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).

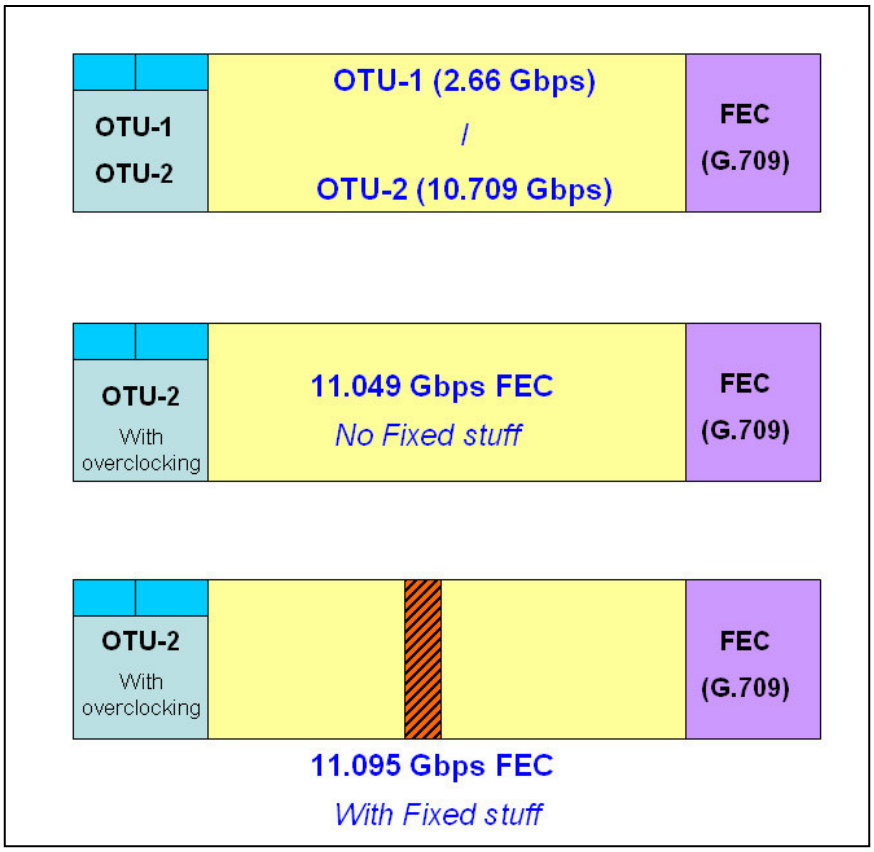


Fig.1: The different OTN frames supported by the CMA5000-UTA

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.

