Product Brochure

Anritsu

CMA5000

Universal **T**ransport **A**nalysis Module

CMA 5000

Universal Transport Analysis Module

One tool is all you need!

Key Features and Benefits

- Multi-technologies module
- Reduce training and test time through targeted, user-friendly applications
- Protect your investment with a complete open architecture and future-proof technology

The last few years have witnessed a tremendous evolution of the transport networks with the emergence of new technologies. Engineers and technicians tasked with the installation, turn-up and maintenance of today's networks have to deal with this increasing complexity in their daily job. In this context, a test instrument like the CMA5000-UTA capable to manage all the main technologies in one single module is a great help.

Universal

The Universal Transport Analysis -UTA- module represents a new generation of tester with this ability to support almost all the existing transport standards: Ethernet, SONET/SDH, OTN, ... With its small size, the UTA module fits in the CMA5000 platform and provides a very portable solution for field engineer.

Flexible

The UTA module also supports hot pluggable XFP and SFP transceivers. This feature brings a lot of configurability to the module. Whatever the network or equipment to test, the field engineer has the insurance to be able to equip his UTA module with the right optical interface.

OTN (OTU-1, OTU-2, 11G)

10 GigE (LAN & WAN-PHY)

SONET

SDH

Module Overview

Key Features

- Field pluggable XFP
- Field pluggable SFP
- “All-in-one” module
- Future-proof hardware

1. Field pluggable XFP
2. Field pluggable SFP
3. Data Communication Channel connector for add & drop
4. Clock reference input at 2.048 Mbit/s or 1.544 Mbit/s (Bantam 100 ohms)
5. Clock reference input at 2.048 Mhz, 1.544 Mhz or 10 MHz (BNC 75 ohms)
6. Clock output at 10 Mhz synchronous with the transmitted signal

Ease of use

Spend your time analyzing the results, instead of trying to understand the equipment. All the UTA applications use the same user-friendly graphical interface. This reduces the time it takes to learn how to use the instrument and increases measurement time efficiency: Pre-configured tests, On-line help, Automatic test reports as shown below:

UTA Applications Family

Key Features

10 GigE Application

- Support of LAN-PHY and WAN-PHY
- Field pluggable XFP: 10GBASE-SR, -LR, -ER, -SW, -LW, -EW
- Automated RFC 2544 tests
- BERT Test
- Sequence test

SONET / SDH Application

- Generates and analyzes SONET/SDH frames down to the tributary level
- Round trip delay measurement with 100 ns resolution
- APS measurement with 125 µs resolution

OTN Application

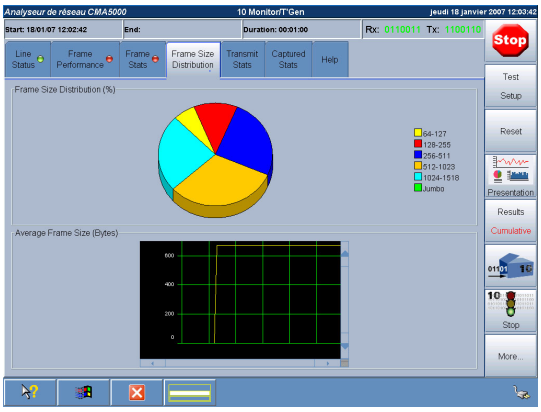
- Test OTN networks up to 11.095 Gbps
- Support Poisson error generation (O.182) for accurate FEC evaluation

Unique Feature

- SDH/SONET mapping into OTU-2/OTU-1
- ODU-1 mapping into ODU-2

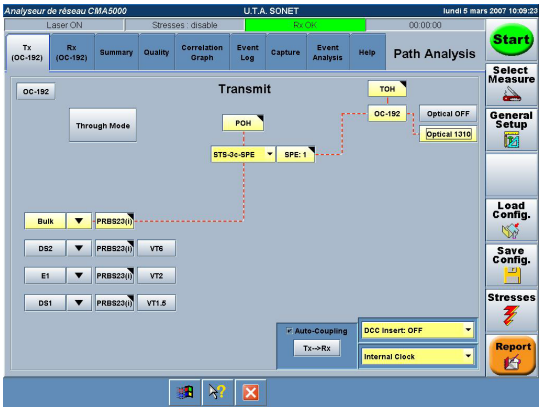
10 GigE Application

To ensure proper and efficient deployment of services, the **UTA 10 GigE application** measures critical parameters during network installation, including throughput, latency, burstability and frame loss (as detailed in RFC 2544). Full line rate traffic generation and shaping up to 10 Gbps, combined with comprehensive professional reporting, ensures the easy installation, maintenance, troubleshooting and documentation of 10 GigE LAN-PHY and WAN-PHY networks.



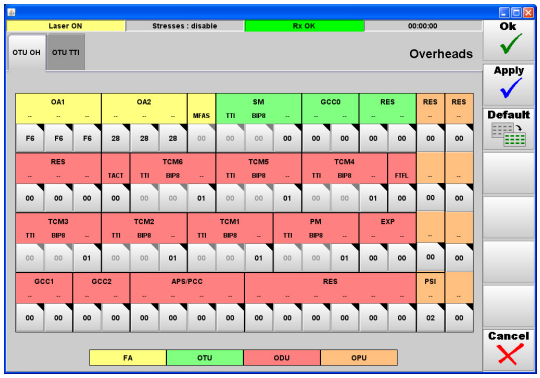
SONET / SDH Application

For characterizing and documenting network performance levels, the **UTA SONET / SDH** application provides efficient, reliable testing of a multitude of parameters, including Alarm and Error analysis, APS with 125 µs resolution, Round Trip Delay measurement with 100 ns resolution, network availability and performance evaluation. The UTA application characterizes SONET/SDH networks from 10 Gbps down to the tributary level (DS1/E1).



OTN Application

The CMA5000-UTA module supports the OTU-1 (2.66 Gbps) and OTU-2 (10.709 Gbps) frame formats as defined in the G.709 recommendation. In addition, the UTA module also supports the 11.049 Gig FEC and 11.095 Gig FEC formats. Both formats are identical to standard OTU-2 frame but with overclocking in order to authorize the mapping of LAN traffic directly into the OTN frame. Error generation according to the O.182 recommendation is also supported for acccurate FEC evaluation.



More applications to come

The UTA module is a future-proof tester. It has been designed to support most of the transport standards. You can ask to your Anritsu contact for the latest update.

General Information

General Specifications

- The UTA hardware is a double size plug-in module compatible with the CMA 5000 Muli-Layer Network Test Platform (small, medium or large bay adapters)
  Note 1: For best performance, the CMA5000 platform must have 512M RAM when using UTA with more than one application.

- AC power: 100 to 250 VAC via CMA 5000 platform

Environmental specifications:	Operating Temperature: 0°C to +40°C Storage Temperature: -20°C to +70°C Humidity: 10% to 80%
Safety:	Electrical: EN 61010-1 Optical: see specifications of XFP / SFP that are used
EMC:	EN 61326
Warranty:	1 year standard

Ordering Information

5610-000-UTA	**UTA base module** *Applications must be ordered separately
5610-101-UTA	10 GigE LAN-PHY application
5610-102-UTA	10 GigE WAN-PHY application
5610-201-UTA	10 Gig SONET/SDH application
5610-216-UTA	“STM-1/4/16 & OC-3/12/48” option for 10 Gig SONET/SDH application
5610-301-UTA	OTN application for UTA module supporting OTU-2 interface
5610-311-UTA	“OTU-1” option for OTN application

Note 2: For more detailed ordering information related to each application (accessories list and options), see the corresponding application datasheet.
Note 3: The XFP/SFP interfaces of the UTA module meets the requirements stated in the MSA standard.
Note 4: All the 10G/11G applications are field upgradeable.
For upgrades with references 5610-216-UTA and 5610-311-UTA, customers must call their Anritsu contact with module Serial Number as hardware upgrade might be required

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CMA 5000 - UTA SPECIFICATIONS

Universal Transport Analysis Module / SDH/SONET Application

Content

- **The perfect tool for testing SDH & SONET core networks up to 10 Gbps**
- **Testing APS switch time reaction of the network with 125 µs resolution**
- **Auto-discovery of the signal structure**
- **Field exchangeable XFP and SFP**
- **Fast and professional reports**

The perfect tool for testing SDH & SONET core networks up to 10 Gbps

SDH and SONET technologies are firmly established in the core and metropolitan networks. STM-64 and OC-192 are widely deployed in today's networks. While great care is devoted to warrant a very high quality of transport, in the real world of day-to-day installation, commissioning and maintenance activities things are not always running smooth. To this effect, several important tests are always carried out in order to assess the good behaviour of these networks before turn-up. Similarly, when the network has been turned on, it is paramount to keep monitoring the network health at physical level and beyond.

The SDH/SONET application of the UTA module provides a complete set of test functions for testing SDH/SONET networks up to 10 Gbps, among which we find the checking & monitoring of the optical levels, alarm, error & frequency stressing, tributary mapping checking, routing, connectivity and pointer tests on the synchronous payloads, round trip delay measurement, BER tests, automatic protection scheme switching time and more.

As a part of the UTA applications family, the SDH/SONET application is just one test solution among many others. The UTA module has been designed to support almost all the transport standards of modern networks (ex: 10 GigE, G.709, …) and represents a new class of tester for the field engineers. One tool is all you need!

Key Features	Key Applications

• SDH/SONET interfaces up to 10 Gbps
• Pluggable XFP & SFP – 1310 nm / 1550 nm
• Generates and analyzes SONET/SDH frames down to the tributary level (DS1/E1)
• Automatic Protection Switching time measurement
  ○ 125 µs measurement accuracy
• Quality assessment as per G.82X and M.21XX recommendations
• Round Trip Delay measurement
  ○ 100 ns of resolution
• Valuable Functions and Options:
  o Trouble scan, APS, RTD, Concatenation, Tandem Connection Monitoring, ATM, NGN monitoring …
• NGN Monitoring option:
  ○ Monitor several VCAT groups simultaneously
  ○ VCAT, LCAS, Differential Delay monitoring
• User-programmable thresholds for visual pass/fail indicators
• Automatic test report in PDF format
	• Installation, commissioning and troubleshooting tests
	• Check the switch time reaction of the network after failure – should not exceed 50 ms
	• Verify QoS with objective performance tests in compliance with ITU-T and Telcordia standards
	• Verify that transport delay through the network is acceptable for the service that is carried
	• Quickly identify network impairments through easy-to-interpret user interface

Testing APS switch time reaction of the network with 125 µs resolution

Due to the large amount of information being transferred over Synchronous Optical Network (SONET/SDH), it is extremely important to ensure that the transport services are as readily available as possible.

APS -Automatic Protection Switching- is the protection mechanism that has been implemented in SDH/SONET networks in order to guarantee the availability of the network in case of problems. The protection process involves switch actions between working fibers and backup fibers. This process is completed when the equipments at both ends of the network have completed these actions within the same 50 ms completion time. The result of this operation is the disappearance of the defaults because the traffic is then transmitted on the backup channel.

