



T-BERD/MTS 5800-100G

Specifications

Platform

Platform Attributes
The mainframe is expandable with modules
The product is field upgradeable
Operating system is Linux to ensure optimum stability and offer high security
Display
Display size 7 inches with 1200x600 resolution
Screen Saver support
Physical screen protector provided
Mode that 'locks' the touchscreen for use without a password
Power/Battery
Supports battery operation
Built-in battery charger
Battery is field replaceable
Can perform two 100GE tests for at least 1 hour on battery power
Can perform one 100GE test for at least 1:30 hours on battery power
Can perform two 10G tests for at least 2:00 hours on battery power
Unit power input 19VDC, 150 Watt Power supply input 100 to 240 VAC, 50/60 Hz, auto-sensing
Industry Standards and Compliance
Safety: UL, CE
EMC: CE compliant, FCC part 15 subpart A, Class A
FCC Part 15 Compliant



Physical and Environment Specifications
Temperature range:
Operating, with dual 100GE: 0°C to +40°C
Operating, with dual 10GE: 0°C to +50°C
Storage: - 20°C to +60°C (-4°F to +140°F)
Storage Humidity: 10-95% without condensing.
Operating Humidity: 10-90% without condensing.
Drop Test - Shock
per IEC 68-2-7 and 68-2-29 Ed. 2.0
Drop Test - Durability
per IEC 721-3-7 2nd Ed./IEC 61010-1
Vibration
per IEC 68-2-6 and MIL-PRF-2800F (Class 2)
Field Operation
Portable, AC or battery operated, switches without disruption, and is rugged for field operations
Protected by bumpers
Weight and Size
Weight of 2.45kg while supporting dual 100G rates
Size of 1778 x 24.13 x 8cm
Operation
Can be turned on and operational in 2 minutes or less
Accepts operations on display screen or with an external keyboard
Boots to a simplified launch page allowing the user to select previous test configurations and/or favorite test configurations

Platform (Continued)

I/O's	
Includes the following I/O interfaces	
VT100 (RJ-45)	
2 x USB	
RJ-45 (Ethernet/IP)	
Serial	
Wifi	
Bluetooth	Comments: - Bluetooth headset support for VoIP and PRI calls - Bluetooth tethering to iOS devices for file transfer
Can download data to PC, Android device, IOS device or compatible device via standard interface or protocol	
Test, Files and Data Storage	
Report Generation: HTML, PDF, TXT, CSV, XML	
Ability to create a customized name structure	
Supports screen capture	
Internal storage capacity shall of at least 3GBbytes	
Job Manager to push common job information into multiple test applications	
Ability to create summary reports including all tests performed in a job with pass/fail verdict of each	
Remote Operation	
Can be remotely controlled via Web browser and/or Smart Access Anywhere	
Access via SSH encryption or local tether with Smart Access Anywhere application	
Can control the UI and transfer files concurrently with Smart Access Anywhere application	
In remote operation, the remote user can FTP files from and to the test set	
Does not require the installation of client software on a PC for remote operation	
Calibration	
Calibration interval of 3 years	
Warranty	
3 year warranty	
Included Items	
User manual	
AC power source	
AC power cords	
Soft carrying case	
Saved Configurations	
Can save test configurations for future recall	
Can transfer pre-defined test configurations between test sets	

40G 100G Ethernet

Test Interfaces/Bit Rates	
40GigE (41.25Gb/s)	
Dual Port Capable	
100GigE (103.125Gb/s)	
Dual Port Capable	
Interface Type	
QSFP+	Applications: 40G
QSFP28	Applications: 100G
CFP4	Applications: 100G
General	
Line Rate Traffic Tx and RX for all Interfaces	
Single Stream Generation/Analysis	
10 Streams Generation/Analysis	Comments: With Viavi (Acterna) test frame pattern (ATP)
Power Level (aggregate)	Comments: Provided by optics
Tx/Rx Power Level (per lambda)	Comments: Provided by optics
Modes Of Operation	
Terminate	
Monitor/Thru	Comments: Monitoring on Rx while keeping Tx up via idles
Logical Loopback	Comments: Manual and Loop up/down; switching of addresses at Layer 2 and Layer 3
Timing	
Recovered from Rx	Comments: Synchronous Ethernet Applications
Internal (Stratum 3)	
Recovered from External (BITS/SETs)	Comments: BITS / SETS / 2.048MHz / 10MHz
Frequency Offset Transmit/Receive	Comments: Required for Synchronous Ethernet Applications, +/- 150ppm range
Ethernet Features	
Layer 1 (Unframed) Patterns	
Scrambled idle PCS BERT pattern	
Framed Pattern Test	
PRBS 2 ³¹ -1 and inverse	
PRBS Payload Patterns	
2 ³¹ -1, 2 ³¹ -1 Inverse	
MAC Frame Payload	
PRBS Pattern	

40G 100G Ethernet (Continued)

ATPv2 and ATPv3	
Flow Control	
Emulation On/Off	
Pause Frames	
Tx Insert	
Pause Quanta - Definable	
Pause Frame Analysis (counts etc)	
Ethernet Generator	
Skew injection per Virtual Lane:	
100GE: 0 to 32000 (6206 ns) bits per lane	
40GE: 0 to 32000 (3103 ns) bits per lane	
Skew alarm (Rx) threshold settings	Compliance: Defaults to 180 ns
	Comments: Up to 6206 ns for 40GE; Up to 12412 ns for 100GE
Skew reporting per virtual lane	
Tx/Rx Decoupling Mode (for Service Disruption Measurements)	Comments: On incoming alarms such as LOF or Remote Fault, traffic generator is not affected (no alarm response)
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 - Auto-increment MAC	Comments: For LAG testing, No. of MACs in sequence, disable OOS
MAC Frame Size	
64, 128, 256, 512, 1024, 1280, 1518	
User defined	
Jumbo (up to 9600 bytes)	
Random	
VLAN (802.1q)	
VLAN Tag Editable Fields	
VLAN ID	
user Priority	
VLAN Stacking (Q-in-Q)	
SVLAN Tag Editable Fields	
SVLAN ID	

SVLAN User Priority	
SVLAN DEI Bit	
SVLAN TPID	
CVLAN Tag Editable Fields	
VLAN ID	
user Priority	
MPLS	
Single and Dual Label Support	
MPLS Unicast	
MPLS Multicast	
MPLS Editable Parameters	
MPLS Label	
MPLS Priority	
MPLS TTL	
IP Packet Generator	
IP	
IPv4 Frame Format	
IPv6 Frame Format	
IP Addressing	
Destination IP Address - User Defined	
Source IP Address - User Defined	
IPv4 Editable Fields	
ToS	
DSCP	
Flags	
Protocol	
TTL	
IPv6 Editable Fields	
Traffic Class	
Flow Label	
Next Header	
Hop Limit	
IP Ping	
Fast Ping	
IP TraceRoute	
Traffic Generator	
Traffic Profiles	
Traffic generation in Mbit/s and % utilization	
Constant B/W	
Burst B/W (duty cycle, bytes/frames/burst up to 33.6 Mbytes, continuous/no. of bursts)	
Ramp B/W (timed step, load step %, stop increment on errors/dropped)	
Flood B/W	Comments: Full line rate
Constant B/w	

40G 100G Ethernet (Continued)

Bit Rate	Comments: 0.1 Mbps granularity
Percentage	Comments: 0.001% granularity
Burst B/w	
Bytes and Information Rate (IR)	
Information Rate (Mbps)	
Burst kBytes	
Continuous or fixed (up to 65535) bursts	
Burst Time and Information Rate (IR)	
Information Rate (Mbps)	
Burst Time	
Continuous or fixed (up to 65535) bursts	
Bytes and Gap Time	
Gap/Idle Time	
Burst kBytes	
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 2M)	
Continuous or fixed (up to 65535) bursts	
Ramp B/w	
Timed Step (0.1 sec 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	Comments: Requires loopback device
RFC2544	
Asymmetric Testing	
Symmetric Testing	
Throughput	

Frame Loss	
Out of sequence frames	
Errored Frames	
Delay	
Back to Back	
Committed Burst Size (CBS)	
Policer Test	
Jitter	
Master/Slave	
Pass/Fail Thresholds per MEF 23.1	
Connectivity QuickCheck	Comments: Enables quick verification of end to end connectivity before executing an RFC test
Parallel Testing	Comments: Reduces test times by 50% by performing Latency, Throughput and Jitter tests simultaneously
Optional Testing with line rate LBM frames	
Definable Frame Size	
LAG Support	
Sequential MAC Addresses	
Suppression of OOS Frames	
Report formats	
Graphical Results	
Total Test Time Display	
ITU-T Y.1564	
10 Traffic Streams	
Service Configuration Test	
Service Performance Test	
Committed Information Rate (CIR)	
Extended IR (EIR)	
Maximum Ir (MIR)	
Frame Loss Rate (FLR)	
Frame Delay (FD)	
Frame Delay Variation	
Committed Burst Size (CBS)	
Policer Test	
Round Trip Testing	
Concurrent Bi-directional Testing	Comments: Enables each test set to perform and collect 1564 results for bi-directional analysis.
Configurable VLAN, Priority, Addressing and Pass/Fail Thresholds	
Programmable Pass/Fail Thresholds	
Graphical Results	
Screenshot Support	

40G 100G Ethernet (Continued)

Auto-Negotiation Check	
Saved Test Profiles	
Saved Reports	
Configurable DEI, TPID, TOS/DSCP	
Inclusive of L2 Ethernet, IPv4, and IPv6	
Integrated TrueSpeed TCP traffic stream with background streams	
Optional Testing with line rate LBM frames	
Asymmetric Testing	
LAG Support	
Sequential MAC Addresses	
Suppression of OOS Frames	
Layer 2 Transparency Testing	
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	
Loopback	
Manual (LLB)	
Automatic	
Local	
Far End	Comments: Can you send a loop command to another test set.

Class of Service Measurements	
Throughput (Tx/Rx)	
Frame Loss (Rate and Ratio)	
OoS Frames	Comments: Out-of-sequence
Round-trip delay measurements	
Acterna Test Protocol Version 3 (default)	
Acterna Test Protocol Version 2 with Fill byte	
Packet Jitter (Frame Delay Variation)	
Capture/Decode	
Wirespeed Capture	
Integrated Wireshark on the TestSet	Comments: Viewing capture files can be performed directly on the test set and not require a separate laptop/PC.
256MB Capture Buffer	
Triggers and filters	
Tx and Rx Capture	Comments: Captures traffic on the test interface receiver and transmitter.
Frame Slicing	
Expert Decode/Analysis	
Decode/Analysis Capture Files	
Detect Half-Duplex Ports	
Detect ICMP Layer Issues	
Identify Top Talkers	
TCP Layer Diagnosis - ex. Retransmissions	

40G 100G Ethernet (Continued)

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	
Errors Tx/Rx	
Errors	
Code Violation	Comments: Per lane/all lanes; Single/Burst (up to 128)/Rate (10^{-3} to 10^{-10})
Alignment Marker	Comments: Per lane/all lanes; Single/Burst (up to 8)/Rate (10^{-3} to 10^{-10})
BIP-8	Comments: Per lane/all lanes; Single/Burst (up to 128)/Rate (10^{-3} to 10^{-10})
Undersized	Comments: Single/Burst (up to 16)
Runt	Comments: Single/Burst (up to 16)
FCS	Comments: Single/Burst (up to 32767)
Acterna Payload	Comments: Single/Burst (up to 32767)
IPv4 Checksum	Comments: Single/Burst (up to 32767)

Bit Error (PRBS)	Comments: Single/Rate (10^{-3} to 10^{-10})
RS-FEC Correctable	Comments: Single/Continuous
RS-FEC Uncorrectable	Comments: Single/Continuous
Alarms Tx/Rx	
Alarms	
HI BER	Comments: High Bit Error Rate (from Sync Header Bits)
LOBL	Comments: Per lane/all lanes; Loss of Block Lock
LOAML	Comments: Per lane/all lanes; Loss of Alignment Marker Lock
RS-FEC LOAMP	
RS-FEC HI SER	
Faults	
Local Fault	
Remote Fault	
Results	
Custom results	
Histogram and Graphical Results Script	
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	Comments: Loss of Alignment Marker Payload
RS-FEC LOA	Comments: Loss of Alignment
RS-FEC HI SER	Comments: High Symbol Error Rate
Throughput Current	
Rx & Tx Mbps L1	
Rx & Tx Mbps L2	
Frame Loss (count & ratio)	

