XTT 5000 User's Manual

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XTT 5000 System

Important Information *Home*

XTT 5000 provides not only sophisticated technical specifications, but easy to use applications for the verification, turn-up, and hand-off of Ethernet services. Use XTT 5000 in conjunction with another test set or loopback device (such as the Metro Responder), to qualify network performance and verify quality of service per ITU and MEF standards and service level agreements.

Unpacking Details

Warnings and Cautions

⚠ Using the supplied equipment in a manner not specified by Sunrise Telecom may impair the protection provided by the equipment.

This is a Class 1 LASER product. Avoid looking directly at the Transmitter source. For added safety, turn off the laser when not in use.

⚠ Using the supplied equipment in a manner not specified by Sunrise Telecom may impair the protection provided by the equipment.

End of Life Recycling and Disposal Information

DO NOT dispose of Waste Electrical and Electronic Equipment (WEEE) as unsorted municipal waste. For proper disposal return the product to Sunrise Telecom. Please contact our local offices or service centers for information on how to arrange the return and recycling of any of our products.

EC Directive on Waste Electrical and Electronic Equipment (WEEE).

The Waste Electrical and Electronic Equipment Directive aims to minimize the impact of the disposal of electrical and electronic equipment on the environment. It encourages and sets criteria for the collection, treatment, recycling, recovery, and disposal of waste electrical and electronic equipment.

Tips on XTT 5000 & this Help System

Disclaimer: Contents of this Help system are subject to change without notice and are not guaranteed for accuracy.
Visit the Working Desktop page to get an overview of how to use XTT 5000's controls and features. Visit the Hardware Notes for hardware tips.

Get a technology tip related to the topic.

Get a testing tip; information that will help you in your testing.

A button may be referred to via text, or via its icon.

FCC Information

FCC ID: UEBXT5000

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.
Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
⚠**Caution**: Exposure to Radio Frequency Radiation

To comply with FCC RF exposure compliance requirements, this device must not be co-located or operating in conjunction with any other antenna or transmitter.

Where do you want to go next?

View a list of Help contents at Home.
Set up a Throughput test.
Set up an RFC2544 test.
Set up an IP test.
Set up a Monitor test.
Configure a Loopback
Customer Service
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Home

Use this page to move through the Help system quickly.

XTT 5000 System Information

Important Information	Warnings and Recycling information; Unpacking.
Working Desktop	An overview of how the STT 5000 desktop works, including the Menu, LEDs and Windows desktop notes.
Hardware Notes	Information about chassis, ports and buttons. Get details on Handling Optical Fiber.
Measurement Setup	Setup a manual or timed test.
Network Setup	Configure system Ethernet settings if necessary.
System Setup	Date, Time Zone, Time (of day).
Status	View or update the system.
Customer Service	Contact Sunrise Telecom; view warranty information.

Port Setup

Choose a Port	Set up test ports.
Port Address	Configure test port addresses if necessary.
RJ-45: Negotiation On	
RJ-45 Negotiation Off	
SFP Port Setup	
XFP Port Setup	

Throughput Testing

Throughput Applications	
Ethernet Connection	Make sure the link is up; troubleshooting.
Signal Setup	Select BERT or Live, and choose the test layer.
Stream Table Setup	MAC, VLAN, MPLS, IP, UDP, TCP, Payload, Traffic Shape, Rx Filter
Summary Results	View overall results for all streams.
Aggregate Results	View counts for results for all test streams.
Stream Results	View statistics for one stream.
Non Test Stream Results	View statistics for traffic not conforming to the test.

RFC2544 Testing

RFC2544

Applications	
RFC2544/NE Test Setup	
Test Sequence Setup	Select to run an RFC2544 or NE Stress Test.
Frame Sizes Setup	
Throughput and Latency Setup	
Frame Loss & Back-to-Back Setup	
Stream Table Setup	
NE Stress Test Setup	
RFC2544 Summary Results	
RFC2544 Throughput Latency Results	
Throughput Chart Results	
Thruput Aggregate Results	

IP/Ping Testing

IP Testing Application	
IP Setup Tab	Choose PING or TRACEROUTE test, setup IP and VLAN details.
Ping Test Setup	
Ping Test Results	
Ping Echo Log	Get details on tx pings and rx ping echoes.
Ping Trace Route Setup	
Ping Trace Route Results	
Aggregate Results	Applies to both PING and TRACEROUTE tests.

Loopback Features

Loopback Test Setup
Loopback Responder
Loop Control

Monitor Testing

Monitor Applications
Monitor Setup

Technology Overview

Learn about Ethernet technology.

Working Desktop *Home*

Important Information	Windows System Notes	Hardware Notes

XTT 5000 is a touch-screen unit. Use your finger or the stylus to make selections. Often, a number pad will appear for use in entering alphanumeric data. The Status Bar is the black row at the top of the screen; it provides system information. The Action Bar of buttons at the bottom of the screens gives access to many functions. Here is an overview:

- Touch buttons to activate (single touch/click) the function, or to open (double touch/click) their configuration screens.
- Button colors have meaning: 

blue-available button; 

orange-active selection, 

light gray-unavailable button.
- Press 

to save changes and apply your new settings. When asked to verify changes,  = Yes and  = No (cancel).
- Press 

to begin taking measurements. Press 

to stop a test.
- The 'Results' button (

) at the top right takes you to the results screens, but doesn't actually start a test.
- Press 

to select a new test mode from the drop down menu. The horizontal Menu Bar tabs will change depending on the test type (shown on the Module Status panel; Throughput, RFC2554, etc.) selected. Touch a menu tab label to see the items in that menu.

Status Bar: Located at the top of the screen.

Section	Information
	Soft virtual LEDs show the logical and physical state of the selected port.
	Module Status Panel: Get module data, such as the port, test mode and transmission status.
	System Status Panel: Get system-related information, including the battery charge status, and the '?' button, which is used to access this Help system. Press '?' again to exit Help
 Menu	Select a new test mode from the drop down menu.
 Results	On the setup screens, press 'Results' to go to measurement results.

Setup	Return to the test setup screen from a results window (e.g Summary Results, Aggregate Results).

Action Bar: The Action Bar is located at the bottom of the screen.

Button	Action
Apply	Save changes and apply your new settings.
Cancel	Cancel (stop/delete) any changes in progress.
Saved Results	Access saved measurement results files.
Profiles	Save or load test profiles. See saved files.
Laser On/Off	Activate the laser for testing. Turn the laser off for safety.
100M / Full Port	View the type or port and its status. Press the button to select a different port to use.
Flow control	Transmits a flow control (pause) frame, according to parameters set on the active port.
LED Reset	Clears all historical LED data, so the LEDs will display the current line status.
Reset	Starts measurements counts over from 0.
Loop Control	Access Loopback Control.
Error Inject	Inject errors in the payload.
Start, Stop	Start and stop a test. To get measurement results, start at test.

Generate a measurement report.

Where do you want to go next?

Configure an RJ-45 port.
Configure an SFP port.
Configure an XFP port.
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Unpacking *Home*

To unpack and test a new test set:

1. Remove the packing list, test set, and accessories from the shipping container.
2. Inspect all parts and immediately report any damage to the carrier and to Sunrise Telecom.
3. Verify that all parts specified on the packing list were received.
4. Complete the Warranty Registration Card and return it immediately to Sunrise Telecom.
   Note: Sunrise Telecom must receive the Warranty Registration Card in order to provide software updates.

Where do you want to go next?

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Windows System Notes *Home*

Press the bottom hardware button to move between the XTT 500 and the Windows system desktop. On the Windows desktop, access useful basic computer tools:

System

- **Reset system**: Shut down and restart.
- **Calibrate Touchscreen**: Recalibrate the touch screen if screen response seems off. Touch each 'x'.
- **XTT 5000**: Start the XTT 5000 application.

PDF Viewer: Launch a viewer to read PDF files.
Calculator
File Manager
System Administrator: Access XTT 5000 system information and setups.
Eject SD Card: Safely eject an SD memory card.
Eject USB Drive: Safely eject a USB memory drive.
⚠**Important Note - Caution**: External memory devices must be ejected properly, using the appropriate button, in order to safeguard your data. Failure to eject a drive properly may result in lost data.

Where do you want to go next?

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Hardware Notes *Home*

XTT 5000 is a touch screen test set; use your finger or a stylus to make selections. However, you may find attaching and using a mouse is fastest. Plug the power cord in on the right side, and press and hold the top round button for a few moments to turn the unit on (or off).
Get unpacking details.

Ports - Right Side

SD Card	Use to transfer files; may also use Micro SD with SD Adapter.
10/100 Ethernet	Use for a network connection.
Mini USB client	Used to send files between a computer and the XTT 5000 hardware.
Power	Plug in the AC charger.

Ports - Left Side

2 USB host ports: Use to attach USB devices, e.g., keyboard and mouse.

USB Mouse Troubleshooting Hint: For best functionality, use a ferrite mouse, or place a ferrite bead on the USB mouse cord.

Ports - Top

The top connector panel holds the test ports; a combination of RJ-45, SFP, and XFP ports, depending on the configuration ordered.

- See Port Address.
- See Choose a Port.
- See SFPs and XFPs are hot-swappable. Handle the bale carefully, and avoid touching the end of the connector. See Handling Optical Fiber.

Buttons

- The round top button is the power on/off button.
- The top square button brings up the soft keyboard. Press it again to bring up a number pad.
- Use the Up (third button) and Down (fourth) buttons on the right side of the chassis to scroll up and down in the screens.
  A scroll bar appears on a screen where there is more information below the current window (for example, results and Help screens often have long pages).
- Use the bottom button to toggle between the computer desktop and the STT 5000 application.

External Storage

If you are using an external form of storage on the XTT-5000 (USB drive, etc.) (and have written files to the external volume), you must cleanly dismount the volume from Windows before removing it, or the files may not be written safely to the external storage volume.
Use a desktop icon to Safely Remove Hardware.

Where do you want to go next?

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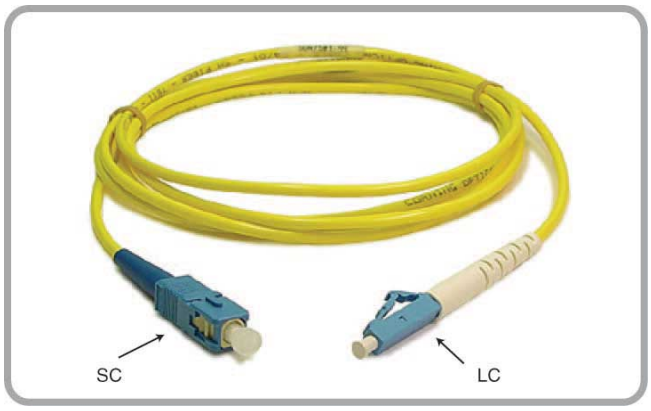
Handling Optical Fiber *Home*

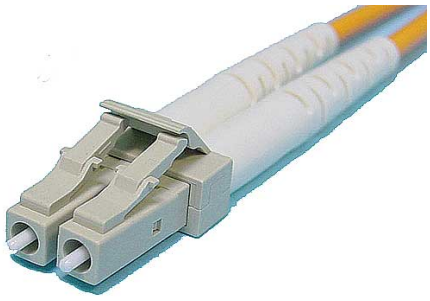
In general, handle fiber patch cords and connectors carefully. Always replace dust covers. Keep the optical connectors clean, and make a practice of not looking into fiber ends.
An optical fiber is a strand of glass about the same diameter as a human hair. Though it is remarkably durable, careful handling is required to ensure continued high performance and long life.

- Do not pull or kink patch cords, as the glass strand in the middle might become damaged or broken.
- A sharp bend will cause excessive signal loss.
- Keep patch cord bend radiuses no less than an inch.
- Use specialized optical cable raceways and plenums whenever they are available.
- Don’t use tie wraps as you would with electrical cables. Tie wraps will put strain on the fiber. The next figure shows the proper method of wrapping and securing fiber patch cords.



SC to LC Cable

There are several types of optical connectors in use today. This figure shows the two most popular for Ethernet, SC and LC.



Duplex LC Cable

This is a duplex multi-mode LC cord. Look closely at the pictures to see the details of the connection mechanism.

- When using optical connectors, insert or remove the ferrule straight into the sleeve.
- Minimize wiggling the connector as this may loosen the tight fit that is required for the ferrule and sleeve.
- For SC connectors, orient the prominent key on the connector body with the slot in bulkhead adapter. Push the connector in until it clicks. To remove,

pinch the connector body between your thumb and finger, and gently pull straight out.
- LC connectors evolved from the basic RJ-45 connector design, and are placed on and removed in the same fashion as an RJ-45. Simply push the rear prongs together to release the connector. Listen for the click when you seat the connector.

Cleaning Optical Fiber

Fiber optic connectors must be kept clean to ensure long life of the connectors and to minimize transmission loss at the connection point.

Precautions

- When not in use, always replace dust covers and caps to prevent deposits and films from airborne particles. A single dust particle caught between two connectors will cause significant signal loss. Dust particles can scratch the polished fiber end, resulting in permanent damage.
- Do not touch the connector end or the ferrules, since this will leave an oily deposit from your fingers.
- Do not allow uncapped connectors to drop on the floor.

How to Clean

- Should a fiber connector become dirty or exhibit high loss, carefully clean the entire ferrule and end face.
- Special lint-free pads should be used with isopropyl alcohol.
- Even though not very accessible, the end face in a bulkhead adapter on test equipment can be cleaned by using a special lint-free swab, again with isopropyl alcohol.
- In extreme cases, a test unit may require more thorough cleaning at the factory.
- Cotton, paper, or solvents should never be used for cleaning since they may leave behind particles or residues.
- Use a fiber optic cleaning kit especially made for cleaning optical connectors, and follow the directions.
- Canned air can do more harm than good if not used properly. Again, follow the directions that come with the kit.

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- RFC2544/NE Applications
- IP Test Setup
- Monitor Setup
- Loopback Test Setup
- Working Desktop
- Home

Customer Service

Sunrise Telecom Customer Service is available 24/7. Customer Service performs the following functions:

- Answers customer questions over the phone on such topics as product operation and repair.
- Repairs malfunctioning XTT promptly.
- Provides information about product upgrades.

The warranty period covering the XTT 5000 is one year from the date of shipment on hardware, software, accessories, and the battery.
A Return Merchandise Authorization (RMA) Number is required before any product may be shipped to Sunrise Telecom for repair. Out-of-warranty repairs require both an RMA and a Purchase Order before the unit is returned. All repairs are warranted for 90 days.
Please contact Customer Service if you need additional assistance:

Customer Service
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Internet: http://www.sunrisetelecom.com
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Where do you want to go next?

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Express Limited Warranty *Home*

A. Hardware Coverage. COMPANY warrants hardware products against defects in materials and workmanship. During the warranty period COMPANY will, at its sole option, either (i) refund of CUSTOMER'S purchase price without interest, (ii) repair said products, or (iii) replace hardware products which prove to be defective; provided, however, that such products which COMPANY elects to replace must be returned to COMPANY by CUSTOMER, along with acceptable evidence of purchase, within twenty (20) days of request by COMPANY, freight prepaid.
B. Software and Firmware Coverage. COMPANY warrants software media and firmware materials against defects in materials and workmanship. During the warranty period COMPANY will, at its sole option, either (i) refund of CUSTOMER'S purchase price without interest, (ii) repair said products, or (iii) replace software or firmware products which prove to be defective; provided, however, that such products which COMPANY elects to replace must be returned to COMPANY by CUSTOMER, along with acceptable evidence of purchase, within twenty (20) days of request by COMPANY, freight prepaid. In addition, during the warranty period, COMPANY will provide, without charge to CUSTOMER, all fixes, patches, new releases and updates which COMPANY issues during the warranty period. COMPANY does not warrant or represent that all software defects will be corrected. In any case where COMPANY has licensed a software product "AS IS," COMPANY'S obligation will be limited to replacing an inaccurate copy of the original material.
C. Period. The warranty period for Hardware, Software and Firmware will be One (1) Year from date of shipment to CUSTOMER. The COMPANY may also sell warranty extensions or provide a warranty term of three years with the original sale, which provide a longer coverage period for the test set chassis, software and firmware, in which case the terms of the express limited warranty will apply to said specified warranty term.
D. Only for CUSTOMER. COMPANY makes this warranty only for the benefit of CUSTOMER and not for the benefit of any subsequent purchaser or licensee of any merchandise.
E. LIMITATION ON WARRANTY. THIS CONSTITUTES THE SOLE AND EXCLUSIVE WARRANTY MADE BY COMPANY WITH RESPECT TO HARDWARE, SOFTWARE AND FIRMWARE. THERE ARE NO OTHER WARRANTIES, EXPRESS OR IMPLIED. COMPANY SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. COMPANY'S LIABILITY UNDER THIS AGREEMENT WITH RESPECT TO A PRODUCT, INCLUDING COMPANY'S LIABILITY FOR FAILURE AFTER REPEATED EFFORTS TO INSTALL EQUIPMENT IN GOOD WORKING ORDER OR TO REPAIR OR REPLACE EQUIPMENT, SHALL IN NO EVENT EXCEED THE PURCHASE PRICE OR LICENSE FEE FOR THAT PRODUCT, NOR SHALL COMPANY IN ANY EVENT BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL, INDIRECT, OR SPECIAL DAMAGES OF ANY KIND OR NATURE WHATSOEVER, ARISING FROM OR RELATED TO THE SALE OF THE MERCHANDISE HEREUNDER, INCLUDING BUT NOT LIMITED TO DAMAGES ARISING FROM OR RELATED TO LOSS OF BUSINESS, LOSS OF PROFIT, LOSS OF GOODWILL, INJURY TO REPUTATION, OVERHEAD, DOWNTIME, REPAIR OR REPLACEMENT, OR CHARGE-BACKS OR OTHER DEBITS FROM CUSTOMER OR ANY CUSTOMER OF CUSTOMER.
F. No Guaranty, Nonapplication of Warranty. COMPANY does not guaranty or warrant that the operation of hardware, software, or firmware will be uninterrupted or error-free. Further, the warranty shall not apply to defects resulting from:
(1) Improper or inadequate maintenance by CUSTOMER;

(2) CUSTOMER-supplied software or interfacing;
(3) Unauthorized modification or misuse;
(4) Operation outside of the environmental specifications for the product;
(5) Improper site preparation or maintenance; or
(6) Improper installation by CUSTOMER.

Where do you want to go next?

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Menu *Home*

Press 'Menu' on the working desktop to choose the type of test to perform. The menu selections appear below the button.

Parameter	Details
SYSTEM	Configure basic system properties if necessary.
THROUGHPUT	Perform a BER test; perform end-to-end testing with a test pattern; get results on the pattern. This is the basic configuration.
RFC2544/NE TEST	Take measurements in accordance with *RFC 2544*.
IP TEST	Perform an IP /Ping Test to check Layer 3 connectivity.
LOOPBACK	Loop incoming traffic back to its source.
MONITOR	Bidirectionally monitor live traffic.  The secondary port may be in Loopback mode regardless of the test performed by the primary port.

Where do you want to go next?

The Working Desktop
BERT Application - Layer 1
BERT Application - Layer 2
RFC2544 Applications
IP Test Setup
Loopback Test Setup
Loop Control
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LEDs *Home*

Physical LEDs are located next to the ports on the top of XTT 5000. They report on the status of the Ethernet connection.
Green = good
Red = bad
Virtual LEDs on the working desktop provide line status.

Green = good
Red = bad
- steady red: currently receiving errors/alarms
- flashing red: errors/alarms received in the past.

Press 'LED Reset' (LED Reset) to clear the flashing.

LED	Details
Link	Connected/not connected Ethernet link status.
ACT	Activity status of the Ethernet link.
ERR	Received errors.
PAT	Test pattern errors; received pattern does not match the expected pattern.
BIT	Bit errors received.

Where do you want to go next?

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Measurement Setup *Home*

Configure how and when results are taken.

Parameter	Options	Details
Start Mode	**PROGRAM**: Program a specified date and time in the future to begin taking measurements. Once you have selected Program, enter the desired date and time in the next two items. **MANUAL**: Manually begin the test measurements.	Select the method to begin your test measurements.
Stop Mode	**CONTINUOUS:** Test will run indefinitely until you press 'Stop'. **TIMED:** Test runs for the Test Duration length of time.	Set the mode in which measurements will be taken.
Start Time	Specify the Hour, Minute, and Seconds to begin measurements.	Start Mode=PROGRAM.
Test Hours/Minutes	Enter the number of Hours and Minutes you want the test to run for in those fields.	Stop Mode=TIMED. Set the length of time a timed test will run once you press 'Start'.
Start Date	Enter the Year, Month, and Day to begin measurements.	Start Mode=PROGRAM. On the calendar which appears, use the arrows to scroll to the month you want, then tap the specific date.
Save Mode	**Auto_Save**: Results are saved automatically when the test is stopped. A file name will be assigned automatically. **Never_Save**: Results are not saved. **Manual_Save**: Results are saved when the test is stopped. A dialog box will appear for you to input a filename in.	Select the method to save your test measurements.
Start TX Coupled	**On**: The transmitter and measurement begin at the same time. **Off**: A 'TX On' button appears on the Action Bar. This button is grayed out until the measurement is started. Once the measurement is started, press the 'TX On' button to begin sending traffic.	Determine when the transmitter will turn on.

To access the window, touch Measurement Setup on the System Setup menu.

Where do you want to go next?

Throughput Stream Table Setup
Throughput Summary Results
Throughput Aggregate Results
Tech: Ethernet Overview
Home

Status *Home*

Get details on XTT 5000 system performance. Select Menu > System > Status.

General

Statistic	Meaning
File Usage	Percentage of system currently in use.
Memory Usage	Percentage of system RAM in use.
Temperature	Unit temperature; normal range is 0°C to 45°C.

Power

Statistic	Meaning
AC Power	ON if the unit is plugged in; OFF if it is not.
Total Charge	The percentage of charge remaining in the battery; see the Battery icon.
Remaining Time	When running on battery, approximately how long the battery will last.
Time to Full Charge	When running on battery, approximately how long it will take to recharge the battery.

Version Information

Firmware Version
Serial Number

Where would you like to go next?

Test Type Menu
Working Desktop Overview
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System Setup *Home*

Set the basic system information if required. Select Menu > System > System Setup.

System Clock

Parameter	Function
Date	Set the calendar date if necessary.
Time	Enter the time of day on the pop window.
Get Local Time	Align the XTT-5000 system clock to the time that is "local" to the PC with the browser. Applies when XTT-5000 is controlled from a "remote browser".

Where do you want to go next?

Throughput Signal Setup
Throughput Stream Table Setup
Throughput Summary Results
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Loopback Test Setup
IP Test Setup
IP Testing
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Date *Home*

Press Date on System Setup tab to set the calendar date for the system. The calendar window is shown below.

To select a date, click on it.
<< , >> Move backward or forward a year.
< , > Move backward or forward a month.

Set the Calendar Date

Where do you want to go next?

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Time Zone *Home*

Press Time Zone on the System Setup tab to select the local time zone.
Press the button corresponding to your time zone.
The window will close and return you to the System Setup window.

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Time *Home*

Set the time of day. Press Time on the System Setup tab to access this function.
The cursor appears to the left of the time on the window.
Enter the entire time of day, in the hours:minutes:seconds format.
Enter the time using the number pad.