The UTA-SDH/SONET application is able to detect defaults that may appear during a protection switch and displays their duration with 125 µs resolution. With the ‘’Event Analysis” function of UTA, you have access to all the information from a single window: total switch duration, details of all the events, partial duration for each event…

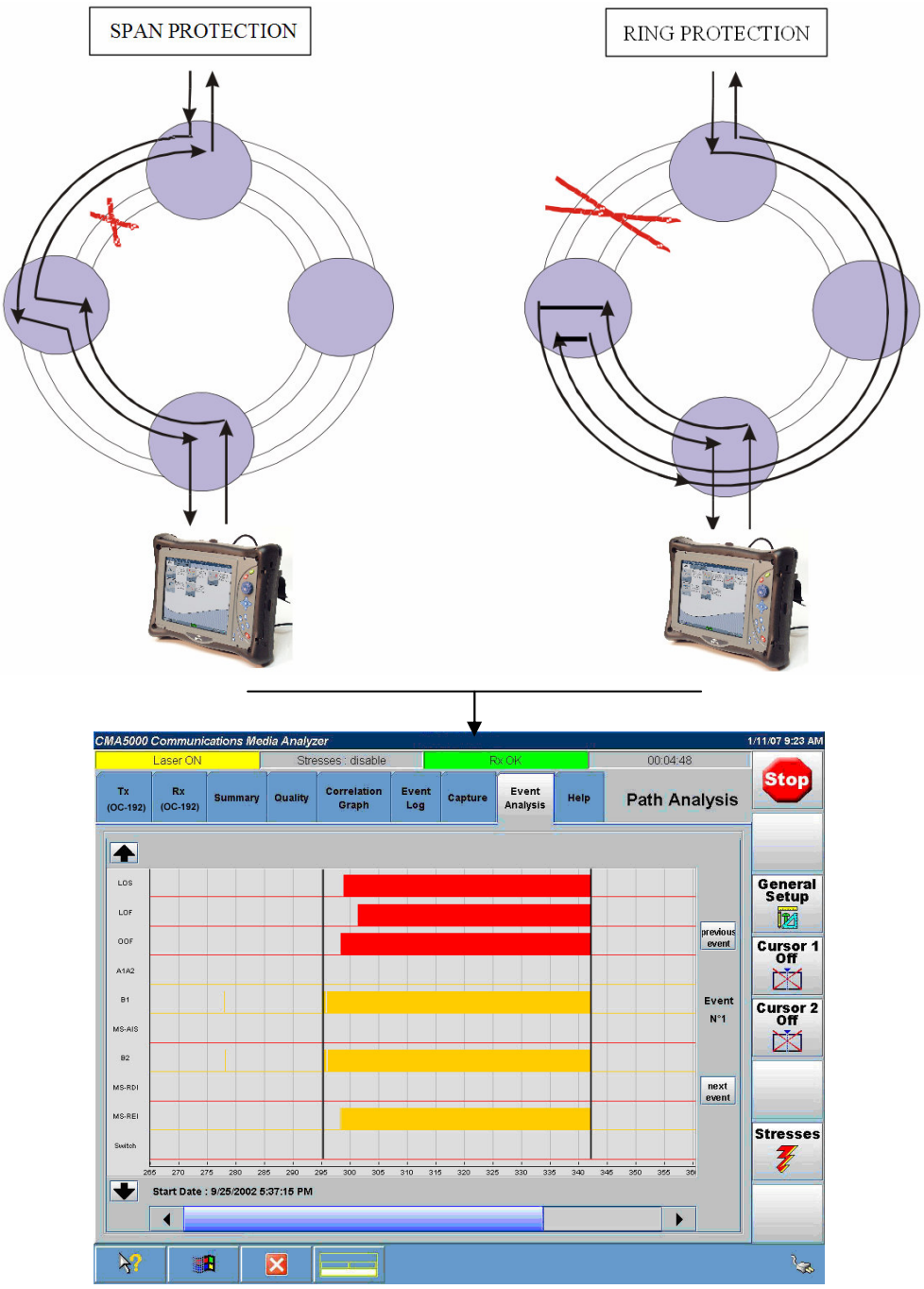


Fig.1: With the “Event Analysis” window, see all the defaults during the protection switch with 125 µs resolution.

Auto-discovery of the signal structure

When performing tests in the field, it is sometimes difficult to configure the test equipment as the signal to be analyzed is not always known: is the signal concatenated, what the frame mapping structure is, are the containers of the frame all equipped or partially equipped? In such a situation, configuring the test equipment can be very painful and time consuming.

The “Structure Scan” function of the UTA application brings a smart solution to this type of problem.
“Structure Scan” automatically analyzes the signal and displays its frame structure in a graph for fast and easy interpretation.
The “Structure Scan” graph can give a complete overview of the frame down to the tributary and allows the automatic configuration of the UTA application.

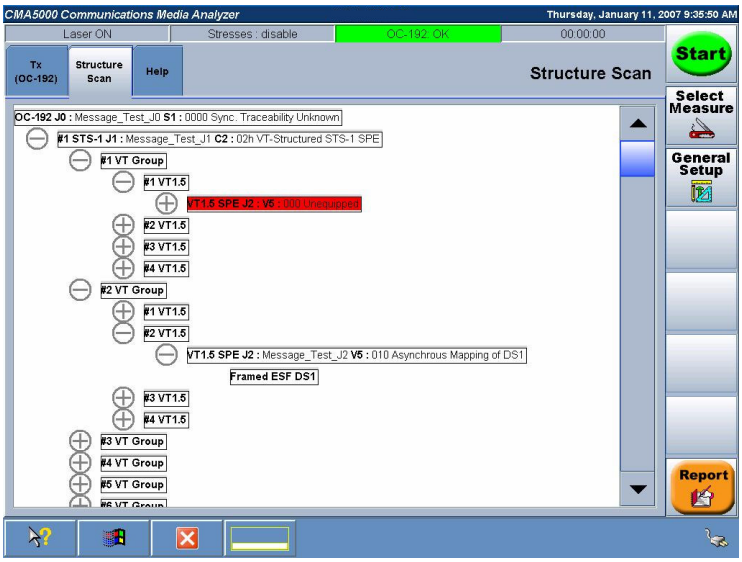


Fig.2: Discovering the frame structure of an unknown signal is easy with the “Structure Scan” function. Mix-payloads are also supported.

Field exchangeable XFP/SFP transceivers

The UTA module supports hot pluggable XFP/SFP transceivers. This feature brings a lot of configurability to the module. In the field, the user just has to replace the XFP/SFP by another to change the optical interface characteristics. Whatever the SDH/SONET link or equipment to test, the field engineer has the insurance to be able to equip his UTA module with the right optical interface.

Fig.3: Change the optical interface of your module in the field via XFP/SFP transceiver

Fast and professional reports

Creating professional report has never been so easy with the UTA application. After stopping a measurement, the report is just one click away: produce, save, print reports directly from the application. Select the set of results you want to produce, fill in the header information associated with the measurement and the UTA application will generate professionally presented reports in PDF format.

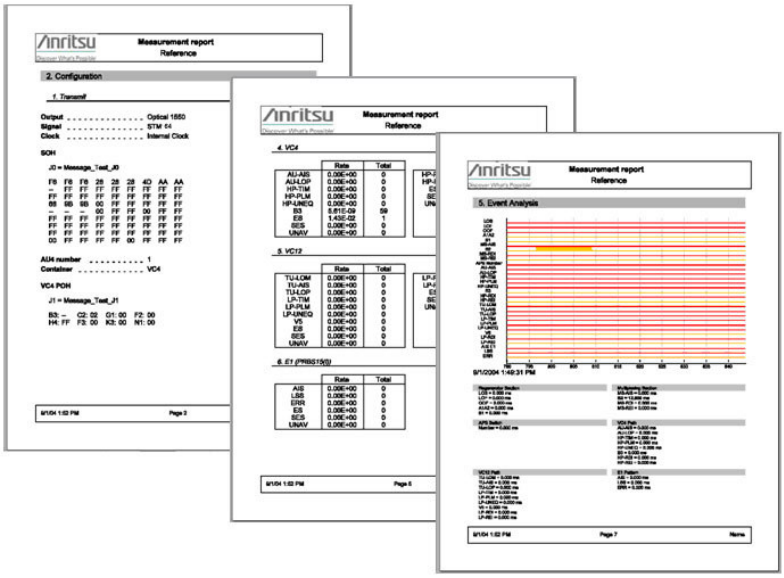


Fig.4: Generate automatic test report in PDF format with just one click

Specifications

Interfaces and Signal Specifications		
Signal	**Port/Connector**	**Format**
STM-64 / OC-192	One XFP port[1]	- SDH: as per ITU-T G.707 - SONET: as per Telcordia GR-253-Core
STM-1 / STM-4 / STM-16 *(option)* OC-3 / OC-12 / OC-48 *(option)*	One SFP port[1]	- SDH: as per ITU-T G.707 - SONET: as per Telcordia GR-253-Core
Clock Input	Bantam 100 Ohms	E1 (2.048 Mb/s) / DS1 (1.544Mb/s)
	BNC 75 Ohms	2.048MHz/1.544MHz/10MHz
Clock Output	BNC 75 Ohms	2.048MHz/1.544MHz
	SMA 50 Ohms	622.08 MHz (with STM-4/16/64) 155.52 MHz (with STM-1)
Data Communication Channel	DB-15 connector	D1-D3: 192 Kb/s channel D4-D12: 576 Kb/s channel

Optical Interfaces [1,2]							
	Ref.	**Interfaces**	**Wavelength**	**Output Power**	**Reach**	**Overload**	**Sensitivity**
XFP	5610-141-UTA	SR-1 / I-64-1	1290 – 1330 nm	-6 to -1 dBm	10 km	-1 dBm	-11 dBm
	5610-150-UTA	SR-1 / I-64.1	1290 – 1330 nm	-6 to -1dBm	10km	-1dBm	-11dBm
	5610-142-UTA	IR-2 / S-64.2b	1530 – 1565 nm	-1 to +2 dBm	40km	-1dBm	-14dBm
	5610-143-UTA	LR-2/L-64.2	1530 – 1565 nm	0 to +4 dBm	80 km	-7 dBm	-24 dBm
SFP	5610-144-UTA	LR-1 / L-16.1	1280 – 1335 nm	-2 to +3 dBm	40 km	-9 dBm	-27 dBm
	5610-145-UTA	LR-2 / L-16.2	1500 – 1580 nm	-2 to +3 dBm	80 km	-9 dBm	-28 dBm

Clock Synchronization	
Clock Reference	• Internal stratum 3 clock generation • External 2.048 MHz reference clock • Timed from 2.048 Mbit/s received signal • External 1.544 MHz reference clock • Timed from 1.544 Mbit/s received signal • External 10 MHz reference clock • Timed from SDH/SONET received signal

Notes

1 The XFP/SFP interfaces of the UTA module meet the requirements stated in the MSA standard

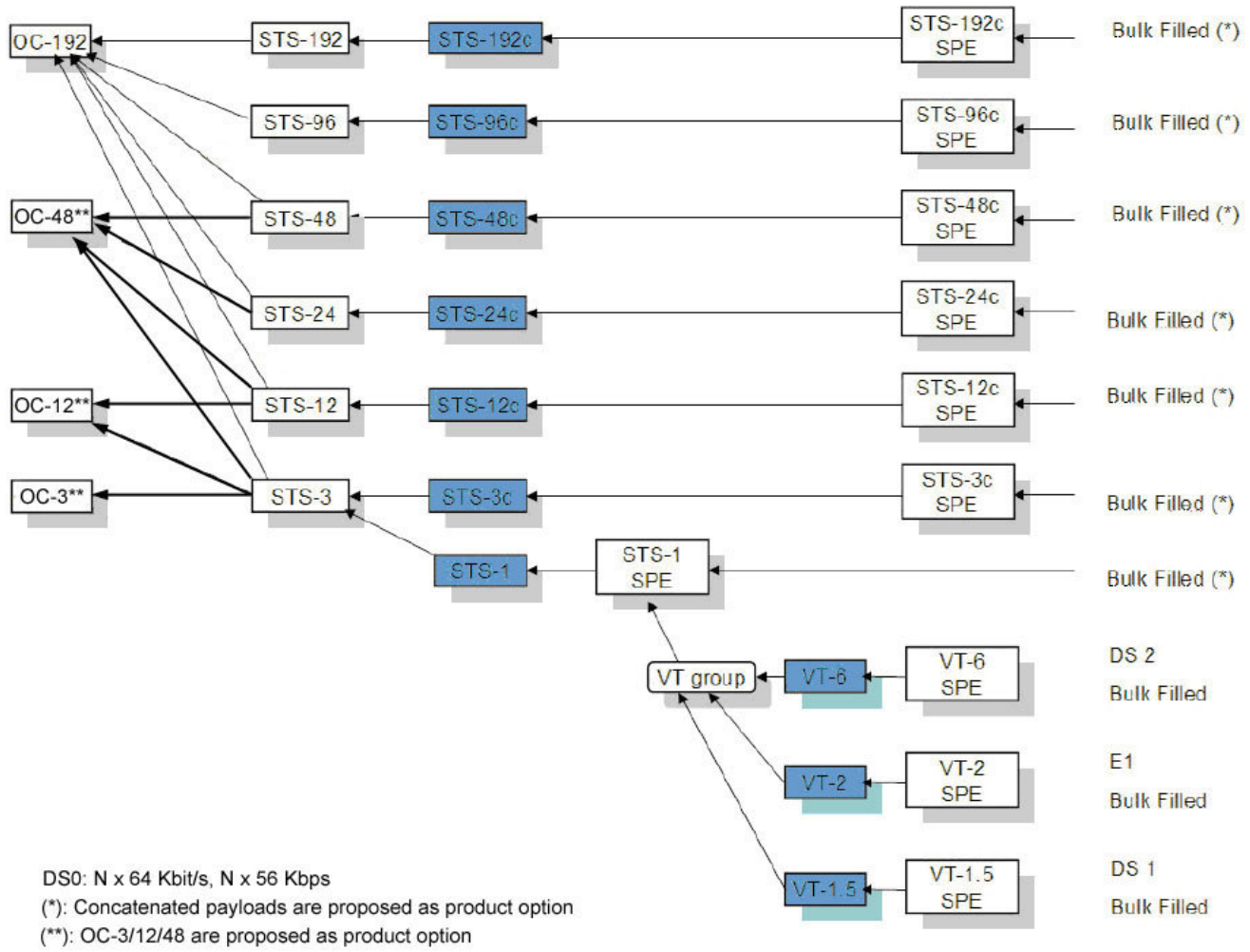
2 Requires XFP/SFP that must be ordered separately (see the ordering guide)

