

# CMA5000a - UTA

## Universal Transport Analysis Module / 10 GigE Application



### Automatic 10G Ethernet tests using CMA 5000a-UTA module

The Universal Transport Analysis (UTA) module 10 GigE application supports powerful test functions for all technicians and engineers tasked with installing, commissioning and troubleshooting today's 10 GigE networks. The all-in-one module with functions for monitoring and generating traffic, RFC2544 performance analysis, PING continuity checks, switched-network loopback tests, and more, fully supports 10 GigE LAN-PHY and WAN-PHY networks. In particular, RFC 2544 tests are completely automated for easy acquisition of Throughput, Frame Loss, Latency, and Burstability rates. Moreover, the UTA 10 GigE application supports users with customized control of line load, frame size, frame rate, and frame contents for effective tailored tests. The unsurpassed ease-of-use quickly brings even novice engineers up to speed. Setup is easy with a step-by-step configuration guide and parameter threshold settings provide quick, clear indication of pass/fail test status.

Key Features	Key Applications
<ul style="list-style-type: none"> <li>• Supports LAN-PHY and WAN-PHY (option)</li> <li>• Hot-pluggable XFP (10GBASE-SR, -LR, -ER, -SW, -LW, -EW)</li> <li>• Supports creation and analysis of Ethernet traffic up to 100% line load</li> <li>• Automated RFC 2544 tests:               <ul style="list-style-type: none"> <li>○ Throughput</li> <li>○ Frame Loss</li> <li>○ Latency</li> <li>○ Burstability</li> </ul> </li> <li>• Capture function (option)               <ul style="list-style-type: none"> <li>○ Record traffic (one shot or continuously)</li> <li>○ Filter traffic: by MAC addresses, IP addresses, Protocols</li> <li>○ Hexadecimal representation of each captured frame</li> </ul> </li> <li>• End-to-end tests in switched networks via Reflector mode (automatic swap of MAC/IP addresses)</li> <li>• User-programmable thresholds for visual pass/fail indicators</li> <li>• Automatic test report in PDF format</li> <li>• BERT tests (option)</li> <li>• Sequence tests (option)</li> <li>• Stacked VLAN (option)</li> <li>• Multi-stream (option)</li> <li>• Channel Stats (option)</li> </ul>	<ul style="list-style-type: none"> <li>• Installing, commissioning and troubleshooting tests</li> <li>• Measure network limitations during installing/commissioning</li> <li>• Verify Service Level Agreement (SLA) criteria as per RFC 2544</li> <li>• Check network bandwidth use</li> <li>• Test both 10 GigE LAN-PHY and WAN-PHY networks</li> </ul>

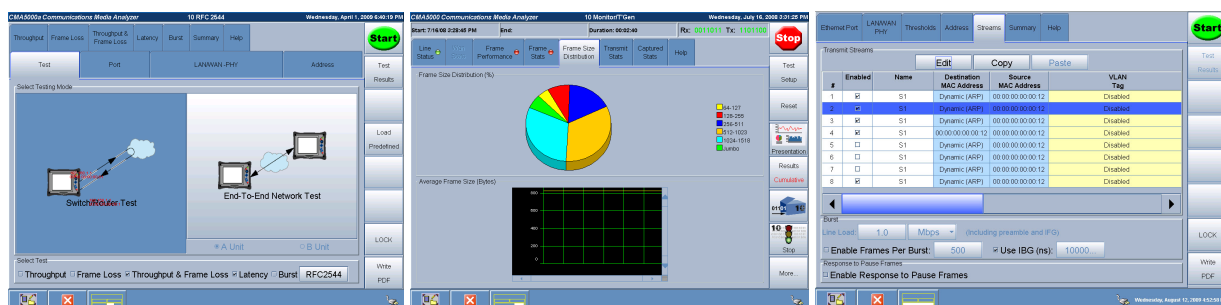


Fig.1: UTA GUI sample screens

### Testing both 10 GigE LAN-PHY and WAN-PHY networks

The IEEE 802.3ae standard defines 2 PHY layers with different bit rates and frame structures. 10 GigE LAN-PHY is the natural evolution of legacy GigE to 10 Gbit/s. The MAC Ethernet frames are transmitted at 10 Gbit/s. The line bit rate is slightly higher at 10.3125 Gbit/s because the 64B/66B physical coding is used.

10 GigE WAN-PHY encapsulates the MAC Ethernet frames into a STM64/OC-192-like frame. Consequently, the line bit rate is 9.953 Gbit/s and the MAC Ethernet frames are mapped into the VC4-64c/STS-192c container at 9.2942 Gbit/s (after 64B/66B decoding). It is important to understand that the WAN-PHY interface does not connect directly to SDH/SONET networks. Many expensive aspects of SDH/SONET interface, such as jitter specifications, clock accuracy, and optical specifications are not supported by WAN-PHY.

The UTA module supports both LAN-PHY and WAN-PHY (software option), providing a cost-effective futureproof solution.

