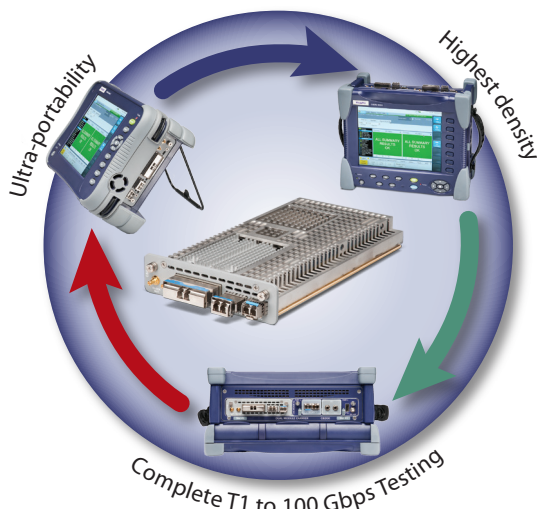


VIAVI T-BERD/MTS

Specifications for T-BERD™/MTS-6000A, –8000 CSAM

40 GE/100 GE

Test Interfaces/Bit Rates		Comments
40 GE (41.25 Gbps)		
100 GE (103.125 Gbps)		
Optics		
40 GE	Multi-lambda single-mode QSFP+ LR4 (4 wavelengths LR4)	Part Number: CQSFP-43G-3-4
	Multi-fiber multimode QSFP+ SR4 (4 fibers/dir SR4)	Part Number: CQSFP-40G-8-4
100 GE	Multi-lambda single-mode CFP2 LR4 (4 wavelengths)	Latency offset factor programmable per CFP2 or QSFP+ type to calibrate latency Part Numbers: CCFP2-112G-3-4 and CCFP4-112G-3-4 (together with 3076/92.92)
	Multi-fiber multimode CFP2 SR10 (10 fibers/dir)	Part Number: CCFP2-112G-8-10
Power level (aggregate) Provided by CFP2 or QSFP+		
Tx/Rx Power Level (per lambda)		
Reporting of overload condition		
CFP2 individual laser on/off tool		Access to registers to control individual Tx lasers



Modes of Operation		
Terminate		
Monitor/Thru		Monitoring on Rx while keeping Tx up via idles
Logical loopback		Loop up/down; switching of addresses at Layer 2 and Layer 3
	Manual (LLB)	
	Automatic loop up/down	Communicates with far-end unit

Timing	Comments
Recovered from Rx	Synchronous Ethernet Applications
Internal (stratum 3)	
Recovered from external (BITS/SETS)	BITS/SETS/2.048 MHz/10 MHz
Frequency Offset Transmit/Receive	Required for synchronous Ethernet applications, ±150 ppm range
Frequency reporting	Resolution in Hz, deviation in PPM

Traffic Attributes		
Line-rate traffic Tx and RX		
Scrambled idle PCS BERT pattern		
Single-Stream Generation/Analysis		With BERT/PRBS or Viavi (Acterna) test frame pattern (ATP)
10-Streams Generation/Analysis		With Viavi (Acterna) test frame pattern (ATP)
PRBS Payload Patterns	$2^{31}-1$, $2^{31}-1$ inverse	

Ethernet Generator		
Skew Injection per Virtual Lane		
100 GE: 0 to 32000 (6206 ns) bits per lane		
40 GE: 0 to 32000 (3103 ns) bits per lane		
Skew Alarm (Rx) Threshold Settings	Defaults to 180 ns	Up to 6206 ns for 40 GE; Up to 12412 ns for 100 GE
Skew Reporting per Virtual Lane		

Tx/Rx Decoupling Mode (for service disruption measurements)	On incoming alarms such as LOF or Remote Fault, traffic generator is not affected (no alarm response).
Frame Type	Comments
802.3	
DIX (Type II)	
VLAN/Q-in-Q	
MPLS (1 or 2 labels)	
Ethertype editing	
MAC Addressing	
Destination MAC address — unicast	
Destination MAC address — broadcast	
Destination MAC address — multicast	
Destination MAC address — ARP support (IPv4)	
Source MAC address — user defined	
Source MAC address — factory default	
Source MAC address — auto-increment MAC	For LAG testing, number of MACs in sequence, disable OOS
MAC Frame Size	
64, 128, 256, 512, 1024, 1280, 1518 settings	
User defined (64 to 1518 bytes + VLANs/labels)	
Jumbo (up to 10,000 bytes)	
Random (from 7 different sizes)	
VLAN (802.1q)	
Editable VLAN tag fields	VLAN ID User priority
VLAN Stacking (Q-in-Q)	
Editable SVLAN tag fields	SVLAN ID SVLAN user priority SVLAN DEI bit SVLAN TPID
Editable CVLAN tag fields	VLAN ID User priority
MPLS	
Single- and dual-label support	
MPLS unicast	
MPLS multicast	
Editable MPLS parameters	MPLS label MPLS priority MPLS TTL
MAC Frame Payload	
BERT/PRBS pattern	
Acterna test protocol version 2 with fill byte	Compatibility across all Viavi equipment
Acterna test protocol version 3 with fill byte	High-accuracy measurements
Flow Control (pause frames)	
Emulation/throttling on/off	
Pause Frames	
Tx insert	

Pause Quanta - Definable	0.0128 ms/quanta for 100 GE; 0.00512 ms/quanta for 40 GE
Pause frame analysis (counts, pause time length)	
Auto-Traffic Start On Laser On	
IP Packet Generator	Comments
IPv4 Support	
IPv6 Support	
Editable IPv4 Fields	
Destination IP address — user defined	
Source IP address — user defined	
Source IP address — subnet mask	
Source IP address — default gateway	
ToS	
DSCP	
TTL	
Protocol	
Editable IPv6 Fields	
Destination address — user defined	
Source address — manual (local addr; global addr; gtwy, subnet len.)	
Source address — stateful	
Source address — stateless	
Traffic class	
Flow label	
Hop limit	
Ping	
By hostname or IP address	
Single with packet size setting	
Multiple with packet size and interval	
Continuous with packet size and interval	
Fast with packet size setting	
TraceRoute	
By hostname or IP address	
Traffic Generator	
Traffic Profiles	
Traffic generation in Mbit/s and % utilization	
Constant B/W	
Burst B/W (duty cycle, bytes/frames/burst up to 2 Mbps, continuous/no. of bursts)	
Ramp B/W (timed step, load step %, stop increment on errors/dropped)	
Flood B/W	Full line rate
Constant B/W	
Bit rate	0.1 Mbps granularity
Percentage	0.001% granularity
Burst B/W	Comments
Bytes and information rate (IR)	Information rate (Mbps) Burst KB Continuous or fixed (up to 65535) bursts

Burst time and information rate	Information rate (Mbps) Burst time Continuous or fixed (up to 65535) bursts	
Bytes and gap time	Gap/idle time Burst KB Continuous or fixed (up to 65535) bursts	
Burst time and gap time	Burst time Gap/idle time Continuous or fixed (up to 65535) bursts	
Frames and duty cycle	Duty cycle (%) Frames/burst (up to 2 MB) Continuous or fixed (up to 65535) bursts	
Ramp B/W		
Timed step (0.1 s granularity)		
Load step (0.001% granularity)		
Stop load incr conditions	Errored frames (count parameter) Dropped frames (count parameter) Pause frames (count parameter)	
RS-FEC Settings		
Incoming FEC	Find and fix errors (default) Find but don't fix errors Ignore	
Disable HI SER Alarms	Off (Default) On	
Calibration and RS-FEC Sync procedure built into SW for lane discovery		Requires loopback device
Multiple Streams		
Up to 10 Streams		
Ethernet, IPv4, IPv6 Support		
Per-Stream Parameters		
Frame type (802.3, DIX, VLAN, Q-in-Q, MPLS)		
Source and destination addresses		
Fixed, random, jumbo frame size		
Constant or ramp traffic generation		
Acterna test protocol version 2 or 3 payload		
Class of Service Measurements		
Throughput (Tx/Rx)		
Frame Loss (rate and ratio)		
OoS Frames		
		Out-of-Sequence
Latency (frame delay)		
Round-trip delay measurements		

Acterna test protocol version 3 (default)	High precision/low delay (up to 37,000 km; 18,500 km round trip)	For high-accuracy RTD measurements (± 65 ns or better accuracy with 10 ns resolution with a hard loopback) Maximum distance 18,500 km x 2 for 100 GE and 47,000 km x 2 for 40 GE (enough to go around the Earth)
Acterna test protocol version 2 with fill byte	High precision/low delay (up to 7,700 km; 3,850 km round trip)	For short distances to be compatible with other Viavi implementations, such as a loopback on the 10 Gbps MSAM Maximum distance 3,873,500 km x 2 for 100 GE and 9,500,000 km x 2 for 40 GE (enough to go around the Earth)
	Lower precision/high delay	For long distances to be compatible with other Viavi implementations, such as a loopback on the 10 Gbps MSAM Packet jitter (frame delay variation)
Packet jitter (frame delay variation)		
Traffic Filtering		
Ethernet (Layer 2) Traffic Filtering		
MAC destination address		
MAC source address		
VLAN (Layer 2.5) Tag		
VLAN ID		
VLAN user priority		
Q-in-Q VLAN (Layer 2.5) Tags		
SVLAN fields	SVLAN ID SVLAN user priority SVLAN DEI bit SVLAN TPID	
CVLAN fields	VLAN ID User priority	
MPLS		
MPLS label		
MPLS priority		
IP (Layer 3) Traffic Filtering		
Destination address		
Source address		
Source subnet mask		
TOS/DSCP fields (IPv4)		
Protocol (IPv4)		
IPv6 traffic class		
IPv6 next header		

Payload Analysis On/Off	
Injection/Detection	Comments
Errors	
Code violation	Per lane/all lanes; single/burst rate (10 ⁻³ to 10 ⁻¹⁰)
Alignment marker	Per lane/all lanes; single/burst (up to 8)/rate (10 ⁻³ to 10 ⁻¹⁰)
BIP-8	Per lane/all lanes; single/burst (up to 128)/rate (10 ⁻³ to 10 ⁻¹⁰)
Undersized	single/burst (up to 16)
Runt	single/burst (up to 16)
FCS	single/burst (up to 32,767)
Acterna payload	single/burst (up to 32,767)
IPv4 checksum	single/burst (up to 32,767)
Bit error (PRBS)	single/rate (10 ⁻³ to 10 ⁻¹⁰)
RS-FEC Correctable	Single / Burst (up to 512) / Rate (10 ⁻² to 10 ⁻⁵)
RS-FEC Uncorrectable	Single / Burst (up to 512) / Rate (10 ⁻² to 10 ⁻⁵)
Alarms	
HI BER	High bit-error rate (from sync header bits)
LOBL	Per lane/all lanes; loss-of-block lock
LOAML	Per lane/all lanes; loss-of-alignment marker lock
RS-FEC LOAMP	
RS-FEC HI SER	
Faults	
Local fault	
Remote fault	
Results	
Custom Results	
LEDs	
Signal present	
Sync acquired	
Link active	
Marker lock	
Loss of alignment	
HI BER	
Frame detect	
ATP detect	
Pattern sync	

VLAN frame detect	
SVLAN frame detect	
Local fault	
Remote fault	
RS-FEC LOAMP	Loss of Alignment Marker Payload
RS-FEC LOA	Loss of Alignment
RS-FEC HI SER	High Symbol Error Rate
SLA/KPI	
Throughput current	Rx and Tx Mbps L1 Rx and Tx Mbps L2
Frame loss (count and ratio)	
Round-trip delay/FD (average, current, maximum)	
Packet jitter/FDV (average, max. avg., peak, instantaneous)	
Event Log (event, date, start and stop time, duration/value)	
Histogram	
CFP2 Rx overload	
Signal loss	
Link loss	
Sync loss	
Alignment marker lock loss	
HI BER	
Local fault	
Remote fault	
Code violation	
BIP-8 AM bit errors	
BIP-8 AM block error	
PCS block errors	
Invalid alignment markers	
Runts	
Jabbers	
FCS errored frames	
Errored frames	
Lost frames	
Out-of-sequence (OoS) frames	
Pause frames	
Bit errors (PRBS)	
Time	
Current date, current time, test time elapsed	
Interface	
Signal losses	
Signal-loss seconds	
Sync-loss seconds	
Link-loss seconds	
CFP2 optical Rx overload	
Optical Rx level (dBm)	
Rx frequency (Hz)	
Rx frequency deviation (ppm)	
Rx frequency max. deviation (ppm)	

Tx clock source		Broadcast packets	
Tx frequency (Hz)		20–45 byte packets	
Tx frequency deviation (ppm)		46–63 byte packets	
Tx frequency max. deviation (ppm)		64–127 byte packets	
Local-fault seconds		128–255 byte packets	
Remote-fault seconds		256–511 byte packets	
Per lambda Rx power	Optics-dependent	512–1023 byte packets	
L2 Link Counts/Statistics (most statistics also per stream)	Comments	1024–1500 packets	
Bandwidth utilization % (avg., current, min., peak)		>1500 packets	
Bandwidth utilization Mbps (Rx, Tx, L1, L2)		IPv6 Tx router solicitations	
Current utilization % (unicast, multicast, broadcast)		IPv6 Rx router advertisements	
Rx pause length (ms) (current, min., max.)		L2 Filtered Counts/Statistics	Comments
Frame rate (avg., current, min., peak)		L3 Filtered Counts/Statistics	
Frame size (avg., min., max.)		BERT	
Round-trip delay/FD (avg., current, max., min.)		Pattern losses	
Packet jitter/FDV (avg., max. avg., peak, instantaneous)		Pattern loss seconds	
VLAN (ID, user priority)		Bit errors	
SVLAN (ID, user priority, DEI)		Bit error rate	
Service disruption time (µs)		Bit error seconds	
Rx frames		Bit error-free seconds	
Tx frames		Bit error-free seconds %	
Tx Acterna frames		J-Proof Results	
Pause frames		Name	
Rx VLAN frames		Tx	
Rx Q-in-Q frames		Rx	
Unicast frames		Status	
Multicast frames		PCS Statistics	
Broadcast frames		Invalid alignment markers	
Rx frame bytes		Invalid alignment marker rate	
Tx frame bytes		Invalid alignment marker seconds	
Span-tree frames		Alignment marker lock	
64 byte frames		Alignment marker lock history	
65–127 byte frames		Alignment marker loss seconds	
128–255 byte frames		BIP-8 AM bit errors	
256–511 byte frames		BIP-8 AM bit error rate	
512–1023 byte frames		BIP-8 AM bit error seconds	
1024–< Jumbo frames		BIP-8 AM block errors	
Jumbo frames	Measures longest gap between frames	BIP-8 AM block error rate	
L3 Link Counts/Statistics (most statistics also per stream)		BIP-8 AM block error seconds	
Bandwidth utilization % (avg., current, min., peak)		Max skew (bits)	
Packet rate (avg., current, min., peak)		Current max skew (bits)	
Packet size (avg., min., max.)		Max skew (ns)	
Bandwidth utilization Mbps (Rx, Tx, L3)		Current max skew (ns)	
TOS		Max virtual lane skew (VLID)	
Received packets		Min virtual lane skew (VLID)	
Transmitted packets		Loss of alignment	
Unicast packets		HI BER	
Multicast packets		HI BER history	
		HI BER seconds	
		PCS block errors	List similar to L2 Link counts/statistics