40G 100G Ethernet (Continued)

Round Trip Delay/FD (average, current, maximum)	
Packet Jitter/FDV (average, max avg, peak, instantaneous)	
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	
Tx Frequency (Hz)	
Tx Frequency Deviation (ppm)	
Tx Freq Max Deviation (ppm)	
Local Fault Seconds	
Remote Fault Seconds	
Per lambda Rx power	Comments: · Optics dependent
L2 Link counts/statistics (most stats also per stream)	
Bandwidth utilization % (avg, current, min, peak)	
Bandwidth utilization Mbps (Rx, Tx, L1, L2)	
Current utilization % (unicast, multicast, broadcast)	
Rx Pause Length (ms) (current, min, max)	
Frame rate (avg, current, min, peak)	
Frame size (avg, min, max)	
Round Trip Delay/FD (average, current, max, min)	
Packet Jitter/FDV (average, max avg, peak, instantaneous)	
VLAN (ID, User Priority)	
SVLAN (ID, User Priority, DEI)	
Service disruption time (usec)	
Received frames	
Transmitted 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	Comments: · Measures longest gap between frames
L3 Link counts/statistics (most stats also per stream)	
Bandwidth utilization % (avg, current, min, peak)	
Packet rate (avg, current, min, peak)	
Packet size (avg, min, max)	
Bandwidth utilization Mbps (Rx, Tx, L3)	
TOS	
Received Packets	
Transmitted 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	
L2 Filtered counts/statistics	
L3 Filtered counts/statistics	
BERT	
Pattern Losses	
Pattern Loss Seconds	
Bit Errors	
Bit Error Rate	
Bit Error Seconds	
Bit Error-Free Seconds	
Bit Error-Free Seconds, %	
PCS Stats	
invalid Alignment Markers	
invalid Alignment Marker Rate	
invalid Alignment Marker Seconds	
Alignment Marker Lock	
Alignment Marker Lock History	
Alignment Marker Loss Seconds	
BIP-8 AM Bit Errors	
BIP-8 AM Bit Error Rate	

40G 100G Ethernet (Continued)

BIP-8 AM Bit Error Seconds	
BIP-8 AM Block Errors	
BIP-8 AM Block Error Rate	
BIP-8 AM Block Error Seconds	
Max Skew (Bits)	
Current Max Skew (Bits)	
Max Skew (ns)	
Current Max Skew (ns)	
Max Virtual Lane Skew (VLID)	
Min Virtual Lane Skew (VLID)	
Loss of Alignment	
HI BER	
HI BER History	
HI BER Seconds	
PCS Block Errors	Comments: List similar to L2 Link counts/statistics
PCS Block Error Seconds	Comments: List similar to L3 Link counts/statistics
Per Lane	
Lane #	
Virtual Lane ID	
Skew (Bits, nsec)	
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 Seconds	
RS-FEC Correctable Count	
RS-FEC Correctable Rate	
RS-FEC Uncorrectable Count	
RS-FEC Uncorrectable Rate	
Capture	Comments: Up to 256 Mbytes
Packets processed	
Capture progress %	
J-Proof Results	
Name	
Tx	

Rx
Status
Error Statistics
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
Event Log
Event, Date, Start Time, Stop Time, Duration, Value
Real Time Histogram
Seconds, Minutes, Hours, Days
Time
Current Date, Current Time, Test Elapsed Time
Graphical Displays
Errors versus Time
Frame Loss versus Time
Packet Jitter versus Time
Latency versus Time
Throughput versus Time

1G 10G Ethernet

Test Interfaces/Bit Rates
10/100/1000M Electrical
Dual Port Capable
GigE (Optical)
Dual Port Capable
10GigE WAN Phy (9.9G)
Dual Port Capable
10GigE LAN Phy (10.3G)
Dual Port Capable

1G 10G Ethernet (Continued)

Interface Type	
RJ-45	
SFP	
SFP+	
SFP28	
General	
Line Rate Traffic Tx and RX for all Interfaces	
Single Stream Generation/Analysis	
10 Streams Generation/Analysis	
Auto Discovery of Test Sets	Comments: Automatically discovers additional test sets on the network for loopback/end to end testing
Power Level	Comments: Provided by SFP/SFP+
Modes Of Operation	
Terminate	
Monitor	
Thru (Intrusive)	
Loopback	
Half Duplex	
Full Duplex	
Timing	
Recoverd from Rx	Comments: Required for Synchronous Ethernet Applications
Internal (Stratum 3)	
Recoverd from External (BITS/SETs)	
Freq Offset Transmit/Receive	Comments: Required for Synchronous Ethernet Applications
Ethernet Features	
GE Layer 1 (Unframed) Bit Error Testing Patterns	
High Frequency test pattern	Comments: Per IEEE 802.3, 2000 Edition, Annex 36A:
Low frequency test pattern	Comments: Per IEEE 802.3, 2000 Edition, Annex 36A:
Mixed frequency test pattern	Comments: Per IEEE 802.3, 2000 Edition, Annex 36A:
Random Data Pattern (RPAT)	Comments: Per NCITS TF-25-1999
Jitter Tolerance Test Pattern (JTPAT)	Comments: Per NCITS TF-25-1999
Supply Noise Test Sequence (SPAT)	Comments: Per NCITS TF-25-1999
GE Layer 2 (Framed) Bit Error Testing Patterns	
Compliant Random Data Pattern (CRPAT)	

Compliant Jitter Tolerance Pattern (CJPAT)	
Compliant Supply Noise Pattern (CSPAT)	
10 GE Layer 1 (Unframed) Bit Error Testing Patterns	
A Seed	
B Seed	
PRBS 31	
Framed Pattern Test	
PRBS (2 ¹¹ -1, 2 ¹⁵ -1, 2 ²⁰ -1, 2 ²³ -1, 2 ³¹ -1 and inverse)	
All 1s	
All 0s	
1:3	
1:7	
3:1	
7:1	
2 in 8	
User defined	
MAC Frame Payload	
PRBS Pattern	
Editable Digital Word	
ATPv2 and ATPv3	
Flow Control	
Emulation On/Off	
Pause Frames	
Tx Insert	
Pause Quanta - Definable	
Pause Frame Analysis (counts etc)	
Ethernet Generator	
10GE Tx/Rx Decoupling Mode (for Service Disruption Measurements)	Comments: On incoming alarms such as LOF or Remote Fault, traffic generator is not affected (no alarm response)
Frame Type	
802.3	
DIX	
VPLS with inner and outer MAC	
MAC in MAC 802.1ah	
EtherType Field - Editable	
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 - Auto Increment	Comments: Automatically increments the source MAC address to replicate multiple source MACs.

1G 10G Ethernet (Continued)

MAC Frame Size	
64, 128, 256, 512, 1024, 1280, 1518	
User defined	
Jumbo (to 10k)	
EMIX	
Random	
VLAN	
VLAN Tagging 802.1q	
VLAN Tag Editable Fields	
Priority	
VID	
VLAN Scan	
VLAN Stacking (Q-in-Q)	
SVLAN Tag Editable Fields	
SVLAN ID	
SVLAN Priority	
SVLAN DEI	
SVLAN TPID	
CVLAN ID	
CVLAN Priority	
Support up to 8 stacked VLAN Tags	
VPLS	
VPLS Parameters - MAC Addresses	
VPLS Parameters - Frame Type	
VPLS Parameters - Ethertype	
VPLS Tunnel and VC Label - Lavel, CoS, TTL	
VPLS Control Word - Reserved Bits, Sequence Number	
MAC in MAC/PBT/PBB	
Parameters - MAC Address	
B-Tag - TPI, VID, Priority, DEI	
I-Tag - TPI, SID, Priority, DEI, NCA, Res1, Res2	
MPLS	
Single Label Support	
Stacked Label Support - Up to 2	Comments: Supports up to 2 MPLS tags
Editable Parameters/Results - Label	
Editable Parameters/Results - CoS	
Editable Parameters/Results - TTL	
MPLS-TP	
MPLS-TP Label Support (Tunnel and VC)	
VLAN Tag Support	
Linerate Traffic Generation	
Traffic Analysis	
Editable Parameters/Results - Label	
Editable Parameters/Results - Priority	
Editable Parameters/Results - TTL	

Rx Filters	
GAL (Label 13) + ACH from ITU-T G.8113.1	
Common Header Label - PW, LSP, Section	
CCM Generation and Analysis	
LBM/LBR Generate and Analysis	
AIS - Generate and and Analysis	
OAM Alert Label (Label 14) from ITU-T G.8114	
Common Header Label - PW, LSP, Section	
CCM Generation and Analysis	
LBM/LBR Generate and Analysis	
AIS - Generate and and Analysis	
OAM Alert Label (Label 14) from ITU-T Y.1711	
Common Header Label - PW, LSP, Section	
CCM Generation and Analysis	
FFD Generation and Analysis	
BDI Generation and Analysis	
FDI Generation and Analysis	
Simultaneous OAM and background traffic generation	
Ethernet OAM	
Y.1731 Service OAM and 802.1agCFM	
CCM Messages	
Programmable CCM Rate	
CCM Type - Unicast, MultiCast	
MEG ID End Point	
Maintenance Domain Level	
AIS Tx/Rx	
RDI Tx/Rx	
LBR/LBM (Ping) - Unicast, MultiCast	
LTM/LTR (Trace)	
MEP Discovery	Comments: Autodiscovery of all MEPs on the Network
802.3ah Link OAM	
Mode - Passive/Active	
Vendor OUI	
Vendor Specific Info	
Max PDU Size	
Unidirectional Links	
Remote Loopback	
Link Events	
Variable Retrieval	
Dying Gasp	
Link Fault	
Critical Event	
Errored Symbol Period Event	
Errored Frame Event	
Errored Frame Period Event	

1G 10G Ethernet (Continued)

Errored Frame Second Summary Event	
IP Packet Generator	
IP	
IPv4 Frame Format	
IPv6 Frame Format	
TCP Port Number	Comments: • Source & Destination Port
UDP Port Number	Comments: • Source & Destination Port
IP Addressing	
Destination IP Address - User Defined	
Source IP Address - User Defined	
IPv4 Editable Fields	
ToS	
DSCP	
Flags	
Protocol	
TTL	
IPv6 Editable Fields	
Traffic Class	
Flow Label	
Next Header	
Hop Limit	
IP Ping	
Fast Ping	
IP TraceRoute	
Traffic Generator	
Number of Traffic Engines	Comments: • How many concurrent streams can be generated with different frame sizes and bandwidths
Bandwidth Contolled	Comments: • User can specify bandwidth by directly specifying the bandwidth setting
Bandwidth Specification in Mbps or kbps	
Bandwidth Granularity	
Bandwidth Specification in %	
Bandwidth Utilization Accuracy - 0.1%	
Burst Mode - Burst Size - 1 to 2M frames	
Bandwidth Specified - Definable	
Continuous Tx	Comments: • Ongoing traffic as defined
Once Tx - Definable frames/burst	
Traffic generation in LBM frames at line rate	
Analysis of LBR frames at line rate	
Traffic Profiles	
Constant B/W	

Ramp B/W	
Bursty B/W	
Flood B/W	
Traffic generation in Mbps, kbps, or % utilization	
B/W configurable based on L1 or L2	
TCP Throughput	
10/100/1000M Linerate Stateful Emulation	
1GigE Linerate Stateful Emulation	
10GigE Linerate Stateful Emulation	
Configurable Src and Dest IP address	
Packet length	
TCP/UDP Traffic Modes	
Source Port	
Destination Port	
Listen Port	
Configurable TCP Window Size	
Measures TCP Efficiency	
Measures Buffer Delay	
TCP Client Emulation	
TCP Server Emulation	
Up to 64 TCP Stateful Sessions Simultaneously	
Supports 4 Background Streams	
Compatible with IPERF	
RFC2544	
Asymmetric Testing	
Symmetric Testing	
Throughput	
Frame Loss	
Out of sequence frames	
Errored Frames	
Delay	
Back to Back	
Committed Burst Size (CBS)	
Policer Test	
Jitter	
Master/Slave	
Pass/Fail Thresholds per MEF 23.1	
Connectivity QuickCheck	Comments: • Enables quick verification of end to end connectivity before executing an RFC test
Parrallel Testing	Comments: • Reduces test times by 50% by performing Latency, Throughput and Jitter tests simultaneously
Optional Testing with line rate LBM frames	
Definable Frame Size	