10GigE LAN-PHY and WAN-PHY Comparison			
Type	Bit Rate of MAC Layer	Bit Rate of Physical Layer	Coding (PCS)
10 GigE LAN-PHY	10 Gbit/s	10.3125 Gbit/s	64B/66B
10 GigE WAN-PHY	9.2942 Gbit/s	9953.28 Gbit/s	64B/66B

Fig.2: Main Differences between LAN-PHY and WAN-PHY

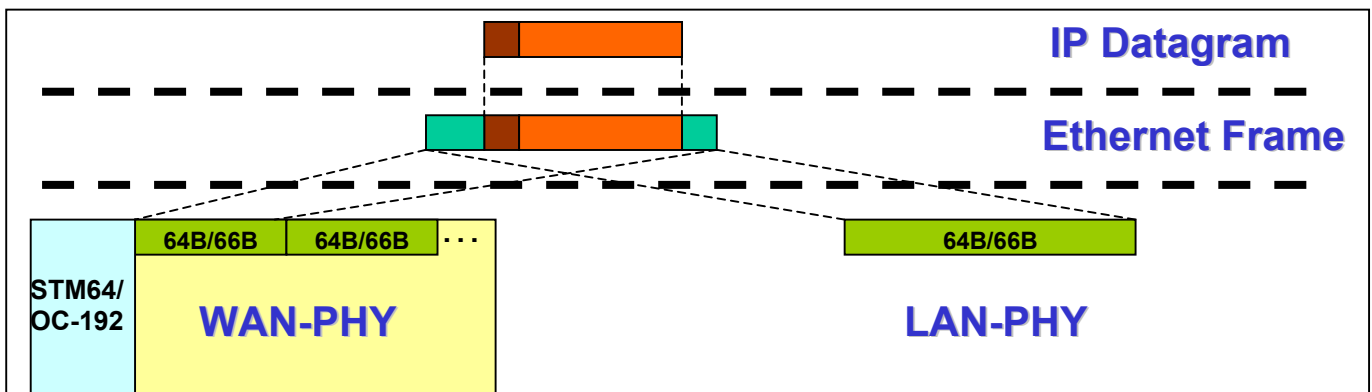


Fig.3: The UTA module supports 10 GigE LAN-PHY and 10 GigE WAN-PHY. Additional 802.3ae modes are also available in WAN-PHY such as Mixed-frequency WAN-PHY and Unframed WAN-PHY (PRBS31 pattern).

### Automated RFC 2544 tests

Assessing performance is key for any network. RFC (Request For Comments) 2544 discusses and defines a number of tests that can be used to describe the performance characteristics of a network-interconnecting device. Today, RFC 2544 is used widely by the industry as the *de facto* performance standard for Ethernet and IP networks. Note that these tests are performed out-of-service because they require traffic generation.

The main RFC2544 tests are:

- Throughput: Maximum bit rate as function of frame size
- Frame Loss: Frame loss as function of frame rate and size
- Back-to-Back Frames: Burst size as function of frame size
- Latency: Time takes for signal to traverse network

The UTA application performs all these tests automatically and displays the results as either tables or graphs for easy analysis.

The screenshot shows the 'Throughput & Frame Loss' results table for a completed test. The test was performed on Thursday, September 29, 2006, at 12:12:44 PM, with a duration of 00:09:04. The test ID is 0110011110010110.

Step	Total Frames	Frame Size	Throughput (Mbps)	Frame Rate	Frames Lost	Loss Rate (%)
Finished	892,855,339	64	10,000.000	14,080,952.381	0	0.000
Finished	586,157,824	128	10,000.000	8,446,946.946	0	0.000
Finished	272,893,425	256	10,000.000	4,528,985.587	0	0.000
Finished	148,977,139	512	10,000.000	2,349,824.860	0	0.000
Finished	95,177,793	768	10,000.000	1,586,294.416	0	0.000
Finished	71,829,888	1,024	10,000.000	1,197,318.888	0	0.000
Finished	57,853,174	1,280	10,000.000	961,538.482	0	0.000
Finished	48,768,198	1,516	10,000.000	812,743.823	0	0.000

Fig.4: Throughput and Frame Loss table screen

### Bi-directional RFC 2544 tests (Testing Mode: End-To-End Network Test)

Network performance of uplink and downlink are different if the network paths and/or the equipment configurations are different in each direction. It was hard to perform RFC2544 test of each direction since the test setting could only be transferred to the data receiving side manually.

Two UTAs located each end of the network can communicate each other and exchange the test setting. It enables each UTAs to compare the data condition from the opposite side and received data, and display the RFC2544 test result. The test engineer can test the performance of each direction simultaneously and find out which direction is the bottleneck of the network.

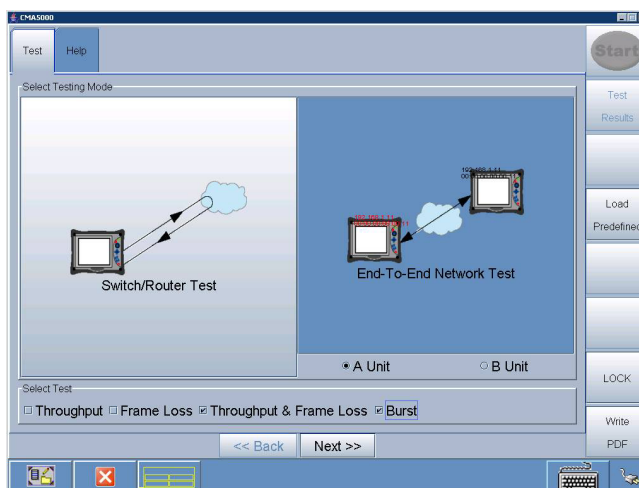


Fig.4: Bi-directional End-To-End RFC 2544 test setup

### Channel Stats

Assured bandwidth services are becoming common and when a fault occurs, carriers must perform detailed troubleshooting for each user and application on each 10G port. With this UTA function, service engineers can automatically divide flows in each field, such as operating signal VLAN ID, TCP IP port, etc., to display detailed information on the bandwidth, errors, frame length distribution for each flow. As a result, they can quickly identify specific user problems, impact on other users, etc, in much less time than required previously using conventional measuring instruments.



