Data Sheet

VIAVI T-BERD®/MTS-5800 Specifications

Platform

<table>
<thead>
<tr>
<th>Platform Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>The mainframe shall be non modular</td>
</tr>
<tr>
<td>The product shall be field upgradeable</td>
</tr>
<tr>
<td>The test system shall utilize Linux operating system to ensure optimum stability</td>
</tr>
</tbody>
</table>

Display

| The size of the display shall be 7 inches minimum, and 1200x600 type for best resolution |
| The Test Set shall support a Screen Saver |
| The Test Set shall support a mode that ‘locks’ the touchscreen for use without a password |

Power/Battery

| The Test Equipment must be battery operated |
| The Test Equipment must have a built-in battery charger |
| The battery must be field replaceable |
| The equipment shall perform a 10G test for a minimum of 3 hours on battery power. |
| Operating time Between 2 to 5 hours depending on the application |
| Charging time Approximately 7 hours from empty |
| Unit power input 12VDC, 60 Watt Max |
| Power supply input 100 to 240 VAC, 50/60 Hz, auto-sensing |
| Power supply output 12VDC, 5 AMP Max |

Industry Standards and Compliance

| CE Class A Compliant |
| EMI/ESD: CE compliant, FCC part 15 subpart A Class A |
| FCC Part 15 Compliant |

Physical and Environment Specifications

| Temperature range |
| Operating, all options: 0°C to +50°C (+32°F to +122°F) |
| 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 68-2-27 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-28800F (Class 2) |

Field Operation

| The Test Equipment shall be portable, battery operated and rugged for field operations. |
| The Test Equipment must be protected by bumpers. |

Weight and Size

| The weight of the test set shall not be greater than 4.2 lbs/1.9kg while supporting up to 10G rates |
| The size of the test set shall not be greater than 17.78 x 24.13 x 7.62cm (7”x9.5”x3”) while supporting up to 10G rates |

Operation

| The base unit shall be able to be turned on and operational in less than 2 minute |
| The Test Equipment shall accept operations with an external keyboard. |
| The unit will boot to a simplified launch page allowing the user to select previous test configurations and/or favorite test configurations. |

I/O’s

| The Test Equipment shall include the following I/O interfaces |
| VT100 (RJ-45) |
| 2 x USB |
| RJ-45 (Ethernet/IP) |
| Serial |
| Wifi (optional) |
| Bluetooth (optional) |
| The Test Equipment shall be able to download data to PC 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.
- The Test Set UI supports a screen capture feature.
- The internal storage capacity shall be at least 1GB.
- 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 verdicts of each.

Remote Operation

- The Test Equipment shall be remotely controlled via Web browser.
- In remote operation, the remote user can FTP files from the test set.
- In remote operation, the remote user can FTP files to the test set.
- The Test Equipment should not require the installation of client software on a PC for remote operation.
- Access via Smart Access Anywhere Codes.

Calibration

- Minimum calibration interval must be 3 years.

Warranty

- The Product shall support a 3 year warranty.

Included Items

- User manual
- AC Power Source
- AC Power cords

Optical Fiber Microscope

- The Test Equipment shall be able to accept an optical video microscope with autofocus capability.
- The connector image shall be displayed on the Test Equipment and saved into a JPEG file format.
- The microscope shall offer a switchable 200/400x magnification capability.
- It shall be provided with the dedicated tips to connect to the patch panel or directly to the connector ferrule.

Saved Configurations

- Users shall be able to save test configurations for future recall.
- Users shall be able to transfer pre-defined test configurations between test sets.

Ethernet

<table>
<thead>
<tr>
<th>Test Interfaces/Bit Rates</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>10/100/1000M Electrical</td>
<td>Dual Port Capable</td>
</tr>
<tr>
<td>100M Ethernet</td>
<td>Optical</td>
</tr>
<tr>
<td>GigE (Optical)</td>
<td>Dual Port Capable</td>
</tr>
<tr>
<td>10GigE WAN Phy (9.9G)</td>
<td>Dual Port Capable</td>
</tr>
<tr>
<td>10GigE LAN Phy (10.3G)</td>
<td>Dual Port Capable</td>
</tr>
</tbody>
</table>

Interface Type

- RJ-45
- SFP
- SFP+
- SFP+Tunable

General

- Line Rate Traffic Tx and RX for all Interfaces
- Single Stream Generation/Analysis
- 10 Streams Generation/Analysis
- Auto Discovery of Test Sets

Modes of Operation

- Terminate
- Monitor
- Thru (Intrusive)
- Loopback
- Half Duplex
- Full Duplex

Timing

- Recovered from Rx
- Internal (Stratum 3)
- Recover from External (BITs/SETs)
- Freq Offset Transmit/Receive

Ethernet Features

Layer 1 (Unframed) Bit Error Testing Patterns

- High Frequency test pattern
- Low frequency test pattern
- Mixed frequency test pattern
- Random Data Pattern (RPAT)
- Jitter Tolerance Test Pattern (JTPAT)
- Supply Noise Test Sequence (SPAT)

Layer 2 ( Framed) Bit Error Testing Patterns

- Compliant Random Data Pattern (CRPAT)
- Compliant Jitter Tolerance Pattern (CJPAT)
- Compliant Supply Noise Pattern (CSPAT)

Framed Pattern Test

- PRBS (2^11-1, 2^15-1, 2^20-1, 2^23-1, 2^31-1 and inverse)
- All Is, All Os
- 1,3, 7, 31, 71, 2 in 8
- User defined

MAC Frame Payload

- PRBS Pattern
- Editable Digital Word

Flow Control

- Emulation On/Off

Pause Frames

- Tx Insert
- Pause Quanta - Definable
- Pause Frame Analysis (counts etc)

Ethernet Generator

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
- Source MAC Address - User Defined
- Source MAC Address - Auto Increment

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
Supports up to 8 stacked VLAN Tags