1G 10G Ethernet (Continued)

LAG Support	
Sequential MAC Addresses	
Suppression of OOS Frames	
Report formats	
Graphical Results	
Total Test Time Display	
One Way Delay with GPS or CDMA receiver	Comments: GPS receiver is Spectrum Instruments TM-4M; CDMA receiver is Precious
ITU-T Y.1564	
10 Traffic Streams	
Service Configuration Test	
Service Performance Test	
Committed Information Rate (CIR)	
Extended IR (EIR)	
Maximum Ir (MIR)	
Frame Loss Rate (FLR)	
Frame Delay (FD)	
Frame Delay Variation	
Committed Burst Size (CBS)	
Policer Test	
Round Trip Testing	
Concurrent Bi-directional Testing	Comments: Enables each test set to perform and collect 1564 results for bi-directional analysis.
Configurable VLAN, Priority, Addressing and Pass/Fail Thresholds	
Programmable Pass/Fail Thresholds	
Graphical Results	
Screenshot Support	
Auto-Negotiation Check	
Saved Test Profiles	
Saved Reports	
Configurable DEI, TPID, TOS/DSCP	
Inclusive of L2 Ethernet, IPv4, and IPv6	
Integrated TrueSpeed TCP traffic stream with background streams	
Optional Testing with line rate LBM frames	
Asymmetric Testing	
LAG Support	
Sequential MAC Addresses	
Suppression of OOS Frames	
One Way Delay with GPS or CDMA receiver	Comments: GPS receiver is Spectrum Instruments TM-4M; CDMA receiver is Praecis II Receiver

IETF RFC 6349
Supported on 10/100/1000 M Electrical and 1/10 G Optical Interfaces
Automated TCP Throughput test per RFC 6349
Path MTU Detection Test
Round Trip TimeTest
Walk the Window Test
TCP Throughput Test
Traffic Shaping Test
TCP Efficiency Metric
Buffer Delay Metric
Up to 64 TCP Stateful Sessions Simultaneously
1 KB TCP Window Size Granularity
Jumbo Frame Support
Graphical Results and Report Generation
Configurable File Sizes and Window Sizes
Total Test Time Display
Configurable Saturation Window Test
Compatible with the following endpoints:
T-BERD/MTS instruments
QT-600 Ethernet Probes
TrueSpeed VNF Server
Layer 2 Transparency Testing
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

1G 10G Ethernet (Continued)

VLAN-BRDGS	
802.1d	
VLAN Trunking (VTP)	
Custom Frame Builder	
Synchronous Ethernet	
10GigE Tx/Rx	
1000M/100M/10M Electrical Tx/Rx	Comments: Electrical SyncE PIM required
100M/1000M Optical Tx/Rx	
G.826x Compliant	
Frequency offsets ± 100 ppm in 1 or 10 ppm increments	
Recovered Interface Timing	
4.6ppm Frequency Accuracy	
SSM Message Decode	
ESMC Message Transmit & Capture	
Quality Message Decode	
Definable SSM PDU Rate (pps)	
Background Dataplane traffic generation	
IEEE 1588v2 PTP	
1G and 10G Tx/Rx	
1588v2 Master Emulation	
1588v2 Slave Emulation	
1 G Dual Monitor	
Encapsulations supported: None, VLAN, and Q-in-Q	
Packet Delay Variation Measurements on Control Plane Traffic	Compliance: Add ipdv add per message type
Generate up to 4 streams of Background Dataplane traffic	Comments: To see the effect of dataplane network traffic on PTP PDV.
Frame/Packet Capture and Decode via Wireshark	Comments: message rates for announce request sync
Layer 2 1588v2 Messaging	
Layer 4 1588v2 Messaging	
Message rates Multicast: fastest 2/16/64/64 (DelayResponse/Announce/Sync/DelayRequest) ; slowest one message every 16 seconds	
Message rates Unicast: fastest 2/16/16/16 (DelayResponse/Announce/Sync/DelayRequest); slowest one message every 16 seconds	
Support for Unicast and Multicast Address Mode	
Support for Forwardable and Non-forwardable Address	
Static unicast message negotiation: ON or OFF	
Thresholds for Delay, PDV and Time Error	
Single- & Dual Step operation in both slave and master modes	
Master Mode Clock Classes Supported	
Primary	
Primary Holdover	

Arbitrary	
Arbitrary Holdover	
Primary A	
Arbitrary A	
1588v2 Delay Measurements (Master/Slave)	Comments: Requires Precision Timing Reference Module
One-way (Master to Slave and Slave to Master) Delay	Comments: Requires Precision Timing Reference Module
Differential Delay and Delay Asymmetry Measurements	
Time Error Measurements (1ns resolution)	
max TE Measurement	
cTE Measurement	
Wander Analysis of Time Error Measurement	
Automated Time Error Measurement workflow.	
Loopback	
Manual (LLB)	
Automatic	
Local	
Far End	Comments: Can you send a loop command to another test set.
Auto Discovery of Test Sets	Comments: Automatically discovers additional test sets on the network for loopback/end to end testing
Class of Service Measurements	
Throughput (Tx/Rx)	
Frame Loss (Rate and Ratio)	
OoS Frames	Comments: Out-of-sequence
Round Trip Delay	
Acterna Test Protocol Version 3 (default)	
Acterna Test Protocol Version 2 with Fill byte	
10GE/GE Optical High Precision - low delay	
Lower Precision - high delay	
One Way Delay	Comments: Across Geographically different locations
Packet Jitter (Frame Delay Variation)	

1G 10G Ethernet (Continued)

CAT-5 Testing		
Link speed		
Link status		
Cable status		
Crossover/straight (MDI/MDIX)		
Distance to fault		
Pin mapping		
Pair length		
Polarity		
Skew		
Capture/Decode		
Wirespeed Capture		
Integrated Wireshark on the TestSet	Comments: Viewing capture files can be performed directly on the test set and not require a separate laptop/PC.	
256MB Capture Buffer per port		
Triggers and filters		
Tx and Rx Capture	Comments: Captures traffic on the test interface receiver and transmitter.	
Frame Slicing		
Expert Decode/Analysis		
Decode/Analysis Capture Files		
Detect Half-Duplex Ports		
Detect ICMP Layer Issues		
Identify Top Talkers		
TCP Layer Diagnosis - ex. Retransmissions		
Traffic Profiling		
Detect and display up to 128 streams of live traffic		
Specify Filters for stream detection		
Stream Classification	Comments: Organize streams by VLAN, MAC, IP Address etc for analysis	
Network Discovery		
Automatically detect networks, domains, devices, and hosts		

Traffic Filtering
Ethernet (Layer 2) Traffic Filtering
MAC source and destination address
Frame Type/Length
VLAN ID
VLAN Priority
VLAN Discovery
VLAN (Layer 2.5) Tags - 802.1q
TPI
Priority
CFI/DEI
VID
VLAN (Layer 2.5) Tags - QnQ, 802.1ah
SVLAN ID
SVLAN Priority
SVLAN TPI
CVLAN ID
CVLAN Priority
MPLS
MPLS Label
MPLS Priority
IP (Layer 3) Traffic Filtering
Source and destination IP address
Subnet mask
IPv6 Traffic Class
TOS/DSCP fields
TCP/UDP (Layer 4) Traffic Filtering
ATP Listen Port
Protocol Analysis
CDP and LLDP Frame Discovery and Decode
CDP Analysis
Device Identifier
Port Identifier
VLAN ID
Source MAC Address
IP Subnet Addresses
LLDP Analysis
Chassis Identifier
Port Identifier
Time To Live
Source MAC address and optional VLAN ID
Management IP Address
MAU Type Information

1G 10G Ethernet (Continued)

Errors Tx/Rx	
Code Error Tx/Rx	Comments: • Single/Burst (up to 16)/Rate (10 ⁻³ to 10 ⁻⁹)
FCS Error Tx/Rx	Comments: • Single/Burst (up to 32767)
Acterna Payload	Comments: • Single/Burst (up to 32767)
IP Checksum Tx/Rx	Comments: • Single/Burst (up to 32767)
Bit Error Tx/Rx	Comments: • Single/Rate (10 ⁻³ to 10 ⁻⁹)
Insertion Profile - Once	
Insertion Profile - Rate	
Insertion Profile - Burst	
Alarms Tx/Rx	
Local Fault Tx/Rx	
Remote Fault Tx/Rx	
Ethernet Results	
Custom results	
Histogram and Graphical Results Script	
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	
Rx & Tx Mbps L2	
Rx & Tx Mbps L3	
Frame Loss (count & ratio)	
Round Trip Delay/FD (average, current, maximum)	
Packet Jitter/FDV (average, max avg, peak, instantaneous)	
One Way Delay (average, current, maximum)	
Time	
Current Date, Current Time, Test Elapsed Time	
Auto-negotiation status	
Link configuration ack	

Link advertisement status
Pause capable
Remote fault
Destination MAC address when using ARP
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)
Rx Frequency Max Deviation (ppm)
Tx Clock Source
Tx Frequency (Hz)
Tx Frequency Deviation (ppm)
Tx Freq Max 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 (average, 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 (usec)
Received frames
Transmitted 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

1G 10G Ethernet (Continued)

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
Received Packets
Transmitted 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
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	Comments: · Up to 256 Mbytes
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 Second	
Severely Errored Seconds	
Unavailable Seconds	
Errored Second Ratio	
Severely Errored Second Ratio	
Event Log	
Event, Date, Start Time, Stop Time, Duration, Value	

1G 10G Ethernet (Continued)

Real Time Histogram
Seconds, Minutes, Hours, Days
Time
Current Date, Current Time, Test Elapsed Time
Graphical Displays
Errors versus Time
Frame Loss versus Time
Packet Jitter versus Time
Latency versus Time
Throughput versus Time
Application Testing
Walk the Window
FTP Throughput
HTTP Throughput

SONET SDH

Test Interfaces/Bit Rates
STS-1(e) (51.84 Mbps)
Dual Port Capable
STM-1(e) (155.52Mb/s)
Dual Port Capable
STM-1(o) (155.52Mb/s)
Dual Port Capable
OC-3 (155.52Mb/s)
Dual Port Capable
OC-12 (622.08Mb/s)
Dual Port Capable
STM-4 (622.08Mb/s)
Dual Port Capable
OC-48 (2.488Gb/s)
Dual Port Capable
STM-16 (2.488Gb/s)
Dual Port Capable
OC-192 (9.953Gb/s)
Dual Port Capable
STM-64 (9.953Gb/s)
Dual Port Capable
Interface Type
SFP
SFP+
SFP+ Tunable
Modes Of Operation
Terminate
Monitor
Thru (Intrusive)

Tributary Scan	
Drop and Insert	
Timing	
Recoverd from Rx	
Internal (Stratum 3)	
Recoverd from External (BITS/SETs)	
Recoverd from 10MHz clock	
Frequency Offset Transmit/Receive	
Traffic Mappings	
SONET/SDH Bulk BERT	Comments: · PRBS as payload in SONET/SDH frames
J-Scan	Comments: · Tributatry scan monitor tool
SONET Mappings	
STS-1 Bulk BERT	Comments: · OC-3/12/48/192
STS-3c Bulk BERT	Comments: · OC-3/12/48/192
STS-12c Bulk BERT	Comments: · OC-12/48/192
STS-48c Bulk BERT	Comments: · OC-48/192
STS-192c Bulk BERT	Comments: · OC-192
SDH Mappings	
AU-3 VC-3 Bulk BERT	Comments: · STM-1/4/16/64
AU-4 VC-3 Bulk BERT	Comments: · STM-1/4/16/64
AU-4 VC-4 Bulk BERT	Comments: · STM-1/4/16/64
AU-4 VC-4-4c Bulk BERT	Comments: · STM-4/16/64
AU-4 VC-4-16c Bulk BERT	Comments: · STM-16/64
AU-4 VC-4-64c Bulk BERT	Comments: · 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	Comments: · OC-48/129 STM-16/64
Digital Word	
Delay pattern	
Rx Live	
SONET/SDH Injection/Detection	
Alarms/Defects	
Signal Present / LOS	Comments: · Terminate & Thru