PCS block error seconds	List similar to L3 Link counts/statistics
Per Lane	
Lane number	
Virtual Lane ID	
Skew (bits, ns)	
Sync acquired	
Marker lock	
Code violations	
Invalid alignment markers	
BIP-8 AM bit errors	
BIP-8 AM block errors	
RS-FEC	
LOAMP Alarm	
LOAMP Seconds	
LOA Alarm	
LOA Seconds	
HI SER Alarm	HI SER Alarm
HI SER Seconds	
Correctable CW Errors	
Correctable CW Error Rate	
Correctable Bit Errors	
Correctable Bit Error Rate	
Uncorrectable CW Errors	
Uncorrectable CW Error Rate	
Corr+Uncorr Bit Error Rate	
Error Statistics	Comments
Code violations	
Code-violation rate	
Code-violation seconds	
Runts/undersized	
Jabbers	
FCS errored frames	
Errored frames	
IP checksum errors (IPv4)	
IP packet length errors	
Acterna payload errors	
Packet error rate	
Lost frames	
Frame-loss ratio	
OoS frames	
Errored-second	
Severely errored seconds	
Unavailable seconds	
Errored-second ratio	
Severely errored-second ratio	
Capture	
Packets processed	
Capture progress %	
Graphical Displays	
Throughput Versus Time	
Frame Loss Versus Time	

Packet Jitter (FDV) Average Versus Time		
Packet Jitter (FDV) Instantaneous Versus Time		
Latency/FD (RTD) Versus Time		
Errors Versus Time		
Invalid-alignment markers		
BIP-8 AM bit errors		
PCS-block errors		
FCS-errored frames		
Runts		
Jabbers		
OoS frames		
Acterna payload errors		
IPv4 checksum errors		
Capture and Decode		
Wirespeed capture at 40 GE and 100 GE		
Integrated Wireshark on unit		
Up to 256 MB capture files		
Support of Triggers and Filters (as in Traffic Filtering section)		User-defined pre- and post-trigger buffer settings
Tx and Rx capture		
Frame slicing		
Wrap or stop on buffer full		
Decode/analysis capture files		
Detect ARP and ICMP issues		
Integrated J-Mentor tool		Examines utilization, error sources, conversations, retransmissions (via post-processing) at Layers 1, 2, 3, and 4
RFC 2544		
Connectivity J-QuickCheck Test		Comments
		Quickly verifies end-to-end connectivity before executing an RFC test
Symmetric, Asymmetric, Unidirectional		Available with IPv4 and IPv6
Loopback, Downstream, and Upstream		
Up to 10 Frame/Packet Sizes (max. 10,000 bytes)		
Up to 8 Frame/Packet Sizes (max. 10,000 bytes)		
Traffic in Mbps or %		
Tests		
Throughput	Zeroing-in: RFC 2544 standard or Viavi-enhanced	
	Measurement accuracy (down to 1 Mbps)	
	Test duration and number of trials	
	Frame-loss tolerance (0.001% granularity)	
	Pass/fail threshold	
Latency (RTD)	Pass/fail threshold	

Frame loss	Procedure choice (RFC 2544, top-down, bottom-up)	
	Bandwidth granularity (down to 1,000 Mbps)	
Back-to-back		
Packet jitter	Pass/fail threshold	
Burst (CBS)	Committed burst size or CBS policing (MEF 34) or burst hunt	
	CBS (KB)	
	CBS duration	
	Number of trials	
Extended load (loopback only)	Trial duration	
Runs Multiple Tests Concurrently For Speed		
Report Generation and Formats		
Graphical Results		
Total-Test-Time Display		
ITU-T Y.1564 SAMComplete		
Layer 2 and 3 Verification Test Suite Against SLA Parameters using Multiple Streams		Available with IPv4 and IPv6
Connectivity J-QuickCheck test		Enables quick verification of end-to-end connectivity before executing an RFC test
Symmetric, Asymmetric, and Unidirectional Loopback, Downstream, and Upstream		
		Comments
10 traffic streams		
Service configuration test		
TOS, DSCP, traffic class (IPv6)		
TOS, DSCP		
Service performance test		
Committed information rate (CIR)		
Policing option		
Extended IR (EIR)		
Maximum IR (MIR)		
Burst testing (CBS or CBS policing MEF 34)		
CBS (KB)		
Frame loss rate (FLR)		
Frame delay (FD)		
Frame delay variation		
Number of steps below CIR		
Step duration		
Graphical results		
Saved test profiles		
Configurable DEI, TPID, TOX/DSCP		
Inclusive of L2 Ethernet and IPv4		
Asymmetric testing		
Report Generation and Formats		
J-QuickCheck		

Connectivity J-QuickCheck test		Quickly verifies end-to-end connectivity as a stand-alone application
Layer 2 or Layer 3 selection		
Local port and remote loop link status		
Auto-negotiation status		For non-10 GE/40 GE/100 GE (for GE/10/100/1000Base-T)
Loopback detection (hardware, Viavi logical, fixed logical)		
Measured Throughput results		
Tx/Rx frame count, errored frames, OoS, and lost frames counts		
Traffic bandwidth, test duration, and frame length settings		
Report generation and formats		
Layer 3 specifics	ARP status	
	Source IP, default gateway, subnet mask, and destination IP settings	
J-Proof Layer 2 Transparency Testing		Comments
		Verifies transparent forwarding of control-plane traffic through Ethernet switch fabrics
Send/receive Ethernet control plane traffic		
Encapsulation supported - VLAN		
Encapsulation supported - QinQ		
Encapsulation supported - Spanning tree		
Encapsulation supported - Cisco protocols (Discovery etc.)		
Encapsulation supported - IEEE		

Send/receive Ethernet control plane traffic	Spanning tree protocol (STP)	
	Rapid spanning tree protocol (RSTP)	
	Multiple spanning tree protocol (MSTP)	
	Link layer discovery (LLDP)	
	Generic multicast registration (GMRP)	
	Generic VLAN registration (GVRP)	
	Cisco discovery protocol (CDP)	
	Link aggregation control protocol (LACP)	
	Port aggregate protocol (PAgP)	
	Unidirection link detection (UDLD)	
	Dynamic trunking protocol (DTP)	
	Inter-switch link (ISL)	
	Per VLAN spanning tree (PVST-PVST+)	
	STP-ULFAST	
	VLAN-BRDGS	
	802.1d	
VLAN trunking (VTP)		
Custom frame builder		

GE 10 GE

Test Interfaces/Bit Rates	Comments
10/100/1000Base-T (electrical)	
100Base-FX (125 Mbps) optical	
GE (1.25 Gbps) optical	
10 GE LAN (10.3125 Gbps)	
10 GE WAN (9.953 Gbps)	Available at Layer 2
Optics	
10/100/1000Base-T (electrical)	Part Number: CSFP-1G-CU
100Base-FX (125 Mbps) optical	Part Numbers: CSFP-100M-8-1, CSFP-100M-3-1, CSFP-100M-3-2, WDM-aligned optics

GE optical	Part Numbers: CSFP-2G-8-1, CSFP-2G-3-1, CSFP-2G-5-1, CSFP-2G5-3-1, CSFP-2G5-5-1, CSFP-2G5-5-2, CSFP-4G-8-1, CSFP-4G-3-1, CSFP-4G-3-2, SFPPLUS-1GE-10GE-8-1, SFPPLUS-1GE-10GE-3-1, CSFPPLUS-1G-10G-8-1, CSFPPLUS-1G-10G-3-1, CSFPPLUS-1G-10G-5-1, WDM-aligned optics	
10 GE LAN/WAN	Part Numbers: SFPPLUS-1GE-10GE-8-1, SFPPLUS-1GE-10GE-3-1, CSFPPLUS-1G-10G-8-1, CSFPPLUS-1G-10G-3-1, CSFPPLUS-1G-10G-5-1, SFPPLUS-1GE-10GE-8-1, SFPPLUS-1GE-10GE-3-1, CSFPPLUS-10G-T-1, CSFPPLUS-16G-8-1, CSFPPLUS-16G-3-1	
Power level	Provided by SFP/SFP+	
Overload condition reporting		
Modes of Operation		
Terminate		
Monitor/Thru	Rx monitoring while maintaining Tx via idles	
Logical Loopback	Loop up/down; address switching at Layers 2, 3, and 4	
	Manual (LLB)	
	Automatic Loop Up/Down	Communicates with far-end unit
Timing		
Recovered from Rx	Synchronous Ethernet applications	
Internal (Stratum 3)		
Recovered from external (bits/sets)	Bits/sets/2.048 MHz/10 MHz	
Frequency offset Tx/Rx	Required for synchronous Ethernet applications, ±100 ppm range	
Frequency reporting	Resolution in Hz, deviation in PPM	
Traffic Attributes		
Comments		
Line rate traffic Tx and Rx		
Layer 1 test patterns	10 GE: A seed, B seed, PRBS31 Optical GE: HFPAT, LFPAT, MFPAT, RDPAT, JTPAT, SNPAT	
Single-stream generation/analysis	With BERT/PRBS or Viavi (Acterna) test frame pattern (ATP)	
10-stream generation/analysis	With Viavi (Acterna) test frame pattern (ATP)	

PRBS payload patterns	10 GE: Numerous, including 2 ³¹ -1, 2 ²³ -1, 2 ²⁰ -1, 2 ¹⁵ -1, 2 ¹¹ -1, inverse, all ones, all zeros	
	Optical GE and below: Numerous including 2 ²³ -1, 2 ²⁰ -1, 2 ¹⁵ -1, 2 ¹¹ -1, inverse, all ones, all zeros	

Ethernet Generator

Tx/Rx Decoupling mode (for 10 GE service disruption measurements)	Incoming alarms, such as LOF or Remote Fault, do not affect the traffic generator (no alarm response)
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Frame Type

802.3	
DIX (Type II)	
VLAN / Q-in-Q	
MPLS (1 or 2 labels)	
Ethertype editing	
MAC Addressing	
Destination MAC address - unicast	
Destination MAC address - broadcast	
Destination MAC address - multicast	
Destination MAC address - ARP support (IPv4)	
Source MAC address - user-defined	
Source MAC address - factory default	
Source MAC address - auto-increment MAC	For LAG testing, number of MACs in sequence, disable OOS

MAC Frame Size

64, 128, 256, 512, 1024, 1280, 1518 settings	
User defined (64 to 1518 bytes + VLANs/ labels)	
Undersized	Size 49 to 63 bytes
Jumbo (up to 10000 bytes)	
Random (from 7 different sizes)	
EMIX	

VLAN (802.1q)

Editable VLAN tag fields	VLAN ID	
	User priority	

VLAN Stacking (Q-in-Q)

Editable SVLAN tag fields	SVLAN ID	Comments
	SVLAN user priority	
	SVLAN DEI bit	
	SVLAN TPID	
Editable CVLAN tag fields	VLAN ID	
	User priority	

MPLS

Single and dual label support	
MPLS unicast	
MPLS multicast	
Editable MPLS parameters	

MPLS label	
MPLS priority	
MPLS TTL	
MAC Frame Payload	
BERT/PRBS pattern	
Acterna test protocol version 2 with fill byte or PRBS	
Acterna test protocol version 3 with fill byte or PRBS	High-accuracy measurements
Flow Control (pause frames)	
Emulation/throttling on/off	
Pause Frames	
Tx Insert	
Pause quanta - definable	
Pause frame analysis (counts, pause time length)	0.0128 ms/quanta for 100 GE; 0.00512 ms/quanta for 40 GE

Auto-Traffic Start On Laser On

IP Packet Generator

IPv4 Support	
IPv6 Support	
Editable IPv4 Fields	
Destination IP address - user-defined	
Source IP address - user-defined	
Source IP address - subnet mask	
Source IP address - default gateway	
ToS	
DSCP	
TTL	
Protocol	
Editable IPv6 Fields	
Destination address	User-defined
	IP ID increment
Source address - manual (local addr; global addr, gtwy, subnet len.)	
Source address - stateful	
Source address - stateless	
Traffic class	
Flow label	
Hop limit	

Source address - manual (local addr; global addr, gtwy, subnet len.)	
Source address - stateful	
Source address - stateless	
Traffic class	
Flow label	
Hop limit	

Ping

	Comments
By hostname or IP address	
Single with packet size setting	
Multiple with packet size and interval	
Continuous with packet size and interval	
Fast with packet size setting	

TraceRoute

By hostname or IP address	
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Traffic Generator

Traffic Profiles	
Traffic generation in frames/s, Mbps, and % utilization	
Constant B/W	

Burst B/W (duty cycle, bytes/frames/burst up to 25 GB at 10 GE, continuous/number of bursts)		
Ramp B/W (timed step, load step %, stop increment on errors/dropped)		
Flood B/W		Full line rate
Constant B/W		
Bit rate		0.1 Mbps granularity
Percentage		0.001% granularity
Frames per second		
Burst B/W		
Bytes and information rate (IR)	IR (Mbps)	
	Burst KB	
Burst time and information rate (IR)	Continuous or fixed (up to 65535) bursts	
	IR (Mbps)	
Burst time and information rate (IR)	Burst time	
	Continuous or fixed (up to 65535) bursts	
Bytes and gap time	Gap/idle time	
	Burst KB	
	Continuous or fixed (up to 65535) bursts	
Burst time and gap time	Burst time	
	Gap/idle time	
	Continuous or fixed (up to 65535) bursts	
Gap time and information rate (IR)	IR (Mbps)	
	Burst type	
Frames and duty cycle	Duty cycle (%)	
	Frames/burst (up to 2 MB)	
	Continuous or fixed (up to 65535) bursts	
Ramp B/W		
Timed step (0.1 s granularity)		
Load step (0.001% granularity)		
Stop load incr conditions	Errored frames (count parameter)	
	Dropped frames (count parameter)	
	Pause frames (count parameter)	
Multiple Streams		Comments
Up to 10 Streams		
Ethernet, IPv4, IPv6 Support		
Per-Stream Parameters		
Frame type (802.3, DIX, VLAN, Q-in-Q, MPLS)		
Source and destination addresses		
Fixed, random, jumbo frame size		
Constant or ramp traffic generation		
Acterna test protocol version 2 or 3 payload		
Class of Service Measurements		
Throughput (Tx/Rx)		