Fig.4: Channel Stats displaying detailed information of each data flow

### Fast professional reports

Creating professional reports has never been so easy. After finishing measurement, just one click creates, saves, and prints reports directly from the application. Select the test result, fill in the header information for the measurement and the UTA application creates professional reports in PDF format.

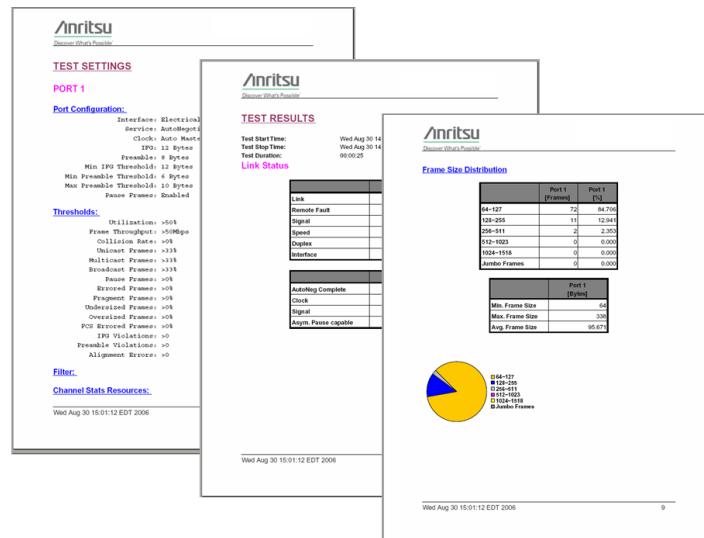


Fig.7: One click generates automatic test report in PDF format

## Field exchangeable XFP transceivers

The UTA module supports hot-pluggable XFP transceivers, offering flexible module configurability. In the field, the user just replaces the XFP with another type to change the optical interface characteristics. This is important, because there are many optical interface standards each specifying a wavelength and maximum transmission range. Whatever the 10 GigE link or equipment test, the field engineer can quickly equip the UTA module with the correct optical interface.

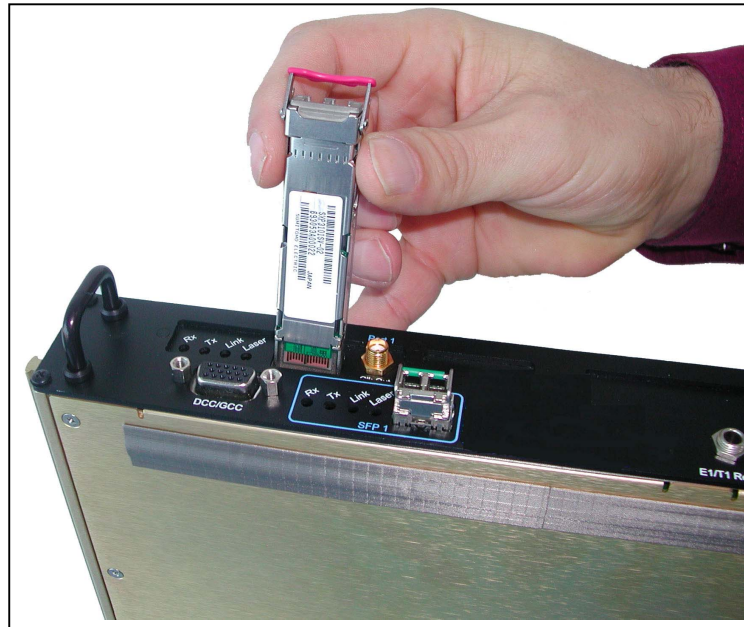


Fig.5: Hot-plugging XFP transceiver to change optical interface in field

10 GigE Optical Standards				
PHY	Interface	Line Rate	Fiber	Range
LAN-PHY	10GBASE-SR	10.3125 Gbit/s	850 nm (MM)	300 m
	10GBASE-LR		1310 nm (SM)	10 km
	10GBASE-ER		1550 nm (SM)	40 or 80 km
WAN-PHY	10GBASE-SW	9.953 Gbit/s	850 nm (MM)	300 m
	10GBASE-LW		1310 nm (SM)	10 km
	10GBASE-EW		1550 nm (SM)	40 or 80 km

Fig.6: IEEE803.3ae 10 GigE optical standards

# Specifications

Interfaces and Signal Specifications		
Signal	Port/Connector	Format
10 GigE	One XFP port * <sup>1</sup>	As per IEEE 802.3ae: - 10GigE LAN-PHY - 10GigE WAN-PHY * <sup>2</sup>
Clock Input	Bantam 100 Ohms	NA
	BNC 75 Ohms	NA
Clock Output	BNC 75 Ohms	10 MHz
	SMA 50 Ohms	Line rate divided by 16: - 644.53 MHz (for LAN-PHY) - 622.06 MHz (for WAN-PHY)