SONET SDH (Continued)

LOF	Comments: • Terminate & Thru
TIM-S / RS-TIM	Comments: • Terminate & Thru
AIS-L / MS-AIS	Comments: • Terminate
RDI-L / MS-RDI	Comments: • Terminate
AIS-P / AU-AIS	Comments: • Terminate
LOP-P / AU-LOP	Comments: • Terminate
RDI-P / HP-RDI	Comments: • Terminate
TIM-P / HP-TIM	Comments: • Terminate & Thru
PLM-P / HP-PLM	Comments: • Terminate & Thru
UNEQ-P / HP-UNEQ	Comments: • Terminate & Thru
Errors/Anomalies	
Frame Word	Comments: • Burst (1 to 32) Terminate & Thru
B1	Comments: • Single/Rate (10^{-6} to 10^{-9}) Terminate
B2	Comments: • Single/Rate (10^{-4} to 10^{-9}) Terminate
REI-L / MS-REI	Comments: • Single/Rate (10^{-4} to 10^{-9}) Terminate
B3	Comments: • Single/Rate (10^{-6} to 10^{-9}) Terminate & Thru
REI-P / HP-REI	Comments: • Single/Rate (10^{-6} to 10^{-9}) Terminate
Bit/TSE	Comments: • Single/Rate (10^{-4} to 10^{-9}) Terminate
Pointers	
Increment	
Decrement	
+2 NDF	
-2 NDF	
Sequence	
SONET/SDH Overhead	
Overhead Manipulation/Analysis	
Overhead viewing & editor for TOH/SOH and POH bytes	
User can set TOH/SOH Tx & 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	Comments: • Mandatory for handling debounce of the NE's Tx.
SD Threshold Time Settings	
Triggers	
Signal Loss	
Bit/TSE Error	Comments: • For PRBS errors
Frame Sync Loss / LOF	

SONET SDH (Continued)

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	Compliance: · 10 to 100000
G.826 Path Allocation % Setting	
G.828 Enable UAS Limit on/off	Compliance: · 10 to 100000
M.2101	Compliance: · MS/HP Setups
See Results section	
J-Scan	
Tributary Scan with STS/STM reporting	Compliance: · 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 & Stop time, Duration/Value)	
Histogram (multiple alarms & 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 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 Freq Max Deviation (ppm)
Round-Trip Delay Current, Avg, Min, Max (100 nsec 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

SONET SDH (Continued)

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
BBE (NE)
ES (NE)
SES (NE)

UAS (NE)
BBER (NE)
ESR (NE)
SESR (NE)
G.829 MS ISM
BBE (NE & FE)
ES (NE & FE)
SES (NE & FE)
UAS (NE & FE)
BBER (NE & FE)
ESR (NE & FE)
SESR (NE & FE)
G.828 HP ISM
Verdict (NE & FE)
BBE (NE & FE)
ES (NE & FE)
SES (NE & FE)
UAS (NE & FE)
SEP (NE & FE)
BBER (NE & FE)
ESR (NE & FE)
SESR (NE & FE)
SEPI (NE & FE)
G.828 HP OOS
Verdict
BBE
ES
SES
UAS
SEP
BBER
ESR
SESR
SEPI
M.2101 MS ISM
Verdict (NE & FE)
BBE (NE & FE)
ES (NE & FE)
SES (NE & FE)
UAS (NE & FE)
SEP (NE & FE)
BBER (NE & FE)
ESR (NE & FE)
SESR (NE & FE)
SEPI (NE & FE)
M.2101 HP ISM

SONET SDH (Continued)

Verdict (NE & FE)
BBE (NE & FE)
ES (NE & FE)
SES (NE & FE)
UAS (NE & FE)
SEP (NE & FE)
BBER (NE & FE)
ESR (NE & FE)
SESR (NE & FE)
SEPI (NE & 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)

OTU4 OTU3

Test Interfaces/Bit Rates	
OTU3 (43.02Gb/s)	
Dual Port Capable	
OTU4 (111.8Gb/s)	
Dual Port Capable	
Interface Type	
QSFP+	Compliance: • 40G
QSFP28	Compliance: • 100G
CFP4	Compliance: • 100G
Modes Of Operation	
Terminate	
Monitor/Thru	Comments: • Monitoring on Rx with no Tx laser. Thru mode provides a full loopback with monitoring capabilities
Timing	
Recovered from Rx	
Internal (Stratum 3)	
Recovered from External (BITS/SETs)	Comments: • BITS / SETS / 2.048MHz / 10MHz
Frequency Offset Transmit/Receive	Comments: • +/- 150ppm
Frequency Reporting	Comments: • Resolution in Hz, deviation in PPM
Traffic Mappings	
OTN Bulk BERT	Comments: • PRBS as payload in OTN frames
OTL BERT	Comments: • PRBS on OTL (with Lane Alignment)
OTU4 with 100GE Client using GMP	Comments: • Full Ethernet functionality at client level
OTU4 with ODU Multiplexing	Comments: • Full SONET/SDH functionality at client level (PRBS as per 40G SONET/SDH)

OTU4 OTU3 (Continued)

ODU3 with bulk. Direct into ODU4	
ODU2e with bulk. Direct into ODU4	
ODU2e with 10GE Transparent client (layer 1 and layer 2). Direct into ODU4	
ODU2 with bulk. Direct in ODU4	
ODU2 with 10GE client via GFP-F (G.7041 Sect 71) (layer 2 and layer 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 (layer 2 and layer 3). Direct in 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 40GE Client transcoded	
OTU3 with ODU Multiplexing	
ODU2e with bulk. Direct into ODU3	
ODU2e with 10GE Transparent client (layer 1 and layer 2) Direct into ODU3	
ODU2 with bulk. Direct in ODU3	
ODU2 with 10GE client via GFP-F (G.7041 Sect 71) (layer 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 (layer 2 and layer 3). Direct into ODU3, via ODU1, via ODU2	
ODUFlex with bulk. Direct in ODU3	Comments: 1 to 8 Tributary Slots worth of bandwidth
ODUFlex with layer 2 MAC via GFP-F. Direct in ODU3	Comments: 1 to 8 Tributary Slots worth 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	
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	Compliance: Defaults to 180 ns
	Comments: 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	Comments: Per lane/all lanes; Single/Burst (up to 128)/Rate (10⁻³ to 10⁻¹⁰)
OTL MFAS	Comments: Per lane/all lanes; Single/Burst (up to 128)/Rate (10⁻³ to 10⁻¹⁰)
OTL LLM (OTU4)	Comments: Per lane/all lanes; Single/Burst (up to 128)/Rate (10⁻³ to 10⁻¹⁰)
FEC Uncorrectable	Comments: Single/Rate (10⁻² to 10⁻⁵)
FEC Correctable	Comments: Single/Rate (10⁻² to 10⁻⁵)
OOM	
SM-BIP	Comments: Single/Rate (10⁻⁵ to 10⁻⁷)
SM-BEI	Comments: Single/Rate (10⁻⁵ to 10⁻⁷)
PM-BIP	Comments: Single/Rate (10⁻⁵ to 10⁻⁷)
PM-BEI	Comments: Single/Rate (10⁻⁵ to 10⁻⁷)
TCM1-6 BIP	Comments: Single/Rate (10⁻⁵ to 10⁻⁷)
TCM1-6 BEI	Comments: Single/Rate (10⁻⁵ to 10⁻⁷)
Bit Error/TSE	Comments: Single/Rate (10⁻³ to 10⁻¹⁰)
Additional Client Level Errors	
Transcoding Errors	
LOBL (1027B)	
LOAML	Comments: Per lane/all lanes
HI BERD (1027B)	
Alarms	
OTL OOF	Comments: Per lane/all lanes
OTL LOF	Comments: Per lane/all lanes
LOM	
SM-IAE	
SM-TIM	
SM-BDI	
SM-BIAE	
ODU AIS	
ODU LCK	
ODU OCI	
PM-BDI	
PM-TIM	
Fwd Sig Fail	

OTU4 OTU3 (Continued)

Fwd Sig Degrade	
Bwd Sig Fail	
Bwd Sig 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	Comments: Single/Burst (up to 128)/Rate (10⁻³ to 10⁻¹⁰)
Marker Seq Violation	Comments: Single/Burst (up to 128)/Rate (10⁻³ to 10⁻¹⁰)
OTN BIP-8	Comments: Per lane/all lanes; Single/Burst (up to 128)/Rate (10⁻³ to 10⁻¹⁰)
Ingress BIP-8	Comments: Per lane/all lanes; Single/Burst (up to 128)/Rate (10⁻³ to 10⁻¹⁰)
Code	Comments: Per lane/all lanes; Single/Burst (up to 128)/Rate (10⁻³ to 10⁻¹⁰)
OTN Overhead	
Support of AMP, GMP, BMP as per client mapping	Comments: AMP client offset up to +/- 65 PPM for SONET/SDH Clients
GCC Transparency Test	Comments: 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 nsec accuracy)	Comments: Selection of PM or TCM1-6
Overhead Manipulation/Analysis	
Overhead editor for OTU, ODU, OPU bytes	Comments: Multiple ODU levels for ODU multiplexing
Full structured PSI editor	
Full PSI and MSI byte maps for each ODU multiplexed level	Comments: Rx & Tx MSI with Byte value, ODU Type, and Tributary Port #
Can copy Rx MSI values to Tx MSI	
Full setting of Tx and Rx Tributary Ports	
Display of 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-zeroes	
Incoming FEC: ignore, correct errors, do not correct errors	
GMP Layer Injection/Detection	
Tx Payload Mapping Type	
Expected Payload Mapping Type	
CM value overwrite	
Nominal and Effective CM Value	
Payload Offset (ppm)	Comments: · +/- 100ppm
Error Injections	
CRC-5	Comments: · Single/Burst (up to 16)
CRC-8	Comments: · 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	Comments: · 1 to 978
Service Disruption Measurement	
Measurement Parameters	
SD Separation/Debounce Time Setting	Comments: · Mandatory for handling debounce of the NE's Tx. Up to 60000 msec
SD Threshold Time Settings	Comments: · Up to 60000 msec
Triggers	
Signal Loss / LOS	
Bit/TSE Error	Comments: · For PRBS errors
OTL LOF	
OTL FAS Error	
OTL MFAS Error	
OTL LLM (OTU4)	
OTU LOM	
OTU SM-IAE	

OTU4 OTU3 (Continued)

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
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 & Stop time, Duration/Value)
Histogram (multiple alarms & 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
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 Freq Max Deviation (ppm)	
Round-Trip Delay Current, Avg, Min, Max (100 nsec res.)	
Per lambda Rx power	Comments: · Optics dependent
Per lambda Tx power	Comments: · Optics dependent
OTL Stats	
Frame Sync Loss Seconds / LOF Seconds	
OOF Seconds	
OOMFAS Seconds	
Marker Lock Loss Seconds / LOR Seconds	Comments: · Loss of Recovery
OOR Errors	Comments: · 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	
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 #	
Logical Lane ID	
Skew (Bits, nsec)	
Frame Sync / OTL LOF	
OTL OOF	
OOMFAS	
Marker Lock / OOLLM	
OTL LOR (OTU4)	Comments: · Out of Recovery

OTU4 OTU3 (Continued)