DCC Signals

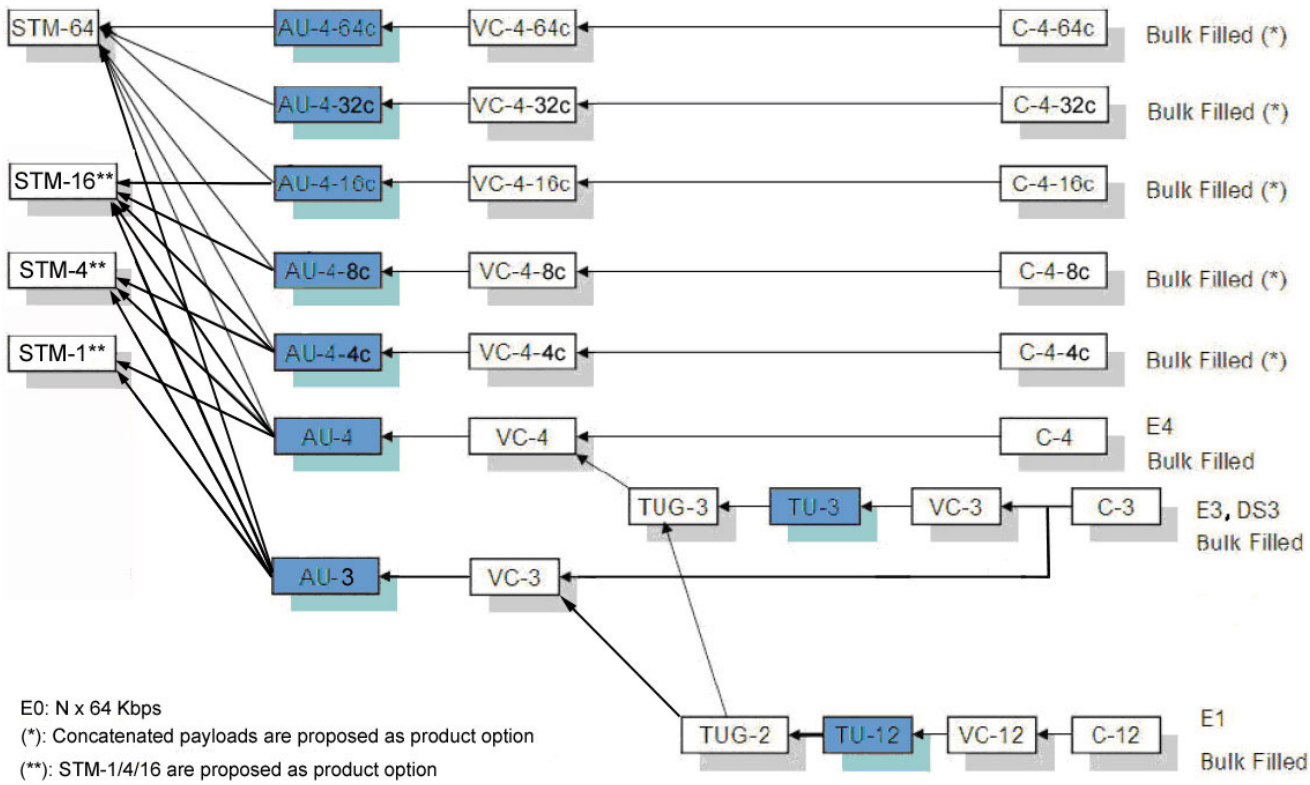
The UTA-SDH/SONET application supports the drop and insert of DCC channels from SONET/SDH

- D1-D3: 192 Kb/s
- D4-D12: 576 Kb/s

SONET Mappings



SDH Mappings



Test Pattern	
PRBS Patterns	• PRBS: 2^9-1, 2^{11}-1, 2^{15}-1, 2^{20}-1, QRSS, 2^{23}-1, 2^{29}-1, 2^{31}-1 inverted and non-inverted
Word Patterns	• All “1” pattern, all “0” pattern, alternative “01” pattern, “1000” pattern, “1010” pattern, user-defined 2 bytes word pattern, 1 in 8, 2 in 8, 3 in 24, T1 Daly

SONET/SDH Overhead Editors	
SONET	
TOH Editor	• All bytes of TOH (STS-1/STS-3) are programmable except B1/B2, H1/H2/H3 and Z0 • J0 (Trace Identifier): ○ programmable 62 bytes ASCII sequence, CRLF added or ○ programmable 15 bytes ASCII sequence, CRC (E.164) added or ○ programmable byte
POH Editor (STS)	• C2, G1, F2, H4, Z3, Z4, N1 • J1 (Trace Identifier): ○ programmable 62 bytes ASCII sequence, CRLF added or ○ programmable 15 bytes ASCII sequence, CRC (E.164) added or ○ programmable byte
POH Editor (VT)	• V5, Z6, Z7 • J2 (Trace Identifier): ○ programmable 62 bytes ASCII sequence, CRLF added or ○ programmable 15 bytes ASCII sequence, CRC (E.164) added or ○ programmable byte
SDH	
SOH Editor	• All bytes of SOH (STM-1) are programmable except B1/B2 and H3 • J0 (Trace Identifier): ○ programmable 15 bytes ASCII sequence, CRC (E.164) added or ○ programmable 62 bytes ASCII sequence, CRLF added or ○ programmable byte
POH Editor (VC-4 and VC-3)	• C2, G1, F2, H4, F3, K3, N1 • J1 (Trace Identifier): ○ programmable 15 bytes ASCII sequence, CRC (E.164) added or ○ programmable 62 bytes ASCII sequence, CRLF added or ○ programmable byte
POH Editor (VC-12)	• V5, N2, K4 • J2 (Trace Identifier): ○ programmable 15 bytes ASCII sequence, CRC (E.164) added or ○ programmable 62 bytes ASCII sequence, CRLF added or ○ programmable byte

Error Addition	
SONET/DSn	• A1/A2, B1, B2, REI-L, B3, REI-P, V5, REI-V, FAW (FAS), SFAW, FPS, MAW, Parity P, Parity CP, F-bit, M-bit, FEBE, CRC-6, PRBS, Word, transmission errors
SDH/PDH	• A1/A2, B1, B2, MS-REI, B3, LP-B3, HP-REI, V5, LP-REI, FAW (FAS), CRC-4, REI (E-bit or REBE), PRBS, Word, transmission errors
Error Control	• Programmable number or rate

Alarm Addition	
SONET/DSn	• LOS, LOF, SEF, TIM-S, AIS-L, RDI-L, AIS-P, LOP-P, TIM-P, PLM-P, UNEQ-P, RDI-P, LOM-V, AIS-V, LOP-V, PLM-V, UNEQ-V, RDI-V, TIM-V, RFI-V, LOMF, LSF, OOF, RAI, IDLE, LSS, LPS, AIS
SDH/PDH	• LOS, LOF, OOF, RS-TIM, MS-AIS, MS-RDI, AU-AIS, AU-LOP, HP-PLM, HP-TIM, HP-UNEQ, HP-RDI, TU-LOM, TU-AIS, TU-LOP, LP-PLM, LP-UNEQ, LP-TIM, LP-RDI, LP-RFI, AIS, RDI, LOMF, LSS, LPS
Alarm Control	• On steady-state or programmable number of frames

Voice Add/Drop (Option)	
SONET	• Supports adding and dropping of a selected 64/56 kb/s voice channel (carried in a DSn signal) to an external handset (µ-Law)
SDH	• NA

Stress Function	
Pointer Movement	• Pointer movement generation on SONET and SDH frames: o Pointer set to any value with or without NDF o Positive and negative movements o Pointer sequences (ITU-T G.783, Telcordia GR-253) : **SDH:** ▪ Single Alternating ▪ Regular + Double ▪ Regular + Missing ▪ Double Alternating ▪ Periodic 87.3 ▪ Periodic 87.3 with Add ▪ Periodic 87.3 with Cancel **SONET:** ▪ Single ▪ Burst of 3 ▪ Periodic ▪ Periodic with Add ▪ Periodic with Cancel ▪ Periodic 87.3 ▪ Periodic 87.3 with Add ▪ Periodic 87.3 with Cancel ▪ Phase Transient
Frequency Shift	• Programmable frequency offset: o -100 ppm to +100 ppm in 0.1 ppm steps SONET/SDH
APS (K1/K2)	• Automatic Protection Switch messages (K1/K2) are user-programmable • MSP Linear (ITU-T G.783) and MSP-Ring (ITU-T G.841) are supported
SDH Through Mode	• SOH overwrite: J0, A1, A2, K1, K2, S1, M0, M1 • Error addition: A1A2, B1, B2, MS-REI, Transmission errors • Alarm addition: LOS, LOF, OOF, MS-AIS, MS-RDI
SONET Through Mode	• TOH overwrite: J0, A1, A2, K1, K2, S1, M0, M1 • Error addition: A1A2, B1, B2, REI-L, Transmission errors • Alarm addition: LOS, LOF, SEF, AIS-L, RDI-L
DS1 Loop Codes	• DS1 SF: Loop Up, Loop Down (CSU / NIU FAC1 / NIU FAC2) • DS1 ESF: Line Loop Back Activate, Payload Loop Back Activate, Line Loop Back Deactivate, Payload Loop Back Deactivate, Universal Loop Back Deactivate (In-Band, Out-of-Band)

Path Analysis	
Signal Qualification	• Power meter • Frequency meter
Errors Analysis	• **SONET/DSn** A1/A2, B1, B2, REI-L, B3, REI-P, V5, REI-V, FAW (FAS), SFAW, FPS, MAW, Parity P, Parity CP, F-bit, M-bit, FEBE, CRC-6, PRBS, Word, ERR • **SDH/PDH** A1/A2, B1, B2, MS-REI, B3, LP-B3, HP-REI, V5, LP-REI, FAW (FAS), CRC-4, REI (E-bit or REBE), PRBS, Word, ERR
Alarms Analysis	• **SONET/DSn** LOS, LOF, SEF, TIM-S, AIS-L, RDI-L, AIS-P, LOP-P, TIM-P, PLM-P, UNEQ-P, RDI-P, LOM-V, AIS-V, LOP-V, PLM-V, UNEQ-V, RDI-V, TIM-V, RFI-V, OOF, LSF, LOMF, RAI, IDLE, LSS, LPS, AIS • **SDH/PDH** LOS, LOF, OOF, RS-TIM, MS-AIS, MS-RDI, AU-AIS, AU-LOP, HP-PLM, HP-TIM, HP-UNEQ, HP-RDI, TU-LOM, TU-AIS, TU-LOP, LP-PLM, LP-UNEQ, LP-TIM, LP-RDI, LP-RFI, AIS, RDI, LOMF, LSS, LPS
Pointer Movement Analysis	• Pointer value • Number of positive and negative pointer movements • Number of pointer movement with NDF
Quality Analysis	• SONET Transmission quality is calculated each second as per GR-253 • SDH/PDH Transmission quality is calculated each second in accordance with recommendations G.826, G.828, M.2100, M2101.1, M.2101, M.2110 for performance
Overhead Analysis	• J0, J1 and J2 Path Trace messages (ASCII sequence) • S1 (synchronization status) • C2/V5 (signal label) • Complete display of SOH/TOH and POH of the analyzed path channel • Capture capacity: 64 consecutive frames
Event Analysis	• Alarms and errors event analysis in temporal graphical display with 125 µs resolution

Round Trip Delay
• Measurement possible at each path level • Resolution: 100 ns • Range: 0 to 2 sec (depending on path level) • Result: Maximum RTD, minimum RTD, Average RTD and errors/alarms detection

Automatic Protection Switching Measurement
• Number of switches • Switch duration (with 125 µs resolution) • K1/K2 capture and interpretation

Performance Analysis
• Direct graphical presentation of performance and availability conformance test result • Automatic calculation of acceptance thresholds according to ITU-T recommandations, such as M.2100, M.2101.1 and M.2101 • Automatic calculation of Performance Objectives according to ITU-T recommendations such as G.826, G.828

Structure Scan
• Complete signal mapping auto discovery (including Mix Payload)