VPLS
VPLS Parameters - MAC Addresses
VPLS Parameters - Frame Type
VPLS Parameters - EtherType
VPLS Tunnel and VC Label - Label, 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
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 Generation and Analysis
AIS Generation and Analysis
OAM Alert Label (Label 14) from ITU-T G.8114
Common Header Label - PW, LSP, Section
CCM Generation and Analysis
LBM/LBR Generation and Analysis
AIS Generation and Analysis

OAM Alert Label (Label 14) from ITU-T Y.1731
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 802.1ag CFM
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
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
Errored Frame Second Summary Event

IP Packet Generator
IP
IPv4 Frame Format
IPv6 Frame Format
TCP Port Number
UDP Port Number

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
Bandwidth Controlled
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
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
**RFC 2544**
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
Parallel Testing
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
One Way Delay with GPS or CDMA receiver
**ITU-T Y1564**
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
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
**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 Time Test
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
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**
Send/Receive Ethernet Control Plane Traffic
Encapsulation supported
  - VLAN
  - Q-in-Q
  - Spanning Tree
  - Cisco Protocols (Discovery etc.)
  - GARP
  - STP
Send/Receive Ethernet Control Plane Traffic
  - Spanning Tree Frames Tx/Rx
  - Cisco Discovery Protocol
  - LDP Frames Tx/Rx
  - Link Aggregation LACP
  - Cisco UDLD, ISL, PAgP, DTP, PVST-PVST+
  - MAC Bridging 802.1d
  - VLAN-BRDGSTP
  - Custom Frame Builder
**Synchronous Ethernet**
1GE and 10GigE Tx/Rx
1000M/100M/10M Electrical Tx/Rx
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**
1GE and 10G Tx/Rx
1588v2 Master Emulation
1588v2 Slave Emulation
1G Dual Monitor
Encapsulations supported
  - None, VLAN, and Q-in-Q
Packet Delay Variation Measurements on Control Plane Traffic
Generate up to 4 streams of Background Dataplane traffic
Frame/Packet Capture and Decode via Wireshark
Layer 2 1588v2 Messaging
Layer 4 1588v2 Messaging
Message rates Multicast: Fastest = 16/128/8 (Announce/Sync/Delay); Slowest = one message every 16 seconds
Message rates Unicast: Fastest = 16/128/8 (Announce/Sync/Delay); 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 Sync and Delay PDV and FPP (Floor Packet Processing)
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)
One-way (Master to Slave and Slave to Master) Delay
Differential Delay and Delay Asymmetry Measurements
Time Error Measurements (1ns resolution)
Max |TE| and cTE Measurement
PktSelected2wayTE Measurements including:
- APTS: pk to pk
- PTS: Abs Max

Wander Analysis of Time Error Measurement
Automated Time Error Measurement workflow.

NTP Features
- Capture
- Analyze
- Monitor

PDV Analysis
- Supports distribution analysis of PDV and comparison against ITU limits
- Graph resolution of up to 5ns
- Supports evaluation according to MAFE
- Supports FFP analysis according to G.8261.1 and comparison against ITU limits
- Supports masks defined by user
- Supports sample rates up to 100 samples per second
- Supports offline data analysis
- Supports packet synchronization data analysis for NTP protocols
- Supports measured data analysis according to PDD packet delay allocation level
- Supports measured data analysis according to FPP minimum packet rate
- Supports PDV data collection of PTP for laboratory analysis and corrective path

Loopback
- Manual (LLB)
- Automatic
- Local

Far End
Auto Discovery of Test Sets
Delay
- Round Trip Delay
- Acterna Test Protocol Version 3 (default)
  - 10GE High Precision - low delay
  - GE Optical High Precision - low delay
- Acterna Test Protocol Version 2 with Fill byte
  - High Precision - low delay
  - Lower Precision — high delay
- One Way Delay
Delay Measurement Accuracy
CAT-5 Testing
- Link speed
- Link status
- Cable status
- Crosstalk/straight (MDI/MDIX)
- Distance to fault
- Pin mapping
- Pair length
- Polarity
- Skew

Capture/Decode
- Wirespeed Capture up to 10Gb/s
- Wirespeed Capture up to 10/100/1000 Mb/s
- Integrated Wireshark on the TestSet
- 256MB Capture Buffer per port
- Triggers
- Tx and Rx Capture
- 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

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
- 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

Errors Tx/Rx
- Code Error Tx/Rx
- FCS Error Tx/Rx
- IP Checksum Tx/Rx
- Bit Error Tx/Rx
- Insertion Profile - Once
- Insertion Profile - Rate
- Insertion Profile - Burst
### VIAVI T-BERD/MTS-5800 Specifications

#### Alarms Tx/Rx
- Local Fault Tx/Rx
- Remote Fault Tx/Rx

#### Ethernet Results

#### Custom Results

#### Histogram and Graphical Results Script

#### Link Status
- Loss of signal
- Link active
- Frame detected
- Sync obtained
- VLAN tagged frame detected

#### Auto-negotiation status
- Link configuration ack
- Link advertisement status
- Pause capable
- Remote fault
- Destination MAC address when using ARP

#### Link counts/statistics
- Bandwidth utilization
- Frame rate
- Tx Mbit/s
- Rx Mbit/s
- Round trip delay
- Service disruption time
- Received frames
- Transmitted frames
- Received packets
- Transmitted packets
- Pause frames
- Lost frames
- Out of sequence frames
- Out of sequence packets
- VLAN frames
- CVLAN ID
- SVLAN ID
- CVLAN Priority
- SVLAN Priority
- Unicast frames
- Unicast packets
- Multicast frames
- Multicast packets
- Broadcast frames
- Broadcast packets
- Frame length

#### Errored Counts
- Packet length
- Packet jitter, Avg
- Packet jitter, Max

#### QoS Measurements
- Throughput
- Frame Loss
- Packet Jitter
- Delay
- Out of Sequence
- Frame/Packet Size Binning
- MAC Throughput Rx
- IP Throughput Rx
- TCP/UDP Throughput Rx
- Payload Throughput Rx
- Service Disruption Measurements
  - Definable Threshold Time
  - Round Trip Delay Measurements
- One Way Delay Measurements
- Rx Bytes
- Rx Mbits
- Rx Frames
- Rx frames per Second
- Utilization %
- Current Rx Results
- Min Rx Results
- Average Rx Results
- Max/Peak Rx Results
- Ratio Rx Results
- Seconds Rx Results
- Event Log