Select AM or PM at the bottom of the number pad.

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Network Setup *Home*

Configure system settings if necessary. Access this window from the System menu Network Setup tab.

Ethernet Port

Configure the system settings, if necessary.
⚠**IMPORTANT NOTE**: These settings apply to the XTT 5000 module's own *LAN* port, NOT the test ports. Changing these settings may cause the module to lose connection with the system.

Parameter	Details
Admin IP	Enter the IP address for the XTT 5000 module.
Subnet Mask	Enter the subnet address for the XTT 5000 module, if appropriate.
Gateway	Specify the gateway address for the XTT 5000. Used for static IP.
DHCP Enabled	XTT 5000 automatically retrieves the appropriate IP address when connected to a LAN. When enabled, the previous three items are grayed out.
MAC Address	View the LAN port's MAC address.

DNS servers

Parameter	Details
Primary DNS Server	Specify the local primary (master) DNS server address. Enter an address directly, using the number pad which pops up. The secondary Server is a server that obtains information about a zone from a Primary Server via a zone transfer mechanism. Sometimes known as a Slave Server.
Secondary DNS Server	Specify the secondary (slave) DNS server address.

Where do you want to go next?

Configure an RJ-45 port.
Configure an SFP port.
Meas. Setup: Configure measurement parameters
Throughput Test Setup
RFC2544/NE Applications
IP Test Setup
Monitor Setup
Loopback Test Setup
Home

System Update *Home*

View the system's current version as well as a list of other available versions, and install updates.
XTT 5000 will check for a software update when you enter the screen; this takes several seconds.
The 'Install Update' button becomes available if a new update is found. Press it to install the update. XTT 5000 will look for upgrade files in the following locations, in order:

USB Drive
SD Card
Network Server

Often, XTT 5000 will power off to complete the update. Power the unit back on to resume testing.
Press 'Refresh' to recheck the current software version.

Where would you like to go next?

Menu
Working Desktop Overview
Home

Port Address *Home*

Configure the local port settings, if necessary.
⚠**IMPORTANT NOTE**: These settings apply to the XTT 5000 module's test ports.

For each port, set the IP Address, Subnet Mask, and Gateway addresses, and view the factory default MAC Source address. The port numbers refer to the port labels on the outside of the unit.
A number pad will appear for you to edit the addresses with.
Make sure to press 'Laser On' in the Action Bar to activate the laser when required.

Where would you like to go next?

Port Summary
RJ45 Port: Auto-Neg On
SFP Port Configuration
XFP Port Setup
Menu
Working Desktop Overview
Home

Port Setup

Choose a Port *Home*

The port selection button at the bottom center of the screen reports the connection type (shown by the connector; RJ-45 here) and rate (100M/Full duplex here).

Press the button to change the port in use. The Ports Summary window appears.
The port in use is highlighted. Port and test data appears for each port.
To select another port, touch its icon.
Configure an RJ-45, Auto Negotiation On, Auto Negotiation Off
Configure a 1 GigE SFP port.
Configure a 10 GigE XFP port.
Configure a Port Address if necessary.

Choose a port to test with

Tests can run on all three ports at the same time.
Port1: *XFP* – 10 GigE test
Port2/3: RJ-45 – 10/100/1000BASE-T test
Port2/3: *SFP* – 1000BASE-T or 100BASE-FX test

Possible Port Combinations

A	Port1: XFP	Port2: RJ-45	Port3: RJ-45
B	Port1: XFP	Port2: RJ-45	Port3: SFP
C	Port1: XFP	Port2: SFP	Port3: SFP
D	Port1: XFP	Port2: SFP	Port3: RJ-45

- Port2/3 can't be selected as RJ-45 and SFP at the same time; only one interface at a time.

Where do you want to go next?

The Working Desktop
Configure an RJ-45 port.
Configure an SFP port.
Configure an XFP port.
Meas. Setup: Configure measurement parameters
Throughput Test Setup
RFC2544/NE Applications
IP Test Setup
Monitor Setup
Loopback Test Setup
Home

RJ-45 Port Setup: Auto-Negotiation On *Home*

Select a test from the menu in order to access the port configuration tabs.
Green buttons: On/active
Gray buttons: Off/inactive

Auto Negotiation: The unit will auto-negotiate with the link partner, selecting the highest mutually compatible rate between the two ports.

- The port settings (including line rate, duplex, pause, etc) are negotiated following the appropriate IEEE standards.
- See the negotiation results in the field.

Parameter	Options	Description
Advertisement	10M Half/Full Duplex, 100M Half/Full Duplex, 1000M Half/Full Duplex	The unit can 'advertise' itself as running at the rate(s) you select by pressing the rate buttons.
Pause	On, Off	Set if the local device will respond to pause packets.
RJ-45 Polarity	Auto, Straight, Cross	Determine the wiring polarity of the Ethernet Port.
Pause Frame Delay	0-335,539 µs	Set the length of time indicated by the Pause frame sent by the module.
Asymmetric Pause		Decide if the TX port will send Pause frames even if the receiver has disabled.

RJ-45 Port Window

Auto-Negotiations Result field: Presents the auto-negotiations results. The field appears on the right side of the window.

Where do you want to go next?

RJ45 Port Setup: Auto-Neg Off
Throughput Applications
RFC2544 Applications
Home

RJ-45 Port Setup: Auto-Negotiation Off *Home*

Select a test from the menu in order to access the port configuration tabs.
Auto Negotiation: The unit will auto-negotiate with the link partner, selecting the highest mutually compatible rate between the two ports.

- The port settings (including line rate, duplex, pause, etc) are negotiated following the appropriate IEEE standards.
- If you set Auto Negotiation to on, you can set how the XTT 5000 advertises itself.

When Auto Negotiation is set to Off, configure the following:

Parameter	Options	Description
Port Rate	10M, 100M, 1000M	Set the line rate
Port Duplex	Full Duplex, Half Duplex	Configure the Ethernet mode.
Pause	On, Off	Set if the local device will respond to pause packets.
RJ-45 Polarity	AUTO, Straight, Cross	Determine the wiring polarity of the Ethernet Port.
Pause Frame Delay	0-335,539	Set the length of time indicated by the Pause frame sent by the module.

Where do you want to go next?

Throughput Test Setup
RFC2544 Applications
Home

Pause Frame Delay *Home*

Parameter	Options	Details
Pause Frame Delay	0 to 3355 µs	Set the length of time indicated by the Pause frame sent by the XTT 5000.

On the RJ45 port setup window (Auto-Negotiation off), touch the 'Pause Frame Delay (µs)' button to access this setting. A number pad appears for you to enter the number with.

Press 

to ok your choice.

Where do you want to go next?

Configure an RJ-45 port
Configure an SFP port
Throughput Test Setup
RFC2544 Test Summary
Home

Port Pause *Home*

Parameter	Options	Details
Port Pause	**Off**: The test port will temporarily stop transmitting upon reception of pause flow control frames. **On**: The test port will not stop upon reception of flow control frames.	Set how the local device will respond to pause packets.

XTT 5000 will only send pause frames when you choose, and it will send them when instructed to do so, even if the RX Pause is off.

Where do you want to go next?

Throughput Test Setup
RFC2544 Test Summary
Home

Port Duplex *Home*

Parameter	Options	Details
Port Duplex	**Half**: The local device will attempt to link up in half-duplex mode. Data cannot be transmitted and received at the same time. **Full**: The local device will attempt to link up in full-duplex mode. The data can be transmitted and received at the same time.	Configure the Ethernet mode.

Where do you want to go next?

Throughput Test Setup
RFC2544 Applications
Home

Asymmetric Pause *Home*

On	The TX port sends Pause frames even if the receiver has disabled Pause.
Off	The TX port does not sends Pause frames.

The Asymmetric Pause settings only apply to Auto-Negotiation.
You may always transmit pause frames regardless of this setting.

Upon completion of the auto-negotiation information exchange, the arbitration process determines the highest common mode and enables the appropriate functions.

Where do you want to go next?

Throughput Test Setup
RFC2544 Test Summary
Home

RJ-45 Port Polarity *Home*

Determine the wiring polarity of the Ethernet Port.

- Match this setting to your cable type for specific testing purposes, or let the unit accommodate whatever type of cable you use.

Options: Auto, Straight-through, Cross-over

Auto	The unit automatically determines the polarity of the cable connected to the Ethernet port.
Straight-through	Force the Ethernet port to work only with a straight-through cable.
Cross-over	Force the Ethernet port to work only with a cross-over cable.

Where do you want to go next?

Throughput Test Setup
RFC2544 Test Summary
Home

SFP Port Configuration *Home*

Interface: Set the Ethernet interface: Gigabit Ethernet, 100Base FX
Auto-Negotiation: Select ON to auto-negotiate with the link partner, selecting the highest mutually compatible rate between the two ports.

Parameter	Options	Details
Pause	On, Off	Set to On, the unit will not stop transmitting on receipt of flow control packets.
Pause Frame Delay	0 to 3355 µs	Set the length of time indicated by the Pause frame sent by the module.
Asymmetric Pause	On, Off	Determine if the TX port will send Pause frames even if the receiver has disabled Pause.

Auto-Negotiation Result
When Auto-Negotiation is On, view the results of the negotiations. Data includes:

Statistic	Details
Line Rate	
Duplex	XTT 5000 duplex: Half or Full
Link Partner AN	Whether the link partner uses Auto-Negotiation; shows as Disable or Enable.
Local RX, Tx Pause	Enable or Disable status of pause transmission by XTT 5000.
Remote RX, TX Pause	Enable or Disable status of link partner's transmission by XTT 5000.
Status	Link status.

Remember to make sure the laser is on for testing.

Where do you want to go next?

Port Address: Set the local port parameters.
Throughput Test Setup
RFC2544/NE Applications
Loopback Test Setup
Throughput Summary Results
IP Test Setup
IP Testing
Throughput Test Setup
IP Ping Testing
Home

XFP Port Setup *Home*

Touch the Port Button and choose the *XFP* 10 GigE port.
Select the XFP port for 10 Gigabit testing per applicable IEEE standards.
XTT 5000 supports the 10GE LAN-PHY. The XFP may be the primary or secondary port.

Parameter	Options	Description
Pause	On: The unit will not stop transmitting on receipt of flow control packets. Off: Transmission stops.	Set the pause transmission
Pause Frame Delay	0 to 3355 µs	Set the length of time indicated by the Pause frame sent by the module

Remember to make sure the laser is on for testing.
XTT 5000 support XFP digital diagnostics including:

- XFP Signal Results
- Vendor name
- Wavelength
- Rx optical power

Where do you want to go next?

Throughput Test Setup
RFC2544/NE Applications
Loopback Test Setup
Throughput Summary Results
IP Test Setup
IP Testing
Throughput Test Setup
IP Ping Testing
Home

Throughput Testing

Throughput Applications *Home*

Select Throughput as the test type on the menu. Before you begin testing, make sure the link is up.

To send loopback commands in a test, press the 'Loop Control' (

) button in the Action Bar.

BERT Applications

Select *BERT* as the Test Type on the Signal tab.

Layer 1 BERT
Layer 1 testing is used for verifying the quality of the physical layer connection. Most commonly, this is done for basic point-to-point fiber connections, whether over a single fiber pair or through a DWDM network.
Layer 2 BERT
Run a BERT between two testers.
Layer 2 testing is often performed to verify the quality of service provided over an Ethernet network. Unlike a Layer 1 BERT , the Layer 2 BERT generates valid MAC frames so that the test traffic can traverse through bridges and switches.

Caution: If you are sending packets to your responder via a router or other device with its own IP address, make sure to set the Dest MAC to the MAC address of the router, NOT the responder. Otherwise, the router will likely discard the packets (without ARP in use).If you are staying down at layer 2 (MAC) this does not apply. IP works fine if all the devices are on the same local network segment; this is applies when sending traffic off your local network segment.

Where do you want to go next?

Throughput Summary Results
Throughput Aggregate Results
Throughput Stream Results
Throughput Test Setup
Working Desktop
Home

Ethernet Connection *Home*

Troubleshooting Extras: ARP Error Message STT Ethernet Connection

Before you begin testing, verify the link.

- Make sure to use the right type of connectors when connecting the test port to the fiber access point of the network.
- Make sure the laser is turned on.
- Verify the port has a green LINK LED.
- For RJ-45 and SFP ports, if there is no link, then go to the Port window and set the Auto-Negotiation to Disable (on both units, if applicable). If that doesn't work, set Auto-Negotiation to Enable, and configure the test set to match the DUT settings.

Getting the link up is the most important step in any application, and it can be the most frustrating. Take the time to ensure the Ethernet tab is properly configured. You may need to make a change, see what effect that has, make another change, and so on, until the configuration is correct.
Once you have a green LINK LED, testing is ready to begin.

Troubleshooting an ARP Error Message

The ARP feature makes configuring XTT 5000 easier. ARP takes an IP address and returns the MAC address of the destination system.
If the unit Failed to resolve the host via ARP, one of two things are likely responsible:

- The IP Address configuration on the test equipment does not match the network you are testing.
  Solution: Enable DHCP if available, or check your network configuration by pinging your default gateway. If you get no response, your configuration is invalid.
- The IP Address provided for the destination host is wrong or the host is not on the network.
  Solution: Please check the configuration of the destination host.
  From that host, attempt to ping the default gateway to verify network connectivity.
- XTT-5000 will always ARP for the default gateway. If the ARP fails it will not affect anything. Requesting the MAC of the default gateway is only required when sending traffic off of your local Ethernet segment.

Troubleshooting an STT Ethernet Connection

If you are testing using an STT Ethernet there common configuration will cause problems:

XTT-5000 Throughput --> STT Ethernet
XTT-5000 Throughput <-- STT Ethernet

By default, if you are using Layer 2-4 testing, the XTT-5000 will default to 802.3 framing, and the STT Ethernet will default to Ethernet type II framing.
When sending Throughput (BERT)traffic in both directions, a LOPS error will appear on one of the units, due to bidirectional traffic.

Where do you want to go next?

Throughput Summary Results
Throughput Aggregate Results
Throughput Stream Results
Throughput Test Setup
Working Desktop
Home

Layer 1 BERT Application *Home*

Layer 1 Throughput testing is used for verifying the quality of the physical layer connection. Most commonly, this is done for basic point-to-point fiber connections, whether over a single fiber pair or through a DWDM network.
As test traffic is not passing through a Layer 2 (or higher) device, a Layer 1 test can be performed with a single STT at one end and a hardware loopback, such as a patch cord, at the far end.
Alternatively, the test can be performed with two STT units, one at each end of the connection.
See the Application Diagram.

Many networks, such as Ethernet over SONET/SDH (EOS), are not true Layer 1 networks, in that they require proper Ethernet framing. Only perform a Layer 1 test when you are certain that framing is not required. Many problems with Layer 1 testing can be corrected by performing a Layer 2 test.

How to Perform Layer 1 BER Testing

1. From the drop down menu, select Throughput as the test type.
2. Configure the port.

RJ-45 - Fast Ethernet
Augo-Negotiation: On
Port Rate: Match the rate of the line under test; 10M, 100M, 1000M
Port Duplex: FULL
Pause: OFF
RJ-45 Polarity: AUTO
Pause Frame Delay: 0 ms
SFP - Gigabit Ethernet
Pause: Off
Pause Frame Delay: 0 ms
XFP - Gigabit Ethernet
Pause: Off
Pause Frame Delay: 0 ms

Remember to make sure the laser is on for testing.

3. Configure the Signal tab.

Test Type: BERT
Test Layer: PRBS + CRC (Layer 1 Framed)
• Set the desired frame size.
Traffic Shape: Constant

- Set the Constant Bandwidth at 100%.
- Use the 2^31 test pattern.

Far End Tester Configuration

- If performing this test between two units back-to-back, configure both units as above.
- If performing to a software loopback, configure the far end module as follows:
  Test Mode: LOOP BACK
  Mode: Manual
  Layer: Layer 1

- Otherwise, make sure the far end has a hardware loop back.

Start the test.

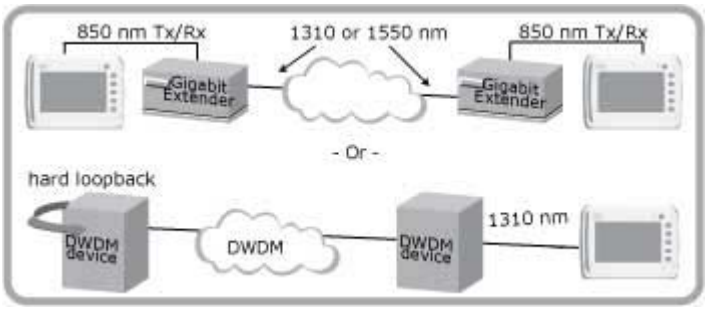
Press  then  to start the BERT .

The Summary Results window will open automatically. Wait a few moments and you should see 'No Errors' on the Summary tab.

Where do you want to go next?

Throughput Summary Results
Throughput Aggregate Results
Throughput Stream Results
Working Desktop
Home

L1 BERT Diagram *Home*



Layer 1 *BERT* Applications

Where do you want to go next?

Home

Layer 2 BERT Application *Home*

In Layer 2 Throughput testing, you can run a *BERT* between two testers.
See the application diagram.

Layer 2 devices (switches) keep track of MAC address information in order to forward traffic to the appropriate port, therefore each test set has to be configured with valid source and destination MAC address.
Layer 2 testing is often performed to verify the quality of service provided over an Ethernet network. Unlike a Layer 1 *BERT*, the Layer 2 *BERT* generates valid MAC frames so that the test traffic can traverse through bridges and switches.

How to perform Layer 2 BER testing

Local Configuration

1. From the drop down menu, select Throughput as the test type.
2. Configure the port.
   RJ-45 - Fast Ethernet
   Augo-Negotiation: On
   Port Rate: Match the rate of the line under test; 10M, 100M, 1000M
   Port Duplex: FULL
   Pause: OFF
   RJ-45 Polarity: AUTO
   Pause Frame Delay: 0 ms
   SFP - Gigabit Ethernet
   Pause: Off
   Pause Frame Delay: 0 ms
   XFP - Gigabit Ethernet
   Pause: Off
   Pause Frame Delay: 0 ms
   Remember to make sure the laser is on for testing.
3. Configure the Signal tab.

Test Type: BERT
Test Layer: Layer 2: Framed
• Set the desired frame size.
4. Configure the Stream Table.
5. Configure the Payload tab.

Traffic Shape: Constant

- Set the Constant Bandwidth at 100%.
- Use the 2^31 test pattern.

Far End Tester Configuration

- If performing this test between two units back-to-back, configure both units as above.
- If performing to a software loopback, configure the far end module as follows:
  Test Mode: LOOP BACK
  Mode: Manual
  Layer: Layer 1
- Otherwise, make sure the far end has a hardware loop back.

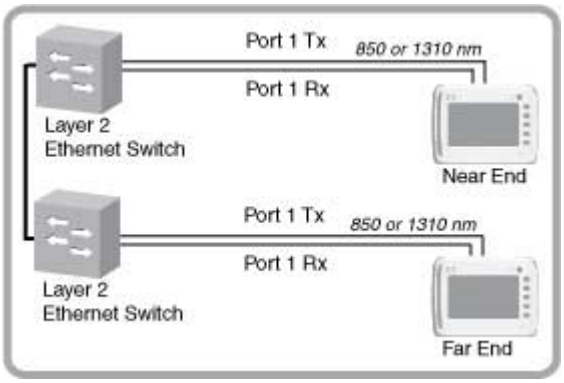
Start the test.

Press  then  to start the BERT. The Summary Results window will open automatically. Wait a few moments and you should see 'No Errors' on the Summary tab.

Where do you want to go next?

Throughput Summary Results
Throughput Aggregate Results
Throughput Stream Results
Home

L2 BERT Diagram *Home*



Layer 2 BERT

Where do you want to go next?

Home

Throughput Signal Setup *Home*

The Signal graphic reflects the Ethernet frame; for L2 Framed, many frame elements may be chosen from; see the Frame Setup tab.
Choose a port and configure the Stream Table (L2 Framed only).
Before you begin testing, make sure the link is up.

Parameter	Options	Details
Test Type	***BERT***: Out-of-service testing; traffic would be disrupted; perform a throughput/BER test. **LIVE**: Take statistics on frames, but does not look for pattern synchronization or bit errors.	Select the type of test. **BERT Note**: The key metrics are utilization and lost frames. This is the basic configuration.
Layer	**L1 64B/66B,L1 8B/10B:** Unframed signal. Continuous bits without framing, containing 8B/10B line coding for RJ-45 and SFP ports. **L2 PRBS+*FCS***: Layer 2 Framed. The BERT is performed at OSI Layer 1 (physical layer), using the FCS or the *CRC* field defined for an Ethernet frame, without the MAC header. **L2:Framed**: The BERT is performed at OSI Layer 2 (data link).	Select the test layer. **L1: Unframed Note**: Configure the Pattern. **L2: PRBS+FCS Note**: Configure the Pattern and Traffic Shape. **L2: Framed Note**: Configure the Stream Table.

To send loopback commands in a test, press the 'Loop Control' (Loop Control) button in the Action Bar.

To start the test, press 'Apply' (Apply), then 'Start' (Start). The results Summary screen will appear.
Select Throughput from the drop down menu.

Where would you like to go next?

Throughput Applications
Ethernet Frame Type
Throughput Summary Results
Throughput Aggregate Results
Throughput Stream Results
Throughput Test Setup
Working Desktop
Home

Stream Table Setup *Home*

- Each stream may be configured independently. See Auto Fill to configure multiple streams.
- Throughput tests support up to 16 streams. RFC 2544 tests support one stream.
- Visit the Technology Overview for information on frame components and more.

To configure a stream, tap a stream row. The Stream Number X window will pop up, for configuring the stream in detail. When there are multiple streams, the window will have scroll arrows for moving between Stream Number x windows. The Frame Setup tab appears on top. Configure each tab on the window.

MAC in MAC^	MAC	VLAN	MPLS	IP	TCP	UDP	Payload	Traffic Shape*: Constant, Ramp, Burst
^Available at a future date.				*Traffic shaping is not available in Layer 1, Unframed mode.				

Rx Filter: Filter on received messages.

Stream Table Buttons

Button	Function
'Structure'	Tap a frame element in the table to configure the frame.
'Total Streams'	View/set the number of streams in use. Use the Total Streams keypad to enter a new quantity (1-16) of streams for the table if necessary. The number in use is shown on the 'Streams' button.
'Remove'	Delete the highlighted stream and reduce the total number of streams by one.
'Auto Fill'	Automatically fill in the addresses of all streams in the table.

'TPID/BERT ID' **Note**: This is a global settings; all BERT streams get the same ID.	Edit the TPID directly in the field if required; applies only when VLAN is in use.
	• 8100 is the standard IEEE 802.1Q/802.1P value.
	  • A TPID is available for each VLAN.
	  Technology: VLAN Tagging
	  BERT ID: Ox40 to 0x8100.
	• The XTT 5000 place the BERT ID value in the IP Header (Identification field) s, the tester can easily identify whether IP traffic is BERT traffic or not.

Where do you want to go next?