Trouble Scan
• Continuous VC-4/SPEs scanning for alarms and errors detection

Ordering Information

Ordering Information	
5610-000-UTA	UTA base module *Applications must be ordered separately
5610-201-UTA	10 Gig SONET/SDH application (XFP not included)
Options	
5610-211-UTA	Concatenation option for 10 Gig SONET/SDH application
5610-212-UTA	Voice add/drop option for 10 Gig SONET/SDH application (only available for SONET)
5610-213-UTA	Tandem Connection Monitoring option for 10 Gig SONET/SDH application
5610-214-UTA	ATM option 10 Gig SONET/SDH application
5610-215-UTA	Virtual Concatenation Monitoring option (VCAT, LCAS, Diff.Delay) for High Order for 10 Gig SONET/SDH application
5610-216-UTA	‘’STM-1/4/16 and OC-3/12/48” option for 10 Gig SDH/SONET application (SFP not included)
5610-239-UTA	Remote Command for SDH/SONET application (via Ethernet) *Remark: Voice Add/Drop / ATM / VCAT Monitoring options are not supported by remote commands*
Accessories	
5610-141-UTA	1310 nm **XFP** (10 km) transceiver (LC connector) **Multi-rates XFP supporting STM-64/OC-192/10 GigE*
5610-150-UTA	1310 nm **XFP** (10 km) transceiver (LC connector) **Multi-rates XFP supporting STM-64/OC-192/10 GigE/OTU-2*
5610-142-UTA	1550 nm **XFP** transceiver (40 km) (LC connector) **Multi-rates XFP supporting STM-64/OC-192/10 GigE/OTU-2*
5610-143-UTA	1550 nm **XFP** transceiver (80 km) (LC connector) **Multi-rates XFP supporting STM-64/OC-192/10 GigE/OTU-2*
5610-144-UTA	1310 nm **SFP** transceiver (40 km) (LC connector) ** Multi-rates SFP supporting STM-1/4/16 & OC-3/12/48 & OTU-1*
5610-145-UTA	1550 nm **SFP** transceiver (80 km) (LC connector) ** Multi-rates SFP supporting STM-1/4/16 & OC-3/12/48 & OTU-1*
Upgrades	
5610-261-UTA	UTA module upgrade with “Concatenation” option
5610-262-UTA	UTA module upgrade with “Voice add/Drop” option
5610-263-UTA	UTA module upgrade with “Tandem Connection Monitoring” option
5610-264-UTA	UTA module upgrade with “ATM” option
5610-265-UTA	UTA module upgrade with “VCAT Monitoring” option
5610-266-UTA	UTA module upgrade with “STM-1/4/16 and OC-3/12/48 option (SFP not included)

Note 1: For best performance, the CMA5000 platform must have 512M RAM when using UTA with more than one application.

Note 2: All the 10G/11G applications are field upgradeable.
For upgrades with reference 5610-266-UTA, customers must call their Anritsu contact with module Serial Number as hardware upgrade might be required.

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Please Contact :

CMA5000 - UTA SPECIFICATIONS

Universal Transport Analysis Module / OTN Application

Content:

- **Test all OTN rates up to 11.095 Gbps with one single module**
- **Accurate FEC performance evaluation with O.182**
- **Field exchangeable XFP and SFP transceivers**
- **Fast and professional reports**

Test all OTN rates up to 11.095 Gbps with one single module

The emergence of ITU-T G.709 recommandation in 2001 (“Network Node Interfaces for the Optical Transport Network (OTN)”) has paved the way for a new generation of DWDM optical transport networks whereby several important mechanisms enable the following capabilities:

- Management and intelligence in the optical domain
- Compatibility with all existing network communication protocols
- Enhancement of about 5-6 dB in optical budget through the use of Forward Error Correction scheme (FEC)

The CMA5000-UTA module supports the OTU-1 (2.66 Gbps) and OTU-2 (10.709 Gbps) frame formats as defined in the G.709 recommendation. In addition, the UTA module also supports the 11.049 Gig FEC and 11.095 Gig FEC formats. Both formats are identical to standard OTU-2 frame but with overclocking in order to authorize the mapping of 10GigE-LAN traffic directly into the OTN frame. The 2 rates (11.049 and 11.095 Gbps) correspond to the 2 different methods of mapping into OTU-2: with and without fixed stuff (see figure 1).

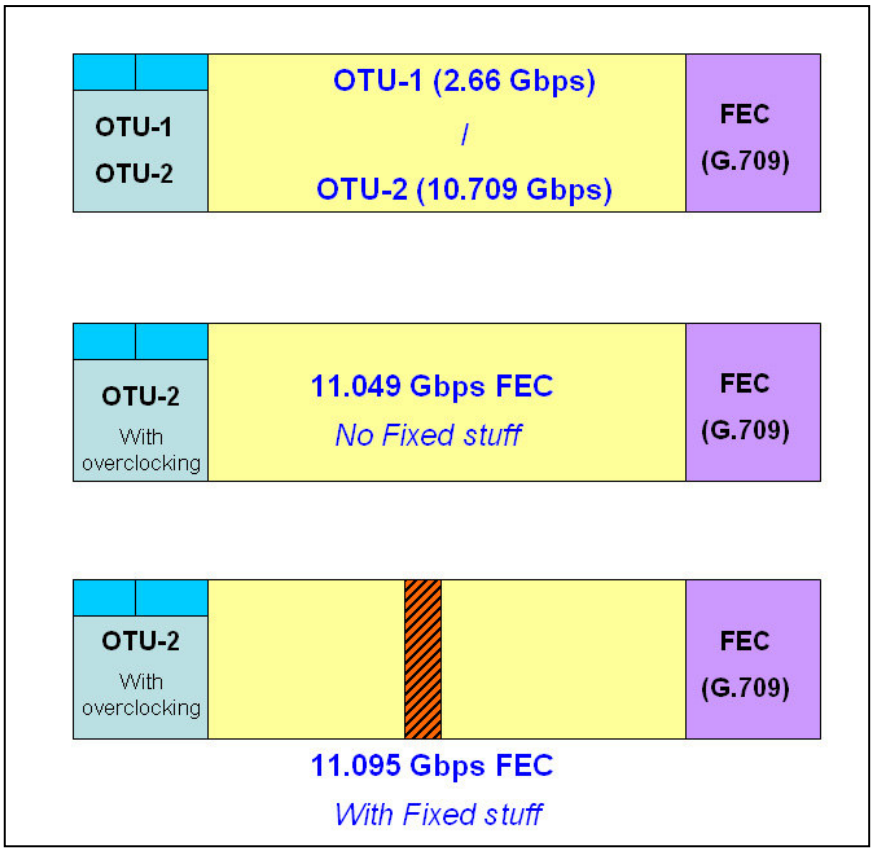


Fig.1: The different OTN frames supported by the CMA5000-UTA

Key Features	Key Applications

• Multi-rates OTN support:
  ○ OTU-2 (10.709 Gbps)
  ○ OTU-1 (2.66 Gbps)
  ○ 11.049 Gbps FEC
  ○ 11.095 Gbps FEC
• SDH/SONET mapping into OTU-1/OTU-2 frames
• ODU-1 mapping into OTU-2
• Edition of OTN overhead bytes: OTU, ODU, OPU
• FEC encoder / decoder can be activated / deactivated
• Poisson error generation according to ITU-T O.182 recommendation
• Field exchangeable XFP
• Automatic test report in PDF
	• Installation, commissioning and troubleshooting tests
	• Accurate FEC performance evaluation through O.182 error insertions
	• Test of "*extended OTN*" equipments at 11.049 Gbps and 11.095 Gbps

Accurate FEC performance evaluation with O.182

The ITU-T G.709 Optical Transport Network (OTN) Forward Error Correction (FEC) code uses the Reed Solomon codes (RS255 and RS239). Since the Reed Solomon codes are block codes, generation of pseudo-random errors makes it impossible to evaluate FEC decoder performance properly by comparing the error correction performance with the theoretical curve. Accordingly, a new method of error generation has been specified by the ITU-T O.182 recommendation. This method involves a special Poisson error generator that approximates the actual conditions of an in-service network and is a suitable condition for evaluating FEC performance. The CMA5000-UTA has a Poisson error generator fully compliant to O.182.

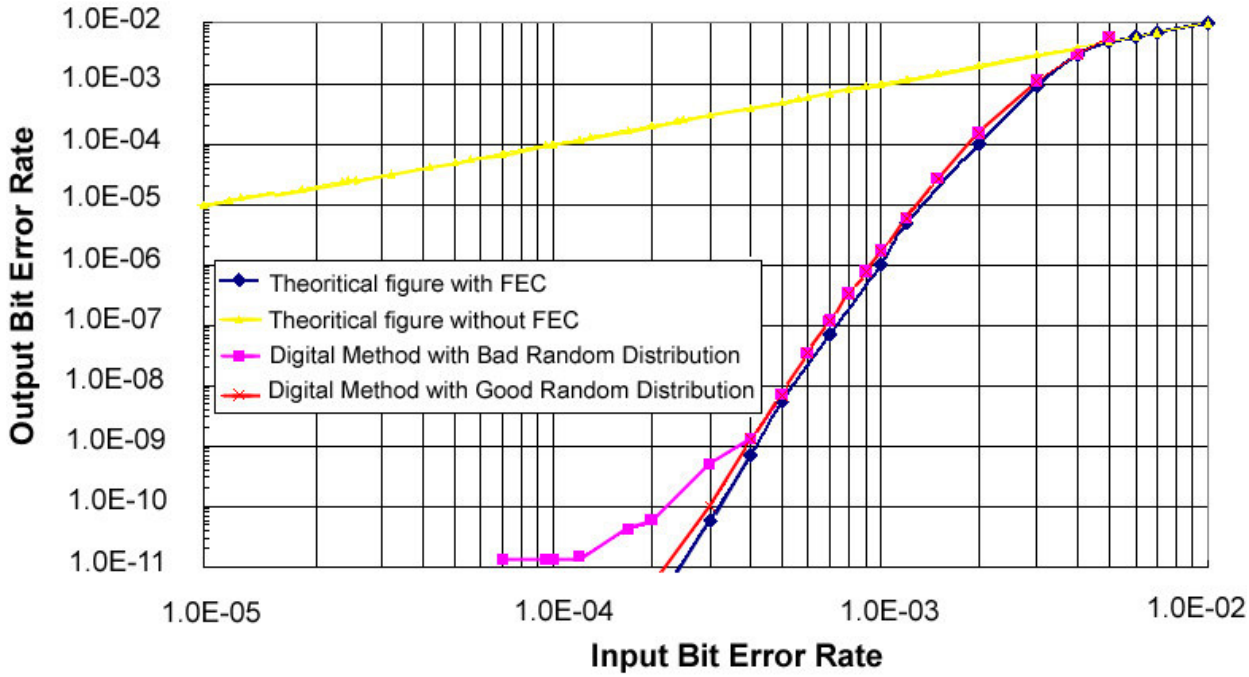


Fig.2: More accurate FEC evaluation with O.182

Field exchangeable XFP and SFP transceivers

The UTA module supports hot pluggable XFP and SFP transceivers. This feature brings a lot of configurability to the module. In the field, the user just has to replace the XFP/SFP by another to change the optical interface characteristics. This is particularly important as many optical interface standards exist today, each of them specifying a wavelength and a maximum transmission range.

Fig.3: Change the optical interface of your module in the field via XFP/SFP transceivers

Fast and professional reports

Creating professional report has never been so easy with the UTA application. After stopping a measurement, the report is just one click away: produce, save, print reports directly from the application. Select the set of results you want to produce, fill in the header information associated with the measurement and the UTA application will generate professionally presented reports in PDF format.

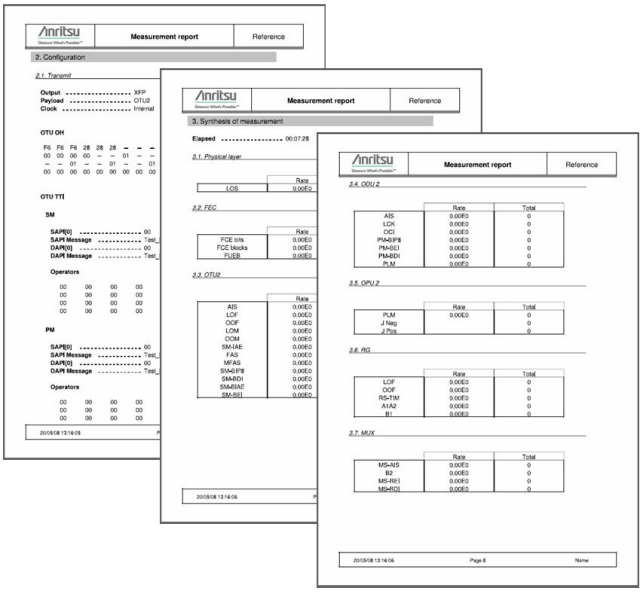


Fig.4: Generate automatic test report in PDF format with just one click

Specifications

Interfaces and Signal Specifications		
Signal	**Port/Connector**	**Format**
OTU-2 (10.709 Gb/s)	One XFP port[1]	As per G.709
11.049 Gb/s FEC 11.095 Gb/s FEC		As per GSup43 subclause 7.2 As per GSup43 subclause 7.1
OTU-1 (2.66 Gb/s)	One SFP port[1]	As per G.709
Clock Input	Bantam 100 Ohms	2,048 Mb/s (E1), 1,544Mb/s (DS1)
	BNC 75 Ohms	2,048MHz / 1,544MHz / 5MHz / 10MHz AC coupled
Clock Output	SMA 50 Ohms	Line rate divided by 16 (AC coupled)
	BNC 75 Ohms	10 MHz