#### SONET/SDH

#### Test Interfaces/Bit Rates
- STS-1 (e) Dual Port Capable
- STM-1 (e) Dual Port Capable
- STM-1 (o) Dual Port Capable
- OC-3 Dual Port Capable
- OC-12 Dual Port Capable
- STM-4 Dual Port Capable
- OC-48 Dual Port Capable
- STM-16 Dual Port Capable
- OC-192 Dual Port Capable
- STM-64 Dual Port Capable

#### Laser Type
- SFP
- SFP+
- SFP - Tunable

#### Modes of Operation
- Terminate
- Monitor
- Thru (Intrusive)
- Tributary Scan
- Drop and Insert

#### Timing
- Recovered from Rx
- Internal (Stratum 3)
- Recovered from External (BITS/SETS)
- Recovered from 10 MHz clock
**SONET/SDH Features**

- SONET/SDH Framing
- Overhead Manipulation/Analysis
- Optical/Electrical Power Level
- PRBS Generation
- PM/SM TTI messages Tx/Rx
- Overhead Byte Viewing/Manipulation
- Service Disruption Measurements
  - SD Separation/Debounce Time Setting
  - SD Threshold Time Settings
- Signal Label generation/display
- Freq Offset Transmit/Receive

**Round Trip Delay Measurement**

- RTD Measurement Accuracy

**PRBS Patterns**

- 2^7-1, 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
- Programmable - 32 bit
- ANSI and ITU implementations

**Anomaly/Error generation**

- Bit/TSE
- Frame Word
- B1
- B2
- B3
- HP-REI
- MS-REI, LP-BIP
- LP-REI
- Insert - Single
- Insert - Rate
- Multiple

**Defects/Alarms Generation/Analysis**

- LOS
- LOF
- RS-TIM
- MS-AIS
- MS-RDI
- AU-LOP
- AU-AIS
- HP-UNEQ
- HP-RDI
- HP-TIM
- HP-PLM
- TU-LOP

**SONET Mappings**

- STS-1, STS-3c, STS-12c, STS-48c, STS-192c
- VT1.5

**SDH Mappings**

- VC4 Bulk, AU-4-4c, AU-4-16c, AU-4-64c
- VC12
- VC4
- VC3
- E4
- D5
- D3
- E3
- E1

**Results**

**Signal Category**

- Signal Present
- Signal Loss Count
- Signal Loss Seconds
- Receive Frequency
- Receive Frequency Deviation
- Receive Frequency Maximum Deviation
- Transmit Frequency
- Electrical Input Level
  - STS-1
  - STM-1e
  - dBdsx, dBm, volts
  - dBnom only
- BPV Count (STS-1 only)
- BPV-Error Rate (STS-1 only)

**Regenerator/Section OH Category**

- FAS/Frame Word Error Count
- FAS/Frame Word Error Rate
- LOF Count
- OOF Count
- B1-BIP error Count
- B1-BIP Error Rate
- Severely Errored Seconds
- OOF Seconds

**Section Trace**

- Mismatch
- J0-Regenerator Trace
- Multiplexer/Line OH Category
- APS Message Count
- APS Bridge Request Code
- Ring
- APS Destination Node
- Ring
- APS Source Node
- Ring
- APS Path Code
- Ring
- APS Status
- Ring
- APS Request Code
- Linear
- APS K1 Channel Number
- Linear
- APS K2 Channel Number
- Linear
- APS MSP Architecture
- Linear
- APS Status
- Linear
- B2-BIP Error Count
- B2-BIP Error Rate
- SES
- Unavailable Seconds
- AIS Seconds
- REI Count
- REI Rate
- Si Synchronization Message
- Z1 Byte Value

**High Path (AU, VC3/4) OH Category**

- Pointer Justification Count
- Pointer Increment Count
- Pointer Decrement Count
- Pointer NDF Count
- Pointer Value
- Pointer Size
- SS Bits
- LOP Count
- B3 (BIP) Error Count
- B3 (BIP) Error Rate
- B3 (BIP) Errored Seconds
- REI Count
- VC-3/4 REI Rate
- POH SES
- POH Unavailable Seconds
- Signal Label
- C2
- J1 Trace Message
- Path Status
- G1
### Low Path (VC3/12, TU3/12, VT1.5)

<table>
<thead>
<tr>
<th>Category</th>
<th>Pointer Transmitted</th>
<th>Pointer Received</th>
<th>Pointer Just Count</th>
<th>Pointer Increment Count</th>
<th>Pointer Dec Count</th>
<th>Pointer NDF Count</th>
<th>LOP Count</th>
<th>LOP Seconds</th>
<th>B3/V5 BIP Count</th>
<th>B3/V5 BIP Error Rate</th>
<th>REI Count</th>
<th>Pointer Transmitted</th>
<th>Pointer Received</th>
<th>Signal Label</th>
<th>C2/V5</th>
<th>Signal Label Mismatch</th>
<th>J2-Lower Order Trace Message</th>
<th>J2 Lower Order TIM</th>
</tr>
</thead>
</table>

### Logic Category

<table>
<thead>
<tr>
<th>Category</th>
<th>Pattern loss Count</th>
<th>Bit Error/TSE Count</th>
<th>Bit Error/TSE Rate</th>
<th>Pattern Slip Count</th>
<th>Pattern Slip Secs</th>
<th>Pattern Loss Count</th>
<th>Pattern Synchronization Loss Secs</th>
<th>Pattern Synchronization Status</th>
</tr>
</thead>
</table>

### Alarms

<table>
<thead>
<tr>
<th>Category</th>
<th>Frame Synchronization Loss Status</th>
<th>Pattern Synchronization Loss Status</th>
</tr>
</thead>
</table>