Optical Interfaces * <sup>3,4</sup>						
Ref.	Interfaces	Wavelength	Output Power	Reach	Overload	Sensitivity (OMA)
5610-140-UTA	10GBASE-SR/SW	840-860 nm	-7.3 to -1.0 dBm	300 m	-1 dBm	-11 dBm
5610-141-UTA	10GBASE-LR/LW	1290-1330 nm	-8.2 to +0.5 dBm	10 km	+0.5 dBm	-12.6 dBm
5610-150-UTA	10GBASE-LR/LW	1290-1330 nm	-8.2 to +0.5 dBm	10 km	+0.5 dBm	-12.6 dBm
5610-142-UTA	10GBASE-ER/EW	1530-1565 nm	-4.7 to +4 dBm	40 km	-1 dBm	-14.1 dBm
5610-143-UTA	10GBASE-ZR/ZW	1530-1565 nm	0 to +4 dBm	80 km	-7 dBm	-24 dBm

## Notes

- \*<sup>1</sup>: The UTA module XFP interface meets the MSA standard.
- \*<sup>2</sup>: 10 GigE WAN-PHY is an option.
- \*<sup>3</sup>: Requires separately ordered XFP
- \*<sup>4</sup>: Defined by IEEE 802.3ae. Actual specifications depend on the XFP.



Traffic Generation	
Instrument's Address Edition	<ul style="list-style-type: none"> <li>• MAC address</li> <li>• IP address</li> </ul>
Frame Edition per stream	<ul style="list-style-type: none"> <li>• Source and Destination MAC addresses.</li> <li>• Source and Destination IP addresses.</li> <li>• ARP function (enable/disable) for destination MAC address discovery.</li> <li>• VLAN Tag (enable/disable)               <ul style="list-style-type: none"> <li>○ Level: 1 – 3 (Stacked VLAN: option)</li> <li>○ TPID: 0x8100, 0x88A8, 0x9100, 0x9200, 0x9300</li> <li>○ Priority: 0 – 7</li> <li>○ ID: 0 - 4095</li> </ul> </li> <li>• Gateway function (enable/disable) with configurable gateway IP address and network mask.</li> </ul>
Frame Contents per stream	<ul style="list-style-type: none"> <li>• Encapsulation Type (Ethernet/SNAP/LLC1).</li> <li>• Payload content: PRBS 2<sup>31</sup>-1 inverted or User Defined pattern up to 16 words</li> </ul>
Generation Modes (Test duration) per stream	<ul style="list-style-type: none"> <li>• Continuous</li> <li>• Number of seconds: : 1 - 9999</li> <li>• Number of frames: 1 - 9999999</li> </ul>
Traffic Profile Edition per stream	<ul style="list-style-type: none"> <li>• Adjustable traffic distribution between broadcast and unicast frames (0% - 100%)</li> <li>• Line load 0.1 - 10000.0 Mb/s or 1 - 100 %</li> </ul>
Frame Size Distribution per stream (excluding VLAN tag)	<ul style="list-style-type: none"> <li>• Constant frame size 64 – 10000 bytes</li> <li>• Random frame size distribution with min and max values 64 - 10000 bytes</li> </ul>
Multi Stream (option)	<ul style="list-style-type: none"> <li>• Number of Stream 1 - 8</li> <li>• Naming ability to each stream</li> <li>• Copy the existing stream and paste to other stream</li> </ul>
Burst	<ul style="list-style-type: none"> <li>• enable/disable</li> <li>• Number of frame per burst 10 - 100000</li> <li>• IBG setting (enable/disable) 10 - 1000000000 ns</li> <li>• Line load 0.1 - 10000.0 Mbps or 1 - 100 % (available IBG setting is disabled)</li> </ul>
Flow Control	<ul style="list-style-type: none"> <li>• Response to Pause frames (enable/disable)</li> </ul>
Error Insertion	<ul style="list-style-type: none"> <li>• FCS errors: User programmable number of frames 1 - 1024</li> </ul>
Pause Frames Insertion	<ul style="list-style-type: none"> <li>• User programmable number of Pause frames 1 - 1024</li> <li>• User programmable Pause quanta value ( 0 – 65535 x 512 bits)</li> </ul>

Line Status	
Interface Status	<ul style="list-style-type: none"> <li>• Link: Up (Green) / Down (Red)</li> <li>• Frames present: Yes (Green) / No (Red)</li> <li>• Speed</li> <li>• Duplexity</li> <li>• Wavelength</li> <li>• XFP Vendor Name</li> <li>• XFP Serial Number</li> <li>• XFP Part Number/Rev</li> </ul>
Gauges	<ul style="list-style-type: none"> <li>• Instantaneous Utilization (%)</li> <li>• Instantaneous Throughput (Mbps)</li> <li>• Errored Frames</li> </ul>





