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Acterna ONT-50 Optical Network Tester

NewGen Module 2.5G

Dynamic SONET/SDH networking

The current market situation demands that operators reduce capital and operating expenditures and requires manufacturers to support operators in this challenge.

As a result, expenditures incurred by operators and manufacturers must now result in immediate return on their investments.

With wide deployment of SONET/SDH networks, it is essential that operators optimize the efficiency of and increase traffic utilization on their networks.

The technologies — virtual concatenation (VC), link capacity adjustment scheme (LCAS), generic frame protocol (GFP) and Ethernet mappings — addressing these needs are summarized under the term New SONET/SDH.

New SONET/SDH not only offers the possibility to increase traffic utilization, but facilitates the adaptation of new services as well.

These technologies together with the integration of different services into one device, reduce points of failure and the number of devices needed.

NewGen Module 2.5G

To address these needs, Acterna has developed a new module for the Acterna Optical Network Tester ONT-50 - the NewGen Module 2.5G.

The ONT-50 stands at the center of these needs with applications for lab and system verification, easing system installation and simplifying network troubleshooting.

The four-slot mainframe test solution with upgradeable modules is designed to reduce development cycle and installation times of New SONET/SDH, OTN and DWDM systems.

With flexible hardware and software architecture design, users are equipped to address whatever technologies emerge with a solution that grows with their needs.

Highlights

- Interfaces for virtual concatenation from 52 Mbps to 2.5 Gbps
- VC-4/STS-1 virtual concatenation up to 1 GbE
- Emulation of LCAS protocol
- Generation and analysis of GFP frames and manipulation of GFP header
- Generation and analysis of MAC frames

New SONET/SDH book

Hardware and software option

The New SONET/SDH module supports line interface rates of 52 Mbps, 155 Mbps, 622 Mbps and 2.488 Gbps for SONET/SDH signals and via the New SONET/SDH book enables generation and detailed analysis of various technologies including VC, LCAS, GFP and Ethernet MAC frames.

Optical interface

One transmitter and one receiver allowing line rates from 52 Mbps to 2.5 Gbps

Line rate

OC-48/STM-16	2.488 Gbps
OC-12/STM-4	622 Mbps
OC-3/STM-1	155 Mbps
OC-1/STM-0	52 Mbps

Line code scrambled NRZ

Connector types FC-PC, SC, ST

Generator unit

The generator meets the specification of ITU-T G.957 / GR.253 for SONET/SDH signals up to 2.5 Gbps

Tx offset ± 50 ppm

Wavelength 1310/1550 nm

Output level -2 to $+3$ dBm

Clock generator

Internal, accuracy ± 4.6 ppm

Synchronization from external signal according to clock specifications of mainframe

Receiver unit

The receiver meets the specification of ITU-T G.957/GR.253 for SONET/SDH signals up to 2.5 Gbps

Wavelength range

1260 to 1360 and 1430 to 1580 nm

Sensitivity

622M to 2.5G -8 to -28 dBm

155M -8 to -34 dBm (typ.)

52M -8 to -34 dBm (typ.)

Maximum input power $+3$ dBm

Measurement of optical input power -34 to -8 dBm

Electrical interface

The generator unit comprises electrical interfaces and a clock signal output.

Generator data signal

Bit rate	2.488 Gbps
	622 Mbps
	155 Mbps
	52 Mbps

Connector type SMA

Impedance AC coupled, 50Ω

Line code Scrambled NRZ

Output level (peak-peak) ≥ 200 mV

Generator clock signal

An additional interface for clock output is supported at the following frequencies.

Tx clock	2.488 GHz
	622 MHz
	155 MHz
	52 MHz

Connector type SMA

Impedance AC coupled, 50Ω

Output level (peak-peak) ≥ 200 mV

Receiver data signal

Bit rate	2.488 Gbps
	622 Mbps
	155 Mbps
	52 Mbps

Connector type SMA

Input impedance AC coupled, 50Ω

Input level (peak-peak) 200 to 1000 mV

New SONET/SDH book

The New SONET/SDH book containing all the necessary topics addressed by the New SONET/SDH technology including: virtual concatenation (VC), link capacity adjustment scheme (LCAS), generic frame procedure (GFP) as well as generation and analysis of Ethernet frames. The New SONET/SDH book enables a detailed analysis of the most important parameters for each technology.