### Signal Loss Status

<table>
<thead>
<tr>
<th>Category</th>
<th>MS/Line-AIS</th>
<th>AIS (HP)</th>
<th>AIS (LP)</th>
<th>LOP (HP)</th>
<th>LOP (LP)</th>
<th>LOS</th>
<th>OOF</th>
<th>LOF</th>
<th>MS/Line-RDI</th>
<th>LP RDI</th>
<th>HP RDI</th>
<th>MS/Line-REI</th>
</tr>
</thead>
</table>

### Laser Type

- SFP
- SFP+ ~ Tunable

### Modes of Operation

- Terminate
- Monitor
- Monitor/Thru

### OTN Layer

- OTN/ODU Framing
- ODU1 in ODU2 Multiplexing
- ODU0 Multiplexing
  - ODU-0 Bulk BERT from an OTU-2
  - ODU-0 1-Gigabit Ethernet Layer 2 & IPv4 traffic from an OTU-2
  - ODU-0 Bulk BERT from an OTU-1
  - ODU-0 1-Gigabit Ethernet Layer 2 & IPv4 traffic from an OTU-1
  - ODUflex Bulk BERT from an OTU-2
  - ODUflex 1-Gigabit Ethernet Layer 2 from and OTU-2
  - Generic Mapping Procedure (GMP) supported
  - GFP-T encapsulation of Ethernet 8B/10B PCS

### GFP-T

- CID
- UPI

### Overhead Manipulation/Analysis

- Power Level
- PM/SM TTI messages Tx/Rx

### Service Disruption Measurements

- SD Separation/Debounce Time Setting
- SD Threshold Time Settings

### Payload Type (PT) Label generation/display

### Transfer Delay

### Freq Offset Transmit/Receive

### PRBS Patterns

- 2^20-1, 2^20-1 Inverse
- 2^23-1, 2^23-1 Inverse
- 2^31-1, 2^31-1 Inverse
- Programmable ~ 32 bit

### ANSI and ITU implementations

### Error Insertion Capability

- Single, Rate

### OTU Error Tx/Rx

- FAS
- MFAS
- SM-BIP/BEI

### OTN G.709

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GCC BERT Bit Error Rate

**ODU**

- ODU-AIS
- ODU-AIS Seconds
- ODU-LCK
- ODU-LCK Seconds
- ODU-OCI
- ODU-OCI Seconds
- PM-BIP Count
- PM-BIP Error Rate
- PM-BDI Seconds
- PM-BDI Count
- PM-BEI Count
- PM-BEI Error Rate
- PM-TIM Seconds
- PM-TIM Count
- PM-DAPI
- PM-Operator Specific
- PM Round Tip Delay Recent
- PM Round Tip Delay Last

**FTFL**

- Forward-Fault Type
- Forward-SF Seconds
- Forward-Operator Specific
- Forward-Operator Identifier
- Backward-Fault Type
- Backward-SF Seconds Count
- Backward-SD Seconds Count
- 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
- TIM Seconds
- SAPI
- DAPI
- Operator Specific
- GCC BERT Bits
- GCC BERT Bit Errors
- GCC BERT Bit Error Rate

**OPU**

- Payload Type Mismatch Seconds
- Payload Type
- Payload
- Pattern Sync Loss Seconds
- Pattern Sync Losses
- TSE/Bit Errors
- TSE/BIT Error Rate

**Ethernet Client**

- As per Ethernet results
- RFC 2544 on 10 GE client

**SONET/SDH Client**

- As per SONET/SDH results

**OTN Check**

- Automated workflow is available at all OTN rates for OTN Bulk
- Set test duration based on Bit Error Rate Theory or actual time
- Bit Error Rate Theory parameters for test duration:
  - Data Rate (e.g. OTU4)
  - BER Threshold
  - Confidence Level (% value)

**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

**Fibre Channel Features**

**General**

- Flow Control
- Login
- Buffer Credits

**Fibre Channel Login**

- at "F-Port"
- at "N-Port"

**Layer 1 (Unframed) Bit Error Testing Patterns**

- High frequency test pattern
- Low frequency test pattern
- Mixed frequency test pattern
- Random Data Pattern (RPAT)
- Jitter Tolerance Test Pattern (JTPAT)
- Supply Noise Test Sequence (SPAT)

**Layer 2 (Framed) Bit Error Testing Patterns**

- Compliant Random Data Pattern (CRPAT)
- Compliant Jitter Tolerance Pattern (CJPAT)
- Compliant Supply Noise Pattern (CSPAT)

**Framed Pattern Test**

- PRBS (2^23-1, 2^31-1 and inverse)
- All 1s
- All 0s
- User defined

**Fibre Channel Traffic Generation**

- Transmit Traffic profiles
  - Constant
  - Ramp
  - Bursty
- Traffic generation in Mbit/s and % utilization

**Configurable Source and Destination ID**

- Sequence ID
- Originator ID
- Responder ID

**Frame length**

- 28, 32, 76, 512, 1024, 1536, 2076, 2140
- User defined

**Packet payload**

**Granularity**

- 1 to 6.7%

---

**Fibre Channel**

**Laser Type**

- SFP
- SFP+

**Modes of Operation**

- Terminate
- Monitor
- Thru

**Test Interfaces/Bit Rates**

- 1.0625 Gbit/s: Dual Port Capable
- 2.125 Gbit/s: Dual Port Capable
- 4.25 Gbit/s: Dual Port Capable
- 8.5 Gbit/s: Dual Port Capable
- 10.519 Gbit/s: Dual Port Capable
- 14.025 Gbit/s: Dual Port Capable
**Fibre Channel Traffic Filtering**
- Routing Control
- Destination Identifier
- Source Identifier
- Data Structure Type
- Sequence Count

**Fibre Channel Error Insertion**
- Bit error
- CRC
- Framed Bit
- Code violation
- Insertion Type - Single, Rate, Burst

**Enhanced Fibre Channel Test (RFC 2544 like)**
- Selectable Configuration Template
- Throughput
- Latency
- Frame Loss
- Back to Back
- Buffer Credits
- Buffer Credit Throughput
- Selectable Flow Control Login Type
- Definable Frame Length
- Pass Fail Thresholds
- Report Generation
- Screen Capture Support
- Graphical Results