RFC 2544 Tests	
Test Modes	<ul style="list-style-type: none"> <li>• Switch/Router Test: Only one unit is required. Used to test the data link layer of a switch or a router somewhere in the network.</li> <li>• End-To-End Network Test: Two units are required, one at each end of the network connection.</li> </ul>
General configuration parameters	<ul style="list-style-type: none"> <li>• Source and Destination MAC, IP addresses</li> <li>• ARP function (enable/disable) for destination MAC address discovery.</li> <li>• VLAN Tag (enable/disable) <ul style="list-style-type: none"> <li>○ Level: 1 – 3 (Stacked VLAN: option)</li> <li>○ TPID: 0x8100, 0x88A8, 0x9100, 0x9200, 0x9300</li> <li>○ Priority: 0 – 7</li> <li>○ ID: 0 - 4095</li> </ul> </li> <li>• Gateway function (enable/disable) with configurable gateway IP address and network mask.</li> </ul>
Throughput	<ul style="list-style-type: none"> <li>• Frame Size / Profile (excluding VLAN tag) configuration: <ul style="list-style-type: none"> <li>○ Constant with frame size from 64 to 10000 bytes</li> <li>○ Stepped with Start and End frame size from 64 to 10000 bytes and step size from 10 to 1000 bytes.</li> <li>○ User Defined (64/128/256/512/768/1024/1280/1518/Jumbo: 1519 - 10000)</li> </ul> </li> <li>• Line Load configuration: <ul style="list-style-type: none"> <li>○ Min./Max. Throughput: 0.1 to 10000.0 Mbps., Step 0.1 to 10000.0 Mbps.</li> <li>○ Auto Search: Enable/Disable.: Step: 0.01/0.1/1/10/100 Mbps</li> <li>○ Stop on No Frame Loss @ Max Throughput: Enable/Disable.</li> </ul> </li> <li>• Measurement Duration Time <ul style="list-style-type: none"> <li>○ 1 to 200 sec.</li> </ul> </li> </ul>
Frame Loss	<ul style="list-style-type: none"> <li>• Frame Size / Profile (excluding VLAN tag) and Line Load configuration: same as Throughput</li> </ul>
Latency	<ul style="list-style-type: none"> <li>• Measure Latency Only at Throughputs: Enable/Disable</li> <li>• Frame Size / Profile (excluding VLAN tag) configuration: <ul style="list-style-type: none"> <li>○ Constant with frame size from 64 to 10000 bytes</li> <li>○ Stepped with Start and End frame size from 64 to 10000 bytes and step size from 10 to 1000 bytes.</li> <li>○ User Defined (64/128/256/512/768/1024/1280/1518/Jumbo: 1519 - 10000)</li> </ul> </li> <li>• Line Load configuration: <ul style="list-style-type: none"> <li>○ Min./Max. Throughput: 0.1 to 10000.0 Mbps Step : 0.1 to 10000.0 Mbps.</li> </ul> </li> <li>• Measurement Duration Time <ul style="list-style-type: none"> <li>○ 1 to 200 sec</li> </ul> </li> <li>• Repeat Count <ul style="list-style-type: none"> <li>○ 1 to 100</li> </ul> </li> <li>• Latency Offset (Latency Calibration) <ul style="list-style-type: none"> <li>○ 0 to 20000 ns</li> </ul> </li> </ul>
Burstability (Back-to-Back)	<ul style="list-style-type: none"> <li>• Frame Size / Profile (excluding VLAN tag) configuration: <ul style="list-style-type: none"> <li>○ Constant with frame size from 64 to 10000 bytes</li> <li>○ Stepped with Start and End frame size from 64 to 10000 bytes and step size from 10 to 1000 bytes.</li> <li>○ User Defined (64/128/256/512/768/1024/1280/1518/Jumbo: 1519 - 10000)</li> </ul> </li> <li>• Burst Profile configuration: <ul style="list-style-type: none"> <li>○ Constant with burst size from 2 to 1024 frames.</li> <li>○ Stepped with Start and End burst size from 2 to 1024 frames and step burst size from 1 to 10 frames.</li> </ul> </li> <li>• Measurement Duration Time <ul style="list-style-type: none"> <li>○ 1 to 200 sec, 10 to 1000 Bursts</li> </ul> </li> <li>• Repeat Count <ul style="list-style-type: none"> <li>○ 1 to 100</li> </ul> </li> </ul>

Reflector Mode	
Reflector Mode Description	<ul style="list-style-type: none"> <li>When in Reflector mode, the UTA application filters selected Ethernet frames and swaps MAC/IP Source and Destination addresses before resending them into the network. The Reflector mode is used for end-to-end or loopback tests in switched networks.</li> </ul>
Swap Parameters	<ul style="list-style-type: none"> <li>Swap IP Addresses (Layer 3): Enable/Disable.</li> <li>Swap MAC Addresses (Layer 2): Enable/Disable.</li> <li>Reflect Errored Frames: Enable/Disable.</li> </ul>
Filter Parameters	<ul style="list-style-type: none"> <li>VLAN               <ul style="list-style-type: none"> <li>Level: 1 to 3</li> <li>ID: 0 to 4095</li> </ul> </li> <li>IP address:               <ul style="list-style-type: none"> <li>Source.</li> <li>Destination.</li> <li>Source &amp; Destination.</li> </ul> </li> <li>MAC address:               <ul style="list-style-type: none"> <li>Source.</li> <li>Destination.</li> <li>Source &amp; Destination.</li> </ul> </li> <li>Protocol Layer 2:               <ul style="list-style-type: none"> <li>Type Field of Ethernet Frame value.</li> </ul> </li> <li>Protocol Layer 3:               <ul style="list-style-type: none"> <li>Protocol Field of IPV4 datagram header.</li> </ul> </li> <li>None</li> </ul>
Flow Control	<ul style="list-style-type: none"> <li>Response to Pause frames: Enable/Disable.</li> </ul>
Statistics	<ul style="list-style-type: none"> <li>Total number of frames (cumulative or current second).</li> <li>Total number of Good Frames</li> <li>Number of reflected Layer 2 frames</li> <li>Number of reflected Layer 3 frames</li> </ul> <p>Display mode: cumulative or current second</p>