General SONET/SDH analysis

All line interface related parameters – for example optical parameters – and transport layer related functions are identical to those specified in the SONET/SDH expert book.

Virtual concatenation (VC)

One higher order virtual concatenation group (VCG) is supported. Maximum group size is 7 members for VC-4 or STS-3, and 21 members for VC-3 (Hi-order) or STS-1.

Path layer overhead generation and analysis is supported for each member of the VCG. Functionality is in accordance with the SONET/SDH expert book and extended H4 byte manipulation as well as evaluation functions are possible.

Generation

A differential delay generation of up to 100 ms is supported.

The following H4 byte related errors and alarms can be generated:

– Loss of multiframe (LOM)

Evaluation

A differential delay compensation of up to 100 ms is supported.

The following H4 byte related errors and alarms can be analyzed:

– Loss of multiframe (LOM)

– Sequence number mismatch (SQM)

– Loss of alignment (LOA)

** in preparation

Link capacity adjustment scheme (LCAS)

LCAS protocol emulation for the source and sink side of one VCG is possible. Same group sizes as for VC supported. The functionality encompasses:

- Emulation of state machines (Source and Sink) and monitoring of LCAS control packets
- Generation and evaluation of control packets
- Generation and evaluation of member status information. Source reacts automatically to received member status
- Full manual control of state machines supported

The LCAS protocol emulation can also be switched off.

Generation

The following manipulation capabilities are supported:

- Source and sink side state machine
- Transmitted member status
- CRC error in control packet

Evaluation

The following events are analyzed:

- Source and sink side machine state
- Received sequence number
- Received control word
- Received member status
- CRC error in control packet

Generic Frame Procedure (GFP)

The GFP functionality of the ONT-50 provides Ethernet MAC frame encapsulation and mapping of GFP to SONET/SDH virtual concatenation.

The ONT-50 also supports frame mapped GFP (GFP-F), and GFP user frames carry an Ethernet MAC payload. Network performance evaluation is performed at Ethernet MAC level.

Transmit side

A GFP-F stream of idle frames and user frames is generated. Frame size and bandwidth are set in accordance with

the parameters entered at MAC layer.

The GFP related transmitter functions are:

- Core header generation
- Payload header generation (only type header supported)
- Rate adaptation (insertion of idle frames)
- Payload scrambling (scrambler can be disabled)
- Insertion of client signal fail frames

Some of the frame header fields are fixed (for example PTI) although others (for example UPI) can be manipulated.

The following errors and alarms can be generated:

- Loss of frame delineation
- Core header single bit error
- Core header multiple bit error
- Type header single bit error
- Type header multiple bit error
- Client signal fail¹

Generation of payload FCS is supported.

Receive side

A received GFP-F stream is analyzed. Received bandwidth and utilization is measured.

GFP related receiver functions are:

- Frame delineation
- Analysis of core header
- Analysis of payload header (only type header supported)
- Payload descrambling (descrambler can be disabled)
- Frame filtering based on type header
- Analysis of client signal fail frames

The following errors and alarms are analyzed:

- Loss of frame delineation
- Core header single bit error
- Type header single bit error
- Type header multiple bit error
- Client signal fail

Evaluation of payload FCS is supported.

Ethernet MAC layer

Ethernet frames in conformance with IEEE 802.3 are generated and analyzed, and MAC frames are encapsulated in GFP-F frames. MAC frames carry special test frame information in the payload. Network performance measurements are performed by evaluation of test frame information.

Transmit side

An Ethernet MAC frame stream is generated and mapped to GFP-F. The frame size ranges from 64 to 1518 bytes². Bandwidth ranges from 0% to 100% and is based on the available bandwidth of the VCG³. Maximum bandwidth is 1000 Mbps.

Source and destination addresses are user programmable.

The following errors can be generated:

- FCS error

Receive side

An Ethernet MAC frame stream is retrieved from the GFP layer. MAC frames are checked for errors and filtered. Filtering is performed based on source and destination addresses. Test frame information is evaluated in order to measure network performance parameters.

Receive bandwidth and utilization is measured.

The following errors are analyzed:

- FCS errors
- Runts
- To long frames

The following network performance parameters are evaluated:

- Frame loss rate
- Frame transfer delay

Ordering information

NewGen Module 2.5G BN 3070/90.40

¹ Client signal frames are generated periodically.

² Count excludes preamble.

³ i.e. the mapping and group size.

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