Frame Loss (rate and ratio)		
OoS Frames		Out-of-sequence
Latency (frame delay)		
Round-trip delay measurements		
Acterna Test Protocol Version 3 (default)		
10 GE high precision/low delay		For high-accuracy RTD measurements (± 80 ns with a hard loopback) Maximum distance 47,000 km x 2 (enough to go around the earth)
GE optical high precision/low delay		For high-accuracy RTD measurements (± 135 ns or better accuracy with a hard loopback) Maximum distance 94,500 km x 2 (enough to go around the earth)
Acterna test protocol version 2 with fill byte		
High precision/low delay		For short to medium distances to maintain compatibility with older Viavi implementations (around ± 4 μ s accuracy) Maximum distance 37,750 km x2 for 10 GE and 377,500 km x 2 for GE
Lower precision/high delay		For very long distances to maintain compatibility with older Viavi implementations
One-way delay measurements		Requires GPS (CGPS-RCVR-KIT) or CDMA kit (CCDMA-RCVR-KIT); runs with ATPv3 or ATPv2
Packet Jitter (frame delay variation)		
Traffic Filtering		Comments
Ethernet (Layer 2) traffic filtering		
MAC destination address		
MAC source address		
VLAN (Layer 2.5) Tag		
VLAN ID		
VLAN user priority		
Q-in-Q VLAN (Layer 2.5) Tags		
SVLAN fields	SVLAN ID	
	SVLAN user priority	
	SVLAN DEI bit	
	SVLAN TPID	
CVLAN fields	VLAN ID	
	User priority	
MPLS		
MPLS label		
MPLS priority		
IP (Layer 3) Traffic Filtering		
Destination address		

Source address		
Source subnet mask		
TOS/DSCP fields (IPv4)		
Protocol (IPv4)		
IPv6 traffic class		
IPv6 next header		
Payload Analysis On/Off		
Injection/Detection		
Errors		
Code violation	Single/burst (up to 16)/ Rate (10 ⁻³ to 10 ⁻⁹)	
FCS	Single/burst (up to 32767)	
Acterna payload	Single/burst (up to 32767)	
IPv4 checksum	Single/burst (up to 32767)	
Bit error (PRBS)	Single/rate (10 ⁻³ to 10 ⁻⁹)	
Faults (10 GE)		
Local fault		
Remote fault		
Results		
Custom Results		
LEDs		
Signal present		
Sync acquired		
Link active		
Frame detect		
IP packet detect		
Pattern sync		
VLAN frame detect		
SVLAN frame detect		
Local fault		
Remote fault		
Time Source		
ToD sync		
1PPS sync		
SLA/KPI		
Throughput current	Rx & Tx Mbps L1	Comments
	Rx & Tx Mbps L2	
	Rx & Tx Mbps L3	
Frame loss (count and ratio)		
Round-trip delay/FD (average, current, maximum)		
Packet jitter/FDV (average, max avg, peak, instantaneous)		
One-way delay (average, current, maximum)		
Event Log (event, date, start and stop time, duration/value)		
Histogram		
Optical Rx overload		
Signal loss		
Link loss		
Timing source loss		

Sync loss	
Local fault	
Remote fault	
Code violation	
Runts	
Jabbers	
Undersized frames	
FCS errored frames	
Errored frames	
Lost frames	
OoS frames	Out-of-sequence
Pause frames	
EB (PCS)	
BSL (PCS)	
Bit errors (PRBS)	
IP checksum errors (IPv4)	
Packet size errors	
Acterna payload errors	
TCP/UDP checksum errors	
Time	
Current date, current time, test time elapsed	
Interface	
Signal losses	
Signal loss seconds	
Sync loss seconds	
Link loss seconds	
Optical Rx overload	
Optical Rx level (dBm)	
Rx frequency (Hz)	
Rx frequency deviation (ppm)	
Max Rx frequency deviation (ppm)	
Tx clock source	
Tx frequency (Hz)	
Tx frequency deviation (ppm)	
Max Tx frequency deviation (ppm)	
Local fault seconds	
Remote fault seconds	
L2 Link Counts/Statistics (most stats also per stream)	
Total utilization % (avg, current, min, peak)	
Current utilization % (unicast, multicast, broadcast)	
Rx pause length (ms) (current, min, max)	
Frame rate (avg, current, min, peak)	
Frame size (avg, min, max)	
Bandwidth utilization Mbps (Rx, Tx, L1, L2)	
Round-trip delay/FD (avg, current, max, min)	
One-way delay (average, current, max, min)	
One-way delay % valid	
Packet jitter/FDV (average, max avg, peak, instantaneous)	
VLAN (ID, user priority)	

SVLAN (ID, user priority, DEI)	
Service disruption time (µs)	
Rx frames	
Tx frames	
Rx Acterna frames	
Tx Acterna frames	
Pause frames	
Rx VLAN frames	
Rx Q-in-Q frames	
Unicast frames	
Multicast frames	
Broadcast frames	
Rx frame bytes	
Tx frame bytes	
Span tree frames	
64 byte frames	
65 – 127 byte frames	
128 – 255 byte frames	
256 – 511 byte frames	
512 – 1023 byte frames	
1024 – <jumbo frames	
Jumbo frames	
L3 Link Counts/Statistics/Config Status (most stats also per stream)	
Total utilization % (avg, current, min, peak)	
Packet rate (avg, current, min, peak)	
Packet size (avg, min, max)	
Bandwidth utilization Mbps (Rx, Tx, L3)	
TOS	
Rx packets	
Tx packets	
Unicast packets	
Multicast packets	
Broadcast packets	
20 – 45 byte packets	
46 – 63 byte packets	
64 – 127 byte packets	
128 – 255 byte packets	
256 – 511 byte packets	
512 – 1023 byte packets	
1024 – 1500 packets	
>1500 packets	
IPv6 Tx router solicitations	
IPv6 Rx router advertisements	
Source IP address	
IP gateway	
IP subnet mask	
Destination IP address	
Destination MAC address	
L2 Filtered Counts/Statistics	Comments
L3 Filtered Counts/Statistics	
L4 Link Counts/Statistics (many stats also per stream)	
Rx source port	
Rx destination port	
Rx/Tx Mbps, current L4	
Rx Mbps, current TCP	
Rx Mbps, current UDP	

TCP packets	
UDP packets	
BERT	
Pattern losses	
Pattern loss seconds	
Bit errors	
Bit error rate	
Bit error seconds	
Bit error-free seconds	
Bit error-free seconds, %	
Capture	
Packet processed	
Capture progress %	
Sync Status Messages	
CDMA/GPS Receiver	
Event, time	
J-Proof Results	
Name	
Tx	
Rx	
Status	
Error Statistics	
Code violations	
Code violation rate	
Code violation seconds	
Undersized frames	
Runts	
Jabbers	
FCS errored frames	
Errored frames	
Errored blocks (PCS)	
Errored block losses (PCS)	
IP checksum errors (IPv4)	
IP packet length errors	
Acterna payload errors	
Packet error rate	
Lost frames	
Frame loss ratio	
OoS frames	
TCP/UDP checksum errors	
Errored seconds	
Severely errored seconds	
Unavailable seconds	
Errored second ratio	
Severely errored second ratio	
Capture	Comments
Packets processed	
Capture progress %	
Graphical Displays	
Throughput versus Time	
Frame Loss versus Time	
Packet Jitter (FDV) Average versus Time	
Packet Jitter (FDV) Instantaneous versus Time	
Latency/FD (RTD) versus Time	
Errors versus Time	

FCS errored frames	
Runts	
Jabbers	
OoS frames	
Acterna payload errors	
IPv4 checksum errors	
TCP/UDP checksum errors	
Bit errors	
Capture and Decode	
Wirespeed capture at 10/100/1000, 100 Mbps optical, GE optical, 10 GE LAN/WAN	
Integrated Wireshark on unit	
Up to 128 MB capture files	
Supports triggers and filters (as in Traffic Filtering section)	User-settable pre- and post-trigger buffer settings
Tx and Rx capture	
Frame slicing	
Wrap or stop on buffer full	
Decode/analysis capture files	
Detect ARP and ICMP issues	
Integrated J-Mentor tool	Examines utilization, error sources, conversations, retransmissions (via post-processing) at Layers 1/2, Layer 3, Layer 4
RFC 2544	
Connectivity J-QuickCheck test	Quickly verifies end-to-end connectivity before executing an RFC test
Symmetric, Asymmetric, Unidirectional	Available with IPv4 and IPv6
Loopback, Downstream, and Upstream	
Up to 10 Frame/Packet Sizes (max. 10,000 bytes)	
Traffic in Mbps or %	
Tests	Comments
Throughput	Zeroing-in: RFC 2544 standard or Viavi-enhanced
	Measurement accuracy (down to 1 Mbps)
	Test duration and number of trials
	Frame loss tolerance (0.001% granularity)
	Pass/fail threshold
Latency (RTD)	Pass/fail threshold

Frame loss	Procedure choice (RFC 2544, top down, bottom up)	
	Bandwidth granularity (down to 1000 Mbps)	
Back-to-back		
Packet jitter	Pass/fail threshold	
Burst (CBS)	Committed burst size or CBS policing (MEF 34) or burst hunt	
	CBS (kB)	
	CBS duration	
	Number of trials	
Extended load (loopback only)	Trial duration	
Runs Multiple Tests Concurrently for Speed		
Report Generation and Formats		
Graphical Results		
Total Test Time Display		
ITU-T Y.1564 SAMComplete		
Layer 2 and 3 Verification Test Suite Against SLA Parameters using Multiple Streams		Available with IPv4 and IPv6
Connectivity J-QuickCheck Test		Quickly verifies end-to-end connectivity before executing an RFC test
Symmetric, Asymmetric, Unidirectional		
Loopback, Downstream, and Upstream		
Comments		
10 traffic streams		
Service configuration test		
Service performance test		
TOS, DSCP traffic class (IPv6)		
Committed information rate (CIR)		
Policing option		
Extended IR (EIR)		
Maximum IR (MIR)		
Burst testing (CBS or CBS policing MEF 34)		
CBS (KB)		
Frame loss rate (FLR)		
Frame delay (FD)		
Frame delay variation		
Number of steps below CIR		
Step duration		
Frame delay variation		
Graphical results		
Saved test profiles		
Configurable DEI, TPID, TOX/DSCP		
Inclusive of L2 Ethernet and IPv4		
Asymmetric testing		

Report Generation and Formats		
QuickCheck		
Connectivity J-QuickCheck Test		Quickly verifies of end-to-end connectivity as standalone application
Layer 2 or Layer 3 Selection		
Local Port and Remote Loop Link Status		
Auto-Negotiation Status		For non-10 GE/40 GE/100 GE (for GE/10/100/1000Base-T)
Loopback Detection (hardware, Viavi logical, fixed logical)		
Measured Throughput Result		
Tx/Rx Frame Count, Errored Frames, OOS, and Lost-Frame Counts		
Traffic Bandwidth, Test Duration, Frame Length Settings		
Report Generation and Formats		
Layer 3 Specifics	ARP status	
	Source IP, default gateway, subnet mask, destination IP settings	
J-Proof Layer 2 Transparency Testing		Comments
Verifies Transparent Control-Plane Traffic Forwarding through Ethernet Switch Fabrics		
Send/receive Ethernet control plane traffic		
Encapsulation support	VLAN	
	Q-in-Q	
	Spanning tree	
	Cisco protocols (discovery and others)	
	IEEE	

Send/receive Ethernet control plane traffic	Spanning tree protocol (STP)	
	Rapid spanning tree protocol (RSTP)	
	Multiple spanning tree protocol (MSTP)	
	Link layer discovery (LLDP)	
	Generic multicast registration (GMRP)	
	Generic VLAN registration (GVRP)	
	Cisco discovery protocol (CDP)	
	VLAN trunking (VTP)	
	Link aggregation control protocol (LACP)	
	Port aggregate protocol (PAgP)	
	Unidirection link detection (UDLD)	
	Dynamic trunking protocol (DTP)	
	Inter-switch link (ISL)	
	Per VLAN spanning tree (PVST-PVST+)	
	STP-ULFAST	
	VLAN-BRDGS	
	802.1d	
Custom frame builder		

RFC 6349 TrueSpeed	
Standards-Based Test Suite to Test Stateful TCP up to Line Rate	
Turn-up and Troubleshooting Modes	
Downstream and upstream matching or nonmatching throughput support	
IPv4 support:MAC, IP (static/DHCP) addressing, VLAN; set TCP port	
Walk the window test (up to 4 window sizes)	
Automatically find MTU size (or manually set)	
Set test time (70 – 3010 s for turn-up)	
Set TOS/DSCP	
Adjust CIR value	
Test threshold settings (TCP pass % of CIR, MTU upper limit)	
Set number of TCP connections (1 to 64)	
Traffic shaping settings (Tc in ms, Bc in kB) for GE and below	
Results showing: Path MTU, RTT (round-trip time), Walk the Window, TCP throughput, and advanced TCP (troubleshooting)	

OTU3/OTU4

Test Interfaces/Bit Rates		Comments
OTU3 (43.02 Gbps)		
OTU4 (111.8 Gbps)		
Optics		
OTU3	Multi-lambda single-mode QSFP+ (4 wavelengths)	Part Number: CQSFP-43G-3-4
OTU4 Latency offset factor programmable per CFP2 or QSFP+ type; to calibrate latency	Multi-lambda CFP2 (4 to 10 wavelengths)	Part Numbers: CCFP2-112G-3-4 and CCFP4-112G-3-4 (together with 3076/92.92)
	Multi-fiber multimode CFP2 (10 fibers/dir)	Part Number: CCFP2-112G-8-10
Power level (aggregate)		Provided by CFP2 or QSFP+
Power level (per lambda/wavelength) Rx and Tx		Provided by CFP2 or QSFP+
Reporting of overload condition		
CFP2 individual laser on/off		Access to registers to control individual Tx lasers
Modes of Operation		
Terminate		
Monitor/Thru	Thru mode provides a full loopback with monitoring capabilities	Monitoring on Rx with no Tx laser
Timing		
Recovered from Rx		
Internal (Stratum 3)		
Recovered from external (bits/sets)		Bits/sets/2.048 MHz/10 MHz
Frequency offset Tx/Rx		±150 ppm
Frequency reporting		Resolution in Hz, deviation in PPM
Traffic Mappings		
OTN bulk BERT		PRBS as payload in OTN frames
OTL BERT		PRBS on OTL (with lane alignment)
OTU4 with 100 GE client using GMP		Full Ethernet functionality at client level