Optical Interfaces						
XFP[2]						
Interfaces	**Ref.**	**Wavelength**	**Output Power**	**Reach**	**Overload**	**Sensitivity**
OTU-2 / 11G FEC	5610-150-UTA	1310 nm	-6 to -1 dBm	10 km	-1 dBm	-11 dBm
	5610-142-UTA	1550 nm	-1 to +2 dBm	40 km	-1 dBm	-14 dBm
	5610-143-UTA	1550 nm * * *with APD XFP*	0 to +4 dBm	80 km	-7 dBm	-24 dBm
SFP[2]						
OTU-1	5610-144-UTA	1310 nm	-2 to +3 dBm	40 km	-9 dBm	-25 dBm
	5610-145-UTA	1550 nm	-2 to +3 dBm	80 km	-9 dBm	-26 dBm

Clock Synchronization	
Clock Reference	• Internal stratum 3 clock generation • External 2.048 MHz reference clock • Timed from 2.048 Mbit/s received signal • External 1.544 MHz reference clock • Timed from 1.544 Mbit/s received signal • External 5 MHz clock • External 10 MHz clock • Timed from OTU-2/OTU-1/11.049 Gbps/11.095 Gbps received signal
Clock Output	• Line rate divided by 16 • 10 MHz

Notes

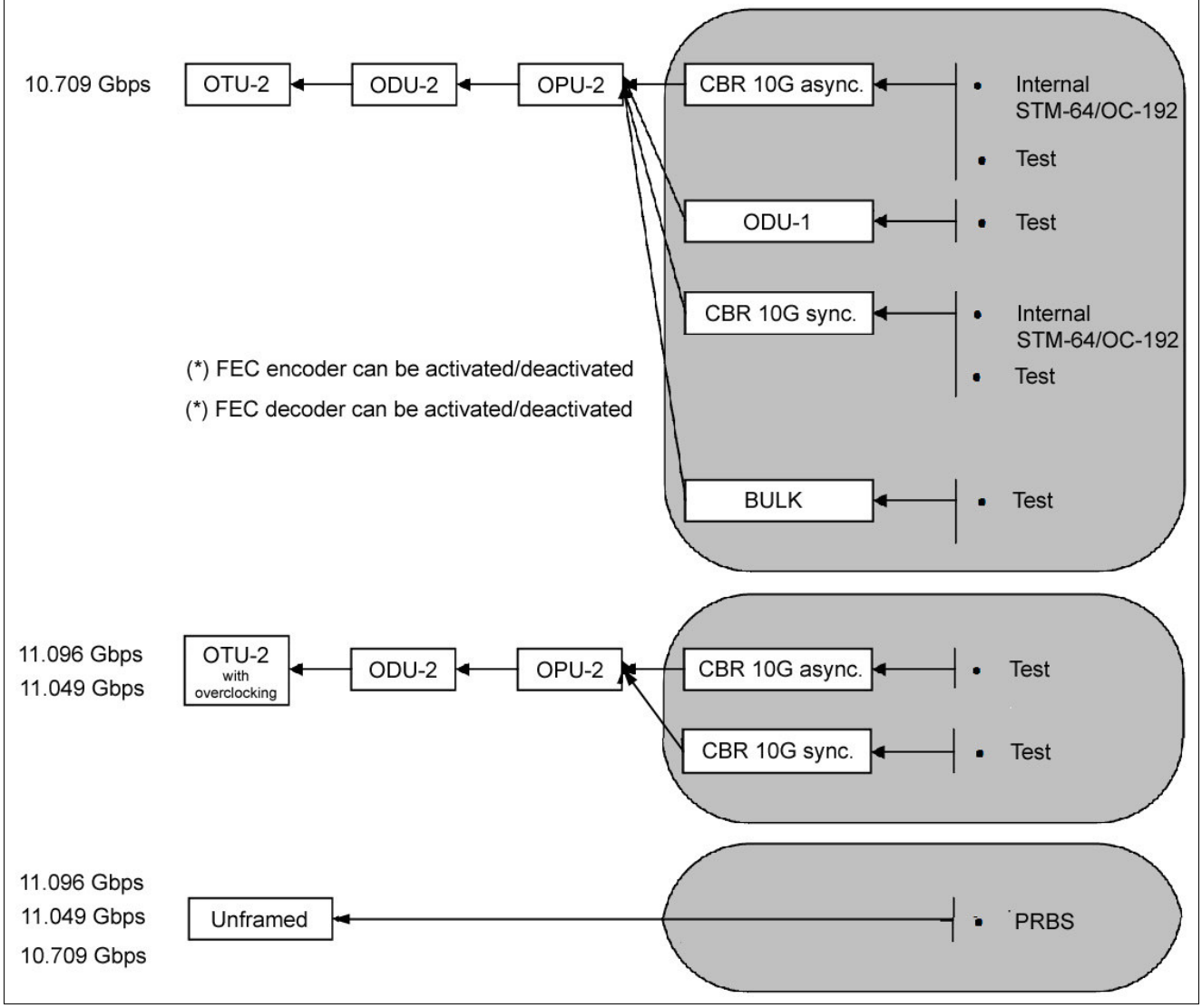
[1] The XFP and SFP interfaces of the UTA module meet the requirements stated in the MSA standard

[2] XFP and SFP must be ordered separately

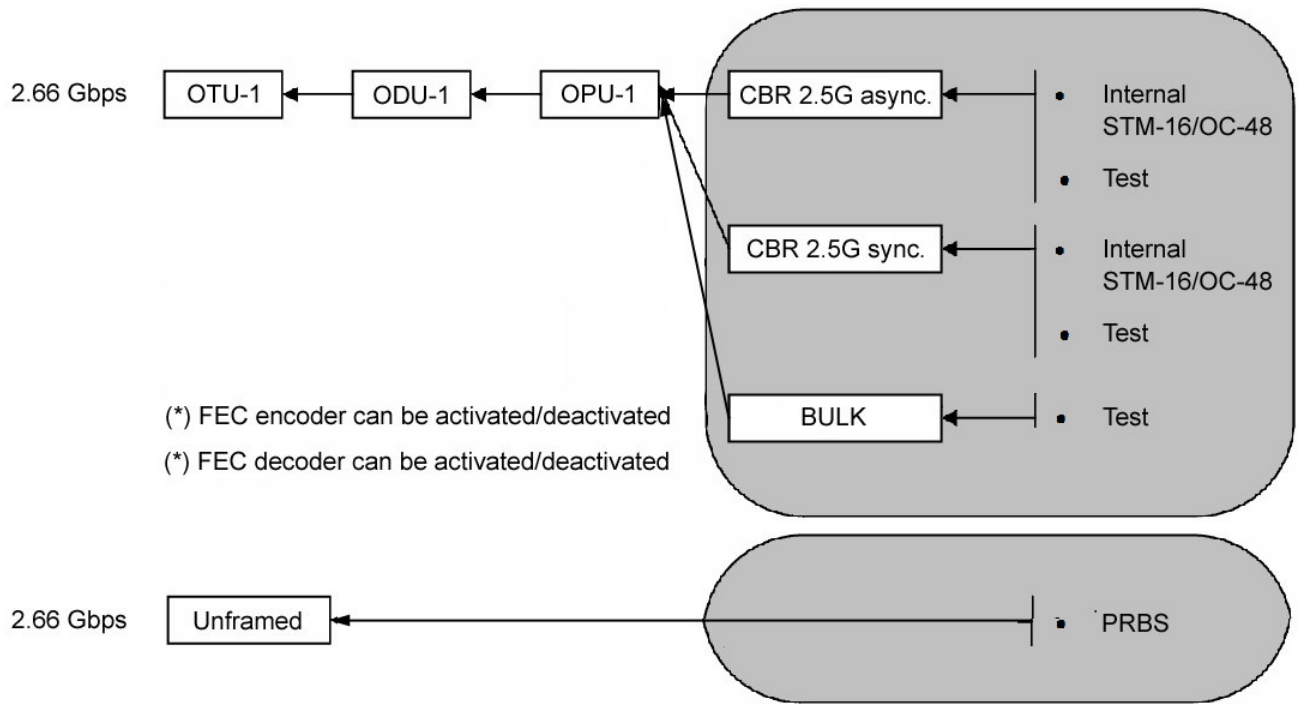
Frame Formats	
OTN format	• OTU-2 and OTU-1 as per ITU-T G.709
SDH format	• STM-64 and STM-16 as per ITU-T G.707
SONET format	• OC-192 and OC-48 as per Telcordia GR-253

Unframed Signals	
Rates	• 10.709 Gbps • 11.04911 Gbps • 11.09573 Gbps • 2.66 Gbps

OTU-2 Mappings & Structures

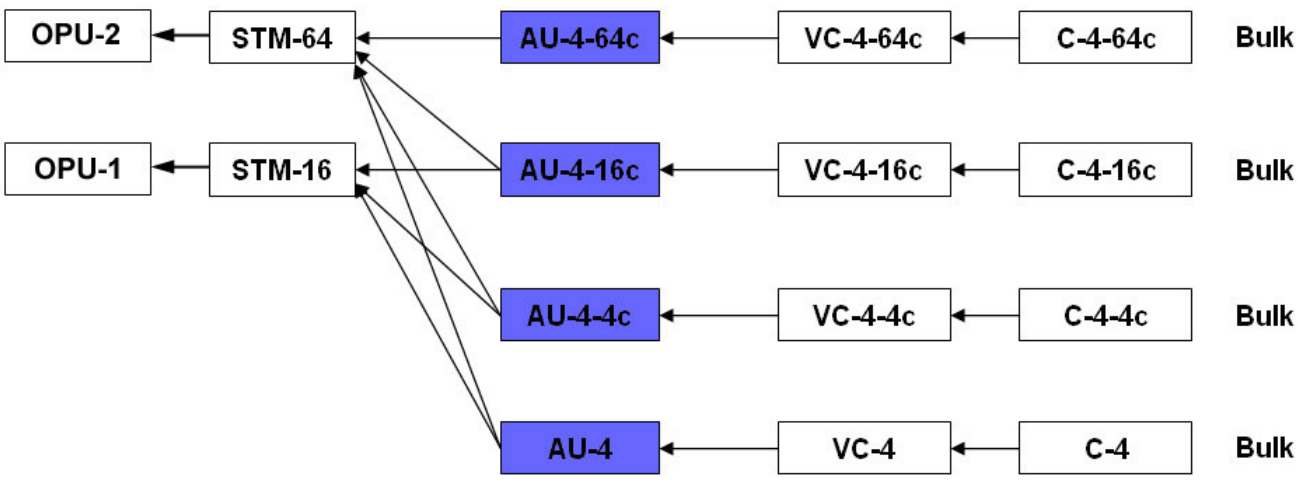


OTU-1 Mappings & Structures

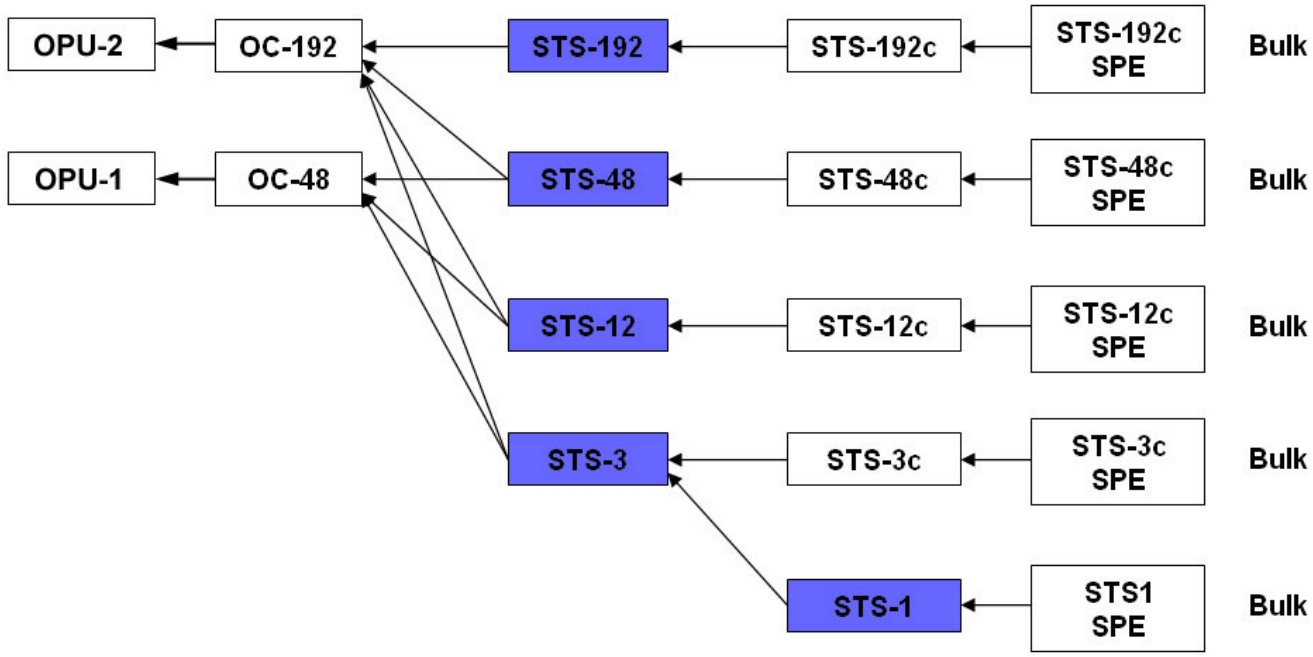


Test Patterns	
PRBS	• PRBS 31, PRBS 23, PRBS 15 (inverted and non-inverted)
Patterns	• NULL pattern, All ‘’1s’’, All ‘’0s’’, Alternate ‘’01’’, 16 bit user programmable pattern

