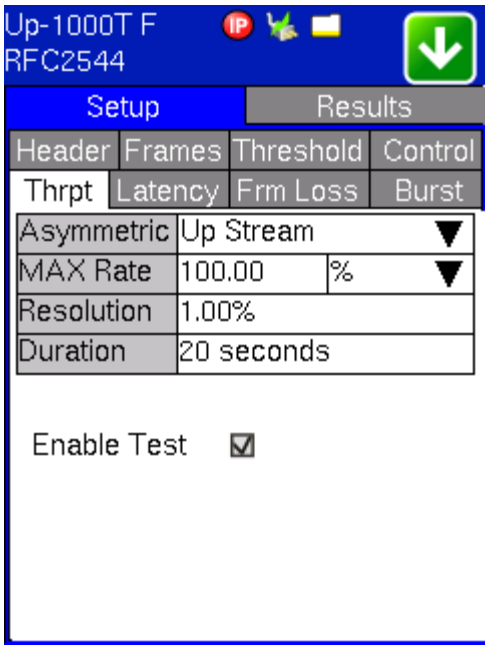
The RFC 2544 test suite allows the user to run all of the four tests, one of the four tests, or a combination of any of the four tests. The user simply has to enable/disable which tests to perform by checking/unchecking a selection box in the respective tab for each test. By default all of the four tests are enabled.

The following parameters must be configured before running the RFC 2544 conformance test suite.

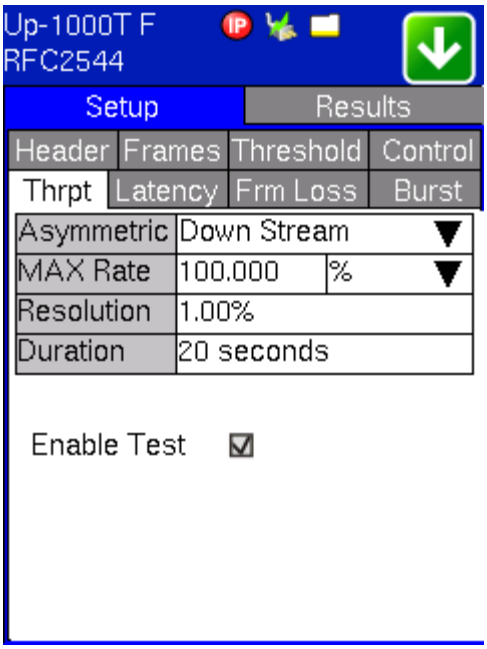
Throughput tab:

- Max Rate: Up to 100% of the negotiated line rate. The default value is 100%.
  - This is the maximum transmit rate to perform the throughput test for each test frame size.
  - The user may configure this rate as a % of the total line rate or in Mbps. For example if the user configures the Max Rate to be 90% and the negotiated line rate of the link is 100Mbps, then the maximum transmit rate will be 90Mbps or 90% of the line rat
- Resolution: 1% to 0.001%. The default value is 1%.
- Duration: 5 to 999 seconds. The default value is 20 seconds.
  - The duration is the amount of time the throughput test is run for, for each frame size at a given rate.

RFC 2544 Setup - Throughput Upstream



RFC 2544 Setup - Throughput Downstream



Accessing Upstream and Downstream Settings

Depending on the Control Mode selected (e.g. Asymmetric mode), test settings for upstream and downstream are also displayed

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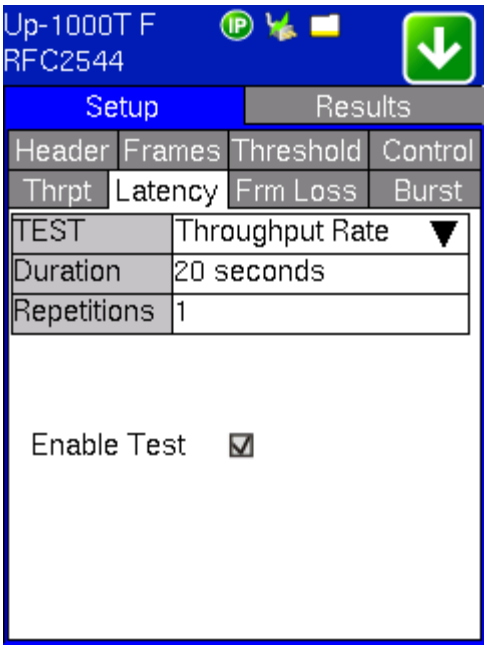
Latency tab: User configures:

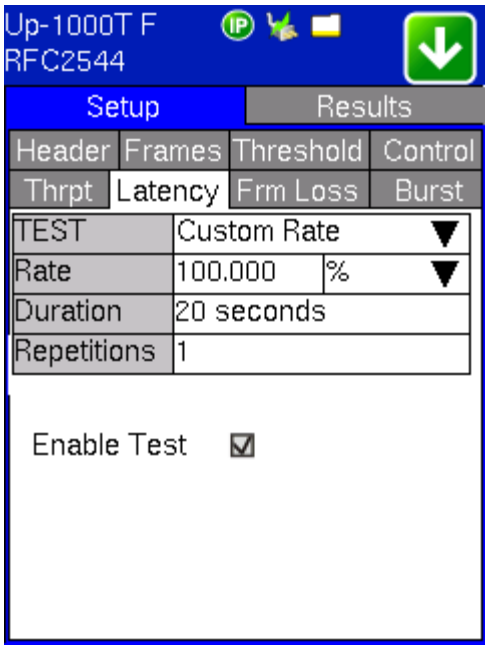
- Test: Throughput Rate or Custom Rate. The default value is throughput.

- Throughput rate - Latency test will be performed at the throughput rate found for each of the tested frame sizes.
- Custom rate - User configures a custom rate in % or Mbps
- Rate: Only available if Custom Rate is selected'. Enter up to 100% of the negotiated line rate or enter the rate in Mbps.
- Duration: 5 to 999 seconds. The default value is 20 seconds.
  This is the amount of time that the latency test will be performed for each test frame size.
- Repetitions: 1 to 100. The default value is 1.
  This is the amount of times that the latency test will be repeated for each test frame size

RFC 2544 Setup - Latency Throughput Rate



RFC 2544 Setup - Latency Custom Rate



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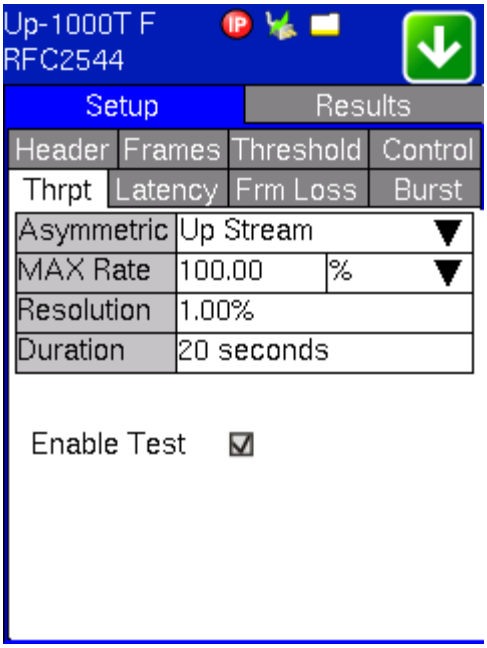
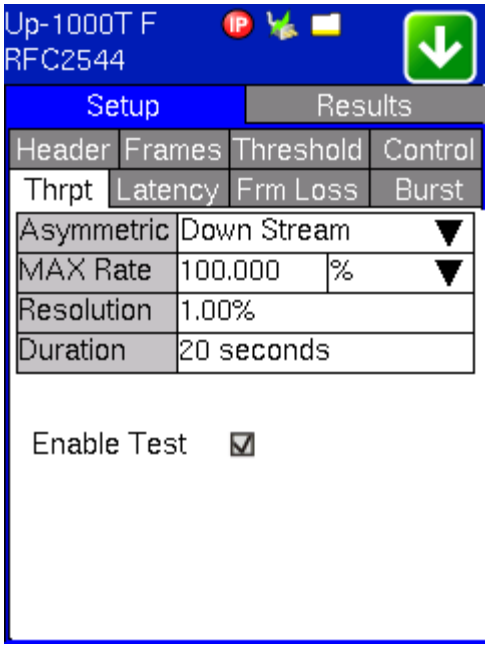
Frame Loss tab:

- Max Rate: Up to 100% of the negotiated line rate. The default value is 100%.
  This is the maximum transmit rate to perform the frame loss test for each test frame size. The user may configure this rate as a % of the total line rate or in Mbps. For example if the user configures the Max Rate to be 90% and the negotiated line rate of the link is 100Mbps, then the maximum transmit rate will be 90Mbps or 90% of the line rate.
- Step Size: 1 to 10%. The default value is 10%.
  The step size is the rate % that the frame loss test will be reduced by in the event of any frame loss. For example if the Max Rate is 100Mbps (or 100%) and frames are lost at this rate, then the transmit rate will be reduced to 90Mbps (or 90%). The frame loss test will now be performed at the new rate until there is zero frame loss at two consecutive rate settings. This means that the test will have to be performed at 80% (assuming that there was zero frame loss at 90%).
- Duration: Selectable in the range 5 to 999 seconds. The default value is 20 seconds.
  The duration is the amount of time the throughput test is run for, for each frame size at a given rate

RFC 2544 Setup - Frame Loss Upstream

RFC 2544 Setup - Frame Loss Upstream





Accessing Upstream and Downstream Settings

Depending on the Control Mode selected (e.g. Asymmetric mode), test settings for upstream and downstream are also displayed

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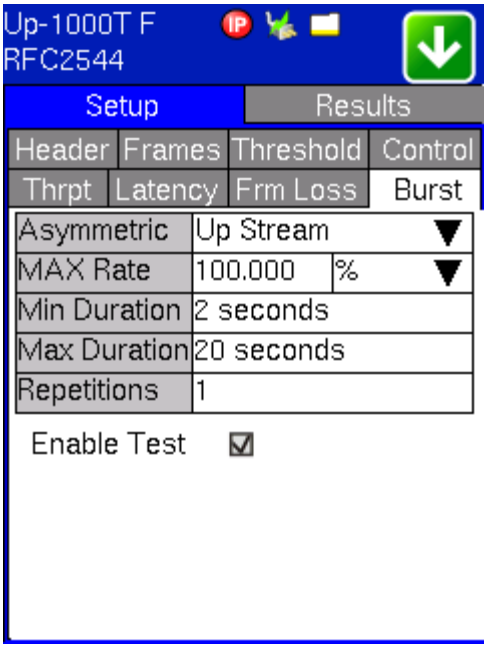
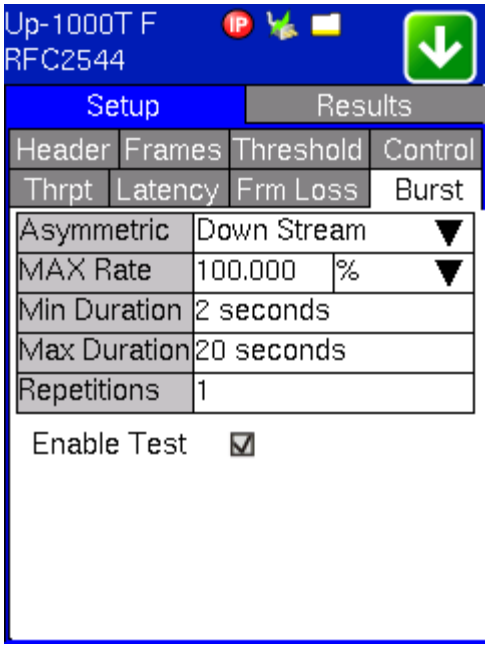
Burst (Back-to-Back) tab:

- Max Rate: The default value is 100%.
  In the burst test, frames are always transmitted at the maximum rate for a given minimum and maximum burst duration.
- Minimum Duration: Selectable in the range 2 to 999 seconds. Default value is 2 seconds.
  This is the duration of the first burst
- Maximum Duration: Selectable up to 999 seconds. The default value is 20 seconds.
  This is the duration of the second burst, which must be greater than the minimum burst.
- Repetitions: Selectable in the range 1 to 100. The default value is 1.
  This is the amount of times that the latency test will be repeated for each test frame size

RFC 2544 Setup - Burst Upstream

RFC 2544 Setup - Burst Downstream





Accessing Upstream and Downstream Settings

Depending on the Control Mode selected (e.g. Asymmetric mode), test settings for upstream and downstream are also displayed

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8.1.5 Control Settings

Overview:

Asymmetrical links like ADSL and VDSL2 provide different line rates in the two directions - normally the downlink line rate is significantly higher than the uplink line rate. To verify the information for both the low and the high rates of the link, the user needs to send a test signal from one instrument located at one end of the link to an instrument at the other end of the link and vice versa to test traffic capacity. The two test instruments have to be synchronized, because the tests defined in RFC 2544 require the receiver to know the contents of the test signal to be transmitted in detail.

The MX120+ offers an automated RFC 2544 test application to perform throughput, frame loss and burstability tests in a local-remote unit setup. The user first configures the test setup in the local MX120+ - once initiated, the local MX120+ transfers the setup information to the remote MX120+ via the line under test. Upon completion, the remote MX120+ transfers the test results back to the local MX120+, enabling the user to read the results for both directions of the link on the local unit. The dual-port capability of the MX120+ allows the user to test two links simultaneously.

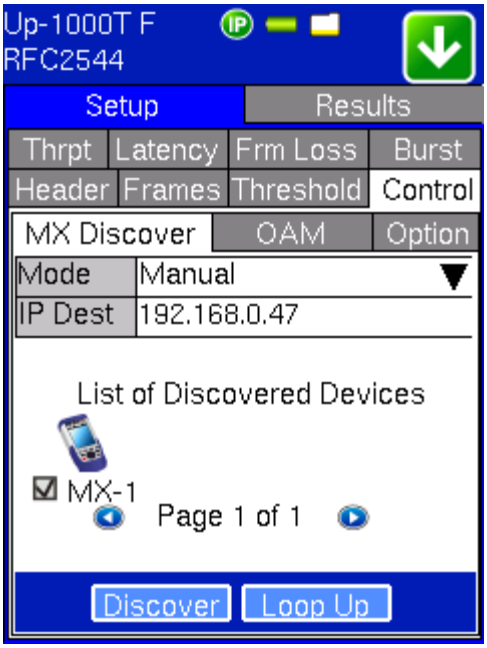
RFC 2544 End-to-End Testing

Control button:

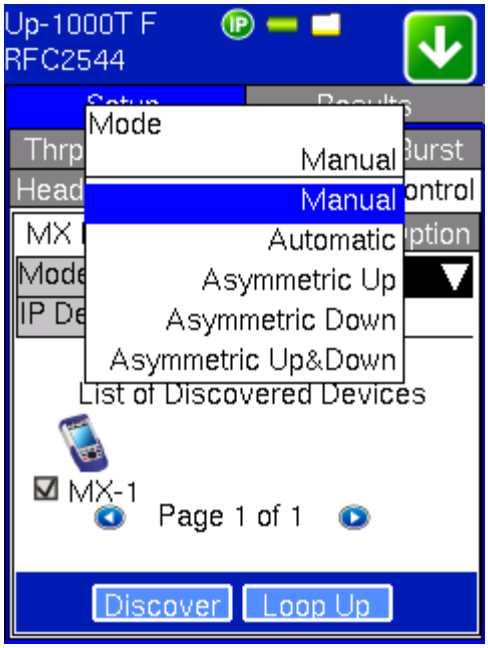
Configures the loop-up and loop-down commands necessary to control the remote unit or the test profile in the case of Asymmetric testing. The user is allowed to configure the commands manually or automatically.

- Manual selection: user must input the destination IP address of the far end device
- Automatic selection:
  - No configuration is necessary - user only has to select the "discovered" far end device to control.
  - Select from a list of discovered devices to loop-up/down.
- Asymmetric Up
- Asymmetric Down
- Asymmetric Up/Down

RFC 2544 Setup - Control Manual



RFC 2544 Setup - Control Modes



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8.1.6 Starting/Stopping a RFC 2544 Test

Once all configurations have been made, the user can start the RFC 2544 test. The following are three scenarios of how to prepare and start the unit for RFC 2544 testing.
Note: If the testing on the fiber ports, make sure the LASER is turned On before starting the test.

- Far End Unit in Manual Loopback Mode:
  - If the far end unit (another MX) is already in a manual loopback mode, the user must make sure that the control settings mode are set to manual. Do not send a loop up command, since it is not necessary.
  - Once the correct control settings are configured, the user can start the test

The selected tests will run automatically. When all the tests are complete the test will stop automatically. If the RFC 2544 test

suite needs to be stopped before they are done, then simply press the Stop button, located in the actions pull down menu. The status of each selected test can be seen in the Results tab.

- Far End Unit Controlled with Manual Mode Loop Up/Down Commands
  - If the far end unit is not manually looped back, then it must first receive a loop up command from the control unit before the RFC 2544 test suite can be started.
  - To loop up the far end unit with the manual mode loop up/down commands, configure the control settings mode to manual.
  - Enter the MAC and/or IP address of the far end unit.
  - Send the loop up command by pressing 'Loop Up'

Once the far end unit has been looped back, start the test by pressing the Start button. When the all of the selected test are completed, the RFC 2544 test suite will stop automatically. Once all tests have been completed and there is no need to test again, go back to the Control tab, and press the 'Loop Down' button. This will send a loop down command to the far end unit to remove the loopback that is in place.

- Far End Unit Controlled with Automatic Mode Loop Up/Down Commands
  - If the far end unit is not manually looped back, then it must first receive a loop up command from the control unit before the RFC 2544 test suite is started.
  - To loop up the far end unit with the automatic mode loop up/down commands, configure the control settings mode to automatic.
  - Enter the MAC and/or IP address of the far end unit.
  - Press Start to automatically loop up the far end unit

Start the RFC 2544 test, and loop down the far end unit when all tests have been completed.

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8.2 RFC 2544 Results

The progress and current result of the RFC 2544 can be viewed as the test is in progress.

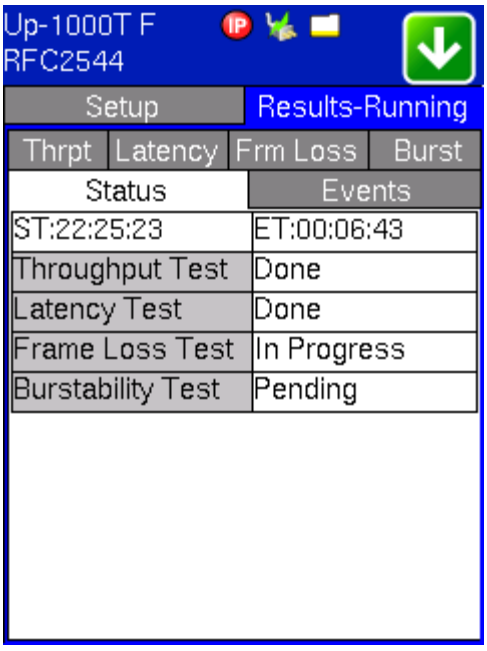
Results tab:

Navigate the respective sub-tabs (throughput, latency, frame loss, or burst) to view the results for each test. For the burst test the results can be viewed in summary table format or test log format.

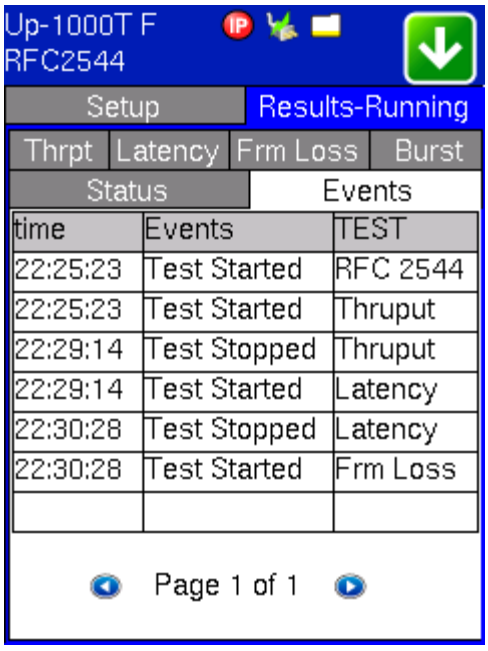
8.2.1 Status and Events

The status of each test is displayed including a time stamped log of each test.

RFC 2544 Results - Status



RFC 2544 Results - Events



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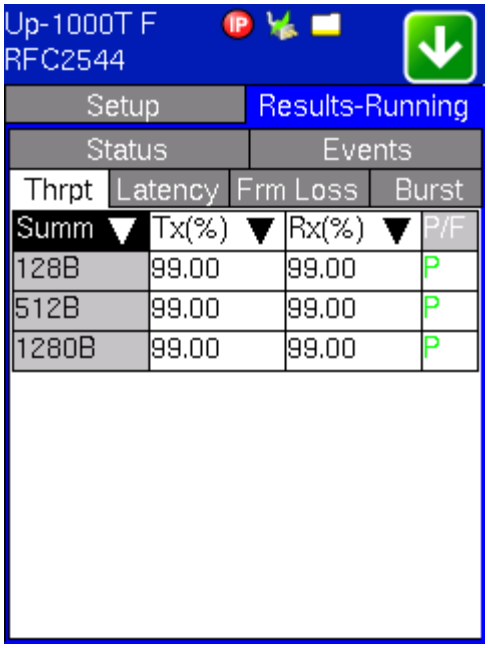
8.2.2 Throughput

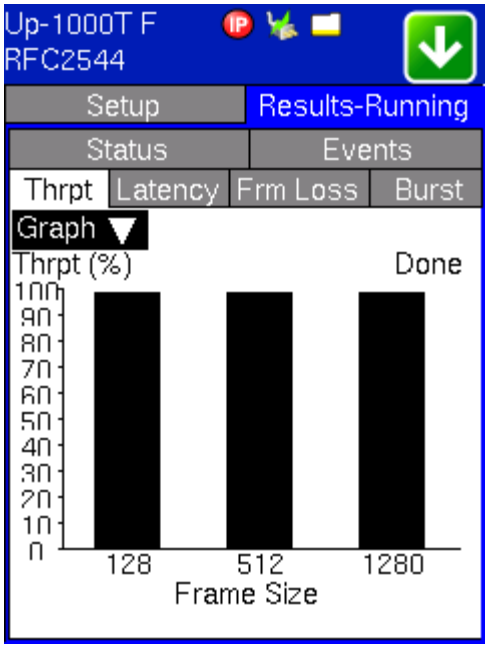
Throughput results are displayed in the following formats:

- Graphical
- Summary table
- Test log table

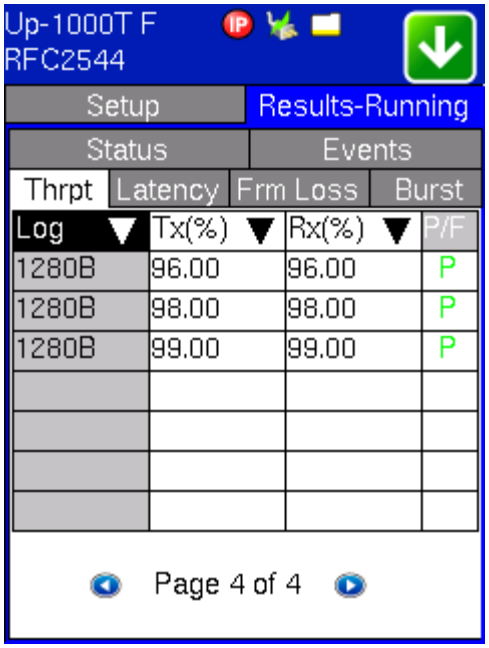
RFC Results - Throughput Summary



RFC Results - Throughput Graph



RFC Results - Throughput Test Log



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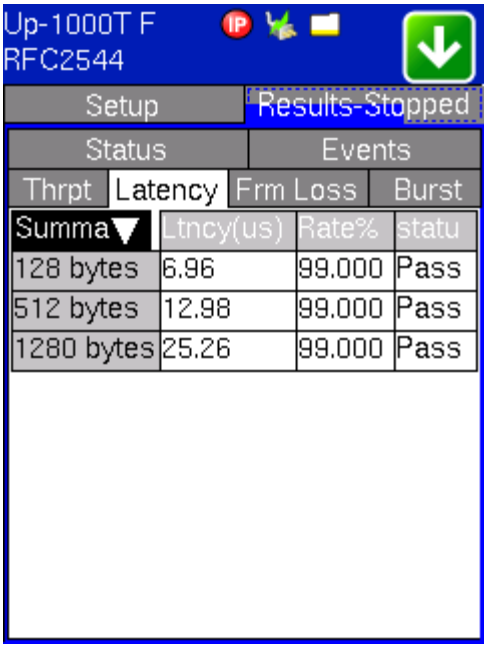
8.2.3 Latency

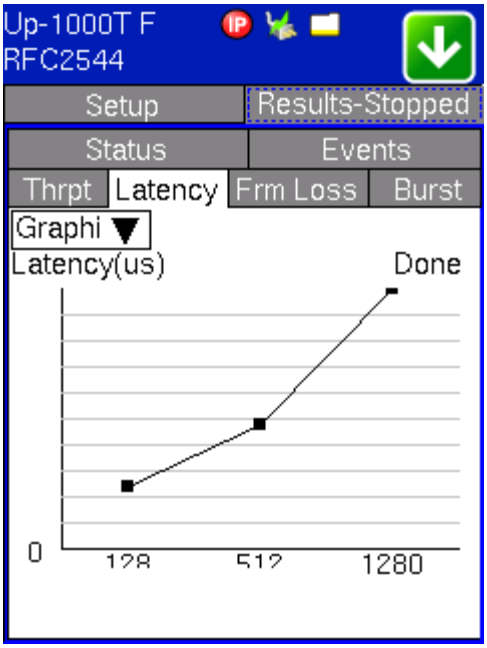
Latency results are displayed in the following formats;

- Graphical
- Summary table
- Test log - Byte Size, Latency (ms), Rate (%) and Status (Pass or Fail)
- Jitter Graph
- Jitter Summary
- Jitter Log

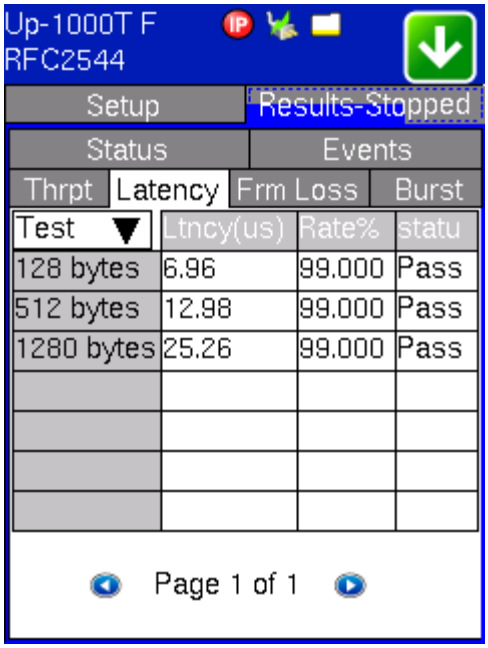
RFC Results - Latency Summary RFC Results - Latency Graph RFC Results - Latency Test Log



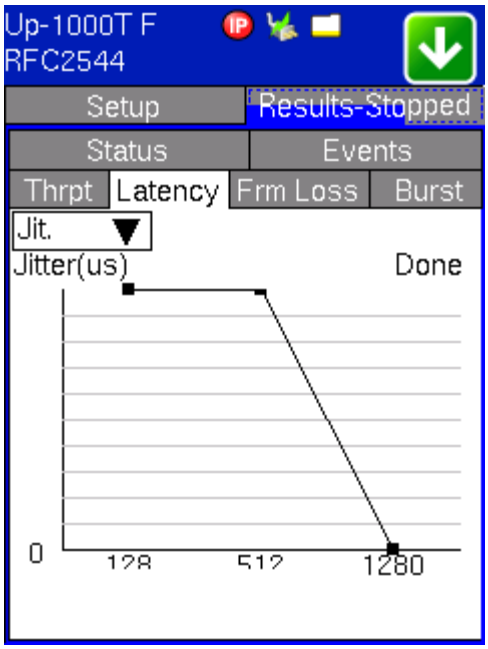
RFC Results - Latency Jitter Graph

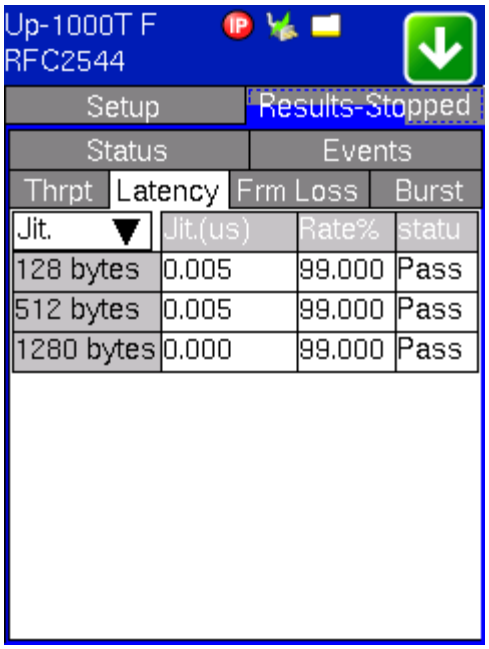


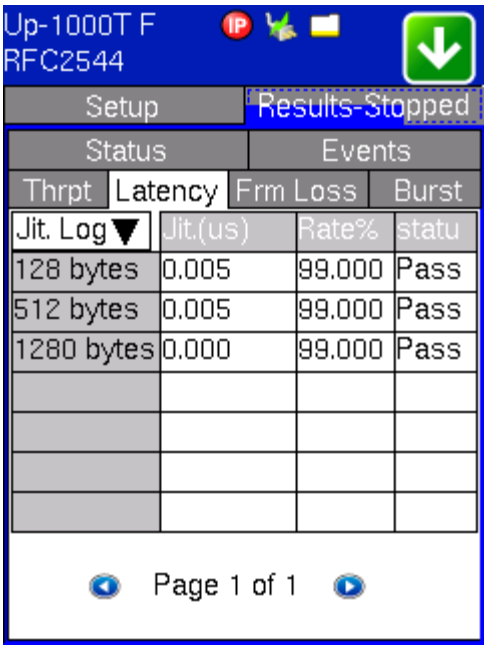
RFC Results - Latency Jitter Summary



RFC Results - Latency Jitter Log







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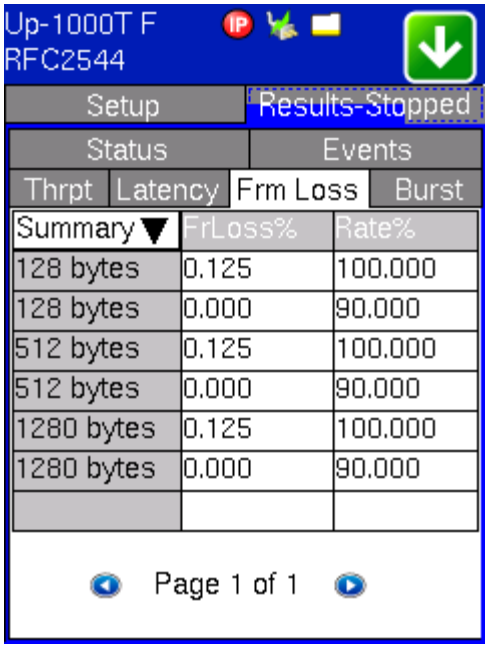
8.2.4 Frame Loss

Frame loss results are displayed in the following formats;

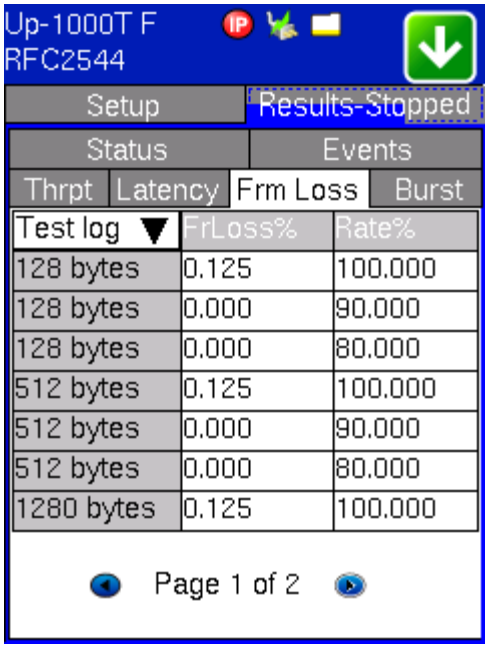
- Summary table
- Test log table
- Graphical

RFC Results - Frame Loss Summary

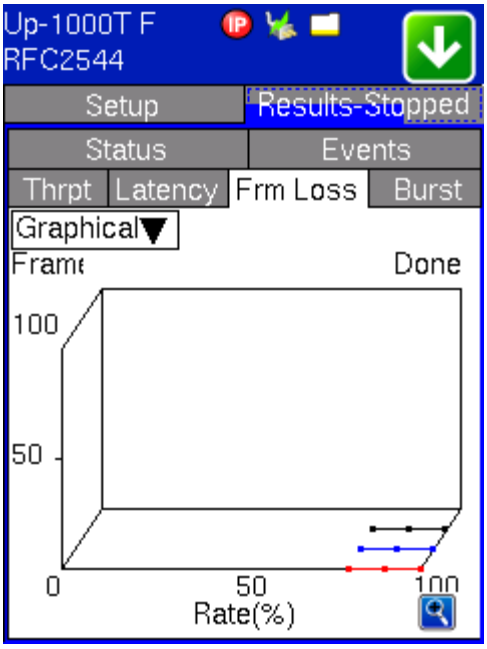
RFC Results - Frame Loss Test Log

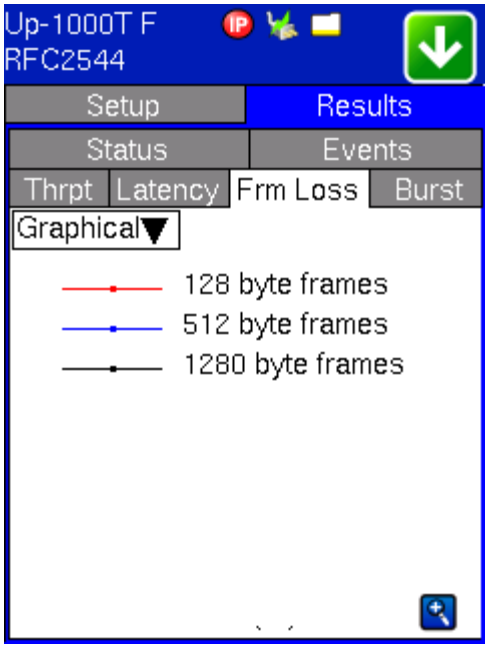


RFC Results - Frame Loss Test Graph



RFC Results - Frame Loss Graph (Zoomed)





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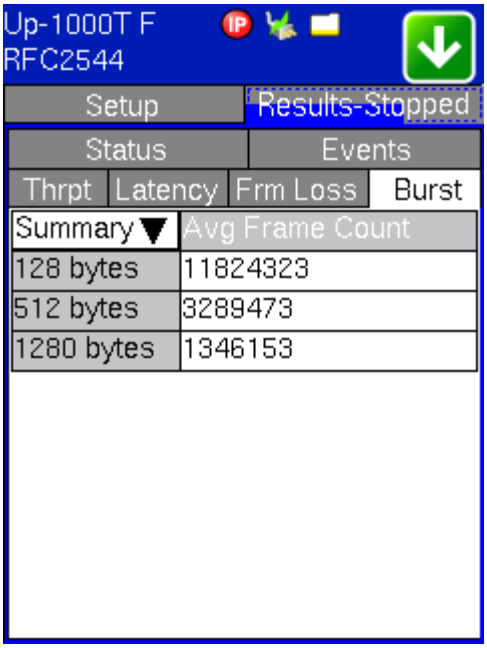
8.2.5 Burst

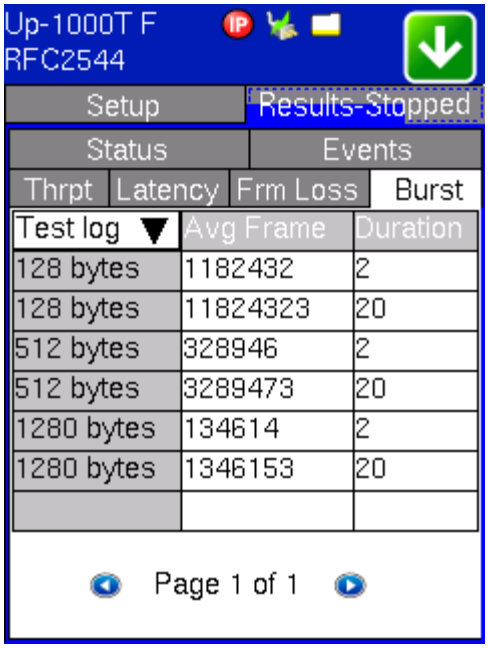
Burstability (back-back) results are displayed in the following formats;

- Summary table
- Test log table

RFC Results - Burstability Summary

RFC Results - Burstability Test Log





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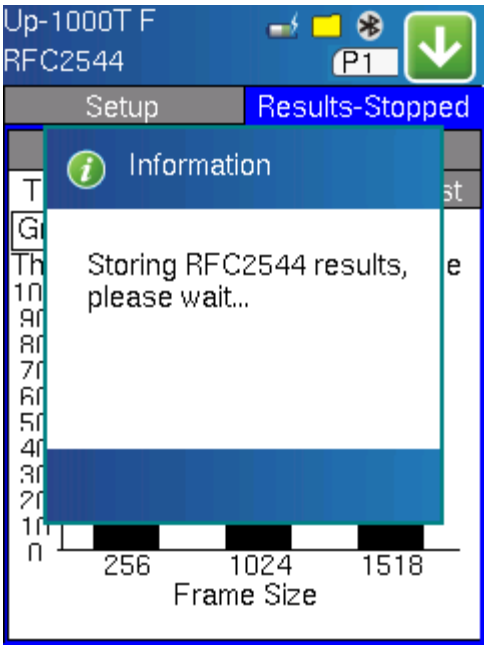
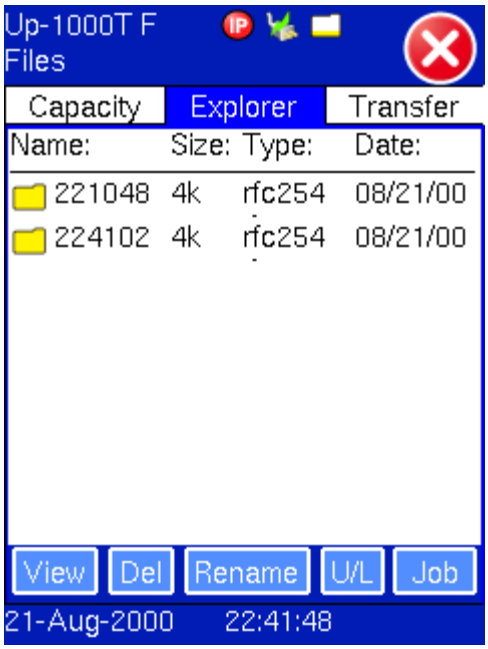
8.2.6 Saving RFC 2544 Results

Once the test has been stopped the results can be saved by pressing the save key on the keypad. The results will be saved and named automatically. Once the results are saved, the user may view or rename the results file by going to the Explorer folder located in the Files menu.