OTU4 with ODU multiplexing	ODU3 with bulk; direct into ODU4	Full SONET/SDH functionality at client level (PRBS as per 40 Gbps SONET/SDH)
	ODU2e with bulk; direct into ODU4	
	ODU2e with 10 GE Transparent client (Layer 1 and 2); direct into ODU4	
	ODU2 with bulk; direct in ODU4	
	ODU2 with 10 GE client via GFP-F (G.7041 Sect 71) (Layers 2 and 3); direct in ODU4	
	ODU1 with bulk; direct in ODU4 and via ODU2	
	ODU0 with bulk; direct in ODU4 via ODU1, via ODU0	
	ODU0 with GE client via GFP-T (Layers 2 and 3); direct into ODU4, via ODU1, via ODU0	
	ODUFlex with bulk; direct in ODU4	
	ODUFlex with Layer 2 MAC via GFP-F; direct in ODU4	
OTU3 with OC-768/STM-256 client		
OTU3 with 40 GE client transcoded		
OTU3 with ODU multiplexing	ODU2e with bulk; direct into ODU3	
	ODU2e with 10 GE Transparent client (Layers 1 and 2); direct into ODU3	
	ODU2 with bulk; direct in ODU3	
	ODU2 with 10 GE client via GFP-F (G.7041 Sect 71) (Layers 2 and 3) direct into ODU3	
	ODU1 with bulk; direct in ODU3 and via ODU2	
	ODU0 with bulk; direct in ODU3, via ODU1, via ODU2	
	ODU0 with GE client via GFP-T (Layers 2 and 3); direct into ODU3, via ODU1, via ODU2	
	ODUFlex with bulk; direct in ODU3	1 to 8 tributary slots of bandwidth
	ODUFlex with Layer 2 MAC via GFP-F; direct in ODU3	1 to 8 tributary slots of bandwidth
	OTU3/4 bulk PRBS patterns	2^9-1 , 2^9-1 inverse
$2^{23}-1$, $2^{23}-1$ inverse		
$2^{31}-1$, $2^{31}-1$ inverse		
Delay pattern		
Rx live		

OTL/OTN Injection/Detection		Comments
Set Tx Scramble On/Off		
Set Rx Descramble On/Off		
Skew Injection per Virtual Lane		
OTU4: 0 to 32000 (5724 ns) bits per lane		
OTU3: 0 to 32000 (2975.5 ns) bits per lane		
Skew Alarm (Rx) Threshold Settings	Defaults to 180 ns	Up to 5951 ns for OTU3; Up to 11448 ns for OTU4
Skew Reporting per Virtual Lane		
Transcoding HI BER Detection On/Off		
Errors		
OTL FAS		Per lane/all lanes; single/burst (up to 128)/rate (10^{-3} to 10^{-10})
OTL MFAS		Per lane/all lanes; single/burst (up to 128)/rate (10^{-3} to 10^{-10})
OTL LLM (OTU4)		Per lane/all lanes; single/burst (up to 128)/rate (10^{-3} to 10^{-10})
FEC uncorrectable		Single/rate (10^{-2} to 10^{-5})
FEC correctable		Single/rate (10^{-2} to 10^{-5})
OOM		
SM-BIP		Single/rate (10^{-5} to 10^{-7})
SM-BEI		Single/rate (10^{-5} to 10^{-7})
PM-BIP		Single/rate (10^{-5} to 10^{-7})
PM-BEI		Single/rate (10^{-5} to 10^{-7})
TCM1-6 BIP		Single/rate (10^{-5} to 10^{-7})
TCM1-6 BEI		Single/rate (10^{-5} to 10^{-7})
Bit error/TSE		Single/rate (10^{-3} to 10^{-10})
Additional client-level errors		
Transcoding Errors		
LOBL (1027B)		
LOAML		Per lane/all lanes
HI BERD (1027B)		
Alarms		
OTL OOF		Per lane/all lanes
OTL LOF		Per lane/all lanes
LOM		
SM-IAE		
SM-TIM		
SM-BDI		
SM-BIAE		

ODU AIS	
ODU LCK	
ODU OCI	
PM-BDI	
PM-TIM	
Fwd signal fail	
Fwd signal degrade	
Bwd signal fail	
Bwd signal degrade	
TCM1-6 IAE	
TCM 1-6 BDI	
TCM1-6 BIAE	
TCM1-6 TIM	
PT mismatch	
Client loss	
Additional client-level alarms	
Transcoding Alarms	
Flag parity	Single/Burst (up to 128)/Rate (10^{-3} to 10^{-10})
Marker seq violation	Single/Burst (up to 128)/Rate (10^{-3} to 10^{-10})
OTN BIP-8	Per lane/all lanes; Single/Burst (up to 128)/Rate (10^{-3} to 10^{-10})
Ingress BIP-8	Per lane/all lanes; Single/Burst (up to 128)/Rate (10^{-3} to 10^{-10})
Code	Per lane/all lanes; Single/Burst (up to 128)/Rate (10^{-3} to 10^{-10})
OTN Overhead	
Supports AMP, GMP, BMP as per client mapping	AMP client offset up to ± 65 PPM for SONET/SDH clients
GCC transparency test	Selection of GCC0, GCC1, GCC2. PRBS verification on Rx interface with bits, errors, and BER
Round-trip delay (RTD) as per G.709 section 15.8 (100 ns accuracy)	Selection of PM or TCM1-6
Overhead Manipulation/Analysis	
Overhead editor for OTU, ODU, OPU bytes	Multiple ODU levels for ODU multiplexing
Full structured PSI editor	
Full PSI and MSI Byte Maps for Each ODU Multiplexed Level	Rx and Tx MSI with byte value, ODU type, and tributary port number
Can copy Rx MSI values to Tx MSI	
Full Tx and Rx tributary port settings	
Displays tributary slots and port for each ODU multiplexed level	
SM/PM and TCM1-6 Trace (TTI) Messages	
Tx and Rx SAPI/DAPI functionality	

TIM alarms on SAPI and/or DAPI mismatch or disable		
Fault Signaling (FTFL) Processing		Comments
Forward and backward messaging		
Payload Type (PT) Label Generation/Display		
Set transmitted and display received PT value		
PLM alarms enable/disable		
Forward Error Correction		
Outgoing FEC	GFEC (G.709 FEC) or all-zeros	
Incoming FEC	Ignore, correct errors, do not correct errors	
GMP Layer Injection/Detection		
Tx payload Mapping Type		
Expected Payload Mapping Type		
CM Value Overwrite		
Client PPM Offset Setting		±100 ppm
Error Injections/Detection		
GMP CRC-5		Single/burst (up to 16)
GMP CRC-8		Single/burst (up to 16)
Ethernet		
As per Ethernet injection/detection		
GFP Layer Injection/Detection		
With Ethernet clients		
Set PFI		
Set EXI		
Set UPI		
Rx filter on CID		
Rx filter on UPI		
GFP-T superblocks per frame		1 to 978
Service Disruption Measurement		
Measurement Parameters		
SD separation/debounce time setting		Mandatory for handling the NE's Tx debounce; up to 60000 ms
SD threshold time settings		Up to 60000 ms
Triggers		
Signal loss/LOS		
Bit/TSE error		For PRBS errors
OTL LOF		
OTL FAS error		
OTL MFAS error		
OTL LLM (OTU4)		
OTU LOM		
OTU SM-IAE		
OTU SM-BIAE		
ODU AIS		
ODU LCK		
ODU OCI		
ODU PM-BDI		
OTU OOM		
ODU PM-BIP		

ODU PM-BEI		
SONET/SDH when present as a client		
Ethernet SD based on gap measurement when present as a client		
Results		Comments
Custom Results		
LEDs		
Signal present/LOS		
Frame sync/LOF		
Marker lock/LOR		
Lanes aligned/LOL		
Pattern sync/LSS		
GMP sync		
GMP (Cm=0)		
GFP CSF-LCCS alarm		
GFP CSF-LCS alarm		
Client- or muxed-level extra		
Summary Status		
Event Log (event, date, start and stop time, duration/value)		
Histogram (multiple alarms and errors)		
Service Disruption Summary Table		
Service Disruption Details		
Service Disruption Statistics		
Longest		
Shortest		
Last		
Average		
Number of disruptions		
Time		
Current date, current time, test elapsed time		
Interface		
Invalid Rx signal seconds		
Signal losses/LOS		
Signal loss seconds/LOS seconds		
QSFP state		
CFP2 state		
CFP2 optical Rx overload		
Optical Rx level (dBm)		
Rx frequency (Hz)		
Rx frequency deviation (ppm)		
Rx frequency max. deviation (ppm)		
Tx clock source		
Tx frequency (Hz)		
Tx frequency deviation (ppm)		
Tx frequency max. deviation (ppm)		
Round-trip delay current, avg, min, max (100 ns resolution)		
Per lambda Rx power		Optics-dependent
Per lambda Tx power		Optics-dependent
OTL Statistics		Comments
Frame sync loss seconds		

LOF seconds	
OOF seconds	
OOMFAS seconds	
Marker lock loss seconds/LOR seconds	Loss of recovery
OOR errors	Out of recovery
Lane aligned loss seconds/LOL seconds	
OOL seconds	
OOLLM seconds	
FAS errors	
FAS-error rate	
FAS-error seconds	
MFAS errors	
MFAS-error rate	
MFAS-error seconds	
Logical-lane-marker errors	
Logical-lane-marker-error rate	
Logical-lane-marker-error seconds	
Marker-lock-loss seconds	
Lane-aligned-loss seconds	
Max. skew (bits)	
Current max. skew (bits)	
Max. skew (ns)	
Current max. skew (ns)	
Max logical-lane skew (LL ID)	
Min logical-lane skew (LL ID)	
OTL per Lane	
Lane number	
Logical-lane ID	
Skew (bits, ns)	
Frame sync/OTL LOF	
OTL OOF	
OOMFAS	
Marker lock/OOLLM	
OTL LOR (OTU4)	
OTL OOR	Out of recovery
FAS errors	
MFAS errors	
Logical-lane marker errors (OTU4)	
Ethernet virtual lane ID	For Ethernet in OTN
Sync acquired	For Ethernet in OTN
Eth marker lock	For Ethernet in OTN
Code violations	For Ethernet in OTN
Invalid alignment markers	For Ethernet in OTN
BIP-8 AM bit errors	For Ethernet in OTN
BIP-8 AM block errors	For Ethernet in OTN
FEC	Comments
Uncorrected-word errors	
Uncorrected-word-error rate	
Uncorrected-word-error seconds	
Corrected-word errors	
Corrected-word-error rate	
Corrected-word-error seconds	

Corrected bit errors	
Corrected-bit-error rate	
Corrected bit-error seconds	
Framing	
OOM seconds	
OTU	
AIS seconds	
SM-IAE seconds	
SM-BIP errors	
SM-BIP-error rate	
SM-BDI seconds	
SM-BIAE seconds	
SM-BEI errors	
SM-BEI-error rate	
SM-SAPI	
SM-DAPI	
SM-operator-specific	
GCC BERT bits	
GCC BERT bit errors	
GCC BERT bit error rate	
ODU	
ODU-AIS seconds	
ODU-LCK seconds	
ODU-OCI seconds	
PM-BIP errors	
PM BIP-error rate	
PM-BDI seconds	
PM-BEI errors	
PM-BEI-error rate	
PM-SAPI	
PM-DAPI	
PM-operator-specific	
GCC BERT bits	
GCC BERT bit errors	
GCC BERT bit error rate	
PM round-trip delay recent	
PM round-trip delay last	
OPU	
Payload type	
PT mismatch seconds	
FTFL	
Forward-fault type	
Forward-SF seconds	
Forward-SD seconds	
Forward-operator identifier	
Forward-operator specific	
Backward-fault type	
Backward-SF seconds	
Backward-SD seconds	
Backward-operator identifier	
Backward-operator specific	
TCM 1-6	

IAE seconds	
BIP errors	
BIP-error rate	
BDI seconds	
BIAE seconds	
BEI errors	
BEI-error rate	
SAPI	
DAPI	
Operator specific	
PM round-trip delay recent	
PM round-trip delay previous	
AMP	
Rx offset (PPM)	
Max Rx offset (PPM)	
PJO1 count	
NJO1 count	
Payload	
Pattern-sync losses /LSSs	
Pattern-sync-loss seconds /LSS seconds	
TSE/bit errors	
TSE/bit-error rate	
TSE/bit-error seconds	
Bit-error-free seconds	
Bit-error-free seconds, %	
GMP (under OTU when used to map payload)	
Sync status	
Sync-loss seconds	
OOS status	
OOS seconds	
GMP alarm (Cm=0)	
Effective CM	
Minimum CM	
Maximum CM	
CM offset (PPM)	
Unchanged CM count	
+1 CM count	
+2 CM count	
-1 CM count	
-2 CM count	
New CM count	
CRC-5 bit errors	
CRC-5 bit-error rate	
CRC-5 bit seconds	
CRC-8 bit errors	
CRC-8 bit-error rate	
CRC-8 bit seconds	
GFP	
Payload FCS errors (count, seconds, ratio, rate)	
Core header single bit errors (count, seconds, ratio, rate)	
Core header multi bit errors (count, seconds, ratio, rate)	

Type header single bit errors (count, seconds, ratio, rate)	
Type header multi bit errors (count, seconds, ratio, rate)	
Extension header single bit errors (count, seconds, ratio, rate)	
Extension header multi bit errors (count, seconds, ratio, rate)	
GFP-T CRC-16 correctable errors (count, seconds, ratio, rate)	
GFP-T CRC-16 uncorrectable errors (count, seconds, ratio, rate)	
GFP-T 10B_ERR (count, seconds, ratio, rate)	
Client	
Client Rx frequency (Hz)	
Client Rx frequency deviation (ppm)	
Client Rx frequency max deviation (ppm)	
Transcoding Statistics	
Sync-loss seconds	
HI BER seconds	
1027B flag parity error	
1027B flag parity error rate	
513B Mkr Seq Vio count	
513B Mkr Seq Vio rate	
513B Mkr Seq Vio seconds	
Total OTN BIP-8 error count	
Total OTN BIP-8 error rate	
Total ingress BIP-8 error count	
Total ingress BIP-8 error rate	
Transcoding per Lane	
Lane number	
OTN BIP-8 error count	
OTN BIP-8 error rate	
Ingress BIP-8 error count	
Ingress BIP-8 error rate	
Ethernet Client	
As per Ethernet results	
SONET/SDH Client	
As per SONET/SDH results	
OTN Check	Comments
Automated workflow is available at all OTN rates for OTN bulk	Key use case is OTN service activation
Set test duration based on bit error rate theory or actual time	
Bit error rate theory parameters for test duration:	
Data rate (e.g., OTU4)	
BER threshold	
Confidence level (% value)	Statistical degree of certainty
Key automated tests	
Payload BERT	PRBS pattern selection Pass/fail BER threshold