OTL OOR	
FAS Errors	
MFAS Errors	
Logical Lane Marker Errors (OTU4)	
Ethernet Virtual Lane ID	Comments: · For Ethernet in OTN
Sync Acquired	Comments: · For Ethernet in OTN
Eth Marker Lock	Comments: · For Ethernet in OTN
Code Violations	Comments: · For Ethernet in OTN
Invalid Alignment Markers	Comments: · For Ethernet in OTN
BIP-8 AM Bit Errors	Comments: · For Ethernet in OTN
BIP-8 AM Block Errors	Comments: · For Ethernet in OTN
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	
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

OTU4 OTU3 (Continued)

Payload
Pattern Sync Losses \ LSSs
Pattern Sync Loss Seconds \ LLS 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 Freq Deviation (ppm)
Client Rx Freq Max Deviation (ppm)

Transcoding Stats	
Sync Loss Seconds	
HI BER Seconds	
1027B Flag Parity Err	
1027B Flag Parity Err Rate	
513B Mkr Seq Vio Cnt	
513B Mkr Seq Vio Rate	
513B Mkr Seq Vio Seconds	
Total OTN BIP-8 Err Cnt	
Total OTN BIP-8 Err Rate	
Total Ingress BIP-8 Err Cnt	
Total Ingress BIP-8 Err Rate	
Transcoding Per Lane	
Lane #	
OTN BIP-8 Err Cnt	
OTN BIP-8 Err Rate	
Ingress BIP-8 Err Cnt	
Ingress BIP-8 Err Rate	
Ethernet Client	
As per Ethernet results	
SONET/SDH Client	
As per SONET/SDH results	
OTN Check	
Automated workfolw is available at all OTN rates for OTN Bulk	Comments: Key use case is OTN service activation
Set test duration based on Bit Error Rate Theory or actual time	
Bit Error Rate Theryory paramters for test duration:	
Data Rate (e.g. OTU4)	
BER Threshold	
Confidence Level (% value)	Comments: 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 field: GCC0, GCC1 or GCC2	
Pass/Fail BER Threshold	
Far-end loopback auto-detect function	
Report generation and formats	

OTU1 OTU2 OTU1e OTU2e

Test Interfaces/Bit Rates	
OTU1 (2.7G)	
Dual Port Capable	
OTU2 (10.7G)	
Dual Port Capable	
OTU1e (11.045G)	
Dual Port Capable	
OTU2e (11.095G)	
Dual Port Capable	
Interface Type	
SFP	
SFP+	
SFP+ - Tunable	
Modes Of Operation	
Terminate	
Monitor/Thru	
Timing	
Recovered from Rx	
Internal (Stratum 3)	
Recovered from External (BITS/SETs)	Comments: • BITS / SETS / 2.048MHz / 10MHz
Frequency Offset Transmit/Receive	Comments: • +/- 50ppm
Frequency Reporting	Comments: • Resolution in Hz, deviation in PPM
Traffic Mappings	
OTN Bulk BERT	Comments: • PRBS as payload in OTU1/2/1e/2e frames
OTU2e with Layer 1 and Layer 2 Traffic	Comments: • Full Ethernet functionality at client level
OTU1e with Layer 1 and Layer 2 Traffic	Comments: • Full Ethernet functionality at client level
OTU2 with STS-192 Bulk BERT	Comments: • Full SONET functionality at client level
OTU2 with STM-64 Bulk BERT	Comments: • 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 (layer 2 and layer 3). Direct in ODU2	
ODUFlex with bulk. Direct in ODU2	
ODUFlex with layer 2 MAC via GFP-F. Direct in ODU2	

OTU1 with STS-48 Bulk BERT	Comments: • Full SONET functionality at client level
OTU1 with STM-16 Bulk BERT	Comments: • Full SDH functionality at client level
OTU1 with ODU Multiplexing	
ODU0 with bulk. Direct in ODU1	
ODU0 with GE client via GFP-T (layer 2 and layer 3). Direct in ODU1	
OTN Bulk PRBS Patterns	Comments: • PRBS as payload in OTU1/2/1e/2e frames
2 ²³ -1, 2 ²³ -1 Inverse	
2 ³¹ -1, 2 ³¹ -1 Inverse	
Delay pattern	
Rx Live	
Digital Word	Comments: • 32 bits
OTN Injection/Detection	
Set Tx Scramble on/off	
Set Rx Descramble on/off	
Errors	
FEC Uncorrectable	Comments: • Single/Rate (10⁻² to 10⁻⁵)
FEC Correctable	Comments: • Single/Rate (10⁻² to 10⁻⁵)
FAS	Comments: • Single/Burst (up to 300)
OOF	Comments: • Single
MFAS	Comments: • Single/Burst (up to 300)
OOM	Comments: • Single
SM-BIP	Comments: • Single/Rate (10⁻⁵ to 10⁻⁷)
SM-BEI	Comments: • Single/Rate (10⁻⁵ to 10⁻⁷)
PM-BIP	Comments: • Single/Rate (10⁻⁵ to 10⁻⁷)
PM-BEI	Comments: • Single/Rate (10⁻⁵ to 10⁻⁷)
TCM1 BIP	Comments: • Single/Rate (10⁻⁵ to 10⁻⁷)
TCM1 BEI	Comments: • Single/Rate (10⁻⁵ to 10⁻⁷)
Bit Error/TSE	Comments: • Single/Rate (10⁻⁴ to 10⁻⁹)
Additional Client Level Errors	
Alarms	
LOF	

OTU1 OTU2 OTU1e OTU2e (Continued)

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	
Support of AMP, GMP, BMP as per client mapping	Comments: AMP client offset up to +/- 65 PPM for SONET/SDH Clients
GCC Transparency Test	Comments: 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 nsec accuracy)	Comments: Selection of PM or TCM1-6
Overhead Manipulation/Analysis	
Overhead editor for OTU, ODU, OPU bytes	Comments: Multiple ODU levels for ODU multiplexing
Full structured PSI editor	
Full PSI and MSI byte maps for each ODU multiplexed level	Comments: Rx & Tx MSI with Byte value, ODU Type, and Tributary Port #
Can copy Rx MSI values to Tx MSI	
Full setting of Tx and Rx Tributary Ports	
Display of 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-zeroes	
Incoming FEC: ignore, correct errors, do not correct errors	
Service Disruption Measurement	
Measurement Parameters	
SD Separation/Debounce Time Setting	Comments: · Mandatory for handling debounce of the NE's Tx. Up to 60000 msec
SD Threshold Time Settings	Comments: · Up to 60000 msec
Triggers	
Signal Loss / LOS	Comments: · For PRBS errors
Bit/TSE Error	
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	
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 & Stop time, Duration/Value)	
Histogram (multiple alarms & errors)	
Service Disruption Summary Table	
Service Disruption Details	
Service Disruption Statistics	

OTU1 OTU2 OTU1e OTU2e (Continued)

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 Freq 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
OOF Seconds
MFAS Errors
MFAS Error Rate
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 Previous
OPI
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

OTU1 OTU2 OTU1e OTU2e (Continued)

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:	
10GE in OTU2e/1e	
40GE in OTU3	
100GE in OTU4	
Includes:	
QuickCheck	
RFC 2544 test suite	
OTN Check	
Automated workfolw is available at all OTN rates for OTN Bulk	Comments: Key use case is OTN service activation
Set test duration based on Bit Error Rate Theory or actual time	
Bit Error Rate Therory paramters for test duration:	
Data Rate (e.g. OTU4)	
BER Threshold	
Confidence Level (% value)	Comments: 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 field: GCC0, GCC1 or GCC2
Pass/Fail BER Threshold
Far-end loopback auto-detect function
Report generation and formats

Fibre Channel

Test Interfaces/Bit Rates	
1G FC (1.0625Gb/s)	
Dual Port Capable	
2G FC(2.125Gb/s)	
Dual Port Capable	
4G FC (4.25Gb/s)	
Dual Port Capable	
8G FC (8.5Gb/s)	
Dual Port Capable	
10G FC (10.5175Gb/s)	
Dual Port Capable	
16G FC (14.025Gb/s)	
Dual Port Capable	
32G FC (28.05Gb/s)	
Dual Port Capable	
Laser Type	
SFP	
SFP+	
SFP28	
Modes Of Operation	
Terminate	
Monitor	
Thru	
Loopback	
Timing	
Internal	
Frequency Offset Transmit/Receive	Comments: +/- 110ppm
Traffic Attributes	
Line Rate Traffic Tx and RX	
Layer 1 Test Patterns	
HFPAT	Comments: 1G/2G/4G FC
LFPAT	Comments: 1G/2G/4G FC
MFPAT	Comments: 1G/2G/4G FC

Fibre Channel (Continued)

RDPAT	Comments: • 1G/2G/4G FC
JTPAT	Comments: • 1G/2G/4G FC
SNPAT	Comments: • 1G/2G/4G FC
A seed	Comments: • 10G/16G FC
B seed	Comments: • 10G/16G FC
PRBS31	Comments: • 10G/16G FC

Layer 2 Test Patterns	
CRPAT	Comments: • 1G/2G/4G/8G FC
CJPAT	Comments: • 1G/2G/4G/8G FC
CSPAT	Comments: • 1G/2G/4G/8G FC

PRBS Payload Patterns	
2^31-1, 2^23-1, 2^20-1, All Ones, All Zeroes	
Scrambling (on/off)	Comments: • 8G FC In FC-1 on total frame
Emissions Lowering Protocol (on/off)	Comments: • 8G FC
Emissions Lowering Protocol Type (Idle-ARBff, ARBff-ARBff)	
Incoming FEC (32G)	Comments: • Find and fix errors, Find but don't fix errors, ignore
Disable Hi SER Alarm (32G)	Comments: • off, on

Fibre Channel Generator	
Frame Length	
28 (no payload), 32, 76 (ATP), 128, 256, 512, 1024, 1536, 2076, 2140 settings	
User defined (28 to 2140)	
Fibre Channel Fields	
Unicast or Broadcast	
Destination ID	
Source ID	
Sequence ID	
Originator ID	
Responder ID	
FC Frame Payload	
BERT/PRBS Pattern	
Acterna Test Protocol Version 2	
Auto-traffic start on laser on	
Traffic Generator	
Traffic Profiles	
Traffic generation in Mbit/s and % utilization	
Constant B/W	

Burst B/W	
Ramp B/W	
Flood B/W	Comments: • Full line rate
Constant B/w	
Bit Rate	
Percentage	
Burst B/w	
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	
Continuous or fixed (up to 65535) bursts	
Ramp B/w	
Timed Step (0.1 sec granularity)	
Load Step (%)	
Stop load incr conditions	
Errored Frames (count parameter)	
Dropped Frames (count parameter)	

Flow Control Login	
General	
Flow Control (on/off)	
Login	
Implicit	
Explicit (E-port)	
Explicit (Fabric/N-port)	
Buffer-to-Buffer Credits	
MAC ID	
Unit Identifier	
Port Name	
Fabric/N_Port Login	
Topology (Fabric, Point-to-Point)	
Source N-port Name	
Source Node Name/Source ID	
Dest N-port Name	
Dest Node Name/Dest ID	

Traffic Filtering	
Routing Control	
Destination ID	
Source ID	
Data Type	
Sequence Control	

Fibre Channel (Continued)

Data	
BERT Rx=Tx	
Payload Analysis	
Rx BERT Pattern	
Injection/Detection	
Errors	
Code	Comments: · Single/Rate (10 ⁻³ to 10 ⁻⁹)
CRC	Comments: · Single/Burst (up to 32767)
Bit Error (PRBS)	Comments: · Single/Rate (10 ⁻³ to 10 ⁻⁹)
RS-FEC Uncorr CW (32G)	Comments: · Single/Burst (up to 512)/Rate (10 ⁻² to 10 ⁻⁹)
RS-FEC Corr CW (32G)	Comments: · Single/Burst (up to 512)/Rate (10 ⁻² to 10 ⁻⁹)
Faults	
Local Fault (10G)	
Remote Fault (10G)	
Alarms	
HI SER (32G)	
Results	
Custom results	
LEDS	
Signal Present	
RS-FEC LOA (32G)	
RS-FEC HI SER (32G)	
Sync Acquired	
Link Active	
ATP Detect	
Pattern Sync	
Local Fault (10G)	
Remote Fault (10G)	
SLA/KPI	
Frame Loss (count & ratio)	
Round Trip Delay/FD (average, current, maximum)	
Event Log (Event, Date, Start & Stop time, Duration/Value)	
Histogram	
Optical Rx Overload	
Signal Loss	
Link Loss	
Timing Src Loss	
Sync Loss	
Local Fault (10G/16G)	
Remote Fault (10G/16G)	
Code Violation	