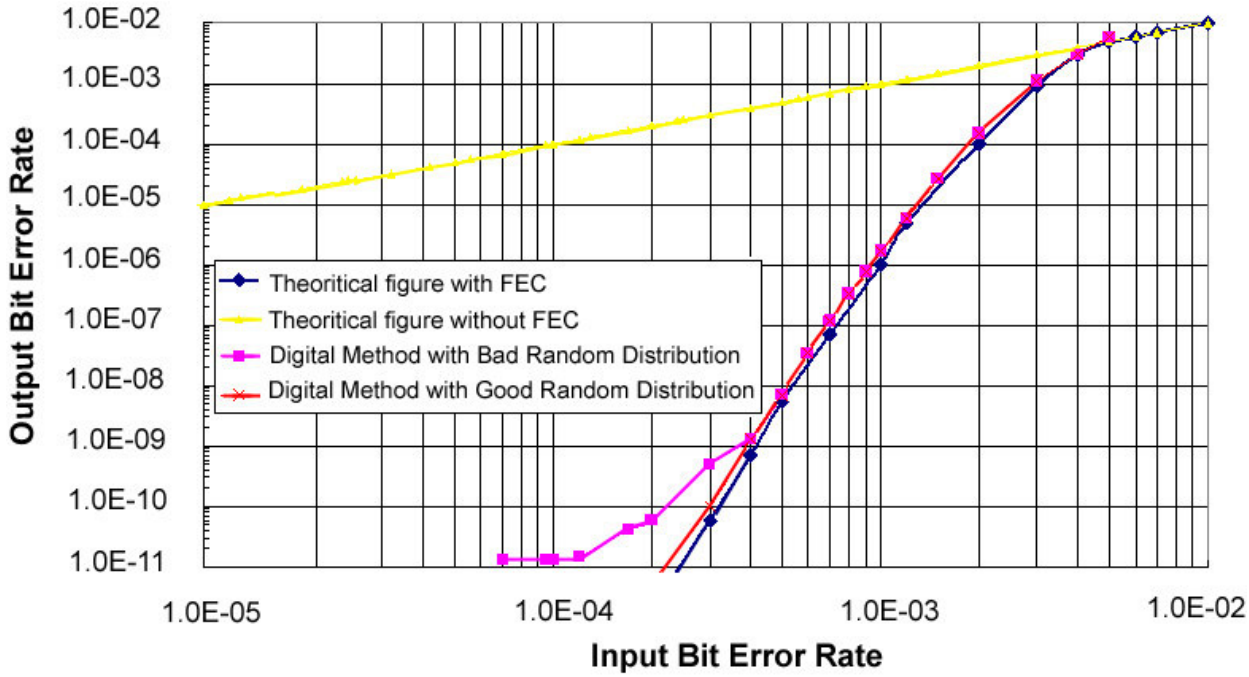


Fig.2: More accurate FEC evaluation with O.182

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.

