VIAVI T-BERD®/MTS-5800 Specifications

Platform

**Platform Requirements**
- The mainframe shall be non modular
- The product shall be field upgradeable
- The test system shall utilize Linux operating system to ensure optimum stability

**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.
- 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 verdict 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.

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**Ethernet**

**Test Interfaces/Bit Rates**
- 10/100/1000M Electrical
- 100M Ethernet Optical
- GigE (Optical)
- 10GigE WAN Phy (9.9G)
- 10GigE LAN Phy (10.3G)

**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)
- Recovered from External (BtS/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 1s, All 0s
- 1, 3, 7, 15, 31, 63, 127, 255, 511, 1023, 2047
- 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 Tagging (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.17711
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
 Sequence MAC Addresses
 Suppression of OOS Frames
Report formats
Graphical Results
Total Test Time Display
One Way Delay with GPS or CDMA receiver
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
Definable Frame Size
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
 Sequence 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
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
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-BRGSTP
 Custom Frame Builder
Synchronous Ethernet
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
1G 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 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

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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)
- One-way (Master to Slave and Slave to Master) Delay
- 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.

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.82611 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
- Crossover/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

### 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
### Packet length
### Packet jitter, Avg
### Packet jitter, Max

### Errored Counts
- Symbol errors
- Code violation
- FCS errored frames
- Runts
- Jabbers
- Oversized frames
- Undersized frames
- OOS frames
- Lost frames
- IP checksum errors
- IP packet length errors
- Pkt Payload Errors
- Bit error
- Bit error rate

### 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
- 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

### Application Testing
- Walk the Window
- FTP Throughput
- HTTP Throughput

### 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

- 215-1, 215-1 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

### SDH Mappings

- VC4 Bulk, AU-4-4c, AU-4-16c, AU-4-64c
- VC12
- VC4
- VC3
- E4
- DS3
- E3
- E1

### SONET Mappings

- STS-1, STS-3c, STS-12c, STS-48c, STS-192c
- VT1.5
- DS3
- DS1
- 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, STS-3c, STS-12c, STS-48c, STS-192c
- 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
- APS Destination Node
- APS Source Node
- APS Path Code
- APS Status
- APS Request Code
- APS K1 Channel Number
- APS K2 Channel Number
- APS MSP Architecture
- APS Status
- Linear

#### 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) Category

<table>
<thead>
<tr>
<th>Pointer Transmitted</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Pointer Received</td>
<td></td>
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<tr>
<td>Pointer Just Count</td>
<td></td>
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<tr>
<td>Pointer Increment Count</td>
<td></td>
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<tr>
<td>Pointer Dec Count</td>
<td></td>
</tr>
<tr>
<td>Pointer NDF Count</td>
<td></td>
</tr>
<tr>
<td>LOP Count</td>
<td></td>
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<tr>
<td>LOP Seconds</td>
<td></td>
</tr>
<tr>
<td>B3/V5 BIP Count</td>
<td></td>
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<tr>
<td>B3/V5 BIP Error Rate</td>
<td></td>
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<tr>
<td>REI Count</td>
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<tr>
<td>Pointer Transmitted</td>
<td></td>
</tr>
<tr>
<td>Pointer Received</td>
<td></td>
</tr>
</tbody>
</table>

Signal Label | C2/V5
Signal Label Mismatch | J2-Lower Order Trace Message
J2 Lower Order TIM | Logic Category

Pattern loss Count | Bit Error/TSE Count
Bit Error/TSE Rate | Pattern Slip Count
Pattern Slip Secs | Pattern Loss Count
Pattern Synchronization Loss Secs | Pattern Synchronization Status

Alarms
Signal Loss Status | Frame Synchronization Loss Status
Pattern Synchronization Loss Status | MS/Line-AIS
AIS (HP) | AIS (LP)
LOP (HP) | LOP (LP)
LOS | ODF
LOF | MS/Line RDI
LP RDI | HP RDI
MS/Line-REI | OTU1e (11.095G) | Dual Port Capable

Laser Type
SFP
SFP+
SFP+ - Tunable

Modes of Operation
Terminate
Monitor
Monitor/Thru

OTN Layer
OTN/ODU Framing
ODU1 in ODU2 Multiplexing

ODU1 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 88/10B 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

Regenerator Trace Identifier Mismatch | TIM
High Path Trace Identifier Mismatch | TIM
HP-UNEQ/UNEQ-P | TIM
Low Path Trace Identifier Mismatch | TIM
Loss of Multiframe | TU-12, TU-3, VT-1.5