Runts
Jabbers
Undersized Frames
CRC errored frames
Errored Frames
Lost frames
OoS Frames
EB (PCS)
BSL (PCS)
Bit Errors (PRBS)
Acternal Payload Errors
Time
Current Date, Current Time, Test Elapsed Time
Interface
Signal Losses
Signal Loss Seconds
Sync Loss Seconds
Link Loss Seconds
Optical Rx Overload
Tx Clock Source
Local Fault Seconds (10G/16G)
Remote Fault Seconds (10G/16G)
L2 Link Statistics
Total Utilization % (avg, current, min, peak)
Frame Rate (avg, current, min, peak)
Frame Size (Avg, Min, Max)
Rx Mbps (L1, L2)
Tx Mbps (L1, L2)
Round Trip Delay (us) (Avg, current, min, max)
Service Disruption (us)
ELP Mismatch Link Active
L2 Link Counts
Rx Frames
Tx Frames
Rx Acterna
Tx Acterna Frames
28-64 Byte Frames
68-124 Byte Frames
128-252 Byte Frames
256-508 Byte Frames
512-1020 Byte Frames
1024-2140 Byte Frames
Rx Frame Bytes
Tx Frame Bytes
Rx R_RDYs
Tx R_RDYs

Fibre Channel (Continued)

Near-end B-B Credits
Tx Avail B-B Credit, Current
Class F Frames
Class 1 Frames
Class 2 Frames
Class 3 Frames
L2 Filtered counts/statistics
Bert Stats
Pattern Losses
Pattern Loss Seconds
Bit Error Rate
Bit Errors
Bit Errored Seconds
Bit Error-Free Seconds
Bit Error-Free Seconds (%)
Login status
Login Status
Tx/Rx ELP Request
Tx/Rx ELP Accept
Tx/Rx ELP Ack1
Fabric Present
Fabric Login Status
F Port Name
Fabric Name
N Port Login Status
Dest N Port ID
Dest N Port Name
Dest Node Name
Source N Port ID
Source N Port Name
Source Node Name
RS-FEC
LOA Alarm
LOA Seconds
HI SER Alarm
HI SER Seconds
Corr. CW Errors
Corr. CW Error Rate
Corr. Bit Errors
Corr. Bit Error Rate
Uncorr. CW Errors
Uncorr. CW Error Rate
Corr+Uncorr Bit Error Rate
Error Stats
Symbol Errors
CRC Errored Frames

Fibre Runts
Fibre Jabbers
Undersized Frames
Errored Frames
Code Violations
Code Violation Rate
Code Violation Seconds
Graphical Displays
Throughput versus Time
Frame Loss versus Time
Latency/FD (RTD) versus Time
Errors versus Time
CRC Errored Frames
Fibre Runts
Fibre Jabbers
Bit Errors
OoS Frames
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
Total Test Time Display

PDH

Test Interfaces
E4 (140Mbps)
DS3 (44.736Mbps)
E3 (34Mbps)
E1 Balanced (2.048Mbps)
E1 Unbalanced (2.048Mbps)
DS1 (1.544Mbps)
Interface Type
BNC
Bantam
RJ-48
Modes Of Operation
Terminate
Monitor
Thru (Intrusive)
Timing
Recoverd from Rx
Internal (Stratum 3)
Recoverd from External (BITs/SETs)
Framing
Framed
Unframed
Test Patterns
2 ¹⁵ -1* (Inverse)
2 ²⁰ -1* (Inverse)
2 ²³ -1* (Inverse)
User Programmable
Round Trip Delay
ANSI and ITU
Mappings
E3
E1
64k
Anomaly/Error Insert/Analysis
Frame Errors
TSE/Bit Error
Single
Rate
Defect/Alarm Insert/Analysis
AIS
RDI/FAS Distant
General
Frequency Offset +/- 100ppm
National Bit Support
Performance Measures
G.821 (OOS)

G.826 (ISM/OOS)
M.2100 (ISM/OOS)
Results
Signal Category
Receive Frequency
Receive Frequency Deviation
Receive Frequency Max Deviation
Transmit Frequency
Round Trip Delay
Frame Category
FAS TSE Count
FAS TSE Rate
FAS Word Error Count
FAS Word Error Rate
Frame Synchronization Loss Count
Frame Synchronization Loss Seconds
Logic Category
TSE/Bit Error Count
TSE/Bit Error Rate
Pattern Slips
Pattern Slip Seconds
Pattern Synchronization Loss Count
Pattern Synchronization Loss Seconds
DS3
Modes Of Operation
Terminate
Monitor
Thru (Intrusive)
Timing
Recoverd from Rx
Internal (Stratum 3)
Recoverd from External (BITs/SETs)
Framing
M13
Cbit
Unframed
Test Patterns
All 1s
All 0s
2 ¹⁵ -1* (Inverse)
2 ²⁰ -1* (Inverse)
2 ²³ -1* (Inverse)
Round Trip Delay
User Programmable (3,,,32 bits)
User Byte
100

PDH (Continued)

1100 (aka IDLE)	
1010 (aka BLUE)	
ANSI and ITU	
Mappings	
E1	
T1	
64k	
Anomaly/Error Insert/Analysis	
BPV/Code Error	
Frame	
Parity	
C-Bit Parity	
TSE/Bit Error	
Single	
Rate	
Multiple	
Defect/Alarm Insert/Analysis	
AIS	
RDI/FAS Distant	
REBE	
TS-16 AIS	
TS-16 RDI/MFAC Distant	
General	
Frequency Offset +/- 100ppm	
Loop Codes Tx NIU, CSU, Line	Comments: · FEAC Loopcodes
Rx Compensation - High - 0 ft	
Rx Compensation - Low - 450 ft	
Rx Compensation - Low - 900 ft	
Service Disruption	Comments: · Frame Sync
Performance Measures	
G.826 (ISM/OOS)	
G.821	
M.2100	
M.2101	
T1.231	
T1.510	
Results	
Signal Category	
Receive Frequency	
Receive Frequency Deviation	
Receive Frequency Maximum Deviation	
Transmit Frequency	
BPV/Code Rate	
BPV/Code Count	
Electrical Input Level	

Round Trip Delay (ms)
Frame
Frame Error Count
Frame Error Rate
Frame Error Seconds
Frame Synchronization Loss Count
Near End Out of Frame Seconds
Far-End Out of Frame Seconds
C-Bit Format
RX X-Bits
FEAC Word
Parity Error Count
Parity Error Rate
Parity Error Seconds
C-Bit Parity Error Count
C-Bit Parity Error Rate
C-Bit Error Seconds
FEBEs
DS2 Frame Synchronization Loss Count
Logic
Bit Error/TSE Count
Bit Error/TSE Rate
Pattern Slips
Pattern Slip Seconds
Pattern Synchronization Loss Count
Pattern Synchronization Loss Seconds
Pattern Synchronization Status
E3
Modes Of Operation
Terminate
Monitor
Thru (Intrusive)
Timing
Recoverd from Rx
Internal (Stratum 3)
Recoverd from External (BITS/SETs)
Framing
Framed
Unframed
Test Patterns
All 1s
All 0s
2047
2 ¹¹⁻¹ * (Inverse)
2 ¹⁵⁻¹ * (Inverse)

PDH (Continued)

2 ²⁰⁻¹ * (Inverse)
2 ²³⁻¹ * (Inverse)
User Programmable (3,32 bits)
User Byte
Round Trip Delay
1:1
1:3
1:4
1:7
ANSI and ITU
Mappings
E1
64k
Anomaly/Error Insert/Analysis
Code Error
FAS Error
TSE/Bit Error
Single
Rate
Defect/Alarm Insert/Analysis
AIS
RDI/FAS Distant
General
Frequency Offset Tx +/- 100ppm
Tx LBO - 0 dB Loss
Tx LBO - 6 dB Loss
National Bit Support - On/Off
Service Disruption
Performance Measures
G.826 (ISM/OOS)
G.821
M.2100
Results
Signal Category
Transmit Frequency
Receive Frequency
Receive Frequency Maximum Deviation
Electrical Input Level
Code Error Count
Code Error Rate
Round Trip Delay (ms)
APS Switch Time (ms)
Frame Category
FAS Bit Error Count
FAS Bit Error Rate
FAS Word Error Count

FAS Word Error Rate
Frame Synchronization Loss Count
8M FAS Word Error Rate
8M FAS Bit Error Count
8M FAS Bit Error Rate
8M FAS Word Error Count
8M FAS Word Error Rate
Logic Category
TSE/Bit Error Count
TSE/Bit Error Rate
Pattern Slips
Pattern Slip Seconds
Pattern Synchronization Loss Count
Pattern Synchronization Loss Seconds
Pattern Synchronization Status
E1
Modes Of Operation
Terminate
Monitor
Thru (Intrusive)
Timing
Recoverd from Rx
Internal (Stratum 3)
Recoverd from External (BITS/SETs)
Framing
Unframed
PCM30
PCM30C
PCM31
PCM31C
Test Patterns
All 1s
All 0s
2 ¹⁵⁻¹ * (Inverse)
2 ²⁰⁻¹ * (Inverse)
2 ²³⁻¹ * (Inverse)
QRSS
User Programmable (32 bits)
Round Trip Delay
1:1
1:3
1:4
1:7
ANSI and ITU

PDH (Continued)

Mappings	
64k	
Anomaly/Error Insert/Analysis	
Code Error	
FAS Error	
MFAS Error	
TSE/Bit Error	
Single	
Multiple	
Rate	
Defect/Alarm Insert/Analysis	
AIS	
REBE	
TS-16 AIS	
TS-16 RDI/MFAS Distant	
General	
Frequency Offset Tx +/- 100ppm	
Service Disruption	Comments: · Frame Sync
Performance Measures	
G.826 (ISM/OOS)	
G.821	
G.829 (ISM/OOS)	
M.2100	
Results	
Signal Category	
2M Receive Frequency	
2M Reference Frequency	
2M Receive Frequency Deviation	
2M Receive Frequency Maximum Deviation	
2M Transmit Frequency	
Electrical Input Level	
Code Error Count	
Code Error Rate	
Round Trip Delay (ms)	
Timing Slips	
Frame Slips	
APS Switch Time	
Logic Category	
TSE/Bit Error Count	
TSE/Bit Error Rate	
Pattern Slips	
Pattern Slip Seconds	
Pattern Synchronization Loss Count	
Pattern Synchronization Status	
Alarm Category	

FAS/Frame Synchronization
MFAS Synchronization
CRC Synchronization
AIS
RDI
Power Loss Count
2M Alarm
Frame Category
FAS Bit Error Count
FAS Bit Error Rate
FAS Word Error Count
FAS Word Error Rate
Non-Frame Alignment Word
MFAS Word Error Count
MFAS Word Error Rate
Time Slot Rx Byte
CRC Error Count
CRC Error Rate
CRC Synchronization Loss Count
FAS Synchronization Loss Count
MFAS Synchronization Loss Count
Remote End Block Error (REBE)
T1
Modes Of Operation
Terminate
Monitor
Thru (Intrusive)
Timing
Recoverd from Rx
Internal (Stratum 3)
Recoverd from External (BITS/SETs)
Framing
Unframed
SF
ESF
SLC-96
Test Patterns
63
511
511 QRSS
2047 QRSS
2047
All 1s
All 0s
2 ^{^15-1*} (Inverse)

PDH (Continued)