Configure the frame
Throughput Applications
Throughput Summary Results
Throughput Aggregate Results

Throughput Stream Results
Throughput Test Setup
Working Desktop
Home

Stream Frame Setup *Home*

On the Stream Table, select a row to configure that stream. Press 'Frame' to set the frame structure. The frame diagram at the bottom of the screen shows the possible elements.

Frame Structure Elements

Touch an element to turn it On; a setup tab will appear for that element. Some elements, such as MPLS and IP, are connected. The graphic at the bottom of the window reflects the structure in use.

Configure each tab.	MAC	VLAN	MPLS	IP	TCP	UDP	Payload	Traffic Shape

Green button: On
Gray button: Off; gray writing means the button is unavailable, black writing that it may be activated/configured.
Dark Gray button: On/Off function. For example, VLAN is ON or OFF.
Press 'Apply to All Streams' to have the selected frame elements used by every stream in the Stream Table.

Frame Size	34-12,000 bytes, depending on the rate*.	Enter the total length of the Ethernet frame in the number pad which pops up;
* The XTT 5000 allows for undersized and oversized frames.		


See the Frame size details table for the maximum and minimum frame sizes.

Frame Length Distribution

Parameter	Options	Details
Frame	Set at Fixed.	Select the frame length distribution to use.

Fixed: All frames transmitted will be of the same length, as indicated in the Frame Size field.

- The most common means of testing a network is to use a fixed frame size. In this way, the network performance can be characterized for different frame lengths.
- For instance, the frame loss rate may be very different for 64-byte frames than for 1518-byte frames. By sending only frames 64 (or 1518) bytes long, the frame loss rate can be calculated for each.
- You will also need to enter the Frame Size.

Where do you want to go next?

Throughput Summary Results
Throughput Aggregate Results
Throughput Stream Results
Home

Stream - Auto Fill *Home*

On the Throughput Stream Table, press 'Auto Fill' to configure the stream element/s (MAC, VLAN, etc) of multiple streams at one time.

On the Stream Auto Fill popup, configure the fill parameters:

1. Select the frame element to configure, using the 'Auto Fill Item' button.
2. Enter the required Auto Fill Item data.

> **Example**: if you had pressed 'Auto Fill Item' and selected MAC Destination (to appear as 'Auto Fill Item MAC Destination'), the button below would appear as 'MAC Destination'. Press it, then enter the starting MAC Destination address.

Auto Fill Action

To access all the Auto Fill options, you must have 2 or more streams.

Parameter	Details	Action
Fixed	The frame element settings will be identical for all active streams.	Apply the Fixed value to or from the current stream, or from the first stream.
Increment	The frame element settings will increase by one each time.	Press 'From Stream' to enter the number of the stream to start applying the Incremented value from. Press 'To Stream' to enter the number of the stream to stop applying the Incremented value to.
Decrement	The frame element settings will decrease by one each time.	Set the 'From Stream' and 'To Stream' values as described above.
Random	The last several bytes of the setting are filled with a random value.	Only the last 1, 2, or 3 bytes of the frame element address are determined randomly. The value of the other bytes is based on the value entered in the item button (e.g. 'MAC Destination' value). Set the 'From Stream' and 'To Stream' values as described above. Addresses are not changed during the test.

Where do you want to go next?

Stream Table Setup
Throughput Applications
Throughput Summary Results
Throughput Aggregate Results
Throughput Stream Results
Throughput Test Setup

Home

Stream MAC Setup *Home*

Configure Layer 2 by setting the MAC Source and Destination addresses for the streams.
Touch a MAC address on the Stream Table to bring up this configuration window; configure the Source and Destination addresses separately. See Auto Fill to configure multiple streams.

Parameter	Options	Details
Frame Type	IEEE 802.3, Ethernet II	Select the Ethernet standard to use.
Ethertype	**IEEE 802.3**: Ethertype= Length. **Ethernet II**: 64-5535. Enter the Ethertype value in its field.	Choices depend on the Frame Type. **802.3 Note**: *LLC* and *SNAP* appears. Some Ethertype values, such as 0800 and AAAA, are considered invalid. To avoid potential problems with how a network device interprets the Ethertype field, 0800 is automatically chosen when IP is selected for the frame setup.
MAC Source/Destination	Enter the address.	Touch the MAC field. Use the number pad which appears to enter the data. • Each MAC address source and destination pair defines traffic flow.
Default MAC Source		Reset the MAC source address of that port to the factory set default. The settings for each port, along with the factory settings of the MAC addresses can be found on System>Port Address.
LLC	On, Off	Toggle the LLC protocol On or Off; 802.3 only.
SNAP	On, Off	Toggle the LLC protocol On or Off; 802.3 only.

Where do you want to go next?

Throughput Stream Table Setup
Throughput Summary Results
Throughput Aggregate Results
Throughput Stream Results
Home

Stream - IP Setup *Home*

Use the *IP* tab to configure the IP addresses for the stream/s, after selecting *UDP* as part of the Frame Setup on the Stream Table. See Auto Fill to configure multiple streams.

Statistic(s)	Options	Details
IP Source and IP Destination	Enter the new IP address source and destination pairs to use.	Enter the address using the pop up number pad. • The IP address is the network layer address that identifies the source and destination of the test frames.
IP Gateway (Ver4)	Specify the gateway addresses.	Leave the gateway value as 000.000.000.000 to indicate no gateway.
IP Version	IP Version 4, IP Version 6.	Select the IP Version.
IP Option (Ver4)	Yes, No	Opt whether or not to include the "option type" IP header field.
IP Header Length (Ver4)	Set the number of 32-bit (4-byte) words.	These form the header. • A setting of 5 indicates an IP header of 20 bytes.
Type of Service (Ver4)	RFC1349, RFC2474	Select the Type of Service protocol. • This selection determines the rest of the third column. • See the TOS parameters.
Flag Don't Fragment (Ver4)	Yes, No	Select whether or not to fragment the packet.
Flag More Fragment (Ver4)	1: Additional fragments follow the current one; 0: No additional fragment bits follow.	The packets generated by the XTT 5000 are never actually fragmented, even if the fragmentation bits are set otherwise.
Fragment Offset (v4)	0-8191 bits	Enter the position of the fragment in the original datagram. • Leave at 0 if you are unsure of what to select
Time to Live (Ver4)	0-255 hops	Enter the time to live. 64 and 128 are commonly used.
Protocol (Ver4) The protocol value selected is the number placed into the IP header; it doesn't indicate	View the originating protocol module.	Set at *TCP* in a TCP/UDP configuration. • The assigned values are maintained by the Internet Assigned Numbers Authority (IANA) ; available on at www.ianan.org/assignments/protoc

the proper datagram or payload of the payload.*		ol-numbers. Commonly used values include 6 (TCP) or 17 (UDP). * For example, setting the Protocol field to 001, which indicates an ICMP payload, does not create an ICMP payload in the test traffic. This can cause problems with network elements who look at the Protocol field and attempt to process the non-existent protocol payload.
Flow Label (Ver6)	20 bits	Specifies special router handling, source to destination(s), for a sequence of packets.
Next Header (Ver6)	8 bits	Specifies the next encapsulated protocol, or the presence of an extension header.
Hop Limit (Ver6)	8 bits	Packet TTL count.

Type of Service Parameters

Statistic	Options	Details
Precedence (RFC1349)	3 digit value	Enter the Precedence using the number pad.
MBZ	0, 1	Select a MBZ (Must Be Zero) on the Number Pad.
TOS Value		Enter the type of service. • Leave it at 0 if you are unsure of what to select. • See RFC 1349 and RFC 2474 for technical details.
DSCP (Bits 0-5)		Enter the RFC 2474 *DSCP* bits.
Currently Unused	0,1 for two bits	Enter the two bits. Reserved

Where do you want to go next?

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Stream MPLS Setup *Home*

Activate MPLS

Touch the MPLS 1-3 buttons to turn them On (green) or Off (gray). Label 1 is required.
MPLS Type: Select the frame type: Unicast, Multicast.
For each label selected , set the following:

Parameter	Options	Details
ID	Up to seven digits	Enter the next hop label.
Exp	Up to seven digits	Enter the Experimental label.
S	One digit	Enter the end-of-stack label.
Time to Live	0-255 hops	The Time Time to Live label expires at the conclusion of this number of hops.

MPLS Label Parameters

See Auto Fill to configure multiple streams.
Enable the MultiProtocol Label Switching architecture by pressing *MPLS* to On on the Stream Table Frame Setup tab.
See Technology: MPLS for details on the parameters.

Where do you want to go next?

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Stream Payload Setup *Home*

Press 'Payload' on the Stream Table or Pattern on the Signal tab configure the test payload elements. See Auto Fill to configure multiple streams.

Parameter	Options	Details
Sunrise Tag Read the notes.	None, SN/TS, STAG	Enable useful proprietary tagging, or not.
Tag: SN/TS	On, Off	Sequence Number + Time Stamp; select for compatibility with STT Ethernet. The SN/TS tags include a sequence number and a time stamp; enable both of these fields on the XTT Ethernet.
Tag: STAG	On, Off	Sequence Number + Time Stamp + Sunrise Tag 5 bytes (Reserved). Select for maximum usefulness of proprietary tagging.
Invert	On, Off	The selected test pattern will be transmitted inverted.
Pattern Type	2^31, 2^23, 2^20, 2^15, 1111, 1010, 0000. User, User 1024*	Select a test pattern to perform a BERT with. Not all patterns are available for all configurations.
(User) Pattern Data 1-32		Enter the four-byte test pattern in hexadecimal format with the number pad. • Edit each line directly. • Use the 'Next/Previous Patterns' button to access the next screen of patterns.
User Pattern Type	**DATA** **DEC**:The payload is filled with decremental bytes. **INC**: The payload is filled with incremental bytes: 00 01 02 03…	Define how a User pattern will fill the payload. After selecting User as the Pattern Type, tap 'Pattern Data' and use the keypad which pops up to enter the test pattern.
'Apply to All Streams' button	Apply the Tag, Type, and Pattern selections to all of the streams in the table.	

Press Apply to apply the new settings and close the window.

Where do you want to go next?

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Throughput Summary Results

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Stream Rx Filter *Home*

To enable filtering, select the Rx Filter tab on the Stream Number x window from the Stream Table. The filter specifies the frame elements that will be captured.
Turn an element On to filter for that element.

- For example, if you sent Source MAC on, only packets which match the Stream Table Source Mac settings will be captured.
- Set to Off, packets would be captured regardless of their Source MAC address.

Testing Tips

Most testing is done with a loopback unit at the other end. In a Layer 2/3 loopback, the Source and Destination MAC/IP will be swapped so the traffic can be returned to the test set. Layer 1 does not touch the traffic it simply copies the input to the output. Hence, configuring the RX Filter Source/Destination requires careful consideration. The behavior of the unit with multiple streams can also be complicated.
If you are sending two streams to the same Destination MAC, with differing Source MAC addresses, the stream data may be captured in unexpected ways.

Example 1
Stream 1
Source MAC: 00::02
Destination MAC: 00::01

Stream 2
Source MAC: 00::03
Destination MAC: 00::01

Without the Rx Filter in use, both streams will be detected normally.

Example 2
Stream 1
Destination MAC Rx Filter
All the traffic from both Stream 1 and Stream 2 will appear in the Stream 1 results; no traffic appears for Stream 2. Be aware of this when troubleshooting traffic. *Try rule 1 then rule 2 etc for each frame.*

In addition, the Destination is best ignored. This is because the Source MAC addresses are different. When they arrive at the loopback device, they will be swapped, making the SRC the DUST, and vice versa. Now the return frames have different Destinations with the same Source.

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Sunrise Tags Notes *Home*

Important Sunrise Tag Notes

When Sunrise tags are enabled, a sequence number will be inserted in the payload of each frame. The sequence number will allow you to detect the number of lost frames, latency checking, and other important information. This is a Sunrise Telecom proprietary feature.

- A frame loss can only be detected when the BERT is running between two Sunrise Telecom Ethernet testers (XTT 5000, STT or MTT) with the sequence number tags enabled on each side.
- Measurements will only display counters for Lost Frames, Duplicate Frames, and Out-of-Sequence frames if a Sunrise Tags is used.
- If a stream as enabled SN/TS of the Sunrise Tag and receives STAG on the incoming traffic, it will lose pattern sync. The reverse is not true; a stream set for STAG will achieve pattern sync if the incoming stream has a SN/TS tag.
- XTT 5000 measures the time it takes for each test frame to pass through the DUT. The value reported for latency only applies when the far end is in loopback mode.
- If two test units are performing and end-to-end Throughput test with the Sunrise Tag enabled, the displayed latency results will not be accurate.

Where do you want to go next?

Stream Payload Setup
Throughput Stream Table Setup
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Stream Traffic Shape Setup *Home*

Traffic Shape: Select the frame length distribution to use.

Constant	Traffic is transmitted at a constant rate (from 0.01% to 100.00% bandwidth) for the entire duration of the test.
Ramp	The traffic is transmitted at a variable rate from Start Bandwidth (between 0.00% and 100.00%) to Stop Bandwidth (between 0.00% and 100.00%), with increments of Step Size (between 0.01% and 100.00%). The ramp is repeated for the duration of the test if Repeat is checked.
Burst	With Burst traffic, traffic is transmitted at a variable rate. Traffic is transmitted at Burst 1 Bandwidth rate (from 0.00% to 100.00%) for Burst 1 Duration seconds, then at Burst 2 Bandwidth rate (from 0.00% to 100.00%) for Burst 2 Duration seconds. Gigabit Ethernet has a minimum burst of 0.01%. This sequence is repeated for the duration of the test.
Traffic shaping is not available in Layer 1, Unframed mode.	

On the Stream Table, select a row to determine the traffic shape for that stream.
Press 'Traffic Shape' to select the frame length distribution to use.
XTT 5000 will generate constant traffic rates from 0.01% up to 100.00% of line rate, and a constant traffic down to 56 kbps.
XTT 5000 will generate constant traffic down to 1 kbps; however, under 0.01% bandwidth, only a single stream can be supported.

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Stream - Burst Traffic Shape Setup *Home*

From the Throughput Stream Table,press 'Traffic Shape' and select Burst to configure Burst traffic
With Burst traffic, traffic is transmitted at a variable rate.
Traffic is transmitted at Burst 1 Bandwidth rate (from 0.00% to 100.00%) for Burst 1 Duration seconds, then at Burst 2 Bandwidth rate (from 0.00% to 100.00%) for Burst 2 Duration seconds.
Gigabit Ethernet has a minimum burst of 0.01%. This sequence is repeated for the duration of the test.

Parameter	Options	Details
Rate	Percentage, IPG (ns), Bit Rate	Determine the traffic rate.*
Rate: Percentage	0.01% to 100.00%	Ethernet traffic is expressed in terms of the percentage of bandwidth used. At 100%, the gap between frames is at its minimum. As the percentage is reduced, the IPG is increased.
Rate: IPG (ns)	The minimum IPG is 12 bytes or 96 bit times.	The interpacket gap (IPG) is the delay between successive frames.
Rate: Bit Rate		The bit rate, given as a number of kbps, is a direct function of the bandwidth percentage. Because the frame length can be random, there is no fixed relationship between bit rate and data rate.
Burst Bandwidth 1/2		Enter the size of the burst the XTT 5000 will transmit.
Burst Duration 1/2		Enter the number of seconds the first or second burst of traffic will last.
* When changing units from Percentage to IPG to Bit Rate, the display will reset back to the last value entered for those units.		

Burst Bandwidth Accuracy

The accuracy of the burst bandwidth is reduced when the burst duration is shorter than the time to send approximately 100 frames at 100% bandwidth. The minimum recommended durations follow:

Burst Size	Duration
64 bytes	0.0051 ms
1519 bytes	0.0121 ms
4096 bytes	0.3278 ms
12000 bytes	0.9600 ms

Minimum Burst Durations

Example: Sending a 1510 byte burst at a burst duration of 0.0051 ms would likely lead to inaccurate results.

Where do you want to go next?

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Stream - Constant Traffic Shape Setup *Home*

From the Throughput Stream Table Traffic Shape tab or via Signal 'Traffic Shape', configure the traffic.

Parameter	Options	Details
Constant Bandwidth	0.00% to 100.00%	Enter the percentage of bandwidth which will be constantly filled directly in the field.
Rate	Percentage, Bit Rate, IPG (ns)	Determine the traffic rate. When changing units from Percentage to IPG to Bit Rate, the display will reset back to the last value entered for those units.
Percentage	Range: 0.01% to 100.00%	Commonly, Ethernet traffic is referred to in terms of the percentage of bandwidth used. At 100%, the gap between frames is at its minimum. As the percentage is reduced, the IPG is increased.
IPG (ns)		Set the interpacket gap. The minimum IPG is 12 bytes or 96 bit times.
Bit Rate		The bit rate, given as a number of kbps, is a direct function of the bandwidth percentage. 1 kbps corresponds to 0.00001% of a 10GE LAN interface. Because the frame length can be random, there is no fixed relationship between the bit rate and the data rate.

Press  to apply the new settings and close the window.

Where do you want to go next?

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Stream - Ramp Traffic Shape Setup *Home*

From the Throughput Stream Table or Pattern on the Signal tab, press 'Traffic Shape' to configure the traffic.
The traffic is transmitted at a variable rate from Start Bandwidth (between 0.00% and 100.00%) to Stop Bandwidth (between 0.00% and 100.00%), with increments of Step Size (between 0.01% and 100.00%).

Parameter	Options	Details
Rate	Percentage, IPG (ns), Bit Rate	Determine the traffic rate.*
Rate: Percentage	0.01% to 100.00%	Ethernet traffic is expressed in terms of the percentage of bandwidth used. At 100%, the gap between frames is at its minimum. As the percentage is reduced, the IPG is increased.
Rate: IPG (ns)	The minimum IPG is 12 bytes or 96 bit times.	The interpacket gap (IPG) is the delay between successive frames.
Rate: Bit Rate		The bit rate, given as a number of kbps, is a direct function of the bandwidth percentage. Because the frame length can be random, there is no fixed relationship between bit rate and data rate.
* When changing units from Percentage to IPG to Bit Rate, the display will reset back to the last value entered for those units.		

The following parameters are explained in terms of percentages, but would appear as ns or kpbs if Percentage was not selected as the Rate.

Parameter	Options	Details
Start Bandwidth		Enter the bandwidth percentage the XTT 5000 will start transmitting at the beginning of the test.
Stop Bandwidth		Enter the bandwidth percentage where the XTT 5000 will stop ramping. After transmitting at this bandwidth (e.g. 100%) for the determined Step Duration, the unit will continue transmitting frames at this maximum rate.
Step Duration	1-60 seconds	Number of seconds the XTT 5000 will transmit each bandwidth step. The time scale on the graph is based on this unit of time.
Step Bandwidth		Enter the bandwidth percentage the unit will increase each step up.

Where do you want to go next?

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Stream - VLAN Setup *Home*

Touch each tag you want to use on the Stream Table. VLAN 1 is set on. For VLAN2 and VLAN3, the labels toggle from Off to On, and the color changes to green. A gray *VLAN* Off button means that tag is not in use. See Auto Fill to configure multiple streams.

Parameter	Options	Details
TPID	0x40 to 0x8100	Edit the TPID if required 8100 is the standard IEEE 802.1Q/802.1P value.
PRI	0-7	Enter the User Priority value, per IEEE 802.1Q. • User Priority 0 is the default for Ethernet networks. • The Number Pad will appear to facilitate numeric entry. The Priority Table shows the traffic types by priority.
CFI	0, 1	The CFI should almost always be set to 0 to be compatible with Ethernet switches.
ID	0-2045	Enter the optional Virtual LAN tags into the field for each stream. VLAN tags conform to IEEE 802.1Q and IEEE 802.1P.

Where do you want to go next?

Stream TPID/BERT ID Setup
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Stream - TCP Setup *Home*

Use the TCP tab to configure the TCP ports and header, after selecting UDP as part of the Frame Setup on the Stream Table. See Auto Fill to configure multiple streams.

Selecting TCP puts a TCP header into the IP packet datagram but does not establish a true TCP connection with the far end. This "static TCP" is useful for entering a proper TCP port value to pass traffic through firewalls and similar security features on a router, but does not test a live TCP connection.

Parameter	Options	Details
UDP Source	0x1 to 0xFFFF	Enter the port address,using the pop up number pad.
UDP Destination	0x1 to 0xFFFF	Enter the port address,using the pop up number pad.

Column 2: TCP Header Config

Statistic	Meaning
UDP Source	Enter the port address,using the pop up number pad; 0x0 to 0xFFFFFFFF.
Acknowledgement Number	Expected next Sequence Number, sent by receiver.
Data Offset (4 bits)	Size of TCP header; also offset of the packet to the data.
Reserved 6 bits	Normally unused: set to 0.
URG	Enter the value for the Urgent Pointer Control Bit.
PSH	Enter the value for the Push Function Control Bit.
RST	Enter the value for the Reset the connection Control Bit.
SYN	Enter the value for the Synchronize sequence number Control Bit.
FIN	Enter the value for the No more data from sender Control Bit.
Window Size (Hex)	Increase the TCP congestion window size up to 1 Gb; *0x0x to 0xFFFF

Where do you want to go next?

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Stream - UDP Setup *Home*

Use the *UDP* tab to configure the UDP ports and header, after selecting UDP as part of the Frame Setup on the Stream Table. See Auto Fill to configure multiple streams.

UDP Source: Enter the port address,using the pop up number pad; 0x1 to 0xFFFF
UDP Destination: Enter the port address,using the pop up number pad; 0x1 to 0xFFFF

Where do you want to go next?

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Summary Results *Home*

Get an overview of the Throughput test results.
It may take a few seconds for results to appear after starting a test.

The left side of the window displays:
Elapsed Time: How long the test has been running.
Remaining Time: How long remains in a scheduled test, or **Continuous.**
Banner: A message summary banner of the status of the test. It reports any errors or alarms, along with a date and time stamp.
Below the banner, view a list of logged events: received errors and/or alarms, e.g. Lost Frame, including a count of the number of errors, with a resolution of one second.

The right side of the window shows more specific results.
In a Live throughput test, statistics are taken on frames, but the test does not look for pattern synchronization or bit errors (no Bit statistics appear).
For a Monitor test, only receive (RX) statistics are reported.

Status: Statistics status.

Statistic	Meaning
TX Utilization	Transmitted bandwidth as a percentage of maximum traffic rate (minimum frame gap).
TX Line Rate	Transmitted bit rate (in kbps, bps, etc.) of the Ethernet frames, ignoring the frame gap, preamble, and SAD. The data rate is always less than the line rate.
TX Data Rate	Transmit data rate (in kbps, bps, etc.). This includes the frame headers but not the IPG or Preamble. Thus, the data rate reflects both the frame rate and frame size.
RX Utilization	Received bandwidth as a percentage of maximum traffic rate (minimum frame gap).
RX Line Rate	Received bit rate, based on the current utilization.(in kbps, bps, etc.).
RX Data Rate	Received bit rate of the Ethernet frames, ignoring the frame gap, preamble, and SAD. The data rate is always less than the line rate (in kbps, bps, etc.).
Signal	The signal information (vendor, wavelength, optical power, etc.) is provided by the SFP/XFP module. Not all manufacturers supply this information, and Sunrise Telecom Inc. is not responsible for modules provided by other vendors. • **Vendor**: Name of the vendor; • **Wavelength**: Optical wavelength is use at the port. • **RX Optical Power**: Received uW and dBm.