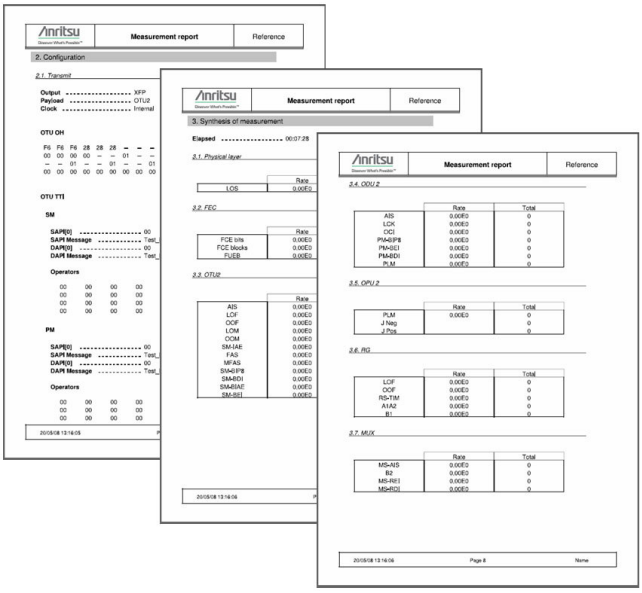


Fig.4: Generate automatic test report in PDF format with just one click

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

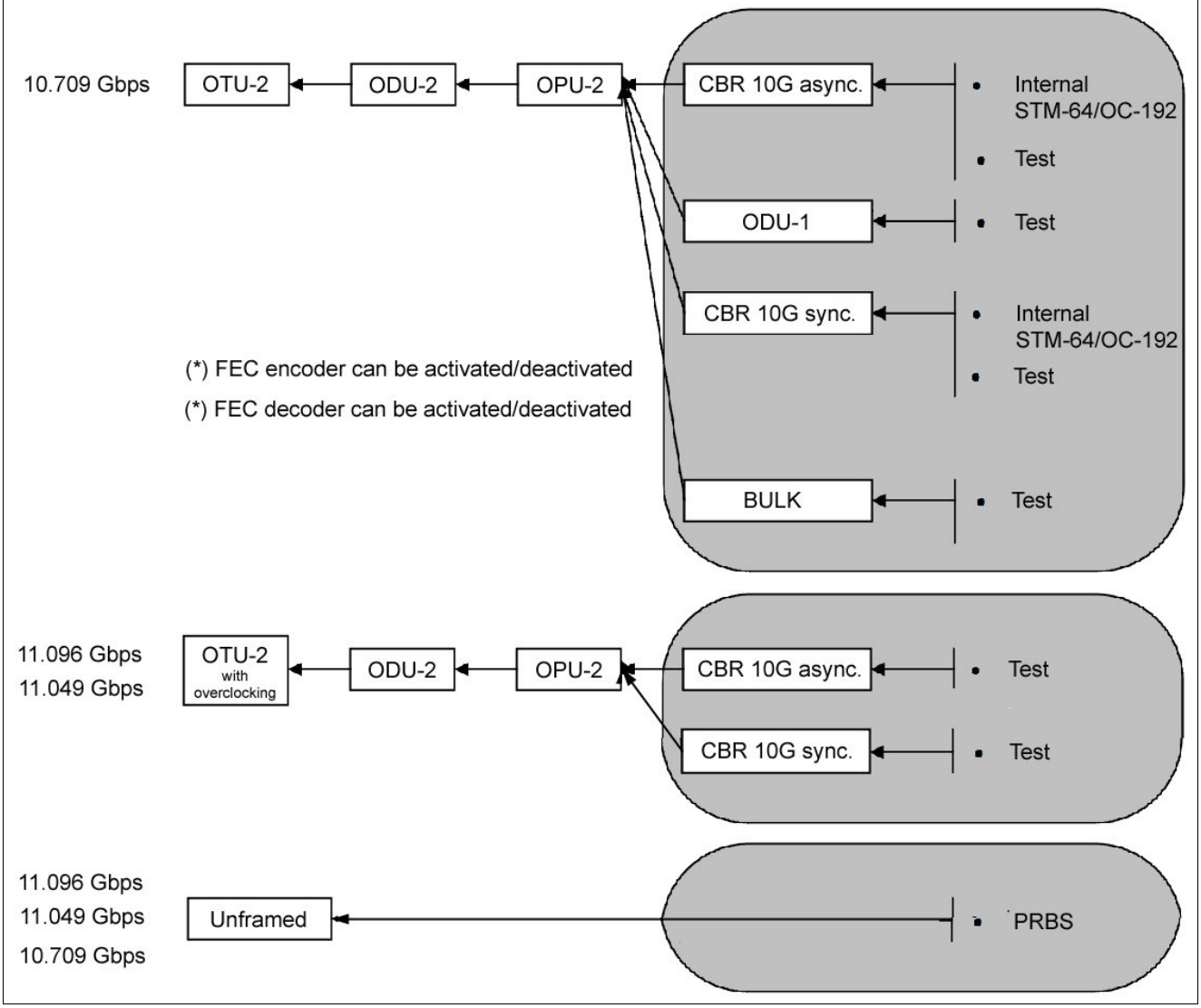
[1] The XFP and SFP interfaces of the UTA module meet the requirements stated in the MSA standard