Overhead Byte Manipulation/Viewing – High Path
A1, A2, J0, J1, D1, D2, D3, C2, H1, H2, H3, G1, B2, K1, K2, F2, D4, D5, D6, H4, D7, D8, D9, H4, D7, D8, D9, Z3/F3, D10, D11, D12, Z4/K3, S1, Z1, M1/Z2, E2, Z5/N1

SDH Low Order View (AU/VT)
V5, S2, N6, K4

SOH and POH Evaluation
Text decode of S and C bytes for the trace identifier. J0 display of 16-byte ASCII sequence. J1, J2 display of 16- or 64-byte ASCII sequence.

Tandem Connection Monitoring (TCM)
Analysis of the N1 and N2 bytes. Monitoring/Display of: AIS, ODI, RDI, OEI, REI, APId, incoming B3/Computed BIP Comparison, IEC, TC-UNEQ

Performance Measures
G.826 | ISM/OOS
G.828 | ISM/OOS
G.829 | ISM/OOS
M.2101 |  
T1.231 |  
T1.514 |  

K1/K2 Event Log
Date, Time, K1 Value, Code, Channel, K2, Bridge, MSP, Status

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

OTN G.709

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

Laser Type
SFP
SFP+
SFP+ - Tunable
SM-BIP/BEI
PM-BIP/BEI
FEC Uncorrectable
FEC Correctable
TCM1-6 BIP
TCM1-6 BEI
Bit Error
Code Word Errors (Correct/Incorrect)
OTU Alarm Tx/Rx
LOF
OOF
LOM
OOF
OOM
SM-IAE
SM-TIM
SM-BDI
SM-BIAE
PM-TIM
PM-BDI
FTFL Fwd Sig Fail
FTFL Fwd Sig Degr.
FTFL Bwd Sig Fail
FTFL Bwd Sig Degr.
TCM1-6 IAE
TCM1-6 TIM
TCM 1-6 BDI
TCM1-6 BIAE
OPU Errors/Alarms Tx/Rx
PT Label Mismatch
Client Loss
Bit Error
ODU Mappings
Bulk
ODU0
ODU1
ODU2
SDH Mappings
VC4 Bulk, AU-4-4c, AU-4-16c, AU-4-64c
VC4
VC3
SONET Mappings
STS-1, STS-3c, STS-12c, STS-48c, STS-192c
Ethernet Mappings
10GigE
1GigE
Results
LEDS
Signal Present
Frame Sync
Pattern Sync
LOS
LOF
LSS
Interface
Invalid Rx Signal Seconds
LOS Count
Optical Rx Level (dBm)
Reference Frequency
Round Trip Delay
Rx Frequency Max Deviation (ppm)
Rx Frequency (Hz)
Rx Frequency Deviation (ppm)
Signal Losses Count
Tx Clock Source
Tx Freq Max Deviation (ppm)
Tx Frequency (Hz)
Tx Frequency Deviation (ppm)
FEC
Uncorrected Word Errors
Uncorrected Word Error Rate
Corrected Word Errors
Correctable Word Errors
Corrected Word Error Rate
Correctable Word Error Rate
Corrected Bit Errors
Correctable Bit Errors
Corrected Bit Error Rate
Correctable Bit Error Rate
Framing
Frame Sync Loss Seconds
Frame Sync Losses
OOF Seconds Count
FAS Errors
FAS Error Rate
LOF
LOF Seconds
Multiframe Sync Loss Seconds
OOM Seconds Count
MFAS Errors
MFAS Error Rate
ODU
OTU
OTU AIS
OTU AIS Seconds
SM-IAE
SM-IAE Seconds
SM-BIP Error Counts
SM-BIP Error Rate
SM-BDI Seconds
SM-BDI Count
SM-BIAE Seconds
SM-BIAE Count
SM-BEI Count
SM-BEI Error Rate
SM-TIM Count
SM-TIM Seconds
SM-SAPI
SM-DAPI
SM-Operator Specific
GCC BERT Bits
<table>
<thead>
<tr>
<th>Specifications</th>
<th>2.125 Gbit/s</th>
<th>Dual Port Capable</th>
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</thead>
<tbody>
<tr>
<td>4.25 Gbit/s</td>
<td>Dual Port Capable</td>
<td></td>
</tr>
<tr>
<td>8.5 Gbit/s</td>
<td>Dual Port Capable</td>
<td></td>
</tr>
<tr>
<td>10.519 Gbit/s</td>
<td>Dual Port Capable</td>
<td></td>
</tr>
<tr>
<td>14.025 Gbit/s</td>
<td>Dual Port Capable</td>
<td></td>
</tr>
</tbody>
</table>