Round-trip delay	Selection of applicable OH fields: PM, TCM1-6	
	Measurement frequency	
	Pass/fail threshold (ms)	
GCC transparency	Selection of applicable OH fields: GCC0, GCC1, or GCC2	
	Pass/fail BER threshold	
OTN far-end loopback auto-detect		
Report generation and formats		

OTU1/OTU2/OTU2e/OTU1e

Test Interfaces/Bit Rates	Comments
OTU1 (2.67 Gbps)	
OTU2 (10.71 Gbps)	
OTU2e (11.1 Gbps)	
OTU1e (11.05 Gbps)	
Optics	
OTU1	Part Numbers: CSFP-2G5-3-1, CSFP-2G5-5-1, CSFP-2G5-5-2
OTU2/2e/1e	Part Numbers: CSFPPLUS-10G-3-1, CSFPPLUS-10G-5-1, CSFPPLUS-10G-5-2, CSFPPLUS-10G-T-1
Power level	Provided by SFP/ SFP+
Overload condition reporting	
Modes of Operation	
Terminate	
Monitor/Thru	Thru mode provides a full loopback with monitoring capabilities
	Monitoring on Rx with no Tx laser
Timing	
Recovered from Rx	
Internal (Stratum 3)	
Recovered from external (bits/sets)	Bits/sets/2.048 MHz/ 10 MHz
Frequency offset transmit/receive	±50 ppm
Frequency reporting	Resolution in Hz, deviation in PPM
Traffic Mappings	
OTN bulk BERT	PRBS as payload in OTU1/2/1e/2e frames
OTU2e with Layers 1 and 2 traffic	Full Ethernet functionality at client level
OTU1e with Layers 1 and 2 traffic	Full Ethernet functionality at client level

OTU2 with STS-192 bulk BERT		Full SONET functionality at client level
OTU2 with VC-4-64 bulk BERT		Full SDH functionality at client level
OTU2 with ODU multiplexing	ODU1 with bulk; direct in ODU2	
	ODU0 with bulk; direct in ODU2	
	ODU0 with GE client via GFP-T (Layers 2 and 3); direct in ODU2	
	ODUFlex with bulk; direct in ODU2	
OTU1 with STS-48 bulk BERT	ODUFlex with layer 2 MAC via GFP-F. Direct in ODU2	Full SONET functionality at client level
OTU1 with STM-16 bulk BERT		Full SDH functionality at client level
OTU1 with ODU multiplexing	ODU0 with bulk; direct in ODU1	
	ODU0 with GE client via GFP-T (Layers 2 and 3); direct in ODU1	
OTN bulk PRBS patterns	2 ²³ -1, 2 ²³ -1 Inverse	PRBS as payload in OTU1/2/1e/2e frames
	2 ³¹ -1, 2 ³¹ -1 Inverse	
	Delay pattern	
	Rx live	
	Digital word	32 bits
OTN Injection/Detection		
Set Tx Scramble On/Off		
Set Rx Descramble On/Off		
Errors	Comments	
FEC uncorrectable	Single/rate (10 ⁻² to 10 ⁻⁵)	
FEC correctable	Single/rate (10 ⁻² to 10 ⁻⁵)	
FAS	Single/burst (up to 300)	
OOF	Single	
MFAS	Single/burst (up to 300)	
OOM	Single	
SM-BIP	Single/rate (10 ⁻⁵ to 10 ⁻⁷)	
SM-BEI	Single/rate (10 ⁻⁵ to 10 ⁻⁷)	
PM-BIP	Single/rate (10 ⁻⁵ to 10 ⁻⁷)	
PM-BEI	Single/rate (10 ⁻⁵ to 10 ⁻⁷)	
TCM1 BIP	Single/rate (10 ⁻⁵ to 10 ⁻⁷)	
TCM1 BEI	Single/rate (10 ⁻⁵ to 10 ⁻⁷)	
Bit error/TSE	Single/rate (10 ⁻⁴ to 10 ⁻⁹)	
Additional client-level errors		
Alarms		
LOF		
LOM		
AIS		

SM-IAE	
SM-TIM	
SM-BDI	
SM-BIAE	
ODU AIS	
ODU LCK	
ODU OCI	
PM-BDI	
PM-TIM	
Fwd Sig Fail	
Fwd Sig Degrade	
Bwd Sig Fail	
Bwd Sig Degrade	
TCM1 IAE	
TCM1 BDI	
TCM1 BIAE	
TCM1-6 TIM	
PT mismatch	
Client loss	
Additional client-level alarms	
OTN Overhead	Comments
Supports AMP, GMP, BMP as per client mapping	AMP client offset up to ±65 PPM for SONET/SDH Clients
GCC transparency test	Select GCC0, GCC1, GCC2; verify PRBS on Rx interface with bits, errors, and BER
Round-trip delay (RTD) as per G.709 Section 15.8 (100 ns accuracy)	Select PM or TCM1-6
Overhead Manipulation/Analysis	
Overhead editor for OTU, ODU, OPU bytes	Multiple ODU levels for ODU multiplexing
Full structured PSI editor	
Full PSI and MSI Byte Maps for Each ODU Multiplexed Level	Rx and Tx MSI with byte value, ODU type, and tributary port number
Can copy Rx values to Tx MSI	
Full Tx and Rx tributary port setting	
Displays tributary slots and port for each ODU multiplexed level	
SM/PM and TCM1-6 Trace (TTI) Messages	
Tx and Rx SAPI/DAPI functionality	
TIM alarms on SAPI and/or DAPI mismatch or disable	
Fault Signaling (FTFL) Processing	
Forward and backward messaging	
Payload Type (PT) Label Generation/Display	
Set transmitted and Display received PT value	
PLM alarms enable/disable	
Forward Error Correction	
Outgoing FEC: GFEC (G.709 FEC) or all-zeros	
Incoming FEC: ignore, correct errors, do not correct errors	

Service Disruption Measurement	
Measurement Parameters	
SD separation/debounce time setting	Mandatory for handling the NE's Tx debounce; up to 60,000 ms
SD threshold time settings	Up to 60,000 ms
Triggers	
Signal loss/LOS	
Bit/TSE error	For PRBS errors
OTU LOM	
OTU SM-IAE	
OTU SM-BIAE	
ODU AIS	
ODU LCK	
ODU OCI	
ODU PM-BDI	
OTU OOM	
ODU PM-BIP	
ODU PM-BEI	
Ethernet SD based on gap measurement when present as a client	
Results	Comments
Custom Results	
LEDs	
Signal present/LOS	
Frame sync/LOF	
Marker lock/LOR	
Lanes aligned/LOL	
Pattern sync/LSS	
GMP sync	
GMP (Cm=0)	
Client or muxed level extra	
Summary Status	
Event Log (Event, Date, Start and Stop Time, Duration/Value)	
Histogram (Multiple Alarms and Errors)	
Service Disruption Summary Table	
Service Disruption Details	
Service Disruption Statistics	
Longest	
Shortest	
Last	
Average	
Number of disruptions	
Time	
Current date, current time, test elapsed time	
Interface	
Invalid Rx signal seconds	
Signal losses/LOS	
Signal losses seconds/LOS seconds	
Rx frequency (Hz)	

Rx frequency deviation (ppm)	
Rx frequency max deviation (ppm)	
Tx clock source	
Tx frequency (Hz)	
Tx frequency deviation (ppm)	
Tx frequency max deviation (ppm)	
FEC	
Uncorrected word errors	
Uncorrected word error rate	
Uncorrected word errored seconds	
Corrected word errors	
Corrected word errors rate	
Corrected word errored seconds	
Corrected bit errors	
Corrected bit errors rate	
Corrected bit errored seconds	
Framing	
Frame sync losses	
Frame sync losses seconds	
OOF seconds	
FAS errors	
FAS error rate	
Multiframe sync loss seconds	
OOM seconds	
MFAS errors	
MFAS error rate	
OTU	Comments
AIS seconds	
SM-IAE seconds	
SM-BIP errors	
SM-BIP error rate	
SM-BDI seconds	
SM-BIAE seconds	
SM-BEI errors	
SM-BEI error rate	
SM-SAPI	
SM-DAPI	
SM-operator specific	
GCC BERT bits	
GCC BERT bit errors	
GCC BERT bit error rate	
ODU	
ODU-AIS seconds	
ODU-LCK seconds	
ODU-OCI seconds	
PM-BIP errors	
PM BIP error rate	
PM-BDI seconds	
PM-BEI errors	
PM-BEI error rate	
PM-SAPI	
PM-DAPI	

PM-operator specific	
GCC BERT bits	
GCC BERT bit errors	
GCC BERT bit error rate	
PM round-trip delay recent	
PM round-trip delay previous	
OPU	
Payload type	
PT mismatch seconds	
FTFL	
Forward-fault type	
Forward-SF seconds	
Forward-SD seconds	
Forward-operator identifier	
Forward-operator specific	
Backward-fault type	
Backward-SF seconds	
Backward-SD seconds	
Backward-operator identifier	
Backward-operator specific	
TCM 1-6	Comments
IAE seconds	
BIP errors	
BIP error rate	
BDI seconds	
BIAE seconds	
BEI errors	
BEI error rate	
SAPI	
DAPI	
Operator specific	
PM round-trip delay recent	
PM round-trip delay previous	
AMP	
Rx offset (PPM)	
Max Rx offset (PPM)	
PJO1 count	
NJO1 count	
Payload	
Pattern sync losses/LSSs	
Pattern sync loss seconds/LLS seconds	
TSE/bit errors	
TSE/bit error rate	
Client	
Client Rx frequency (Hz)	
Client Rx freq deviation (ppm)	
Client Rx freq max deviation (ppm)	
Ethernet Client	
As per Ethernet results	
SONET/SDH Client	
As per SONET/SDH results	

Ethernet in OTN applications	
Applicable to:	
10 GE in OTU2e/1e	
40 GE in OTU3	
100 GE in OTU4	
Includes:	
QuickCheck	
RFC 2544 test suite	
OTN Check	
Automated workflow is available at all OTN rates for OTN bulk	Key use case is OTN service activation
Set test duration based on bit error rate theory or actual time	
Bit error rate theory parameters for test duration:	
Data rate (e.g., OTU4)	
BER threshold	
Confidence level (% value)	Statistical degree of certainty
Key automated tests	
Payload BERT	PRBS pattern selection Pass/fail BER threshold
Round-trip delay	Selection of applicable OH fields: PM, TCM1-6 Measurement frequency Pass/fail threshold (ms)
GCC transparency	Selection of applicable OH fields: GCC0, GCC1, or GCC2 Pass/fail BER threshold
OTN far-end loopback auto-detect	
Report generation and formats	

40 Gbps SONET/SDH

Test Interfaces/Bit Rates	Comments
OC-768/STM-256 (39.81 Gbps)	
Optics	
Mutli-lambda single-mode QSFP+ (4 wavelengths)	Part Number: CQSFP-43G-3-4 Note: Most networks require serial optics for SONET/SDH
Power level (aggregate)	Provided by QSFP+
Power level (per lambda/wavelength) Rx and Tx	Provided by QSFP+
Overload condition reporting	
Modes of Operation	
Terminate	
Thru (intrusive)	Transparent payload pass-through; injects STL LOF, SEF, AIS, FAS, LLM, and B3
Monitor	Monitoring on Rx with no Tx laser

Timing	
Recovered from Rx	
Internal (Stratum 3)	
Recovered from external (bits/sets)	Bits/sets/2.048 MHz/10 MHz
Frequency offset transmit/receive	±100 ppm
Frequency reporting	Resolution in Hz, deviation in ppm
Traffic Mappings	
SONET/SDH Bulk BERT	PRBS as payload in SONET/SDH frames
STL BERT	PRBS on STL (with lane alignment)
PRBS Patterns	
2 ¹¹ -1, 2 ¹ -1 Inverse	
2 ¹³ -1, 2 ³ -1 Inverse	
2 ²³ -1, 2 ²³ -1 Inverse	
2 ³¹ -1, 2 ³¹ -1 Inverse	
Delay pattern	
Rx Live	
SONET Mappings	
STS-1 bulk BERT	
STS-3c bulk BERT	
STS-12c bulk BERT	
STS-48c bulk BERT	
STS-192c bulk BERT	
STS-768c bulk BERT	
SDH Mappings	
AU-3 VC-3 bulk BERT	
AU-4 VC-4 bulk BERT	
AU-4 VC-4-4c bulk BERT	
AU-4 VC-4-16c bulk BERT	
AU-4 VC-4-64c bulk BERT	
AU-4 VC-4-256c bulk BERT	
STL/SONET/SDH Injection/Detection	Comments
Alarms/Defects	
Signal present/LOS	Terminate and Thru
STL LOF	Per lane/all lanes, with parallel optics all lanes injection only; Terminate and Thru
STL SEF/STL OOF	Per lane/all lanes, with parallel optics all lanes injection only; Terminate and Thru
STL AIS	Per lane/all lanes injection with parallel optics only; Terminate and Thru
TIM-S/RS-TIM	Terminate and Thru
AIS-L/MS-AIS	Terminate
RDI-L/MS-RD	Terminate