RFC Results - Storage



RFC Results - File Explorer



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9.0 Throughput Testing (Multiple Streams)

Overview:

The throughput application (or the multiple streams application) performs the following measurements: throughput performance, frame loss analysis, delay analysis, frame/packet arrival analysis, received traffic type analysis, and received traffic frame size analysis. On the transmit side, the throughput application allows for the configuration of up to 8 traffic streams with their own MAC and IP addresses, VLAN tags (up to 3 per stream), bandwidth/rate, frame size, and L2 and/or L3 quality of service (QoS)

parameters. On the receiver end the traffic is analyzed on a per stream (up to 8 streams) basis as well as a global or aggregate measurement.

This application is very useful in verifying the transport of traffic with different prioritization settings across a network link. The test helps verify that the network can handle high priority traffic and low priority traffic accordingly.

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9.1 Setup

Unless otherwise noted, the Frame Header and related setups are identical to the BERT and RFC 2544 Applications described above. The following parameters must be configured prior to performing a Throughput test;

- Number of streams (See General settings below)
- Bandwidth per stream (See General settings below)
- Test layer
- Frame Type
- VLAN tags
- MPLS tags
- Frame header per stream (if applicable)
- Traffic profile per stream (if applicable)
- Error injection per stream (if applicable)
- Control settings of the far end devices (if applicable).

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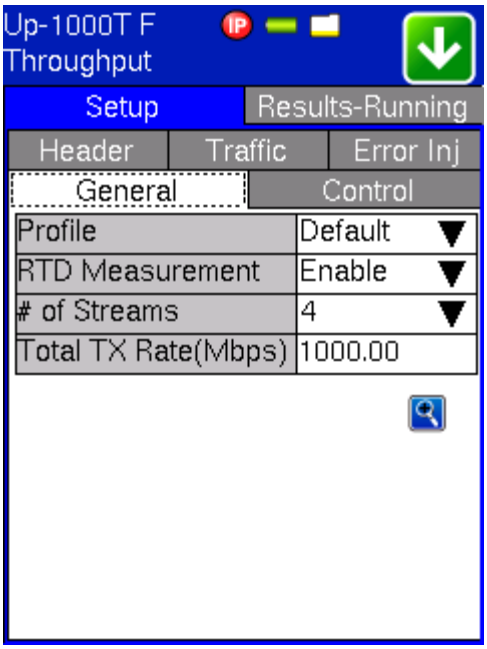
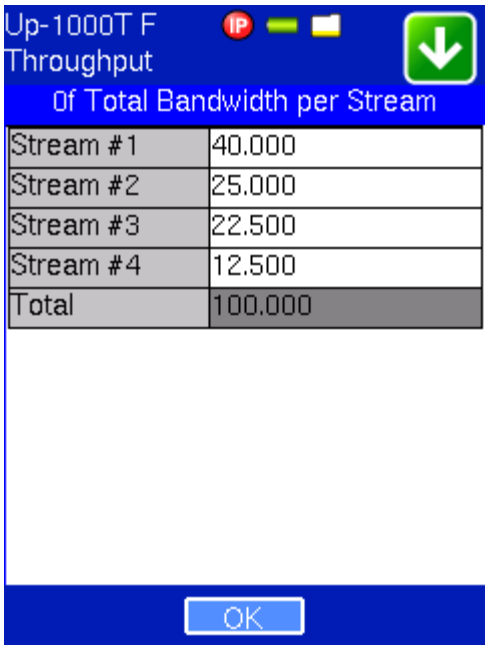
9.1.1 General Settings

- Profile: Load a previously configured test profile or create a new profile from the existing settings.
- # of Streams: From 1 to 8 streams. Pressing the zoom function, displays the Bandwidth allocated per Stream: Note: The total bandwidth for all streams cannot exceed 100%.

Throughput Setup - General



Throughput Setup - Stream BW Overview



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9.1.2 Control

Control button:

Overview: Configures the loop-up and loop-down commands necessary to control the far end unit. The user is allowed to configure the commands manually or automatically.

- Manual selection: user must input the destination MAC/IP address of the far end device including the command type
- Automatic selection: User must select from a list of discovered devices to loop-up/down.
  - In automatic mode no configuration is necessary - user only has to select the "discovered" far end device to control.

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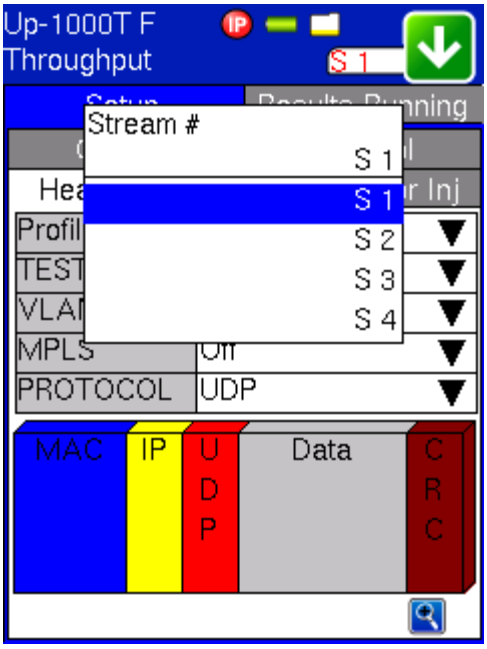
9.1.3 Per Stream Configurations

Please note that for any of the per stream configurations (Header, Traffic, and Error Injection), a stream number will be displayed. The user must select each stream number separately to configure the respective parameters. Select the stream # by tapping the stream number box at the top right hand side of the screen.

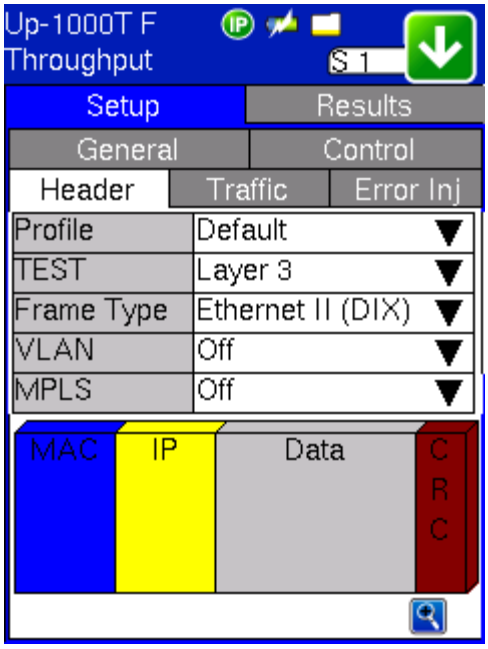
Header Settings (Per Stream Configurations)

- Profile: Load a previously configured test profile or create a new profile from the existing settings.
- Test: Select the test layer. Options Layer 2 and Layer 3.
- Frame Type: Select the Ethernet frame type. The options are 802.3 Raw (IEEE 802.3 frame without LLC), 802.3 LLC (IEEE 802.3 frame with LLC header), 802.3 SNAP (IEEE 802.3 frame with SNAP header), and Ethernet II (Dix). Note: The 802.3 Raw frame type is not available when Layer 3 is selected.
- VLAN: Off, 1 tag, 2 tags, or 3 tags. The user will be able to configured up to 3 VLAN tags (VLAN stacking, for Q-in-Q applications).
- MPLS: Off, 1 tag, 2 tags, or 3 tags. MPLS tag configuration is only available when the MPLS option is purchased.
- MAC, VLAN, MPLS, and IP: To configure the MAC addresses, VLAN ID/priority, MPLS label/CoS/etc, IP addresses and header, tap on the 3-D image of the frame on the screen. This will bring you to the configuration screens for all the header fields.
- MAC Header Tab: In the MAC tab the user must configure the destination MAC address of the far end partner test set. For the source address use the default source address of the test set or configure a different one. Depending on the type of frame the user may also configure an Ethernet Type filed (Ethernet II frame), LLC header fields (802.3 LLC frame), or SNAP header fields (802.3 SNAP frame).
- VLAN Tab: In the VLAN tab the, the VLAN ID, priority, and Tag Type (or Ethernet Type) can be configured for all available VLANs.
- MPLS Tab: In the MPLS tab the MPLS label, CoS priority settings, TTL, and S-bit fields are configured for all available MPLS tags.
- IP Tab: In the IP tab the user must configure the destination IP address and source address. The user may also configure the following IP header fields; IP TOS (for quality of service testing), TTL, fragment offset byte, and the protocol field.
- RX Filter: Filter traffic by MAC or IP source and destination addresses or VLAN tag.

Throughput Setup - Stream List



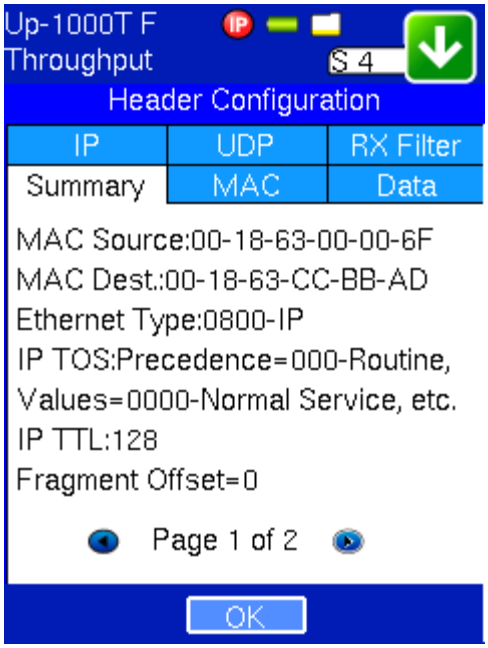
Throughput Setup - Header / Stream #1



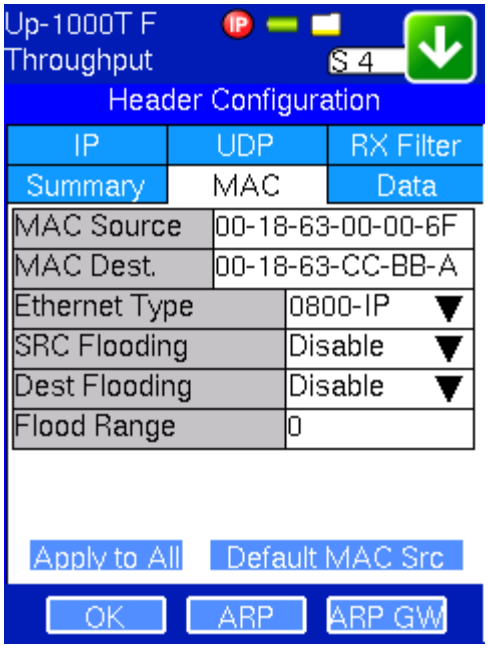
Multiple Streams

All streams are configured for the same test layer - if layer 2 is selected, then all streams will be layer 2 traffic.

Throughput - Header Summary Stream #1



Throughput - MAC Setup Stream #1



Multiple Streams - MAC/IP address setups

If all streams are going to the same far end unit, then the MAC/IP destination addresses must be the same on all of the streams.
If any of the traffic streams are going to more than one far end unit, please ensure that the correct MAC/IP destination addresses are configured for the respective streams.

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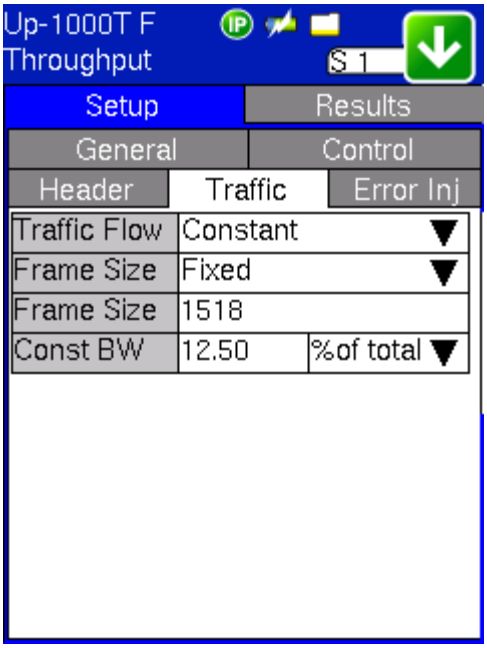
9.1.4 Traffic Settings (Individual Stream Configuration)

In the Traffic tab the user is be able to configure the traffic profile per stream, including frame size selection, traffic type, and transmit rate. If the same traffic type applies to all streams, apply this profile to all streams using the Apply to ALL button

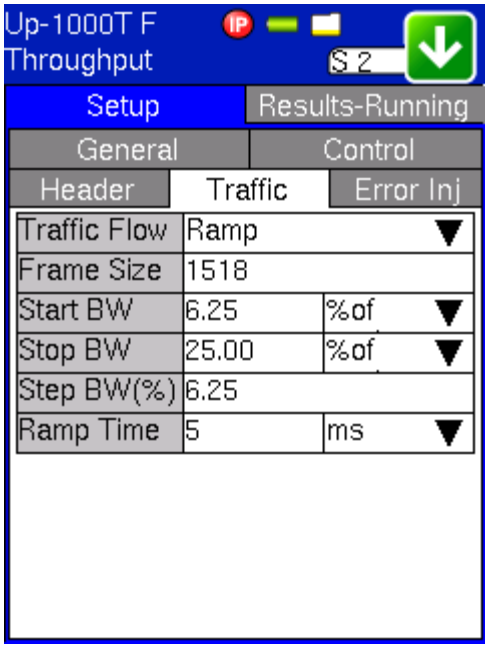
- Frame Size: Enter the frame size when a Layer 2 or Layer 3 BERT is selected. Frame size configuration is not available for Layer 1 BERT. Frame sizes can be from 64 bytes to 1518 bytes, in addition to jumbo frames up to 9k bytes.
- Traffic Flow: Select from Constant, Ramp, Burst or Single Burst traffic flow.
- BW (Transmit Bandwidth): Configure the transmit rate for the stream.
  Note: the bandwidth allocation per stream is already configured in the General Settings tab, but can be modified in this screen as well.

Throughput - Traffic Setup - Constant

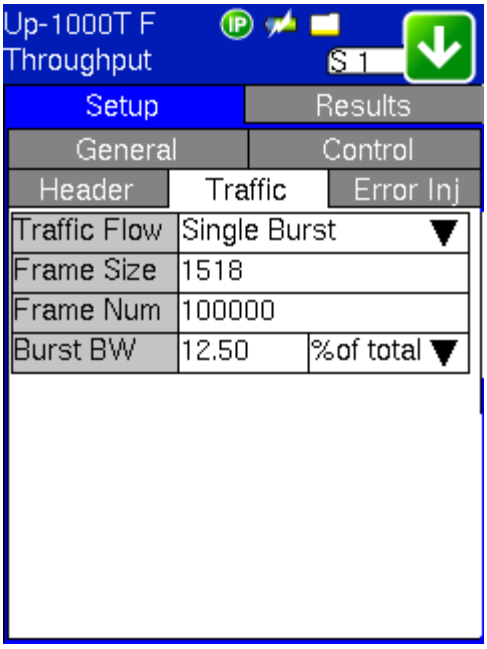
Throughput - Traffic Setup - Ramp

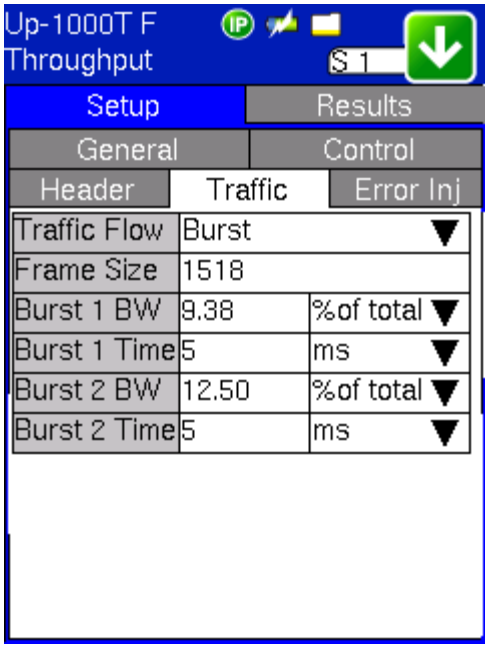


Throughput - Traffic Setup - Single Burst



Throughput - Traffic Setup - Burst





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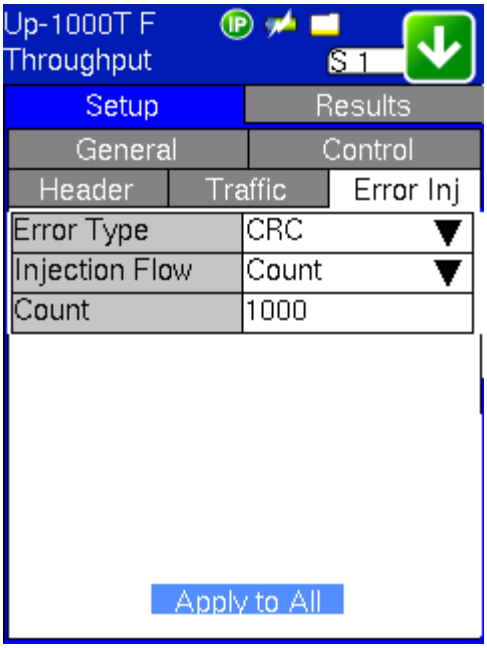
9.1.5 Error Injection Settings (Individual Stream Configuration)

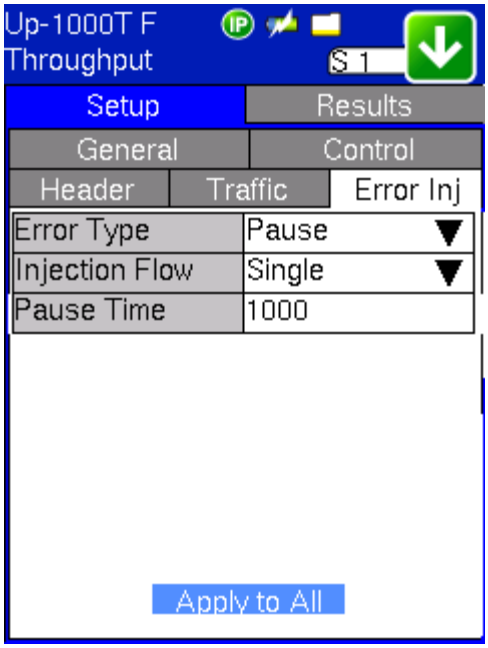
Error injection can be performed during test. The type of errors and error injection are configured in the Error Injection tab. Once the test is running, error injection can be performed by pressing the Error Inject button on the right side of the screen.

- Error type: Select from Bit, CRC, Bit and CRC, OOS/IPR, TCP/UDP Checksum (Layer 4 only), or Pause.
- Injection Flow: The error injection flow determines how the selected errors will be injected. The user can select a single error or a specific count.
- Count: The user will be able to configure the error count via numeric keypad.

Throughput - Error Inject Setup - CRC

Throughput - Error Inject Setup - Pause





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9.1.6 Starting/Stopping a Throughput (Multiple Streams) Test

Once all the necessary configurations have been made, the user can now start the Throughput test. The following are three scenarios of how to prepare and start the unit for Throughput testing.
Note: If the testing on the fiber ports, make sure the LASER is turned On before starting the test.

- Far End Unit in Manual Loopback Mode:
  - If the far end unit (another MX) is already in a manual loopback mode, the user must make sure that the control settings mode is set to manual. Do not send a loop up command, since it is not necessary.
  - Once the correct control settings are configured, the user can start the test

The selected tests will run automatically. When all the tests are complete the test will stop automatically. If the Throughput test needs to be stopped before they are done, then simply press the Stop button, located in the actions pull down menu. The status of each selected test can be seen in the Results tab.

- Far End Unit Controlled with Manual Mode Loop Up/Down Commands
  - If the far end unit is not manually looped back, then it must first receive a loop up command from the control unit before the Throughput test can be started.
  - To loop up the far end unit with the manual mode loop up/down commands, configure the control settings mode to manual.
  - Enter the MAC and/or IP address of the far end unit.
  - Send the loop up command by pressing 'Loop Up'

Once the far end unit has been looped back, start the test by pressing the Start button. Once Throughput tests have been completed and there is no need to test again, go back to the Control tab, and press the 'Loop Down' button. This will send a loop down command to the far end unit to remove the loopback that is in place.

- Far End Unit Controlled with Automatic Mode Loop Up/Down Commands
  - If the far end unit is not manually looped back, then it must first receive a loop up command from the control unit before the Throughput test is started.
  - To loop up the far end unit with the automatic mode loop up/down commands, configure the control settings mode to automatic.
  - Enter the MAC and/or IP address of the far end unit.
  - Press Start to automatically loop up the far end unit

Start the Throughput test, and loop down the far end unit when all tests have been completed.

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9.2 Throughput Results

9.2.1 Viewing Test Results (Individual and Multiple Streams)

When the test is first started, the screen automatically changes to the Global/Aggregate results screen.

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9.2.2 Global Results

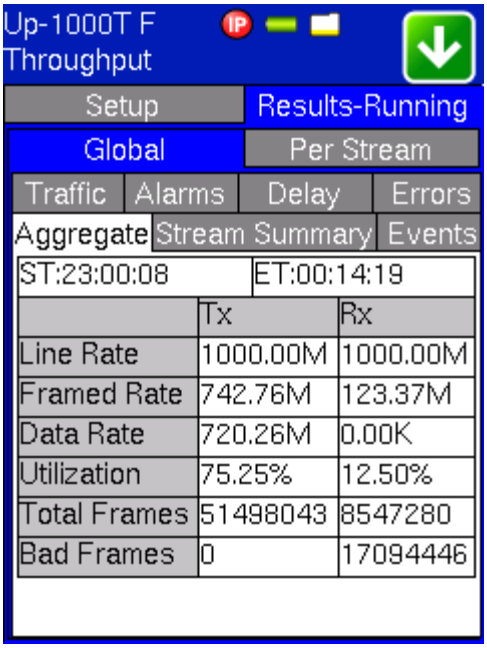
The Aggregate screen displays;

- Line rate
- Framed rate
- Total data rate
- Total utilization
- Total # of frames
- Total number of bad frames
- Optical power measurement (if applicable).

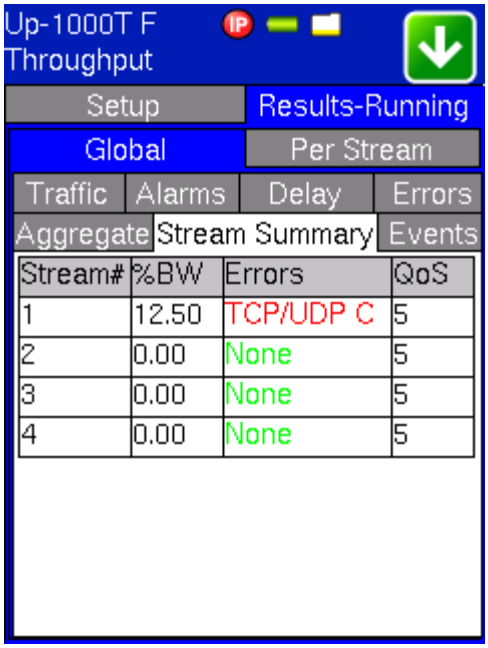
The Global 'Stream Summary' screen displays;

- Stream number (#)
- Total received bandwidth per stream
- Errors/alarms associated with the stream
- Quality of Service (QOS) associated with each stream

Throughput Results - Global Aggregate



Throughput Results - Stream Summary



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The Global 'Errors' screen displays the Current and Total error count of all streams:

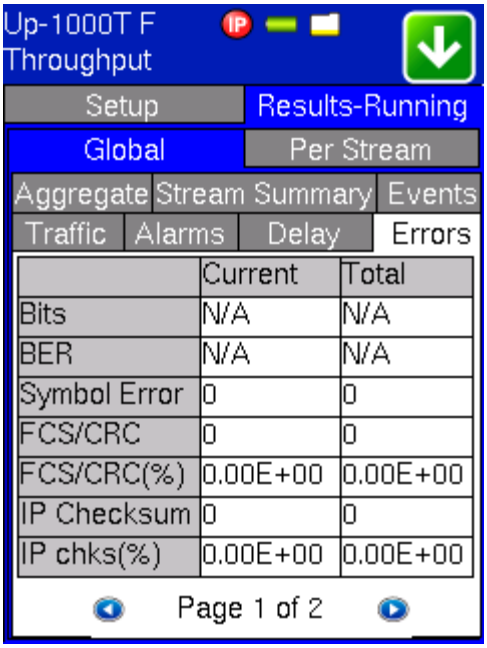
- Bits
- BER
- Symbol
- FCS/CRC
- IP Checksum
- Jabber Frames
- Runt Frames

The Global 'Alarms' screen displays the Current and Total alarm count of all streams:

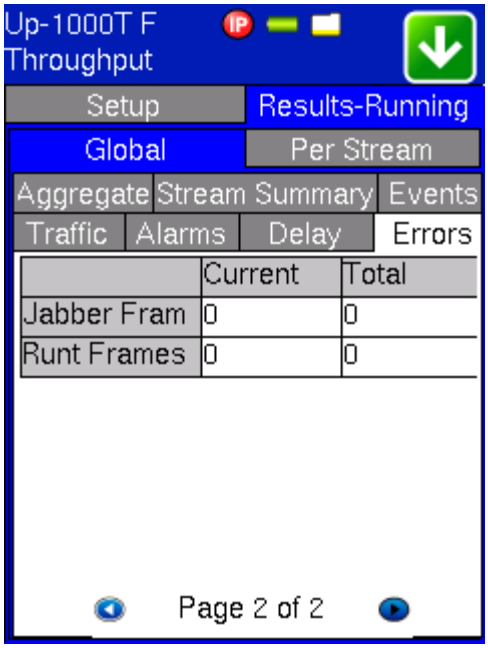
- LOS

- LOS synchronization in ms
- Service Disruption statistics in ms

Throughput Results - Global Errors (Page 1)



Throughput Results - Global Errors (Page 2)



Throughput Results - Global Alarms

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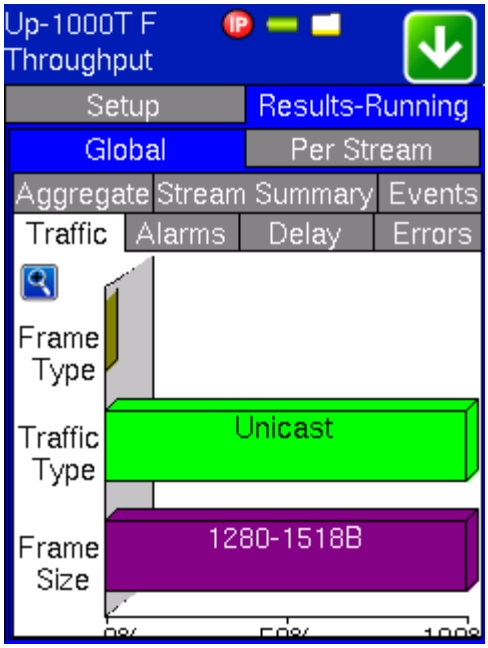
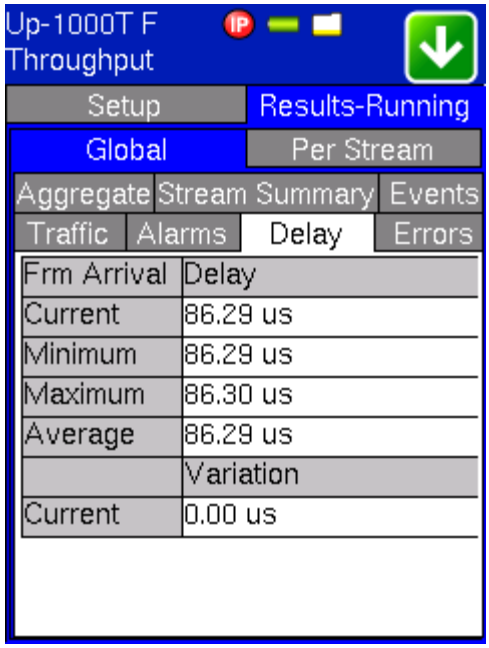
The Global 'Traffic' screen displays:

- Frame Type of all streams
- Traffic Type/s of all streams
- Frame size of all streams

Throughput Results - Global Traffic Summary

Throughput Results - Global Stream Delay





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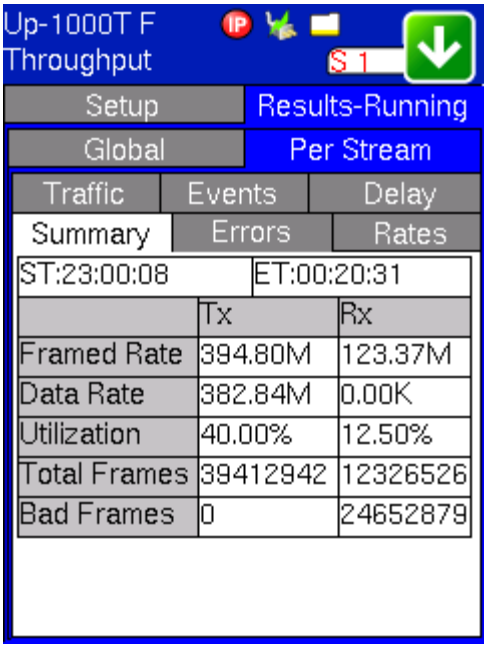
9.2.3 Individual Stream Results

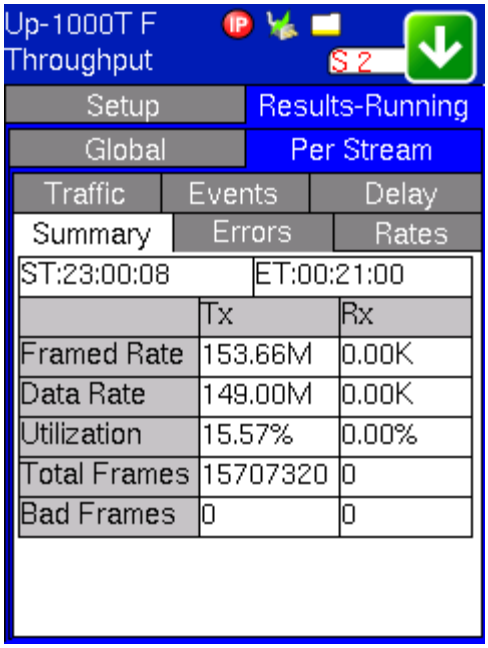
In the 'Per Stream' tab the following measurements are available:

- Summary - Framed rate, data rate, # of bytes, total # of frames associated with each stream
- Errors - Errors associated with each stream
- Events - Events associated with each stream
- Traffic - Traffic statistics associated with each stream
- Delay - Delay associated with each stream
- Rates - Rates information associated with each stream

Throughput Results - Summary Stream #1



Throughput Results - Summary Stream #2



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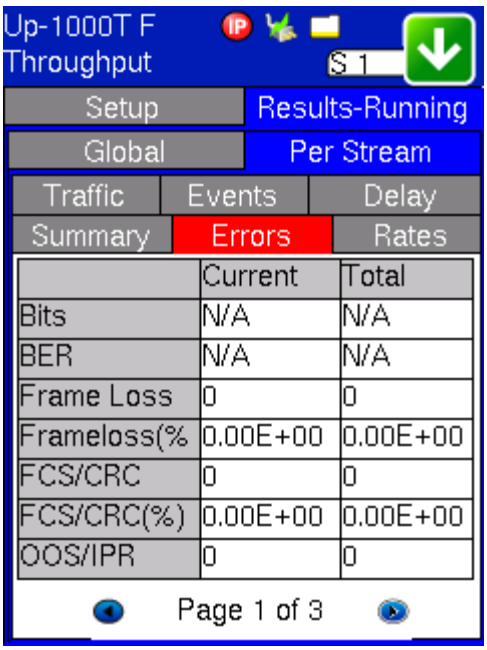
The Per Stream 'Errors' screen displays the Current and Total error count of each stream:

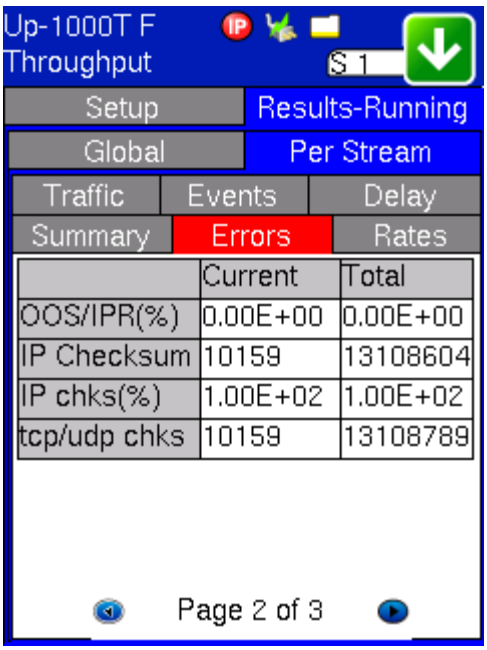
- Bits
- BER

- Frame Loss
- Frame Loss %
- FCS/CRC
- Out of Sequence (OOS) frames
- IP Checksum
- Jabber Frames
- Runt Frames
- Giant Frames

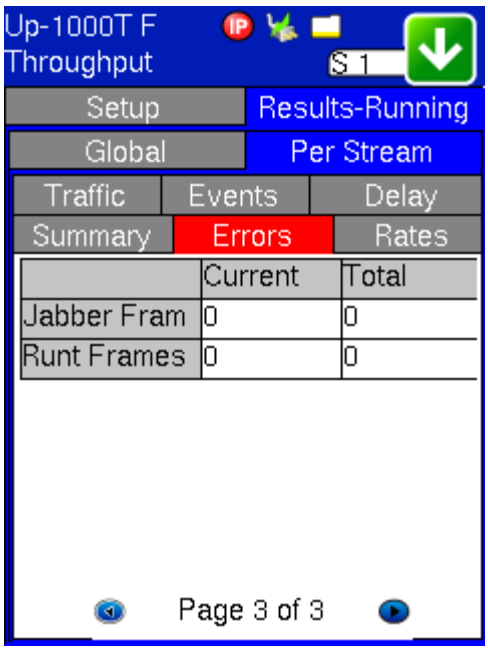
Throughput Results - Errors (Page 1)



Throughput Results - Errors (Page 2)



Throughput Results - Errors (Page 3)



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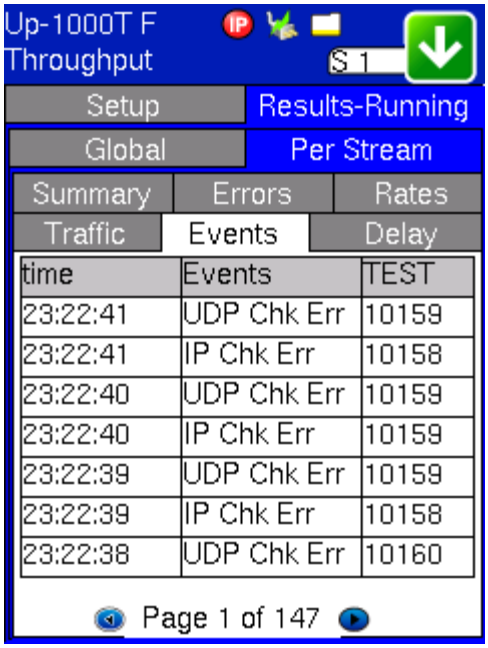
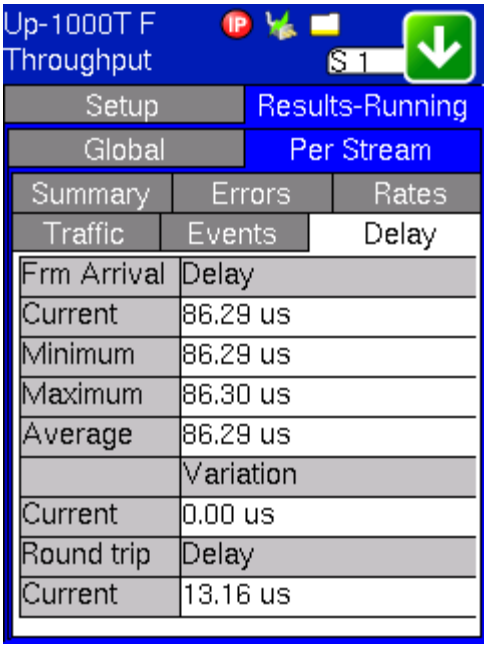
The Per Stream 'Events' screen displays a Date and Time stamped record of bit errors, alarms and other anomalies pertaining to each stream.