2 ²⁰⁻¹ * (Inverse)
2 ²³⁻¹ * (Inverse)
QRSS
User Programmable (3,32 bits)
User Byte
BridgeTap
MultiPat
Round Trip Delay
1:1
1:3
1:4
1:7
2 in 8
3 in 24
MIN/MAX
T1 DALY
55 OCTET
T1-2/96
T1-3/54
T1-4/120
T1-5/53
Mappings
64k
56k
Anomaly/Error Insert/Analysis
Frame Errors
BPV Errors
TSE/Bit Error
Single
Rate
Multiple
Defect/Alarm Insert/Analysis
AIS
REBE
General
Frequency Offset Tx +/- 100ppm
Performance Measures
G.826 (ISM/OOS)
G.828 (ISM/OOS)
G.829 (ISM/OOS)
M.2100
T1.231
Tx LBO - 0 dB Loss
Tx LBO - 7.5 dB Loss
Tx LBO - 15 dB Loss
Tx LBO - 22.5 dB Loss

Service Disruption
Loop Codes
Loop Code Tx - NIU
Loop Code Tx - CSU
Loop Code Tx - Repeater
Loop Code Emulation - NIU
Loop Code Emulation - CSU
HDSL Loopcode Tx
CO to Customer direction
Customer to CO direction
User Defined Loopcode Support
Results
Signal Category
Receive Frequency
Reference Frequency
Receive Frequency Deviation
Receive Frequency Maximum Deviation
Transmit Frequency
Simplex Current
Receive Level (Vp)
Receive Level (dBdsx)
Receive Level (dBm)
BPV Error Count
BPV Error Rate
Frame Slip Count
Signal Loss Count
Signal Loss Seconds
Round Trip Delay (ms)
Timing Slips
Frame Slips
APS Switch Time
Frame Category
Frame Error Count
Frame Error Rate
Frame Error Seconds
Frame Loss Count
Frame Loss Seconds
Severely Errored Seconds
CRC Error Count
CRC Error Rate
CRC Errored Seconds
CRC Severely Errored Seconds
Logic Category
Bit Error/TSE Count
Bit Error/TSE Rate
Bit Error/TSE Seconds

PDH (Continued)

Pattern Slips	
Pattern Slip Seconds	
Pattern Synchronization Loss Count	
Pattern Synchronization Loss Seconds	
Channel	
DSO Channel Payload View	Comments: · View the data in all 24 embedded channels.
ABCD Bit Signaling View	
DS1 Dual HDLC Monitor and PPP Ping	
Modes of Operation	
Bridge	
Terminate	
DSX Monitor	
Line Code	
B8ZS	
AMI	
Clock Source (PPP Ping Only)	
Internal	
Recovered	
External	
Selectable Clock Offset	
Transmit LBO (PPP Ping Only)	
0 dB	
-7.5 dB	
-15.0 dB	
-22.5 dB	
Framing	
Unframed	
ESF	
D4 (SF)	
SLC-96	
Payload	
Bulk	
Fractional Rate	
HDLC	
Normal or Inverted HDLC Mode	
CRC16 or CRC32	
PPP (PPP Ping Only)	
PPP Mode (Client or Server)	
IP Mode (Static or Auto)	
Optional Authentication	
IP (PPP Ping Only)	
IPv4 Frame Format	
Local IP	
Remote IP	
Destination IP Address - User Defined	

Subnet Mask
Preferred & Alternate DNS Server
IPv4 Editable Fields
ToS
DSCP
TTL
IP Ping
Editable Packet Length (46 - 1500 bytes)
Single
Multiple
Continuous
Fast
Alarms/Errors Generation and Analysis (PPP Ping Only)
LOS
LOF
AIS
RAI
BPV
Frame
Results
Interface
Signal Losses
Signal Loss Seconds
Rx Level (Vpp)
Rx Level (dBsx)
Rx/Tx Frequency (Hz)
Rx/Tx Frequency Deviation (ppm)
Rx/Tx Frequency Max Deviation (ppm)
Bi-Polar Violations (BPVs)
BPV Rate
Excess Zeros State Count
Ones Density State Count
DS1
Frame Sync Losses
Frame Sync Loss Seconds
AIS Alarms
AIS Seconds
T1 Alarm Seconds
Frame Errors
Frame Error Rate
Frame Error Seconds
Excess Zeros
Maximim Consecutive Zeros
HDLC
Rx/Tx Frame Count
Rx/Tx Octet Count

PDH (Continued)

Frame Aborts
Short Frames
FCS Errored Frames
Percent Utilization (Average, Current, Maximim)
Throughput (Average, Current, Maximim)
Average Fame Rate (frames/sec)
Average Frame Size (octets)
PPP (PPP Ping Only)
PPP Status
Local IP
IP Subnet Mask
Remote IP
Preferred & Alternate DNS Server
Destination IP Address
Resolved Host Name
Ping (PPP Ping Only)
Ping Requests Tx
Ping Replies Rx
Lost Pings
Lost Ping %
Delay (ms)
Ping Requests Rx
Ping Replies Tx
Capture/Decode
Wirespeed Capture
Integrated Wireshark on the TestSet
256MB Capture Buffer
Triggers
Frame Slicing
DS3 HDLC Dual Monitor
Modes of Operation
DSX-MON
Terminate
Framing
Unframed
M13
C-Bit
HDLC
Normal or Inverted HDLC Mode
CRC16 or CRC32
Results
Interface
Signal Losses
Signal Loss Seconds
Rx Level (Vpeak)
Rx Level (dBdsx)

Rx Frequency (Hz)
Rx Frequency Deviation (ppm)
Rx Frequency Max Deviation (ppm)
Bi-Polar Violations (BPVs)
BPV Rate
BPV Error Seconds
Excess Zeros Count
Excess Zeros Seconds
DS3
Frame Sync Losses
Frame Sync Loss Seconds
Near End OOF Seconds
Far End OOF Seconds
AIS Seconds
RAI Seconds
FEAC Word
Frame Errors
Frame Error Rate
Parity Errors
Parity Error Bit Rate
C-Bit Errors
C-Bit Error Rate
C-Bit Error Seconds
C-Bit Frame Mismatch Seconds
C-Bit Sync Loss Seconds
FEBEs
FEBE Rate
FEBE Seconds
Rx X-Bits
HDLC
Rx Frame Count
Rx Octet Count
Frame Aborts
Short Frames
FCS Errored Frames
Percent Utilization (Average, Current, Maximim)
Throughput (Average, Current, Maximim)
Average Fame Rate (frames/sec)
Average Frame Size (octets)

Jitter

General Features
Generate and measure Jitter
on electrical interfaces: DS1 & E1
Automatic Measurement Sequences
Maximum Tolerable Jitter (MTJ)
Measure Intrinsic Jitter
Jitter Transfer Function (JTF)
Support different Measurement Bands
High Band
Wide Band
Extended Band
Ability to set user definable band
Common Jitter mask selectable
Ability to create user definable masks
Results
Jitter Results per measurement band
Current peak to peak jitter [UI]
Peak to peak jitter [UI]
Positive peak jitter [UI]
Negative peak jitter [UI]
Maximum peak to peak jitter [UI]
Peak to peak jitter [UI]
Positive peak jitter [UI]
Negative peak jitter [UI]
Phase Hits
Percentage of mask
RMS Jitter [UI]
Jitter Graphs

CPRI

Test Interfaces/Bit Rates
614 Mbps Optical - Option 1
Dual Port Capable
1.2 Gbps Optical - Option 2
Dual Port Capable
2.4 Gbps Optical - Option 3
Dual Port Capable
3.1 Gbps Optical - Option 4
Dual Port Capable
4.9 Gbps Optical - Option 5
Dual Port Capable
6.1 Gbps Optical - Option 6
Dual Port Capable
9.8 Gbps Optical - Option 7

Dual Port Capable
10.137G Gbps Optical - Option 8
Dual Port Capable
Laser Type
SFP
SFP+
SFP+ Tuneable
SFP28
Modes Of Operation
Terminate
Monitor/Thru
Timing
Recoverd from Rx (Slave)
Internal (Stratum 3) (Master)
Recoverd from External (BITS/SETs) (Master)
Recoverd from 10MHz clock (Master)
CPRI Features
Optical/Electrical Power Level
Comments: · List Accuracy
Freq Offset Transmit/Receive
CPRI Startup Sequence - Normal or Bypass
Signal Generation and Monitoring
L1 - PRBS Pattern Inserted in Hyperframe Structure
L2 - PRBS Pattern Inserted in CPRI Basic Frame
L2 - PRBS Pattern Inserted in CPRI Antenna-carrier (AxC) Group
L2 Test Waveform Inserted in CPRI Antenna-carrier (AxC) Group
Interface Type
Master
Slave
Selectable CPRI Protocol Verion
Control and Management (C&M) Channel
Ethernet
HDLC
Selectable C&M Channel Rate
Service Disruption Measurements
SD Seperation/Debounce Time Setting
SD Threshold Time Settings
Round Trip Delay Measurement
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
Delay
Live
Digital Word
ANSI and ITU implementations

CPRI (Continued)

Anomaly/Errors generation
Bit/TSE
Code
K30.7
Running Disparity
Insert - Single
Insert - Rate
CPRI AxC Mapping
Mapping Method: Method 1
Sample Width
Bandwidth
AxC Group Number
Offset
Test Waveform Selections
Continuous Wave (CW)
LTE-FDD TM1.1
LTE-FDD TM1.2
LTE-FDD TM2
LTE-FDD TM3.1
LTE-FDD TM3.2
LTE-FDD TM3.3
Defects/Alarms generation/analysis
LOS
LOF
SDI
RAI
Results
Results Accuracy
1ns
Signal Category
Signal Losses
Sync Loss Seconds
Optical Rx Overload
Optical Rx Level (dBm)
Receive Frequency
Receive Frequency Deviation
Receive Frequency Maximum Deviation
Transmit Frequency
Tx Frequency Deviation (Hz)
Tx Frequency Deviation (ppm)
Tx Frequency Max Deviation (ppm)
CPRI CPRI Inband Protocol
Tx/Rx Protocol Version
Tx/Rx C&M HDLC Rate
Tx/Rx C&M Ethernet Subchannel Number
Port Type (Master/Slave)

Start-up State
CPRI Counts
Code Word Count Tx/Rx
Frame Count Tx/Rx
Error Stats
Word Sync Loss Events
Word Sync Loss Seconds
Code Violations
Code Violation Rate
Code Violation Seconds
K30.7 Words
Frame Sync Loss Events
Frame Sync Loss Seconds
Pattern Sync Losses
Pattern Sync Loss Seconds
Bit Error Rate
Bit Errors
Errored Seconds
Error-Free Seconds
Error Free Seconds, %
Total bits Received
Round Trip Delay Current (ms)
Round Trip Delay Average (ms)
Round Trip Delay Minimum (ms)
Round Trip Delay Maximum (ms)
Remote LOS
Remote LOS Seconds
Remote LOF
Remote LOF Seconds
RAI
RAI Seconds
SDI
SDI Seconds
Running Disparity Errors
Running Disparity Error Rate

Wander

General Features	
Measure Wander on 1PPS Signal	Comments: Use Ext Clk input and Multi Access timing adapter 22035030 or Precision Timing Reference Module
Measure Wander on 1G Optical SyncE Interface	
Measure Wander on T1, E1, & unframed 2.048 MHz Signals	Comments: O.171
Measure Wander on 10 MHz Signal	
Selectable Peak Time Offset Threshold	
Resolution 1 ns	
Sample Rate 1, 30, 60 samples per second	
Internal Data Storage - 256M	
External Data Storage on USB stick	
Start Stop via key	
Results	
Time Interval Error (TIE)	
Current TIE [s]	
Maximum TIE [s]	
Minimum TIE [s]	
Maximum Peak-to-Peak TIE (MTIE) [s]	
Offset Between Test Signal and Reference	
Current Offset [μs]	
Minimum Offset [μs]	
Maximum Offset [μs]	
Pass/Fail Result	
TIE Graph	
Reference Clock for 1pps wander: 1pps reference signal	Comments: Use Ext Clk input and Multi Access timing adapter 22035030 or Precision Timing Reference Module
Reference Clock for 1G SyncE Optical, T1, E1, 2 MHz, & 10 MHz wander: 2MHz or 10 MHz reference signal	Comments: Use Ext Clk input and Multi Access timing adapter 22035030 or Precision Timing Reference Module
Cables for 1pps Wander	
Wander Analysis Tool	
Offline analysis of captured/imported TIE measurements	
Maximum Peak-to-Peak TIE (MTIE) [s]	
TDEV (Time Deviation)	Comments: for GigE Optical; compliant to O.174, Available in wander analysis tool; not available on 1PPS signal