Internal SDH Frame Structures



Internal SONET Frame Structures



OTN Overhead Editors	
OTU Editor	• **FAS**: OA1, OA2 • **SM**: SAPI, DAPI, Operator bytes • **GCC 0**
ODU Editor	• **RES**: 3 bytes • **TCM/ACT**: 1 byte • **TCM-i** (i=1 to 6): SAPI, DAPI, Operator bytes • **FTFL:** 1 byte • **GCC 1:** 2 bytes • **GCC 2:** 2 bytes • **APS/PCC:** 4 bytes
OPU Editor	• **PSI:** PT

SDH/SONET Overhead Editors	
SDH Frame	
SOH	• All bytes of SOH (STM-1) are programmable except B1/B2 • J0 (Trace Identifier): programmable 15 bytes ASCII sequence, CRC (E.164) added
POH	• C2, G1, F2, H4, F3, K3, N1 • J1 (trace Identifier): programmable 15 bytes ASCII sequence, CRC (E.164) added
SONET Frame	
SONET frame (TOH)	• All bytes of SOH (STS-3) are programmable except B1/B2 and Z0 • J0 (Trace Identifier): programmable 62 bytes ASCII sequence, CRLF added
POH	• C2, G1, F2, H4, Z3, Z4, N1 • J1 (trace Identifier): programmable 62 bytes ASCII sequence, CRLF added

Errors Addition	
SDH over OTN	• A1/A2, B1, B2, B3, MS-REI, AU-REI, ERR
SONET over OTN	• A1/A2, B1, B2, B3, REI-L, REI-P, ERR
OTN	• **FEC**: Correctable FEC bit, Correctable FEC block, Uncorrectable FEC block Error generation according to O.182 (Poisson error generation) • **OTU**: FAS, MFAS, SM-BIP 8, SM-BEI • **ODU**: PM-BIP 8, PM-BEI
Error Control	• Programmable number or Rate • FEC error control: User-programmable 8-bit mask

Alarms Addition	
SDH over OTN	• LOF, OOF, RS-TIM, MS-AIS, MS-RDI, AU-AIS, AU-LOP, HP-PLM, HP-TIM, HP-UNEQ, HP-RDI, LSS
SONET over OTN	• LOF, SEF, TIM-S, AIS-L, RDI-L, AIS-P, LOP-P, TIM-P, PLM-P, UNEQ-P, RDI-P, LSS
OTN	• **OTU**: LOF, OOF, LOM, OOM, OTU-AIS, SM-TIM, SM-IAE, SM-BDI, SM-BIAE, SM-SAPI, SM-DAPI • **ODU**: ODU-AIS, ODU-LCK, ODU-OCI, PM-BDI, PM-SAPI, PM-DAPI • **OPU**: PLM
Alarm Control	• On steady-state or programmable number of frames

Test Functions	
OTU Frequency Shift	• Programmable frequency offset: -100 ppm to +100 ppm
OPU Justifications	• Generation of payload frequency offset: -65 ppm to +65 ppm
FEC	• FEC encoder can be deactivated
SDH/SONET Pointer Movements	• Pointer movement generation: ○ Pointer set to any value with or without NDF ○ Positive and Negative movements ○ G.783 sequences

OTN Analysis	
Signal Qualification	• Power meter (dB) • Frequency meter (ppm)
Error Analysis	• **FEC**: FEC bit, FEC block, FUEB • **OTU**: FAS, MFAS, SM-BIP 8, SM-BEI • **ODU**: PM-BIP 8, PM-BEI • **Payload**: ERR
Alarm Analysis	• **OTU**: LOF, OOF, LOM, OOM, OTU-AIS, SM-TIM, SM-IAE, SM-BDI, SM-BIAE • **ODU**: ODU-AIS, ODU-LCK, ODU-OCI, PM-BDI, PM-TIM • **OPU**: PLM
Justifications	• Positive and Negative OPU justifications count • OPU frequency shift (ppm)

SDH/SONET over OTN Analysis	
SDH	
Error Analysis	• A1/A2, B1, B2, B3, MS-REI, AU-REI, ERR
Alarm Analysis	• LOF, OOF, RS-TIM, MS-AIS, MS-RDI, AU-AIS, AU-LOP, HP-PLM, HP-TIM, HP-UNEQ, HP-RDI, LSS
Pointer Movements	• Pointer value • Number of positive and negative pointer movements • Number of pointer movements with NDF
SONET	
Error Analysis	• A1/A2, B1, B2, B3, REI-L, REI-P, ERR
Alarm Analysis	• LOF, SEF, TIM-S, AIS-L, RDI-L, AIS-P, LOP-P, TIM-P, PLM-P, UNEQ-P, RDI-P, LSS
Pointer Movements	• Pointer value • Number of positive and negative pointer movements • Number of pointer movements with NDF

Ordering Information

Ordering Information	
5610-000-UTA	UTA base module *Applications must be ordered separately
5610-301-UTA	‘’OTN’’ application for UTA module supporting: - OTU-2 interface (XFP not included)
Options	
5610-311-UTA	“OTU-1” option for OTN application (SFP not included)
Accessories	
5610-150-UTA	1310 nm **XFP** transceiver (10 km) (LC connector) ** Multi-rates XFP supporting STM-64/OC-192/10 GigE/OTU-2*
5610-142-UTA	1550 nm **XFP** transceiver (40 km) (LC connector) ** Multi-rates XFP supporting STM-64/OC-192/10 GigE/OTU-2*
5610-143-UTA	1550 nm **XFP** transceiver (80 km) (LC connector) ** Multi-rates XFP supporting STM-64/OC-192/10 GigE/OTU-2*
5610-144-UTA	1310 nm **SFP** transceiver (40 km) (LC connector) ** Multi-rates SFP supporting STM-1/4/16/OC-3/12/48/OTU-1*
5610-145-UTA	1550 nm **SFP** transceiver (80 km) (LC connector) ** Multi-rates SFP supporting STM-1/4/16/OC-3/12/48/OTU-1*
Upgrades	
5610-360-UTA	UTA upgrade with “OTN application supporting OTU-2 “ (XFP not included)
5610-361-UTA	UTA upgrade with “OTU-1” option (SFP not included) ** Requires the “OTN” application*

Note 1: For best performance, the CMA5000 platform must have 512M RAM when using UTA with more than one application.

Note 2: All the 10G/11G applications are field upgradeable.
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Data Sheet

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

• Supports LAN-PHY and WAN-PHY (option)
• Hot-pluggable XFP (10GBASE-SR, -LR, -ER, -SW, -LW, -EW)
• Supports creation and analysis of Ethernet traffic up to 100% line load
• Automated RFC 2544 tests:
  ○ Throughput
  ○ Frame Loss
  ○ Latency
  ○ Burstability
• Capture function (option)
  ○ Record traffic (one shot or continuously)
  ○ Filter traffic: by MAC addresses, IP addresses, Protocols
  ○ Hexadecimal representation of each captured frame
• End-to-end tests in switched networks via Reflector mode (automatic swap of MAC/IP addresses)
• User-programmable thresholds for visual pass/fail indicators
• Automatic test report in PDF format
• BERT tests (option)
• Sequence tests (option)
• Stacked VLAN (option)
• Multi-stream (option)
• Channel Stats (option)
	• Installing, commissioning and troubleshooting tests
	• Measure network limitations during installing/commissioning
	• Verify Service Level Agreement (SLA) criteria as per RFC 2544
	• Check network bandwidth use
	• Test both 10 GigE LAN-PHY and WAN-PHY networks

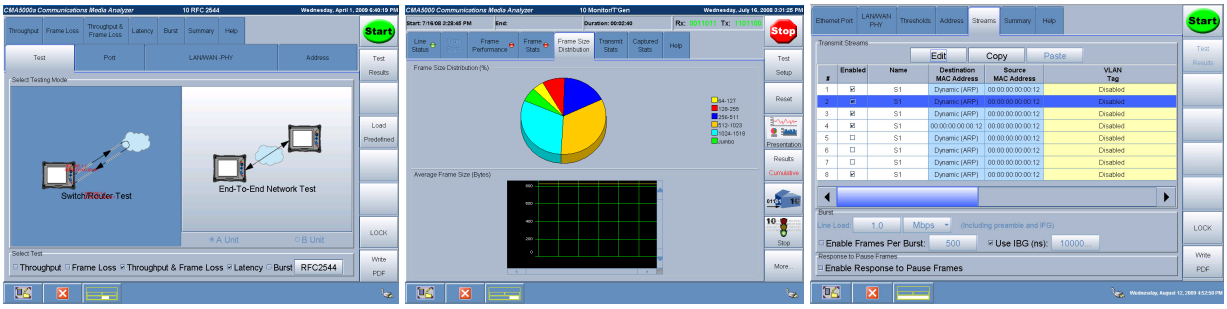

Fig.1: UTA GUI sample screens

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

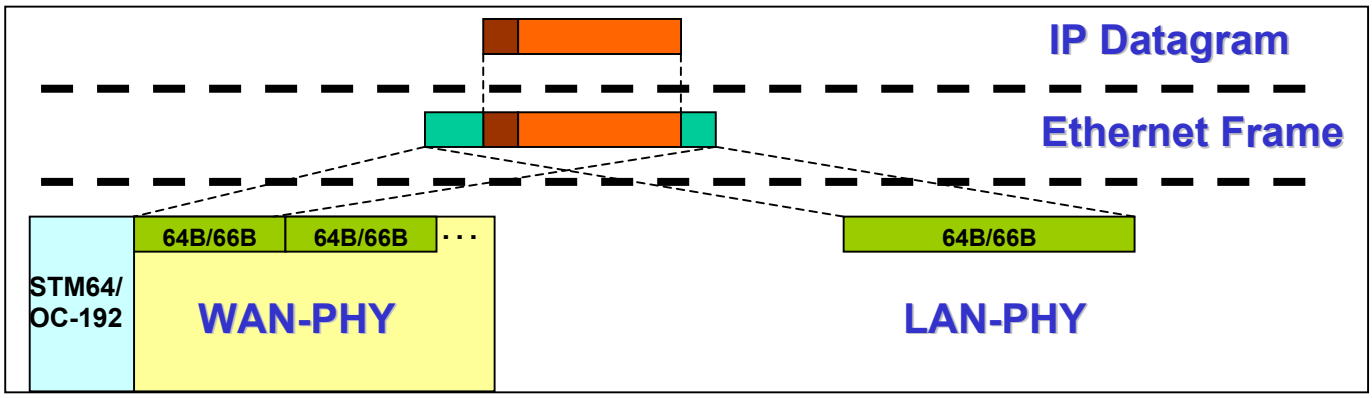

Fig.3: The UTA module supports 10 GigE LAN-PHY and 10 GigE WAN-PHY. Additional 802.3ae modes are also available in WAN-PHY such as Mixed-frequency WAN-PHY and Unframed WAN-PHY (PRBS31 pattern).

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.

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.

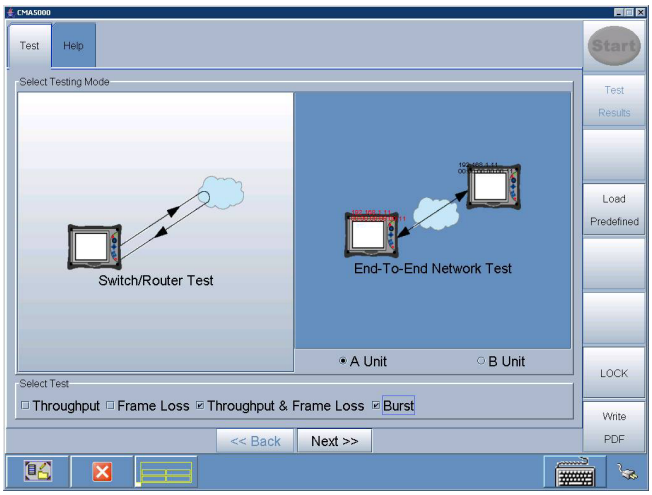

Fig.4: Bi-directional End-To-End RFC 2544 test setup

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.