AIS-P/AU-AIS	Terminate
LOP-P/AU-LOP	Terminate
RDI-P/HP-RDI	Terminate
TIM-P/HP-TIM	Terminate and Thru
PLM-P/HP-PLM	Terminate and Thru
UNEQ-P/HP-UNEQ	Terminate and Thru
Errors/ Anomalies	
STL FAS	Per lane/all lanes, with parallel optics all lanes injection only; single/burst (up to 128)/rate (10 ⁻³ to 10 ⁻¹⁰) Terminate and Thru
STL LLM	Per lane/all lanes with parallel optics all lanes injection only; single/burst (up to 128)/rate (10 ⁻³ to 10 ⁻¹⁰) Terminate and Thru
B1	Single/rate (10 ⁻⁶ to 10 ⁻¹²) Terminate
B2	Single/rate (10 ⁻³ to 10 ⁻¹²) Terminate
REI-L/MS-REI	Single/rate (10 ⁻³ to 10 ⁻¹²) Terminate
B3	Single/rate (10 ⁻⁶ to 10 ⁻¹²). Terminate and Thru
REI-P/HP-REI	Single/rate (10 ⁻⁶ to 10 ⁻¹²) Terminate
Bit/TSE	Single/rate (10 ⁻³ to 10 ⁻¹⁰) Terminate
Pointers	
Increment	
Decrement	
+2 NDF	
-2 NDF	
Sequence	
SONET/SDH Overhead	
Comments	
Overhead Manipulation/Analysis	
Overhead viewing and editor for TOH/SOH and POH bytes	
User can set TOH/SOH Tx and Rx channels	
POH byte capture (manual trigger)	
Set STS-N/STM-N Channel	
Section/RS Trace Message Editor (J0)	
Tx edit and Rx display functionality	
Unformatted, single byte, CR/LF terminated, ITU-T G.707	
TIM-S/RS-TIM alarms on mismatch	
Path/Trace Message Editor (J1)	
Tx edit and Rx display functionality	
Unformatted, single byte, CR/LF terminated, ITU-T G.707	
TIM-P/HP-TIM alarms on mismatch	

APS (K1/K2)	
Set based on ring or linear topology	
Set bridge request code, destination node ID, source node ID, path code, status	
Path Code, Status	
Set Sync Status (S1) Based on Message	
Signal Label Generation/Display (C2)	
Tx edit and Rx display functionality	
PLM-P/HP-PLM alarms on mismatch	
Pointer Movements	
Set Pointer Movements	
±Single pointers of opposite polarity	
±Regular pointers plus one double pointer	
±Regular pointers with one missing	
±Double pointers of opposite polarity	
±Single	
±Burst	
±Periodic — 87-3 pattern	
±With add: periodic — 87-3 pattern	
±With cancel periodic — 87-3 pattern	
±Periodic — continuous pattern	
±With add: periodic — continuous pattern	
±With cancel: periodic — continuous pattern	
±Periodic — 26-1 pattern	
±With add: periodic — 26-1 pattern	
±With cancel periodic — 26-1 pattern	
±Phase transient	
Service Disruption Measurements	
Measurement Parameters	
SD separation/debounce time setting	Mandatory for handling the NE's Tx debounce
SD threshold time settings	
Triggers	
Signal loss	
Bit/TSE error	For PRBS errors
STL AIS	
STL signal present/LOF	
STL SEF/OOF	
STL FAS	
AIS-L/MS-AIS	
RDI-L/MS-RDI	
AIS-P/HP-AIS	
LOP-P/AU-LOP	
P-RDI/HP-RDI	
B1 error	
B2 error	
REI-L/MS-REI error	
B3 error	
REI-P/HP-REI	
Performance Monitoring	
G.828 Path allocation % setting	
G.828 Enable UAS limit on/off	10 to 100000
See Results section	
Results	
Custom Results	
LEDs	

Signal present/LOS	
STL frame sync/LOF	
STL marker lock/LOML	
STL lanes aligned/LOL	
Path pointer present/AU pointer present	
Pattern sync/LSS	
Summary Status	
Event Log (Event, Date, Start and Stop Time, Duration/Value)	
Histogram (Multiple Alarms and Errors)	
Service Disruption Summary Table	
Service Disruption Details	
Service Disruption Statistics	
Longest	
Shortest	
Last	
Average	
Number of disruptions	
Time	
Current date, current time, test elapsed time	
Interface	
Invalid Rx signal seconds	
Signal losses/LOS	
Signal losses seconds/LOS seconds	
Optical Rx level (dBm)	
Rx frequency (Hz)	
Rx frequency deviation (ppm)	
Rx frequency max deviation (ppm)	
Tx clock source	
Tx frequency (Hz)	
Tx frequency deviation (ppm)	
Tx freq max deviation (ppm)	
Round-trip delay current, avg, min, max (100 ns res.)	
Per lambda Rx power	Optics dependent
STL Statistics	Comments
Frame sync loss seconds/LOF seconds	
OOF/SEF seconds	
AIS errors	
Marker lock loss seconds/LOR seconds	
OOR seconds	
Lane aligned loss seconds/LOL seconds	
OOL seconds	
FAS errors	
FAS error rate	
FAS error seconds	
Logical lane marker errors	
Logical lane marker error rate	
Logical lane marker error seconds	
Max skew (bits)	
Current max skew (bits)	
Max skew (ns)	
Current max skew (ns)	
Max logical lane skew (LL ID)	
Min logical lane skew (LL ID)	
STL per Lane	
Lane number	

Logical lane ID	
Skew (bits, ns)	
Frame Sync/STL LOF	
STL OOF	
STL AIS	
Marker lock/STL LOR	
STL OOR	Out of recovery
FAS errors	
Logical lane marker errors	
Section/RSOH	
B1 errors	
B1 error rate	
Section/RS trace format (J0)	
Section/RS trace (J0)	
Line/MSOH	
AIS-L/MS-AIS seconds	
RDI-L/MS-RDI seconds	
B2 errors	
B2 error rate	
REI-L/MS-REI errors	
REI-L/MS-REI rate	
APS messages	
APS K1 bridge request dode (ring)	
APS K1 destination node ID (ring)	
APS 2 source node ID (ring)	
APS K2 path code (ring)	
APS K2 status (ring)	
Sync status (S1)	
Path/HP	
AIS-P/AU-AIS seconds	
LOP-L/AU-LOP seconds	
Path/AU pointer loss seconds	
P-RDI/HP-RDI seconds	
Path/AU pointer adjustments	
Path/AU pointer increments	
Path/AU pointer decrements	
Path/AU new pointer	
Path/AU pointer value	
Path/AU pointer size	
B3 errors	
B3 error rate	
REI-P/HP-REI errors	
REI-P/HP-REI rate	
Path/HP trace format (J1)	
Path/HP trace (J1)	
Signal label (C2)	
UNEQ-P/HP-UNEQ seconds	
K1/K2 Log (Linear)	
K1/K2 Log (Ring)	
Payload	
Pattern sync losses	
Pattern sync loss seconds	

Bit/TSE errors	
Bit/TSE error rate	
Bit/TSE error seconds	
Bit/TSE error-free seconds	
Bit/TSE error-free seconds, %	
G.829 RS ISM	
BBE (NE)	
BBE (NE)	
ES (NE)	
SES (NE)	
UAS (NE)	
BBER (NE)	
ESR (NE)	
SESR (NE)	
G.829 MS ISM	
BBE (NE)	
ES (NE)	
SES (NE)	
UAS (NE)	
BBER (NE)	
ESR (NE)	
SESR (NE)	
G.828 HP ISM	
Verdict (NE)	
BBE (NE)	
ES (NE)	
SES (NE)	
UAS (NE)	
SEP (NE)	
BBER (NE)	
ESR (NE)	
SESR (NE)	
SEPI (NE)	
G.828 HP OOS	

155 Mbps to 10 Gbps SONET/SDH

Test Interfaces/Bit Rates	Comments
OC-3/STM-1 (155.52 Mbps)	
OC-12/STM-4 (622.08 Mbps)	
OC-48/STM-16 (2.488 Gbps)	
OC-192/STM-64 (9.95 Gbps)	
Optics	
OC-3/12/48 STM-1/4/16	Part Numbers: CSFP-2G5-3-1, CSFP-2G5-5-1, CSFP-2G5-5-2
OC-192/STM-64	Part Numbers: CSFPPLUS-10G-3-1, CSFPPLUS-10G-5-1, CSFPPLUS-10G-5-2, CSFPPLUS-10G-T-1

Power level	Provided by SFP/ SFP+
Overload condition reporting	
Modes of Operation	
Terminate	
Thru (intrusive)	Transparent passthru of payload; frame word and B3 injections
Monitor	Monitoring on Rx with no Tx laser
Drop and Insert	Insert a channel while non- intrusively passing the remainder of the signal through unaffected.
Timing	
Recovered from Rx	
Internal (Stratum 3)	
Recovered from external (bits/sets)	Bits/sets/2.048 MHz/ 10 MHz
Frequency offset transmit/receive	±50 ppm
Frequency reporting	Resolution in Hz, deviation in PPM
Traffic Mappings	
SONET/SDH bulk BERT	PRBS as payload in SONET/SDH frames
J-Scan	Tributary scan monitor tool
SONET Mappings	
STS-1 bulk BERT	OC-3/12/48/192
STS-3c bulk BERT	OC-3/12/48/192
STS-12c bulk BERT	OC-12/48/192
STS-48c bulk BERT	OC-48/192
STS-192c bulk BERT	OC-192
SDH Mappings	
AU-3 VC-3 bulk BERT	STM-1/4/16/64
AU-4 VC-3 bulk BERT	STM-1/4/16/64
AU-4 VC-4 bulk BERT	STM-1/4/16/64
AU-4 VC-4-4c bulk BERT	STM-4/16/64
AU-4 VC-4-16c bulk BERT	STM-16/64
AU-4 VC-4-64c bulk BERT	STM-64
PRBS Patterns	
2 ¹⁵ -1, 2 ¹⁵ -1 Inverse	
2 ²⁰ -1, 2 ²⁰ -1 Inverse	
2 ²³ -1, 2 ²³ -1 Inverse	
2 ³¹ -1, 2 ³¹ -1 Inverse	OC-48/129 STM-16/64
Digital word	
Delay pattern	
Rx live	

SONET/SDH Injection/Detection	
Alarms/Defects	
Signal present/LOS	Terminate and Thru
LOF	Terminate and Thru
TIM-S/RS-TIM	Terminate and Thru
AIS-L/MS-AIS	Terminate
RDI-L/MS-RDI	Terminate
AIS-P/AU-AIS	Terminate
LOP-P/AU-LOP	Terminate
RDI-P/HP-RDI	Terminate
TIM-P/HP-TIM	Terminate and Thru
PLM-P/HP-PLM	Terminate and Thru
UNEQ-P/HP-UNEQ	Terminate and Thru
Errors/Anomalies	
Frame word	Burst (1 to 32) Terminate and Thru
B1	Single/rate (10 ⁻⁶ to 10 ⁻⁹) Terminate
B2	Single/rate (10 ⁻⁴ to 10 ⁻⁹) Terminate
REI-L/MS-REI	Single/rate (10 ⁻⁴ to 10 ⁻⁹) Terminate
B3	Single/rate (10 ⁻⁶ to 10 ⁻⁹) Terminate and Thru
REI-P/HP-REI	Single/rate (10 ⁻⁶ to 10 ⁻⁹) Terminate
Bit/TSE	Single/rate (10 ⁻⁴ to 10 ⁻⁹) Terminate
Pointers	
Increment	
Decrement	
+2 NDF	
-2 NDF	
Sequence	
SONET/SDH Overhead	
Overhead Manipulation/Analysis	
Overhead viewing and editor for TOH/SOH and POH bytes	
User can set TOH/SOH Tx and Rx channels	
POH byte capture (manual trigger)	
Set STS-N/STM-N Channel	
Section/RS Trace Message Editor (J0)	
Tx edit and Rx display functionality	
Unformatted, single byte, CR/LF terminated, ITU-T G.707	
TIM-S/RS-TIM alarms on mismatch	
Path/Trace Message Editor (J1)	
Tx edit and Rx display functionality	

Unformatted, single byte, CR/LF terminated, ITU-T G.707	
TIM-P/HP-TIM alarms on mismatch	
APS (K1/K2)	
Set based on ring or linear topology	
Set bridge request code, Dest node ID, Src node ID, path code, status	
Set sync status (S1) based on message	
Signal Label Generation/Display (C2)	
Tx edit and Rx display functionality	
PLM-P/HP-PLM alarms on mismatch	
TCM (N1) monitoring/generation	
Pointer Movements	
Set Pointer Movements	
±Single pointers of opposite polarity	
±Regular pointers plus one double pointer	
±Regular pointers with one missing	
±Double pointers of opposite polarity	
±Single	
±Burst	
±Periodic — 87-3 pattern	
±with add: Periodic — 87-3 pattern	
±with cancel Periodic — 87-3 pattern	
±Periodic — continuous pattern	
±with add: Periodic — continuous pattern	
±with cancel: Periodic — continuous pattern	
±Periodic — 26-1 pattern	
±with add: Periodic — 26-1 pattern	
±with cancel Periodic — 26-1 pattern	
±Phase transient	
Service Disruption Measurements	
Measurement Parameters	
SD separation/debounce time setting	Mandatory for handling the NE's Tx debounce
SD threshold time settings	
Triggers	
Signal loss	
Bit/TSE error	For PRBS errors
Frame sync loss/LOF	
SEF/OOF	
Frame word error	
AIS-L/MS-AIS	
RDI-L/MS-RDI	
AIS-P/HP-AIS	
LOP-P/AU-LOP	
P-RDI/HP-RDI	
B1 error	

B2 error	
REI-L/MS-REI error	
B3 error	
REI-P/HP-REI	
Performance Monitoring	
G.828 path allocation % setting	
G.828 enable UAS limit on/off	10 to 100,000
G.826 path allocation % setting	
G.828 enable UAS limit on/off	10 to 100,000
M.2101	MS/HP setups
See Results section	
J-Scan	
Tributary scan with STS/STM reporting	High path scan
Results	
Custom Results	
LEDS	
Signal present/LOS	
Frame sync/LOF	
Path pointer present/AU pointer present	
Pattern sync/LSS	
Summary Status	
Event Log (event, date, start and stop time, duration/value)	
Histogram (multiple alarms and errors)	
Service Disruption Summary Table	
Service Disruption Details	
Service Disruption Statistics	Comments
Longest	
Shortest	
Last	
Average	
Number of disruptions	
Time	
Current date, current time, test elapsed time	
Interface	
Invalid Rx signal seconds	
Signal losses/LOS	
Signal losses seconds/LOS seconds	
Optical Rx overload	
Optical Rx level (dBm)	
Rx frequency (Hz)	
Rx frequency deviation (ppm)	
Rx frequency max deviation (ppm)	
Tx clock source	
Tx frequency (Hz)	