[2] XFP and SFP must be ordered separately

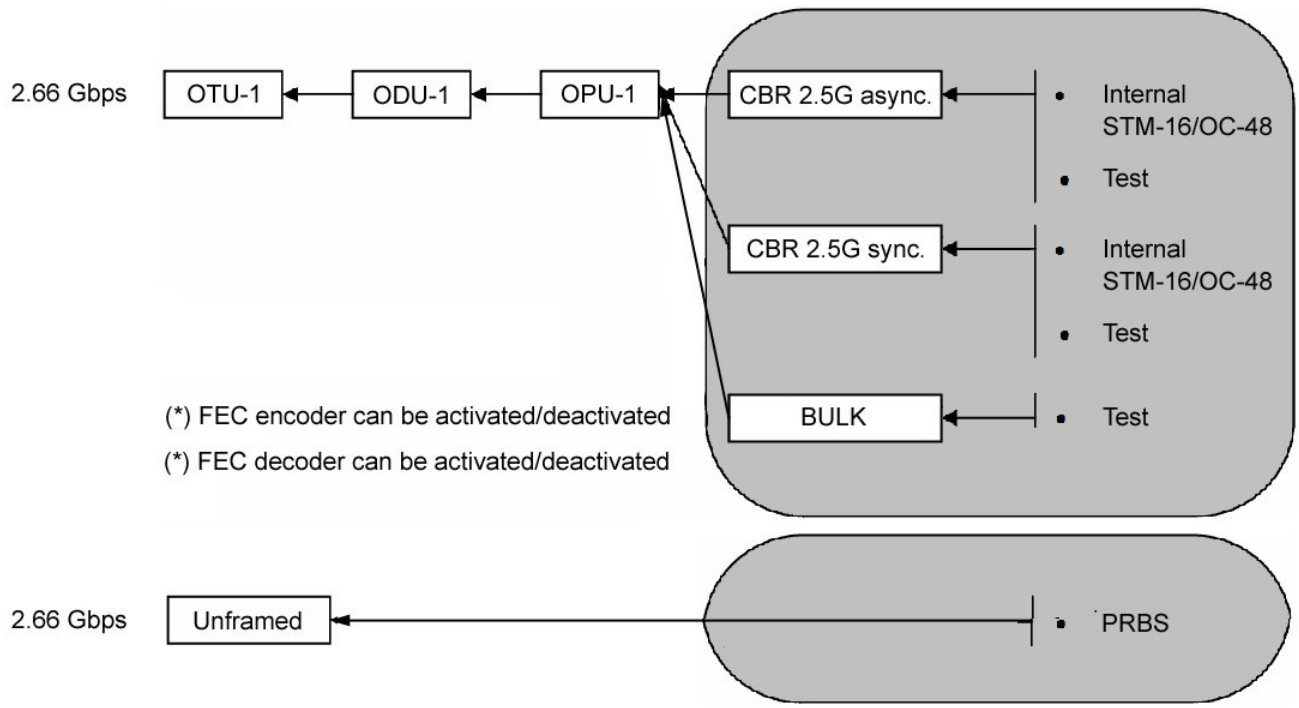
Frame Formats	
OTN format	• OTU-2 and OTU-1 as per ITU-T G.709
SDH format	• STM-64 and STM-16 as per ITU-T G.707
SONET format	• OC-192 and OC-48 as per Telcordia GR-253