**8 Gig Fibre Channel Specific**
- Scrambling in FC-1/MAC layer, on total FC frame
- Supported IDLE and FILL WORD patterns include IDLE on Link INIT and as FILL WORD; IDLE on INIT and ARBFF on FILL WORD; ARBFF on INIT and as FILL WORD

**Results**

**Interface Type**
- BNC
- Bantam
- RJ48
- E4

**Modes of Operation**
- Terminate
- Monitor
- Thru (Intrusive)

**Timing**
- Recovered from Rx
- Internal (Stratum 3)
- Recovered from External (BITs/SETs)

**Framing**
- Framed
- Unframed

**Test Patterns**
- $2^{15}$-1* (Inverse)
- $2^{20}$-1* (Inverse)
- $2^{23}$-1* (Inverse)

**BERT Stats**
- Symbol Errors
- CRC Errored Frames
- Fiber Runs
- Fiber Jabbers
- Undersized Frames
- Code Violations
- Code Violation Rate
- Code Violation Seconds

**PDH**

**Test Interfaces**
- E4
- DS3
- E3
- E1 Balanced
- E1 Unbalanced
- T1

**Interface Type**
- BNC
- Bantam
- RJ48
- E4

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**PDH**

**Test Interfaces**
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- E1 Balanced
- E1 Unbalanced
- T1
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
Through (Intrusive)
Timing
Recovered from Rx
Internal (Stratum 3)
Recovered from External (BITs/SETs)
**Framing**
M13
C-bit
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
110 (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
RDV/FAS Distant
REBE
TS-16 AIS
TS-16 RDV/MFAC Distant

**General**
Frequency Offset +/- 100ppm
Loop Codes Tx NIU, CSU, Line
Rx Compensation - High - 0 ft
Rx Compensation - Low - 450 ft
Rx Compensation - Low - 900 ft
Service Disruption

**Performance Measures**
G.826
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
Recovered from Rx
Internal (Stratum 3)
Recovered from External (BITs/SETs)

**Framing**
Framed
Unframed

**Test Patterns**
All 1s
All 0s
2^15-1^* (Inverse)
2^20-1^* (Inverse)
2^23-1^* (Inverse)
2^11-1^* (Inverse)
2^15-1^* (Inverse)
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
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
Recovered from Rx
Internal (Stratum 3)
Recovered 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
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
Performance Measures
G.826
G.821
G.829
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
### VIAVI T-BERD/MTS-5800 Specifications

#### 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
- Through (Intrusive)

#### Timing
- Recovered from Rx
- Internal (Stratum 3)
- Recovered 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)
- 2^20-1^ (Inverse)
- 2^23-1^ (Inverse)

#### 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
- Pattern Slips
- Pattern Slip Seconds
- Pattern Synchronization Loss Count
- Pattern Synchronization Loss Seconds

#### Channel
- DSO Channel Payload View
- ABCD Bit Signaling View

#### 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 ±100 ppm

#### Performance Measures
- G.826 ISM/OOS
- G.828 ISM/OOS
- G.829 ISM/OOS
- M.2100
- T1.231
- Tx LBO 0, 75, 15, 22.5 dB Loss
- Service disruption

#### Loop Codes
- Loop Code Tx NIU, CSU
- Loop Code Emulation NILJ, CSU

#### Loop Code Tx - Repeater
- HDSL Loop Code Tx
- CO to Customer direction
- Customer to CO direction
- User Defined Loop Code Support

#### Loop Code Tx - Repeater
- NIU, CSU

#### Loop Code Emulation
- NIU, CSU

#### Channel
- DSO Channel Payload View
- 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
Maximum Consecutive Zeros

HDLC
Rx/Tx Frame Count
Rx/Tx Octet Count
Frame Aborts
Short Frames
FCS Errored Frames
Percent Utilization (Average, Current, Maximum)
Throughput (Average, Current, Maximum)

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
Wireshared 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**

**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, Maximum)**

**Throughput (Average, Current, Maximum)**

**Average Frame Rate (frames/sec)**

**Average Frame Size (octets)**

---

**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**

**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, Maximum)**

**Throughput (Average, Current, Maximum)**

**Average Frame Rate (frames/sec)**

**Average Frame Size (octets)**

---

**31 Gbps optical (Rate 4)**

**4.9 Gbps optical (Rate 5)**

**6.1 Gbps optical (Rate 6)**

**9.8 Gbps optical (Rate 7)**

**10.137 Gbps optical (Rate 8)**

**12.2 Gbps Optical (Rate 9)**

**Dual Port Capable**

**Dual Port Capable**

**Dual Port Capable**

**Dual Port Capable**

**Dual Port Capable**

**Dual Port Capable**

---

**Test Interfaces/Bit Rates**

<table>
<thead>
<tr>
<th>614 Mbps optical (Rate 1)</th>
<th>Dual Port Capable</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.2 Gbps optical (Rate 2)</td>
<td>Dual Port Capable</td>
</tr>
<tr>
<td>2.4 Gbps optical (Rate 3)</td>
<td>Dual Port Capable</td>
</tr>
</tbody>
</table>

---

**Laser Type**

- SFP
- SFP+
- SFP+ Tuneable

**Modes of Operation**

- Terminate
- Monitor/Thru

**Timing**

- Recovered from Rx (Slave)
- Internal (Stratum 3) (Master)
- Recovered from External (BITS/SETs) (Master)
- Recovered from 10MHz clock (Master)

**CPRI Automation**

- CPRI Service Activation automated workflow

**CPRI Features**

- Optical/Electrical Power Level
- 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 Version**

**Control and Management (C&M) Channel**

- Ethernet
- HDLC

**Selectable C&M Channel Rate**

**Service Disruption Measurements**

**SD Separation/Debounce Time Setting**

**SD Threshold Time Settings**

**Round-Trip Delay Measurement**

**RTD Measurement Accuracy**

**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

**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 TM11
- LTE-FDD TM12
- LTE-FDD TM2
- LTE-FDD TM31
- LTE-FDD TM32
- LTE-FDD TM33