The Per Stream 'Delay' screen displays the frame delay information pertaining to each stream.

Throughput Results - Events per Stream



Throughput Results - Delay per Stream



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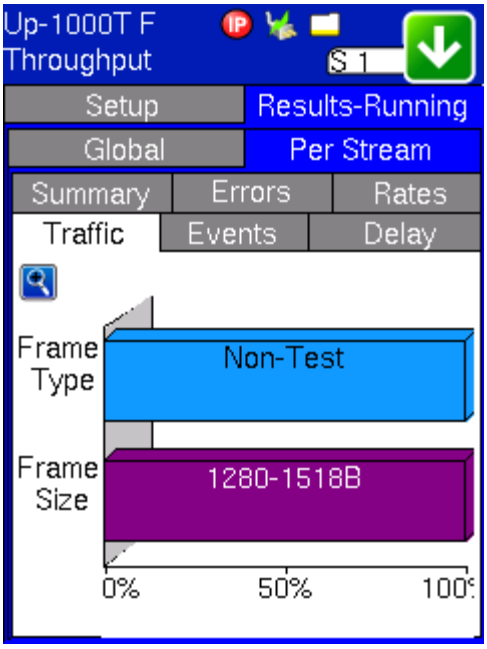
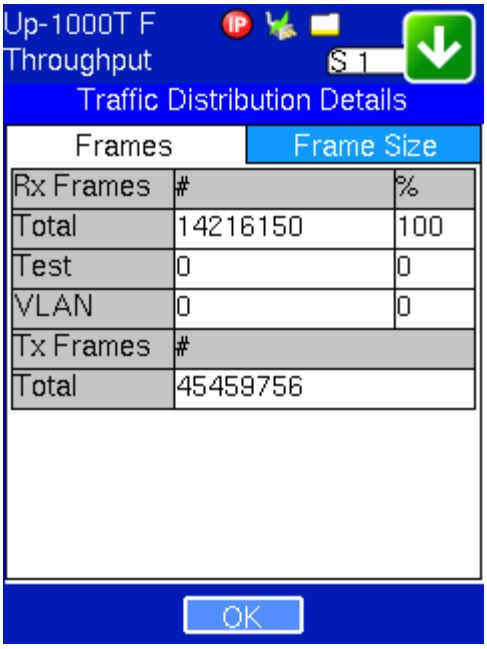
The Per Stream 'Traffic' screen displays the frame type summary (graphical), frame type (tabular) and frame size distribution pertaining to each stream.

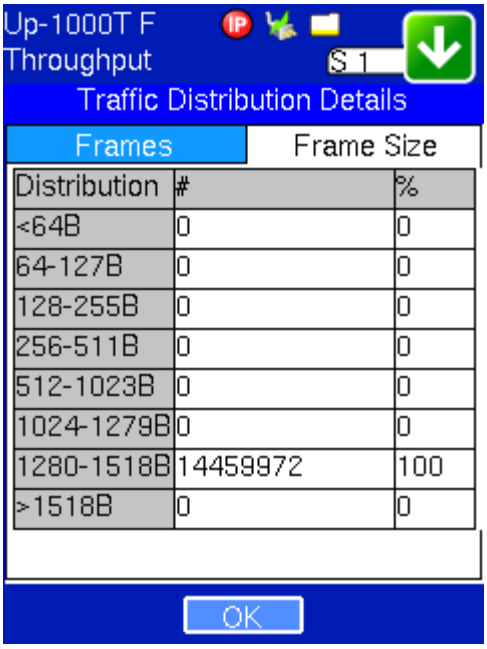
Throughput Results
Traffic Overview per Stream



Throughput Results
Frame Types per Stream



Throughput Results
Frame size per Stream



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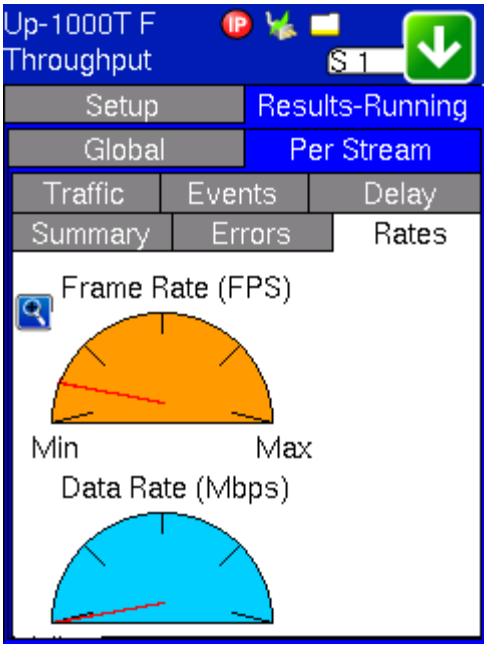
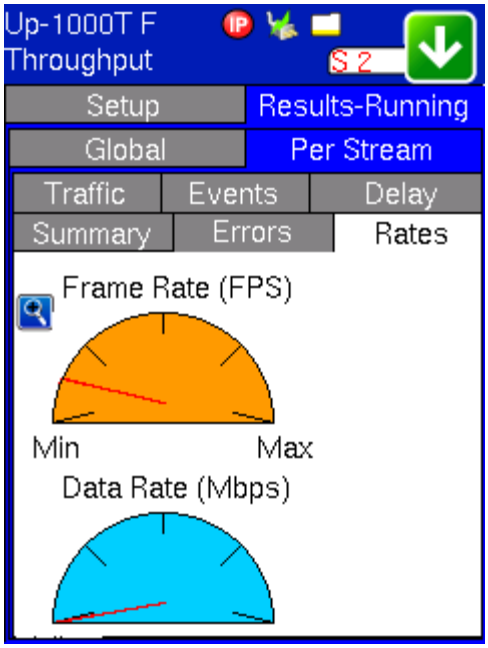
The Per Stream 'Rate' screen displays the frame rate and data rate pertaining to each stream. Tapping the zoom icon displays the rate details applicable to that stream

Throughput Results - Rates Stream 1

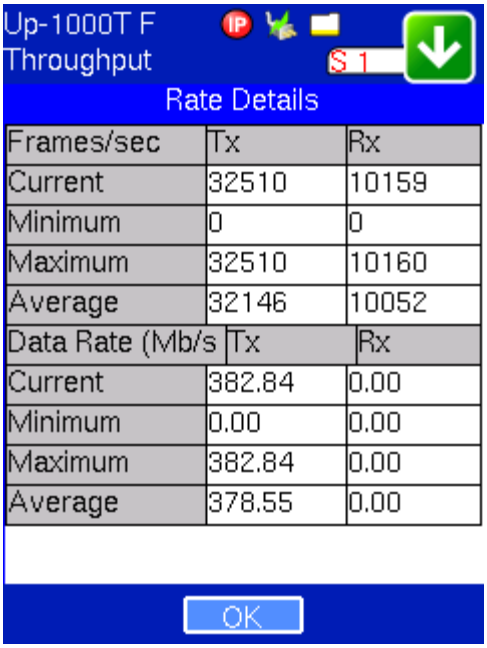


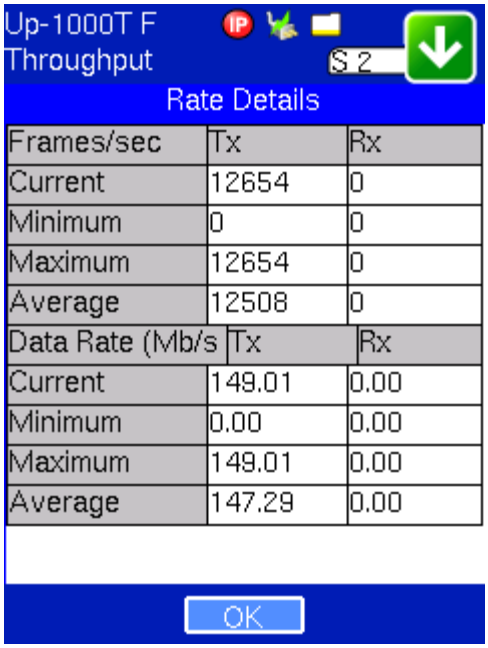
Rate Details Stream 1

Throughput Results - Rates Stream 2



Rate Details Stream 2





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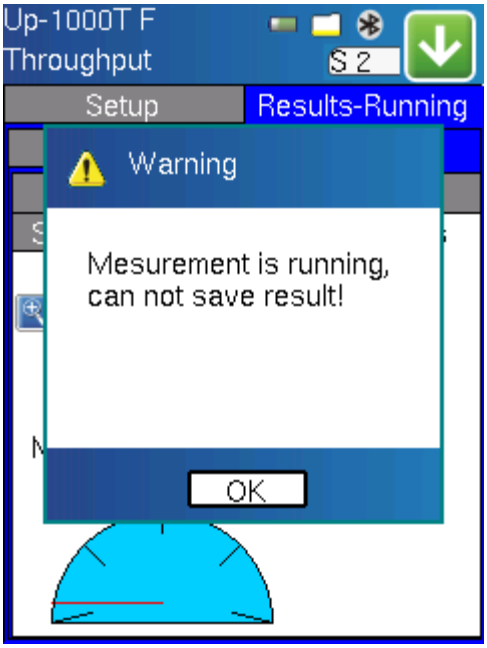
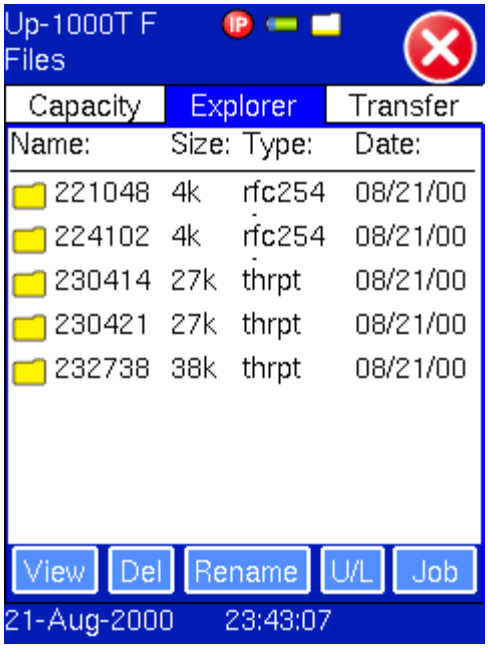
9.2.4 Saving Throughput (Multiple Streams) Results

- Only once the test has been stopped, can the results be saved by pressing the save function key on the VePAL keypad
- If the measurement is not stopped, a pop-up message will appear warning the user.
- The test results are saved and named automatically. Once saved, the user may view or rename the results file by going to the Explorer tab located in the Files menu.

Throughput Results - Storage Warning



Stored Throughput Results - File Explorer



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10.0 Loopback

The Loopback application in the main menu allows the user to establish a manual loopback on the test set. The loopback function is used when an end-to-end test needs to be performed with one of the test partners in software loopback mode. The Loopback function will loopback the incoming traffic to the test set back into the network under test.

The type of traffic that the loopback function loops back will depend on the type of test layer configured; Layer 1, Layer 2, or

Layer 3. Layer 1:

- In Layer 1 loopback, all incoming traffic to the Rx loopback interface will be sent out unaltered to the Tx loopback interface.
- Layer 2 or 3: In a Layer 2 or 3 loopback all incoming test traffic will be looped back.
  - The loopback function will swap the MAC destination and MAC Source addresses (for Layer 2) or MAC and IP destination and source addresses (for Layer 3).
  - All incoming frames with CRC errors will be dropped; similar to what an Ethernet switch does.
  - All broadcast and multicast frames will be dropped including any incoming unicast frames that have the MAC Source address equal to the MAC Destination address

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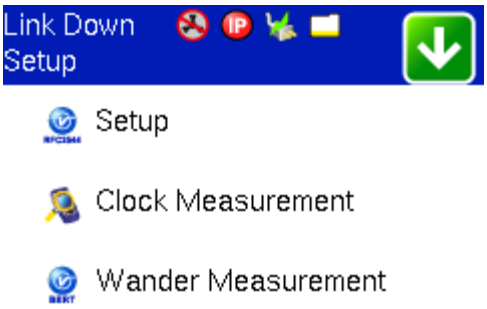
11.0 SyncE

11.1 SyncE Setup

SyncE Main Menu



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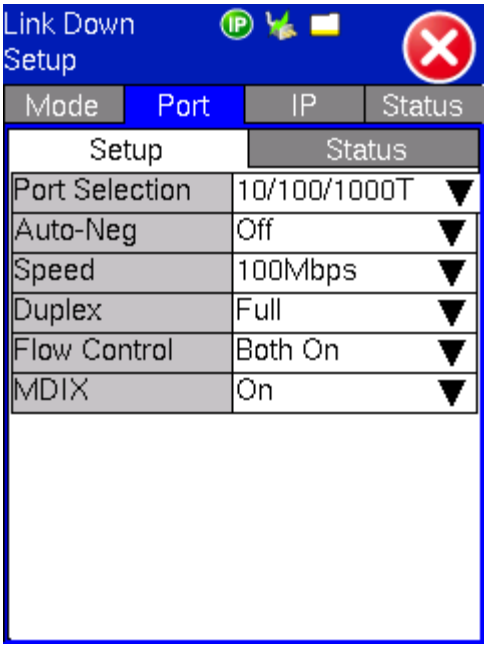
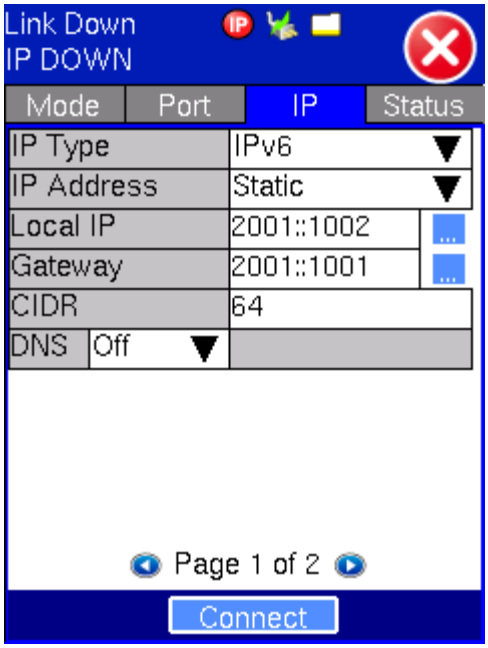
11.1.1 Port (Test Port selection)

Prior to starting the SyncE operation, the selected test port must be connected to a network that supports SyncE timing synchronization. Port selections include 10/100/1000T and 100/1000BaseX. After setting up the port, establish an IP connection by tapping on the IP tab and going through the IP setup. Please see section 6.1 Port Setup for port configuration instructions.

Port Setup IP Menu





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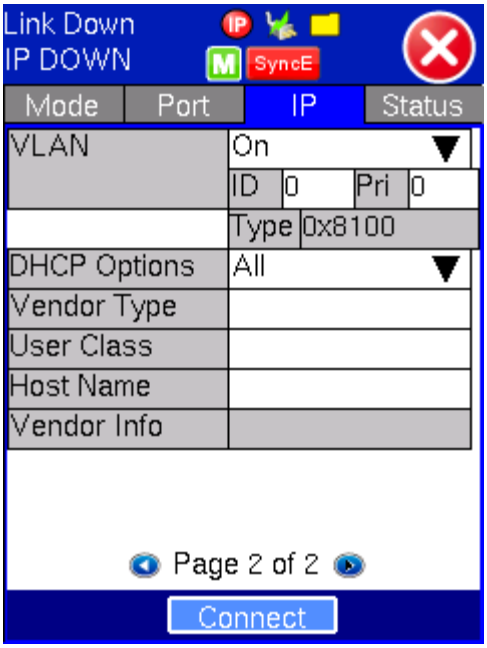
11.1.2 IP (IP Setup)

IP configuration settings are as follows:

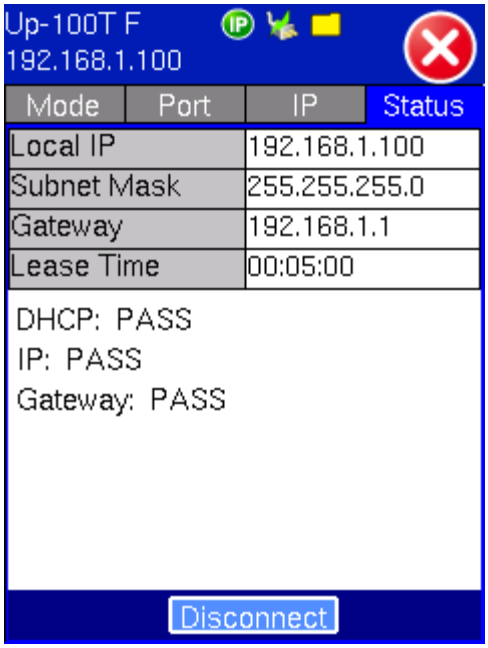
(Page 1)

- IP Type - IPv4 or IPv6
- IP Address - Static, DHCP (IPv4 only) or AUTO (IPv6 only)
- Static - The user is required to enter a Local IP, Gateway address, and Subnet. All Static fields can be filled by tapping on the section to access an alphanumeric keyboard
  - Local IP - IPv4/IPv6 address of the test set
  - Gateway - IPv4/IPv6 address of the network gateway
  - CIDR (IPv6 only) - The user can enter a Classless Inter-domain Routing Network
  - Subnet (IPv4 only) - The user can enter a subnet mask
- DNS - Off, Manual, or Auto. If Manual is selected, a DNS IP is required in order to use the URL as a destination. Enter the IP address of the Domain Name System (DNS) Server providing domain name translation to IP addresses.

VLAN (Page 2)



IP Status



(Page 2)

- VLAN - Off/On. For each VLAN tag, enter the following:
  - ID - VLAN ID. Enter value 0 to 4095.
  - Pri - VLAN priority 0 to 7.
  - Type - Set to 8100. Indicates 802.1q tag type.
- DHCP Options - DHCP options can be edited. Off, All, Vendor Type, User Class, Host Name, and Vendor Info.
  Note: DHCP Options are only available under AUTO or DHCP.

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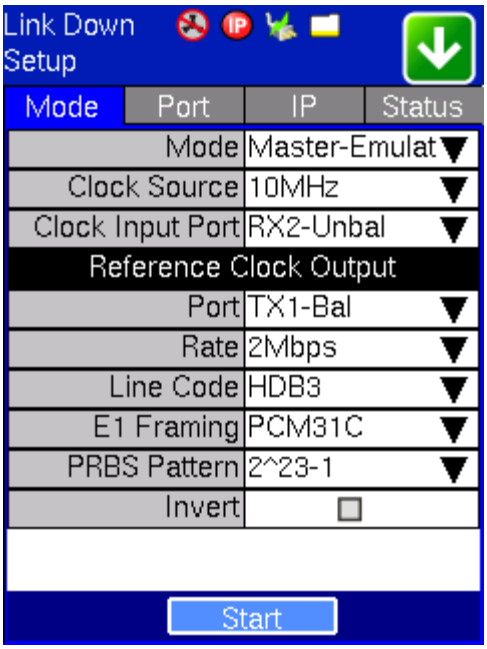
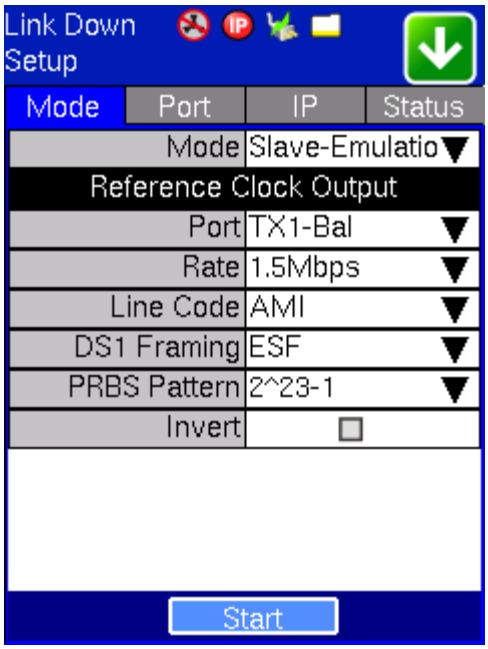
11.1.3 Mode (SyncE test mode)

SyncE Master-Emulation Mode



SyncE Slave-Emulation Mode

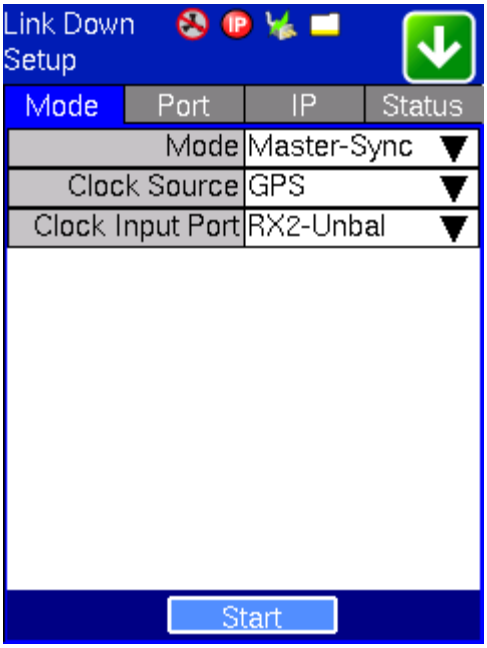


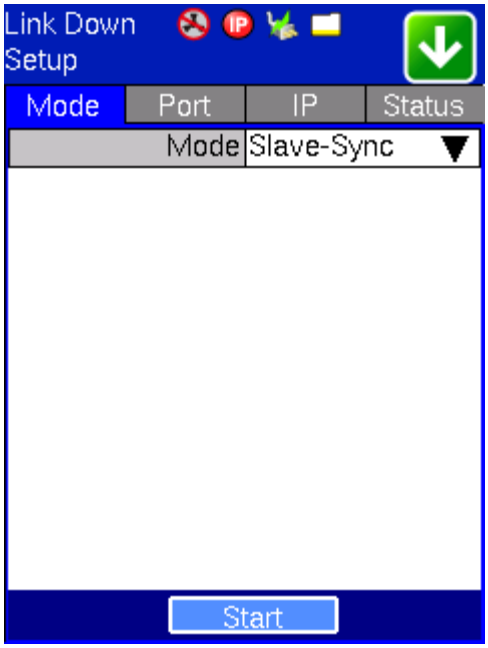
The Mode setup parameters are as follows:

- Mode: There are four test modes available: Master Emulation, Slave Emulation, Master Sync, and Slave Sync.
  - Master Emulation - emulates a SyncE Master clock device. Reference clock used on the SyncE link can be made available for other network elements out of the PDH TX port at a different frequency but synchronized to the reference clock The clock can be regenerated out of the PDH TX port with a different clock format and is synchronized. The clock can be formatted to: 2Mbps (E1 signal), 2.048MHz, 1.544Mbps (T1 signal), 1.544MHz, 10MHz, 25MHz, and 125MHz.
  - Slave Emulation - emulates a SyncE Slave clock device. Recovered clock can be regenerated out of the PDH TX port with a different clock format and is synchronized. The clock can be formatted to: 2Mbps (E1 signal), 2.048MHz, 1.544Mbps (T1 signal), 1.544MHz, 10MHz, 25MHz, and 125MHz.

Master Sync Mode

Slave Sync Mode



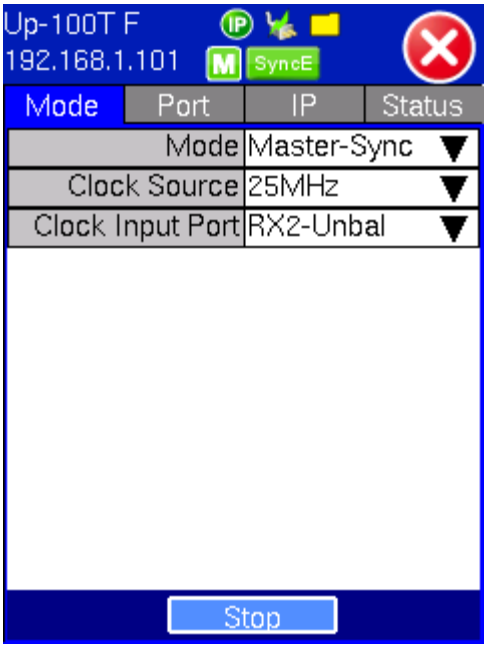


- Master Sync- Reference clock to be used on the SyncE link can be used for Ethernet and PDH testing simultaneously while the clocks are synchronized.
- Slave Sync - Clock recovered from the SyncE link can be used for Ethernet and PDH testing simultaneously while the clocks are synchronized.
- Note: In Sync mode, the PDH TX port is used for BERT testing, therefore, reference clock output is not available. The main application of the Sync mode is test whether the PDH network and Ethernet network are properly synchronized.

- Clock Source - Select between an internal or external clock source. Possible external clock sources can be: 2 MHz, 2 Mbps (E1 signal), 10MHz, 25MHz, 125MHz or GPS (1 pps).
- Clock Input Port - If a non-internal clock source is chosen, the external reference clock is connected through the Aux Rx port
- Reference Clock Output
  - Port - Tx1 - Unbalanced or Tx1 - Balanced
  - Rate - Signal rate to transmit to slave clock. Options include: 2 Mbps, 10 MHz, 25 MHz, 125 MHz, or None
  - Line Code - HDB3 or AMI
  - E1 Framing - Unframed, PCM31, PCM31C, PCM30, or PCM30C
  - PRBS Pattern
  - Invert

Press Start to start the connection.

Indicator Symbols - M and SyncE



Indicator Symbols

An M or S indicates that the test set is in Master or Slave Mode. A green SyncE icon indicates that the SyncE test is running and a green 1588 icon indicates that the 1588 test is running. If the icon is flashing or solid red, there may be an issue with setup and the test will not work.

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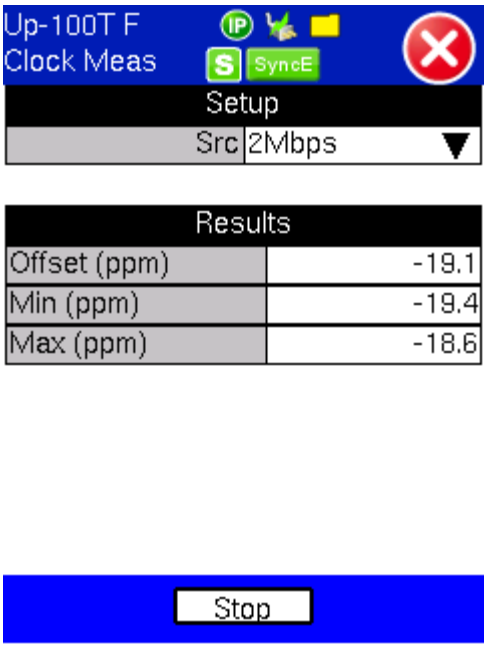
11.2 Clock Measurement

Clock Measurement Results



Note: Clock and Wander measurements are only available in slave mode.

Src - Select the source of the reference clock used for the wander measurement. Possible external clock sources can be: 2 MHz, 2 Mbps (E1 signal), 10MHz, 25MHz, 125MHz or GPS.

Press Start to start the test. Offset, Min, and Max clock measurement offset results are displayed in ppm.

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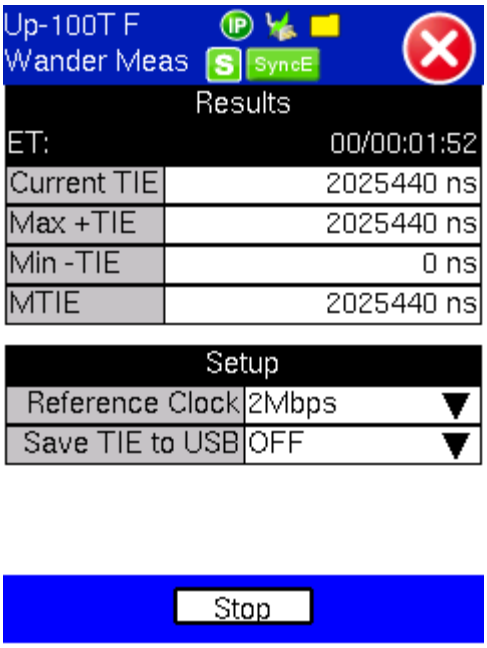
11.3 Wander Measurements Setup

- Reference Clock - Select between an internal or external clock source. Possible external clock sources can be: 2 MHz, 2 Mbps (E1 signal), 10MHz, 25MHz, 125MHz or GPS (1 pps).
- Save TIE to USB - OFF/ON. Insert a USB and select ON to save test results to USB for further analysis of MTIE/TDEV with wander analysis PC software provided by VeEX. The USB memory stick must be inserted to the USB port before turning on this option.

Press Start to initiate the test. Current, Max, Min and MTIE results are displayed in nanoseconds.