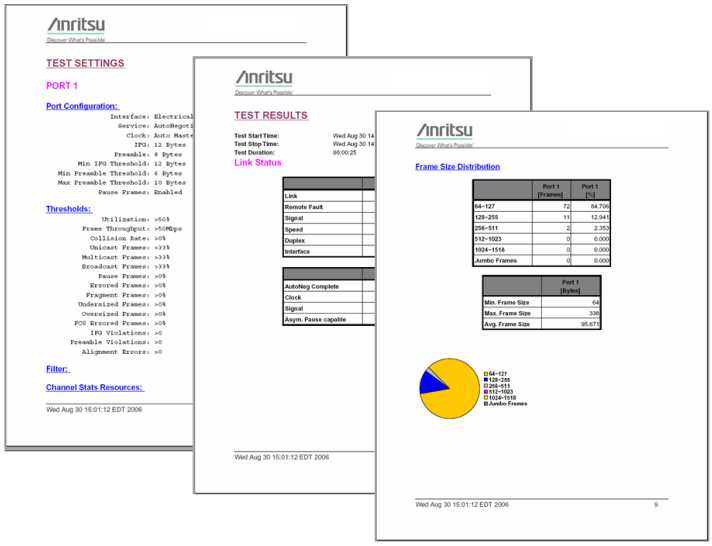

Fig.7: One click generates automatic test report in PDF format

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 *1	As per IEEE 802.3ae: - 10GigE LAN-PHY - 10GigE WAN-PHY *2
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 *3,4						
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

*1: The UTA module XFP interface meets the MSA standard.

*2: 10 GigE WAN-PHY is an option.

*3: Requires separately ordered XFP

*4: Defined by IEEE 802.3ae. Actual specifications depend on the XFP.

Traffic Generation	
Instrument's Address Edition	• MAC address • IP address

Frame Edition per stream	• Source and Destination MAC addresses.
	• Source and Destination IP addresses.
	• ARP function (enable/disable) for destination MAC address discovery.
	• VLAN Tag (enable/disable)
	  ○ Level: 1 – 3 (Stacked VLAN: option)
	  ○ TPID: 0x8100, 0x88A8, 0x9100, 0x9200, 0x9300
	  ○ Priority: 0 – 7
	  ○ ID: 0 - 4095
	• Gateway function (enable/disable) with configurable gateway IP address and network mask.

Frame Contents per stream	• Encapsulation Type (Ethertype/SNAP/LLC1). • Payload content: PRBS 2^31-1 inverted or User Defined pattern.up to 16 words
Generation Modes (Test duration) per stream	• Continuous • Number of seconds: : 1 - 9999 • Number of frames: 1 - 9999999
Traffic Profile Edition per stream	• Adjustable traffic distribution between broadcast and unicast frames (0% - 100%) • Line load 0.1 - 10000.0 Mb/s or 1 - 100 %
Frame Size Distribution per stream (excluding VLAN tag)	• Constant frame size 64 – 10000 bytes • Random frame size distribution with min and max values 64 - 10000 bytes
Multi Stream (option)	• Number of Stream 1 - 8 • Naming ability to each stream • Copy the existing stream and paste to other stream
Burst	• enable/disable • Number of frame per burst 10 - 100000 • IBG setting (enable/disable) 10 - 1000000000 ns • Line load 0.1 - 10000.0 Mbps or 1 - 100 % (available IBG setting is diabled)
Flow Control	• Response to Pause frames (enable/disable)
Error Insertion	• FCS errors: User programmable number of frames 1 - 1024
Pause Frames Insertion	• User programmable number of Pause frames 1 - 1024 • User programmable Pause quanta value (0 – 65535 x 512 bits)

Line Status	
Interface Status	• Link: Up (Green) / Down (Red) • Frames present: Yes (Green) / No (Red) • Speed • Duplexity • Wavelength • XFP Vendor Name • XFP Serial Number • XFP Part Number/Rev
Gauges	• Instantaneous Utilization (%) • Instantaneous Throughput (Mbps) • Errored Frames

Traffic Monitoring	
Thresholds	User programmable thresholds (to trigger LED error indicators): • Utilization (%) • Throughput (Mbps) • Unicast Frames (%) • Multicast Frames (%) • Broadcast Frames (%) • Pause Frames • Errored Frames (%) • Fragment Frames (%) • Undersized Frames (%) • Oversized Frames • FCS Errored Frames (%) • Internal MAC Errors • Symbol Errors • In Range Length Errors • Jabbers
Frame Performance	• Utilization (%): Average / Max / Min • Throughput (Mbps): Average / Max / Min • Frame Rate (Fps): Average / Max / Min Display Mode: Cummulative or Instantaneous (refreshed every second)
Frame Statistics (available for both Tx and Rx)	• Frames: o Total frames: Number and % o Total good frames: Number and % o Unicast frames: Number and % o Multicast frames: Number and % o Broadcast frames: Number and % o Pause frames: Number and % o Single VLAN frames: Number and % o Stacked VLAN frames: Number and % • Errored Frames: o Total errored frames: Number and % o Fragment frames: Number and % o Undersize frames: Number and % (only for Rx) o Oversize frames: Number and % o FCS errored frames: Number and % • Miscellaneous: o Frames lost due to Internal MAC Errors: Number and % o Symbol errors: Number and % o In Range Length error: Number and % o Jabbers: Number and % Display Mode: Cummulative or Instantaneous (refreshed every second)
Frame Size Distribution (available for both Tx and Rx)	• Frames with size between 64 and 127 bytes: Number and % • Frames with size between 128 and 255 bytes: Number and % • Frames with size between 256 and 511 bytes: Number and % • Frames with size between 512 and 1023 bytes: Number and % • Frames with size between 1024 and 1518 bytes: Number and % • Jumbo frames: Number and % • Average frame size (bytes) Display Mode: Cummulative or Instantaneous (refreshed every second)

RFC 2544 Tests	
Test Modes	• 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. • End-To-End Network Test: Two units are required, one at each end of the network connection.

General configuration parameters	• Source and Destination MAC, IP addresses
	• ARP function (enable/disable) for destination MAC address discovery.
	• VLAN Tag (enable/disable)
	  ○ Level: 1 – 3 (Stacked VLAN: option)
	  ○ TPID: 0x8100, 0x88A8, 0x9100, 0x9200, 0x9300
	  ○ Priority: 0 – 7
	  ○ ID: 0 - 4095
	• Gateway function (enable/disable) with configurable gateway IP address and network mask.

Throughput	• Frame Size / Profile (excluding VLAN tag) configuration:
	  ○ Constant with frame size from 64 to 10000 bytes
	  ○ Stepped with Start and End frame size from 64 to 10000 bytes and step size from 10 to 1000 bytes.
	  ○ User Defined (64/128/256/512/768/1024/1280/1518/Jumbo: 1519 - 10000)
	• Line Load configuration:
	  ○ Min./Max. Throughput: 0.1 to 10000.0 Mbps., Step 0.1 to 10000.0 Mbps.
	  ○ Auto Search: Enable/Disable.: Step: 0.01/0.1/1/10/100 Mbps
	  ○ Stop on No Frame Loss @ Max Throughput: Enable/Disable.
	• Measurement Duration Time
	  ○ 1 to 200 sec.

Frame Loss	• Frame Size / Profile (excluding VLAN tag) and Line Load configuration: same as Throughput

Latency	• Measure Latency Only at Throughputs: Enable/Disable
	• Frame Size / Profile (excluding VLAN tag) configuration:
	  ○ Constant with frame size from 64 to 10000 bytes
	  ○ Stepped with Start and End frame size from 64 to 10000 bytes and step size from 10 to 1000 bytes.
	  ○ User Defined (64/128/256/512/768/1024/1280/1518/Jumbo: 1519 - 10000)
	• Line Load configuration:
	  ○ Min./Max. Throughput: 0.1 to 10000.0 Mbps Step : 0.1 to 10000.0 Mbps.
	• Measurement Duration Time
	  ○ 1 to 200 sec
	• Repeat Count
	  ○ 1 to 100
	• Latency Offset (Latency Calibration)
	  ○ 0 to 20000 ns

Burstability (Back-to-Back)	• Frame Size / Profile (excluding VLAN tag) configuration:
	  ○ Constant with frame size from 64 to 10000 bytes
	  ○ Stepped with Start and End frame size from 64 to 10000 bytes and step size from 10 to 1000 bytes.
	  ○ User Defined (64/128/256/512/768/1024/1280/1518/Jumbo: 1519 - 10000)
	• Burst Profile configuration:
	  ○ Constant with burst size from 2 to 1024 frames.
	  ○ Stepped with Start and End burst size from 2 to 1024 frames and step burst size from 1 to 10 frames.
	• Measurement Duration Time
	  ○ 1 to 200 sec, 10 to 1000 Bursts
	• Repeat Count
	  ○ 1 to 100

Reflector Mode	
Reflector Mode Description	• 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.
Swap Parameters	• Swap IP Addresses (Layer 3): Enable/Disable. • Swap MAC Addresses (Layer 2): Enable/Disable. • Reflect Errored Frames: Enable/Disable.
Filter Parameters	• VLAN o Level: 1 to 3 o ID: 0 to 4095 • IP address: o Source. o Destination. o Source & Destination. • MAC address: o Source. o Destination. o Source & Destination. • Protocol Layer 2: o Type Field of Ethernet Frame value. • Protocol Layer 3: o Protocol Field of IPV4 datagram header. • None
Flow Control	• Response to Pause frames: Enable/Disable.
Statistics	• Total number of frames (cumulative or current second). • Total number of Good Frames • Number of reflected Layer 2 frames • Number of reflected Layer 3 frames Display mode: cumulative or current second

PING Test	
Frame Edition	• MAC and IP source and destination addresses. • ARP function (enable/disable) for destination MAC address discovery. • VLAN Tag (enable/disable) o Level: 1 – 3 (Stacked VLAN: option) o TPID: 0x8100, 0x88A8, 0x9100, 0x9200, 0x9300 o Priority: 0 – 7 o ID: 0 - 4095 • Gateway function (enable/disable) with configurable gateway IP address and network mask. • Do Not Fragment Frame (enable/disable)
Test Setup	• Test Duration: Continuous/Seconds/Frames. • Interval (seconds): 1-100 (interval between ping request).
Frame Size Edition (excluding VLAN tag)	• 64 to 10000 bytes
PING Statistics	• Number of transmitted packets. • Number of received packets. • % of packet loss • Round-trip time: Min./Average/Max.

Capture & Decode (option)	
Capture & Decode Modes	• Stop-On-Full Mode: The capture is stopped as soon as the capture buffer (64 kbit) is full. • 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. •
Trigger Configuration	• Triggering condition: Start capture condition or End capture condition • The triggering criteria: o IP: ▪ Source. ▪ Destination. ▪ Source & Destination. o MAC. ▪ Source. ▪ Destination. ▪ Source & Destination. o Protocol Layer 2. ▪ Type Field of Ethernet Frame value. o Protocol Layer 3. ▪ Protocol Field of IPV4 datagram header. o None.
Filter Parameters	• Filtering criteria: o IP: ▪ Source. ▪ Destination. ▪ Source & Destination. o MAC. ▪ Source. ▪ Destination. ▪ Source & Destination. o Protocol Layer 2. ▪ Type Field of Ethernet Frame value. o Protocol Layer 3. ▪ Protocol Field of IPV4 datagram header. o None.
Decode Data	• Number of frames • Captured Date. • Captured Length. • Ethernet Frame Information: o Frame Type (Type Field Value). o Source MAC Address value. o Destination MAC Address value. • IP datagram header information: o IP Version. o TOS. o Length. o Identification. o Fragment. o Time –To-Live. o Protocol. o Source IP Address. o Destination IP Address.
Capture Data	• Hexadecimal (and ASCII) representation of a selected frame. • Data can be saved as Libpcap format and be analyzed by capturing softwares.

SEQUENCE Test (option)	
SEQUENCE Test Description	• The UTA application generates Ethernet frames with a sequence number in order to analyze special events like duplicated frames, lost frames and more.
Frame Edition	• MAC and IP source and destination addresses. • ARP function (enable/disable) for destination MAC address discovery. • Gateway function (enable/disable) with configurable gateway IP address and network mask. • Encapsulation Type (Ethertype/SNAP/LLC1). • Do Not Fragment Frame (enable/disable)
Test Setup	• Test Duration: Continuous/Seconds/Frames.
Traffic Edition	• Uniform: Line load defined by the user between 0.1 and 10000.0 Mb/s
Frame Size Distribution	• Constant with frame size between 64 and 10000 bytes. • Random distribution with configurable min and max value between 64 and 10000 bytes
Flow Control	• Response to Pause frames: Enable/Disable.
Statistics	• Total number of frames • Number of Out Of Order frames • Number of Duplicated frames • Number of Late frames • Number of Lost frames Display mode: cumulative or current second.