**Loopback AxC (ALU/Nokia RRH)**

**Set Power levels and Bands (ALU/Nokia RRH)**

**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 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

**OBSAI**

<table>
<thead>
<tr>
<th>Test Interfaces/Bit Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>768 Mbps Optical</td>
</tr>
<tr>
<td>1.5 Gbps Optical</td>
</tr>
<tr>
<td>3.1 Gbps Optical</td>
</tr>
<tr>
<td>6.1 Gbps Optical</td>
</tr>
</tbody>
</table>

**Laser Type**
- SFP
- SPF+
- SPF+ Tunable

**Modes of Operation**
- Terminate
- Monitor/Thru

**Timing**
- Recovered from Rx (Slave)
- Internal (Stratum 3) (Master)
- Recovered from External (BiTs/SETs) (Master)
- Recovered from 10MHz clock (Master)

**OBSAI Features**
- Optical/Electrical Power Level
- Freq Offset Transmit/Receive

**PRBS Generation and Monitoring**
- Unframed
- L1 - Pattern Inserted in Frame Structure
- L2 - Pattern Inserted in OBSAI Message

**OBSAI Interface**
- Selectable Port Type (Master or Slave)
- LOS Enable (On or Off)
- Force Tx Idle (On or Off)
- Definable RP3 Address
- Selectable RP3 Type (WCDMA/FDD, GSM/EDGE, WiMAX 802.16, LTE)
- Selectable Number of Message Groups in Master Frame

**Selectables**
- Selectable Number of Message Slots in Message Group
- Selectable Number of Idle Bytes After Message Group
- FCB Message Generation
- Round Trip Delay Measurement
- RTD Measurement Accuracy
- 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
- D6.6 D25.6
- Delay
- Live
- Digital Word
- Anomaly/Errors Generation
- Bit
- Code
- Insert – Single
- Insert – Rate

**Results**
- 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)

**OBSAI Counts**
- Code Word Count Tx/Rx
- Frame Count Tx/Rx
- Message Group Counts Tx/Rx

**Remote Message Counts**
- Control, Measurement, WCDMA/FDD, WCDMA/TDD, GSM/EDGE, TETRA, CDMA2000, WLAN, Loopback, Frame Clock Burst, Ethernet, RTT, WiMAX, Virtual HW Reset, LTE, Generic Packet, Multi-hop RTT

**Error Stats**
- Word Sync Loss Events
- Word Sync Loss Seconds
- Code Violations
<table>
<thead>
<tr>
<th>Code Violation Rate</th>
<th>Code Violation Seconds</th>
<th>K30.7 Words</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frame Sync Losses</td>
<td>Frame Sync Loss Seconds</td>
<td>Pattern Sync Losses</td>
</tr>
<tr>
<td>Pattern Sync Loss Seconds</td>
<td></td>
<td>Bit Error Rate</td>
</tr>
<tr>
<td>Bit Errors</td>
<td></td>
<td>Error-Free Seconds</td>
</tr>
<tr>
<td>Error-Free Seconds, %</td>
<td>Total bits Received</td>
<td>Round Trip Delay Current (ms)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Round Trip Delay Average (ms)</td>
</tr>
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</tr>
<tr>
<td></td>
<td></td>
<td>Round Trip Delay Maximum (ms)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tx/Rx OBSAI State</td>
</tr>
</tbody>
</table>

**Jitter O.172**

**General Features**
- Generate and measure jitter on electrical interfaces
  - DS1, E1, E3, E4, STM1e
- 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

**Wander**

**General Features**
- Measure Wander on 1PPS Signal
- Measure Wander on 1G Optical SyncE Interface
- Measure Wander on T1, E1, & unframed 2.048 MHz Signals
- 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 (μs)
  - Maximum TIE (μs)
  - Minimum TIE (μs)
- Maximum Peak-to-Peak TIE (MTIE) [μs]
- Offset Between Test Signal and Reference
  - Current Offset (μs)
  - Minimum Offset (μs)
  - Maximum Offset (μs)
- Pass/Fail Result
- TIE Graph
- Reference Clock for 1 pps wander
  - 1 pps reference signal
- Reference Clock for 1G SyncE Optical, T1, E1, 2 MHz, & 10 MHz wander
  - 2 MHz or 10 MHz reference signal
- Cables for 1 pps Wander

**Wander Analysis Tool**
- Offline analysis of captured/imported TIE measurements
- Maximum Peak-to-Peak TIE (MTIE) [μs]
- TDEV (Time Deviation)
- Frequency Offset (ppm)
- Drift Rate (ppm/s)

**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**

**VoIP Testing**
- 10/100/1000M Electrical Ethernet Interfaces
- 1GigE Optical Ethernet Interface
- 10GigE Optical Ethernet Interface
- SIP, Cisco SCCP and H.323 Fast Connect

**Supported SIP Parameters**
- Dial by phone/URL/e-mail
- Nortel & Huawei SIP emulation
- Proxy login and proxyless operation

**Supported SCCP Parameters**
- Selectable Cisco Phone emulation supporting at least 15 models
- Configurable device name

**Supported H.323 Parameters**
- H.323 ID
- Bearer Capability including Unrestricted Digital, Speech & 1K Audio
- Configurable Calling & Called Party Number Plans and Number Types

**ITU**
- G.8261
  - SEC network IF (G.832, G.825)
  - SEC option 1 (G.813)
  - SEC option 2 (G.813)
  - SEC holdover option 2 (G.813)
  - SEC trans. option 2 (G.813)
  - SSU network IF (G.823, G.825)
  - SSU Type I (G.812)
  - SSU Type II, III (G.812)
  - SSU Type IV (G.812)
  - PRC (G.811)
  - EEC-1 Noise Generation (G.8262 constant temp.)
  - EEC-1 Noise Generation (G.8262 with temp. effects)
  - EEC-2 Noise Generation (G.8262 constant temp.)
  - EEC-1 Noise Tolerance (G.8261)
  - EEC-1 Noise Tolerance (G.8262)
  - PRC (G.811)
  - DTE Network Limit (G.82711)
  - Wander Generation (G.8271)
  - DTE Noise Generation (G.8273.2 constant temp.)
  - DTE Noise Generation (G.8273.2 variable temp.)
Static, auto-discoverable and no gatekeeper operation