Wander Measurement Setup and Results



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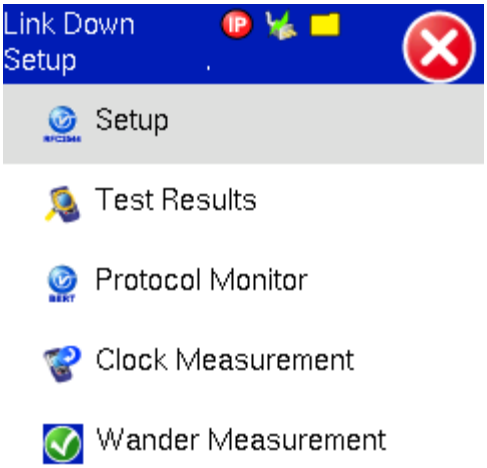
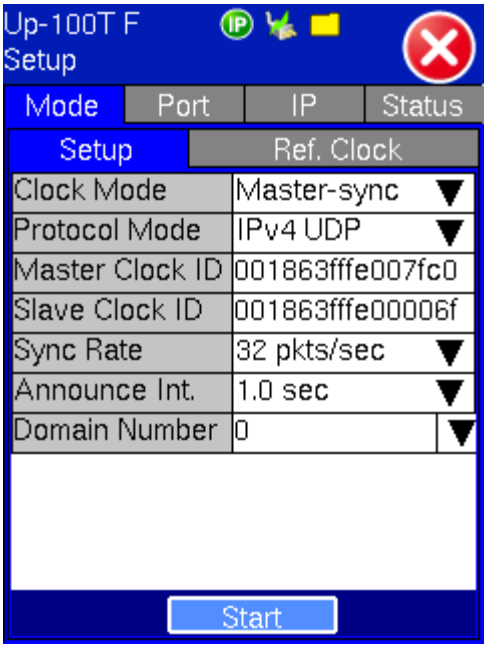
12.0 1588v2/PTP

12.1 Setup

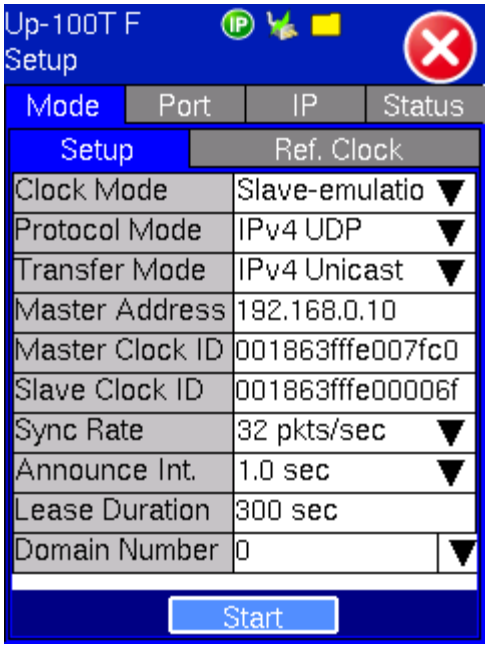
1588v2/PTP Main Menu



Setup - Master-sync



Setup - Slave-emulation



Before proceeding with any tests, please configure the Port and IP connection. Refer to 11.0 SyncE Port and IP sections for further configuration instructions, then continue to Mode Setup. Reference Clock configuration instructions can be found in the 11.1.3 SyncE Mode Setup section. Prior to starting the 1588v2 operation, the selected test port must be connected to the network.

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12.1.1 Mode (Test Mode)

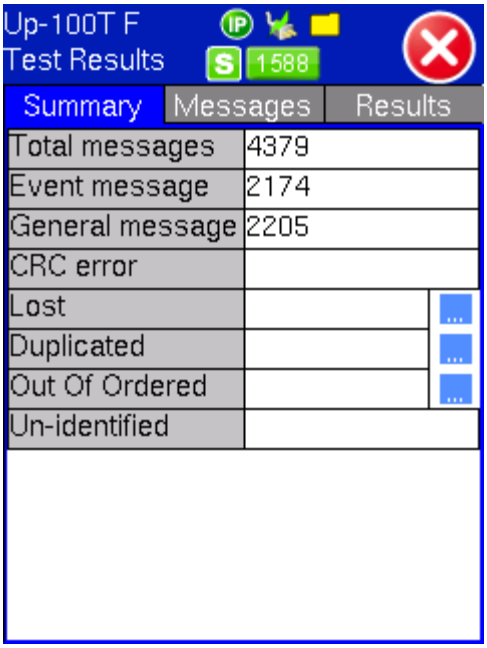
- Clock Mode - Master-emulation, Master-sync, Slave-emulation and Slave-sync. Please refer to SyncE Mode Setup in 11.0 SyncE for further information on these clock mode types.
- Protocol Mode - IPv4 UDP, IPv6 UDP or Layer 2
- Master clock ID - this is the MAC address of the TX130M+ in Master sync/emulation mode. The format of the ID is MAC's first 3 byte -- FF -- FE -- last 3 byte. The MAC address can be manually changed in Tool > IP menu.
- Slave clock ID - same as above. Note, the clock IDs will be populated once the 1588v2 is synchronized. The TX130M+ in master clock mode supports ONE slave clock only.
- Sync Rate (master or unicast only) - The sync packet sending rate for the Master clock.
- Announce Int - Interval of the announcement message to be sent by the master clock. Options are 1, 2, 4, 8, and 16 seconds.
- Domain Number - Enable/Disable. Enabling this feature allows the user to assign a domain number to a slave-master network. The domain number limit is 255.

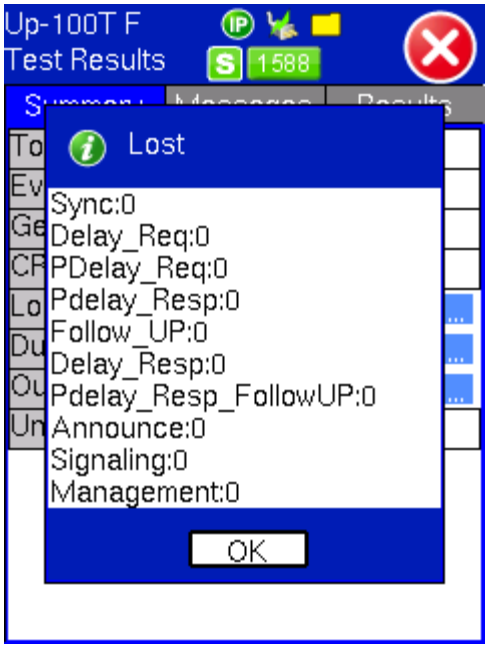
Slave-emulation and Slave-sync only options

- Transfer Mode - Select between Unicast or Multicast mode of the Master Clock. If Unicast is selected, Master Clock's IP address needs to be entered. Master Clock ID and Slave Clock ID are automatically populated once 1588v2 is synchronized between the master and slave clock devices.
- Master Address (unicast only) - Tap on the field and use the soft-keyboard to enter the master address.
- Lease duration - Set to 300 sec by default

Test Results - Summary

Test Results - Summary - Details





Note: Tap on the "..." next to the Lost, Duplicated, or Out of Ordered to view detailed error counters.

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12.2 Test Results

The Summary screen displays message statistics including the number of Total messages, Event messages, and General messages along with information on Lost, Duplicated and Out of Ordered messages. Tap on the "..." tab to see more detailed message error information. Additional message information is displayed on the Messages screen.

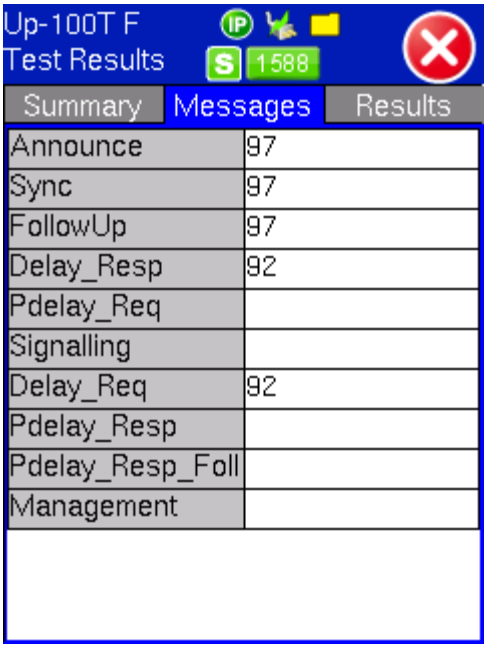
Tap on the Results tab to access histogram and PDV, RTD and IPG statistics. Tap on the NEXT tab to view additional Data statistics. Pressing the "-t" or"+t" respectively decreases or increases the time frame on the histogram, as shown in the PDV Test Result screens below.

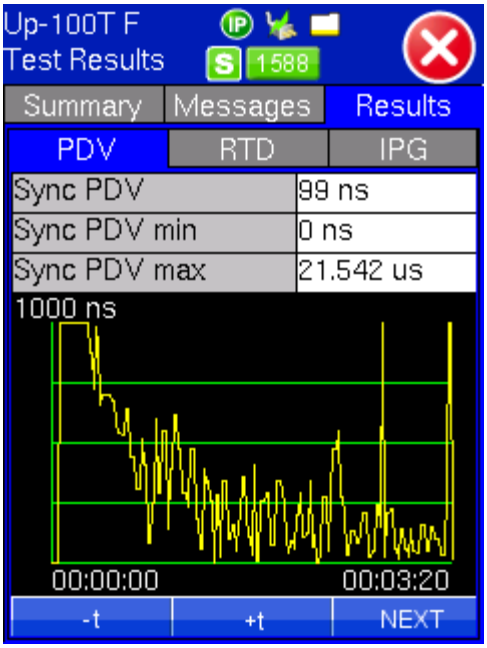
PDV - Delay Request, Asymmetry, and Sync PDV min and max information.

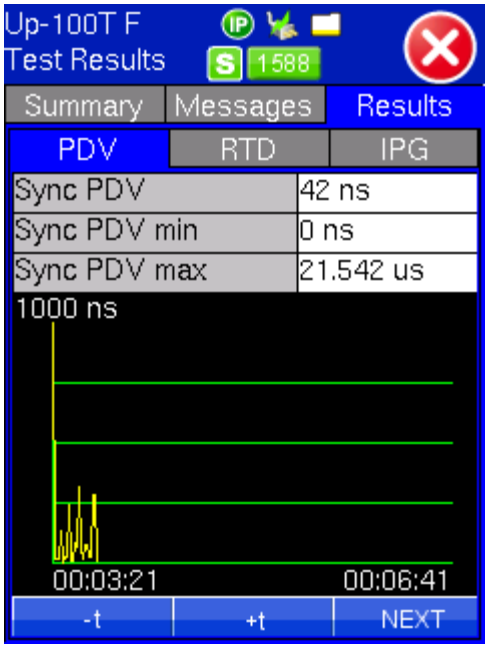
RTD - RTD and Delay Response RTD min and max information.

IPG - Sync and Delay Response IPG min and max information.

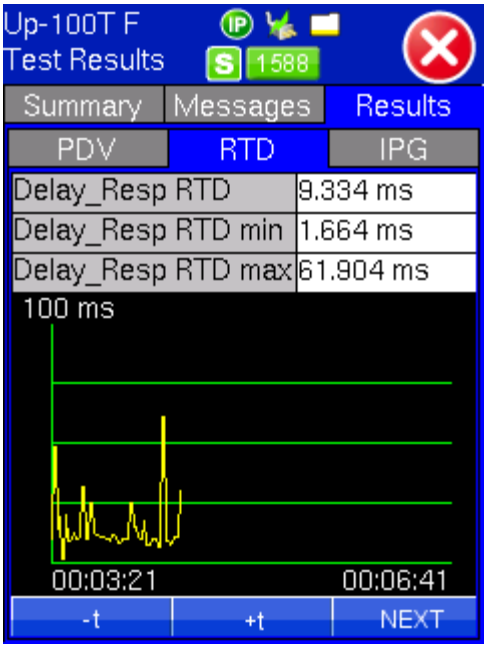
Test Results - Summary PDV Test Results (0-3:20) PDV Test Results (3:21-6:41)



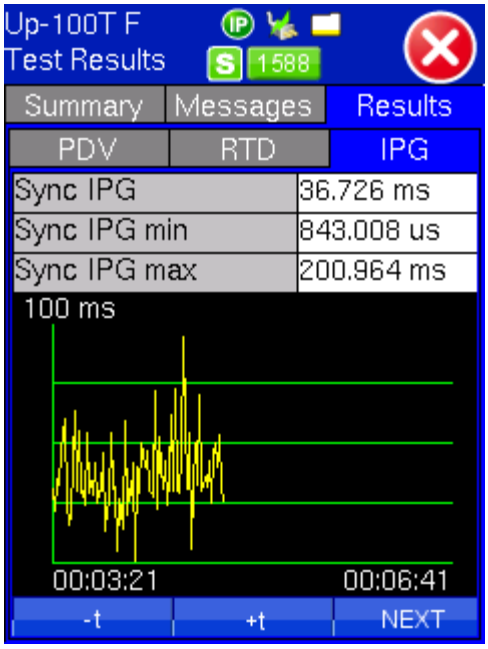




RTD Test Results



IPG Test Results



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12.3 Protocol Monitor

The Tracer shows the 1588v2 messages from both Master and Slave clock devices. The TX130M+ stores up to 2000 messages. There are 4 function keys:

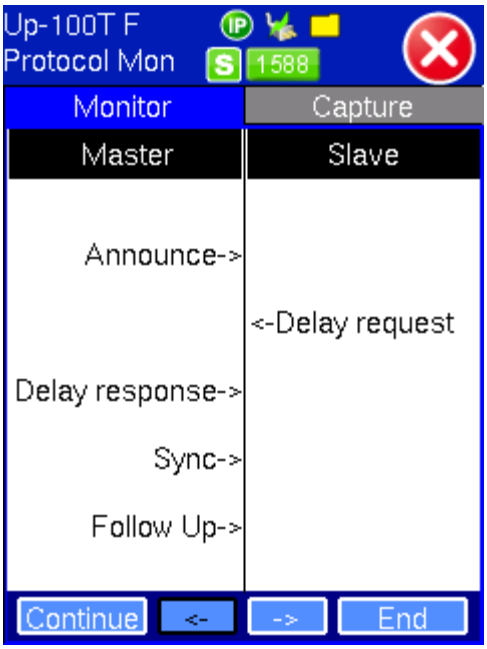
- Pause/Continue - to pause or continue the tracer.
- -> & <- - in Pause mode, use the key to page up or page down.
- End - in Pause mode, use End key to jump to the end of the trace.

To view decoded messages, press Pause to pause the protocol tracer and tap on the desired message to view decoded message details.
Tap on the Capture tab then hit Start to capture packets. The Capture function can store up to 20,000 messages. The messages are saved in pcap format and can be viewed on wire shark for future analysis.

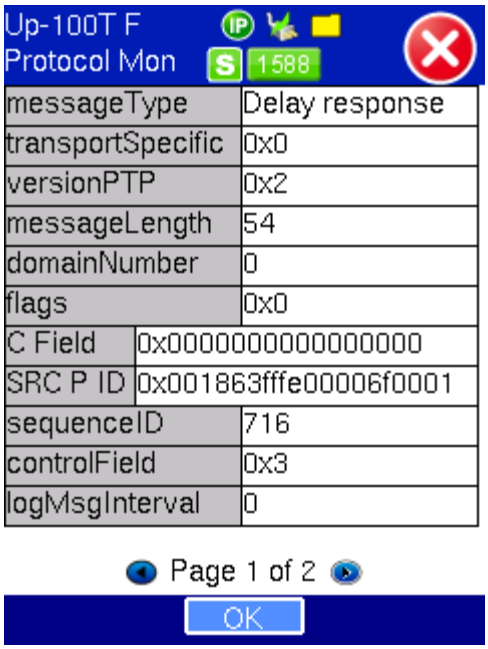
For Clock and Wander Measurement Results, please refer to 11.2 Clock Measurements (SyncE) and 11.3 Wander

Measurements Setup.

Protocol Monitor - Monitor Mode



Protocol Monitor - Message Details



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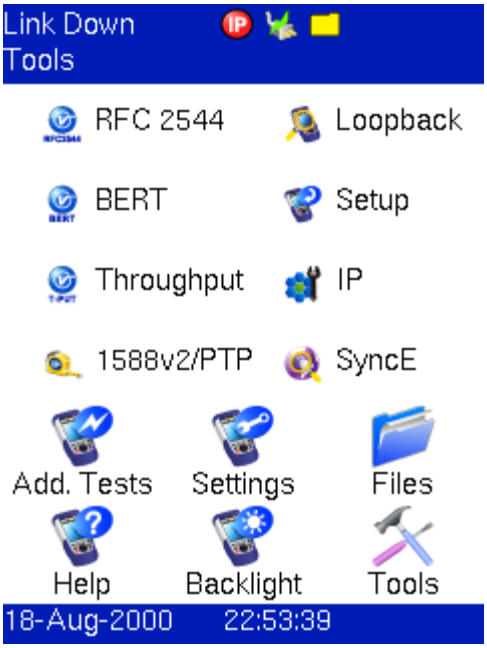
13.0 Common Functions

Home Menu A
(Common functions listed at the bottom portion of screen)



The following functions, (Chapters 13.1-13.6) are functions common to all V100+ test sets. Please refer to the V100+ Common Functions Manual for these sections. The sections are renumbered in the V100+ Common Functions Manual as follows:

- 13.1 Additional Tests: (5.2) Net Wiz
- 13.2 (6.0) Settings

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14.0 V-SAM

V-SAM
(found under Additional Tests)

Note: To access V-SAM, go to Home > Add. Tests > V-SAM.

V-SAM (VeEX Service Activation Methodology) is an automated Ethernet service activation test feature conforming to the ITU-T Y.1564 standard, created to address and solve the deficiencies of RFC 2544:

- RFC2544 was limited to test at the maximum throughput line rate for a single service. SAM is able to run multiple services on a single 10/100/1000 or 10G Ethernet line at a bandwidth ranging from 0 to the line rate, allowing for more realistic stream testing.
- The Frame Delay Variation, also known as (packet) jitter was not included in RFC2544. Jitter is a critical parameter for real time voice and video services. It is now part of the SAM test suite.
- RFC2544 validates the service parameters like frame loss, throughput and latency, one after the other, while SAM allows testing all the service critical parameters simultaneously. This results in significant time saving compared to RFC2544.

Comparison of RFC2544 and Y.1564

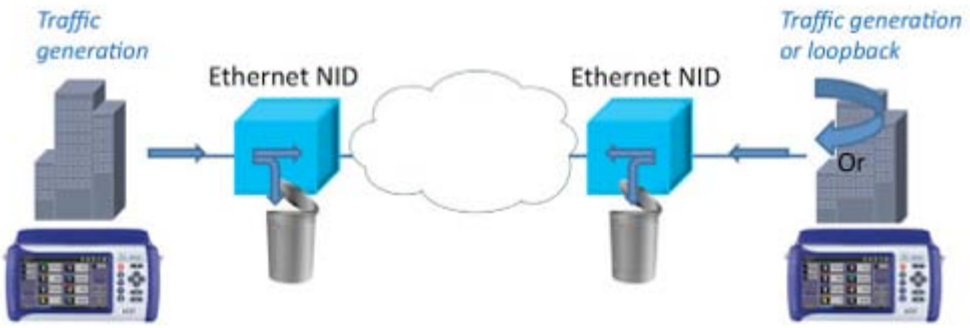
	RFC2544	Y.1564
Key Test Objective	Device performance	Network Service verification/activation
Service validation	One service at a time	Multiple services simultaneously
Throughput	Yes	Yes
Latency	Yes	Yes
Frame Loss	Yes	Yes
Burstability	Yes	Yes
Packet Jitter	No	Yes
Multiple Streams	No	Yes
Test Duration	Long (serialized test procedure)	Short (simultaneous test/service)
Test Result	Link performance limit	Related to SLA, fast, simple, Pass/Fail

Test Methodology

The purpose of the SAM test suite is to verify that the service is compliant to its Bandwidth Profile and Service Acceptance Criteria. The test is broken down into two phases:

- Phase 1: Service Configuration test: The services running on the same line are tested one by one to verify the correct service profile provisioning.
- Phase 2: Service Performance test: The services running on the same line are tested simultaneously over an extended period of time, to verify network robustness.

Test Application



Phase 1: Service Configuration Test

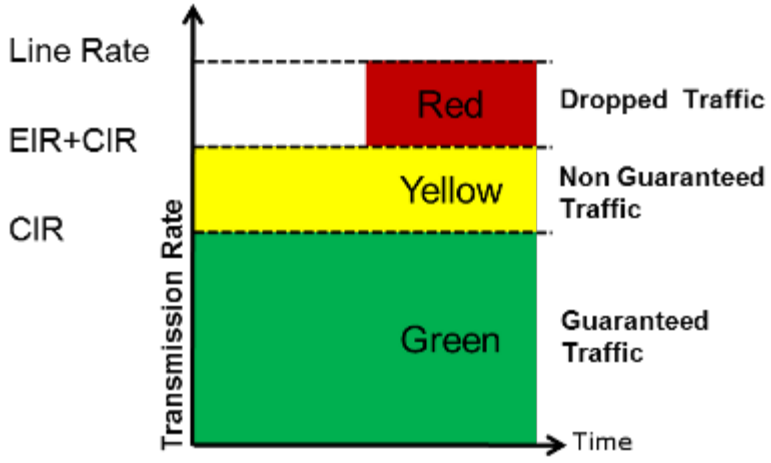
The service configuration test is broken down into three steps. The steps are tested individually for all the services delivered on the same line.

- Step 1: Committed Information Rate (CIR) Test: Traffic is transmitted at the CIR for a short period of time and the received traffic is evaluated against the Service Acceptance Criteria (FLR, FTD, FDV) measured simultaneously. The CIR test passes if the measurements on the received traffic stay below the performance objectives.
- Step 2: Excess Information Rate (EIR) Test: Traffic is transmitted at the CIR+EIR rate for a short period of time; the EIR test passes if the received traffic rate is between the CIR (minus the margin allowed by the FLR) and CIR+EIR.

- Step 3: Traffic Policing (Overshoot Test): The purpose of the Traffic Policing Test is to ensure that when transmitting at a rate higher than the allowed CIR+EIR, the excess traffic will be appropriately blocked to avoid interference with other services. For this test, traffic is transmitted at 25% higher than the CIR+EIR for a short period of time. The test passes if the received traffic rate is at least at the CIR (minus the margin allowed by the FLR) but does not exceed the allowed CIR+EIR.

- At this time the Committed Burst Size (CBS) and Excess Burst Size (EBS) tests are considered experimental and not an integral part of the standard.

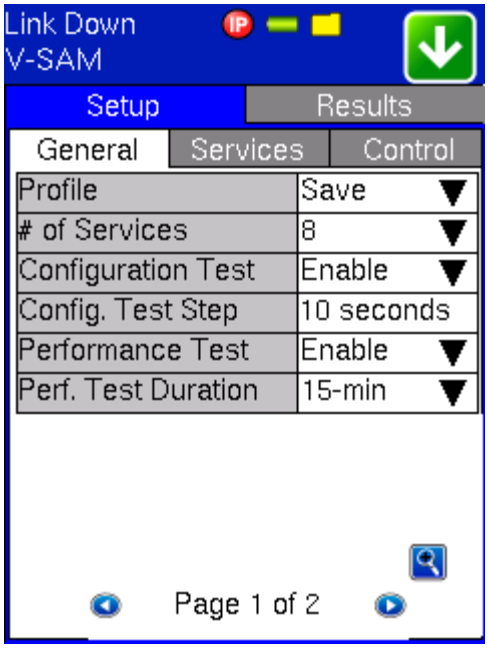
Service Bandwidth Profile



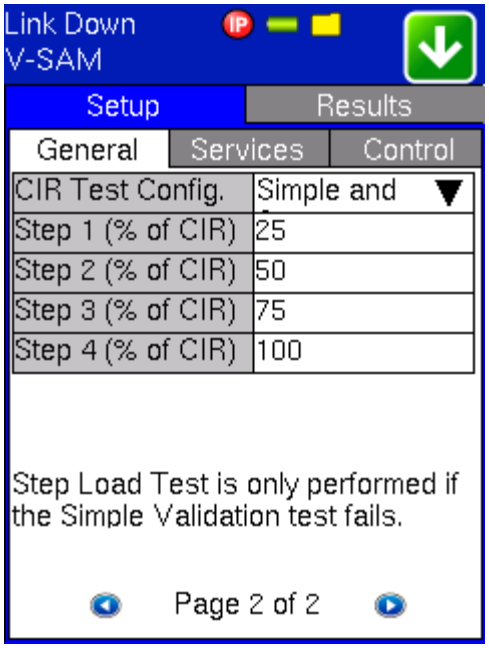
Phase 2: Service Performance Test

Services running on the same line are tested simultaneously over an extended period of time, to verify network robustness. Service Acceptance Criteria (SAC) including Frame Transfer Delay (FTD), Frame Delay Variation (FDV), Frame Loss Ratio (FLR) and Availability (AVAIL) are verified for each service.

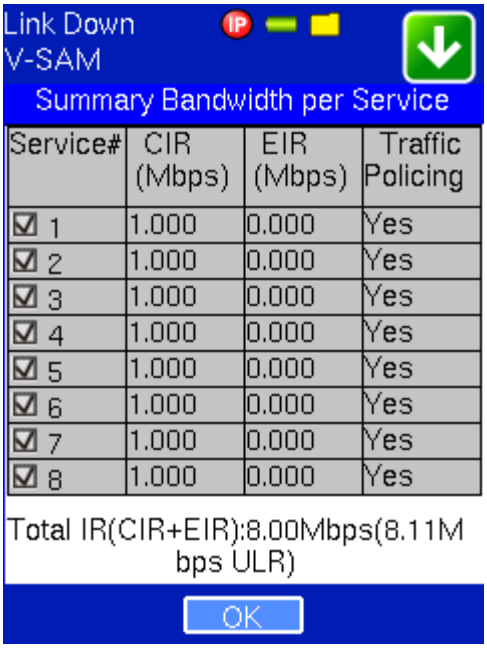
V-SAM Setup (Page 1)



V-SAM Setup (Page 2) - Simple and Step Load Test



V-SAM Services Summary



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14.1 V-SAM Setup

General (Page 1)

- Profile - Default, Save, Save as New
- # of Services - Select the number of services to run. Up to 8 services can be chosen for a 1 GE interface and up to 10 services can be chosen for a 10 GE interface.
- Configuration Test - Enable or Disable the configuration test.
- Configuration Test Step - Specify min and max duration for the configuration test step.
- Performance Test - Enable or Disable the performance test.

Perf. Test Duration - Selections are 15 min, 30 min, 1 hour 2 hours, 24 hours, and user defined. User defined enables the user to specify min and max duration for the performance test.

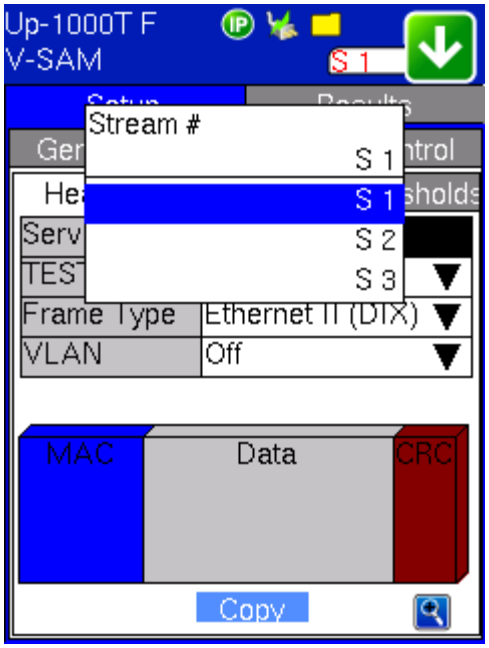
General (Page 2)

- CIR Test Config. - Select Simple Test, Step Load Test, or Simple and Step.
  - Simple Test - Starts the tests at the CIR.
  - Step Load Test - Starts the test below the CIR and continues in steps until it reaches the CIR.
  - Simple and Step Load Test - Step Load Test performs only if the Simple Validation test fails.
- Step # - Tap on the corresponding box to enter the percentage of CIR that the test will reach for each step.

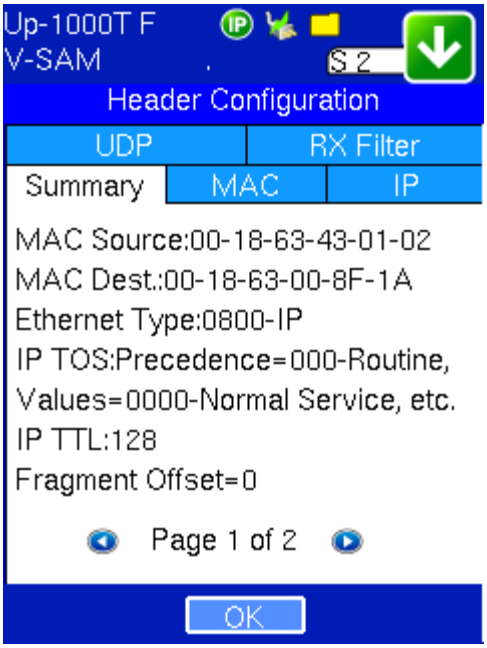
V-SAM Services Summary

Once setup parameters are completed, tapping the zoom function at the bottom right hand side of the screen displays a summary of all service settings. A check next to the Service number indicates that the test for the corresponding service is set to run. Tap on the box to remove the check and cancel the test for that service.

V-SAM Services - Header - Selecting a Stream



V-SAM Header Configuration



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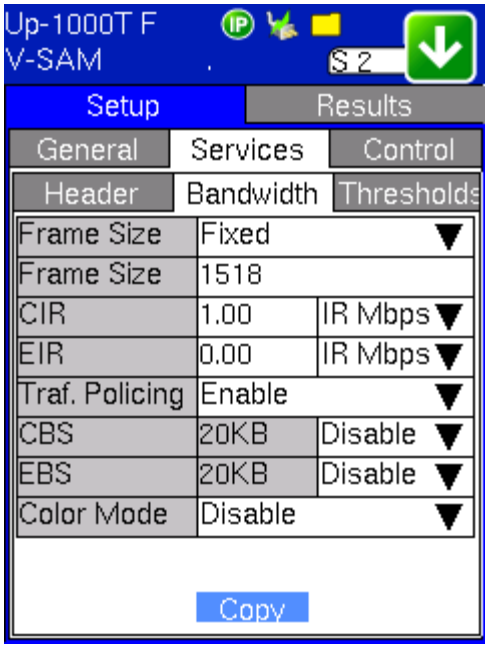
14.1.1 Header Settings

Please see 8.1 RFC 2544 Setup and follow the setup procedure to configure the Header Settings for V-SAM. Tapping the zoom function on the bottom right hand side of the screen displays the Summary, MAC and RX Filter tabs which are also explained in the RFC 2544 Setup section. The user can assign a name to each stream by tapping on the Service Name box and entering a name.

Selecting a Stream

On the Services tab, tap on the stream number (S #) next to the Action Menu icon to select a service to configure.

V-SAM Services - Bandwidth



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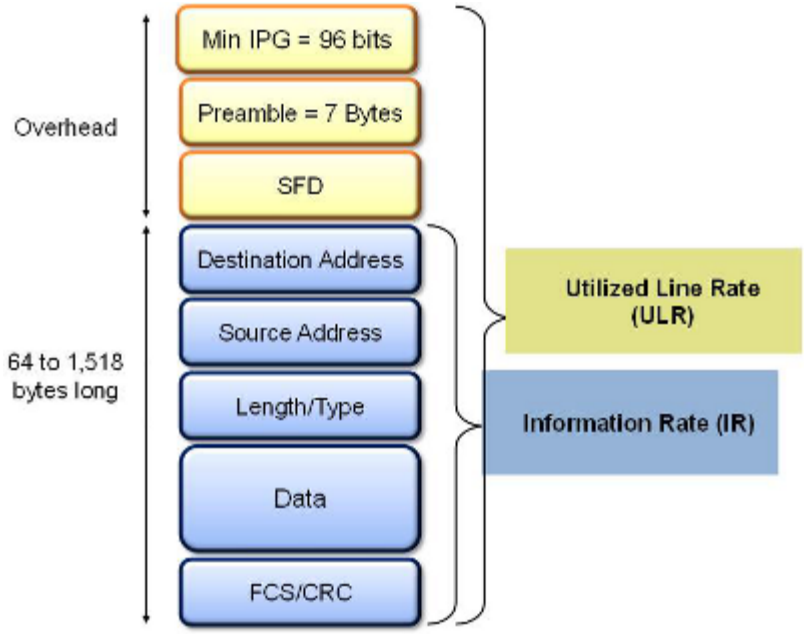
14.1.2 Bandwidth Profile

The Bandwidth Profile specifies how much traffic the customer is authorized to transmit and how the frames are prioritized within the network. Under the Bandwidth tab, the user specifies the following bandwidth criteria:

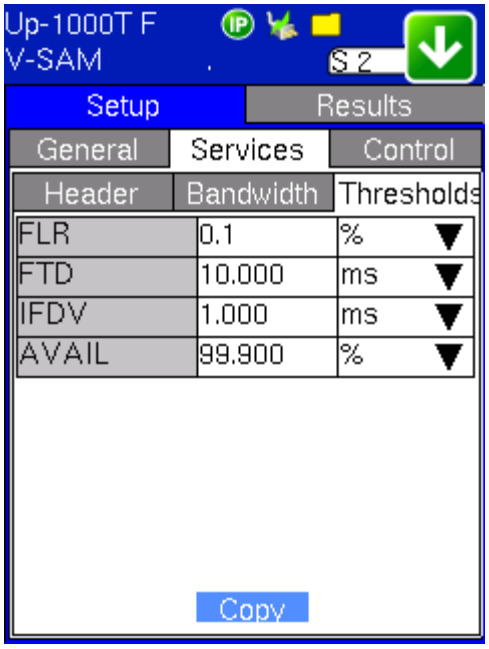
- Frame Size - Input a fixed frame size within the range of 64-10000 bytes.
- CIR - Committed Information Rate. This is the guaranteed maximum rate at which the customer can send frames that are assured to be forwarded through the network without being dropped. Tap on the box to enter a rate and choose between IR Mbps or ULR Mbps. Allowed values range from 0.01Mbps to the line bandwidth.
    - Information Rate (IR) - Measures the average Ethernet frame rate starting at the MAC address field and ending at the CRC.
    - Utilized Line Rate (ULR) - Measures the average Ethernet frame rate starting with the overhead and ending at the CRC.

V-SAM Services - Header

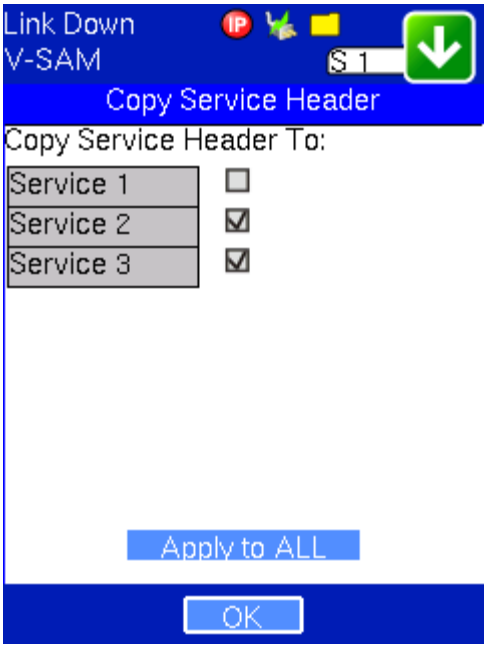


- Excess Information Rate (EIR) - Maximum rate above the CIR at which the customer can send frames that will be forwarded on a best effort basis, but may be dropped in the event of congestion within the network. The combined CIR and EIR must not exceed the line bandwidth. Traffic beyond CIR + EIR will be dropped when it enters the carrier's network. Tap on the box to enter a rate. EIR is expressed in terms IR Mbps or ULR Mbps. Select a term to express EIR or select Disable to disable the test.
- Traf. Policing - Enable or Disable the traffic policing test. For this test, traffic is transmitted at 25% higher than the CIR+EIR. The Policing test fails if the higher traffic rate is allowed through the network.
- CBS, EBS, and color mode are currently not supported with this release.

V-SAM Services - Thresholds



Copying Frame Configurations Between Services



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14.1.3 Thresholds

The user establishes Pass/Fail test criteria for the following Service Acceptance Criteria. Values define the minimum requirements to ensure that the service meets the Service Level Agreement (SLA):

- FLR - Ratio of lost frames to the total transmitted frames.

FTD - Measures the transfer time that the frames can take to travel from source to destination. Values are measured in us, ms, or sec. Input a value within the digital range of .001-999 and 1 us-999sec. The user can also choose to Disable the FTD threshold evaluation. FTD will be measured regardless, but the value will not contribute toward passing or failing the service.