PING Test	
Frame Edition	<ul style="list-style-type: none"> <li>MAC and IP source and destination addresses.</li> <li>ARP function (enable/disable) for destination MAC address discovery.</li> <li>VLAN Tag (enable/disable)               <ul style="list-style-type: none"> <li>Level: 1 – 3 (Stacked VLAN: option)</li> <li>TPID: 0x8100, 0x88A8, 0x9100, 0x9200, 0x9300</li> <li>Priority: 0 – 7</li> <li>ID: 0 - 4095</li> </ul> </li> <li>Gateway function (enable/disable) with configurable gateway IP address and network mask.</li> <li>Do Not Fragment Frame (enable/disable)</li> </ul>
Test Setup	<ul style="list-style-type: none"> <li>Test Duration: Continuous/Seconds/Frames.</li> <li>Interval (seconds): 1-100 (interval between ping request).</li> </ul>
Frame Size Edition (excluding VLAN tag)	<ul style="list-style-type: none"> <li>64 to 10000 bytes</li> </ul>
PING Statistics	<ul style="list-style-type: none"> <li>Number of transmitted packets.</li> <li>Number of received packets.</li> <li>% of packet loss</li> <li>Round-trip time: Min./Average/Max.</li> </ul>

Capture & Decode (option)	
Capture & Decode Modes	<ul style="list-style-type: none"> <li>• Stop-On-Full Mode: The capture is stopped as soon as the capture buffer (64 kbit) is full.</li> <li>• Circular Mode: The capture runs indefinitely. When the capture buffer is full, data are read back by the SW, then the buffer is cleared and a new capture starts.</li> <li>•</li> </ul>
Trigger Configuration	<ul style="list-style-type: none"> <li>• Triggering condition: Start capture condition or End capture condition</li> <li>• The triggering criteria: <ul style="list-style-type: none"> <li>○ IP: <ul style="list-style-type: none"> <li>▪ Source.</li> <li>▪ Destination.</li> <li>▪ Source &amp; Destination.</li> </ul> </li> <li>○ MAC. <ul style="list-style-type: none"> <li>▪ Source.</li> <li>▪ Destination.</li> <li>▪ Source &amp; Destination.</li> </ul> </li> <li>○ Protocol Layer 2. <ul style="list-style-type: none"> <li>▪ Type Field of Ethernet Frame value.</li> </ul> </li> <li>○ Protocol Layer 3. <ul style="list-style-type: none"> <li>▪ Protocol Field of IPV4 datagram header.</li> </ul> </li> <li>○ None.</li> </ul> </li> </ul>
Filter Parameters	<ul style="list-style-type: none"> <li>• Filtering criteria: <ul style="list-style-type: none"> <li>○ IP: <ul style="list-style-type: none"> <li>▪ Source.</li> <li>▪ Destination.</li> <li>▪ Source &amp; Destination.</li> </ul> </li> <li>○ MAC. <ul style="list-style-type: none"> <li>▪ Source.</li> <li>▪ Destination.</li> <li>▪ Source &amp; Destination.</li> </ul> </li> <li>○ Protocol Layer 2. <ul style="list-style-type: none"> <li>▪ Type Field of Ethernet Frame value.</li> </ul> </li> <li>○ Protocol Layer 3. <ul style="list-style-type: none"> <li>▪ Protocol Field of IPV4 datagram header.</li> </ul> </li> <li>○ None.</li> </ul> </li> </ul>
Decode Data	<ul style="list-style-type: none"> <li>• Number of frames</li> <li>• Captured Date.</li> <li>• Captured Length.</li> <li>• Ethernet Frame Information: <ul style="list-style-type: none"> <li>○ Frame Type (Type Field Value).</li> <li>○ Source MAC Address value.</li> <li>○ Destination MAC Address value.</li> </ul> </li> <li>• IP datagram header information: <ul style="list-style-type: none"> <li>○ IP Version.</li> <li>○ TOS.</li> <li>○ Length.</li> <li>○ Identification.</li> <li>○ Fragment.</li> <li>○ Time –To-Live.</li> <li>○ Protocol.</li> <li>○ Source IP Address.</li> <li>○ Destination IP Address.</li> </ul> </li> </ul>
Capture Data	<ul style="list-style-type: none"> <li>• Hexadecimal (and ASCII) representation of a selected frame.</li> <li>• Data can be saved as Libpcap format and be analyzed by capturing softwares.</li> </ul>