Configurable Local and Gatekeeper RAS port and Call Control Port

Configurable Time Zone

Configurable RTP port range

General Parameters

Auto answer on/off

Codecs:
- G.711 A Law
- G.711 U Law
- G.723 5.3 K
- G.723 6.3 K
- G.729A
- G.726
- G.722

Configurable Call Manager port

Selectable silence suppression

Configurable jitter buffer and speech parameters

ACR or G.107 MOS Scoring

Configurable Jitter, Loss, Delay and Content

Threshold pass/fail

Mean Opinion Score Results (MOS)

Graphical Summary Results including Ethernet, transport & Content

Transaction Log including call log and protocol signaling

Phone book of last 10 numbers and IP addresses called

DTMF Digits

Triple Play Automated Test Script

10/100/1000M Electrical Ethernet Interfaces

1GigE Optical Ethernet Interface

10GigE 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

IPTV

10/100/1000M Electrical Ethernet Interfaces

1GigE Optical Ethernet Interface

10GigE Optical Ethernet Interface

- Single Program Transport Stream (SPTS) and Multiple Program Transport Stream (MPTS) formats
- Video explorer capable of detecting SPTS and MPTS and a video analyzer that supports SPTS and MPTS
- Supported measurements include bandwidth utilization, packet loss, packet jitter, PCR jitter, continuity error bit and error bit indicator
- TR 101 290 priority 1 errors such as program identification (PID), program association table (PAT) and program map table (PMT)
- Loss distance and period errors per RFC3357, results per transport stream and per PID
- Media Delivery Index (MDI) measurements
- Measure ICC latency and R-UDP latency
- Microsoft Television (MSTV) Support
- Internet Group Management Protocol (IGMP) support

Primary Rate ISDN

<table>
<thead>
<tr>
<th>Test Access</th>
<th>T1</th>
</tr>
</thead>
<tbody>
<tr>
<td>TE Emulation</td>
<td></td>
</tr>
<tr>
<td>NT Emulation</td>
<td></td>
</tr>
</tbody>
</table>

D-Channel Signaling Decodes

<table>
<thead>
<tr>
<th>Call Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>National SES</td>
</tr>
<tr>
<td>NI-1</td>
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<table>
<thead>
<tr>
<th>D-Channel Rate</th>
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</thead>
<tbody>
<tr>
<td>64 k</td>
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<tr>
<td>56 k</td>
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<table>
<thead>
<tr>
<th>Call Type</th>
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</thead>
<tbody>
<tr>
<td>Data Voice</td>
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<tr>
<td>31 k audio</td>
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<table>
<thead>
<tr>
<th>Channel Number</th>
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<tbody>
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<td>1 to 24</td>
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</table>

<table>
<thead>
<tr>
<th>D-Channel Rate</th>
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</thead>
<tbody>
<tr>
<td>56 k</td>
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</tbody>
</table>

DTMF digits

Primary Rate E1 ISDN

<table>
<thead>
<tr>
<th>Test Access</th>
<th>E1</th>
</tr>
</thead>
<tbody>
<tr>
<td>TE Emulation</td>
<td></td>
</tr>
<tr>
<td>NT Emulation</td>
<td></td>
</tr>
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</table>

D-Channel Signaling Decodes

Codec μ-law, A-law

<table>
<thead>
<tr>
<th>Call Control</th>
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<tbody>
<tr>
<td>1TR6</td>
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<td>1TR67</td>
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<tr>
<td>EDSS-1</td>
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<td>VN3</td>
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<tr>
<td>VN4</td>
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<tr>
<td>VN6</td>
</tr>
<tr>
<td>TPH1962</td>
</tr>
<tr>
<td>Q.SIG</td>
</tr>
<tr>
<td>Q.931</td>
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<tr>
<td>TN-1R6</td>
</tr>
<tr>
<td>SwissNet-3</td>
</tr>
<tr>
<td>CorNet-N</td>
</tr>
<tr>
<td>CorNet-NQ</td>
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<tr>
<td>DREX</td>
</tr>
<tr>
<td>Alcatel</td>
</tr>
<tr>
<td>QSIG</td>
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</tbody>
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Services

<table>
<thead>
<tr>
<th>Channel Number - 1 to 31</th>
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</thead>
<tbody>
<tr>
<td>Speech</td>
</tr>
<tr>
<td>31 kHz Data</td>
</tr>
<tr>
<td>Fax G4</td>
</tr>
<tr>
<td>Teletex</td>
</tr>
<tr>
<td>Videotex</td>
</tr>
<tr>
<td>Speech BC</td>
</tr>
<tr>
<td>Data BC</td>
</tr>
<tr>
<td>Data 56Kb</td>
</tr>
<tr>
<td>Fax 2/3</td>
</tr>
</tbody>
</table>

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 64 k |

Fractional T1 | n x 56 k |

Contiguous Channels

Non Contiguous Channels

V54 Loop Codes Support

Voice Frequency

Test Access - T1

Listed to an Audio Call

Insert VF Tones 404, 1004, 1804, 2713, and 2804 Hz
Fiber Inspection

Optical Fiber Microscope

The Test Equipment shall be able to accept an optical video microscope.

The connector image shall be displayed on the Test Equipment and saved into a .JPEG file format.

The microscope shall offer a switchable 200/400x magnification capability.

It shall be provided with the dedicated tips to inspect fiber connectors on the patch panel and the patch cords.

The microscope shall be capable of automatically centering the fiber image.

The microscope shall be capable of performing on-board Pass/Fail analysis.

The microscope shall be compatible with Android tablets/smartphones.