- IFDV - Measures the frame jitter.
- AVAIL - Minimum percentage of service availability allowed to still be compliant with the SLA. The service becomes unavailable if more than 50% of the frames are errored or missing in a one second interval. Availability is only guaranteed for traffic conforming to the CIR. Enter a percentage from 0-100. The user can also choose to Disable the AVAIL threshold evaluation. AVAIL will be measured regardless, but the value will not contribute toward passing or failing the service.

Copying Services

Tap on the Copy button on the bottom of any of the Services tabs (Header, Bandwidth, Threshold) to copy frame parameters specific to that tab to other services. For example, pressing Copy on the Header tab will only transfer header parameters to other services.

Control Settings

Please see 7.1.4 Control Settings for information on setting up a remote connection with another unit. Note that Asymmetric Mode, mentioned in that section, is unavailable for V-SAM Control settings.

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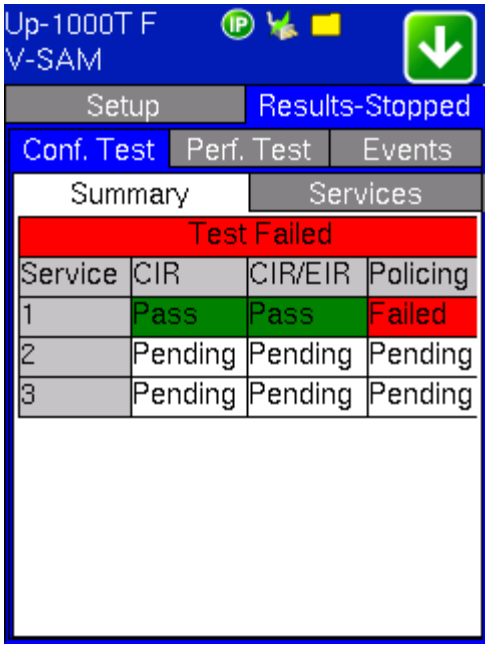
14.2 Results

Configuration Test

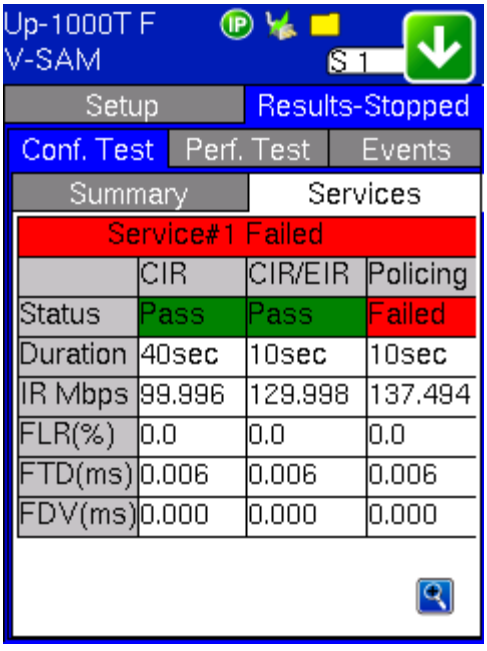
Note: To run the test, make sure that traffic is being looped back at the far end of the network under test.

The Summary tab displays the status of each service and test as Pass, Failed, Pending, or Disabled. Tapping on Services displays live values for FLR, FTD, and FDV as the test is running. If any measured values do not meet the service test parameters set in the Bandwidth and Threshold tabs, the test fails. The zoom function on the bottom right side of the screen displays detailed results for each stream.

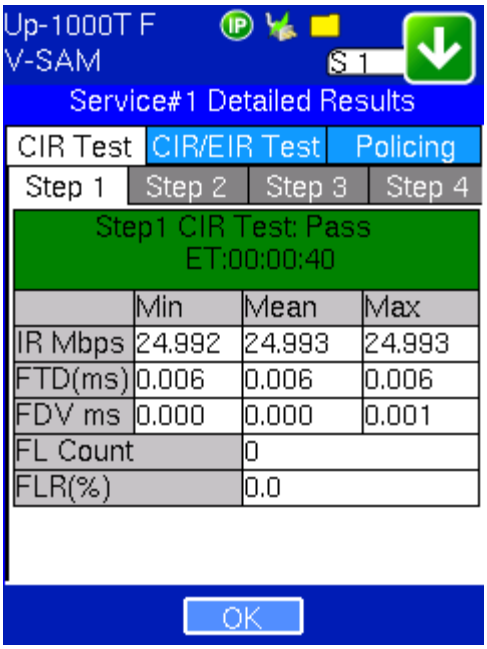
Conf. Test - Summary Tab



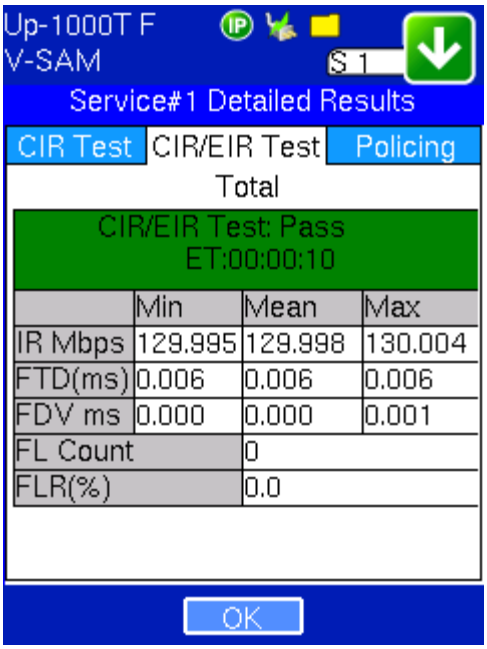
Conf. Test - Services Tab



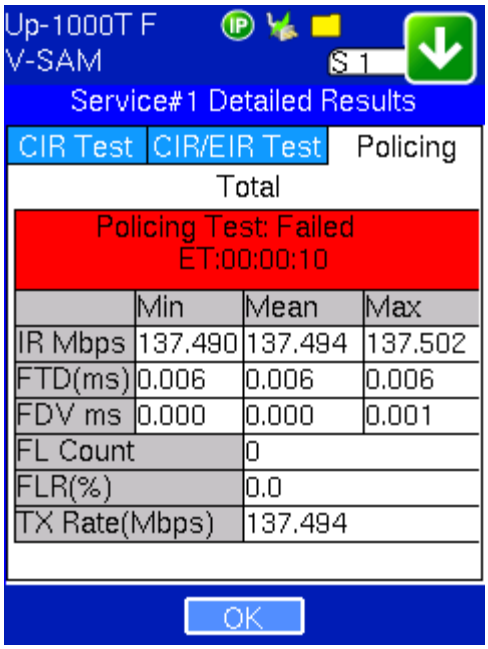
S1 Detailed Results - CIR Test



S1 Detailed Results - CIR/EIR Test



S1 Detailed Results - Policing Test



Viewing Test Results on Different Streams

On the Services tab of Conf. Test and Perf. Test, tap on the service number (S #) next to the Action Menu icon to view the test results for a specific stream.

CIR test: The test passes if all measured values are below the thresholds configured. If a threshold is disabled, it will not be evaluated towards pass/fail criteria.

CIR/EIR test: The test passes if the received IR value is between the CIR (minus the margin allowed by the FLR) and CIR+EIR.

Policing test: The test passes if the received traffic rate is at least at the CIR (minus the margin allowed by the FLR) but does not exceed the allowed CIR+EIR.

CIR, CIR/EIR Test, and Policing tabs display min, mean, and max values for IR Mbps, FTD, FDV, FL Count, and FLR (%). If Step Load was selected for the CIR Test, these values will be displayed for each step.

Performance Test

The Summary tab displays the status of each service and test as Pass, Failed, or Pending. Tapping on Services displays live values for the following parameters as the test is running:

Page 1

- IR Mbps - Information Rate. Measures the average Ethernet frame rate starting at the MAC address field and ending at the CRC.
- FTD - Measures the transfer time that the frames can take to travel from source to destination.
- FDV - Measures the frame jitter.
- FL Count - Counts the number of lost frames.

FLR - Ratio of lost frames to the total transmitted frames.

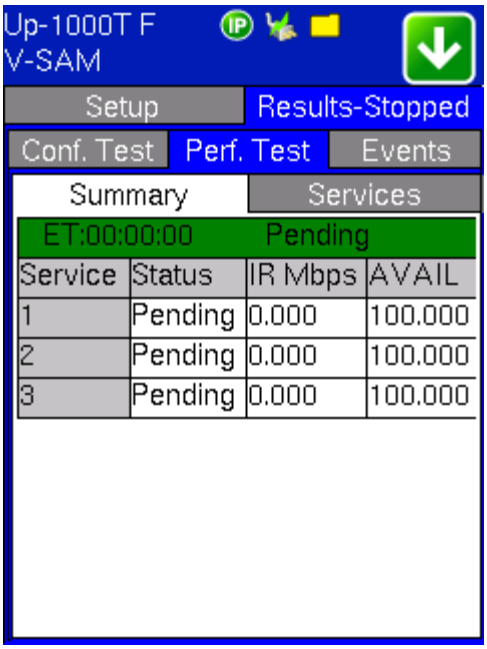
- AVAIL - Minimum percentage of service availability allowed to still be compliant with the SLA. The service becomes unavailable if more than 50% of the frames are errored or missing in a one second interval. Availability is only guaranteed for traffic conforming to the CIR.

Page 2

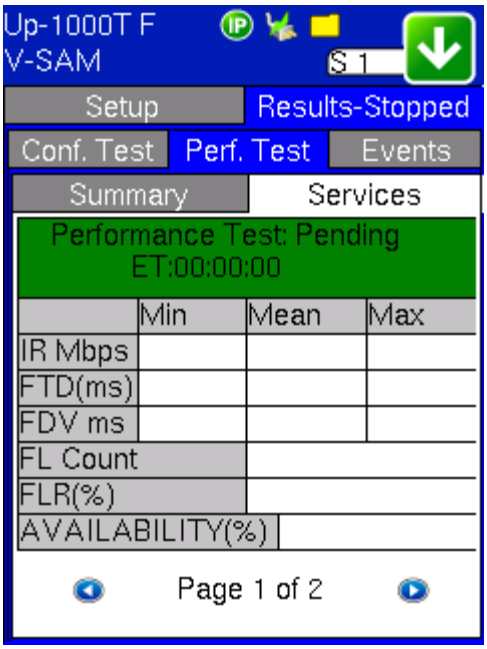
- Severely Errored Sec (SES) - Occurs for a block of frames over a one-second interval, when more than 50% of the frames are errored or missing.
- Unavailable Sec - An interval of time that begins at the start of 10 consecutive SES occurrences. The ethernet network is in unavailable state during this time span.
- Total RX Frames - Total number of frames received
- number of Out of Sequence Counts
- Errored Frame Count - Number of frames with CRC or IP Checksum errors

Measured values that do not meet the service test parameters set in the Bandwidth and Threshold tabs cause the test to fail.

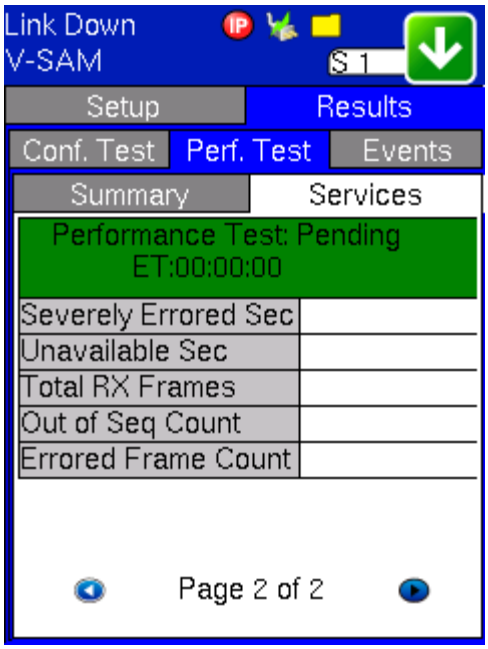
Perf. Test - Summary



Perf. Test - Services (Page 1)



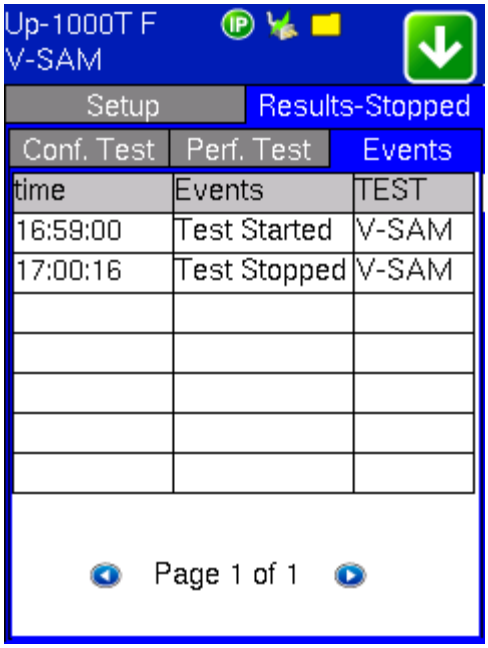
Perf. Test - Services (Page 2)



Events

A time stamped record or log of test types and test statuses (start/stop).

Events



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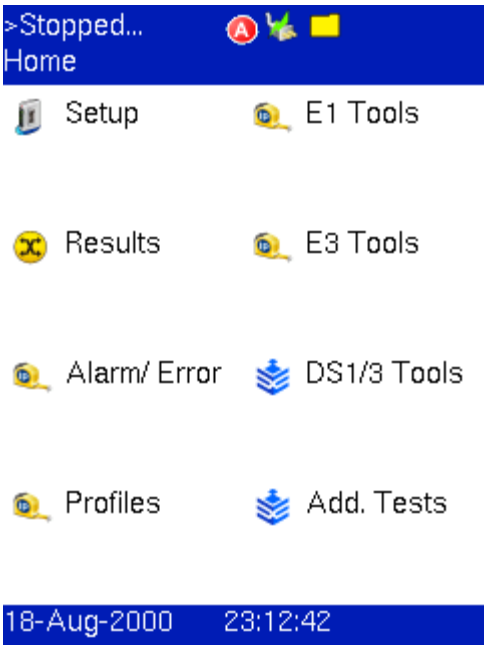
15.0 Menu B - PDH/Dsn Setup

PDH/DSn Home Menu

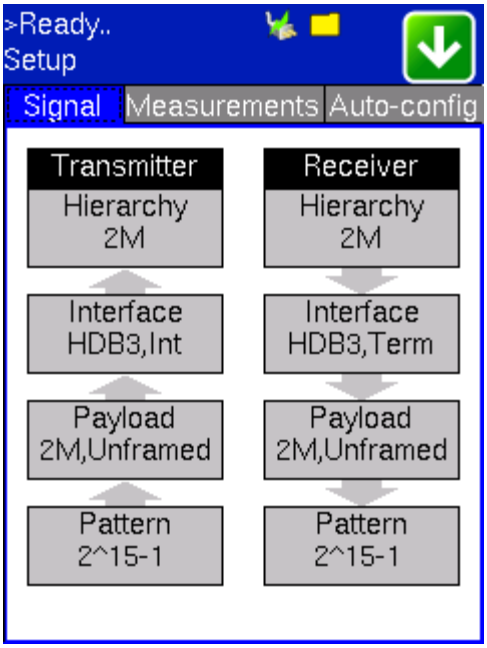


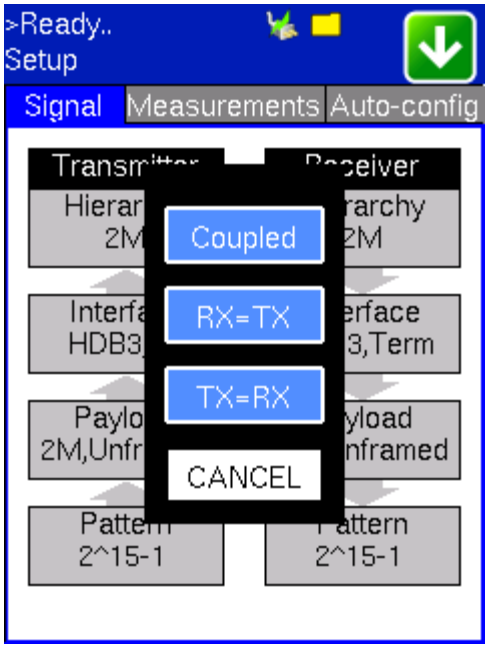
To access the Setup application, tap on the Setup icon. This application allows the user to set up the Transmitter and Receiver interfaces and associated test parameters prior to running a test.

The Setup page has three tabs for setting the PDH, DSn (T-Carrier) parameters. The Signal, Measurements and Auto-Config tabs are described below.

PDH/DSn Signal Setup Menu

Coupling TX and RX





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15.1 Signal Overview

The Transmitter and Receiver configurations are grouped into a simple yet intuitive block diagram. The Tx and Rx signal parameters can be modified by tapping the applicable block which brings up a new dialog window displaying additional input and specific selection settings. The transmitter transmits as soon as a valid configuration is entered. The receiver will check for a valid signal on its input so the measurement function is synchronized. When a test is not running, the LEDs will still indicate errors and alarms, but any other results displayed will be the results of a previous test.

When the Tx and Rx signal structures are required to be identical or symmetrical, coupling the Transmitter and Receiver is possible. The signal structure can be copied from Tx to the Rx, or vice versa.

Changes to Setup are applied immediately unless an invalid parameter has been selected.

When the Tx and Rx signal structures need to be independent or asymmetrical, uncoupling the transmitter and receiver is possible.

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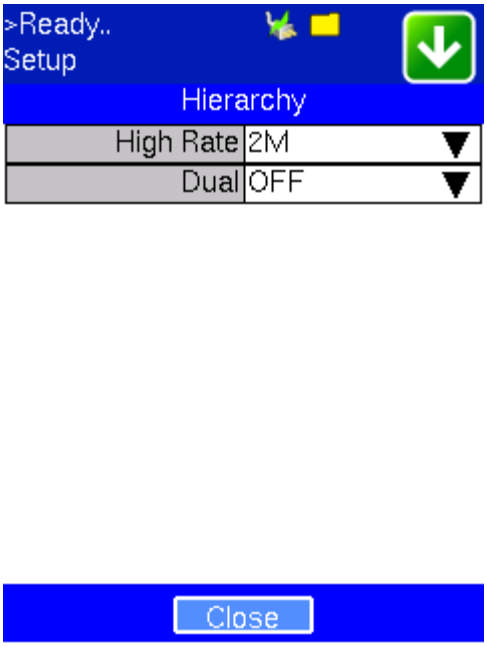
15.1.1 Hierarchy

Tapping the Hierarchy box opens the Hierarchy Setup screen. The screen examples shown in this part of the manual depict and describe the settings for 2M or E1 signals. The options for other bit rates and modes are described in text format.

High Rate - In PDH mode, 2Mbit/s, Options are 34Mbit/s and 1.5Mb/s, 45Mbit/s.
Dual (Rx only) - Dual DS1or E1 Receiver Option ON/OFF; the Receiver 2 set exact same configuration as Receiver 1.

Coupled Hierarchy



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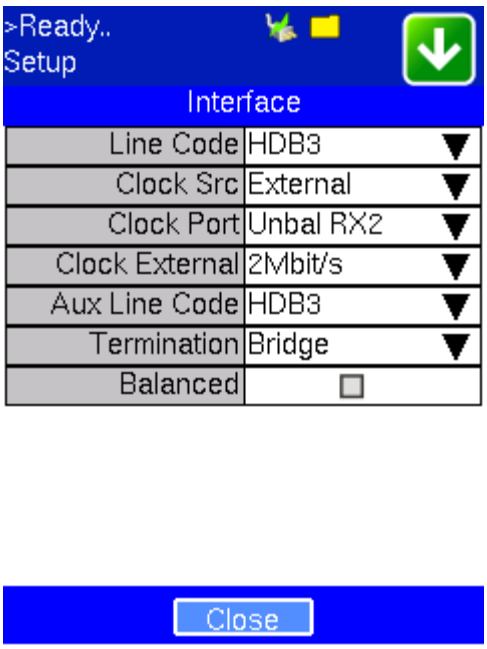
15.1.2 Interface

Tap the Interface box to access this feature. Interface allows the user to select clock source. Offset options are also configured in this screen.

Coupled Interface - External



Line Code:

- In E1 mode, the line code options default to HDB3 or AMI. Normal E1 systems use HDB3 line coding while AMI is reserved for special applications.
- In E3 mode, the line code defaults to HDB3 only

- In DS1 mode, the line code options default to B3ZS or AMI
- In DS3 mode, the line code is B3ZS, AMI

Clock Source (Tx only): Can be configured as follows:

- Internal - The clock for the transmitter is derived from the internal clock. The internal clock has an accuracy of +/- 3.5ppm conforming to G.812 recommendations.

- External
  - Clock Port - Unbalanced RX2 selected as default.
  - Clock External
  - Aux Line Code - HDB3, B8ZS, or AMI
- Rx - The clock for the transmitter is derived from the received signal and the jitter of the incoming signal is suppressed.
- Offset
  - Clock Offset - With the Clock Offset box checked, a custom deviation value of +/- 50ppm can be entered

Termination (Rx only): The sensitivity of the receiver can be set for ITU-T/ANSI, Protected Monitoring Points (PMP) or High Impedance connections. The options under the Termination menu are

- Terminated - The received signal is terminated with a 100ohm impedance enabling the unit to decode the signal over a wide range of cable losses.
- Monitor - To be used when the measurement is made at a Protected Monitoring Point (PMP) of network equipment. The PMP level can range between -20 and -26dB. The TX130M+ is fully compliant with ITU-T G.772 and relevant sections defining PMP.
- Bridge - Select this mode for a high impedance monitor test or when the receiver is connected directly in parallel to a DS1 line carrying live traffic. The isolation circuit of the unit protects the DS1 signal from any possible disruption.

Balanced (Tx only): Check when using the RJ-45 connectors. The transmitter output impedance will be set to 120 ohms. The Primary test port is "1" on top panel. If unchecked, the unit will assume that testing is taking place on the 75ohm unbalanced BNC TX connector for E1 mode.

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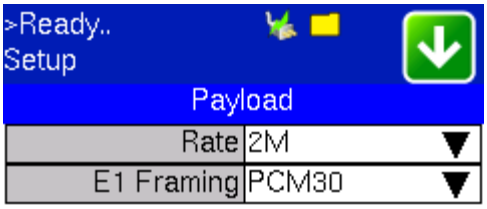
15.1.3 Payload

Tap the payload box to access this feature. Payload allows the user to configure a low rate signal (if applicable) and associated framing.

Payload - 2M



Rate:

In 2M mode, the options are 2M or Fractional E1 (N x64) where:

- 2M: Configures the transmitter for full rate testing at 2,048Mbit/s
- Fractional E1 (N x64): Configures the transmitter for fractional testing using N or M 64kbit/s timeslots. (Contiguous or noncontiguous timeslots)

In E3 (34Mbit/s) mode, the options are 34M or 2M Mux (E3/E1 Mux) or Fractional E1 (Nx64) Mux where:

- 34 M: Configures the transmitter for full rate testing at 34Mbit/s

- 2 M (E3/E1 Mux): Configures the transmitter for full rate testing at 34Mbit/s signal with E1 payloads (1 to 16 channels)
- Fractional E1 (E3/E1Mux w/Nx64): Configures the transmitter for full rate testing at 34Mbit/s signal with E1 payloads (1 to 16 channels) for fractional testing using N or M 64kbit/s timeslots. (Contiguous or noncontiguous timeslots)

In DS1 (1.544 Mbit/s) mode, the options are 1.544M or Fractional DS1(Nx64 or Nx56) where;

- 1.544 M: Configures the transmitter for full rate testing at 1.544Mbit/s
- Fractional DS1 (Nx64 or Nx56): Configures the transmitter for fractional testing using N or M 64kbit/s timeslots. (Contiguous or noncontiguous timeslots)

In DS3 (45Mbit/s) mode, the option are 45M or 1.544M (DS3/DS1 Mux) or Nx64 (DS3/DS1 w/Nx64 Mux) where:

- 45 M: Configures the transmitter for full rate testing at 45Mbit/s
- 1.544 M (DS3/DS1 Mux): Configures the transmitter for full rate testing at 45Mbit/s signal with DS1 payloads (1 to 28 channels)
- Fractional DS1 Mux: Configures the transmitter for full rate testing at 45Mbit/s signal with DS1 payloads (1 to 28 channels) for fractional testing using N or M 64kbit/s timeslots. (Contiguous or noncontiguous timeslots)

Framing:

In E1 mode, the options are unframed, PCM31, PCM31C, PCM30, and PCM30C. Framing conforms to G.704 and G.706 recommendations and are briefly described below:

- Unframed: No Frame Alignment Signal (FAS) or Multi Frame Alignment Signal (MFAS) is transmitted
- PCM31: Unit transmits a Frame Alignment Signal (FAS)
- PCM31C: Unit transmits a Frame Alignment Signal (FAS) with CRC-4 bits for error checking
- PCM30: Unit transmits a Frame Alignment Signal (FAS) and a Multi Frame Alignment Signal (MFAS)
- PCM30C: Unit transmits a Frame Alignment Signal (FAS) and a Multi Frame Alignment Signal (MFAS) with CRC-4 bits for error checking

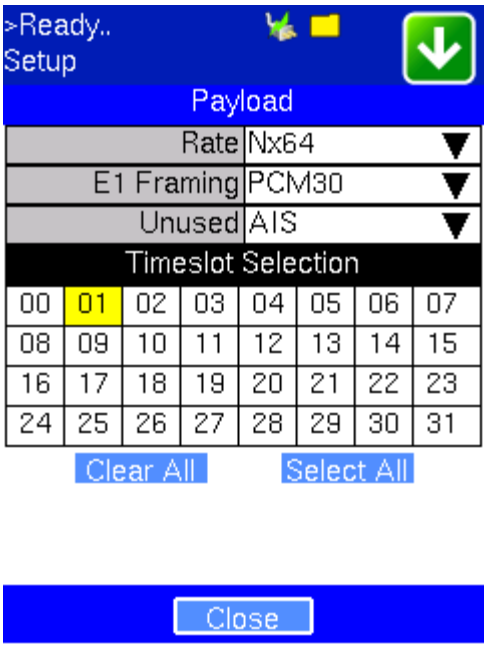
In E3 mode, the options are unframed and G.751 (PCM 480)

In DS1 mode, the options are unframed, D4 (SF) and ANSI T1.107 (ESF)

In DS3 mode, the options are unframed, M13 and C-Parity

When the Nx64 fractional rate is selected, the following screen is displayed:

Payload - Nx64



Framing: Options are PCM31, PCM31C, PCM30, and PCM30C per G.704 and G.706 recommendations same as E1 described above.

Note: Unframed signal types are not supported in the Nx64 fractional mode because framing is required to determine the location of timeslots.

Unused: AIS, Broadcast, Unequipped used to fill up the unused (idle) timeslots

Timeslot Selection: Select the timeslot by tapping the applicable box. Deselect the timeslot by tapping the box again.

Note: Timeslots 1-31 correspond to channels 1-31 when using PCM-31 framing. When using PCM-30 framing, timeslots 1-15 correspond to channels 1-15, while timeslots 17-31 correspond to channels 16-30. Timeslot 16 is used for the Multi Frame Alignment Signal.

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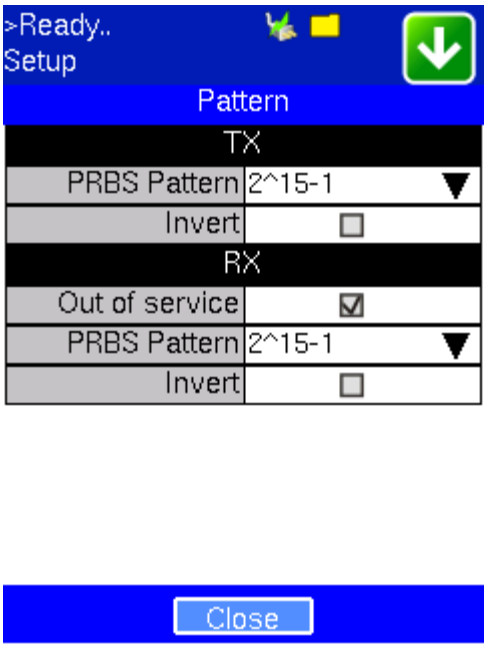
15.1.4 Pattern

Tap on the pattern box to access this feature. The test patterns can be applied to all PDH/DSn rates; however, ITU-T recommends certain sequences dependent on the bit rate under test.

Coupled Pattern



Pattern: Use the pattern drop down box to select the test pattern which will be inserted into the transmitted signal. Pseudo Random Bit Sequences (PRBS) defined by ITU-T 0.150 and 0.151 standards, fixed words and 24-bit or 32 bit user defined patterns are available. Note, if the 32 bit user pattern entered is incorrect, the default pattern will be 0xFFFFFFFF.

Invert: Inversion of polarity is available.

Out of Service (Rx only): Should be selected if the incoming signal is expected to contain a known test pattern. Deselect this option if signal is expected to contain live network traffic, this will disable the pattern detection process and will enable the reporting of LSS.

Note: ITU-T specification 0.150 recommends the following test patterns:

Test Sequences for PDH/DSn signals according to ITU-T 0.150 recommendation		
PRBS	**Zeros**	**Application**
2^9-1	8	Error measurements for bit rates ≤ 14,400 kbits/s
2^11-1	10	Error & jitter measurements for bit rates of n x 64 kbit/s & 64 kbits/s
2^15-1	15	Error & jitter measurements for T1, E1 and DS3 bit rates
2^20-1	14	Error & jitter measurements for T1, E1 and DS3 bit rates
2^23-1	23	Error & jitter measurements for DS3 bit rates
2^31-1	31	Delay measurements for DS3 bit rates

Warning Message

While a test is running, it is possible to view the signal configuration, but it is not possible to change the setup or modify other measurements settings on the fly. This warning screen is only shown during initial setup to alert the user.

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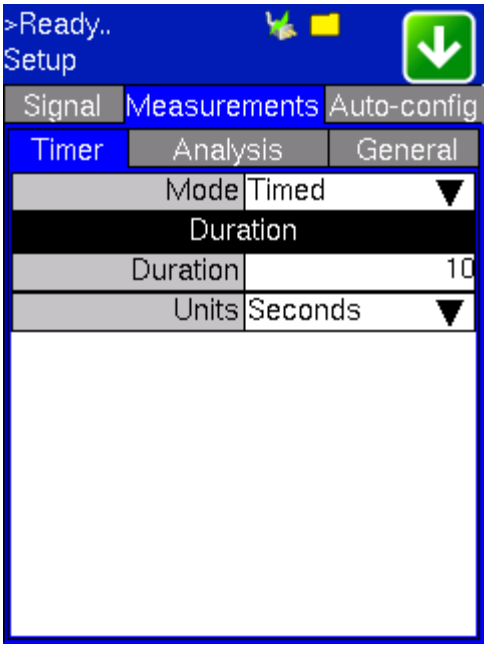
15.2 Measurement Configuration

Tapping the Measurements box opens the setup screen for the Timer, Performance Analysis and General configurations.

Measurement - Timed Mode



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15.2.1 Timer Setup

Configure a test to run for a fixed duration or a delayed start.

Mode: Manual, Timed and Auto selections are available

- Manual: This is linked to the Start/Stop function on the pull-down menu
- Timed: The test duration can be set by the user. The test duration can be set in seconds, minutes, hours or days. The test is activated by the Start/Stop function on the pull-down menu
- Auto: A predetermined start time can be set by the user. The test duration can be set in seconds, minutes, hours or days. After programming the start time and duration, press the Start button on the pull-down menu and the test will be activated automatically when the programmed start time is reached.

Note: The timed mode will be required when running a M.2100 performance

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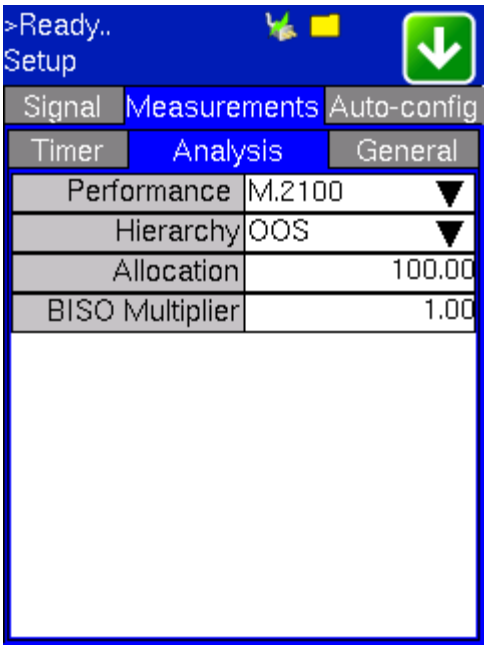
15.2.2 Performance Analysis

The Analysis setup page selects the ITU-T performance test that will be performed by the unit. The selections include None, G.821, G.826 and M.2100. The recommendations are briefly defined as follows:

Measurements - Analysis



- G.821: Error performance of an international digital connection operating at a bit rate below the primary rate and forming part of an Integrated Service Digital Network (ISDN)
  - Long term error performance Conducted Out of Service (OOS)
  - Based on measuring bit errors
  - Evaluation period of 30 days
  - Since there is no overhead structure at these bit rates, in-service measurements are extremely difficult
- G.826: End-to-end error performance parameters and objectives for international, constant bit rate digital paths and connections.
  - Long term error performance for Out of Service (OOS) and In-Service Measurement (ISM)
  - Based on measuring bit errors for connections and block errors for paths
  - Evaluation period of 30 days
- M.2100: Performance limits for bringing into service and maintenance of international multi-operator PDH paths and connections
  - Deals exclusively with PDH paths, sections and systems
  - Based on measuring bit errors and block errors
  - BIS limits for OOS/ISM
  - Evaluation periods of 15 minutes, 2 hours and 24 hours
  - First step is a continuity test for 15 minutes
  - PDH paths are composed of sub-elements of different lengths each with its own set Reference Performance Objectives (RPO)

Note: Only one performance analysis can be performed at a time. To view or enable the M.2100 analyses, the measurement timer has to be set to a determined

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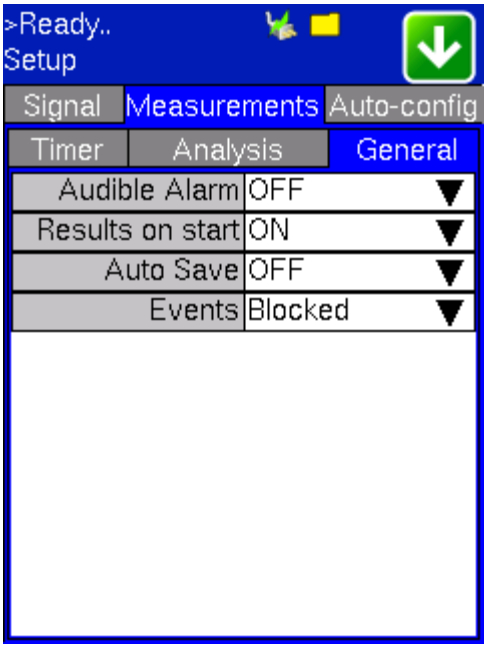
15.2.3 General

The General setup page configures the Audible Alarm and Auto Save settings.

Measurements - General



- Audible Alarm: On or Off. Provides an audible indication when alarm or error condition is recorded.
- Results on start: On or Off. Provides an automatic move to results screen when it starts
- Auto Save: The Automatic Save results file. Tapping the Auto Save set to "ON" will automatically save the results file.
- Measurement Clock Source: Internal Clock or Tx Clock Source; the measurement synchronized to the Tx clock.