Where do you want to go next?

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Throughput Stream Results

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Summary Notes *Home*

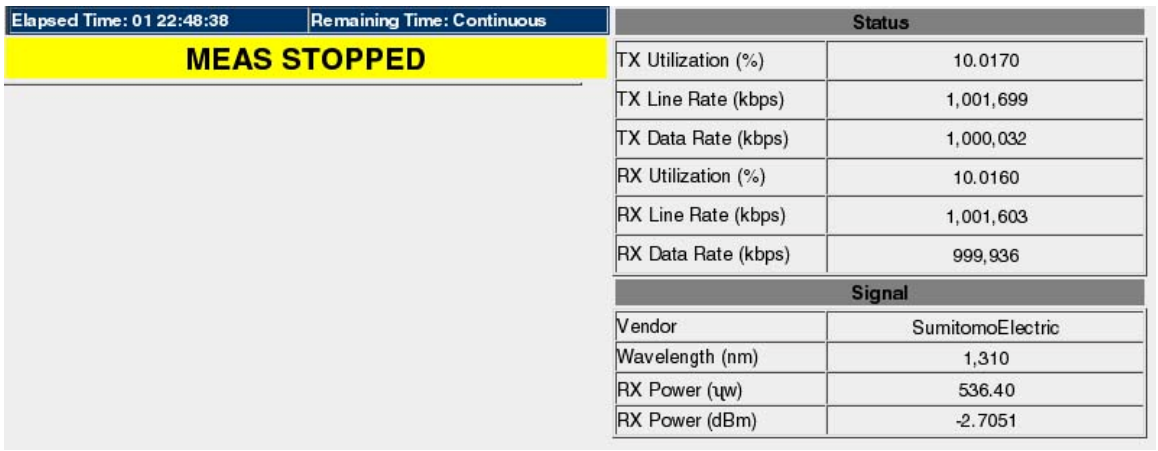
The Throughput Summary results window includes banners and event status reports.

Status Banners

Banner	Meaning	Color
MEAS STOPPED	No test is underway	Yellow banner
NO ERRORS	Test is underway with no errors or alarms	Green banner
ERRORS/ALARMS	Errors or alarms currently received in the test	Red banner
ERRORS HISTORY	Test underway; errors or alarms were received in the past, but are not currently being received	Red banner
NO BERT TRAFFIC	Either the RX Rate is zero or the received traffic does not match the stream table settings for that port	Yellow banner
NO LINK	The Ethernet link is down	Red banner

Events

- REC Start: Start recorded
- REC Stop: Stop recorded
- Link Up
- Link Down



Throughput Summary Results

Where do you want to go next?

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Aggregate Results *Home*

View information on errors received, and frame statistics, for a Throughput, Monitor, Ping, or RFC2544 test.

- For the following test frame types, view the frame count or **Current** frame rate (frames per seconds, the **Average** frame rate (fps) at which the error was received, and possibly the **Utilization** rates (percentage of bandwidth). Counts and rates may show for the Transmit and/or Receive directions.
- Not all statistics will show for all ports or setups.
- In Live and Monitor Test Modes, only Receive Statistics appear.
- For information about frame component usage, see the Ethernet Technology Overview.

Total Frames	Number of received/transmitted frames.
Total Bytes	Number of received/transmitted bytes.
Frame Rate Current / Average / (fps)	Current rate at which frames are being transmitted and received at this second.
Frame Rate Minimum / Maximum (fps)	Minimum or maximum transmitted and received frames per second since the beginning of the test.
Line Rate	Transmitted and Received data rates.
Data Rate	Transmit data rate (in kbps, bps, etc.). The data rate includes the frame headers but not the IPG or Preamble. Thus, the data rate reflects both the frame rate and frame size.
Utilization Current (%)	Percentage of current/average/Minimum/Maximum bandwidth in use.
Frame Sizes	Count of frames of each size: Under 64 Bytes/64 Bytes/65-127/128-255/256-511/512-10234/ 1024-1518/ Over 1518 Bytes (aka jumbo frames). *Undersized Frames Tip*
Bit Error	Count of the number of bit errors since the beginning of the test.
Service Disruption	Packet interval (ms) detected during the measurement. This is a very precise disruption measurement.
Non Test Traffic	Number of received frames that do not match the ports Stream Table, such as live traffic. Multicast and broadcast frames are reported as non-test frames. Consult the Stream Table.
Pause Frames	Count of received pause frames.
FCS / CRC Errors	Frame Check Sequence or Cyclic Redundancy Check errors.
Unicast	Count of Layer 2 Unicast frames transmitted and received.
Multicast	Count of Layer 2 multicast frames transmitted and received.

Test Frames	Count of Frames which match the Stream Table.
Non Test Frames	Count of Frames that do not match the ports Stream table, such as live traffic. Multicast and broadcast frames are reported as non-test frames. Consult the Stream Table.
Unicast Test Frames	Count of unicast test frames.
Broadcast Test Frames	A broadcast frame is a frame that is intended for all of the devices on the network, the destination MAC address is set to 'FF-FF-FF-FF-FF-FF'.
Keep Alive Mac Frames	Count of frames with MAC Keep Alive frames.
Invalid Mac Frames	Count of frames with invalid MAC addresses.
Good Frames	Count of unerrored frames.
Error Frames	Count of errored frames.
Frame Rate Current (fps)	Number of frames currently received per second.
Total VLAN Frames	Frames containing VLAN tags.
Single-Tagged VLAN Frames	Frames containing one VLAN tag.
Multi-Tagged VLAN Frames	Frames containing more than one VLAN tag**.**
MPLS Frames	Frames containing MPLS tags.
IPv4 Frames Frame Rate	IP version 4 frames.
Unicast IPv4 Frames	Unicast IP version 4 frames.
Multicast IPv4 Frames	Multicast IP version 4 frames.
Broadcast IPv4 Frame	Broadcast IP version 4 frames.
IPv6 Frames	IP version 6 frames.
Unicast IPv6 Frames	Unicast IP version 6 frames.
Multicast IPv6 Frames	Multicast IP version 6 frames.
TCP Frames	Frames containing Layer 4 Transmission Control Protocol.
UDP Frames	Frames containing Layer 4 User Datagram Protocol.
Pause Frames	Pause flow control frames.
Frame Gap	IPG/IFG delay between successive frames.
Avg Service Disruption Events	Average duration of packet intervals.
Latency	Latency measurement.
LOS	Loss of Signal (Seconds).
LOSync	Loss of Synchronization; count of Events, Aggregate totals, Minimum/Maximum/Current/Average
IP Checksum Error	Number of IP checksum errors received.

TCP Checksum Error	Number of TCP checksum errors received.
UDP Checksum Error	Number of UDP checksum errors received.
Lost SN Error	Frames where the Sequence Number was lost
Out of Sequence Error:	Frames which arrive out of numerical sequence.

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Thoughput Stream Results *Home*

- Results apply to the stream number highlighted at the top of the screen.
- Press another stream button to see results for another active (orange) stream.
- For information about frame component usage, see the Ethernet Technology Overview.

Statistic	Details
Total Frames	Number of received/transmitted frames.
Total Bytes	Number of received/transmitted bytes. • Frame Rate Current (fps), Average (fps), Minimum (fps),Maximum (fps) • Utilization Current (%)/Average (%)/Minimum (%)/Maximum (%)
Line Rate	Transmitted and Received data rates.
Data Rate	Transmit data rate (in kbps, bps, etc.). The data rate includes the frame headers but not the *IPG* or Preamble. Thus, the data rate reflects both the frame rate and frame size.
Frame Sizes	Count of frames of each size. • Frame Size Under 64 Bytes/64 Bytes/65-127/128-255/256-511/512-10234/ 1024-1518/ Over 1518 Bytes

Test Frames

For the following test frame types, view the frame count or **Current** frame rate (frames per seconds) and the **Average** frame rate (fps). Counts and rates may show for the Transmit and/or Receive directions. Not all statistics will show for all ports or setups.
See the Aggregate Results for the most of the statistics. Here are a few differences

Statistic	Details
Bit Error	Count of bit errors.
Current Bit	Count of the number of bit errors since the beginning of the test.
Bit Error Ratio BER	Bit error ratio since the beginning of the test.
LOP(s)	Count of number of seconds containing Loss of Pattern.
No *BERT* Traffic (s)	Seconds containing no BERT traffic.

Frame Interval Average*: The frame interval averaged all received frames.*
Frame Interval Technology Note

Frame Interval Minimum: Smallest frame interval observed during the measurement.
Frame Interval Maximum: The maximum frame interval observed during the measurement.

Frame Interval Variation: The maximum frame interval minus the minimum frame interval. This measurement is equivalent to a one-point frame delay variation or frame jitter measurement.

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Throughput Non Test Stream Results Home

Non Test Stream traffic gives statistics on traffic which does not meet the Stream Table configurations.

Totals

Statistic	Details
Total Frames	Number of received/transmitted frames.
Total Bytes	Number of received/transmitted bytes. • Frame Rate Current (fps), Average (fps), Minimum (fps),Maximum (fps) • Utilization Current (%)/Average (%)/Minimum (%)/Maximum (%)
Line Rate	Transmitted and Received data rate (in kbps, bps, etc.). The data rate includes the frame headers but not the IPG or Preamble. Thus, the data rate reflects both the frame rate and frame size.
Data Rate	Transmit data rate (in kbps, bps, etc.). The data rate includes the frame headers but not the IPG or Preamble. Thus, the data rate reflects both the frame rate and frame size.
Frame Sizes	Count of frame types of each size. • Frame Size Under 64 Bytes/64 Bytes/65-127/128-255/256-511/512-10234/ 1024-1518/ Over 1518 Bytes

Test Frames

For the following test frame types, view the frame count or **Current** frame rate (frames per seconds) and the **Average** frame rate (fps). Counts and rates may show for the Transmit and/or Receive directions. Not all statistics will show for all ports or setups.

- Unicast
- Multicast
- Broadcast
- Invalid MAC Frames
- Total VLAN Frames
- Single-Tagged VLAN Frames
- Multi-Tagged VLAN Frames
- IPv4/6 Frames:Count/Unicast/Multicast/Broadcast
- TCP Frames
- UDP Frames

Statistic	Meaning
Bit Error	Count of bit errors
Current Bit	Count of the number of bit errors since the beginning of the test.
Bit Error Ratio BER	Bit error ratio since the beginning of the test.
LOP(s)	Count of number of seconds containing Loss of Pattern.
No BERT Traffic	Seconds containing no BERT traffic.

(s)	
Frame Interval Minimum	Smallest frame interval observed during the measurement.
Frame Interval Maximum	The maximum frame interval observed during the measurement.
Frame Interval Variation	The maximum frame interval minus the minimum frame interval. This measurement is equivalent to a one-point frame delay variation or frame jitter measurement.
Frame Interval Technology Note	

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RFC2544 / NE Testing

RFC2544 Applications *Home*

XTT 5000 uses UDP echo request frames, as specified by RFC2544.
See the application diagram.

RFC2544 Throughput Test
RFC2544 is an automated test which will transmit a variety of frame lengths at different frame rates to find the optimal performance of the device under test (DUT). The signal configuration is the same as BERT, but without the need to specify frame length, traffic setting, or test pattern. The Test Layer selection and Stream Table for RFC2544 is identical to that for BERT.
To configure an RFC2544 throughput test, select RFC2544NE Test as the test mode on the drop down menu. Configure the Layer and Filter Selection (if desired). Only 1 stream is allowed.

RFC2544 NE Stress Test
In a Network Element (NE) stress test, tests are performed incrementally for each frame size. NE tests are particularly useful for longer burn-in tests.
To configure an NE stress test, select RFC2544.NE Test as the test mode on the drop down menu, then set the Test Mode to NE Test on the Test Sequence tab. On the Throughput Latency tab, set the Starting and Stop Rates as well as the Step Size.

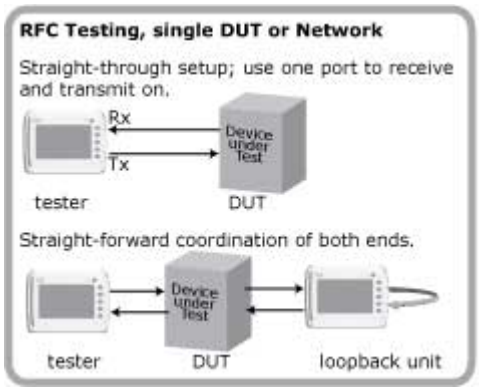
Press Apply then Start on the Action Bar to start a test.

Where do you want to go next?

RFC2544 Throughput Test Setup
RFC2544 NE Stress Test Configuration
RFC2544 Applications
RFC2544 Summary Results
IP Test Setup
Throughput Test Setup
Home

RFC2544 One Tester Application Diagram

Home



RFC2544 Throughput and NE Test Setup

Where do you want to go next?

RFC Applications
RFC2544 Throughput Test Setup
RFC2544 NE Stress Test Configuration
Home

RFC2544 Test Notes *Home*

Test Types Latency Frame Loss Rates

Test Layers

RFC2544 is designed for Layer 2 and Layer 3 devices. As such, each test frame must have a valid MAC header, preamble, and interpacket gap. For testing Layer 3 devices, such as routers, a valid IP header is also required.
Though VLAN support is not mentioned in RFC 2544, VLAN-based services should include the appropriate VLAN tags. Unframed testing, where the payload data is not encapsulated into a valid Ethernet frame, is not compatible with RFC2544 device testing.
XTT 5000 uses a frame payload that consists of a sequence number, a time stamp, and a test pattern specified by the user. The sequence number and time stamp are used to accurately measure lost frames and latency, respectively.

Frame Sizes

The standard frame sizes for Ethernet testing are 64, 128, 256, 512, 1024, 1280, and 1518 bytes. With systems that support jumbo frames, such as 4096- or 9000-byte frames, these frame sizes should be tested as well. The XTT 5000 defaults to the frame size defined in RFC 2544, but allows you to set the frame size to any valid value.

RFC2544 Test Types

Throughput

The throughput test determines the maximum frame rate without lost frames the DUT can manage. The test begins at 100% frame rate by sending a predetermined number of frames, or, more commonly, sending the frames for a predetermined length of time. If any frames are lost, the test is repeated at a lower frame rate. This process continues until the maximum throughput is determined.
Sunrise Telecom uses a binary search algorithm for determining the throughput. The standard test method reduces the throughput by a set increment, such as 10%. This is not the most efficient algorithm available especially for determining the throughput with a better resolution, such as 1%. The binary search changes the throughput value by ever decreasing increments: 50%, 25%, etc. The throughput is increased or decreased depending on the results of the previous test. The algorithm continues to run until the throughput is determined to within the specified resolution, typically 1% to 10%.

Latency

The standard latency test is to run test traffic at the predetermined throughput rate or two minutes, and measure the latency of a single tagged frame sent at least one minute into test. The reported latency is the average of twenty such tests.
Strict adherence to the standard would require 280 minutes, over four hours, to complete for all frame sizes. The XTT 5000 provides the option to instead perform a 'Quick Latency" test that eliminates the need to run a separate and time consuming latency test. During the throughput test, the latency of the test frames is measured

and averaged. Results from failed throughput tests are discarded. The latency results from the highest successful throughput test are kept and reported. Latency results as a function of frame size and throughput are tabularized.

Frame Loss Rate

The frame loss rate test plots the frame loss as a function of utilization. Similar to the throughput test, the test begins at 100% frame rate by sending a predetermined number of frames, and recording the percentage of lost frames. The bandwidth is reduced by a preset amount, 10% or less, and the test is repeated. If two successive trials result in no frame loss, the lower rates are not tested and assumed to have zero frame loss. This test is repeated for each frame size.

Where do you want to go next?

RFC2544 Throughput Test Setup
RFC2544 NE Stress Test Configuration
Home

RFC2544 Throughput Application *Home*

Test Notes

The following sample test presumes the use of an RJ-45 port for a RFC2544 throughput test. The test operates between two XTT modules or two test ports on the same module. Configure your RJ-45 or SFP port, then follow this procedure.
See the application diagram.

1. From the menu, select RFC2544/NETEST as the test type. The Test Sequence tab will open.
2. Configure the Test Sequence tab. Tap the button for each test you want to run.
   A. Select Throughput, Latency, and Frame Loss.
3. Configure the Throughput/Latency tab.
   Duration: Enter a Time of 10 seconds; longer values will increase testing time proportionately.
   When performing delay measurements over a network with more than 1 ms of delay, the average reported delay may be smaller than the minimum reported delay. Use the Maximum delay as the benchmark for delay testing.
   Starting Rate: 100%.
   Resolution: As desired—1% is typical.
4. Configure the Latency tab.
   - Select Frame Loss.
5. Configure the Frame tab.
   - Check 64, 128, 256, 512, 1024, 1280, and 1518.
   - Selecting fewer frames will decrease testing time proportionately.
6. Configure the Frame Loss tab.
   Duration: Enter a Time of 10 seconds; longer values will increase testing time proportionately.
   -- **Starting Rate**: 100%.
   -- **Step size**: As desired; 10% is typical.
7. Configure the second test port or the far end module with a software loopback as follows:
Menu test type: Loopback
--**Mode**: Manual
--**Layer**: Layer 2
8. Press Apply then Start on the Action Bar to start the RFC2544 tests. The Summary measurement window will open automatically after a few moments.

Where do you want to go next?

RFC2544 NE Stress Test Configuration
RFC2544 Applications
RFC2544 Summary Results
RFC2544 Thruput Latency Results
RFC2544 Frame Loss Chart Results
Aggregate Results
Home

RFC2544 Test Sequence *Home*

Select RFC2544/NE Test as the test type on the Menu to perform RFC-2544 tests. Use the 'Loop Control' () button to set a loop if necessary.

Left Column - Test Basics

Type: Determine the type of RFC2544 test to perform.

- An **RFC2544** test tests a device by transmitting various frame lengths at different rates to find the maximum throughput rate.
- An **NE** test stresses a NE at a variety of rates, which you define.

Run Continuously: N/A. The RFC2544 test will run continuously when this is set to On.

- Once the test sequence is completed, the module will run the sequence again without saving the test results. This allows RFC2544 to be used as a long term test.

Estimated Test Time: View an estimation of how long it will take to run theselected tests, in a days, hours, minutes format.54qaz\`z`QRFTG12Choose the Tests to Run **To select a throughput or NE test to run**, press its button to turn it On. The Estimated Test Time reflects the predicted test run time for the tests selected.

- You may run several tests in sequence.

Trial Description	Set at On, the RFC2544 Trial Description runs before the main test starts. If it fails, no further testing occurs.
Throughput	This test uses a binary search to determine the maximum traffic rate (expressed as a percentage) the DUT can pass without losing any frames.
Latency	Determines the round trip delay of the frame through the DUT. **Latency Mode**: • **Standard** follows the guidelines of RFC 2544, which can take several hours for a complete test. • **Quick** measures the round trip delay while it is performing the Throughput test and takes no extra time. Results from failed throughput tests are discarded, and only the results from the highest successful throughput test are kept and recorded.
Frame Loss	Generates a table that shows the percentage of lost frames as a function of frame rate, expressed as a percentage.
Back to Back	Determines the maximum number of frames sent back to- back at 100% frame rate that the DUT can process without losing frames
DUT Type	Select the type of far end device under test: ROUTER or BRIDGE.

Multi-Port

View or set the port connections. RFC-2544 tests require the use of two ports. RFC 2544 may be run between two different ports such as:

XFP - SFP
XFP - RJ-45
SFP - SFP
SFP - RJ-45

RJ-45 – RJ-45

- If you need to change the connection, touch first the TX port, then the RX port you want to have work with it.
- Pair the TX port with the matching RX port, unless otherwise indicated by your design.
- Active ports are shown in green; you may not reassign those ports.

The most common method of using RFC2544 for testing Ethernet services, as opposed to Ethernet devices, is to transmit frames through the network to the far end, where they are looped back and sent back to the test module. In this configuration, the TX and RX test port should be the same.

However, there are times when the TX and RX test port need to be different, such as when testing a switch or when the TX and RX line rates are different. For example, if you were to transmit from a 10GE port to a GE port, the throughput rate couldn't be higher than 10%, since 1 Gigabit Ethernet is 10% of the bandwidth of 10 Gigabit Ethernet.

Where do you want to go next?

RFC2544 Throughput Test Setup
RFC2544 NE Stress Test Configuration
RFC2544 Applications
RFC2544 Summary Results
IP Test Setup
Throughput Test Setup
Home

RFC2544 Throughput Latency *Home*

Select RFC2544/NE Test as the test type on the Menu to perform RFC-2544 tests.

Set the Throughput/NE parameters, and the Latency parameters. Press  to save the configuration.

Throughput - NE

Parameter	Options	Details
Duration	TIME FRAMES	Set how measurements will be taken. TIME: Base measurements on a length of time. FRAMES: Base measurements on a number of frames
Frames	• N/A FE • GigE Options: 10,000-1,000,000 • 10GE Options: 10,000-10,000,000	Duration = Frames
Time	4-60 seconds	Duration = Time
Starting Rate	.01-100%	Set the rate at which frames will begin being transmitted. • 100% is a good starting rate for a standard RFC test, recommended in RFC 2544. • For NE testing, select the rate applicable to your setup.
Stop Rate (N/A RFC2544 test)	01-100%	Set the rate at which frames will stop being transmitted. 100% is typical.
Resolution (N/A NE Test)	01-100%	Determine measurement precision. • 1% is typical; you can go as precise as .01% (very precise tests take longer to run). • The search algorithm continues until the step between two consecutive tests is lower than this specified resolution.
Rate Step Size * (N/A RFC2544 test)	01-100%	Each step increases (or decreases) the traffic rate by the specified amount. The NE Test tests the throughput and/or latency at different test rates and gives the result for each one.
*RFC2544 specifies a default resolution of 10%. This means if the true throughput rate of the DUT was 98.5%, the test would report 90%. In some cases, higher precision is required, hence the default for the test set is set to 1.0%. Make sure to set the Starting and Stop Rates when configuring an NE test.		

Latency

Parameters	Options	Details
Latency	**Standard** follows RFC 2544 guidelines, which can take several hours for a complete test. **Quick**: Performs the latency test at the same time as the Throughput test.	Determine the round trip delay of the frame through the DUT. The Quick test takes no extra time.

Standard Latency

Latency measures the time it takes for the test frame to pass through the device under test. The latency of each frame is measured.
Duration: Determine for how long each frame size will be transmitted.
See the **Starting Rate**, **Stop Rate** parameters above.
Rate Step Size (N/A RFC2544 test): Each step increases (or decreases) the traffic rate by the specified amount. The NE Test tests the throughput and/or latency at different test rates and gives the result for each one.
Warm-up: Determine the amount of time to transmit frames before taking the latency measurement.


RFC 2544 recommends 60 seconds.
Repetitions: Determine the number of repetitions taken for averaging.


RFC 2544 recommends 20 repetitions.

Where do you want to go next?

RFC2544 Applications
RFC2544 NE Stress Test Configuration
RFC2544 Summary Results
Home

RFC2544 NE Test Configuration *Home*

Test Notes
See the application diagram.

RFC2544 NE Stress Test

To stress an RFC2544 network element, tests are performed incrementally for each frame size. This is a burn-in test.