SEQUENCE Test (option)	
SEQUENCE Test Description	<ul style="list-style-type: none"> <li>The UTA application generates Ethernet frames with a sequence number in order to analyze special events like duplicated frames, lost frames and more.</li> </ul>
Frame Edition	<ul style="list-style-type: none"> <li>MAC and IP source and destination addresses.</li> <li>ARP function (enable/disable) for destination MAC address discovery.</li> <li>Gateway function (enable/disable) with configurable gateway IP address and network mask.</li> <li>Encapsulation Type (Ethertype/SNAP/LLC1).</li> <li>Do Not Fragment Frame (enable/disable)</li> </ul>
Test Setup	<ul style="list-style-type: none"> <li>Test Duration: Continuous/Seconds/Frames.</li> </ul>
Traffic Edition	<ul style="list-style-type: none"> <li>Uniform: Line load defined by the user between 0.1 and 10000.0 Mb/s</li> </ul>
Frame Size Distribution	<ul style="list-style-type: none"> <li>Constant with frame size between 64 and 10000 bytes.</li> <li>Random distribution with configurable min and max value between 64 and 10000 bytes</li> </ul>
Flow Control	<ul style="list-style-type: none"> <li>Response to Pause frames: Enable/Disable.</li> </ul>
Statistics	<ul style="list-style-type: none"> <li>Total number of frames</li> <li>Number of Out Of Order frames</li> <li>Number of Duplicated frames</li> <li>Number of Late frames</li> <li>Number of Lost frames</li> </ul> <p>Display mode: cumulative or current second.</p>

BERT Test (option)	
Frame Edition	<ul style="list-style-type: none"> <li>MAC Source Address</li> <li>MAC Destination Address</li> </ul>
VLAN	<ul style="list-style-type: none"> <li>VLAN Tag (enable/disable) <ul style="list-style-type: none"> <li>Level: 1 – 3 (Stacked VLAN: option)</li> <li>TPID: 0x8100, 0x88A8, 0x9100, 0x9200, 0x9300</li> <li>Priority: 0 – 7</li> <li>ID: 0 - 4095</li> </ul> </li> </ul>
Test Setup	<ul style="list-style-type: none"> <li>Test Duration: Continuous/Seconds (1 to 9999)/Frames (1 to 9999999)</li> </ul>
Traffic Edition	<ul style="list-style-type: none"> <li>Uniform: Line load defined by the user between 0.1 and 10000.0 Mb/s</li> </ul>
Frame Size (excluding VLAN tag)	<ul style="list-style-type: none"> <li>Constant from 64 and 10000 bytes.</li> </ul>
Result	<ul style="list-style-type: none"> <li>Bit Error Rate</li> </ul>

WAN-PHY (option)	
WAN-PHY Modes	<ul style="list-style-type: none"> <li>• 10GigE</li> <li>• WAN-PHY with Mixed-frequency test pattern</li> <li>• Unframed with PRBS 31 pattern</li> </ul>
SOH/TOH Overhead Edition	<ul style="list-style-type: none"> <li>• A1, A2, K1, K2, S1, M1</li> <li>• J0 Path Trace Message: User-programmable 15 bytes ASCII sequence (CRC-7 added)</li> </ul>
POH Overhead Edition	<ul style="list-style-type: none"> <li>• C2, G1</li> <li>• J1 Path Trace Message: User-programmable 15 bytes ASCII sequence (CRC-7 added)</li> </ul>
Alarms Analysis	<ul style="list-style-type: none"> <li>• SDH terminology:               <ul style="list-style-type: none"> <li>○ LOS, LOF, OOF, RS-TIM, MS-AIS, MS-RDI, AU-AIS, AU-LOP, HP-TIM, HP-PLM, HP-UNEQ, HP-RDI, ERDI-SD, ERDI-CD, ERDI-PD, LCD, LSS</li> </ul> </li> <li>• SONET terminology:               <ul style="list-style-type: none"> <li>○ LOS, LOF, SEF, TIM-S, AIS-L, RDI-L, AIS-P, LOP-P, TIM-P, PLM-P, UNEQ-P, RDI-P, ERDI P-SD, ERDI P-CD, ERDI P-PD, LCD-P, LSS</li> </ul> </li> </ul>
Errors Analysis	<ul style="list-style-type: none"> <li>• SDH terminology:               <ul style="list-style-type: none"> <li>○ A1A2, B1, B2, MS-REI, B3, HP-REI, ERR</li> </ul> </li> <li>• SONET terminology:               <ul style="list-style-type: none"> <li>○ A1A2, B1, B2, REI-L, B3, REI-P, ERR</li> </ul> </li> </ul>
Pointer Analysis	<ul style="list-style-type: none"> <li>• Value, Positive movements, Negative movements, New Data Flag (NDF)</li> </ul>
Alarms Generation	<ul style="list-style-type: none"> <li>• SDH terminology:               <ul style="list-style-type: none"> <li>○ LOS, LOF, OOF, RS-TIM, MS-AIS, MS-RDI, AU-AIS, AU-LOP, HP-TIM, HP-PLM, HP-UNEQ, HP-RDI, ERDI-SD, ERDI-CD, ERDI-PD, LSS</li> </ul> </li> <li>• SONET terminology:               <ul style="list-style-type: none"> <li>○ LOS, LOF, SEF, TIM-S, AIS-L, RDI-L, AIS-P, LOP-P, TIM-P, PLM-P, UNEQ-P, RDI-P, ERDI P-SD, ERDI P-CD, ERDI P-PD, LSS</li> </ul> </li> </ul>
Errors Generation	<ul style="list-style-type: none"> <li>• SDH terminology:               <ul style="list-style-type: none"> <li>○ A1A2, B1, B2, MS-REI, B3, HP-REI, ERR</li> </ul> </li> <li>• SONET terminology:               <ul style="list-style-type: none"> <li>○ A1A2, B1, B2, REI-L, B3, REI-P, ERR</li> </ul> </li> </ul>