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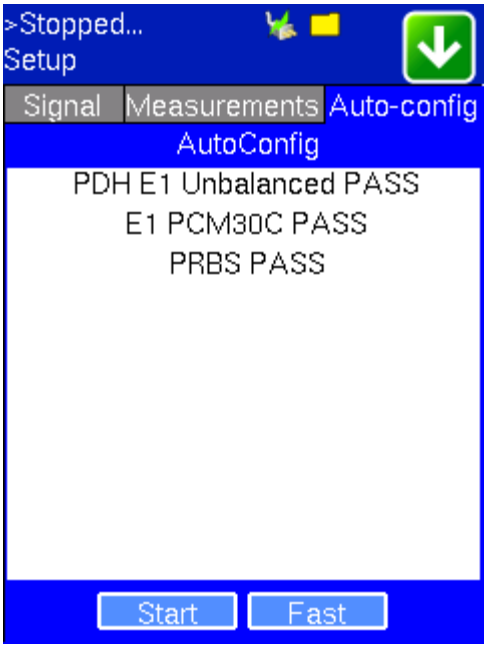
15.3 Auto-Config

The Auto-Configuration function is described below.

Setup - Auto Config



The “Auto-Config” function automatically sets the receiver of the TX130M+. A search of PDH signals at both the electrical inputs is performed to determine the signal structure. For electrical signals, both Terminated and PMP voltage ranges are searched and supported.

Procedure

Tap the “Start” button to begin the search. The received signal is checked for network type, hierarchy and bit rate, payload structure, payload framing, test pattern and signal level. If the search is successful, a “PASS” result is displayed.

Search Parameters and Criteria

- Interface: Checks physical parameters (bit rate line code)
- Payload: Only test patterns defined in ITU-T or ANSI standards will be recognized. If no test pattern is detected, the unit assumes live traffic.

PDH Signals: Unframed or framed payloads at all hierarchies. For 2M signals containing 64kbit/s timeslots, the TX130+ will assume live traffic and will not search for a test pattern.

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16.0 Results

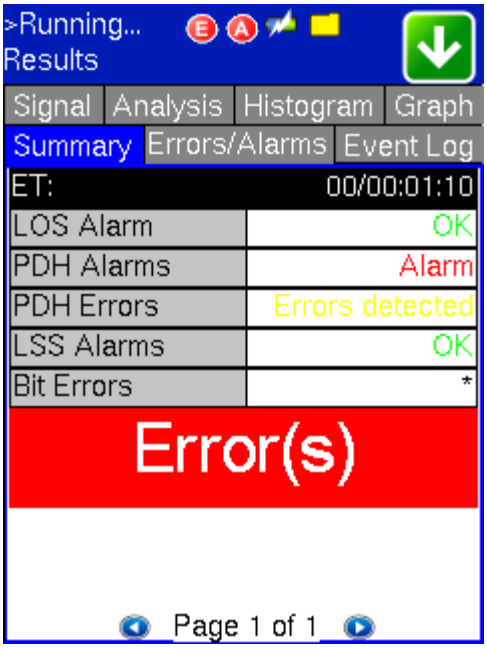
Measurements are accessed by tapping the Results icon in the main menu. The results comprise a range of tabbed pages, similar to the setup pages.

16.1 PDH Results

16.1.1 Summary

The Summary tab displays an overview of the major test parameters. At a glance, the user is able to see if there are any alarms, errors or signal failure. The selected performance analysis test and its current verdict (Pass or Fail) is also displayed..

PDH Summary



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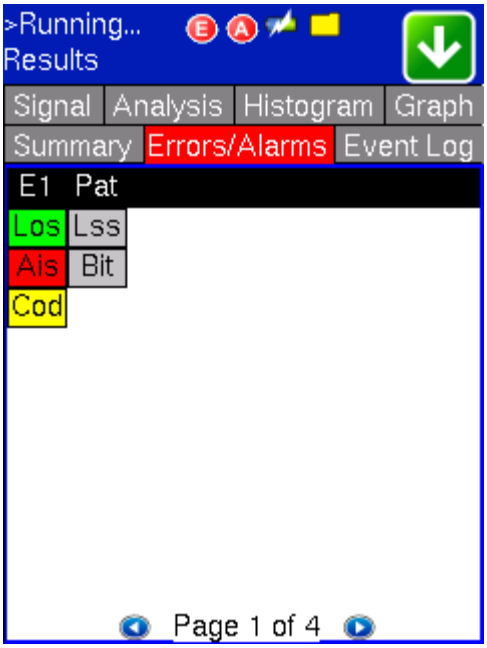
16.1.2 PDH Errors/Alarms

The Errors/Alarms tab brings up several pages showing the errors and alarm status. Page 1 of 4 (Dual E1 mode, Page 1 of 6) provides an overview of all the errors and alarms applicable to the signal or network under test. The color of the page tab is normally blue; however, it will turn red when an alarm error condition has been detected or recorded.

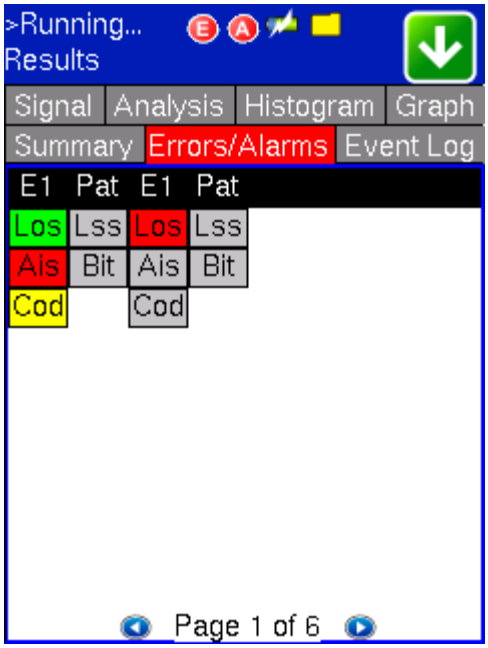
The soft LEDs on-screen are arranged logically and will depend on signal hierarchy, structure, payload and framing selected. The soft LEDs have a tricolor function:

- Green: No error or alarm is present
- Red: An error or alarm condition is detected and is currently present
- Yellow: Indicates a history condition. An error or alarm was detected during the measurement interval, but it is no longer present or active

Errors/Alarms Tab



Errors/Alarms Tab - Dual E1 Mode



Note: Tapping the individual soft LED will automatically link you to the applicable result screen which provides detailed information.

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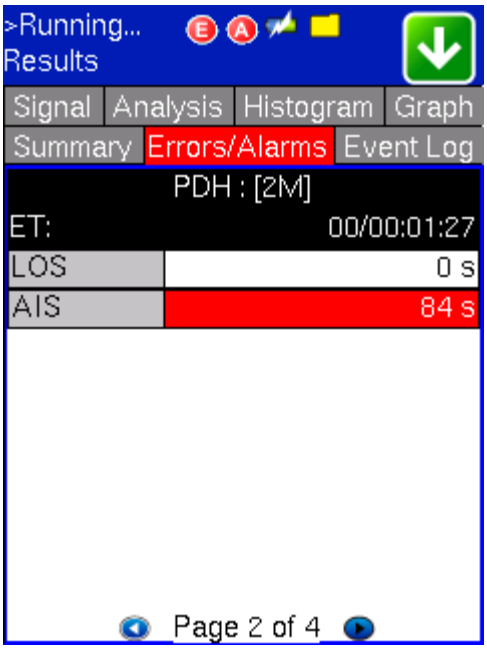
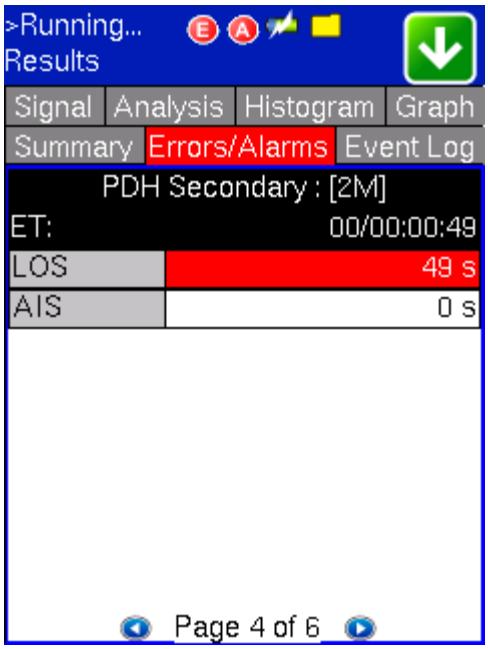
Errors/Alarms (Page 2)

Page 2 of 4 lists the alarms in logical order that are associated with the signal under test. All alarms are evaluated and stored. The time resolution of alarms is 100ms.

Errors/Alarms Tab (Page 2)



Errors/Alarms Tab (Page 4) - Dual E1 Mode



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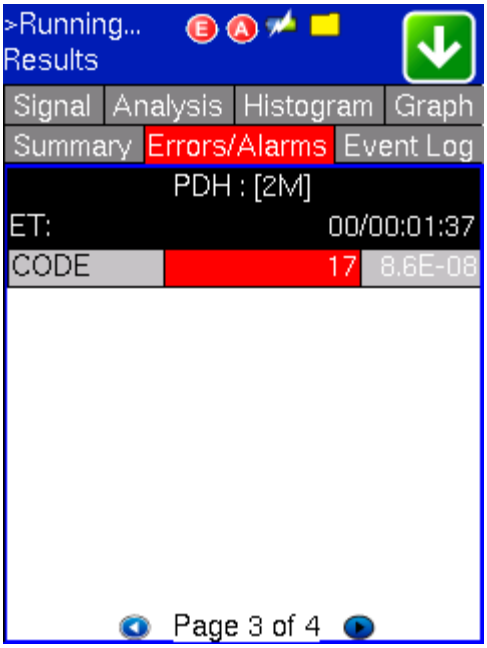
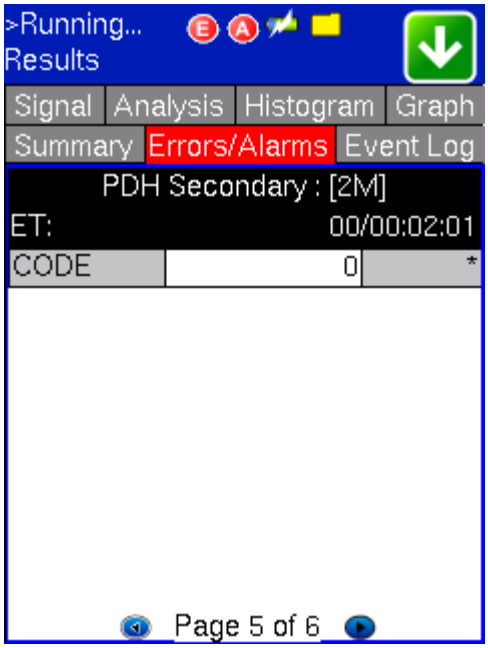
Errors/Alarms (Page 3)

Page 3 of 4 lists the errors in logical order that are associated with the signal under test. All errors are counted simultaneously and stored.

Errors/Alarms Tab (Page 3)

Errors/Alarms Tab (Page 5) - Dual E1 Mode





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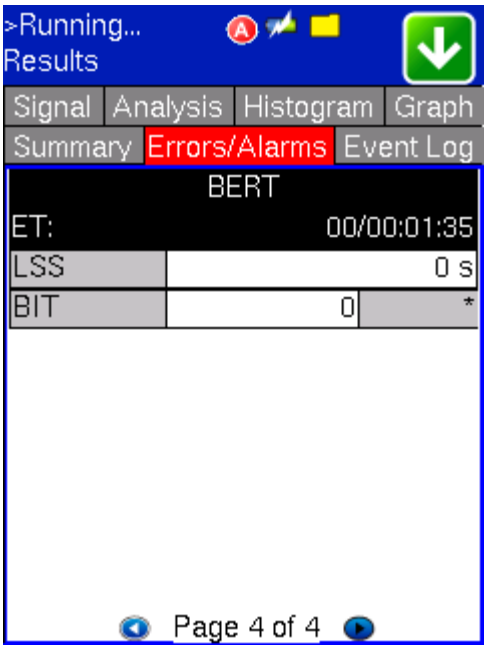
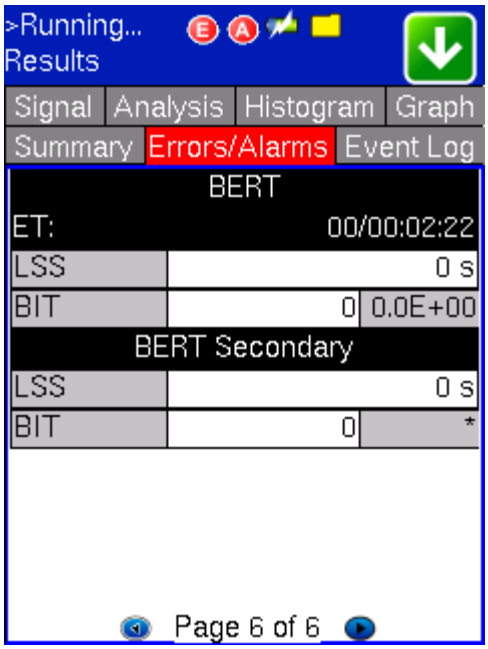
Errors/Alarms (Page 4)

Page 4 of 4 lists the Bit Error Performance (BERT) associated with the signal under test.

Errors/Alarms Tab (Page 4)



Errors/Alarms Tab (Page 6) - Dual E1 Mode



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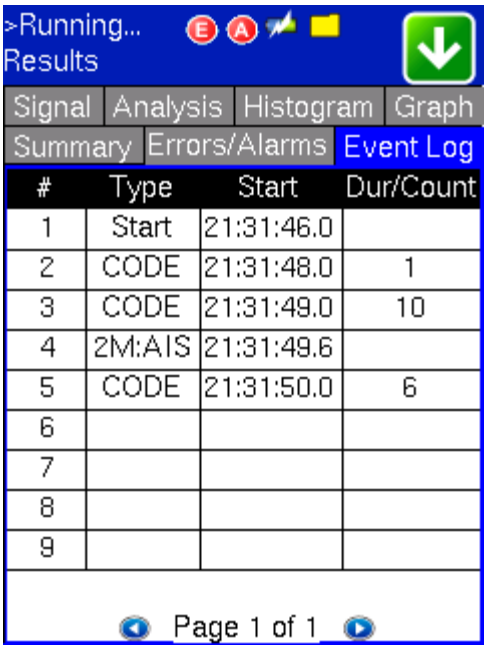
16.1.3 Event Log

The Event log tab brings up the screen listing the error and alarm events recorded during a test. The events are presented in chronological sequence:

- Number (#): Event number, events are numbered sequentially
- Type: Indicates alarm or error type
- Start: Indicates when the alarm or error was detected
- Dur/Count: Indicates for how long the alarm or error was detected and provides count (alarms) and ratio (errors). The duration format is day:hour:minute:second
- Pages: Scroll through the pages depending on the number of events recorded.

Event Log



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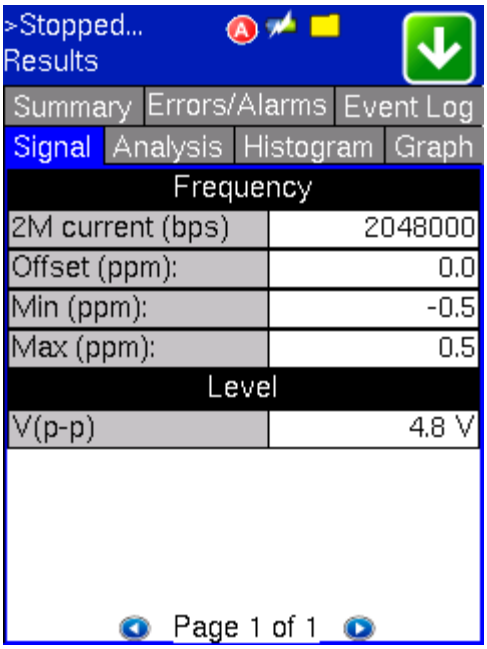
16.1.4 Signal

The Signal tab brings up the Frequency and Level result screen.

Signal



Frequency: The received signal frequency and offset is measured and displayed. For E1 signals, the measurement is performed on both balanced 120ohm and unbalanced 75ohm interfaces.

- Current: Indicates the frequency of the input signal
- Offset: Indicates the difference between the standard rate and the rate of the input signal
- Min (ppm): Indicates the difference between the standard rate and the minimum deviation detected in the input signal
- Max (ppm): Indicates the difference between the standard rate and the maximum deviation detected in the input signal

A Min (ppm) and Max (ppm) function can be used to ensure that the received signal is within a certain clock tolerance and that the network element is transmitting correctly. The frequency limits for the various signal types according to ITU-T recommendations are presented in the table below.

Frequency Tolerances for PDH and T-Carrier Systems	
Signal	**Frequency Specification**
E1 PDH	2.048 Mbps ± 50 ppm
E3 PDH	34.368 Mbps ± 20 ppm
DS1 T-Carrier	1.544 Mbps ± 30 ppm
DS3 T-Carrier	44.736 Mbps ± 20 ppm

Level: Measures the Peak and Peak-Peak voltage values of the incoming signal. The levels for the various signal types according to ITU-T recommendations are presented in the table below.

PDH Signal Levels per ITU-T G.703 Recommendations				
Signal	**Bit Rate**	**Line code**	**Input**	
			Termination	**Level**
E1	2 Mbit/s	HDB3	75 ohm unbalanced BNC 120 ohm balanced RJ45	Terminate: 2.37 Volt peak Monitor: 2.37 Volt peak with 20 or 26dB gain Terminate: 3.0 Volt peak Monitor: 3.0 Volt peak with 20 or 26dB gain
E3	34 Mbit/s	HDB3	75 ohm unbalanced BNC	Terminate: 1.0 Volt peak Monitor: 1.0 Volt peak with 20 or 26dB gain

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16.1.5 Analysis

ITU-T recommendations are available to analyze results.

ITU-T G-series: Telecommunications design, checking of performance limits, expected behaviors and design structures

ITU-T M-series: Applies to the installation and maintenance of the network and defines “Bringing Into Service” (BIS) procedures and test limits for fault detection and localization.

The ITU-T recommendations are described in greater detail in the Measurements section.

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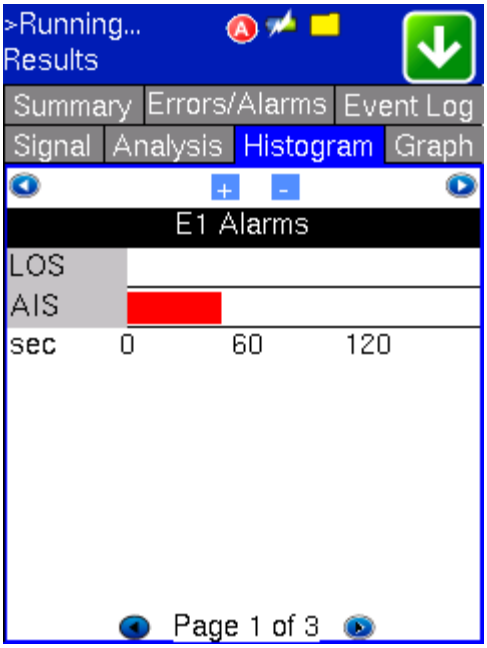
16.1.6 Histograms

The Histogram tab brings up the screen displaying a historical record of the Alarms and Errors recorded during the measurement interval. A dedicated page is available for errors, alarms including BER. Scroll through the various pages to display the anomalies of interest.

Histogram (E1 Alarms)

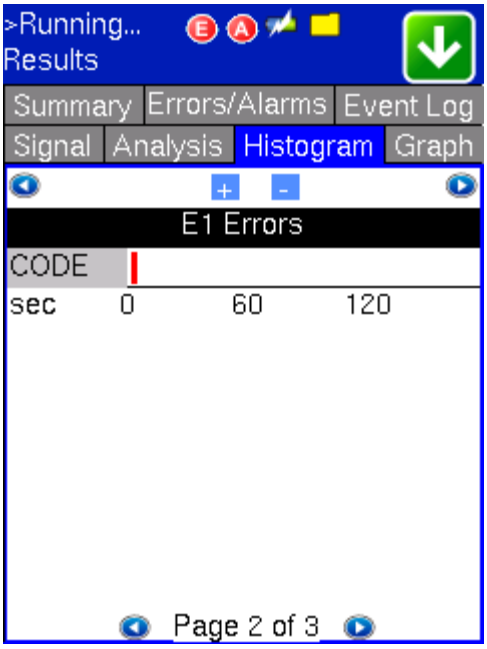


The alarms and errors presented will depend on the signal type and structure selected. A graphical timeline on the horizontal axis indicates when the event occurred since the test was started. The upper left and right arrows allow the user to scroll through the measurement period while the + and – keys allow zooming of the time axis. The events presented above are shown in the table below.

E1 signal	Alarm description
LOS	Loss of signal
AIS	Alarm Indication Signal
LOF	Loss of Frame
LOMF	Loss of Multi Frame
RDI	Remote Defect Indication

The screen below depicts E1 Errors.

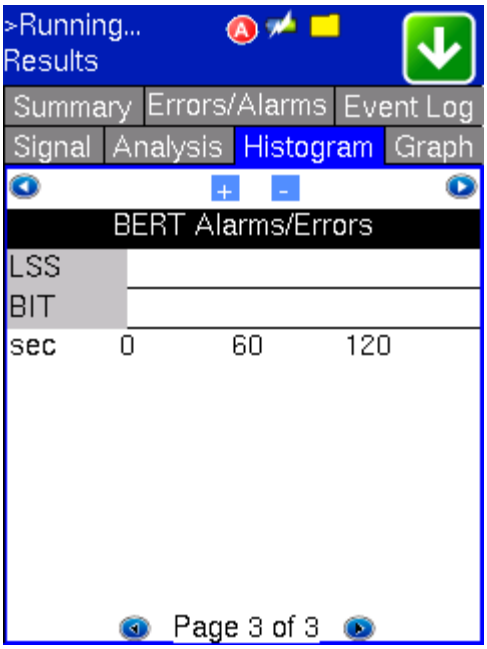
Histogram (E1 Errors)



E1 signal	Error description
Code	Code error (HDB3, AMI)
FAS	Frame Alignment Signal
CRC	Cyclic Redundancy Check error
REI	Remote Error Indication

The screen below depicts BER and bit errors.

Histogram (BERT Alarms/Errors)



BERT	Description
LSS	Loss of Sequence Synchronization
Bit	Bit error

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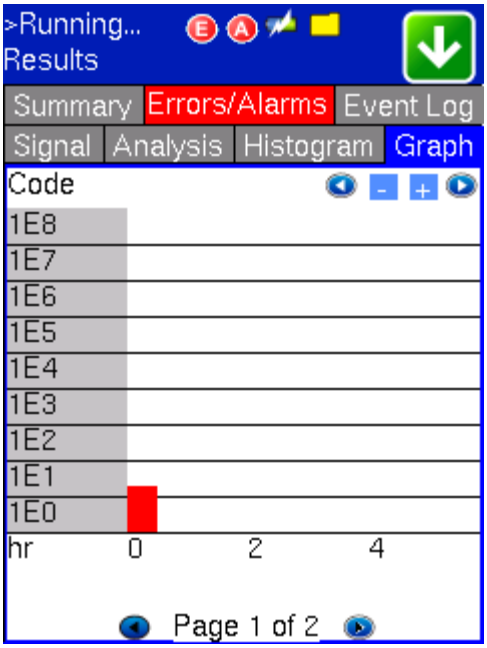
16.1.7 Graph

The Bar tab brings up the screen displaying a log of the Errors recorded during the measurement interval. A dedicated page is available for each error type. Scroll through the various pages to display the anomaly of interest.

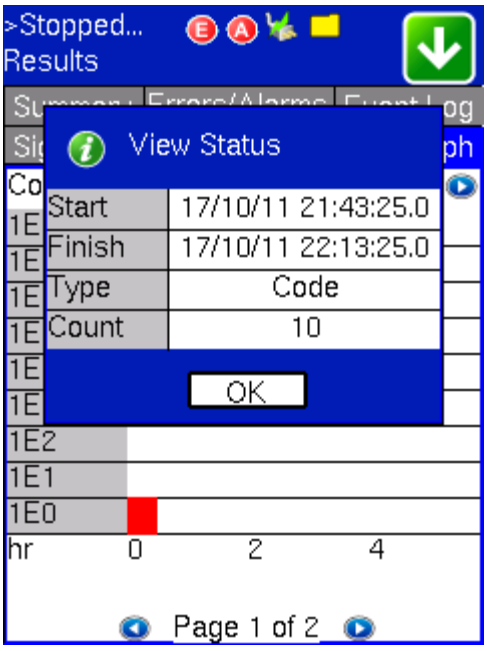
Graph



A graphical timeline on the horizontal axis indicates when the event occurred while, the vertical axis indicates the error ratio. The upper left and right arrows allow the user to scroll through the measurement period while the + and – keys allow zooming of the time axis.

A View status screen can be accessed by tapping on the result area. A start and finish time, including count of the event type will be displayed. The View status screen is shown below.

Graph - View Status



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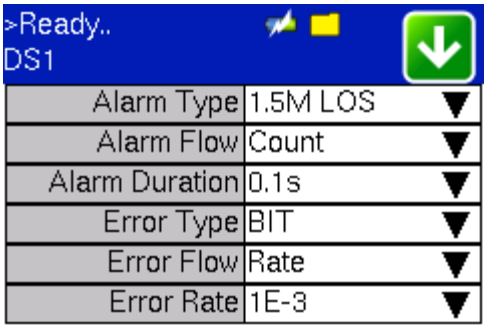
17.0 Alarms/Errors

The Alarm and Error generation functionality can be found on the main menu.

Tap the Alarm/Error icon to display the Alarm and Error Generation screen. The Alarm and Error functions are used in conjunction with the pull-down menu, which has dedicated buttons for Error Injection and Alarm Generation. The alarm and error selections will depend on PDH signal types.

PDH/DSn



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17.1 Alarm Generation

The following PDH/DSn (T-Carrier) alarms can be generated:

Alarm Type:

- E1 signals: LOS, LOF, AIS, RDI
- E3 signals: LOS, LOF, AIS, RDI
- DS1 signals: AIS, Yellow, idle, LOS, LOF
- DS3 signals: LOS, LOF, OOF, AIS, Parity

Alarm Flow - Continuous, Count

Alarm Duration - 0.1s, 1s, 10s, 100s

Error Type:

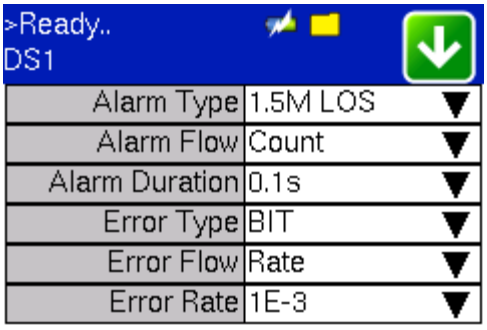
- E1 signals: Code, FAS, CRC, REI, E-bit, Bit
- E3 signals: Code, FAS, Bit
- DS1 signals: Code, FAS, Bit
- DS3 signals: Code, FAS, Bit

Error Flow - Injects a range of different anomalies into the transmit signal. Error insertion modes include:

- Single: Inserts a single error every time the insertion button is tapped
- Count: Specific count or number of errors when the insertion button is tapped
- Rate: Specific rate between $1^{10^{-3}}$ and $5^{10^{-6}}$

The list of available error types depends on the type of framing being used, and the PDH/DSn hierarchies and line interfaces that have been selected.

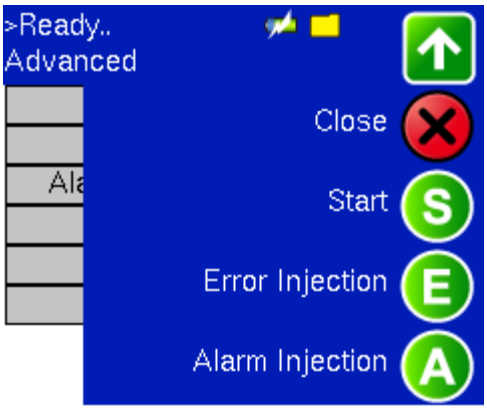
PDH/DSn



Alarm Generation Error Insertion (pull-down menu)

At any time during the test process, you can inject errors or generate alarms by tapping the Error Injection and Alarm Generation buttons in the pull-down menu.

Alarm/Error Injection Menu



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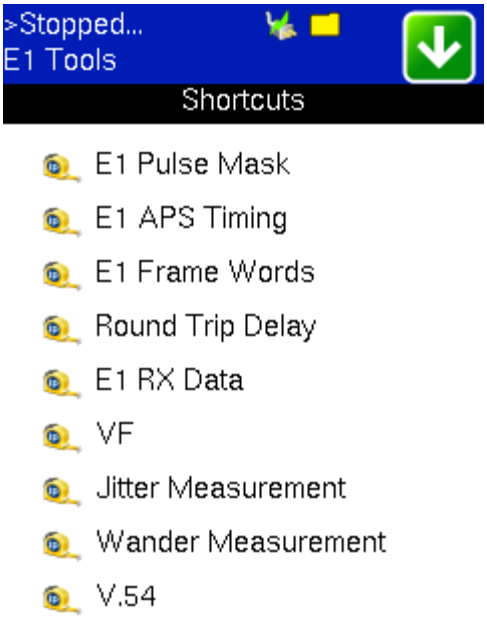
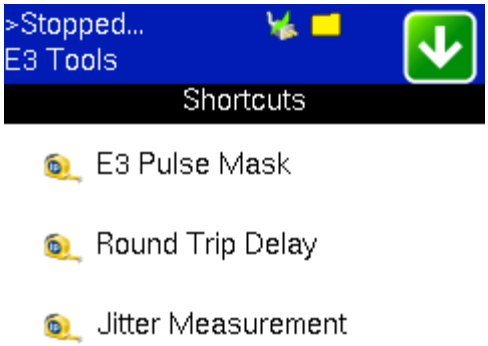
18.0 E1/E3 Tools

The E1 and E3 Tools can be found on the main menu. Tap the E1 and E3 Tools icon to display the shortcut screen shown below.

E1 Tools Menu

E3 Tools Menu





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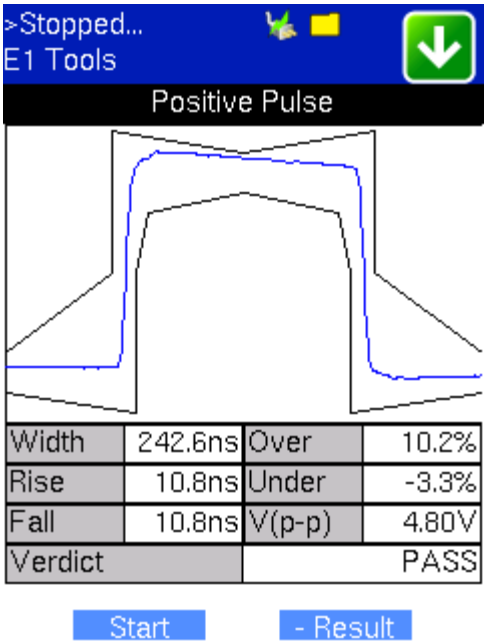
18.1 E1/E3 Pulse Mask

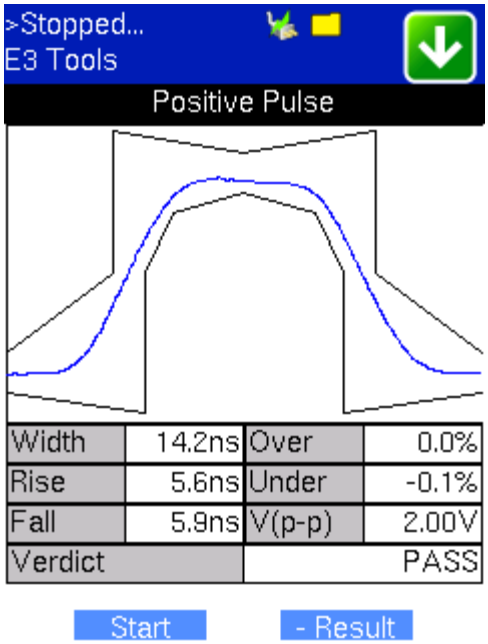
This function captures and analyzes E1 (2,048Mbits/s) or E3 (34,368Mbits/s) pulse shape. The purpose of maintaining the correct pulse shape is to reduce inter-symbol interference – if the logic 1s and 0s cannot be detected by the receiver correctly, bit and code errors will result.

The pulse amplitude and overall shape are superimposed and compared with the ITU-T G.703 pulse conformance template. Telecommunications signals require specific load impedance for pulse mask compliance testing to be accurate. When high frequency pulses are transmitted down a transmission line, a portion of the pulse will be reflected when and wherever it encounters an impedance mismatch. The reflection is proportional to the impedance mismatch i.e. the greater the mismatch, the greater the reflection of the pulse. To avoid reflections impacting the E1 measurement, the TX130M+ will terminate twisted pair cables with 120 ohms and coax cable with 75 ohms impedance. Note that 75ohm and 120ohm twisted pair cables each have different nominal amplitudes associated with them - For the 75ohm coax cable, the pulse amplitude must be 2.37V ± 10% while for 120ohm twisted pair cables, the pulse amplitude must be 3.0V ± 10%.

According to the G.703 recommendation, E1 pulses need only be measured at the transmitter output, and are *not* required to meet the pulse template over a variety of cable lengths – this of course will not provide information on distortions caused by misalignment and other impairments of the line. The TX130M+ on the other hand allows you to connect to a live system at the Tx output port via a Protected Monitoring Point (PMP) or at the far end of a transmission line. In either case, the signal will be attenuated or amplified as necessary to compensate for test point or cable attenuation characteristics.

E1 Pulse Mask E3 Pulse Mask





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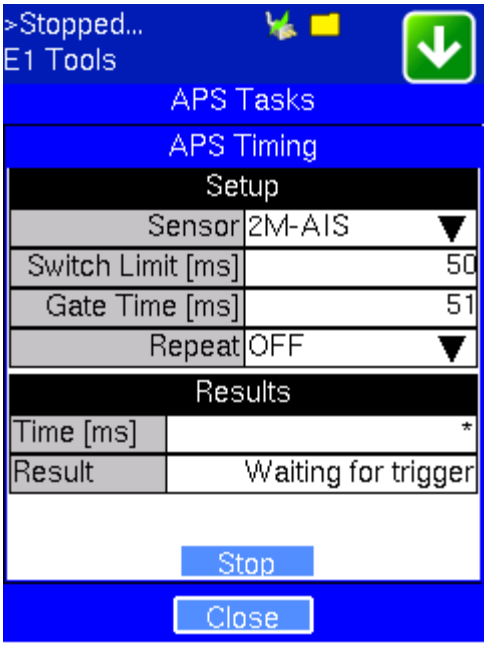
18.2 E1 APS Testing

This function measures the Automatic Protection Switching (APS) limits of the network. APS applies the Multiple E1 Links and enables network elements to reroute traffic to a backup circuit in the event of network failure or problems.