OTDR

OTDR Solution for Troubleshooting from Central Offices

Wavelengths: 1310 & 1550 nm
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 1310 nm: 35 dB
• at 1550 nm: 33 dB
Event Dead Zone:
• at 1310 nm/1550 nm: 1.5 m maximum
Attenuation Dead Zone:
• at 1310 nm/1550 nm: 6 m maximum
Pulse width: 5 ns to 20 ms
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, 1550 nm
Connector type: UPC or APC for 1310 nm/1550 nm (Note: Only one should be selected) and UPC for 850/1300 nm
Adapter type: FC, SC, LC or ST (Note: One or several can be selected)
Dynamic Range:
• at 850 nm: 26 dB
• at 1310 nm: 24 dB
• at 1310 nm: 37 dB
• at 1550 nm: 35 dB
Event Dead Zone:
• at 850 nm/1310 nm: 0.8 m maximum
• at 1310 nm/1550 nm: 0.9 m maximum
Attenuation Dead Zone:
• at 850 nm/1310 nm: 4 m maximum
• at 1310 nm/1550 nm: 4 m maximum
Pulse width:
• at 850 nm/1310 nm: 3 ns to 1 ms
• at 1310 nm/1550 nm: 3 ns to 20 μs
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 Cloud RAN & Access/Backhaul Network Testing

Wavelengths: 1310, 1550, 1625 nm (Note: 1625 nm 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 1310 nm: 43 dB
• at 1550 nm: 43 dB
• at 1625 nm: 41 dB
Event Dead Zone:
• at 1310/1550/1625 nm: 0.8 m maximum
Attenuation Dead Zone:
• at 1310/1550/1625 nm: 4 m maximum
Pulse width: 3 ns to 20 ms
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, 1611 nm

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: 35 dB

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**

**Precision Timing Reference for Mobile Backhaul (PTP) Service Activation**

Connector types:
- SMA for GPS Antenna,
- SMB for 1PPS and 10 MHz Timing Inputs and Outputs

**Integral GPS Receiver**

Support for GNSS tuning including GPS, GLONASS, Beidou, and SBAS

Support for Cable/Antenna Calibration factor

GPS Synchronization Modes; Dynamic, Static, and Survey

Capable of savings surveyed locations and recalling saved locations

Capable of powering external antenna with 5VDC or 3.3 VDC

Capable of detecting short circuit and open circuit fault conditions with external antenna

Capable of providing accurate timing with only a single satellite visible in static timing mode

Support for user tuning of minimum satellite elevation angle

Provides real-time satellite constellation sky plot identifying potential visible satellites and those being used

Provides real-time bar graph of satellite Carrier to Noise Ratio (CNR) for all visible satellites

Support for 72 channels; 32 for satellite tracking, 40 for acquisition aiding and noise estimation

**Rubidium Clock**

Support for two 1PPS inputs and capable of measuring phase difference between them down to 5nsec

Support for measuring ToD offset for a device under test with NMEA and G.8271 (draft) formats

Support for a 10MHz input

Support for a 1PPS output disciplined to the Rubidium clock

Support for a 10MHz output disciplined to the Rubidium clock

Selectable auto-power on for the Rubidium clock upon instrument power-up

Minimum holdover of 7 usec over 24 hours over full temperature range

Minimum oscillator stability of 1.5E-11 over 2 hours.

**GPS Results**

Number of satellites used

UTC Time

Estimated position error

Sky plot

Carrier to Noise bar graph

Carrier to Noise (C/No) measurement per satellite

Mean C/No measurement (current and average)

C/No Bar Chart

Mean 3D Accuracy

Position Dilution of Precision (current and average)

Leap seconds

Event Log

**Rubidium Clock Results**

Total holdover time elapsed

Holdover time remaining (for selectable clock accuracy)

Synchronization state (Course tune, Intermediate Tune, Fine Tune)

Event Log
### Test Interfaces/Bit Rates

<table>
<thead>
<tr>
<th>Bit Rate</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.048Mhz</td>
<td>Dual Port Capable</td>
</tr>
</tbody>
</table>

### Laser Type

- SFP

### Modes of Operation

- Terminate

### Framing

- Framed

### Payload

- N x 64 kbps

### Test Patterns

- $2^{11} - 1$ (INV)
- $2^{15} - 1$ (INV)
- $2^{20} - 1$ (INV)
- $2^{23} - 1$ (INV)
- QRSS
- All Ones
- All Zeros
- Delay
- Live

### Performance

- ANSI and ITU
- G.826
- G.821
- M.2100

### Alarms

- LOF
- RDI

### Errors

- FAS

---

**Results**

<table>
<thead>
<tr>
<th>Interface</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signal Losses</td>
<td></td>
</tr>
<tr>
<td>Signal Loss Seconds</td>
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</tr>
<tr>
<td>Optical Rx Overload</td>
<td></td>
</tr>
<tr>
<td>Optical Rx Level (dBm)</td>
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</tr>
<tr>
<td>Optical Tx Level (dBm)</td>
<td></td>
</tr>
<tr>
<td>Laser Bias Current (mA)</td>
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</tr>
<tr>
<td>Rx Frequency (Hz)</td>
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<tr>
<td>Rx Frequency Deviation (ppm)</td>
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</tr>
<tr>
<td>Tx Frequency (Hz)</td>
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<tr>
<td>Tx Frequency Deviation (ppm)</td>
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<tr>
<td>Tx Frequency Maximum Deviation (ppm)</td>
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<tr>
<td>C37.94 - Frame</td>
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</tr>
<tr>
<td>Frame Sync Losses</td>
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<tr>
<td>Frame Sync Loss Seconds</td>
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<td>LOF</td>
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<tr>
<td>LOF Seconds</td>
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<td>RDI Alarms</td>
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<tr>
<td>RDI Seconds</td>
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<tr>
<td>FAS Word Errors</td>
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<td>FAS Word Error Rate</td>
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<td>FAS Bit Errors</td>
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<tr>
<td>FAS Bit Error Rate</td>
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</tr>
<tr>
<td>N x 64 kbps</td>
<td></td>
</tr>
</tbody>
</table>

**Payload - BERT**

- Pattern Sync Losses
- Pattern Sync Loss Seconds
- Round Trip Delay (ms)
- Round Trip Delay Avg (ms)
- Round Trip Delay Minimum (ms)
- Round Trip Delay Maximum (ms)