Tx frequency deviation (ppm)	
Tx frequency max deviation (ppm)	
Round-trip delay current, avg, min, max (100 ns res.)	
Section/RSOH	
Frame sync losses	
Frame sync loss seconds/LOF seconds	
OOFs/SEFs	
OOF/SEF seconds	
Frame word errors	
Frame word error rate	
B1 errors	
B1 error rate	
Section/RS trace format (J0)	
Section/RS trace (J0)	
Line/MSOH	
AIS-L/MS-AIS seconds	
RDI-L/MS-RDI seconds	
B2 errors	
B2 error rate	
REI-L/MS-REI errors	
REI-L/MS-REI rate	
APS messages	
APS K1 bridge request code (ring)	
APS K1 destination node ID (ring)	
APS 2 source node ID (ring)	
APS K2 path code (ring)	
APS K2 status (ring)	
Sync status (S1)	
Path/HP	
AIS-P/AU-AIS seconds	
LOP-L/AU-LOP seconds	
Path/AU pointer loss seconds	
P-RDI/HP-RDI seconds	
Path/AU pointer adjustments	
Path/AU pointer increments	
Path/AU pointer decrements	
Path/AU new pointer	
Path/AU pointer value	
Path/AU pointer size	
Tx path pointer value	
Tx path pointer size	
B3 errors	
B3 error rate	
REI-P/HP-REI errors	
REI-P/HP-REI rate	
Path/HP trace format (J1)	
Path/HP trace (J1)	
Signal label (C2)	
UNEQ-P/HP-UNEQ seconds	
TCM (Forward)	
TC-UNEQ	

TC-UNEQ seconds	
TC-LTC	
TC-LTC seconds	
TC-AIS	
TC-AIS seconds	
B3 errors	
TC-IEC	
TC-DIFF	
TC-APId label	
TCM (Backward)	
TC-RDI	
TC-RDI seconds	
TC-ODI	
TC-ODI seconds	
TC-REI	
TC-REI seconds	
TC-OEI	
TC-OEI seconds	
TC-REIs	
TC-OEIs	
TC-APId label	
K1/K2 Log (Linear)	
K1/K2 Log (Ring)	
Payload	
Pattern sync losses	
Pattern sync loss seconds	
Bit/TSE errors	
Bit/TSE error rate	
G.829 RS ISM	Comments
BBE (NE)	
ES (NE)	
SES (NE)	
UAS (NE)	
BBER (NE)	
ESR (NE)	
SESR (NE)	
G.829 MS ISM	
BBE (NE and FE)	
ES (NE and FE)	
SES (NE and FE)	
UAS (NE and FE)	
BBER (NE and FE)	
ESR (NE and FE)	
SESR (NE and FE)	
G.828 HP ISM	
Verdict (NE and FE)	
BBE (NE and FE)	
ES (NE and FE)	
SES (NE and FE)	
UAS (NE and FE)	
SEP (NE and FE)	
BBER (NE and FE)	
ESR (NE and FE)	
SESR (NE and FE)	

SEPI (NE and FE)	
G.828 HP OOS	
Verdict	
BBE	
ES	
SES	
UAS	
SEP	
BBER	
ESR	
SESR	
SEPI	
M.2101 MS ISM	
Verdict (NE and FE)	
BBE (NE and FE)	
ES (NE and FE)	
SES (NE and FE)	
UAS (NE and FE)	
SEP (NE and FE)	
BBER (NE and FE)	
ESR (NE and FE)	
SESR (NE and FE)	
SEPI (NE and FE)	
M.2101 HP ISM	Comments
Verdict (NE and FE)	
BBE (NE and FE)	
ES (NE and FE)	
SES (NE and FE)	
UAS (NE and FE)	
SEP (NE and FE)	
BBER (NE and FE)	
ESR (NE and FE)	
SESR (NE and FE)	
SEPI (NE and FE)	
M.2101 HP OOS	
Verdict	
BBE	
ES	
SES	
UAS	
SEP	
BBER	
ESR	
SESR	
SEPI	
T1.514 ISM	
BBE (Path NE)	
ES (Path NE)	
SES (Path NE)	
UAS (Path NE)	
SEP (Path NE)	
% BBE (Path NE)	
% ES (Path NE)	
% SES (Path NE)	

SEPI (Path NE)	
T1.514 OOS	
BBE (Path)	
ES (Path)	
SES (Path)	
UAS (Path)	
SEP (Path)	
% BBE (Path)	
% ES (Path)	
% SES (Path)	
SEPI (Path)	
T1.231	
ES (Section NE ISM)	
SES (Section NE ISM)	
UAS (Section NE ISM)	
ES (Line NE ISM)	
SES (Line NE ISM)	
UAS (Line NE ISM)	
ES (Path NE ISM)	
SES (Path NE ISM)	
UAS (Path NE ISM)	

Fibre Channel

Test Interfaces/Bit Rates	Comments
1 G FC (1.0625 Gbps)	
2 G FC(2.125 Gbps)	
4 G FC (4.25 Gbps)	
8 G FC (8.5 Gbps)	
10 G FC (10.5175 Gbps)	
16 G FC (14.025 Gbps)	
Optics	
1 G/2 G FC	Part Numbers: CSFP-2G-8-1, CSFP-2G-3-1, CSFP-2G-5-1, CSFP-2G5-3-1, CSFP-2G5-5-1, CSFP- 2G5-5-2, CSFP-4G-8-1, CSFP-4G-3-1, CSFP-4G-3-2, SFPPLUS-1GE-10GE-8-1, SFPPLUS-1GE-10GE-3-1, CSFPPLUS-1G-10G-8-1, CSFPPLUS-1G-10G-3-1, CSFPPLUS-1G-10G-5-1
4 G FC	Part Numbers: CSFP-4G-8-1, CSFP- 4G-3-1, CSFP-4G-3-2, SFPPLUS-1GE-10GE-8-1, SFPPLUS-1GE-10GE-3-1, CSFPPLUS-1G-10G-8-1, CSFPPLUS-1G-10G-3-1, CSFPPLUS-1G-10G-5-1, CSFPPLUS-16G-8-1, CSFPPLUS-16G-3-1

8 G/10 G FC	Part Numbers: CSFPPLUS-10G-3-1, CSFPPLUS-10G-5-1, CSFPPLUS-10G-5-2, SFPPLUS-1GE-10GE-8-1, SFPPLUS-1GE-10GE-3-1, CSFPPLUS-1G-10G-8-1, CSFPPLUS-1G-10G-3-1, CSFPPLUS-1G-10G-5-1, CSFPPLUS-10G-T-1, CSFPPLUS-16G-8-1, CSFPPLUS-16G-3-1
16 G FC	Part Numbers: CSFPPLUS-16G-8-1, CSFPPLUS-16G-3-1
Power Level	Provided by SFP/SFP+
Overload Condition Reporting	
Modes of Operation	
Terminate	
Monitor/Thru	
Logical Loopback	Loop up/down; switching of addresses
Manual (LLB)	
Automatic Loop Up/Down	Communicates with far-end unit
Timing	
Internal	
Traffic Attributes	
Line rate traffic Tx and Rx	
Layer 1 test patterns	
HFPAT	1 G/2 G/4 G FC
LFPAT	1 G/2 G/4 G FC
MFPAT	1 G/2 G/4 G FC
RDPAT	1 G/2 G/4 G FC
JTPAT	1 G/2 G/4 G FC
SNPAT	1 G/2 G/4 G FC
A seed	10 G/16 G FC
B seed	10 G/16 G FC
PRBS31	10 G/16 G FC
Layer 2 test patterns	
CRPAT	1 G/2 G/4 G/8 G FC
CJPAT	1 G/2 G/4 G/8 G FC
CSPAT	1 G/2 G/4 G/8 G FC
PRBS Payload Patterns	
2 ³¹ -1, 2 ²³ -1, 2 ²⁰ -1, all ones, all zeros	
Scrambling (On/Off)	8 G FC In FC-1 on total frame
Emissions Lowering Protocol (On/Off)	
Emissions lowering protocol type (Idle-ARBff, ARBff-ARBff)	8 G FC

Fibre Channel Generator			MAC ID	
Frame Length			Unit identifier	
28 (no payload), 32, 76 (ATP), 128, 256, 512, 1024, 1536, 2076, 2140 settings			Port name	
User defined (28 to 2140)			Fabric/N_Port Login	
Fibre Channel Fields			Topology (fabric, point-to-point)	
Unicast or broadcast			Source N-port name	
Destination ID			Source node name/source ID	
Source ID			Dest N-port name	
Sequence ID			Dest node name/dest ID	
Originator ID			Traffic Filtering	
Responder ID			Routing Control	
Fibre Channel Frame Payload			Destination ID	
BERT/PRBS pattern			Source ID	
Acterna test protocol version 2			Data Type	
Auto-traffic start on laser on			Sequence Control	
Traffic Generator			Data	
Traffic Profiles			BERT Rx=Tx	
Traffic generation in Mbps and % utilization			Payload analysis	
Constant B/W			Rx BERT pattern	
Burst B/W			Injection/Detection	
Ramp B/W			Errors	
Flood B/W			Code	
Constant B/W			Single/rate (10 ⁻³ to 10 ⁻⁹)	
Bit rate			CRC	
Percentage			Single/burst (up to 32767)	
Burst B/W			Bit error (PRBS)	
			Single/rate (10 ⁻³ to 10 ⁻⁹)	
			Faults	
Comments			Local fault (10 G/16 G)	
			Remote fault (10 G/16 G)	
			Results	
			Comments	
			Custom Results	
			LEDs	
			Signal present	
			Sync acquired	
			Link active	
			ATP detect	
			Pattern sync	
			Local fault (10 G/16 G)	
			Remote fault (10 G/16 G)	
			SLA/KPI	
			Frame loss (count and ratio)	
			Round-trip delay/FD (avg, current, max)	
			Event Log (Event, Date, Start & Stop time, Duration/Value)	
			Histogram	
			Optical Rx overload	
			Signal loss	
			Link loss	
			Timing source loss	
			Sync loss	
			Local fault (10 G/16 G)	
Flow Control Login				
General				
Flow control (on/off)				
Login			Implicit	
			Explicit (E-port)	
			Explicit (fabric/N-port)	
			Buffer-to-buffer credits	

Remote fault (10 G/16 G)		Class F frames	
Code violation		Class 1 frames	
Runts		Class 2 frames	
Jabbers		Class 3 frames	
Undersized frames		L2 Filtered Counts/Statistics	
CRC errored frames		BERT Stats	
Errored frames		Pattern losses	
Lost frames		Pattern loss seconds	
OoS frames		Bit error rate	
EB (PCS)		Bit errors	
BSL (PCS)		Bit errored seconds	
Bit errors (PRBS)		Bit error-free seconds	
Viavi payload errors		Bit error-free seconds (%)	
Time		Login Status	
Current date, current time, test time elapsed		Login status	
Interface		Tx/Rx ELP request	
Signal losses		Tx/Rx ELP accept	
Signal loss seconds		Tx/Rx ELP Ack1	
Sync loss seconds		Fabric present	
Link loss seconds		Fabric login status	
Optical Rx overload		F port name	
Tx clock source		Fabric name	
Local fault seconds (10 G/16 G)		N port login status	
Remote fault seconds (10 G/16 G)		Dest N port ID	
L2 Link Statistics		Dest N port name	
Total utilization % (avg, current, min, peak)		Dest node name	
Frame rate (avg, current, min, peak)		Source N port ID	
Frame size (avg, min, max)		Source N port name	
Rx Mbps (L1, L2)		Source node name	
Tx Mbps (L1, L2)		Error Stats	
Round-trip delay (us) (avg, current, min, max)		Symbol errors	
Service disruption (us)		CRC errored frames	
ELP mismatch link active		Fiber runts	
L2 Link Counts	Comments	Fiber jabbers	
Rx frames		Undersized frames	
Tx frames		Errored frames	
Rx Viavi frames		Code violations	
Tx Viavi frames		Code violation rate	
28–64 byte frames		Code violation seconds	
68–124 byte frames		Graphical Displays	
128–252 byte frames		Throughput versus Time	
256–508 byte frames		Frame Loss versus Time	
512–1020 byte frames		Latency/FD (RTD) versus Time	
1024–2140 byte frames		Errors versus Time	
Rx frame bytes		CRC errored frames	
Tx frame bytes		Fiber runts	
Rx R_RDYs		Fiber jabbers	
Tx R_RDYs		Bit errors	
Near-end B-B credits		OoS frames	
Tx avail B-B credit, current			

FC RFC2544	
Symmetric, Loopback	
Loopback	
Set Addresses, Loop Type, IDs	
Tests	
Throughput	Zeroing-in: RFC 2544 standard or Viavi-enhanced
	Bandwidth granularity
	Test duration and number of trials
	Pass/fail threshold
Latency (RTD)	Pass/fail threshold
Frame loss	Test duration and number of trials
	Pass/fail threshold
Back-to-back	Max burst duration
	Burst granularity
Buffer credit	Flow control login type (implicit, explicit)
	Max buffer size
Buffer credit throughput	Throughput steps
Traffic in Mbps or %	
Up to 10 frame/packet sizes (max 2140 bytes)	
Can run multiple tests concurrently for speed	
Report generation and formats	
Graphical results	
Displays total test time	

Platform and Module

Platform Support		Comments
T-BERD/MTS-6000A v2 or -8000 v2 with DMC v2		
CSAM can operate on battery, duration depends on application	>1 hour on -6000A v2 >1.5 hours on -8000 v2	
Power requirements	Use 150 W power supply on -6000A and 220 W on -8000	Scalable to 300 W for large, multimodule configurations on -8000 v2
Size	-6000A v2 (with bumpers)	188 mm x 290 mm x 97 mm
	-8000 v2 (with bumpers)	267 mm x 326 mm x 163 mm
Weight	-6000A v2 with battery	3.4 kg
	-8000 v2 with batteries (1 CSAM in DMC v2)	7.4 kg

Can be combined with additional modules		Examples: with MSAMv2 for T1/E1 up to 100 Gbps; dual CSAM for dual 100 Gbps; with an OSA module; up to 4 CSAM modules in a T-BERD/MTS-8000v2
Quick launch main panel		
Local GUI touchscreen view		
Remote GUI control via VNC/Web browser		Also remote access via StrataSync and SmartAccess Anywhere
Automation via use of SCPI commands		Script control GUI tool available
Platform supports WiFi and Bluetooth		
Timed options		
Floating options		
Both 6000Av2 and 8000v2 are equipped with a hard drive for storage		
CSAM Storage		
Processor Flash		
Dynamic RAM	2 GB	
UI Language Support		
English		
Simplified Chinese		
Spanish		
French		
German		
Italian		
Portuguese		
Russian		
Korean		
Japanese		
Test Control		Comments
Test restart		
Timed test	Timed	Up to 48 days
	Delayed start test	
Optics		
CFP2		Hot-swappable, can switch between 10x10G and 4x25G electrical I/O. Compliant with CFP MSA, CFP2 Hardware Specification Rev 1.0, E 802.3ba
QSFP+		Compliant with QSFP+ MSA (SFF-8436), IEEE P802.3ba