1. Tap the Menu button, and select RFC2544/NE TEST.
2. On the Test Summary tab:
   - Tap Type and select NE TEST.
   - Tap Throughput to turn that test On.
3. On the Throughput tab, set
   Starting Rate: 10%
   Stop Rate: 100%
   Step size: 10%
4. Press 'Start' in the Action Bar to being the test.
5. View the results.

Where do you want to go next?

RFC2544 Throughput Test Setup
RFC2544 Applications
RFC2544 Summary Results
Home

RFC2544 Frame Sizes Thresholds *Home*

XTT 5000 defaults to the standard frames sizes: 64, 128, 256, 512, 1024, 1280, 1518, 4096, 8192, 12,000.
The Frame Length row shows frame sizes in bytes.

- Check the corresponding box above for each frame size you want to test.
- The default frame sizes are based on RFC 2544, but all are user-configurable.

To Edit Frame Sizes and Thresholds

1. Press 'Thresholds' at the bottom of the screen to enable thresholds.
2. Place a check in the box for each frame size you want to test.
3. Click on the Frame Sizes row you want to configure. The Frame Size & Thresholds window pops up.
    - 'Frame Length': Set the required frame size using the number pad.
      Options: 34-12,000 frames.
    - 'Throughput': Configure the required Throughput percentage using the number pad.
      Options: 1-100 percent.
    - 'Latency (ms)': Configure the allowable Latency, using the number pad.
      Options: 1-100 ms
    - On the Frame Size & Thresholds window, touch 

.

Non-standard (user) frame sizes are used to test frame sizes that are outsized, such as a jumbo or undersized frames.

When testing with VLAN and/or MPLS tags, 64 bytes is no longer a proper frame length, and it does not appear on the list of frame sizes. However, it can be added using the Custom Frame Size field.

Press the 

button when you are ready to save the configuration.

These thresholds have no direct effect on the RFC2544 Throughput or Latency results. They are intended to go beyond the RFC2544 standards and provide a means to standardize minimum acceptable results of these tests.
Select RFC2544/NE Test as the test type on the Menu to perform RFC-2544 tests.

Where do you want to go next?

RFC2544 Throughput Test Setup
RFC2544 NE Stress Test Configuration
RFC2544 Applications
RFC2544 Test Sequences
RFC2544 Summary Results
Home

RFC2544 Back-to-Back Testing Notes *Home*

At the start of the test, the XTT 5000 will send frames back-to-back for the specified duration.

- If the test runs without losing frames, the duration will be increased and the test redone until frames are lost or until the maximum duration is reached.
- If frames are lost, the duration will be reduced until no frames are lost.
- This cycle will continue until the specified resolution is reached.
- Once completed, this is counted as one repetition; the test is then repeated, starting at the original duration, for the number of repetitions specified.

Where do you want to go next?

RFC2544 Back-to-Back Setup
RFC2544 Throughput Test Setup
RFC2544 NE Stress Test Configuration
RFC2544 Applications
RFC2544 Summary Results
Home

RFC-2544 Frame Loss & Back to Back Setup *Home*

Configure the RFC-2544 frame loss and back-to-back tests. Press  to save the configuration.

Frame Loss - NE

Parameters	Options	Details
Duration	**Time**: Base measurements on a length of time (1-99,999 seconds), which you enter at the 'Time' button. **Frames** (N/A FE): Base measurements on a number of frames, which you enter at the 'Frames' button.	Set how measurements will be taken.
Starting Rate	.01-100%	Set the rate at which frames will begin being transmitted.  The rate recommended by RFC2544 is 100%.
Rate Step Size	.01-100%	Determine the size (percentage) of each rate step. • The RFC 2544 default is steps of 10%.

Back to Back

Back-to-Back testing determines the maximum number of frames sent back-to-back at 100% frame rate that the DUT can process without losing frames.
Back-to-Back Testing Notes

Parameters	Options	Details
Time Duration	2-100 seconds	Enter the amount of time the frames will be sent initially.
Max Duration	2-100 seconds	Enter the longest amount of time, in seconds, the frames will be sent back-to-back. • In a perfect network, the duration is infinite, so the maximum duration is used to place a realistic cap on the time it takes to run the test.
Repetitions	1-100	Enter the number of times the test will be run. • The average result will be taken over all repetitions. Each repetition of the test can include many cycles of changing the duration and the number of frames sent.

Where do you want to go from here?

RFC2544 Latency Configuration

RFC2544 Applications
RFC2544 Throughput Test Setup
RFC2544 NE Stress Test Configuration
RFC2544 Summary Results
Working Desktop
Home

Stream Table Setup *Home*

- Each stream may be configured independently. See Auto Fill to configure multiple streams.
- Throughput tests support up to 16 streams. RFC 2544 tests support one stream.
- Visit the Technology Overview for information on frame components and more.

To configure a stream, tap a stream row. The Stream Number X window will pop up, for configuring the stream in detail. When there are multiple streams, the window will have scroll arrows for moving between Stream Number x windows. The Frame Setup tab appears on top. Configure each tab on the window.

MAC in MAC^	MAC	VLAN	MPLS	IP	TCP	UDP	Payload	Traffic Shape*: Constant, Ramp, Burst
^Available at a future date.				*Traffic shaping is not available in Layer 1, Unframed mode.				

Rx Filter: Filter on received messages.

Stream Table Buttons

Button	Function
'Structure'	Tap a frame element in the table to configure the frame.
'Total Streams'	View/set the number of streams in use. Use the Total Streams keypad to enter a new quantity (1-16) of streams for the table if necessary. The number in use is shown on the 'Streams' button.
'Remove'	Delete the highlighted stream and reduce the total number of streams by one.
'Auto Fill'	Automatically fill in the addresses of all streams in the table.

'TPID/BERT ID' **Note**: This is a global settings; all BERT streams get the same ID.	Edit the TPID directly in the field if required; applies only when VLAN is in use.
	• 8100 is the standard IEEE 802.1Q/802.1P value.
	  • A TPID is available for each VLAN.
	  Technology: VLAN Tagging
	  BERT ID: Ox40 to 0x8100.
	• The XTT 5000 place the BERT ID value in the IP Header (Identification field) s, the tester can easily identify whether IP traffic is BERT traffic or not.

Where do you want to go next?

Configure the frame
Throughput Applications
Throughput Summary Results
Throughput Aggregate Results

Throughput Stream Results
Throughput Test Setup
Working Desktop
Home

RFC2544 Summary Results *Home*

View the overall RFC2544 results, including a Status report, such as "Pass" or "Fail" NE test results include the throughput status for each frame rate, with "Pass" or "Fail" result.
For Throughput, the "Pass/Fail" message is an indication of whether or not any frames were lost during the test. This has no bearing on the Thresholds set in the configuration.

Left Side Results Table

Statistic	Meaning
Seq#	Sequence number denoting the order and repetitions of the tests.
Test	Type of test.
Size	Frame size under test.
Rate	The throughput rate currently being tested is reported, in percentage of bandwidth.
Frames	Number of frames tested. Applies to Back-to-Back frames test.
Status	Test status; pass/fail, percentage of frames lost.

Status

Statistic	Meaning
RT	Remaining Time for the test in progress. Once the test is completed, the results of the test will be indicated.
TX Utilization	Transmitted percentage bandwidth utilization
TX Line Rate	Transmitted data rate (in kbps, bps, etc.).
TX Data Rate	Transmit data rate (in kbps, bps, etc.).
RX Utilization	Received percentage bandwidth utilization.
RX Line Rate	Receive data rate (in kbps, bps, etc.).
RX Data Rate	Receive data rate (in kbps, bps, etc.).

Signal

The signal information for optical interfaces (vendor, wavelength, optical power, etc.) is provided by the SFP module. Not all manufacturers supply this information, and Sunrise Telecom Inc. is not responsible for modules provided by other vendors.

- **Vendor**: Name of the vendor;
- **Wavelength**: Optical wavelength is use at the port.
- **RX Optical Power**: Received uW and dBm.

Where do you want to go next?

RFC2544 Summary Results

RFC2544 Throughput Latency Results
RFC2544 Throughput Chart Results
RFC2544 Aggregate Results
RFC2544 Throughput Test Setup
RFC2544 NE Stress Test Configuration
RFC2544 Applications
Home

RFC2544 Thruput Latency Results *Home*

View the throughput and latency results for each selected frame size, in tabular form. Latency results are shown by frame size and throughput.

- **Quick Latency**: Results from the highest successful throughput test.
- **Standard Latency**: Runs traffic at the set throughput rate for two minutes, measuring the latency of a single tagged frame sent a minute into the test; the reported latency is the result of twenty such tests.

Frame Size: Frame size, in bytes.
Throughput: Throughput **Percentage**, and In Progress/Pass/Fail/No Link **Status**.

- The rate passes if it meets or exceeds the Throughput standard.

Latency: View the **Average**, **Maximum**, and **Minimum** latency results in microseconds, and the link **Status** for each frame size.

Where do you want to go next?

RFC2544 Summary Results
RFC2544 Throughput Chart Results
Aggregate Results
RFC2544 Throughput Test Setup
RFC2544 NE Stress Test Configuration
RFC2544 Applications
Home

RFC2544 Frame Loss Table Results *Home*

- View the percentage of frames of each size lost for the indicated input rate.
- Frames are plotted as a function of bandwidth utilization.
- See the Frame Loss Chart for a graphical representation of the results.

Where do you want to go next?

RFC2544 Throughput Test Setup
RFC2544 NE Stress Test Configuration
RFC2544 Applications
RFC2544 Summary Results
IP Test Setup
Throughput Test Setup
Home

RFC2544 Back-to-Back Table Results *Home*

This function determines the maximum number of frames sent back-to-back with minimal IPG (in other words, at 100% frame rate) that the DUT can process without losing frames.
The test begins with a specified number of frames and repeats with more or fewer frames until it determines the maximum number. As always, this is repeated for each frame size.

- The Average, Minimum, and Maximum number of frames processed without error for each frame size is shown in the table.

Where do you want to go next?

Configure an RJ-45 port.
Configure an SFP port.
Meas. Setup: Configure measurement parameters
Throughput Test Setup
RFC2544/NE Applications
IP Test Setup
Monitor Setup
Loopback Test Setup
Home

RFC2544 Thruput Chart Results *Home*

The graph presents Throughput results.

- Horizontal axis: Size of each frame under test
- Vertical axis: Frame rate (percentage of 100% maximum).

Each result is the maximum throughput rate for the frame size.

See the Throughput/Latency tab for exact values.

If you use very small values, you will need to zoom in to see the results.

Where do you want to go next?

RFC2544 Summary Results
RFC2544 Throughput Latency Results
RFC2544 Throughput Chart Results
RFC2544 Aggregate Results
RFC2544 Throughput Test Setup
RFC2544 NE Stress Test Configuration
RFC2544 Applications
Home

Aggregate Results *Home*

View information on errors received, and frame statistics, for a Throughput, Monitor, Ping, or RFC2544 test.

- For the following test frame types, view the frame count or **Current** frame rate (frames per seconds, the **Average** frame rate (fps) at which the error was received, and possibly the **Utilization** rates (percentage of bandwidth). Counts and rates may show for the Transmit and/or Receive directions.
- Not all statistics will show for all ports or setups.
- In Live and Monitor Test Modes, only Receive Statistics appear.
- For information about frame component usage, see the Ethernet Technology Overview.

Total Frames	Number of received/transmitted frames.
Total Bytes	Number of received/transmitted bytes.
Frame Rate Current / Average / (fps)	Current rate at which frames are being transmitted and received at this second.
Frame Rate Minimum / Maximum (fps)	Minimum or maximum transmitted and received frames per second since the beginning of the test.
Line Rate	Transmitted and Received data rates.
Data Rate	Transmit data rate (in kbps, bps, etc.). The data rate includes the frame headers but not the IPG or Preamble. Thus, the data rate reflects both the frame rate and frame size.
Utilization Current (%)	Percentage of current/average/Minimum/Maximum bandwidth in use.
Frame Sizes	Count of frames of each size: Under 64 Bytes/64 Bytes/65-127/128-255/256-511/512-10234/ 1024-1518/ Over 1518 Bytes (aka jumbo frames). *Undersized Frames Tip*
Bit Error	Count of the number of bit errors since the beginning of the test.
Service Disruption	Packet interval (ms) detected during the measurement. This is a very precise disruption measurement.
Non Test Traffic	Number of received frames that do not match the ports Stream Table, such as live traffic. Multicast and broadcast frames are reported as non-test frames. Consult the Stream Table.
Pause Frames	Count of received pause frames.
FCS / CRC Errors	Frame Check Sequence or Cyclic Redundancy Check errors.
Unicast	Count of Layer 2 Unicast frames transmitted and received.
Multicast	Count of Layer 2 multicast frames transmitted and received.

Test Frames	Count of Frames which match the Stream Table.
Non Test Frames	Count of Frames that do not match the ports Stream table, such as live traffic. Multicast and broadcast frames are reported as non-test frames. Consult the Stream Table.
Unicast Test Frames	Count of unicast test frames.
Broadcast Test Frames	A broadcast frame is a frame that is intended for all of the devices on the network, the destination MAC address is set to 'FF-FF-FF-FF-FF-FF'.
Keep Alive Mac Frames	Count of frames with MAC Keep Alive frames.
Invalid Mac Frames	Count of frames with invalid MAC addresses.
Good Frames	Count of unerrored frames.
Error Frames	Count of errored frames.
Frame Rate Current (fps)	Number of frames currently received per second.
Total VLAN Frames	Frames containing VLAN tags.
Single-Tagged VLAN Frames	Frames containing one VLAN tag.
Multi-Tagged VLAN Frames	Frames containing more than one VLAN tag**.**
MPLS Frames	Frames containing MPLS tags.
IPv4 Frames Frame Rate	IP version 4 frames.
Unicast IPv4 Frames	Unicast IP version 4 frames.
Multicast IPv4 Frames	Multicast IP version 4 frames.
Broadcast IPv4 Frame	Broadcast IP version 4 frames.
IPv6 Frames	IP version 6 frames.
Unicast IPv6 Frames	Unicast IP version 6 frames.
Multicast IPv6 Frames	Multicast IP version 6 frames.
TCP Frames	Frames containing Layer 4 Transmission Control Protocol.
UDP Frames	Frames containing Layer 4 User Datagram Protocol.
Pause Frames	Pause flow control frames.
Frame Gap	IPG/IFG delay between successive frames.
Avg Service Disruption Events	Average duration of packet intervals.
Latency	Latency measurement.
LOS	Loss of Signal (Seconds).
LOSync	Loss of Synchronization; count of Events, Aggregate totals, Minimum/Maximum/Current/Average
IP Checksum Error	Number of IP checksum errors received.

TCP Checksum Error	Number of TCP checksum errors received.
UDP Checksum Error	Number of UDP checksum errors received.
Lost SN Error	Frames where the Sequence Number was lost
Out of Sequence Error:	Frames which arrive out of numerical sequence.

Where would you like to go next?

Throughput Applications
Ethernet Frame Type
Throughput Summary Results
Throughput Aggregate Results
Throughput Stream Results
Throughput Test Setup
Home

IP Ping Testing

IP Testing *Home*

The IP test tests end-to-end connectivity between active IP stations, providing various performance related statistics. This feature includes four generic testing methods (IP Test Types) for IP networks:

- **Ping Test**: Commonly used to discover whether two remote LAN segments, using TCP-IP protocol, are connected
- **Trace Route Test**: Trace the route to the far end device
- **FTP:** Web transfer testing.
- **HTTP**: Web access testing.

Ping and trace route tests typically requires two XTT 5000 modules, or a XTT 5000 and a MTT-28 or -29 module. However, the ping test can also be used to ping a distant router directly, provided its IP address or URL are known, and the end router has been configured to respond to pings. Also note that some networks are set to not allow ping packets through. In that case, this test will not provide useful results.
See the application diagram.

Caution: If you are sending packets to your responder via a router or other device with its own IP address, make sure to set the Dst MAC to the MAC address of the router, NOT the responder. Otherwise, the router will likely discard the packets (without ARP in use).If you are staying down at layer 2 (MAC) this does not apply. IP works fine if all the devices are on the same local network segment; this is applies when sending traffic off your local network segment.
To perform IP testing, select IP TEST from the menu.

IP Ping Test Application

1. From the drop down menu, select IP TEST as the test type.
2. Configure the port.

RJ-45 - Fast Ethernet
Augo-Negotiation: On
Port Rate: Match the rate of the line under test; 10M, 100M, 1000M
Port Duplex: Full
Pause: OFF
RJ-45 Polarity: AUTO
Pause Frame Delay: 0 ms

SFP - Gigabit Ethernet
Interface: Gigabit Ethernet or 100Base FX; different parameters apply
Augo-Negotiation: On
Port Rate: Match the rate of the line under test; 10M, 100M, 1000M
Pause: Off
Asymmetric Pause: Off
Pause Frame Delay: 0 ms
Laser: On

2. Configure the IP Setup tab:

IP Test Type: PING.
Source IP Mode: Select the network *addressing system* as required

- If connected to a DHCP network, selecting DHCP will configure the IP Address, Subnet, Gateway, and possibly DNS if Auto (DHCP) is checked as well. If Auto (DHCP) is not checked, then a static IP address must be entered, as well as the Subnet mask and Gateway.
- For DHCP networks, see the Details field for more information.
  Note: The DHCP Status, if enabled, will appear in the DHCP Status field.
- Configure the remaining IP Setup items for Static Source IP Mode.

STATIC SOURCE IP MODE Parameters

Source IP Address:Enter the unit's IP source address.
Gateway: Enter the STT gateway address. If there's no gateway, enter 000.000.000.000.
Subnet: Enter the STT subnet mask value. 255.255.255.000 is the most common value.
DNS: Enter the IP address of the DNS server. This is only required when you wish to ping a URL rather than an IP address.
VLAN: If required, select 1-3 VLAN tags, and configure them appropriately.

Procedure, continued

3. Select the Ping Setup tab.
Ping Delay: 50-1000 ms; this is the delay between pings—affects the rate.
Ping Rate: 1-20; this is the rate at which pings are transmitted. Typical values used are 500 ms delay of 2 pings per second. This is read only, based on the Ping Delay setting.
Frame Length: Enter the length of the ping; 64 bytes is common.
 # Ping Packets: Enter a number of pings of which the test will consist; 4 is common, though
Continuous: Send pings continuously**.** Continuous is also used frequently.
Time to Live (TTL): Enter the Time to Live value (in hops).
Time Out: Enter the time-out period, in seconds
Ping of Death: Set to Off..
Destination IP Address: Use the Number Pad to enter the IP address to send the ping to.
4. Press  then  on the Action Bar to begin the IP test. Measurement windows include: Ping Result, Ping Details and TX and RX Statistics.

- Look for the Ping messages in the Status field. This lets you track the progress of the test.
- View the Ping results on the right side of the window, under Round Trip and
- Ping Results.
- Go to the Ping Detail tab to get additional details on the transmitted ping packets.

Where do you want to go next?

IP Test Setup
IP Testing
Throughput Test Setup
RFC2544 Applications
Home

IP Setup Tab *Home*

IP Setup

Parameter	Options	Details
Source IP Mode	**DHCP**: The test port will obtain an IP source and gateway address from a DHCP server. A status field shows the message exchange, under 'Detail'. **Static**: Manually assign the network parameters;the port will use the same IP address each time it connects.	Set how the unit will obtain an IP source and gateway address. **DHCP Note**: Press 'Reset' to start the process over.
Source IP	Enter the static IP address to use for the test port.	Static only.
Gateway	Specify the gateway address.	Static only.
Subnet Mask	Specify the subnet mask.	Static only. The default is 255.255.255.0.
DNS	Specify the DNS server address.	Static only.
IP Test Type	Ping Test: Verify and test IP connectivity. Trace Route: See each hop of the test route; only a subset of the remaining items will apply.	Choose the type of IP test to run. Configure the test tab.

VLAN Setup

To add (turn On) VLAN tags, touch the corresponding VLAN button.

- Up to three VLANS are available.
- Enter the TPID, PPI, CFI, and VLAN ID for each VLAN; touch a button, then use the number pad to enter the data. See Tech: VLAN Tagging for technology information.

IP Test Basics

Select IP TEST as the test type from the menu, to perform an IP test. Select the IP Setup tab to configure the IP setup.

Where do you want to go next?

IP Testing
Throughput Test Setup
RFC2544 Applications
Tech: IP Overview
Home

Ping Setup *Home*

Verify connectivity to the far end network.

Parameter	Options	Details
Ping Rate pings/s	1-20 pings per second	Set the rate at which pings are sent.
Frame Length	**GigE, 100Base FX**: 64-1550 bytes **10GigE**: 68-3004 bytes	Set the length of the ping frame.
# Ping Packets	1-9999 pings, Continuous	Set the number of pings the module will send during the test.
Time to Live (TTL)	1-256 hops	Set the time to live. This places an effective maximum on the number of hops to the destination device.
Time Out	1-5 seconds	Set how long the XTT 5000 will wait for a response to a ping before timing out.
Destinations	1-10 destinations	Set the number of addresses pings will be sent to. A corresponding number of IP/URLs will become available.
Continuous	**On**: Green when active. **Off**: Red when switched off after being active.	Sends pings continuously for the duration of the test.

Destination IP/URL Selection

Touch a button to configure a ping destination; the number corresponds to the 'Destinations' setting.
For each ping destination, enter the DNS name/URL (e.g. www.pingme.org) or IP address (e.g. 123.123.123.23) on the number pad which pops up.

After pressing  on the number pad and returning to the Ping Setup screen, press 'Save' to save this address for future use.

IP/URL Buttons	
Save	Saves the current IP destination address(es) to a list for future use.
Restore	Select a previously saved IP address from a list.
Keyboard	**On**: When you click a Destination IP/URL button, it brings up a keyboard to type either number or letter. In this case you can enter URL: www.sunrisetelecom.com, or enter the IP address, such as 192.168.3.1 Off: Only a number pad appears for address entry; you can only enter numerical IP addresses, such as "192.168.3.1"

Ping Test Basics

Select IP TEST as the test type from the menu, then select PING as the IP Test Type on the IP Setup tab, in order to send an ICMP echo message of "echo request" to another device.
Select the Ping Setup tab to configure the IP setup.

Where do you want to go next?

IP Test Setup
IP Testing
Throughput Test Setup
RFC2544 Applications
Home

IP Summary Results *Home*

The top left of the window displays test status:
Elapsed Time: How long the test has been running.
Remaining Time: How long remains in the scheduled test, or Continuous.
Banner: A message summary banner of the status of the test. It reports any errors or alarms, along with a date and time stamp.
Below the banner, view a list of logged events: received errors and/or alarms, e.g. Lost Frame, including a count of the number of errors, with a resolution of one second.

The right side of the window shows more specific results.

Status

Even though the test set generates pings, there are circumstances which cause the pings not to be sent. For example, the port could lose link or be paused, preventing the transmission of the Ethernet frames in which the ping packets reside. In these situations, the number of pings sent will not be displayed to avoid confusion.