Frequency Offset (ppm)	
Drift Rate (ppm/s)	
Masks	
ANSI	Compliance: SMC Holdover (T1.105.109)
ETSI	Compliance: SEC (ETS 300 462-5-1)
	Compliance: SEC Netw. IF (ETS 300 462-3-1)
	Compliance: SSU (ETS 300 462-4-1)
	Compliance: SSU Netw. IF (ETS 300 462-3-1)
GR253	Compliance: SMC Transient
ITU	Compliance: G.8261
	Compliance: SEC Netw. IF (G.832, G.825)
	Compliance: SEC Opt. 1 (G.813)
	Compliance: SEC Opt. 2 (G.813)
	Compliance: SEC Hold. Opt. 2 (G.813)
	Compliance: SEC Trans. Opt. 2 (G.813)
	Compliance: SSU Netw. IF (G.823, G.825)
	Compliance: SSU Type I (G.812)
	Compliance: SSU Type II, III (G.812)
	Compliance: SSU Type IV (G.812)
	Compliance: PRC (G.811)
	Compliance: EEC-1 Noise Generation (G.8262 constant temp.)
	Compliance: EEC-1 Noise Generation (G.8262 with temp. effects)
	Compliance: EEC-2 Noise Generation (G.8262 constant temp.)
	Compliance: EEC-1 Noise Tolerance (G.8261)
	Compliance: EEC-1 Noise Tolerance (G.8262)
	Compliance: PRC (G.811)

	Compliance: • DTE Network Limit (G.8271.1)
	Compliance: • Wander Generation (G.8272)
	Compliance: • DTE Noise Generation (G.8273.2 constant temp.)
	Compliance: • DTE Noise Generation (G.8273.2 variable temp.)
Masks	
PRC/SSU/SEC: Masks for G.811/G.812/G.813 clocks (ETS 300 462-2)	
Networks: According to G.823/G.824	
SyncE: According to G.8261, G.8262	
ANSI-Standard: DS1 masks	

Services

Triple Play Automated Test Script
10/100/1000M Electrical Ethernet Interfaces
1GigE Optical Ethernet Interface
10GigE Optical Ethernet Interface
Over 11,000 simulated calls with configurable Codec and sampling rate
Configurable voice call or tone with configurable silence suppression, sampling rate and jitter buffer
up to 250 simulated SDTV channels with configurable frame size and MPEG-2/4 compression
up to 52 simulated HDTV channels with configurable frame size and MPEG-2/4 compression
2 configurable data streams with individual constant or ramp traffic and configurable frame sizes including random frames
Primary Rate T1 ISDN
Test Access - T1
TE Emulation
NT Emulation
D-Channel Signaling Decodes
Call Control - National
Call Control - 5ESS
Call Control - NI-1
D-Channel Rate - 64k
D-Channel Rate - 56k
Call Type - Data
Call Type - Voice
Call Type - 3.1k Audio
Channel Number - 1 to 24
D-Channel Rate - 56k
DTMF Digits

Primary Rate E1 ISDN
Test Access - E1
TE Emulation
NT Emulation
Codec μ -law, A-law
Call Controls - 1TR6, 1TR67, EDSS-1, VN3, VN4, VN6, TPH1962, Q.SIG, Q.931, TN-1R6, SwissNet-3, CorNet-N, CorNet-NQ, DREX, Alcatel Q.SIG
D-Channel Signaling Decodes
Services - Speech, 3.1 KHz, Data, Fax G4, Teletex, Videotex, Speech BC, Data BC, Data 56Kb, Fax 2/3
Channel Number - 1 to 31
DTMF Digits
Signaling - Place/Receive Call
Test Access - T1
E&M Signaling
Loop Start Signaling
Ground Start Signaling
Audio Drop/Insert
Signaling Bits
Place Call
Receive Call
MF Digits
DTMF Digits
Event Log
VF Tone Insertion
Fractional T1/E1
Test Access - T1
Fractional T1 - n x 64k
Fractional T1 - n x 56k
Contiguous Channels
Non Contiguous Channels
V.54 Loop Codes Support

Services (Continued)

Voice Frequency
Test Access - T1
Listed to an Audio Call
Insert VF Tones
404 Hz
1004 Hz
1804 Hz
2713 Hz
2804 Hz
User Frequency
Quiet Tone
Holding Tone
Three Tone
Frequency Sweep
Impulse Noise
Rx Frequency
Level (dBm)
DC Offset mV

Fibre Inspection

Optical Fiber Microscope
Accepts an optical video microscope with autofocus capability
Microscope connector image displayed on the Test Equipment and saved into a .JPEG file format.
Microscope offer a switchable 200/400x magnification capabilities
Microscope provided with the dedicated tips to connect to the patch panel or directly to the connector ferrule
Capable of automatically centering the fiber image
Capable of performing on-board Pass/Fail analysis
Compatible with Android tablets/smartphones
Microscope supports MPO connectors

OTDR

OTDR Solution for Troubleshooting from Central Offices
Wavelengths: 1310 & 1550nm
Connector type: UPC or APC (Note: Only one should be selected)
Adapter type: FC or SC (Note: Only one should be selected)
Dynamic Range:
at 1310nm: 35dB
at 1550nm: 33dB
Event Dead Zone:
at 1310nm/1550nm: 1.5m maximum
Attenuation Dead Zone:
at 1310nm/1550nm: 6m maximum
Pulse width: 5ns to 20ms
Number of data points: up to 128,000
Light source:
On the OTDR port
Wavelength: same as the OTDR
Output power: -3.5 dBm typical
Test results shall be stored in SOR format (Telcordia GR-196-CORE) as well as in PDF format
The test result page shall display the graphical OTDR trace and event table
The test solution shall be able to convert automatically the OTDR trace into an icon-based map that makes OTDR results interpretation quick and easy
OTDR Solution for FTTA & DAS Singlemode & Multimode Network Testing
Wavelengths: 850, 1300, 1310, 1550 nm
Connector type: UPC or APC for 1310nm/1550nm (Note: Only one should be selected) and UPC for 850/1300nm
Adapter type: FC, SC, LC or ST (Note: One or several can be selected)
Dynamic Range:
at 850nm: 26 dB
at 1300nm: 24 dB
at 1310nm: 37 dB
at 1550nm: 35 dB
Event Dead Zone:
at 850nm/1300nm: 0.8m maximum
at 1310nm/1550nm: 0.9m maximum
Attenuation Dead Zone:
at 850nm/1300nm: 4m maximum
at 1310nm/1550nm: 4m maximum
Pulse width:
at 850nm/1300nm: 3ns to 1ms
at 1310nm/1550nm: 3ns to 20µs
Number of data points: up to 128,000
Light source:
On the OTDR port
Wavelength: same as the OTDR

OTDR (Continued)

Output power: -3.5 dBm typical
Power meter:
On the OTDR port
Calibrated wavelengths: 850, 1300, 1310, 1490, 1550, 1625, 1650 nm
Power level range (MM/SM): -3 to -30dBm / -2 to -50 dBm
The test result page shall display the graphical OTDR trace and event table
The test solution shall be able to convert automatically the OTDR trace into an icon-based map that makes OTDR results interpretation quick and easy
The test solution shall be able to identify and label network elements
OTDR Solution for Cloud RAN & Access/Backhaul Network Testing
Wavelengths: 1310, 1550, 1625 nm (Note: 1625nm is optional)
Connector type: UPC or APC (Note: Only one should be selected)
Adapter type: FC, SC, LC or ST (Note: One or several can be selected)
Dynamic Range:
at 1310nm: 40 dB
at 1550nm: 38 dB
at 1625nm : 37 dB
Event Dead Zone:
at 1310/1550/1625nm: 0.9m maximum
Attenuation Dead Zone:
at 1310/1550/1625nm: 4m maximum
Pulse width: 3ns to 20ms
Number of data points: up to 128,000
Light source:
On the OTDR port
Wavelength: same as the OTDR
Output power: -3.5 dBm typical
Power Meter:
On the OTDR port
Calibrated wavelengths: 1310, 1490, 1550, 1625, 1650 nm
Power level range: 0 to -50 dBm
The test result page shall display the graphical OTDR trace and event table
The test solution shall be able to convert automatically the OTDR trace into an icon-based map that makes OTDR results interpretation quick and easy

OTDR Solution for Metro & Access/Backhaul Network Testing
Wavelengths: 1310, 1550, 1625 nm (Note: 1625nm is optional)
Connector type: UPC or APC (Note: Only one should be selected)
Adapter type: FC, SC, LC or ST (Note: One or several can be selected)
Dynamic Range:
at 1310nm: 43 dB
at 1550nm: 43 dB
at 1625nm : 41dB
Event Dead Zone:
at 1310/1550/1625nm: 0.8m maximum
Attenuation Dead Zone:
at 1310/1550/1625nm: 4m maximum
Pulse width: 3ns to 20ms
Number of data points: up to 256,000
Light source:
On the OTDR port
Wavelength: same as the OTDR
Output power: -3.5 dBm typical
Power Meter:
On the OTDR port
Calibrated wavelengths: 1310, 1490, 1550, 1625, 1650 nm
Power level range: 0 to -50 dBm
The test result page shall display the graphical OTDR trace and event table
The test solution shall be able to convert automatically the OTDR trace into an icon-based map that makes OTDR results interpretation quick and easy
OTDR Solution for CWDM Network Testing
8 CWDM wavelengths should be available on 1 optical port
Wavelengths:1471, 1491, 1511, 1531, 1551, 1571, 1591, 1611nm
Connector type: UPC or APC (Note: Only one should be selected)
Adapter type: FC, SC or LC (Note: One or several can be selected)
Dynamic Range: 35dB
Event Dead Zone:
at 1310/1550/1625nm: 1.5m maximum
Attenuation Dead Zone:
at 1310/1550/1625nm: 5m maximum
Pulse width: 10ns to 20ms
Number of data points: up to 256,000
Light source:
On the OTDR port
Wavelength: same as the OTDR
Output power: -3.5 dBm typical
The test result page shall display the graphical OTDR trace and event table
The test solution shall be able to convert automatically the OTDR trace into an icon-based map that makes OTDR results interpretation quick and easy

Optical Spectrum Analyzer

Optical Spectrum Analyzer Solution for Mobile Backhaul Service Activation	
Connector type: PC	
Adapter type: FC, SC, LC or ST (Note: One or several can be selected)	
Spectral measurement	
Wavelength range: From 1260 to 1625 nm	
Wavelength accuracy: ± 0.5 nm	
Readout resolution: 0.001nm	
Resolution bandwidth FWHM: 4nm	
Minimum channel spacing: 8 nm	
Power measurement	
Dynamic range: -55 to +10 dBm	
Noise floor RMS -55 dBm	
Absolute accuracy: ± 0.5 dB	
Linearity: ± 0.1 dB	
Readout resolution: 0.01 dB	
Scanning time (1260 to 165 nm): <4 sec	
Maximum total safe power: +15 dBm	
Optical return loss: > 35 dB	
The Optical Spectrum Analyzer shall be equipped with a bay for up to 2 SFPs (optional)	

Precision Timing Reference

Optical Spectrum Analyzer Solution for Mobile Backhaul Service Activation	
Connector type: PC	
Adapter type: FC, SC, LC or ST (Note: One or several can be selected)	
Spectral measurement	
Wavelength range: From 1260 to 1625 nm	
Wavelength accuracy: ± 0.5 nm	
Readout resolution: 0.001nm	
Resolution bandwidth FWHM: 4nm	
Minimum channel spacing: 8 nm	
Power measurement	
Dynamic range: -55 to +10 dBm	
Noise floor RMS -55 dBm	
Absolute accuracy: ± 0.5 dB	
Linearity: ± 0.1 dB	
Readout resolution: 0.01 dB	
Scanning time (1260 to 165 nm): <4 sec	
Maximum total safe power: +15 dBm	
Optical return loss: > 35 dB	
The Optical Spectrum Analyzer shall be equipped with a bay for up to 2 SFPs (optional)	

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