SFP+	Compliant with MSA (SFF-8436), IEEE P802.3b; supports the same optics as 5800v2 and MSAMv2
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CFP2 Information	
Vendor	
Vendor PN	
Vendor SN	
Date code	
Lot code	
Hardware/software version number	
MSA hardware spec. rev. number	
MSA mgmt. I/F rev. number	
Module ID (identify as CFP2)	
Rates supported	
Transceiver	
Power class	
Rx power level type	
Max. lambda power (dBm)	
Number of active fibers	
Wavelengths per fiber	
Diagnostic byte	
Wavelength per fiber range (nm)	
Max. network lane bit rate (Gbps)	
Extended power class support	
Support and display of QSFP28 adapter in CFP2 slot	

QSFP+/QSFP28 Information	
Vendor	
Vendor PN	
Vendor SN	
Vendor rev.	
Date code	
Lot code	
Power level type	
Max. Rx level (dBm)	
Nominal wavelength (nm)	
Nominal bit rate (Mbps)	
Diagnostic byte	
Wavelength	
Transceiver information	
Guideline on RS-FEC usage based on interface type	

SFP+ Information	Comments
Wavelength	
Recommended rates details	
Vendor	
Vendor PN	
Vendor rev.	
Power level type	
Diagnostic monitoring	

Diagnostic byte	
Nominal bit rate (Mbps)	
Min. rate (Mbps)	
Max. rate (Mbps)	
Max. Rx level (dBm)	
Max. Tx level (dBm)	
Transceiver information	

Optics Expert Mode	
Tx pre-emphasis settings	CFP2
Rx equalization settings	CFP2
Clock divider setting	CFP2 (1/16, 1/64)
Tx, Rx invert polarity	CFP2 and QSFP+/QSFP28
Tx, Rx ignore LOS	CFP2 and QSFP+
Full peek access to any register	CFP2 and QSFP+/QSFP28
Poke access to turn individual lasers off or on	CFP2
CDR Bypass Tx & RX	QSFP28/QSFP+

Optics Self-Test	
Line rates	39.81 Gbps
	41.25 Gbps
	43.02 Gbps
	103.125 Gbps
	111.8 Gbps

Options	PPM offset, BER threshold, stop on error, CFP2, QSFP+, skew alarm verification
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Display per lambda power from within the application	
Selection of pre-FEC BER and post-FEC BER threshold (default pre-FEC)	
Loadable configuration	
Report generation	

Timing and Synchronization	
External Clock Input via SMB Connector	
Impedance	75 Ω
Input coupling	AC internally
Input frequency and level	T1/BITS (1.544 Mbps) +4 to -20 dBdsx through 100/75 balun
	E1/SETS (2.048 Mbps) +4 to -20) dBnom through 100/75 balun
	1.544 MHz square wave TTL/CMOS amplitude
	2.048 MHz square wave TTL/CMOS amplitude
	10.0 MHz square wave TTL/CMOS amplitude
	25.0 MHz square wave TTL/CMOS amplitude

Calibrateable Internal Timing Source	
Initial accuracy	±0.2 ppm
Temperature stability	±1.5 ppm

Long-term stability	±1 ppm/year	
PPM offset injection		See each protocol for range
External Clock Output via SMB Connector		
Bits	1.544 Mbps	
	1.544 MHz	
Sets	2.048 Mbps	
	2.048 MHz	
	10 MHz	
	25 MHz	
Same connector can be used as 1 PPS input or output		

Optics

CCFP2-112G-3-4		
Vendor	Lumentum	
LC Connectors		
Wavelengths		
Lane 0	1294.53 to 1296.59 nm	
Lane 1	1299.02 to 1301.09 nm	
Lane 2	1303.54 to 1305.63 nm	
Lane 3	1308.09 to 1310.19 nm	
Data Rate		
100 GE and OTU4		
Total Launch Power		
100 GE	Max. 10.5 dBm	
OTU4	Max. 10.0 dBm	
Average Launch Power per Lane		
100 GE	Min. -4.3 dBm Max. +4.5 dBm	
OTU4	Min. -0.6 dBm Max. +4.0 dBm	
Receiver Sensitivity		
OMA per lane for 100 GE	Max. -8.6 dBm	
OTU4	Max. -8.4 dBm	
Average Receive Power per Lane		
100 GE	Min. -10.6 dBm Max. +4.5 dBm	
OTU4	Min. -6.9 dBm Max. +4.0 dBm	
Vendor	Finisar	
LC Connectors		
Data Rate		
100 GE and OTU4		
Total Average Launch Power		
10.0 dBm		
Average Launch Power per Channel	Min: -0.6 dBm Max: +4.0 dBm	
Average Input Power per Channel	Min: -6.9 dBm Max: +4.0 dBm	
Equivalent Sensitivity per Channel	Max: -8.4 dBm	
Vendor	Oclaro	
LC Connectors		
Data Rate		

100 GE and OTU4	
Average Optical Output Power in OMA	
100 GE	Min: -1.3 dBm Max: +4.5 dBm
OTU4	Min: -2.5 dBm Max: +2.9 dBm
Receiver Sensitivity in OMA	
100 GE	Min: -8.6 dBm Max: +4.5 dBm
Mean Channel Input Power for ER 4 dB	
OTU4	Min: -6.9 dBm Max: +4.0 dBm
Mean Channel Input Power for ER 7 dB	
OTU4	Min: -8.8 dBm Max: +2.9 dBm

CCFP2-112G-8-10	
Vendor	Avago
MPO Connector (2x12 multimode fibers)	
Center Wavelength	
Min.	840 nm
Max.	860 nm
Data Rates per Channel	
100 GE	
Modulated Optical Output Power in OMA	
Min.	-5.6 dBm
Max.	+3.0 dBm
Peak Optical Output Power per Lane	
Max.	+4.0 dBm
Average Optical Input Power per Lane	
Min.	-9.5 dBm
Max.	+2.4 dBm
Damage Threshold	
Min.	+3.4 dBm
CCFP2-112G-8-10	
Vendor	Finisar
MPO Connectors (2x12 multimode fibers)	
Center Wavelengths	
Min.	840 nm
Max.	860 nm
Data Rates	
100 GE or OTU4	
OMA Transmit per Lane	
Min.	-5.6 dBm
Max.	+3.0 dBm
Average Launch Power per Lane	
Min.	-7.6 dBm
Max.	+2.4 dBm
Average Rx Power per Lane	
Min.	-9.5 dBm
Max.	+2.4 dBm
OMA Receive Power per Lane	
Max.	+3 dBm
Damage Threshold	
Min.	+3.4 dBm

CCFP4-112G-3-4	
Requires adapter	Part Number 3076/92.92
Vendor	Lumentum
LC Connectors	
Wavelengths	
Lane 0	1294.53 to 1296.59 nm
Lane 1	1299.02 to 1301.09 nm
Lane 2	1303.54 to 1305.63 nm
Lane 3	1308.09 to 1310.19 nm
Data Rate	
100 GE and OTU4	
Total Launch Power	
100 GE	Max. 10.5 dBm
OTU4	Max. 10.0 dBm
Average Launch Power per Lane	
100 GE	Min. -4.3 dBm Max. +4.5 dBm
OTU4	Min. -0.6 dBm Max. +4.0 dBm
Receiver Sensitivity	
OMA per lane for 100 GE	Max. -8.6 dBm
Average Receive Power per Lane	
100 GE	Min. -10.6 dBm Max. +4.5 dBm
OTU4	Min. -6.9 dBm Max. +4.0 dBm
Average Receive Power per lane	
OTU4 (ER<7 dB)	Min. -8.8 dBm Max. +2.9 dBm
Receiver Sensitivity in OMA per Lane	
100GE	Max. -8.6 dBm
Vendor	Oplink
LC Connectors	
Data Rates	
100 GE and OTU4	
Total Average Launch Power	
100 GE	Max. 10.5 dBm
OTU4	Max.8.9 dBm
Average Launch Power per Lane	
100 GE	Min. -4.3 dBm Max. +4.5 dBm
OTU4	Min. -2.5 dBm Max. +2.9 dBm
Average Receive Power per lane	
100 GE	Min. -0.6 dBm Max +4.5 dBm
OTU4	Min. -8.8 dBm Max. +2.9 dBm
Receiver Sensitivity in OMA per Lane	
100 GE	Max. -8.6 dBm
OTU4	Max. -10.3 dBm
CQSFP-43G-3-4	
Vendor	Lumentum
LC Connectors	
Wavelengths	
Lane 0	1264.5 to 1277.5 nm
Lane 1	1284.5 to 1297.5 nm
Lane 2	1304.5 to 1317.5 nm

Lane 3	1324.5 to 1337.5 nm
Data Rate per Lane	
40 GE	10.3125 Gbps ±100 ppm
OTU3	10.7546 Gbps ±20 ppm
Average Launch Power per Lane	
At 10.31 Gbps	Min. -7 dBm Max. 2.3 dBm
At 10.75 Gbps	Min. -2.3 dBm Max. 3.3 dBm
Average Rx Power per Lane	
At 10.31 Gbps	Min. -13.7 dBm Max. 2.3 dBm
At 10.75 Gbps	Min. -9 dBm Max. 2.3 dBm
OMA Receiver Power per Lane	
Max.	3.5 dBm
OMA Receiver Sensitivity per Lane	
At 10.31 G	-11.5 dBm
At 10.75 G	-10.5 dBm
Vendor	Finisar
LC Connectors	
Wavelengths	
Lane 0	1264.5 to 1277.5 nm
Lane 1	1284.5 to 1297.5 nm
Lane 2	1304.5 to 1317.5 nm
Lane 3	1324.5 to 1337.5 nm
Data Rates	
40 GE	
OTU3	
Total Average Launch Power	
Max.	+8.3 dBm
Average Launch Power per Lane	
Min.	-2.3 dBm
Max.	+2.3 dBm
Average Rx Power per Lane	
Min.	-13.7 dBm
Max.	+2.3 dBm
OMA Receiver Sensitivity per Lane	
Max.	-9.6 dBm
CQSFP-40G-8-4	
Vendor	Lumentum
MPO Connector (12 multimode fibers)	
Center Wavelengths	
Min.	840 nm
Max.	860 nm
Data Rate per Channel	
40 GE	10.3125 Gbps ±100 ppm
Average Launch Power per Channel	
Min.	-7.6 dBm
Max.	2.4 dBm
OMA Power per Channel	
Min.	-5.6 dBm
Max.	3 dBm
Average Rx Power per Channel	
Min.	-9.5 dBm
Max.	2.4 dBm
OMA Receiver Power per Channel	
Min.	-7.5 dBm
Max.	3 dBm

OMA Receiver Sensitivity per Lane	
At 10.31 Gbps	-11.5 dBm
At 10.75 Gbps	-10.5 dBm
CQSFP-112G-3-4-LR4	
QSFP28 requires adapter	Part Number 3076/92.93
Vendor	Finisar
LC Connectors	
Data Rate	
100 GE and OTU4	
Total Average Launch Power	
Max.	+10 dBm
Average Launch Power per Channel	
Min.	-0.6 dBm
Max.	+4.0 dBm
Average Input Power per Channel	
Min.	-6.9 dBm
Max.	+4.0 dBm
Equivalent Sensitivity per Channel	
Max.	-8.4 dBm
CQSFP-103G-8-4-SR4-CSAM	
QSFP28 requires adapter	Part Number 3076/92.93
Includes MPO-12F MMF loopback part for calibration	
Vendor	Finisar
LC Connectors	
Center Wavelength	
Min.	840 nm
Max.	860 nm
Data Rate	
100 GE	
Average Launch Power per Lane	
As per 802.3 bm	
Min.	-8.4 dBm
Max.	+2.4 dBm
Average Receive Power per Lane	

As per 802.3 bm	
Min.	-10.3 dBm
Max.	+2.4 dBm
10 G and Below SFP/SFP+ Optics	
List of part numbers for Viavi-supported optics:	
CSFP-1G-CU (copper SFP 10/100/1000)	
CSFP-100M-8-1 (100M Optical)	
CSFP-100M-3-1 (100M Optical)	
CSFP-100M-3-2 (100M Optical)	
CSFP-2G-8-1 (GE, 1 G/2 G FC)	
CSFP-2G-3-1 (GE, 1 G/2 G FC)	
CSFP-2G-5-1 (GE, 1 G/2 G FC)	
CSFP-2G5-3-1 (GE, OC-3/12/48, STM-1/4/16, OTU1, 1 G/2 G FC)	
CSFP-2G5-5-1 (GE, OC-3/12/48, STM-1/4/16, OTU1, 1 G/2 G FC)	
CSFP-2G5-5-2 (GE, OC-3/12/48, STM-1/4/16, OTU1, 1 G/2 G FC)	
CSFP-4G-8-1 (GE, 1 G/2 G/4 G FC)	
CSFP-4G-3-1 (GE, 1 G/2 G/4 G FC)	
CSFP-4G-3-2 (GE, 1 G/2 G/4 G FC)	
CSFPPLUS-10G-3-1 (10 GE, 10 G SON/SDH, 10 G OTN, 8 G/10 G FC)	
CSFPPLUS-10G-5-1 (10 GE, 10 G SON/SDH, 10 G OTN, 8 G/10 G FC)	
CSFPPLUS-10G-5-2 (10 GE, 10 G SON/SDH, 10 G OTN, 8 G/10 G FC)	
SFPPLUS-1GE-10GE-8-1 (GE, 10 GE LAN, 1 G/2 G/4 G/8 G/10 G FC)	
SFPPLUS-1GE-10GE-3-1 (GE, 10 GE LAN, 1 G/2 G/4 G/8 G/10 G FC)	
CSFPPLUS-1G-10G-8-1 (GE, 10 GE LAN, 1 G/2 G/4 G/8 G/10 G FC)	
CSFPPLUS-1G-10G-3-1 (GE, 10 GE LAN, 1 G/2 G/4 G/8 G/10 G FC)	
CSFPPLUS-1G-10G-5-1 (GE, 10 GE LAN, 1 G/2 G/4 G/8 G/10 G FC)	
CSFPPLUS-10G-T-1 (C-band tunable for 10 GE LAN, 10 G SON/SDH, 10 G OTN, 8 G/10 G FC)	
CSFPPLUS-16G-8-1 (4 G/8 G/10 G/16 G FC, 10 GE)	
CSFPPLUS-16G-3-1 (4 G/8 G/10 G/16 G FC, 10 GE)	

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 SilverCare	Maintenance & Measurement Accuracy	Premium	✓	✓	✓	✓*	✓



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