Parameter	Details
TX Utilization	Transmitted bandwidth as a percentage of maximum traffic rate (minimum frame gap)
TX Line Rate	Transmitted bit rate (in kbps, bps, etc.) of the Ethernet frames, ignoring the frame gap, preamble, and SAD. The data rate is always less than the line rate.
TX Data Rate	Transmit data rate (in kbps, bps, etc.). This includes the frame headers but not the IPG or Preamble. Thus, the data rate reflects both the frame rate and frame size.
RX Utilization	Received bandwidth as a percentage of maximum traffic rate (minimum frame gap).
RX Line Rate	Received bit rate, based on the current utilization (in kbps, bps, etc.).
RX Data Rate	Received bit rate of the Ethernet frames, ignoring the frame gap, preamble, and SAD. The data rate is always less than the line rate (in kbps, bps, etc.).

Press  on the Action Bar to start a test.

Where do you want to go next?

Ping Trace Route Results
Ping Test Results
IP Test Setup
IP Testing
Throughput Test Setup
RFC2544 Applications
Home

IP Aggregate Results *Home*

View information on received errors, and presents frame statistics.
The top line of the results tables shows you the port number and the type of test the statistics are for (e.g: PING or TRACEROUTE).
Both the specific count of the error and the average rate at which the error was received may be displayed for each type of error. Frame statistics are shown for both the transmit direction and the receive direction, as appropriate.
For both the Transmit and Receive directions, view the Total number of frames transmitted/received, and the Current, Minimum, Maximum and Average Frame Rates, as well as the Current, Minimum, Maximum and Average Data Rate. Results are aggregate totals since the beginning of the test, for all test streams and live traffic.

Statistic	Details
Total Frames	Number of received/transmitted frames.
Total Bytes	Number of received/transmitted bytes.
Frame Rate	Transmitted and received frames per second. **Frame Rate Current**: Current rate at which frames are being TX and RX at **Frame Rate Average**: Average transmitted and received frames per second over the duration of the test. **Frame Rate Minimum**: Minimum TX and RX frames per second since the beginning of the test. **Frame Rate Maximum**: Maximum TX and RX frames per second since the beginning of the test.
Utilization	Percentage of bandwidth in use: **Current**, **Maximum**, **Minimum**, and **Average** usages.
Line Rate	Transmitted bit rate, based on the current utilization.
Data Rate	Transmitted bit rate of the Ethernet frames, ignoring the frame gap, preamble, and SFD. The data rate is always less than the line rate.
Frame Size Under 64 Bytes	Number of undersized/fragmented frames with a length of less than 64 bytes. Some VLAN and MPLS frames may be undersized even if they fall within standard Ethernet frame sizes. For example, a 64-byte frame with VLAN is too short—the length must be at least 68 bytes. • For Unframed tests, only Bit Errors are reported.
FS 64 bytes	Count of frames with a length of 64 bytes.
FS 65-127	Count of frames with a length of 65-127 bytes.
FS 128-255 bytes	Count of frames with a length of 128-255 bytes.
FS 256-511	Count of frames with a length of 256-511 bytes.
FS 512-1023	Count of frames with a length of 512-1023 bytes.
FS 1024-1518	Count of frames with a length of 1024-1518 bytes.
FS Over 1518	Count of jumbo frames with a length of 1519 or more bytes.
Test Frames	View statistics on frames matching the stream table.

	Frame Rate Current (fps):Current rate at which frames are being transmitted and received at this second. **Frame Rate Average (fps)**: Average transmitted and received frames per second over the duration of the test. **Utilization Current (fps)**:Current percentage of bandwidth in use. **Utilization Average (fps)**:Average Percentage of bandwidth in use.
Non Test Frames	Number of received frames that do not match the ports Stream Table, such as live traffic. Multicast and broadcast frames are reported as non-test frames. **Frame Rate Current (fps)**:Current rate at which non-test frames are being transmitted and received at this second. **Frame Rate Average (fps)**: Average transmitted and received non-test frames per second over the duration of the test. **Utilization Current (fps)**:Current percentage of non-test bandwidth in use. **Utilization Average (fps)**:Average Percentage of non-test bandwidth in use.
Unicast	Number of Layer 2 unicast frames transmitted and received. View the **Current** and **Average Unicast Test Frame rates**, and the **Current** and **Average unicast bandwidth utilization**.
Multicast	Number of Layer 2 multicast frames transmitted and received. Multicast Test Frame rates, and the Current and Average multicast bandwidth utilization.
Broadcast Test Frames	Number of broadcast frames transmitted and received. A broadcast frame is a frame that is intended for all of the devices on the network, the destination MAC address is set to 'FF-FF-FF-FF-FF-FF'. View **Broadcast Test Frame rates** and the **Current** and **Average multicast bandwidth utilization** statistics.
Invalid MAC Frames:	Number of MAC frames which don't match the Stream Table. View **Invalid MAC Frames Current and Average Frame rates,** and the **Current** and **Average Invalid MAC Frames bandwidth utilization** statistics
Good Frames	Number of frames which match the Stream Table. View **G**ood Frames **Current and Average Frame rates,** and the **Current** and **Average Good Frames bandwidth utilization** statistics.
Error Frames	Number of frames containing errors. View **Error Frames Current and Average Frame rates,** and the **Current** and **Average Error Frames bandwidth utilization** statistics.
Total VLAN Frames	Number of frames containing VLAN tags. View **Total VLAN Frames Current and Average Frame rates,** and the **Current** and **Average Total VLAN Frames bandwidth utilization** statistics.
Single Tag	Number of frames containing exactly one VLAN tag.

VLAN Frames	View **Single Tag VLAN Frames Current and Average Frame rates,** and **Current** and **Average Single Tag VLAN Frames bandwidth utilization** statistics.
Multi-Tagged VLAN Frames	Number of frames containing exactly more than one VLAN tag. View **Multi-Tagged VLAN Frames Current and Average Frame rates,** and the **Current** and **Average Multi-Tagged VLAN Frames bandwidth utilization** statistics.
MPLS Frames	Number of frames containing MPLS labels. View **MPLS Frames Current and Average Frame rates,** and the **Current** and **Average MPLS Frames bandwidth utilization** statistics.
IPv4 Frames	Number of frames containing version 4 IP. View: **IPv4 Frames Current and Average Frame rates IPv4 Current** and **Average IPv4 Frames bandwidth utilization** statistics. **IPv4 Multicast Current** and **Average Frame Rates**, as well as Current and Average **utilization** rates. **IPv4 Broadcast Current** and **Average Frame Rates**, as well as Current and Average **utilization** rates.
TCP Frames	Number of frames containing TCP. View **TCP Frames Current and Average Frame rates,** and the **Current** and **Average TCP Frames bandwidth utilization** statistics.
UDP Frames	Number of frames containing TCP. View **UDP Frames Current and Average Frame rates,** and the **Current** and **Average UDP Frames bandwidth utilization** statistics
Pause Frames	Count of received pause frames.
Frame Gap	View the **Minimum**, **Maximum**, and **Average** frame gap. The minimum IPG is 12 bytes or 96 bit times.
Service Disruption Events	Count of received service disruptions. **Service Disruption Duration**: The longest packet interval detected during the measurement is displayed in microseconds. **Service Disruption Min/Max/Avg**: Minimum, Maximum, and Average disruptions.
Latency Min/Max/Avg	Measures the time it takes for each test frame to pass through the device under test. Sunrise Tagging required. View Minimum, Maximum, and Average statistics. These measurements assume a loopback at the far end. If you have two units back to back, the latency results will be erroneous.
LOS	Count of the number of times signal has been lost (LOS).
LOSS	Count of seconds of loss of signal: Minimum, Maximum, Current and Average.
LOSync	Count of the number of times synchronization has been lost View the Seconds and Min, Max, Current, and Average counts of LOSync.
FCS/CRC	Count of frames containing FCS/CRC error codes.

Error	**FCS/CRC Error Current and Average Frame rates,** and the **Current** and **Average FCS/CRC Error bandwidth utilization** statistics.
IP Checksum Error	Count of frames containing **IP Checksum** error codes. **IP Checksum Error Current and Average Frame rates,** and the **Current** and **Average IP Checksum Error bandwidth utilization** statistics.
UDP Checksum Error	Count of frames containing **UDP Checksum** error codes. **UDP Checksum Error Current and Average Frame rates,** and the **Current** and **Average UDP Checksum Error bandwidth utilization** statistics.
Lost SN Error	Count of frames with no sequence number. **Lost SN Error Current and Average Frame rates,** and the **Current** and **Average Lost SN Error bandwidth utilization** statistics
Out of Sequence Error	Count of frames received out of sequence. **Out of Sequence Error Current and Average Frame rates,** and the **Current** and **Average Out of Sequence Error bandwidth utilization** statistics.
Duplicate SN Error	Count of frames with duplicated sequence numbers. **Duplicate SN Error Current and Average Frame rates,** and the **Current** and **Average Out of Duplicate SN Error bandwidth utilization** statistics.

Where do you want to go next?

IP Test Setup
Ping Trace Route Results
Ping Test Results
IP Testing
Throughput Test Setup
RFC2544 Applications
Home

Ping Test Results *Home*

Status

Ping test messages appear in this field. The number of Pings Sent is reported in the Status Bar, as is the number of Pings Remaining to be sent.
Even though the test set generates pings, there are circumstances which cause the pings not to be sent. For example, the port could lose link or be paused, preventing the transmission of the Ethernet frames in which the ping packets reside. In these situations, the number of pings sent will not be displayed to avoid confusion.

Ping Results

View the overall Ping Test results.

Statistic	Meaning
IP Address	IP address the pings were sent to.
Sent	Number of transmitted pings.
Received	Number of correct echo responses received .
Lost	Number echo responses missing.
Unreachable	Number of echo responses with an 'unreach' flag.
Timeout	Number of pings which timed out.
Round Trip Delay (ms)	Current: Current ping round trip delay. Average: Average of all round trip delay. Minimum: Maximum value of round trip delay. Maximum: Minimum value of round trip delay.

Where do you want to go next?

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IP Testing
Ping Trace Route Results
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Ping Trace Route Setup *Home*

Parameter	Options	Details
Maximum Hops	1-255 hops	Enter the maximum number of hops allowed for the Trace Route.
Time Out	1-5 seconds	Determine how long the test set will wait for a response to a ping before timing out.
Destination IP/URL		Enter the IP address of the ping destination. • The number pad will appear for manual data entry. • Highlight a previously used address in the Destination IP Address List, then press '< Select' to move it to the 'Dest. IP/URL' button.

Trace Route Basics

Select IP TEST as the test type from the menu, then select TRACEROUTE as the IP Test Type on the IP Setup tab, in order to perform a ping trace route test. Select the Traceroute Setup tab to configure the test setup.

Where do you want to go next?

IP Test Setup
IP Testing
IP Summary Results
Trace Route Results
IP Aggregate Results
Throughput Test Setup
RFC2544 Applications
Home

Ping Trace Route Results *Home*

The Trace Route results window displays:

- the sequence of hops
- the time between hops, between the test port and the destination address.

Select Trace Route as the Ping Test Type and press 'Start' to access this results window.

Where do you want to go next?

IP Test Setup
IP Testing
IP Summary Results
Ping Trace Route Setup
Throughput Test Setup
RFC2544 Applications
Home

Ping Echo Log *Home*

Get details on the transmitted pings and received ping echoes.
Observe the following for each ping response:

- Source addresses
- Destination address
- PING size in bytes
- PING round-trip time, in microseconds
- TTL of the inbound packet

The details are for reference only.
Only one line is displayed per second, even if the ping rate is higher.

Where do you want to go next?

Ping Trace Route Results
Ping Test Results
IP Test Setup
IP Testing
Throughput Test Setup
Home

Aggregate Results *Home*

View information on errors received, and frame statistics, for a Throughput, Monitor, Ping, or RFC2544 test.

- For the following test frame types, view the frame count or **Current** frame rate (frames per seconds, the **Average** frame rate (fps) at which the error was received, and possibly the **Utilization** rates (percentage of bandwidth). Counts and rates may show for the Transmit and/or Receive directions.
- Not all statistics will show for all ports or setups.
- In Live and Monitor Test Modes, only Receive Statistics appear.
- For information about frame component usage, see the Ethernet Technology Overview.

Total Frames	Number of received/transmitted frames.
Total Bytes	Number of received/transmitted bytes.
Frame Rate Current / Average / (fps)	Current rate at which frames are being transmitted and received at this second.
Frame Rate Minimum / Maximum (fps)	Minimum or maximum transmitted and received frames per second since the beginning of the test.
Line Rate	Transmitted and Received data rates.
Data Rate	Transmit data rate (in kbps, bps, etc.). The data rate includes the frame headers but not the IPG or Preamble. Thus, the data rate reflects both the frame rate and frame size.
Utilization Current (%)	Percentage of current/average/Minimum/Maximum bandwidth in use.
Frame Sizes	Count of frames of each size: Under 64 Bytes/64 Bytes/65-127/128-255/256-511/512-10234/ 1024-1518/ Over 1518 Bytes (aka jumbo frames). *Undersized Frames Tip*
Bit Error	Count of the number of bit errors since the beginning of the test.
Service Disruption	Packet interval (ms) detected during the measurement. This is a very precise disruption measurement.
Non Test Traffic	Number of received frames that do not match the ports Stream Table, such as live traffic. Multicast and broadcast frames are reported as non-test frames. Consult the Stream Table.
Pause Frames	Count of received pause frames.
FCS / CRC Errors	Frame Check Sequence or Cyclic Redundancy Check errors.
Unicast	Count of Layer 2 Unicast frames transmitted and received.
Multicast	Count of Layer 2 multicast frames transmitted and received.

Test Frames	Count of Frames which match the Stream Table.
Non Test Frames	Count of Frames that do not match the ports Stream table, such as live traffic. Multicast and broadcast frames are reported as non-test frames. Consult the Stream Table.
Unicast Test Frames	Count of unicast test frames.
Broadcast Test Frames	A broadcast frame is a frame that is intended for all of the devices on the network, the destination MAC address is set to 'FF-FF-FF-FF-FF-FF'.
Keep Alive Mac Frames	Count of frames with MAC Keep Alive frames.
Invalid Mac Frames	Count of frames with invalid MAC addresses.
Good Frames	Count of unerrored frames.
Error Frames	Count of errored frames.
Frame Rate Current (fps)	Number of frames currently received per second.
Total VLAN Frames	Frames containing VLAN tags.
Single-Tagged VLAN Frames	Frames containing one VLAN tag.
Multi-Tagged VLAN Frames	Frames containing more than one VLAN tag**.**
MPLS Frames	Frames containing MPLS tags.
IPv4 Frames Frame Rate	IP version 4 frames.
Unicast IPv4 Frames	Unicast IP version 4 frames.
Multicast IPv4 Frames	Multicast IP version 4 frames.
Broadcast IPv4 Frame	Broadcast IP version 4 frames.
IPv6 Frames	IP version 6 frames.
Unicast IPv6 Frames	Unicast IP version 6 frames.
Multicast IPv6 Frames	Multicast IP version 6 frames.
TCP Frames	Frames containing Layer 4 Transmission Control Protocol.
UDP Frames	Frames containing Layer 4 User Datagram Protocol.
Pause Frames	Pause flow control frames.
Frame Gap	IPG/IFG delay between successive frames.
Avg Service Disruption Events	Average duration of packet intervals.
Latency	Latency measurement.
LOS	Loss of Signal (Seconds).
LOSync	Loss of Synchronization; count of Events, Aggregate totals, Minimum/Maximum/Current/Average
IP Checksum Error	Number of IP checksum errors received.

TCP Checksum Error	Number of TCP checksum errors received.
UDP Checksum Error	Number of UDP checksum errors received.
Lost SN Error	Frames where the Sequence Number was lost
Out of Sequence Error:	Frames which arrive out of numerical sequence.

Where would you like to go next?

Throughput Applications
Ethernet Frame Type
Throughput Summary Results
Throughput Aggregate Results
Throughput Stream Results
Throughput Test Setup
Home

Ping Test Results *Home*

Status

Ping test messages appear in this field. The number of Pings Sent is reported in the Status Bar, as is the number of Pings Remaining to be sent.
Even though the test set generates pings, there are circumstances which cause the pings not to be sent. For example, the port could lose link or be paused, preventing the transmission of the Ethernet frames in which the ping packets reside. In these situations, the number of pings sent will not be displayed to avoid confusion.

Ping Results

View the overall Ping Test results.

Statistic	Meaning
IP Address	IP address the pings were sent to.
Sent	Number of transmitted pings.
Received	Number of correct echo responses received .
Lost	Number echo responses missing.
Unreachable	Number of echo responses with an 'unreach' flag.
Timeout	Number of pings which timed out.
Round Trip Delay (ms)	Current: Current ping round trip delay. Average: Average of all round trip delay. Minimum: Maximum value of round trip delay. Maximum: Minimum value of round trip delay.

Where do you want to go next?

IP Test Setup
IP Testing
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Loopback Features

Loopback Test Setup *Home*

Select LOOP BACK from the drop down Menu. XTT 5000 can Control a loopback or act as a loopback responder.

To send loopback commands in a test, press the 'Loop Control' () button in the Action Bar.

See the application diagram.

Loopback Test Tab Layer Notes

Loopback Test Tab

Type: Select the loopback function; Manual, Responder

Manual: Send a loop up/down command to a Sunrise Telecom Ethernet tester, such as another XTT 5000 module or a SunSet MTT -28 or -29 module. See Loop Control.

Respond: XTT 5000 respond to loopbacks. See Loopback Responder.

Layer: Select the test layer format for the loop up and loop down frames; Layer 1, Layer 2/3. Scroll down for Layer Notes.

VLAN/**MAC**/**IP**:To enable an address (MAC, IP, or Gateway) or tag id (such as a VLAN TPID tag), touch the top tag button to turn it on (it turns green), then touch a lower parameter button (e.g. TPID), then use the pop up number pad to enter the address or tag data.

- The Source addresses are those used by the test port sending the command.
- The Destination addresses must match the MAC and IP addresses of the port or unit to be looped.

  An IP Destination may need to be entered even for a Layer 2 loopback.
- A Gateway is required if you the device to be looped is outside the local subnetwork.

  The addresses in this window do not necessarily correspond to those in the Stream Table.
- To use VLAN tags, touch the VLAN-1, VLAN-2, and of VLAN-3, buttons to select up to three VLAN tags. Configure the VLAN TIPD, PRI, CFI, and ID as necessary.

Layer Notes

- **Layer 1**: The test set can transmit a Layer 1 loop up or loop down command to a remote test set configured as a responder. Upon receiving the Layer 1 loop up command, the remote test set will retransmit the incoming frames without modifying them.
- **Layer 2/3**: The test set can transmit a Layer 2 or Layer 3 loop up or loop down command to a remote test set configured as a responder. Upon receiving the Layer 2/3 loop up command, the remote test set will retransmit the incoming frames and swap the source and destination MAC address fields, adding IP addresses for Layer 3

  Layer 3 loopback can only be used in a network where the source and destination IP addresses are located in the same network (direct routing). It will not function through a gateway.

Sunrise Telecom STT and MTT Ports Note

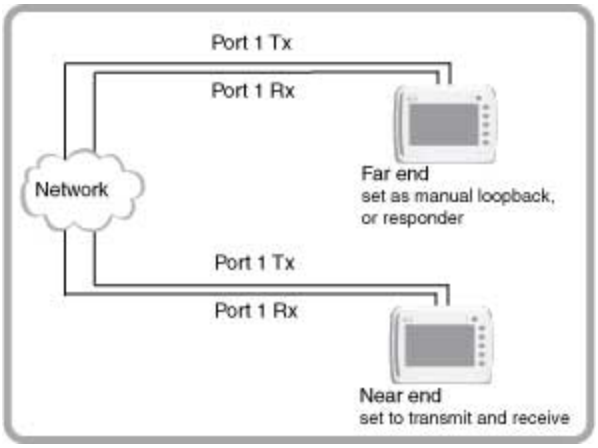
Press 'Loopback Control' to bring up the Loopback Control pop up to send loopback commands in a Throughput or RFC2544 Test Mode, as configured in this Loopback window. Making changes one of these windows affects the other.

Where do you want to go from here?

Loopback Responder
Loop Control
Throughput Test Setup
Throughput Summary Results
Home

Loopback Diagram

Home



Loopback Mode Diagram

Where do you want to go next?

Loopback Test Setup
Home

Loopback Ports Note *Home*

Different ports on the Sunrise Telecom XTT, STT and MTT behave differently in Loopback mode, based on the type of MAC frame received.

Frame	STT FE	STT GE	STT 10GE	MTT-28/-29
MAC	Yes	Yes	Yes	Yes
Unicast	Yes	No	No	No
Multicast	Yes	Yes	No	No
Broadcast	Yes	Yes	No	No
Keepalive*	Yes	Yes	No	No
Yes: The frame will be looped back. No: The frame will not be looped back *Identical Source and Destination addresses				

Loopback Mode and MAC Frames

Where do you want to go next?

Loopback Test Setup
Home

Loop Control *Home*

To perform loopback testing, touch the Menu button and select LOOP BACK as the test type, or press the 'Loop Control' () button in the Action Bar to access the Loopback Control screen, in a BER test or RFC2544 test. The commands are sent as configured here, on the Control tab.
See Loopback Test Setup for details on using the loopback test mode.
When the test has started, the Summary and Aggregate results windows appears.
XTT 5000 can loop-up and loop-down Sunrise Telecom Ethernet testers, using the standard Sunrise Telecom loop commands.
XTT 5000 reports if the loop-up or loop-down was successful.

- The loop-up command indicates the layer:1, or 2/3.
- The loopback command contains the MAC and IP address of the test set to be looped, as appropriate.

Ethernet Settings

Layer: Select the format for the loop up and loop down frames. This selection determines which of the remaining items need to be configured.
Option: Layer 1, Layer 2/3

- **Layer 1**: The test set will transmit a Layer 1 loop up or loop down command to a remote test set configured as a responder. Upon receiving the Layer 1 loop up command, the remote test set will retransmit the incoming frames without modifying them.
- **Layer 2/3**: The test set will transmit a Layer 3 loop up or loop down command to a remote test set configured as a responder. Upon receiving the Layer 2/3 loop up command, the remote test set will swap the MAC/IP addresses, and loop the frame if it is not destined for that specific test port.

Parameter	Details
MAC/IP Source	The Source addresses are those used by the test port sending the command.
MAC/IP Destination	The Destination addresses must match the MAC and IP addresses of the port or unit to be looped. An IP Destination may need to be entered even for a Layer 2 loopback
Gateway	Required if the device to be looped is outside the local subnetwork.
VLAN	For a Layer 2/3 loopback, touch VLAN-1/-2/-3 to turn the VLAN tag on. Next, enter the VLAN Priority level (UPI), CFI and ID information.

Start Loopback Control

Press 'Apply' to confirm the settings.
Press 'Loop Up' or 'Loop Down' to send the indicated command from the Control tab.
The field to the left reports on the status of the loop.

Possible Status Messages

You may see these for each test layer:

- Waiting for response....
- Timeout
- Loopup Successful!
- Loopdown Successful!

Where do you want to go next?

Loopback Test Setup
IP Test Setup
IP Testing
Throughput Test Setup
RFC2544 Applications
Working Desktop
Home

Loopback Responder *Home*

To perform loopback testing, touch the Menu button and select LOOP BACK as the test type.
To have XTT 5000 respond to loopbacks, configure the Loopback Test Setup tab, setting Responder as the Type. XTT 5000 will enact a Layer 1, Layer 2, or Layer 3 loopback as instructed in the command.