Test Procedure:

1. The TX130M+ should be connected to transmission system to ensure that the switching time is measured for the service transported by the E1 links.
2. Ensure that no errors or alarms are present on the transmission system because this will impact the measurement.
3. The measurement will be triggered by an Alarm Indication Signal (AIS) or a Test Sequence Error (TSE) event of >1 x 10-4
4. The TX130M+ measures how long the AIS or TSE event remains present after the event is first recognized and will continue to measure the total disruption time in the event of multiple disruptions

E1 APS Testing



18.3 E1 Frame Words

This function requires the E1 signal to be framed. The NFAS word is used to carry information about the status of the link and to

provide control signals for primary rate multiplexers.

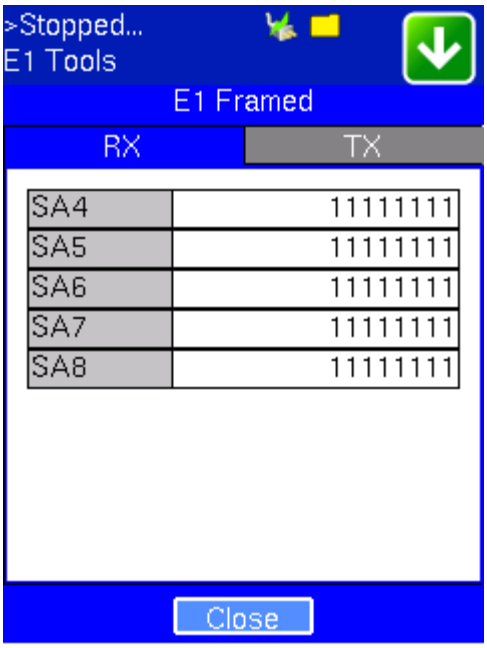
Not Frame Alignment Signal (NFAS)								
Bit	1	2	3	4	5	6	7	8
Value	Si (M)	1	A	Sa4	Sa5	Sa6	Sa7	Sa8

- Bit 1: Reserved for International use (M is used to transmit the CRC multiframe signal in PCM30C and PCM31C)
- Bit 2: Set to “1” to prevent simulation of FAS
- Bit 3: A shows the remote alarm indication
- Bits 4 to 8: Sa4 to Sa8 are spare bits.

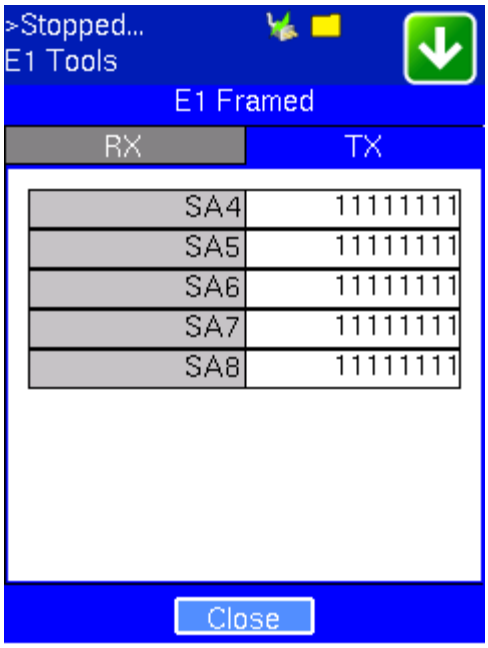
Tx: Bits Sa4 to Sa8 are used to send optional network messages. The Sa bits should be set to “1” when they are not used or when links cross International borders.

Rx: Bit Sa4 can be used as a message based data link for operations, maintenance and performance monitoring.

E1 Frame Words - Rx



E1 Frame Words - Tx



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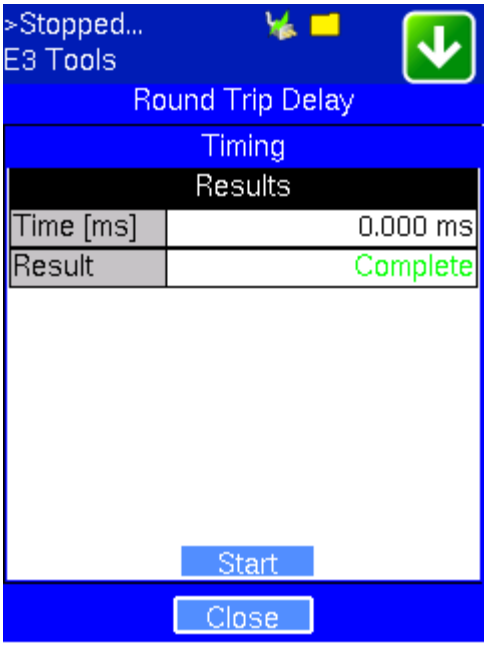
18.4 Round Trip Delay



The Round Trip Delay (Propagation Delay) measurement works by sending a test pattern. A errors is transmitted in the pattern. The time it takes for the error to reach the receiver is the propagation time through the network.

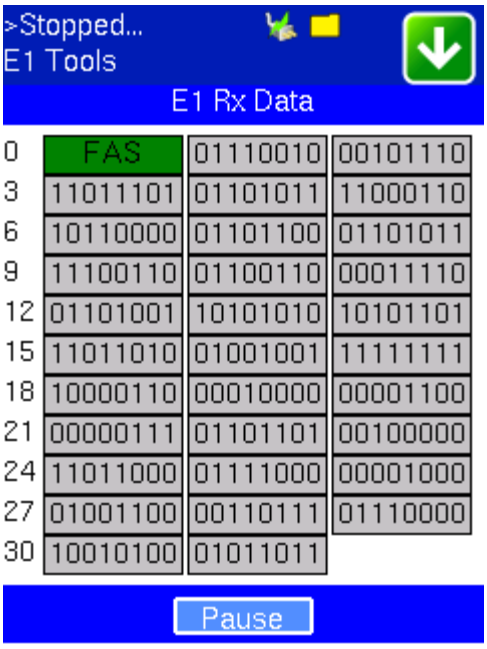
- View the Round Trip Delay of a looped back signal.
- Set check box on Setup Rx pattern to Out-of-Service

Go back to top

18.5 E1 Rx Data

Tapping the E1 Rx Data the E1 Tools screen displays the PDH E1 Rx Data showing received data and captures the current timeslots.

E1 Rx Data



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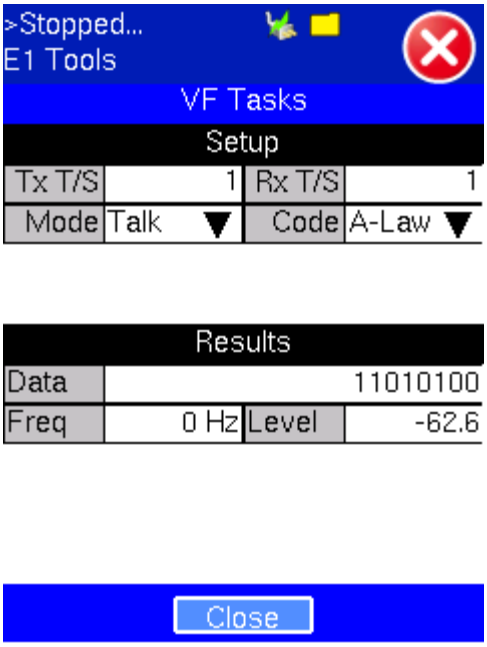
18.6 E1 VF

Tapping the VF the E1 Tools screen displays the VF Tasks showing The VF menu performs a variety of talk/listen functions.

E1 VF Tasks



E1 Warning

Note

Do not attempt to enter VF Tasks if the Frame LED is not green. Green LEDs indicate that the framing found on the received signal matches the framing selected in the Setup screen. It is impossible to talk, listen, or perform other channelized functions in the absence of frame synchronization, since channels can be identified only within a framed signal.

The VF Tasks screen lets you choose:

Setup:

- Timeslot - Channel to test for both transmitting and receiving: Options: 1 - 31
- Mode - Talk, send a Tone on the transmit signal. Transmit audio data from the external headset into selected timeslot.
- Code: Options: u-Law or A-Law
- Programmable ABCD: Manual edit ABCD (User) or IDLE, SEIZE
- Transmitted Frequency: Options: 50 to 3950Hz
- Transmitted Level: Options: -60 to 3dBm

Results:

- Measure signal frequency and level in selected timeslot.
- Listen to the voice channel in selected timeslot via external headset.
- ABCD bits monitor and View data in selected T/S channel.

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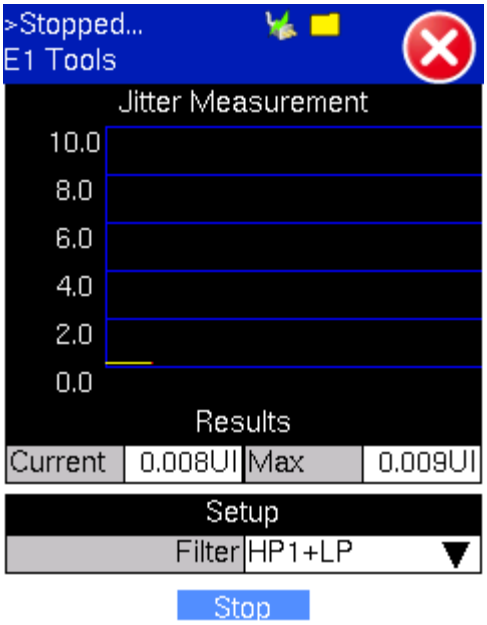
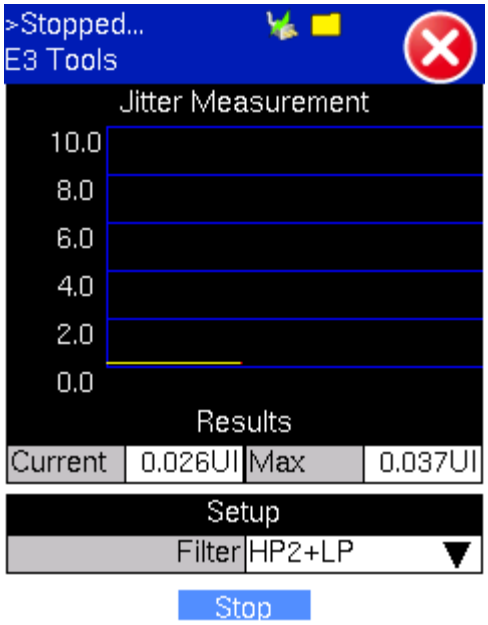
18.7 Jitter Measurement

By tapping the Jitter Measurement, the E1/E3 Tools screen displays the jitter measurements showing measurements and analysis of jitter in received signal.

E1 Jitter Measurement

E3 Jitter Measurement





The Jitter Measurement submenu allows the user to measure and analyze received signal jitter. The measurements example is shown above (the vertical grid spacing is 2.0UIpp). Red Bar is Max. peaked jitter during testing and Yellow is the current peaked jitter.

Press "Start" to start measurement

Select the HP1+LP (20Hz to 100kHz) or HP2+LP (18kHz to 100kHz) filter for E1, and HP1+LP (10Hz to 400kHz) or HP2+LP (30kHz to 400kHz) filter for E3

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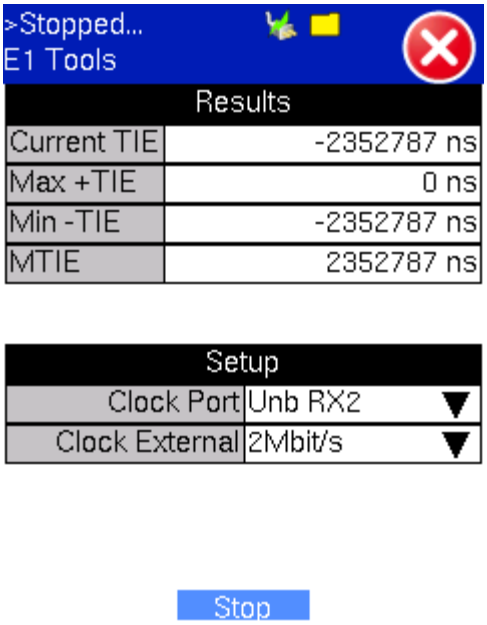
18.8 Wander Measurement

Setup

- Clock Port - Unb RX2 selected as default. The external reference clock is connected through the Aux Rx port.
- Clock External - 2Mbit/s chosen as default

Press Start to run the test. The Wander Measurement Menu displays Current, Max, Min, and MTIE results in nanoseconds.

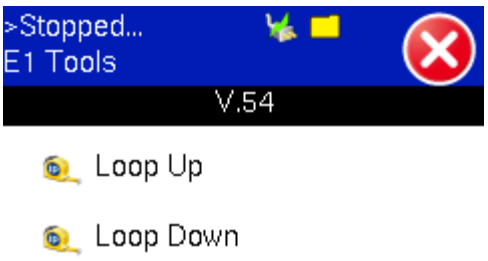
Wander Measurement Menu



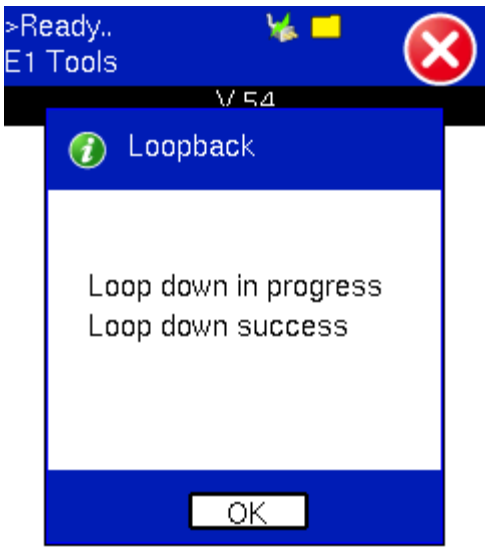
18.9 V.54

The V.54 menu features the Loop Up and Loop Down functions for Loopback testing. Tap on Loop Up or Loop Down to create or cancel a loopback.

V.54 Main Menu



Loopback Message

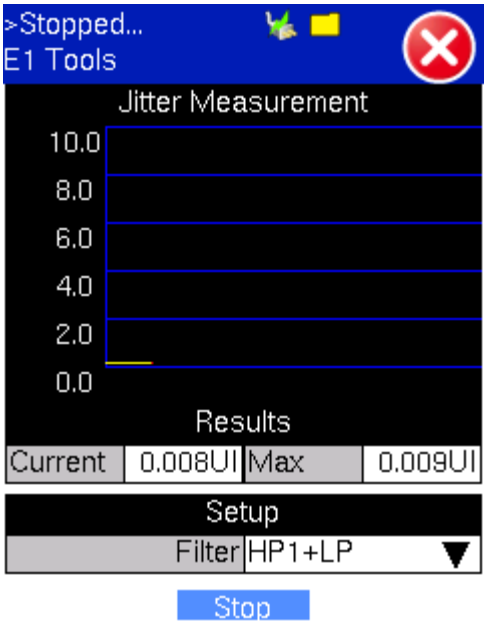


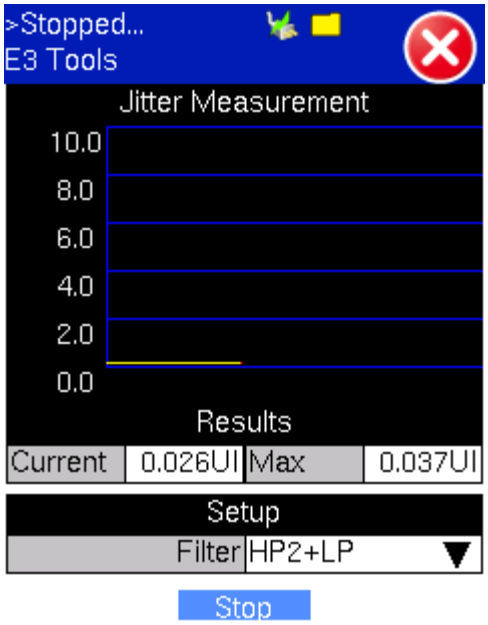
19.0 DS1/3 Tools

The DS1/3 Tools can be found on the main menu. Tap the DS1/3 Tools icon to display the shortcut screen shown below.

E1 Jitter Measurement

E3 Jitter Measurement





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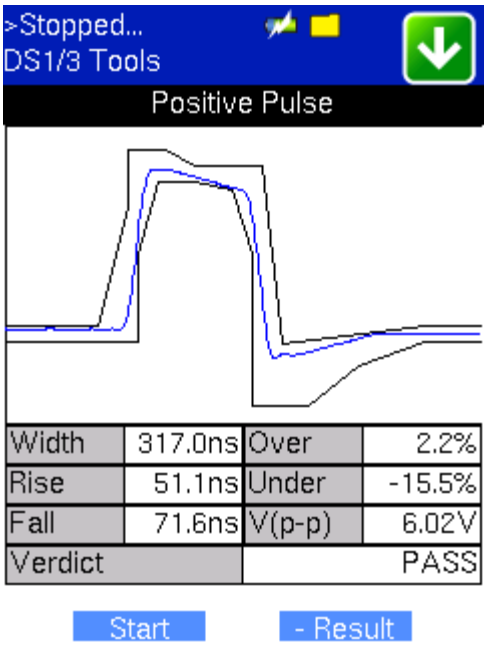
19.1 DS1 Pulse Mask

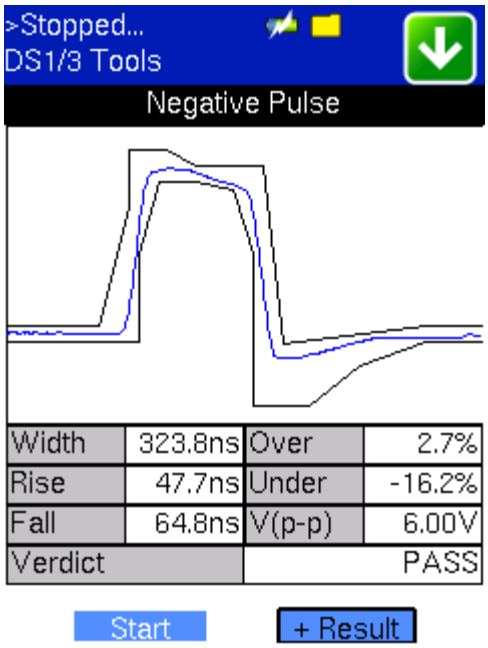
This function captures and analyzes DS1 (1.544Mbits/s) pulse shape. The purpose of maintaining the correct pulse shape is to reduce inter-symbol interference – if the logic 1s and 0s cannot be detected by the receiver correctly, bit and code errors will result.

The pulse amplitude and overall shape are superimposed and compared with the Telcordia TR-TSY-000499 and ITU-T G.703 pulse conformance template. Telecommunications signals require specific load impedance for pulse mask compliance testing to be accurate. When high frequency pulses are transmitted down a transmission line, a portion of the pulse will be reflected when and wherever it encounters an impedance mismatch. The reflection is proportional to the impedance mismatch i.e. the greater the mismatch, the greater the reflection of the pulse.

DS1 Positive Pulse Mask



DS1 Negative Pulse Mask



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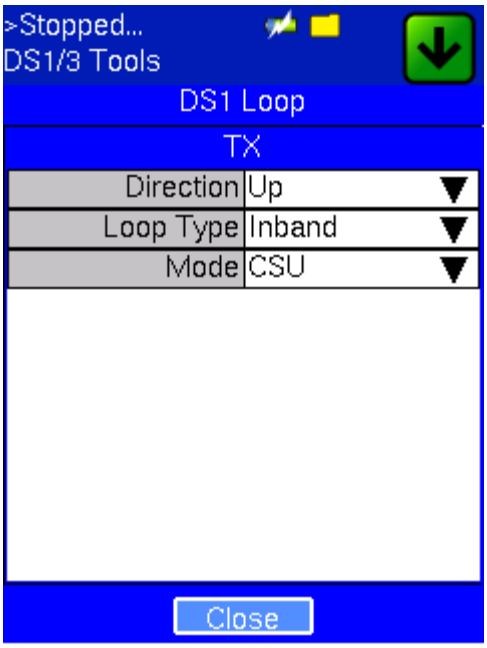
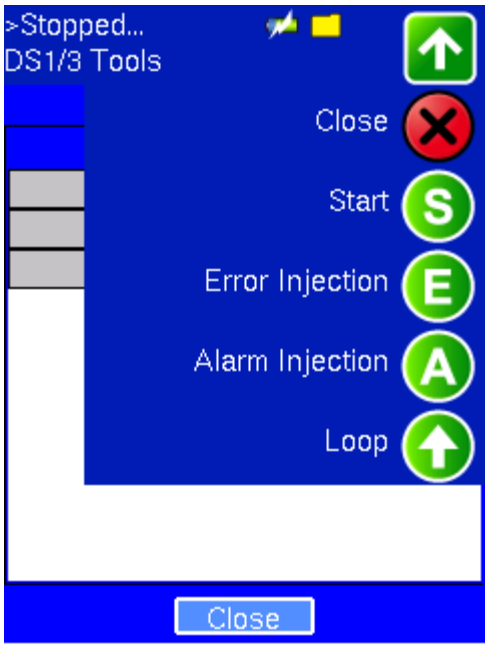
19.2 DS1 Loop

Tap the DS1 Loop icon to display the shortcut screen shown below.

DS1 Loop



DS1 Loop Menu



Loopback Control: Tap the Loop Icon located at the top of the screen to select Up (Loop Up) or Down (Loop Down).

Loop Up:

1. Send a known test pattern and check if the pattern is received. If received, declare “pre-exist loop” and stop.
2. Send the loop up code for 5 seconds. If in-band, check if the loop up code is returned. If out of band (ESF FDL), send a known pattern in the payload and check if the known pattern is returned. If not returned in 10 seconds, declare loop up failed.

Loop Down:

1. Send a known test pattern and check if the pattern is received. If not received, declare “loop down” and stop.
2. Send the loop down code for 5 seconds. Same as loop up but check for the return code disappeared.

Transmits in-band and out-of-band DS1 loop

In-band:CSU, NIU FAC1, NIU FAC2. Transmit: Select code transmitted for 5 seconds (nominal).

ESF DFL (Out-of-band): Line, Payload, Network.
Transmit: Selected code transmitted either continuously or a burst of n-messages (where n is selectable in the range 1 to 15).

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19.3 Round Trip Delay

The Round Trip Delay (Propagation Delay) measurement works by sending a test pattern. Errors are transmitted in the pattern. The time it takes for the error to reach the receiver is the propagation time through the network.

- View the Round Trip Delay of a looped back signal.
- Set check box on Setup Rx pattern to Out-of-Service

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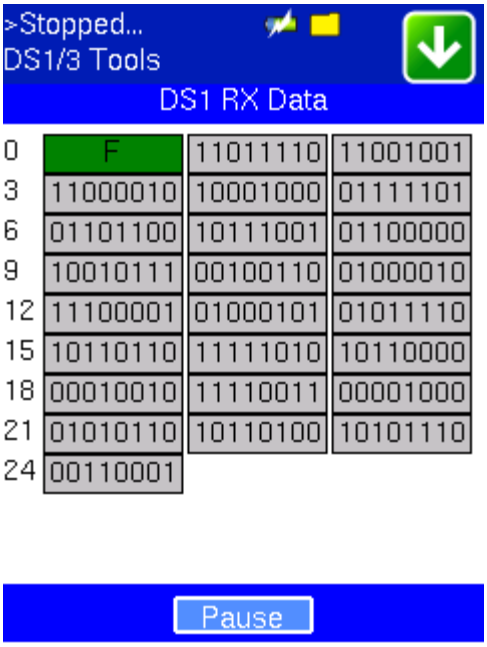
19.4 DS1 Rx Data

Tapping the DS1 Rx Data the DS1 Tools screen shows the DS1 Rx Data, which shows received data and captures the current timeslots.

DS1 Rx Data



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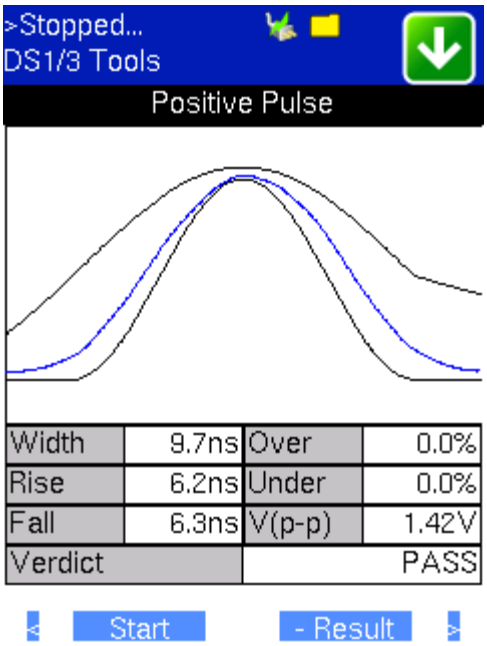
19.5 DS3 Pulse Mask

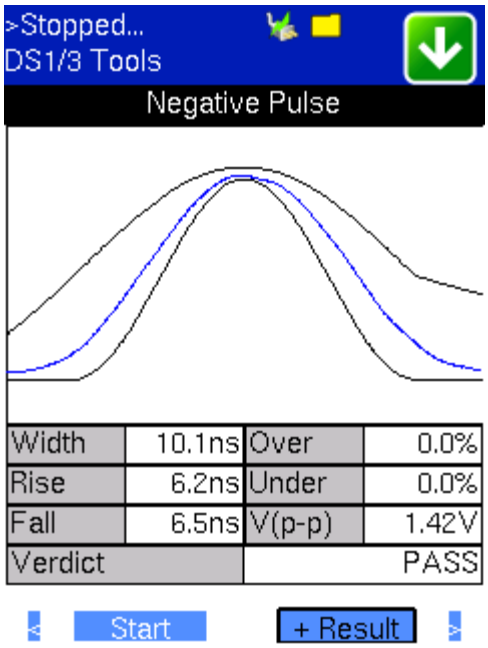
This function captures and analyzes DS3 (44.736Mbits/s) pulse shape. The purpose of maintaining the correct pulse shape is to reduce inter-symbol interference – if the logic 1s and 0s cannot be detected by the receiver correctly, bit and code errors will result.

The pulse amplitude and overall shape are superimposed and compared with the Telcordia TR-TSY-000499 and ITU-T G.703 pulse conformance template. Telecommunications signals require specific load impedance for pulse mask compliance testing to be accurate. When high frequency pulses are transmitted down a transmission line, a portion of the pulse will be reflected when and wherever it encounters an impedance mismatch. The reflection is proportional to the impedance mismatch i.e. the greater the mismatch, the greater the reflection of the pulse.

DS3 Positive Pulse



DS3 Negative Pulse



- Left/Right button: To move the pulse mask to left or right direction, press the left or right button first and re-run the test.

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19.6 DS3 FEAC

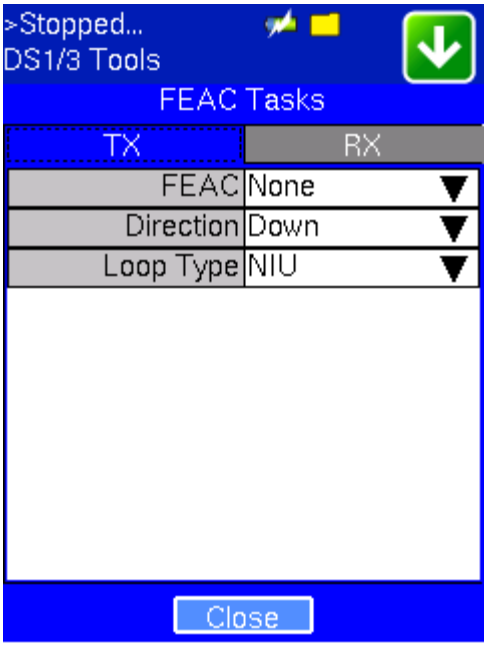
DS3 FEAC responses (Far End Alarm and Control Channel Responses):

Enabling this option allows loop-back to be configured from any “far-end” equipment connected on the other end of the line. These can be used to send and receive loop up codes and information from the far end T3 device. You can enable and disable through a drop down menu in this field.

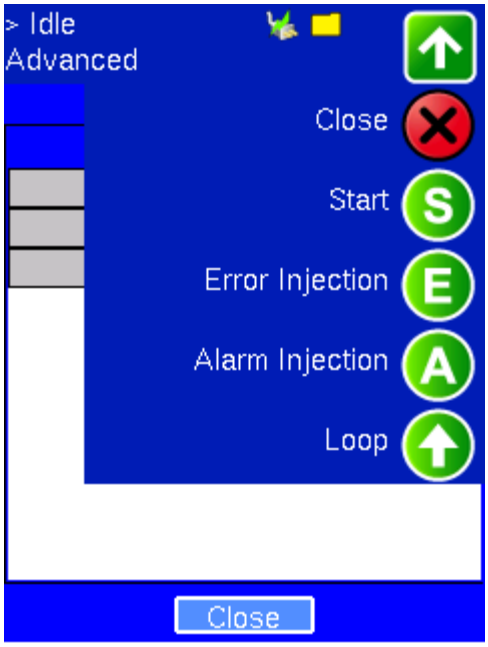
- LoopUP Activate: 00010010 11111111 sent >10 repetitions
- LoopDown Deactivate: 00100100 11111111 sent >10 repetitions

FEAC alarms are sent from the remote end device towards the local device by means of the C bit in the sub-frame. When a failure is declared on the remote end unit, this is how it notifies the near end unit. Some FEAC Codes are shown below

DS3 FEAC Menu



DS3 FEAC Action Menu



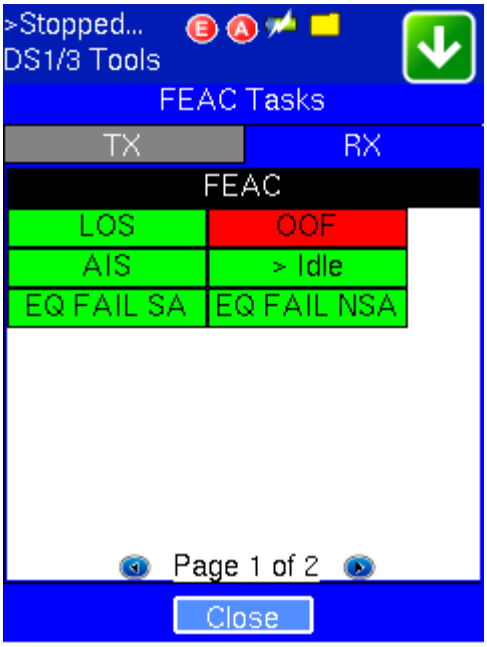
FEAC Alarm TYPE

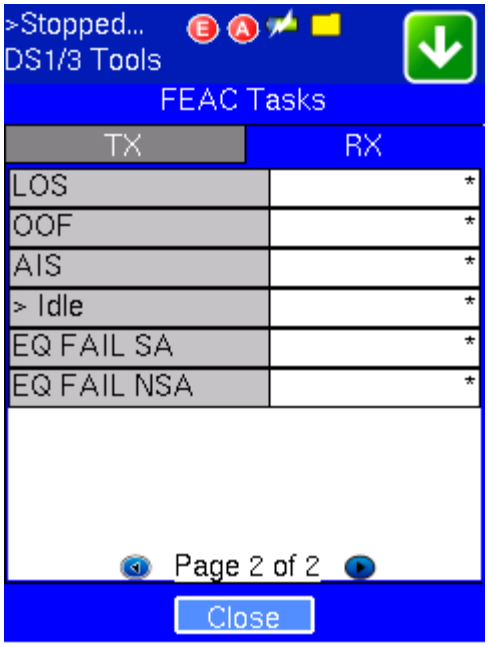
DS3 Equip. Failure(Service Affecting)
DS3 LOS
DS3 OOF
DS3 AIS RCV
DS3 IDLE RCV
DS3 EQUIQ FAIL(NON-SERVICE AFFECT)
COMMON EQUIP. FAIL (NSA)
MULTIPLE DS1 LOS
DS1 EQUIP FAIL
SINGLE DS1 LOS
DS1 EQUIP FAIL(NON-SERVICE AFFECT)

LOOP TYPE: Options: NIU, LINE

DS3 FEAC Tasks (Page 1)

DS3 FEAC Tasks (Page 2)





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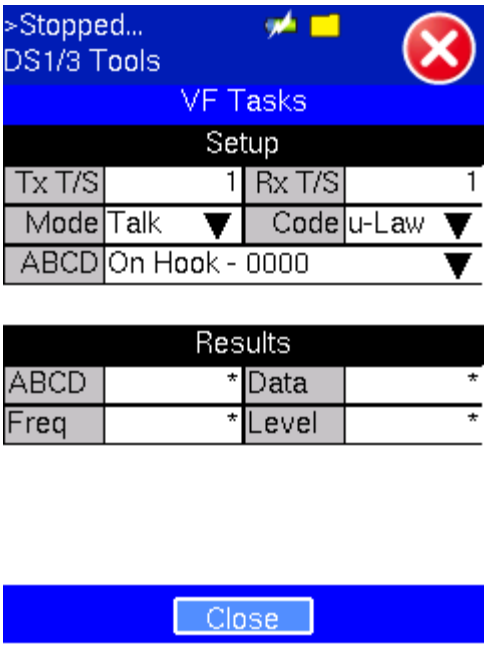
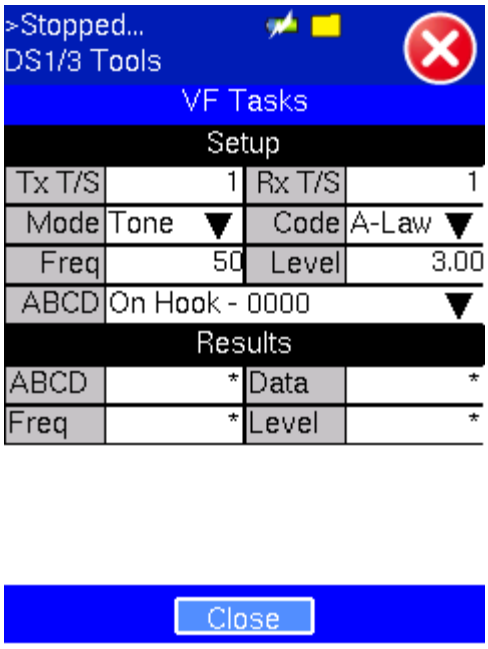
19.7 DS1 VF

Tapping the VF the DS1 Tools screen displays the VF Tasks showing The VF menu performs a variety of talk/listen functions.

DS1 VF Tasks - Talk Mode



DS1 VF Tasks - Tone Mode



Note

Do not attempt to enter VF Tasks if the Frame LED is not green. Green LEDs indicate that the framing found on the received signal matches the framing selected in the Setup screen. It is impossible to talk, listen, or perform other channelized functions in the absence of frame synchronization, since channels can be identified only within a framed signal.

The VF Tasks screen lets you choose:

Setup:

- Timeslot - Channel to test for both transmitting and receiving: Options: 1 - 24
- Mode - Talk, send a Tone on the transmit signal. Transmit audio data from the external headset into selected timeslot.
- Code: Options: u-Law or A-Law
- Programmable ABCD state for On-Hook, Off-Hook, Wink, User
- Transmitted Frequency: Options: 50 to 3950Hz
- Transmitted Level: Options: -60 to 3dBm

Results:

- Measure signal frequency and level in selected timeslot
- Listen to the voice channel in selected timeslot via external headset.
- ABCD bits monitor in selected channel

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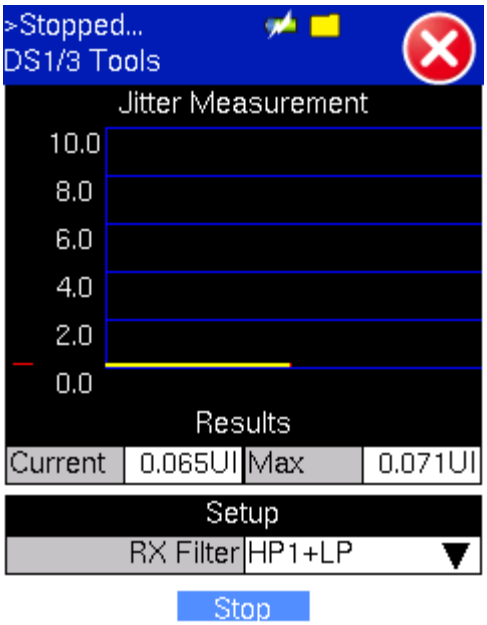
19.8 Jitter Measurement

By tapping the Jitter Measurement, the DS1/3 Tools screen displays the jitter measurements showing measurements and analysis of jitter in received signal.