Channel Stats (option) 1/2	
Channel Stats Description	<ul style="list-style-type: none"> <li>• With this Channel Stats, they can automatically divide flows in each field, such as operating signal VLAN ID, TCP IP port, etc., to display detailed information on the bandwidth, errors, frame length distribution for each flow. As a result, they can quickly identify specific user problems, impact on other users, etc, in much less time than required previously using conventional measuring instruments.</li> <li>• They can filter the flow and choose the target flow before dividing it.</li> </ul>
Filter	<ul style="list-style-type: none"> <li>• Encapsulation (Ether Type / SNAP / LLC1)</li> <li>• Exclusion (Broadcast Frames / Errored Frames)</li> <li>• Source MAC address</li> <li>• Destination MAC address</li> <li>• Source IP address (range)</li> <li>• Destination IP address (range)</li> <li>• Ethernet Type Code (L2 Protocol)</li> <li>• IP Protocol Number (L3 Protocol)</li> <li>• VLAN 1, 2, 3 ID (range) / TPID / Priority</li> <li>• Source Port number</li> <li>• Destination Port number</li> <li>• MPLS label (range)</li> </ul>
Flow dividing key	<ul style="list-style-type: none"> <li>• Source MAC address</li> <li>• Destination MAC address</li> <li>• VLAN 1, 2, 3 : ID / TPID / Priority</li> <li>• MPLS</li> <li>• Source IP address</li> <li>• Destination IP address</li> <li>• Source Port number</li> <li>• Destination Port number</li> <li>• Ethernet Type Code (L2 Protocol)</li> <li>• IP Protocol Number (L3 Protocol)</li> </ul>



## Channel Stats (option) 2/2

Result field

### Ethernet Statistics

- Frame Count
- Frame Rate
- Frame Throughput
- Byte Count
- MPLS Frame Count
- MPLS Bytes Count
- Errored Frame Count
- Errored Frame Rate
- Errored Throughput
- Errored Byte Count
- IPv4 Datagram Bytes Count

### Size Distribution

- 64 – 127, 128 – 255, 256 – 511, 512 – 1023, 1024 – 1518, 1519 – Jumbo Frame (User configurable), Jumbo Frame + 1 - Oversize

### IP Statistics

- IP Header Byte Count
- IP Frame Count
- IP Fragment Frame Count
- TTL Violations Byte Count

### IPv4

- Packet Count
- Packet Rate
- Frame Byte Count
- Throughput

### TCP

- Frame Byte Count
- Packet Count
- Packet Rate
- Packet Throughput

### UDP

- Frame Byte Count
- Packet Count
- Packet Rate
- Packet Throughput

### TCP/UDP

- Errored Packet Count

## Ordering Information

Ordering Information	
5610-000-UTA	UTA base module *Applications must be ordered separately
5610-101-UTA	10 GigE LAN-PHY application (XFP not included)
5610-102-UTA	10 GigE WAN-PHY application (XFP not included)
Options	
5610-111-UTA	"Capture & Decode" option for LAN-PHY / WAN-PHY applications
5610-112-UTA	"BERT" option for LAN-PHY / WAN-PHY applications
5610-113-UTA	"Sequence Test" option for LAN-PHY / WAN-PHY applications
5610-114-UTA	"Stacked VLAN" option for LAN-PHY / WAN-PHY applications
5610-115-UTA	"Multi Stream" option for LAN-PHY / WAN-PHY applications
5610-116-UTA	"Channel Stats" option for LAN-PHY / WAN-PHY applications
Accessories	
5610-140-UTA	850 nm XFP (300 m) transceiver (LC connector)
5610-141-UTA	1310 nm XFP (10 km) transceiver (LC connector) <i>*Multi-rates XFP supporting STM-64/OC-192/10 GigE</i>
5610-150-UTA	1310 nm XFP (10 km) transceiver (LC connector) <i>*Multi-rates XFP supporting STM-64/OC-192/10 GigE/OTU-2</i>
5610-142-UTA	1550 nm XFP transceiver (40 km) (LC connector) <i>*Multi-rates XFP supporting STM-64/OC-192/10 GigE/OTU-2</i>
5610-143-UTA	1550 nm XFP transceiver (80 km) (LC connector) <i>*Multi-rates XFP supporting STM-64/OC-192/10 GigE/OTU-2</i>
Upgrades	
5610-160-UTA	UTA module upgrade with LAN-PHY application
5610-161-UTA	UTA module upgrade with WAN-PHY application
5610-162-UTA	UTA module upgrade with "Capture & Decode" option
5610-163-UTA	UTA module upgrade with "BERT" option
5610-164-UTA	UTA module upgrade with "Sequence Test" option
5610-165-UTA	UTA module upgrade with "Stacked VLAN" option
5610-166-UTA	UTA module upgrade with "Multi Stream" option
5610-167-UTA	UTA module upgrade with Channel Stats" option

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