Use caution when using loopback mode, because some network equipment may not allow the loopback of some frames. It can cause such equipment to shut down the port.

- The graphic on the Signal window shows how Loopback mode works. In Loopback mode, a red 'LB' status banner appears in the Status Bar, reporting status such as "LB Running" or "LB Waiting."
- The test set will only respond to those loop commands addressed to it.
- In this mode the layer is NOT selected.
- XTT 5000 will *not* respond to any loop commands until you press Start. Once the test has started, XTT 5000 will go into a waiting for loopback command state. A screen message informs you that the test set is in the waiting for loopback command state.
- The test set's MAC and IP address appear, as appropriate.
- Once XTT 5000 receives a loop-up command from the received traffic, it will begin looping back frames based on the layer indicated in the loop command frame: Layer 1, Layer 2, or Layer 3.
- A screen message appears, informing you that the test set is in an active loopback state.
- When XTT 5000 receives a loop-down command from the received traffic, it will cease looping back frames and re-enter the waiting for loopback command state.
- Once you stop the test, XTT 5000 will return to the waiting for loopback command state.

Where do you want to go next?

Loopback Test Setup
Loop Control
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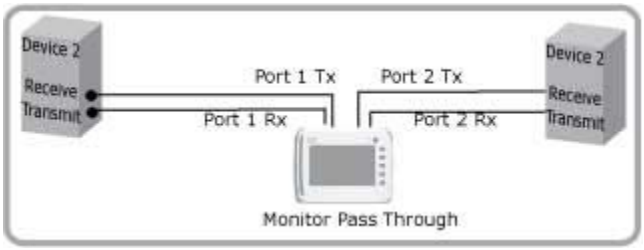
RFC2544 Applications
Home

Monitor

Monitor Applications *Home*

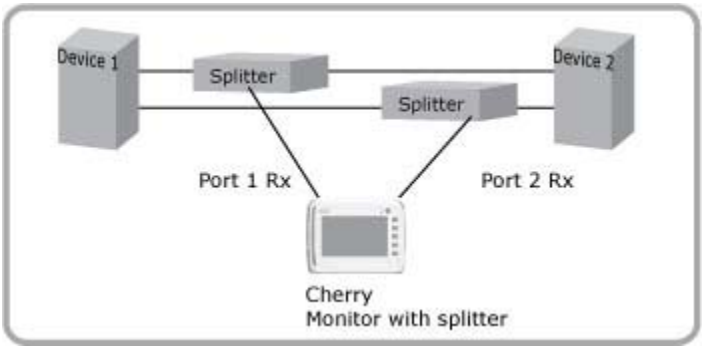
Monitor Test Mode can be used in either of the following two configurations.

- Pass Through mode: the test set is inserted between two devices, to monitor the frames in both directions.



Pass Through Monitor Mode Connection

- Splitter mode: the test set is inserted between two devices using splitters. In this mode you can insert and remove the test set without interrupting the traffic.



Splitter Monitor Mode

Where do you want to go next?

Monitor Setup
Summary Results
Home

Monitor Setup *Home*

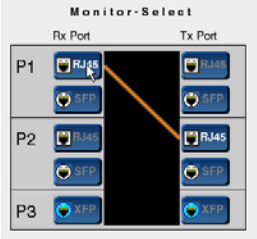
To monitor traffic, select MONITOR as the test type on the menu, then configure the Monitor Setup tab.
Monitor results statistics appear for the receive side only.
Touch the two ports you want to connect; one to receive on (Rx), one to transmit on (Tx).

- 10GE loops back the traffic to itself, for you to monitor.
- Port 2 can send traffic to Port 3 for Fiber and Copper.

Press Apply then Start on the Action Bar to begin monitoring.

See the applications diagram.

You can only view one port (the active one) at a time.
Starting monitor on two ports starts the measurement on both ports 2 and 3.
When you press 'Stop', data for the active port (for example, Port 2) is saved. However, this data also includes results for the other port (Port 3).



Connect two ports

Where do you want to go next?

Monitor Applications
Summary Results
Aggregate Results
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Home

Save Features

Save Features *Home*

Press the 'Saved Results' icon () at the bottom of the screen to access saved results. Press  to save a test profile.

Test Profiles

- Press 'Save' to save the current test configuration as a file which you may later Load.

 Profiles Window; Setup Tab

Highlight a saved file to perform an action, via the buttons at the bottom of the window:

'Save'	Save the current test profile.
'View'	Open a saved profile to review it.
'Load'	Load the highlighted profile.
'Delete'/'Delete All'	Delete the highlighted profile, or all saved profiles.
'Rename'	Rename the highlighted file, using the soft keyboard which appears.
'Copy'	Save a copy of the file under a new name.
'Load Default'	Load the factory default profile.
Use 'Page Up' and 'Page Down' to scroll through the saved results.	

Setup Files Buttons

 Profiles Window; File Usage Tab

View the number of files saved, and the percentage of memory used, for Setup and Results files.

 Save a File

- When a test has concluded, a window will pop up asking if you would like to save the measurement. Press 'Yes.'
- Test results are saved automatically at the end of a test, unless you have chosen otherwise on the Measurement Setup screen.
- To know how much storage space is left, look at the File Usage tab. It reports on both Setup (Profiles) and Saved Results. It will prompt you when the user storage is within 5% of full. Delete old results to make space.
- In the event of a controlled power failure, such as a low battery, XTT 5000 will automatically save the current measurement.
- XTT 5000 will save results during a test such that an abnormal power failure will result in minimal loss of data.

Results Files Window; Results Tab

For each saved file, view the Test Mode (eg Throughput or RFC2544), file size (eg 30 kb), and date the record was saved.
Highlight a saved file to perform an action, via the buttons at the bottom of the window:

'View'	Open a saved file.
'Delete'/'Delete All'	Delete the highlighted file, or all saved files
'Rename'	Rename the highlighted file, using the soft keyboard which appears.
'Copy'	Save a copy of the file under a new name.
'Report'	Generate a report; enter Trouble Ticket data on the Data Entry Tab, and view the test setup on the Report Setup tab.
Use 'Page Up' and 'Page Down' to scroll through the saved results.	

Results Files Buttons

Open a Saved Results File

Press 'Saved Results' (

) in the Action Bar, then press 'View' on the Results File window.

Export a Results Report to Use in a Database

To use test results in a program such as Excel©, export them in the .csv format.

1. Select 'Generate Report'.
2. On the Report Results window, select the Report Setup tab.
3. Choose CSV File: On.
4. Choose PDF File: Off
5. Select the Reports (turn them On) you need.
6. Press 'Create Report' at the bottom of the screen.

Exported test results include all measurement data and the test configuration.

Generate a Report to View Offline

XTT 5000 can create PDF reports, which you can use anywhere.

1. Press 'Saved Results', select the file name on the Results File window, then press 'Generate Report' at the bottom of the screen.
2. On the Report Results window, select the Report Setup tab.
3. Choose CSV File: Off.
4. Choose PDF File: On
5. Select the Reports (turn them On) you need.
6. Press 'Create Report' at the bottom of the screen.

Reports include:

- Measurement data and test configuration
- Measurement graphs
- User information
- Trouble Ticket information
- Comments

Where do you want to go next?

The Working Desktop
Meas. Setup: Configure measurement parameters
Throughput Test Setup

RFC2544/NE Applications
IP Test Setup
Monitor Setup
Loopback Test Setup
Home

Error Injection *Home*

Error injection is used to insert defects into the traffic generated by the test module, in the Throughput test mode.
To configure error injection, press the error injection button when it's available on the Action Bar.
To inject an error, you must first start the measurement and transmit traffic.
Error Type: Select the type of error to inject, which depends on the type of test. Details.

Default Errors: 2^{31}-1, 2^{23}-1, 2^{20}-1, 2^{15}-1, 1111, 0000, 1010, 1100 CJPAT, CRPAT, User 32, User 1024
User 32: 32 bits pattern data.
User 1024: 1024 bits pattern data. It doesn't support increment pattern.

Payload length is 1000 bytes. A User pattern is filled with every four bytes with same data. The User 1024 pattern is filled every 128 bytes.

Layer	Default Errors	SN (Sequence Number)*	IP	TCP	UDP
Layer 1 Unframed	Bit				
PRBS + FCS	FCS/CRC, BIT				
Layer 2 & above	FCS/CRC, BIT	Lost Frame, Out-of-Sequence, Duplicate Sequence Number	IP Checksum	TCP Checksum	UDP Checksum
*__To inject Sequence Errors__: 1. Turn Broadcast Error Off; 2. Press Error Type; 3. Select a Sequence error. __Note__: You may turn Broadcast Error back On.					

Error Availability

Mode: Select the error injection method.
Options: Single, Burst, Rate, Bit/sec - Details
Broadcast Error: Inject errors on all streams; On is the default.

- For 10G, press On to inject errors On all streams.
- To inject errors on only one stream, press the button to Off, and touch the stream number on the pad which appears to transmit on.

Pattern Inversion: When enabled, the XTT 5000 will transmit the selected test pattern inverted. This is indicated by INV on the 'TX Pattern' button.

Error Type Details

Error	Details
FCS/CRC	Frame Check Sequence/Cyclic Redundancy Check error.
Bit Error	Bit error in the frame payload/pattern. Pattern bit errors are inserted before the FCS/CRC is calculated, and therefore do not cause an FCS/CRC error, or cause the frame to be dropped.

Code	8B/10B encoding error.
Disparity	Running disparity error.
IP Checksum	IP Checksum error.
Lost Frame	The transmitted sequence number will skip a value, causing a lost frame to be detected at the far end. Requires a Sunrise Tag be enabled the Stream table Payload tab.
Duplicate Packet	The transmitted sequence number will be duplicated once, causing a duplicate or misinserted packet defect at the far end. Requires Sequence Number enabled on the Ethernet Layer Selection window.
Out of Sequence	The transmitted sequence number will transpose two values, causing an out of sequence defect at the far end. Requires a Sunrise Tag be enabled on the Ethernet Layer

Error Mode Details

- **Single**: Inject an individual error.
- **Burst**: Inject a set number of errors with each press of the 'Send' or 'Error Inject' button. In the Burst field, enter the number of errors you wish to inject in a burst when the Send' button is pressed. Send a burst of up to 254 errors for Ethernet.
- **Rate**: Inject errors continuously at a specified rate between 1e-3 and 9e-9. Enter the constant rate at which you wish to inject errors. A red 'ERR-INJ' banner appears when errors are being injected. Note: Remember to press the 'Stop' button when you have been injecting errors at a rate, and want to stop.
- **Bit/sec**: Injects the specified number of errors each second, up to 64,000.

Where do you want to go next?

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Home

Technology Overview

Technology: Ethernet Overview *Home*

Once the primary delivery mechanism for data across a LAN, the utilization of Ethernet has expanded to MAN and WAN to challenge traditional TDM-based technologies such as T-Carrier, PDH, and SONET/SDH.
Its superior cost performance, proven ability to carry packet-based data, and easy integration into a LAN environment make it a preferred solution to ATM, Token Ring, and Frame Relay for delivering IP-based services such as VoIP and IPTV as well as traditional data and internet traffic.
Ethernet interface rates today span from 10 Mbps up to 10 Gbps. Typically, Ethernet is carried over UTP (unshielded twisted pair) or fiber optic cable (single-mode or multi-mode, depending on wavelength), but other options exist, including thin coaxial cable.
The original Ethernet standard was for 10M and 100M is referred to as Fast Ethernet. Most copper Ethernet ports support both 10M and 100M (and even 1000M in some cases) and they are usually referred to as 10/100M ports or 10/100BASE-T.
10G LAN has a line rate of 10 Gbps. 10G WAN encapsulates Ethernet traffic into an OC-192c/STM-64c frame has thus has a line rate of 9.953 Gbps.
Ethernet Standards
Ethernet Frames
Frame Size Efficiency
Frame Size Details
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Where do you want to go next?

Home

Technology: Standards *Home*

IEEE Standards Request For Comments Metro Ethernet Forum

Ethernet is controlled by the IEEE 802.3 body of standards, but its historical development has also lead to deviations, such as the DIX Ethernet (also known as Ethernet II), as well as vendor-specific implementations (such as 1000BASE-LH for long-haul Ethernet). Except where noted, the following refers to IEEE standards.

IEEE Standards

The following 802 standards are available for free download from the IEEE website at http://standards.ieee.org/getieee802/index.html

- IEEE 802®: Overview & Architecture
- IEEE 802.1™ Bridging & Management
- IEEE 802.2™: Logical Link Control
- IEEE 802.3™: CSMA/CD Access Method
- IEEE 802.5™: Token Ring Access Method
- IEEE 802.11™: Wireless
- IEEE 802.15™: Wireless Personal Area Networks
- IEEE 802.16™: Broadband Wireless Metropolitan Area Networks
- IEEE 802.17™. Resilient Packet Rings

IEEE Registration Authority has a number of public listings available at http://standards.ieee.org/regauth/publiclistings.html

- OUI (Organizationally Unique Identifier) Public Listing
- IAB (Individual Address Block) Public Listing
- OUI-36 Public Listing
- EtherType Field Public Listing
- Manufacturer ID Public Listing
- LLC (Logical Link Control) Public Listing
- Standard Group MAC Address Public Listing
- URN (Unique Registration Numbers) Public Listing
- IEEE 802.16 Operator ID

Requests for Comments (RFC) Documents

RFC documents are a series of memoranda on internet technologies, techniques, and innovations. Organized through the Internet Society, RFCs are the best resource for technical information on these technologies and protocols. Some RFCs become internet standards through the IETF (Internet Engineering Task Force).
All RFCs are available for free online at the RFC Editor: http://www.rfc-editor.org/rfc.html, but most can be found easily simply by typing the RFC number (such as ”RFC 791”) into a web browser.
The most common RFCs for Ethernet services testing are:

- RFC 768: User Datagram Protocol
- RFC 793: Transmission Control Protocol
- RFC 791: Internet Protocol
- RFC 792: Internet Control Message Protocol
- RFC 826: Ethernet Address Resolution Protocol
- RFC 2544: Benchmarking Methodology for Network Interconnect Devices
- RFC 2889: Benchmarking Methodology for LAN Switching Devices class uses the label to determine the per hop behavior of the class.

Metro Ethernet Forum (MEF)

The Metro Ethernet Forum is an industry alliance which develops technical specifications for carrier Ethernet worldwide. Over a dozen specifications are online at www.metroethernetforum.org.

Where do you want to go next?

Ethernet Overview
Home

Technology: Ethernet Optical Line Encoding

Home

Before being transmitted across optical fiber, the bits of the Ethernet signal are converted using an encoding scheme known as 8B/10B encoding (for Gigabit Ethernet) or 64B/66B encoding (for 10 Gigabit Ethernet). A receiving device reverses the encoding, so that the encoding is completely transparent to the user.
Encoding helps to ensure a balanced transmission of 1s and 0s in the signal which aids in DC balance and clock recovery.

8B/10B Encoding

8B/10B encoding takes each block of 8 bits and translated them into a code word that is 10 bits long. For a Gigabit Ethernet, this means the number of bits transmitted is actually 1.25 Gbps (1 Gbps x 10 bits / 8 bits). With 10 bits, there are 1024 unique code words for mapping 256 possible 8-bit data blocks.

- Many code words are not used.
- Some are reserved for link-level signaling.
- In many cases, a single 8-bit block can be mapped into one of two code words that are bitwise inverts of each other.

Code words are chosen in such a manner so as the number of 1s and 0s balance out in a process called running disparity. A violation of these rules is called a disparity error.
Note: The 8 data bits are actually first broken into 5-bit and 3-bit blocks which are encoded separately into 6- and 4-bit code words, but for the purposes of this discussion, thinking of the encoding process as a single step of 8-bits to 10-bits is sufficient.

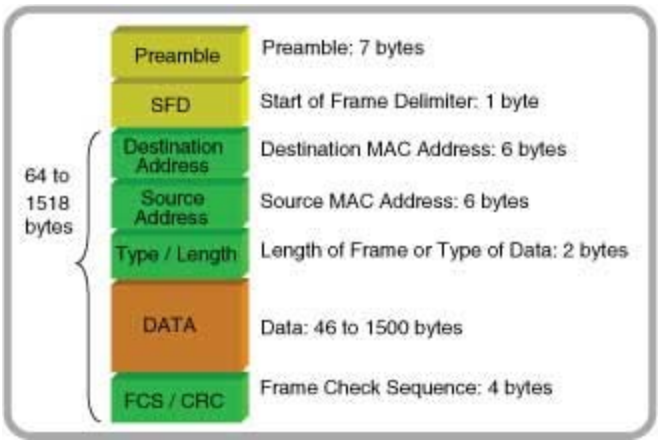
64B/66B Encoding

64B/66B encoding serves a similar function but uses a different method of mapping data bits into code words.
The 64 data bits (8 bytes) are scrambled, and then a 2-bit synchronization header is added.
For 10GE LAN, the physical line rate is actually 10.3125 Gbps (10G x 66 bits / 64 bits).
For 10GE WAN, the encoding is done before the Ethernet payload is placed side the OC-192c/STM-64c payload envelope.

Where do you want to go next?

Ethernet Overview
Home

Technology: Ethernet Frames



Basic Ethernet Frame

- **Preamble and SFD** (Start Frame Delimiter). Preceding each frame is a preamble of 7 bytes and a 1-byte SFD. The preamble is a pattern of alternating 1s and 0s (10101010) for all 7 bytes. The SFD has a pattern of 10101011. The preamble allows devices to detect and synchronize to incoming Ethernet frames; the SFP marks the end of the preamble. For the purposes of calculating frame lengths, the 8 bytes of Preamble and SFP are not included.
- **Ethernet frame: C**onsists of a MAC (Media Access Control) header, followed by the frame payload, and ends with a FCS (Frame Check Sequence).
- **MAC header**: 14-bytes- consists of a 6-byte Destination Address, a 6-byte Source Address, and a 2-byte Ethertype field (see MAC Address Overview).
- **Ethertype field: U**sed as a frame length indicator or as protocol indicator, depending on which Ethernet standard is being used. IEEE 802.2 uses the field to indicate the frame length (in hex). The DIX or Ethernet II standard uses the field to indicate the type of data being transmitted. In most IP-based applications, the Ethernet II standard is used and the field is set to an Ethertype of 0x0800 to indicate an IP version 4 payload. Ethertype values: http://standards.ieee.org/regauth/ethertype/eth.txt
- **Payload Size**: The minimum payload size is 46 bytes.
  Frames with fewer payload bytes are considered undersized.
  The minimum Ethernet frame size is 64 bytes.
  The maximum frame size is 1518 bytes.
  Frame sizes above 1518, called jumbo frames, are allowed by some systems, and are an effective means of increasing the efficiency of the network.
  The presence of VLAN tags changes the effective minimum and maximum frame sizes .
- **FCS**: A 4-byte CRC performed over the entire Ethernet frame. Sometimes the FCS is called the CRC field.
  To avoid confusion, it is sometimes written as the FCS/CRC field. When an Ethernet device receives a frame, it performs a CRC calculation and compares it to the frame's FCS field. If they match, the frame is processed. If they do not match, the frame is discarded. Due to the limits of the error-checking capabilities of a 4-byte CRC, the largest practical size for an Ethernet frame is roughly 12,000 bytes.

- **Note**: Because errored frames are discarded, performing a bit error test at the Ethernet layer is very different than for TDM networks. The presence of a bit error that does not also cause a CRC error is exceedingly rare. In the vast majority of cases, a bit error translates into a lost frame. For this reason, most Ethernet QoS (Quality of Service) standards use lost frames as its primary metric and do not rely on bit error or BER (Bit Error Ratio).

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Where do you want to go next?

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Optical Line Encoding
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Technology: Frame Size Details *Home*

64 or 1518 bytes are used most often since these represent the normal minimum and maximum frame size allowed by the network.
The standard frame sizes for Ethernet testing are 64, 128, 256, 512, 1024, 1280, and 1518 bytes.
When testing RFC2544 with VLAN and/or MPLS tags, 64 bytes is no longer a proper frame length.
With systems that support jumbo frames, such as 4096- or 9000- byte frames, these frame sizes should be tested as well.
The XTT 5000 defaults to the frame size defined in RFC 2544, but allows you to set the frame size to any valid value.

Test Layer	Undersized	Oversized	FE	GE
Layer 1: FCS/CRC	N/A	N/A	20—20480	20—65535
Layer 2: MAC	Under 64	Over 1518	38—20480	38—65535
L2 + VLAN	Under 68	Over 1522	42—20480	42—65535
Layer 3: MAC + IP	Under 64	Over 1518	58—20480	58—65535
L3 + VLAN	Under 68	Over 1522	62—20480	62—65535

Table 10/100/1000M Ethernet Frame Length Options.

Where do you want to go next?

Stream - Frame -Setup
Throughput Summary Results
Throughput Aggregate Results
Throughput Stream Results
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Technology: Ethernet Frame Size and Efficiency

Home

Because each frame is followed by a frame gap and preamble, there is an inherent inefficiency built into Ethernet traffic. The percentage of bandwidth lost to the 20 bytes of *IPG* and preamble is lower for larger frames than smaller frames, as shown:

Data size	Overhead /frame	Frames/sec.	Total bits lost (oh)	% of Bandwidth Lost
64 Bytes (512 bits)	160 bits	1,488,095	238,095,238	23%
128 Bytes (1024 bits)	160 bits	844,594	135,135,135	13%
512 Bytes (4096 bits)	160 bits	234,962	37,593,984	3.7%
1024 Bytes (8192 bits)	160 bits	119,731	19,157,088	1.9%
1518 Bytes (12144 bits)	160 bits	81,274	13,003,901	1.3%

Frame Rates

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Where do you want to go next?

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Technology: Gaussian Frame Probability

Home

The probability that a given frame length will be sent is given the following function:

$$P(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-(x-\mu)^2/2\sigma^2} \qquad Width = 2\sigma\sqrt{2\ln 2}$$

X is the frame length, μ is the mean o r average, and σ is the standard deviation. The variance determines the width of the distribution (as measured at half its maximum value).
In the XTT 5000, you specify the width (Width at 50%), which then sets the standard deviation of the distribution. Approximately two-thirds of the frames sent will be within one standard deviation of the mean.

Where do you want to go next?

Tech: Ethernet Overview
Stream Frame Setup
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Technology: Frame Interval *Home*

Frame Interval: The time between the start of one frame and the start of the next frame. The frame interval increases as the frame size increases. However, as the effect of frame size is usually very small compared to the duration of traffic problems, the frame interval is useful for measuring service disruptions.

Minimum Frame Interval Note

Under normal network conditions, the smallest possible frame interval is for two 64-byte frames with a minimum frame gap. This is:

(64 + 20 bytes) x 8 bits / byte or 672 bit times.

For Gigabit Ethernet, the bit time is 1.0 ns, making the minimum frame interval 672 ns over Gigabit Ethernet.
Undersized frames or abnormally small frame gaps will reduce the frame interval further.

Maximum Frame Interval Note

This value is also used as the basis for the Service Disruption measurement.
If there is a network disruption on the far side of a switch from the test set, the only indication of a problem will be an increase in the frame interval.
Because these disruptions are on the order of tens of milliseconds, the minor variances in frame interval caused by shorter or longer frames is negligible.