DS1/3 Jitter Measurement



The Jitter Measurement submenu allows the user to measure and analyze received signal jitter. The measurements example is shown above (the vertical grid spacing is 2.0UIpp). Red Bar is Max. peaked jitter during testing and Yellow is the current peaked jitter.

Press "Start" to start measurement

Select the HP1+LP (10Hz to 40kHz) or HP2+LP (8kHz to 40kHz) filter for DS1, and HP1+LP (10Hz to 400kHz) or HP2+LP (30kHz to 400kHz) filter for DS3

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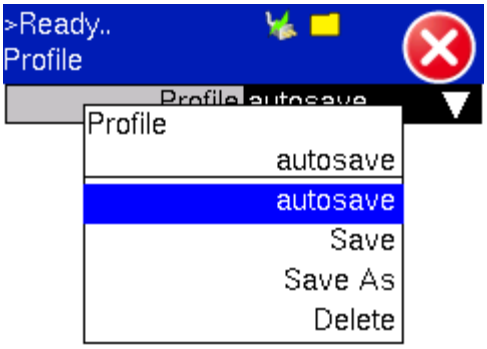
20.0 Profiles

Profiles can be created in any application that has a 'Profiles' pull-down menu available. The PDH & DS1/3 applications all have the ability to save profiles. Profiles can be viewed and loaded in the Profiles folder located in the Files folder structure.

Profile Menu



To save a new profile from the PDH & DS1/3 applications mentioned above, select the 'Save as New' pull-down menu option. This will bring up an alpha-numeric keypad to name the profile. When the profile is saved, all of the test configurations that apply to the particular application (PDH & DS1/3) are saved. This allows for fast access to pre-configured test configurations.

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21.0 Additional Tests

21.1 ISDN PRI Call

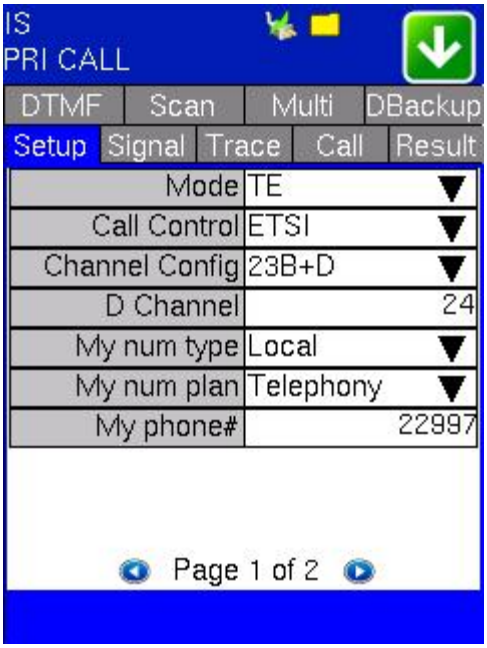
21.1.1 Setup (PRI Call Setup)

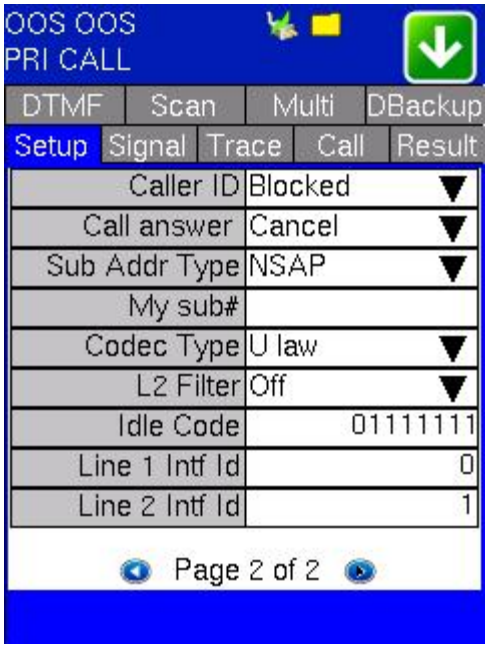
Configuration parameters for ISDN PRI Call are as follows:

(Page 1)

- Mode: TE or NT
  - TE: Terminating Equipment used when the TX130M+ is emulating customer equipment. TE usually uses the received signal to clock the transmitter.
  - NT: Network Terminal is used when the TX130M+ is emulating an ISDN switch, such as DMS-100, 5ESS. NT usually uses the internal clock
  - Monitor: Trace message details:
    - D Channel decodes help to verify that a call is successfully established, or determine why a call was not completed by examining the protocol cause values.
- Call Control: The Q.931 specification indicates which type of ISDN switch is to be tested.
  - AT&T relates to the 5ESS switch
  - NTI relates to the Northern Telecom DMS-100 switch
  - ETSI is the ETSI standard
- Channel Config: 23B+D, 46B+2D, 47B+D, or 23Bx2 in T1; Single/Dual PRI in E1.
- D Channel - Designates the time slot to transmit D Channel messages. The D Channel decoder helps to verify that a call is successfully established, or determine why a call was not completed by examining the protocol cause values.
- My num type: Unknown, International, National, or Local
- My num plan: Unknown, Telephony, or Private
- My phone#: Tap on the box and enter the phone number using the alphanumeric keyboard

PRI Call Setup (Page 1) PRI Call Setup (Page 2)





(Page 2)

- Caller ID - Blocked/Allow.
- Call Answer - Prompt, Accept or Cancel.
  - Prompt - Prompts the user to answer or reject incoming calls. Selecting Prompt displays an answer and reject button on the Call tab.
  - Accept - Automatically answers incoming calls
  - Cancel - Automatically rejects incoming calls
- Sub Addr Type - NSAP or User
- My sub# - Tap on the box and enter the sub address number using the alphanumeric keyboard
- Codec Type - A law or U law
- L2 Filter - Turn ON or OFF layer 2 filter. Turning on the filter prevents layer 2 messages from displaying in the captured trace
- Idle Code - Code to be transferred on unused channels. Tap on the box and use the alphanumeric keyboard to enter the code.
- Line Intf Id - Line interference ID. Tap on the box and enter the line interference ID using the alphanumeric keyboard

Note: In Service (IS) indicates a proper port connection, while Out of Service (OOS) indicates a faulty port connection in which the user will be unable to run any tests. If OOS is displayed, please check that the physical cable is correctly connected to the port.

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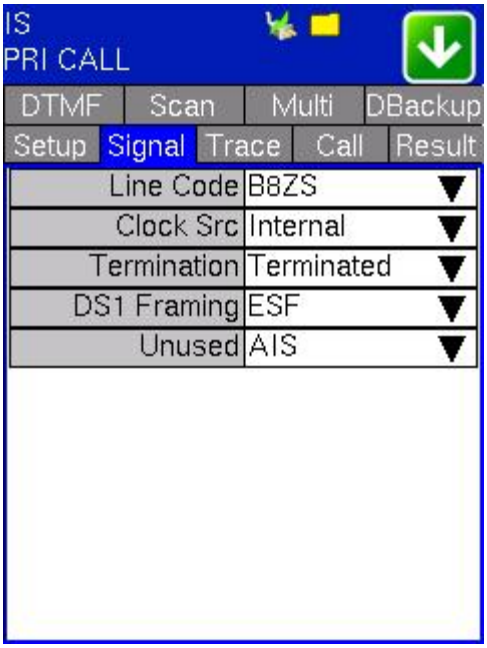
21.1.2 Signal

- Line Code - B8ZS or AMI
- Clock Source - Internal, External, Rx, or Offset. If the test set is in TE mode, select Rx to receive timing signals from the master clock.
- Termination - Terminated, Monitor, or Bridge
- DS1 Framing - SF or ESF
- Unused - AIS or Idle

PRI Call Signal



Main Setup

- Connect to the CPE or Network.
- Connect headsets to the mini USB port
- Select Call Control protocol type
- Select the emulation type (Should be TE on the other NT)

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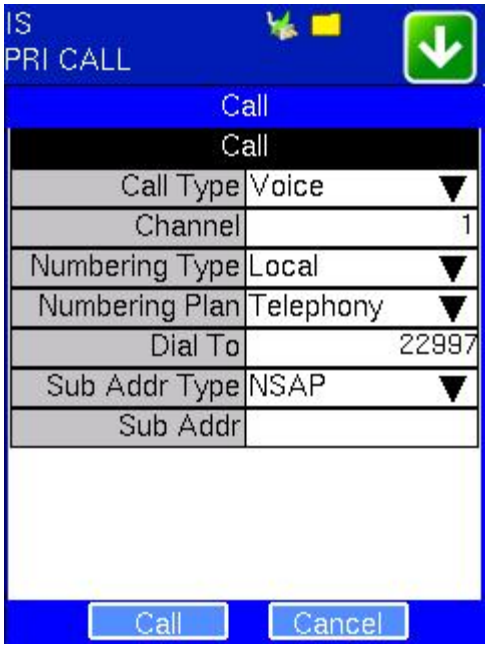
21.1.3 Call - Voice Setup

Press Call to bring up the Call Setup menu. Fill out the following parameters:

- Call Type - Select Voice
- Channel
- Line - If the Channel Config is set to 46B+2D or 47B+D in T1 mode or Dual PRI in E1, the user can choose which line to use.
- Numbering Type - Unknown, International, National, or Local
- Numbering Plan - Unknown, Telephony, or Private
- Dial To - Tap on the corresponding box and use the alphanumeric keypad to enter the number of the receiving line.
- Sub Addr Type - NSAP or User
- Sub Addr - Tap on the corresponding box and use the alphanumeric keypad to enter a subaddress

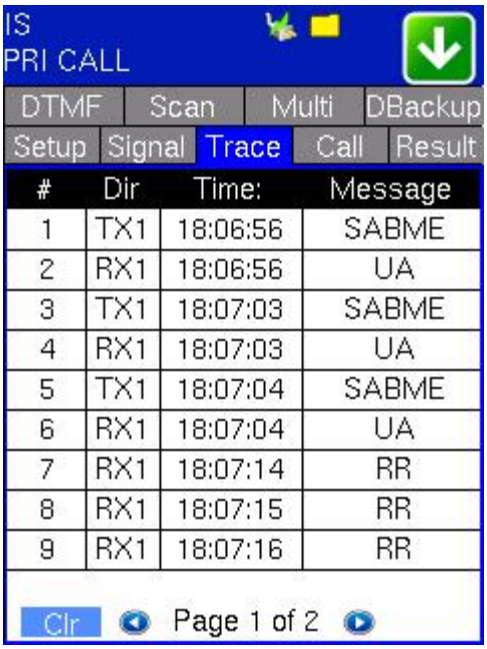
Press Call to initiate a call to the receiving number. If Prompt was selected for Call Answer in the Setup tab, the unit receiving the call will ring and the user can press Answer or Reject to accept or reject the call.

Call Call - Voice Setup

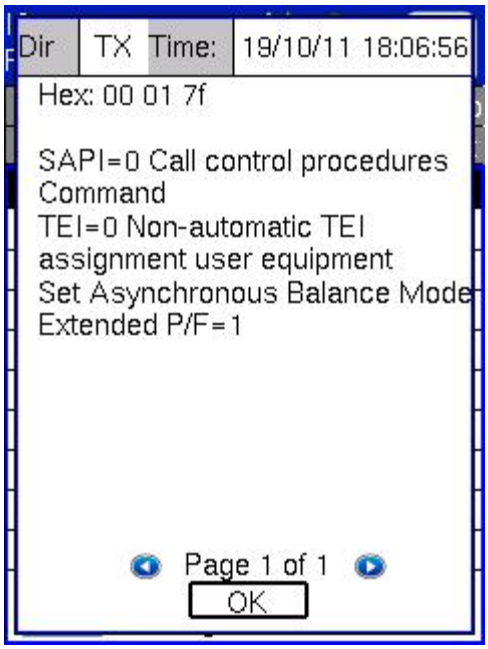


Trace: ISDN Protocol Decode

Trace



Trace Details



D Channel Decodes help to verify that a call is successfully established, or determine why a call was not completed by examining the protocol messages. The user can monitor layer 2 (Q.921) and layer 3 (Q.931) messages on the D Channel in both terminate and monitor modes. Layer 2 results give technicians the ability to check link and D Channel status, verify LAPD frames and check utilization rates. Following link establishment, layer 3 decodes allow technicians to verify such factors as call state, who made or dropped the call, why the call was dropped, where the call is being carried (Interface ID/B channel) and call types.

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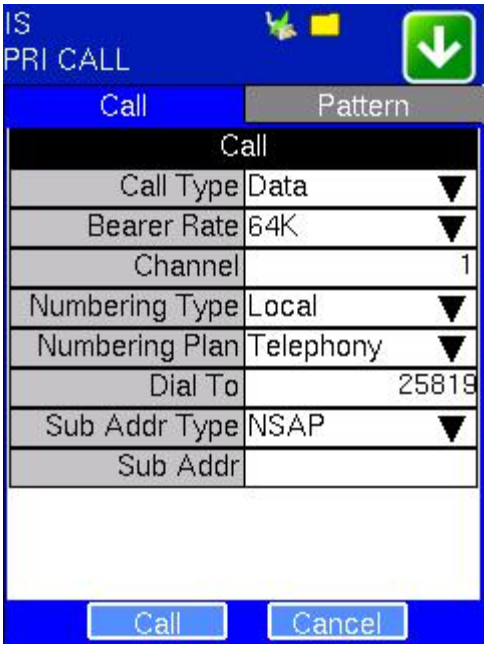
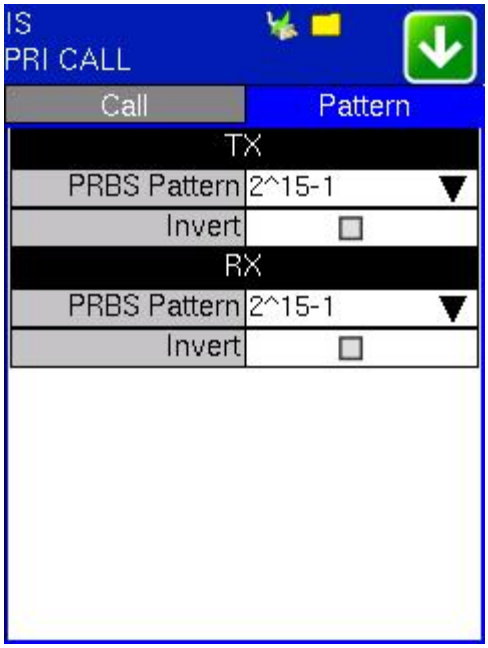
21.1.4 Call - Data Setup

Press Call to bring up the Call Setup menu. Fill out the call setup parameters as mentioned in 21.1.3 Voice Setup, but select Data as the Call Type. Select a Bearer Rate in the call setup options. Press the Pattern tab and select a test pattern to be transmitted on the B channel during data calls.
Note: Test pattern is only applied when call button is pressed.

Call - Data Setup



Pattern tab



Press Call and the other unit should ring.

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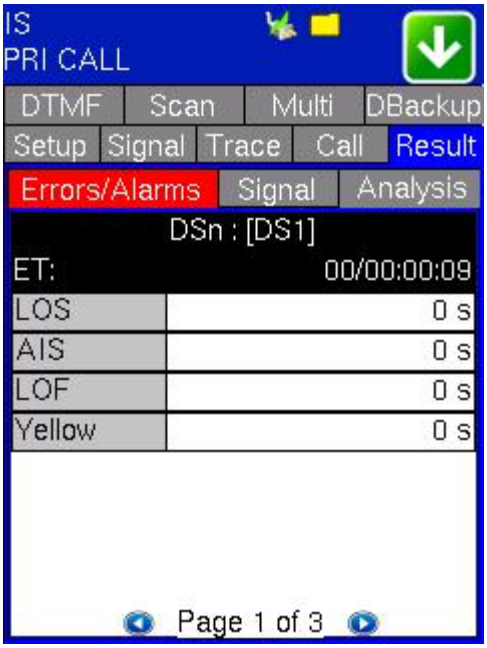
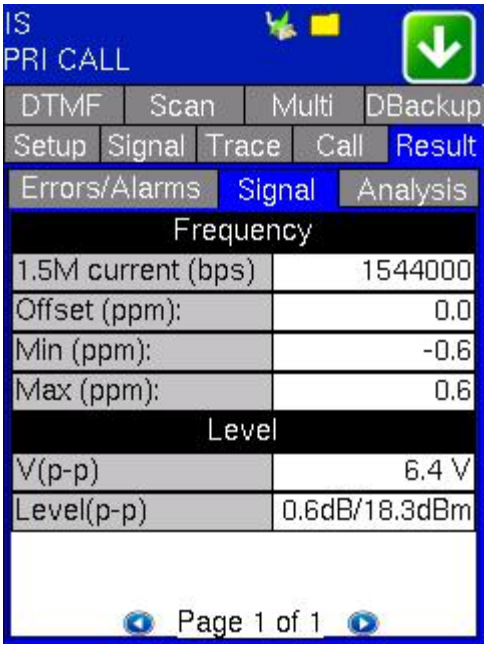
21.1.5 Data Call BERT Results (Result)

After successfully placing a data call, the BER is available. Pressing the Result screen presents the measurement parameters specified in G.821. Only DATA-64/56 and Nx64 Data Call Type in the CALL mode can give BER measurements. When viewing BER measurements, verify that both the PAT SYNC LED and the appropriate framing LED are green. These two LEDs signify that the patterns and framing match for the transmitting and receiving patterns.

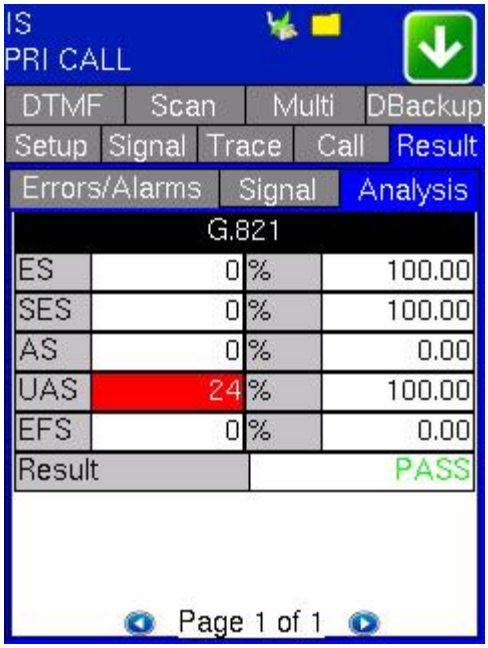
Data Call - BERT - Errors/Alarms



Data Call - BERT - Signal



Data Call - BERT - Analysis



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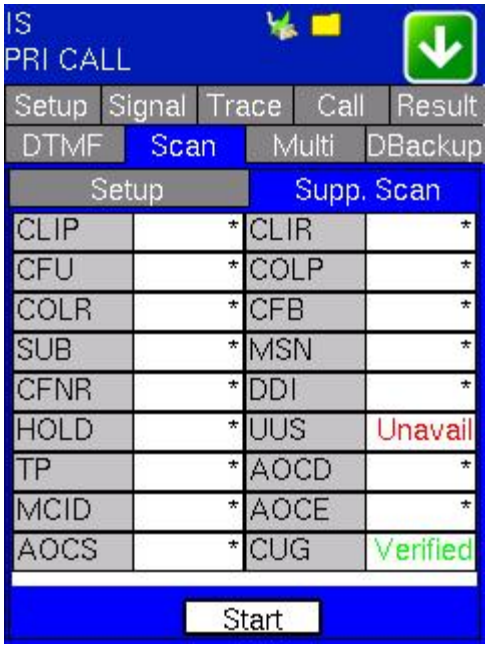
21.1.6 Supplementary Service Scan (Scan)

In ETSI protocol, a Supplementary Service Scan scans a line to determine which of a variety of supplementary services are available on it.

Call - Data Setup

Pattern tab



SubAddress Type:

- NSAP to select the Network Service Access Point subaddress.
- User to use a subaddress defined by a user (no standard applied)

When the test is finished, Here is a list of the services:

- CLIP: Calling Line Identification Presentation presents the Calling Party Number to the called user.
- CLIR: Calling Line Identification Restriction prevents the Calling Party Number from showing to the called user.
- CFU: Call Forwarding Unconditional€”diverts a received call to a specified different number.
- COLP: Connected Line Identification Presentation€”the answering party's number is conveyed to the calling party.
- COLR: Connected Line Identification Restriction€”allows the connected subscriber to stop COLP from operating.
- CFB: Call Forwarding Busy Calls are forwarded to a specified number only when the subscriber (called party) 's number is busy.
- SUB: Sub Address digit is added to an incoming call to specify an extension.
- MSN: Multiple Subscriber Number. Multiple full numbers are assigned to one BRI line.
- CFNR: Call Forwarding No Reply calls are forwarded to a specified number only when the subscriber (called party) does not pick up the line in a specified amount of time.
- DDI: Direct Dialing In adds a number of telephone number to a circuit which can be used to dial that BRI (common use is a company number with individual 4 or 4 digit extension numbers that can be dialed)
- HOLD: Call Hold - the user may interrupt a call, then reestablish it later. Interruption frees the associated B channel.
- UUS: User to User Signaling allows a user to send an Information message in the Setup, Alerting, or Connect message on the D Channel, without connecting the call; the message shows on the ISDN phone display.
- TP: Terminal Portability; the ability to suspend and reconnect a call; for example, to move a phone from one plug to another.
- AOC-D/E/S: Advice of Charge determines when charging information is available to the served user; during the call, when the call is terminated, when the call is established.
- MCID: Malicious Call Identification. The called party, on a per call basis, requests the network to register the called party phone number, the calling party number, and the date and time of the calls.
- CW: Call Waiting informs a user of an incoming call which has no B-ch available; user may accept, reject, or ignore.
- CUG: Closed User Group; a private network which restricts communication between members and nonmembers.

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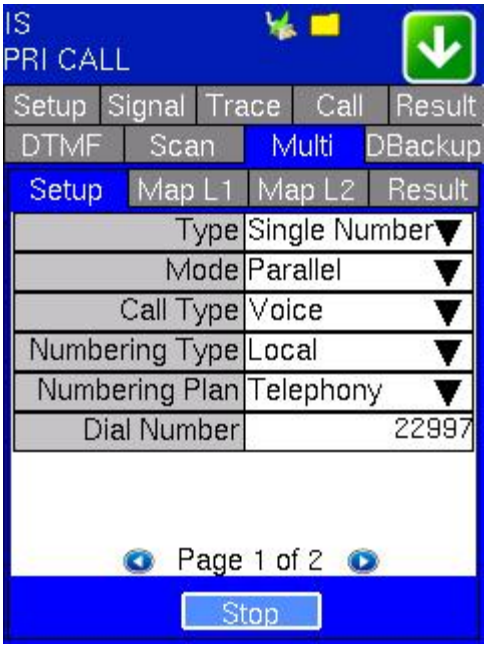
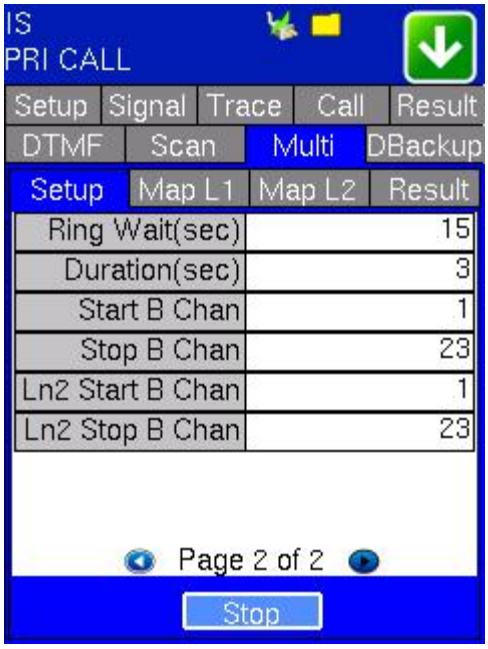
21.1.7 Multi Call

- Type - Single Number or Number Script
- Mode - Parallel or Sequential.

Multi Call Setup (Page 1)

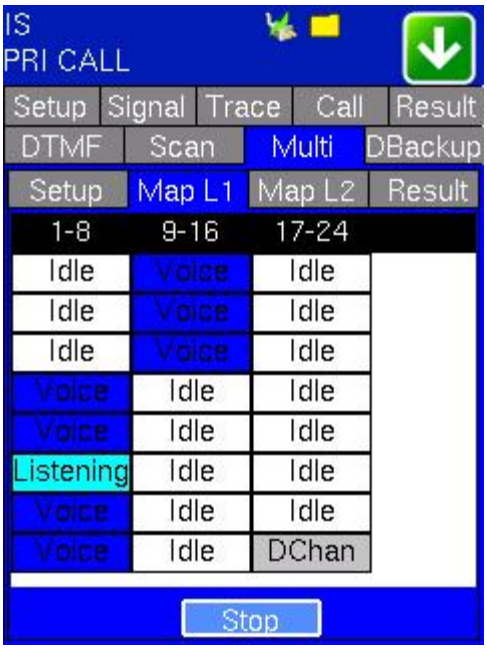
Multi Call Setup (Page 2)



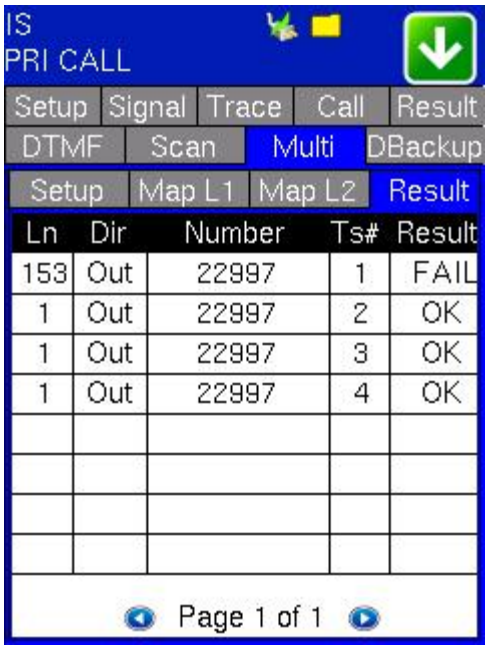


Multi Call by Single Call Number

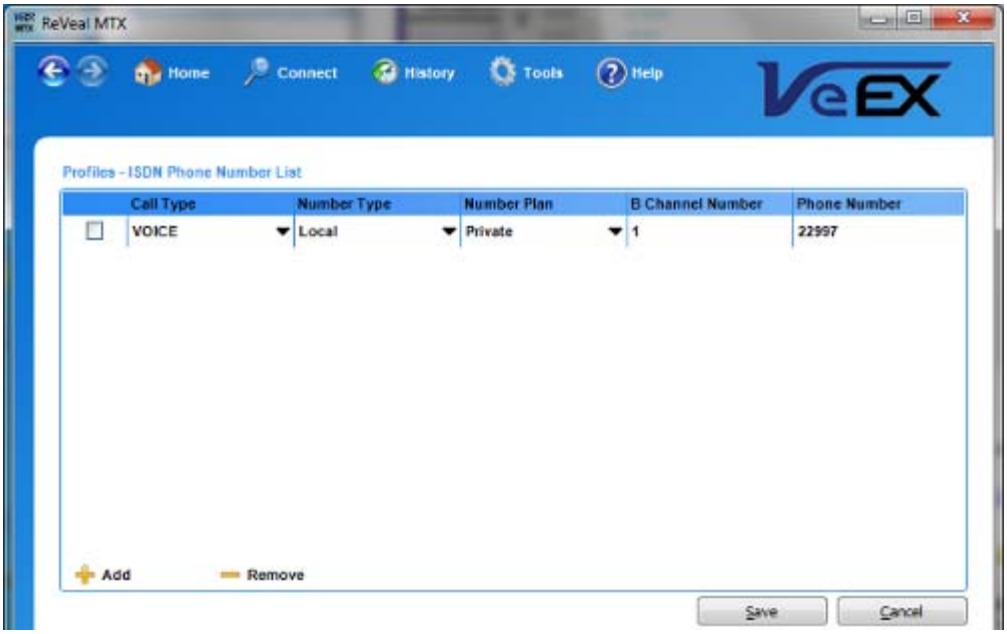
Multi Call Map L1



Multi Call Result



ISDN Phone Number List Using Reveal MTX



Alternately, the user can prepare a Multi Call list using ReVeal MTX software and upload the list to the test set.

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21.1.8 DTMF

During the call DTMF tones can be transmitted.

To transmit DTMF tones, access the DTMF tab. An alphanumeric keypad will be displayed. DTMF tones are transmitted as soon as they are typed.

DTMF

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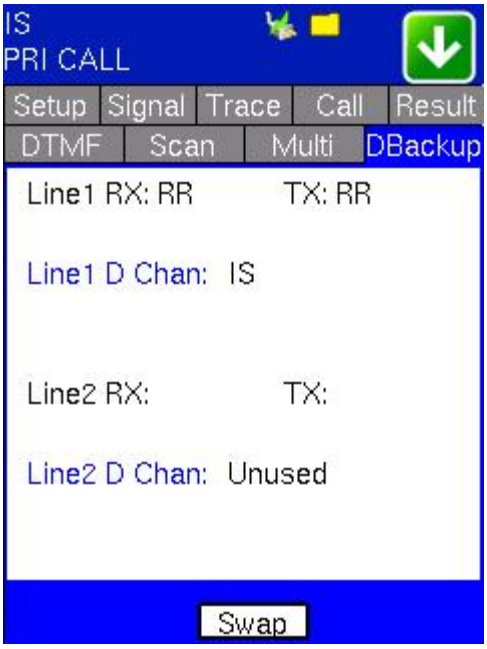
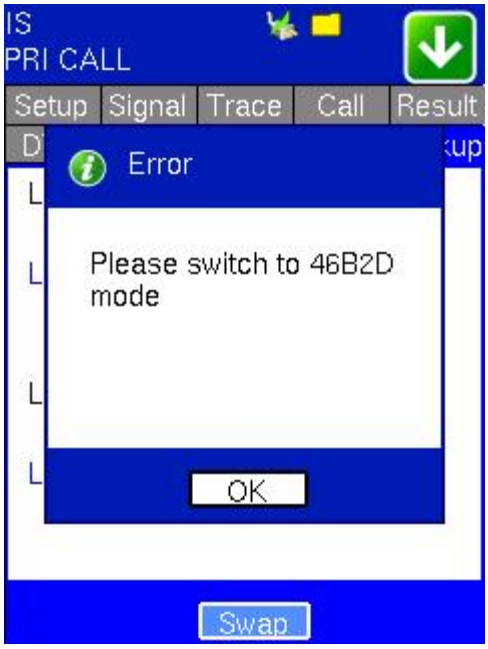
21.1.9 DBackup

To setup a backup D Channel, go to the Dbackup tab and press Swap. This operation is only applicable for 46B+2D Channel Config. Any other Channel Config will yield an error message when pressing Swap.

DBackup DBackup Notice





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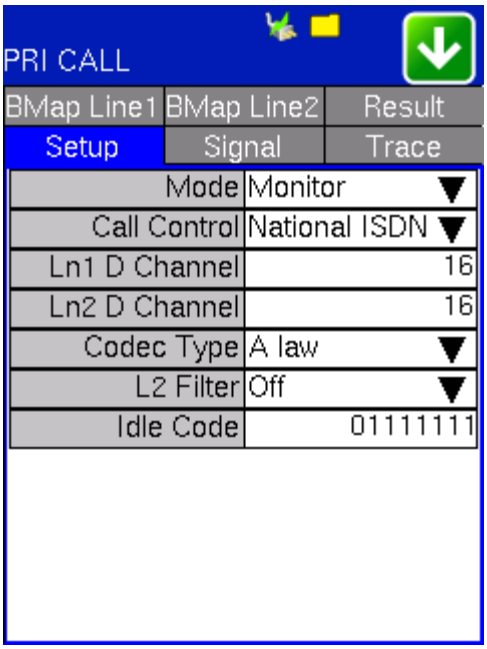
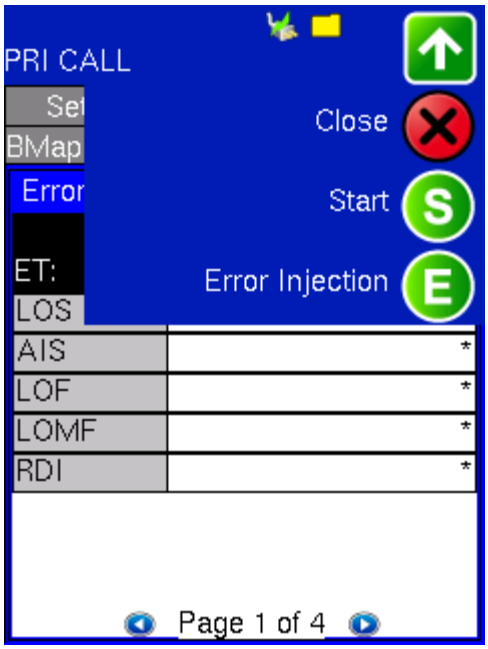
21.2 ISDN PRI Monitor

ISDN PRI Monitor



PRI Monitor Action Menu



The ISDN PRI Monitor's setup and results resemble those found in ISDN PRI Call. Please refer to 21.1 ISDN PRI Call for more information on these respective sections:

- Setup: 21.1.1 Setup (PRI Call Setup)
- Signal: 21.1.2 Signal
- BMap Line: Detects active traffic on the timeslots. The user can listen to the conversation by pressing on active call cells. Please see 21.1.7 Multi Call for more information.
- Trace: 21.1.3 Call Voice Setup
- Result: Press the green arrow to access the action menu and press Start to initiate BERT Testing. Please refer to 21.1.5 Data Call BERT Results for more details.

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21.3 WAN IP Test

Please consult the factory.

22.0 Warranty and Software

Warranty Period:
The warranty period for hardware, software and firmware is three (3) years from the date of shipment to the customer. The warranty period for battery pack, 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 only.

Hardware Coverage: VeEX Inc warrants hardware products against defects in materials and workmanship.

- Repair the products
- Replace hardware which proves 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,

- Repair the products
- Replace software and/or firmware which proves 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 guarantee 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 misuse
- Damage occurred from operating the unit from outside of the environmental specifications for the product
- Improper installation by the customer

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23.0 Product Specifications

The TX130M+ product specifications are available in pdf format by clicking the link or specification sheet below. Please note you

will need Adobe Reader version 9.0 or higher to open and view the file.

To get the latest free version of Adobe Reader, click here

TX130M+ Product Family - Click here

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24.0 Certification and Declarations

CE

Declaration of Conformity

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.

For a copy of the CE Declaration of Conformity relating to VeEX products, please contact VeEX customer service.

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 Statement

RoHS compliance.

Click here for ROHS Statement relating to VeEX products

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25.0 About VeEX

VeEX (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 and technical support.

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

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End of User Manual