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

OTU-2 Mappings & Structures

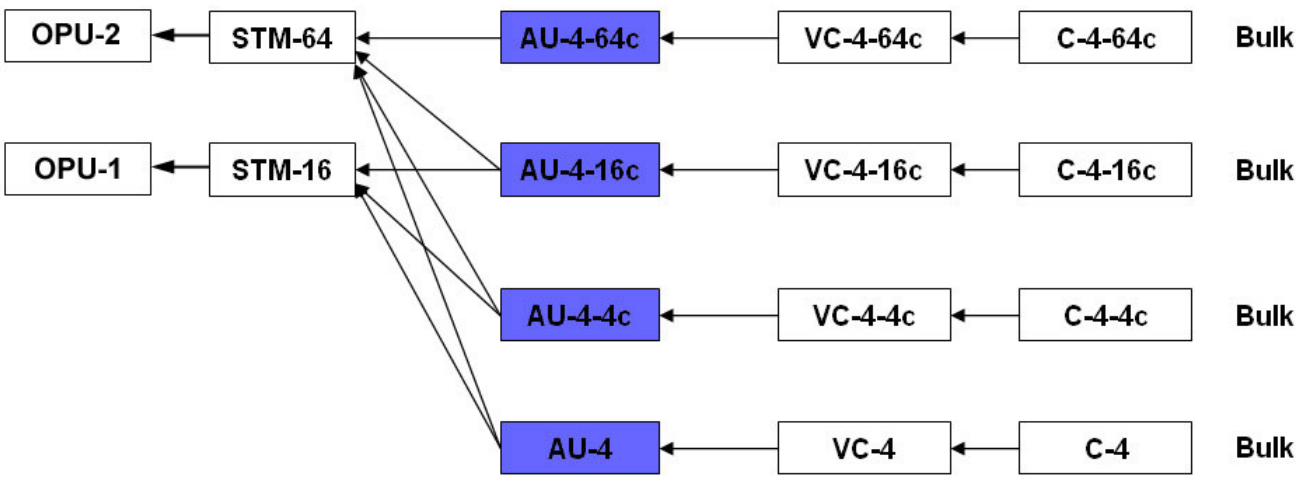


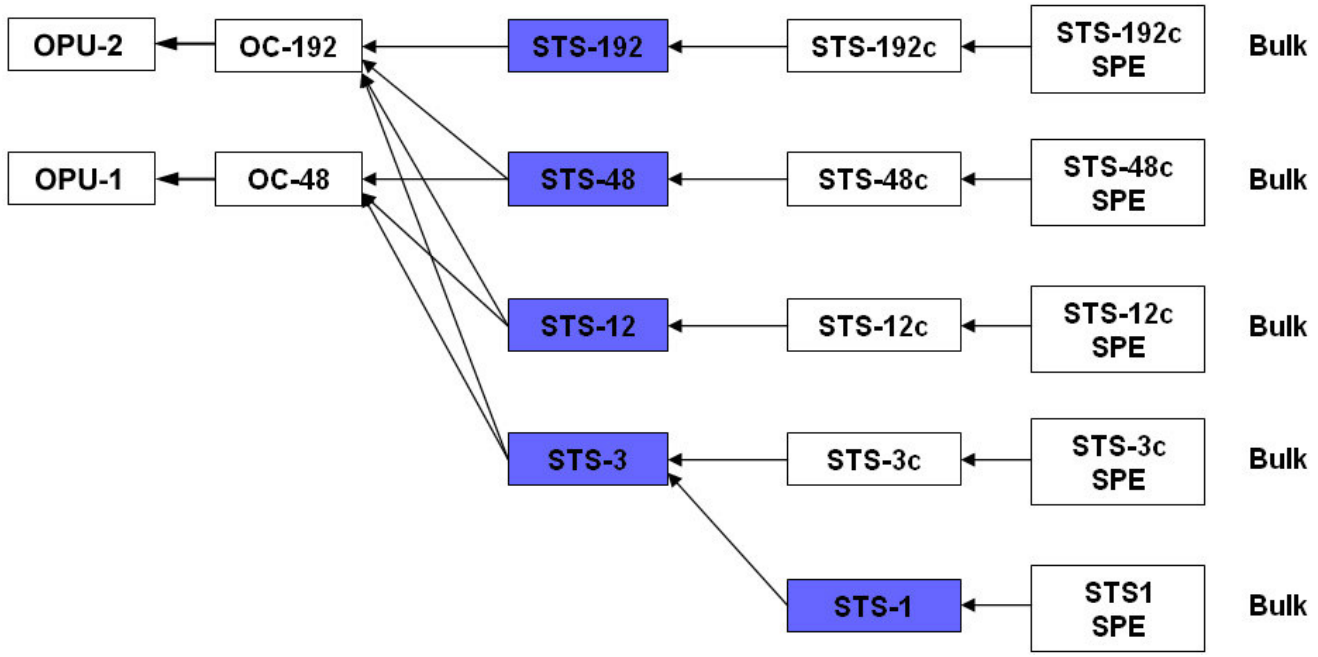
OTU-1 Mappings & Structures



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.
For upgrades with reference 5610-361-UTA, customers must call their Anritsu contact with module Serial Number as hardware upgrade might be required.

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