Where do you want to go next?

Tech: Ethernet Frames
Summary Results
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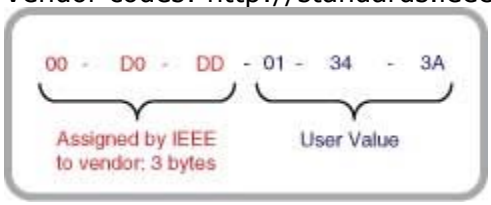
Technology: Ethernet MAC Addresses *Home*

The MAC addresses is six bytes, written in hexadecimal.

- The first three bytes contain a vendor code, also known as the OUI (Organizationally Unique Identifier) or company_id.
- The last three bytes contain a unique station ID. Vendor codes are assigned and administered by the IEEE.

The OUI for Sunrise Telecom is 00-D0-DD. The station IDs are assigned by the manufacturers are often tied to the serial number of the device.
Vendor codes: http://standards.ieee.org/regauth/oui/oui.txt



MAC Address Format

Unicast: Most Ethernet traffic is designated to travel from one station to another specific station. This is called unicast traffic.
Broadcast Ethernet traffic is sent to all stations on the network; such frames are given a MAC destination of all-ones: FF-FF-FF-FF-FF-FF. Because broadcast traffic is very polluting, it should be avoided whenever possible.
Multicast traffic is sent from one station, but is then directed to a group of stations. Multicasting is more efficient and more network-friendly than broadcasting. Typical applications for multicast traffic include IP video delivery and LAN protocols.
Multicast traffic is designated by setting the first bit of the address to 1. Because the least significant bit is transmitted first, this means the last bit of the first byte is set to 1; in other words, the byte value is odd. The MAC vendor code used for IP multicast packets it typically 01-00-5E-xx-xx-xx, as specified by RFC 1112.
Unicast/Multicast Testing Note

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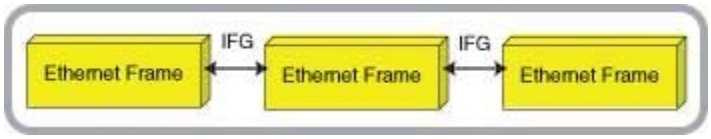
Technology: Ethernet IPG *Home*

The gap of time between the end of one frame and the start of the preamble for the next frame is called the inter frame gap (IFG); the delay between successive frames. IFG.



IFG

Because most Ethernet traffic carries IP packets, the IFG is often called the IPG (Inter Packet Gap). In fact, the terms packet and frame tend to be used interchangeably by users even though they refer to very distinct entities.
The minimum IFG is 12 bytes, or 96 bit-times. The minimum IFG thus depends on the interface rate, as follows:

Interface	Bit Time	Minimum IFG
10M	100.0 ns	9.6 s
100M	10.0 ns	0.96 s
1G	1.0 ns	96.0 ns
10G	0.1 ns	9.6 ns

Minimum IFG

To improve efficiency, some network elements support frame gaps lower than 12 bytes, but the non-standard implementation is not wide-spread and not generally recommended.
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Where do you want to go next?

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Technology: Unicast / Multicast Testing Note *Home*

Most Ethernet testing is performed with unicast traffic. One tester generates unicast frames that are received by the far end unit, which is either sending unicast traffic of its own or looping the frames by swapping the source and destination addresses. Furthermore, different test streams can be designated by their MAC addresses. When testing multicast services, some care must be taken. Loopback devices will not loop multicast (or broadcast) traffic. Also, the use of multicast MAC destination addresses may cause problems designating test traffic. As shown below, the MAC addresses sent by a tester do not match the MAC addressed received.

	MAC Source	MAC Destination
Generated	00-D0-DD-12-34-56	01-00-5E-00-00-05
Received	00-D0-DD-AB-CD-EF	01-00-5E-00-00-06

Sample MAC Addresses

Thus, when running this test, the test summary will show "NO BERT TRAFFIC" since the incoming traffic does not match that sent. Fortunately, all normal traffic statistics and measurements can be made, with the exception of bit errors and BER.

Where do you want to go next?

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Ethernet MAC Addresses
Tech: Multicast Frames
Ethernet Overview
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Technology: VLAN Tagging *Home*

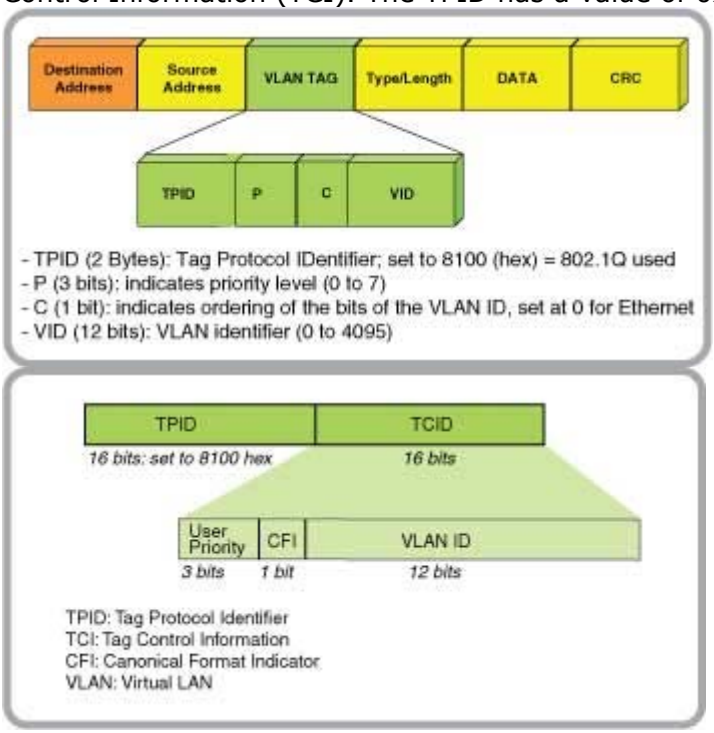
TPID VLAN Membership Stacked VLAN Tags

A virtual LAN (or VLAN) is an independent logical LAN within a physical network. For example, with in a single enterprise LAN, different divisions may be grouped within their own VLANs.

VLANs provide a secure means of sub-diving networks, control broadcast domains, and manage user access. VLANs are defined in the IEEE 802.1p and 802.1q standards.

VLANs are designated by a VLAN tag that is added to the MAC frame after the MAC source address.

The 4-byte tag consists of a 2-byte Tag Protocol Identifier (TPID) and 2-byte Tag Control Information (TCI). The TPID has a value of 0x8100.



VLAN Tag

Note: The TPID can actually be thought of as an Ethertype designation, identifying the payload as a VLAN. The original MAC frame's Ethertype field is moved to the inside of the VLAN payload, following the TCI.

The TCI contains the 12-bit VLAN identification, 3-bit priority field, and 1-bit canonical format indicator (CFI). The VLAN ID can have a value between 0 and 4095. However, values 0, 1, and 4095 are reserved and best avoided. The priority field allows the network administrator to assign a value from 0 to 7 based on the type of traffic. The CFI is always set to 0 for Ethernet traffic.

See the VLAN User Priority table.

VLAN Membership

Ethernet traffic can be assigned VLAN memberships through several means:

By Port: all traffic through a particular switch port is assigned the same VLAN.

- Fast traffic forwarding

- Easy to maintain for network administrators
- VLAN membership tied to geographic location

By MAC address: Each MAC source address is assigned a specific VLAN ID.

- Great flexibility
- VLAN lookup tables require manual configuration by network administrators
- MAC address lookup takes more processing time

By Protocol: VLAN IDs are assigned based on IP address, or protocol used (such as AppleTalk).

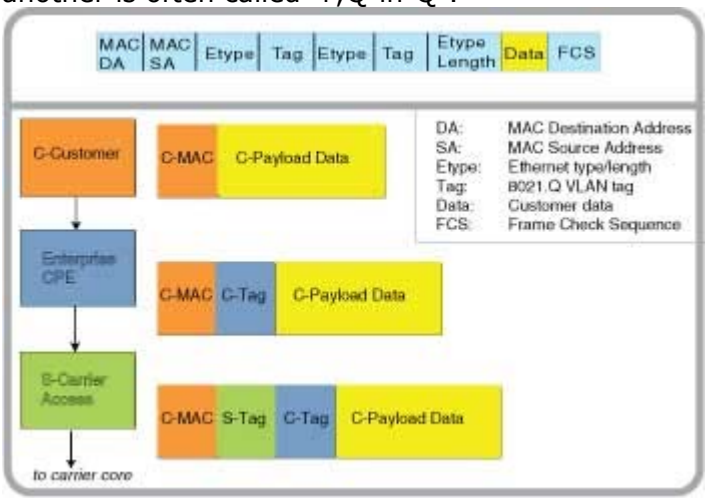
- Great flexibility
- Protocol lookup takes more processing time

By Authentication: VLAN IDs are assigned based on authentication credentials or the result of IEEE 802.1X authentication results.

- Improved security
- Ideal for wireless connectivity

Stacked VLAN Tags

IEEE 802.1ad amends 802.1q by providing a means to stack multiple VLAN tags for traffic management and bridging. This technique of placing one 802.1q tag inside another is often called ”r;Q-in-Q”.



Stacked VLAN Tags

Stacking VLAN tags is an efficient means of differentiating traffic through a network backbone, especially when then the user data may itself have VLAN tags.
The outer tag, also known as the service tag or S-tag is distinguished from the customer tag, or C-tag. The TPID of the C-tag is usually 0x8100, as for normal VLAN traffic. The TPID of the S-Tag may have a proprietary value, depending on the implementation by the vendor.
Each tag layer has its own priority setting. The priority of the outer tag allows the network provider to achieve the desired quality of service for the bridged traffic.

VLAN and Frame Size

Because the minimum payload size for an Ethernet frame is 46 bytes, the presence of the 4-byte VLAN TPID and TCI pushes the minimum frame size from 64 bytes to 68 bytes.
Likewise, the largest, non-Jumbo frame size increases from 1518 to 1522 bytes. Stacked VLAN tags also increase the minimum and maximum frame sizes by 4 bytes per VLAN tag.

When a device receives a VLAN tagged frame that is only 64 bytes, and it must remove the VLAN tag and forward the Ethernet payload, it is left with a frame that is only 60 bytes long.
At this point, the device may simply drop the frame. Some systems may add 4 bytes of filler at the end of the payload to create a legal 64-byte frame.
MPLS
MAC Addresses
IPG
Frame Size Efficiency

Where do you want to go next?

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Technology: VLAN User Priority *Home*

The User Priority may affect the speed and efficiency with which the frame data will be transmitted through the Ethernet network.

User Priority	Traffic Type
0	Best Effort
1	Background
2	Spare
3	Excellent Effort
4	Controlled Load
5	Video < 100 ms latency and jitter
6	Voice < 10 ms latency and jitter
7	Network Control

User Priority Table

Where do you want to go next?

Stream Table Setup
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Throughput Aggregate Results
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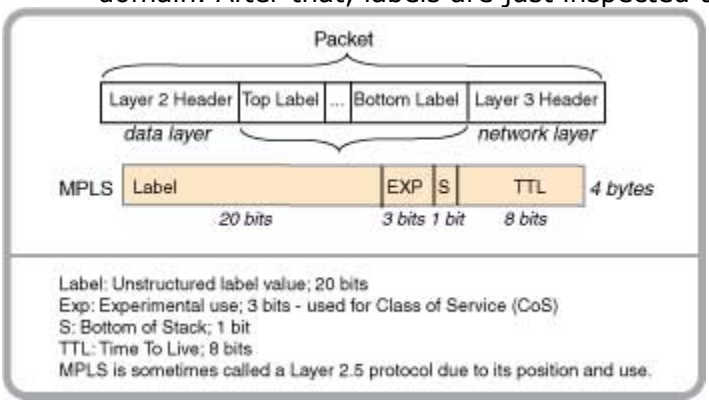
Technology: MPLS *Home*

MultiProtocol Label Switching architecture provides a unified data-carrying service/simple routing for both circuit-based clients and packet-switching clients providing a datagram service model.

- It allows voice, IP, ATM, Frame Relay and Ethernet services all to be carried on the same network.
- It can be used with many types of framing, including Ethernet.
- The Layer 3 label analysis is only just once, when the packet enters the *MPLS* domain. After that, labels are just inspected to continue packet forwarding.



MPLS Structure

The **MPLS header** contains a 'stack' of one or more labels. A label has four fields:

- 20-bit label value
- 3-bit field for CoS priority (experimental)
- 1-bit bottom of stack flag. If used, it signifies the current label is the last in the stack
- 8-bit TTL (time to live) field; The Time to Live label will expire at the conclusion of this number of time-to-live hops.
- The Experimental field can be used to distinguish classes of service, or per hop behavior, for differing classes of traffic traveling within the MPLS tunnel (AKA Label Switched Path - LSP). Alternatively, an LSP carrying a single traffic class uses the label to determine the per hop behavior of the class.

Frame Size Efficiency
VLAN Tagging
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IPG

Where do you want to go next?

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Technology: IP Overview *Home*

TCP Routers Gateways ICMP and Ping DNS DHCP ARP

IP

Internet Protocol is the language computers on the Internet use to talk to one another.

IP Packet

To send a message using IP, the computer adds extra information, known as the IP header, in front of the message, creating an IP packet. The IP header contains the address of the computer meant to receive the message, as well as the address of the sender. It is like regular mail: the IP header is the envelope, with the recipient address and the sender addresses on it, and the message itself is inside. In this case the addresses are numbers, like "67.34.22.199". The IP packet is sent to the Internet, over Ethernet, DSL, or PPP.
The computers that make up the Internet itself look at the destination address in the IP header, and forward the packet on, from one to another, until it gets to where it is going, just as the Post Office forwards envelopes from one sorting office to the next until it is finally sent out for delivery.

TCP

IP is unreliable: packets can get lost due to faults or overloads in the network. If a packet does get lost the sender has no way of knowing. TCP (Transmission Control Protocol) is designed to fix this. Nearly everything that happens on the Internet – web browsing, e-mail, instant messaging, etc – uses TCP.
TCP adds its own header to the message, saying how much data it has already sent and how much it has received from the other end. The combination of TCP header and the actual message is then wrapped in IP and sent to the network, hopefully to reach the addressed computer - usually after passing through many, many forwarding computers on the way.
When the recipient computer receives the TCP message it sends an acknowledgment back. If the original sender sees that acknowledgment, then all is well: the next message can be sent.
If the sender does not get an acknowledgment within a reasonable time, it sends the message again, repeating this until it knows the message has got through, or until it eventually gives up and assumes that the network is broken.
In reality, TCP acknowledges many messages at a time, while simultaneously sending its own messages. For example, a TCP header might say "I have received all your messages up to number 97, and here is my message number 38".

ICMP and Ping

ICMP (Internet Control Message Protocol), like TCP, uses IP to communicate from one computer to another. Unlike with TCP, these messages do not carry information of interest to users; instead they let the computers find out about one another.
One important type of ICMP message is called echo request. When one computer wants to check that it can reach another, it sends it echo request ICMP packet, which asks ”r;are you there?” When the other end receives that, it sends back a reply, called an echo response, meaning ”yes, I am here”. This process is called a ping. By sending a series of pings it is possible to learn a lot about the state of the network.

If we send a series of echo requests and never get any echo replies, then something is broken: perhaps the network itself is down, or perhaps the computer we are trying to reach has lost its network connection.
If we send a series of echo requests, but only get replies to some of them, then the network and remote computer are working, but not very well: some IP packets are getting lost. Even though TCP can compensate for lost packets, there is a limit to how much it can do – and every time a packet gets lost TCP has to send it again, making the overall network slower.
As a rough guide, anything more than about 10% packet loss will break TCP, and anything more than 1% will tend to make it painfully slow. A well engineered network should have negligible packet loss.
Each time we send an echo request, we can time how long it takes for the echo reply to come back. This can tell us something about the quality of the network connection. For example, if it takes a second for the reply to come back, then there is a long network delay which probably makes it unusable for some delay-sensitive applications, such as voice.

Routers

A router is a computer in the core of the network that forwards – routes – packets from one part of the network to another. It has multiple network interfaces, each connected to another router. Every time it receives a packet, a router looks at the destination IP address in the IP header, consults its internal tables to decide what to do with the packet, and then forwards it on, usually over a different network interface to a different router.
The backbone of the Internet is made up of thousands of routers, working in collaboration to forward packets from one to another, until they reach their destination.

Gateways

A gateway is a router that provides access to the Internet for user computers; it connects dissimilar networks and passes information between them.. On one side it has one or more connections to network of routers that make up the internet. On the other side it connects to individual computers.
In TCP/IP, the default gateway address is the address where the Internet protocol sends packets destined for remote networks, unless a different route is configured. Only used for static IP.
There is no fundamental difference between what a gateway does and what a router does (and the terms are often used interchangeably). They both take in packets on one interface, and forward them out of another, according to the destination IP address.
The difference is in their position in the network. Routers live inside the network, communicating with one another. Gateways live at the edge of the network, communicating between routers and individual users.

DNS

The DNS (Domain Name System) was created to handle the challenge of both remembering IP addresses and the fact that computer addresses may change over time. DNS runs on computers known as Name Servers. They have regularly updated tables of the names and IP addresses of all known computers on the Internet.
When you type ”r;www.google.com” into the address bar of your web browser, the first thing that happens is that a DNS request is sent to one of the name servers saying ”r;what is the IP address of www.google.com?” The name server will reply

with the numerical IP address, such as 208.67.219.230. Your computer will then use that address in its IP packets to communicate with Google's servers.

DHCP

DHCP (Dynamic Host Control Protocol) is the way a computer which is just joining the Internet can find its own IP address and other information, such as the IP addresses of the name server gateway to use.
When the network software is starting up, it sends out a DHCP message in an IP message which has a special type of destination address called a Broadcast address. This will be received by all computers connected to the same network segment and one (or more) of them will reply, giving the IP address that should be used and other information.

ARP

The ARP (Address Resolution Protocol) allows a networked computer to search for a computer with a particular IP address. ARP is important on LANs, such as Ethernet, where there may be many computers attached to the network, but IP packets should only be sent to one of them.
To find another computer, an ARP message is sent saying "who has IP address 192.168.1.2?" All of the computers on the network will see that message, but only the one with that IP address will respond, saying "r;that's me, at Ethernet address 12:34:56:78:9A:BC". From then on, IP packets for 192.168.1.2 will be sent to Ethernet address 12:34:56:78:9A:BC, so that only that computer will see them: all the others on the network will filter out those packets.

Where do you want to go next?

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Home

Glossary

0

0000: Industry-standard all zeros test pattern.

1

100BaseFx: Fast Ethernet; 100 Mbps on twisted pair copper.

1010: Industry-standard alternating ones and zeros test pattern.

1111: Industry-standard all 1s test pattern.

2

2e15-1, 2^15: Industry-standard 215-1 pseudo random bit sequence. This signal is formed from a 15-stage shift register and is not zero constrained. This pattern contains up to 14 zeros in a row.

2e20-1, 2^20: Industry-standard 2e20-1 pseudo random bit sequence. This signal is formed from a 20-stage shift register and is not zero constrained. This pattern contains up to 19 zeros in a row.

2e23-1, 2^23: Industry-standard 2e23-1 pseudo random bit sequence. This signal is formed from a 23-stage shift register and is not zero constrained. This pattern contains up to 22 zeros in a row.

2e31-1, 2^31: Industry-standard 2e31-1 pseudo random bit sequence. This signal is formed from a 31-stage shift register and is not zero-constrained. This pattern contains up to 30 zeros in a row.

A

Avg: Average

B

BERT: Bit Error Rate Test.

C

CFI: Canonical Format Indicator

CJPAT: Continuous Jitter Test Pattern is used for jitter measurements. It is intended to expose a receiver’s CDR (Clock and Data Recovery circuit) to large instantaneous phase jumps. The pattern alternates repeating low transition density patterns with repeating high transition density patterns.

CRC: Cyclic Redundancy Check

CRPAT: Continuous Random Test Pattern is intended to provide broad spectral content and minimal peaking that can be used for the measurement of jitter at either a component or system level.

D

DEC: Decrease

DHCP: Dynamic Host Configuration Protocol; a network application protocol used by devices (DHCP clients) to obtain configuration information for operation in an Internet Protocol network.

DNS: Domain Name System: Internet system to translate names into IP addresses.

DSCP: Differentiated Services Code Point

DUT: Device Under Test

F

FCS: Frame Check Sequence

fps: Frames Per Second

FTP: File Transfer Protocol; network protocol used to transfer data from one computer to another through a network (Internet).

G

GigE: Gigabit Ethernet

GUI: Graphic User Interface

H

H.323: H.323 is an umbrella Recommendation from the ITU Telecommunication Standardization Sector (ITU-T) that defines the protocols to provide audio-visual communication sessions on any packet network.

I

IFG: Inter Frame Gap; same as IPG.

INC: Increase

IP: Internet Protocol

IPG: Inter Packet Gap; The gap of time between the end of one frame and the start of the preamble for the next frame is also called the inter frame gap (IFG).

IPTV: Internet Protocol Television. Digital television service delivered using Internet Protocol over a network infrastructure.

K

kbps: A unit of data transfer rate equal to 1,000 bits per second.

L

LAN: Local Area Network

LLC: LLC (Logical Link Control) IEEE Public Listing; upper sublayer of the OSI data link layer.

M

M: Megabits per second; a unit of data transfer rate equal to 1,000,000 bits per second. As there are 8 bits in a byte, a transfer speed of 8 megabits per second (8 Mbit/s) is equivalent to 1,000,000 bytes per second.

MAN: Metropolitan Area Network

MPLS: Multi Protocol Label Switching; provides a unified data-carrying service for both circuit-based clients and packet-switching clients providing datagram service model; carries Ethernet frames.

P

PRBS: Pseudo-Random Binary Sequence; test pattern

R

RFC 1349: Type of Service in the RFC for Internet Protocol Suite

RFC2474: RFC for the Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers

RX: Receive

S

SFP: Small form-factor plugable optical transceiver, for rates up to but not including 10G.

SIP: Session Initiation Protocol; signalling protocol, used for setting up and tearing down multimedia communication sessions.

SN: Sequence Number; Sunrise Tag

SNAP: Subnetwork Access Protocol; allows multiplexing of additional protocols on IEEE 802.2 LLC networks.

STAG: Sunrise Tag

T

TCP: Transmission Control Protocol (TCP) is one of the core protocols of the Internet protocol suite. It manages the individual conversations between web servers and web clients.

TPID: Tag Protocol Identifier; part of a VLAN tag.

Triple Play: High speed interne, television, and telephone service all provided over one broadband connection.

TS: Time Stamp; Sunrise Tag

TX: Transmit

U

UDP: User Datagram Protocol; timely data protocol, oft used for real-time service such as VOIP.

URL: Uniform Resource Locator; often used to mean a website address.

V

VLAN: Virtual LAN; a network of hosts not actually on the same physical LAN, but grouped that way.

VOIP: Voice over IP. A protocol optimized for the transmission of voice through the Internet or other packet switched networks.

W

WAN: Wide Area Network

X

XFP: 10G Small Form Pluggable hot-swappable optical transceiver.

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