BERT Test (option)	
Frame Edition	• MAC Source Address • MAC Destination Address
VLAN	• VLAN Tag (enable/disable) o Level: 1 – 3 (Stacked VLAN: option) o TPID: 0x8100, 0x88A8, 0x9100, 0x9200, 0x9300 o Priority: 0 – 7 o ID: 0 - 4095
Test Setup	• Test Duration: Continuous/Seconds (1 to 9999)/Frames (1 to 9999999)
Traffic Edition	• Uniform: Line load defined by the user between 0.1 and 10000.0 Mb/s
Frame Size (excluding VLAN tag)	• Constant from 64 and 10000 bytes.
Result	• Bit Error Rate

WAN-PHY (option)	
WAN-PHY Modes	• 10GigE • WAN-PHY with Mixed-frequency test pattern • Unframed with PRBS 31 pattern
SOH/TOH Overhead Edition	• A1, A2, K1, K2, S1, M1 • J0 Path Trace Message: User-programmable 15 bytes ASCII sequence (CRC-7 added)
POH Overhead Edition	• C2, G1 • J1 Path Trace Message: User-programmable 15 bytes ASCII sequence (CRC-7 added)
Alarms Analysis	• SDH terminology: o 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 • SONET terminology: o 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
Errors Analysis	• SDH terminology: o A1A2, B1, B2, MS-REI, B3, HP-REI, ERR • SONET terminolgy: o A1A2, B1, B2, REI-L, B3, REI-P, ERR
Pointer Analysis	• Value, Positive movements, Negative movements, New Data Flag (NDF)
Alarms Generation	• SDH terminology: o 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 • SONET terminology: o 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
Errors Generation	• SDH terminology: o A1A2, B1, B2, MS-REI, B3, HP-REI, ERR • SONET terminolgy: o A1A2, B1, B2, REI-L, B3, REI-P, ERR

Channel Stats (option) 1/2	
Channel Stats Description	• 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. • They can filter the flow and choose the target flow before dividing it.
Filter	• Encapsulation (Ether Type / SNAP / LLC1) • Exclusion (Broadcast Frames / Errored Frames) • Source MAC address • Destination MAC address • Source IP address (range) • Destination IP address (range) • Ethernet Type Code (L2 Protocol) • IP Protocol Number (L3 Protocol) • VLAN 1, 2, 3 ID (range) / TPID / Priority • Source Port number • Destination Port number • MPLS label (range)
Flow dividing key	• Source MAC address • Destination MAC address • VLAN 1, 2, 3 : ID / TPID / Priority • MPLS • Source IP address • Destination IP address • Source Port number • Destination Port number • Ethernet Type Code (L2 Protocol) • IP Protocol Number (L3 Protocol)

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) **Multi-rates XFP supporting STM-64/OC-192/10 GigE*
5610-150-UTA	1310 nm XFP (10 km) transceiver (LC connector) **Multi-rates XFP supporting STM-64/OC-192/10 GigE/OTU-2*
5610-142-UTA	1550 nm XFP transceiver (40 km) (LC connector) **Multi-rates XFP supporting STM-64/OC-192/10 GigE/OTU-2*
5610-143-UTA	1550 nm XFP transceiver (80 km) (LC connector) **Multi-rates XFP supporting STM-64/OC-192/10 GigE/OTU-2*
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

Anritsu

Specifications are subject to change without notice.

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CMA 5000

Universal Transport Analysis Module (UTA)
Asynchronous Transfer Mode (ATM) Option

Notes:

[1]: Rates only available with STM-1/4/16 & OC-3/12/48 option

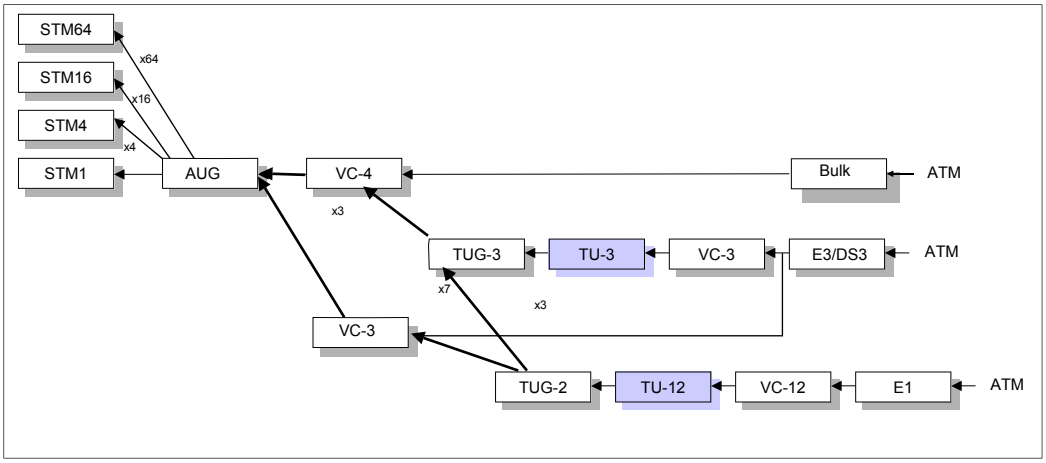
All specifications are subject to change

Historically, SDH/SONET technology has been designed to carry voice traffic. But the changes in the telecommunications market for many years have brought new challenges for network operators and service providers. Data traffic becomes more and more important and today's networks are evolving to meet these new multimedia communications challenges.
Asynchronous Transfer Mode (ATM) is a networking technology capable of accomodating the inherently bursty nature of data applications and the fixed bit rates of the historical synchronous networks.
ATM, coupled with SDH/SONET for transport, provides a very flexible solution and makes multimedia calls as easy, reliable and as secure as voice calls are today.
With the "ATM" option, the CMA 5000 UTA module provides all the functions needed to check the quality of ATM cell transport through the SDH/SONET networks.
The "ATM" option is a software option of the SDH/SONET application of the UTA.

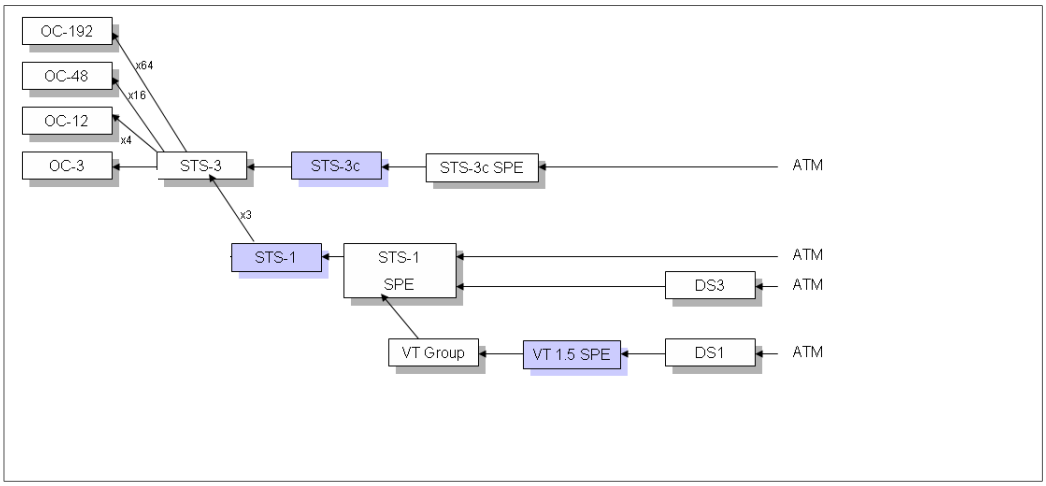
Physical Layer

SONET	SDH	Rate (Mb/s)	Interfaces
OC-192 OC-48(1) OC-12(1) OC-3(1)	STM64 STM16(1) STM4(1) STM1(1)	9953.280 2488.320 622.080 155.520	Optical (Depends on the XFP/SFP used)

ATM Mapping



SDH Mappings



SONET Mappings

ATM Transmit Functions

Physical Adaptation Layer
• Scrambler and HEC calculation

ATM Layer	
Foreground Traffic	• One VP/VC channel for which the header, the payload and the traffic are programmable • Each field of the header is programmable: Type of interface (UNI or NNI), VPI, VCI, GFC, PTI, CLP • The payload is filled with PRBS (AAL0) • The average traffic level is user programmable
Background Traffic	• The number of backgound channels is programmable up to a maximum of 1000. • For each background channel, the header is fully programmable (manually or automatically): Type of interface (UNI or NNI), VPI, VCI, GFC, PTI, CLP • The payload is filled with a 16 bit user programmable word (AAL0) • For each background channel, the average traffic level is user programmable
Empty Cells	• Empty cells can be defined as idle or unassigned

Stress Functions	
Physical Adaptation Layer Error Error Injection	Single HEC, Multiple HEC Programmable number
Payload Error Error Injection	BER generated on the Foreground channel payload Programmable number or rate
OAM Alarms Alarm Injection	AIS, RDI, Loss of Continuity for F4 and F5 flows of the Foreground channel On steady-state

ATM Analysis Functions[2]

Physical Adaptation Layer	
Errors	Single HEC, Multiple HEC
Alarm	LCD

ATM Layer Performance	
Errors	BERT on the test VP/VC channel payload
Alarm	AIS, RDI, Loss of Continuity measured on the test VP/VC

Traffic
• Instantaneous and average traffic level of the total traffic
• Instantaneous and average traffic level of the selected VP
• Instantaneous and average traffic level of the selected VC

ATM Scan
• Automatic detection of the open ATM channels on the link with indication for each of: - Channel number: VPI, VCI - Average traffic

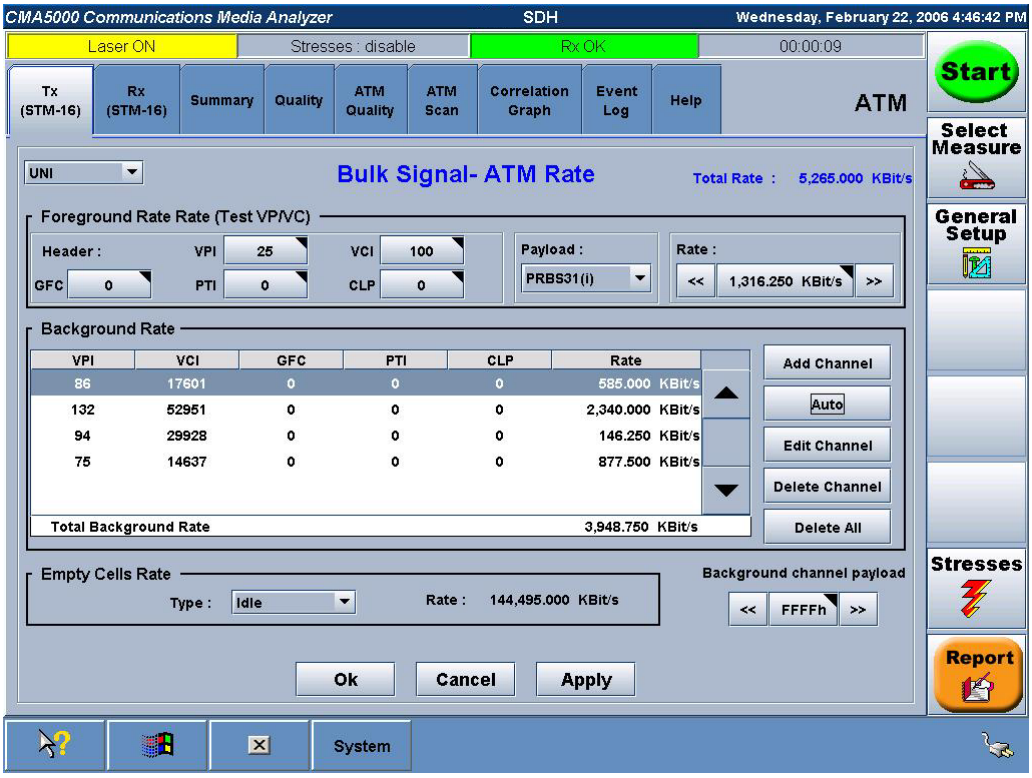
Notes:

[2]All ATM parameters can also be displayed graphically

The Quality measurement screen provides all the alarms, errors and quality information at the ATM layer for fast measurement interpretation.

Ordering Information

Universal Transport Analysis (UTA) Module	
Order Number	**Description**
5610-000-UTA	UTA Base Module
5610-201-UTA	10G SDH/SONET Application
5610-216-UTA	‘‘STM-1/4/16 & OC-3/12/48’’ option for 10G SDH/SONET application
5610-214-UTA	ATM option for SDH/SONET application



All the ATM traffic parameters are available in one single window.