### Fibre Channel Features

<table>
<thead>
<tr>
<th>General</th>
<th>Flow Control</th>
<th>Login</th>
<th>Buffer Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<table>
<thead>
<tr>
<th>Fibre Channel Login</th>
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</thead>
<tbody>
<tr>
<td>at &quot;F-Port&quot;</td>
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</table>

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

<table>
<thead>
<tr>
<th>High frequency test pattern</th>
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</thead>
<tbody>
<tr>
<td>Low frequency test pattern</td>
</tr>
<tr>
<td>Mixed frequency test pattern</td>
</tr>
<tr>
<td>Random Data Pattern (RPAT)</td>
</tr>
<tr>
<td>Jitter Tolerance Test Pattern (JTPAT)</td>
</tr>
<tr>
<td>Supply Noise Test Sequence (SPAT)</td>
</tr>
</tbody>
</table>

### 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% |

---

### GCC BERT Bit Errors

<table>
<thead>
<tr>
<th>GCC BERT Bit Error Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPU</td>
</tr>
<tr>
<td>Payload Type</td>
</tr>
<tr>
<td>Payload</td>
</tr>
<tr>
<td>Pattern Sync Loss Seconds</td>
</tr>
<tr>
<td>Pattern Sync Losses</td>
</tr>
<tr>
<td>TSE/Bit Errors</td>
</tr>
<tr>
<td>TSE/Bit Error Rate</td>
</tr>
</tbody>
</table>

### ODU

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

| 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 |

### BIP Errors

<table>
<thead>
<tr>
<th>BIP Error Rate</th>
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</thead>
</table>

### BDI Seconds

| BIAE Seconds |
| BEI Errors |
| BEI Error Rate |
| TIM Seconds |

### TIM Seconds

| SAPI |
| DAPI |

### Operator Specific

| GCC BERT Bits |
| GCC BERT Bit Errors |

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10 VIAVI T-BERD®/MTS-5800 Specifications
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
Signal Losses
Signal Loss Seconds
Sync Loss Seconds
Optical Rx Overload
Optical Rx Level (dBm)

Login Status
Far-end Buffer to Buffer Credits
Login Status
Tx/Rx ELP Accept
Tx/Rx ELP Ack1
Tx/Rx ELP Reject

L2 Link Statistics
Tx/Rx ELP Request

L2 Link Counts
Rx Frames
Tx Frames
Rx Acterna Frames
Tx Acterna Frames
Rx Frame Bytes
Tx Frame Bytes
Class F Frames
Class 1 Frames
Class 2 Frames
Class 3 Frames

BERT Stats
Pattern Losses
Pattern Loss Seconds
Bit Error Rate
Bit Errors
Bit Errored Seconds
Bit Error-Free Seconds
Bit Error-Free Seconds (%)

Error Stats
Symbol Errors
CRC Errored Frames
Fiber Runts
Fiber Jabbers
Undersized Frames
Code Violations
Code Violation Rate
Code Violation Seconds

PDH
Test Interfaces
E4
DS3
E3
E1 Balanced
E1 Unbalanced

Modes of Operation
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)
User Programmable
Round Trip Delay
ANSI and ITU

Mappings
E3
E1
64 k

Anomaly/Error Insert/Analysis
Frame Errors
TSE/Bit Error
Single
Rate

Defect/Alarm Insert/Analysis
AIS
RDI/FAS Distant

General
Frequency Offset ±100 ppm
National Bit Support

Performance Measures
G.821 OOS
G.826 ISM/OOS
M.2100 ISM/OOS

Results
Signal Category
## Specifications

<table>
<thead>
<tr>
<th>Frame Category</th>
<th>Logic Category</th>
<th>Patterns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receive Frequency</td>
<td>TSE/Bit Error Count</td>
<td>Mapped</td>
</tr>
<tr>
<td>Receive Frequency Deviation</td>
<td>TSE/Bit Error Rate</td>
<td>Mapped</td>
</tr>
<tr>
<td>Receive Frequency Max Deviation</td>
<td>Pattern Slips</td>
<td>Mapped</td>
</tr>
<tr>
<td>Transmit Frequency</td>
<td>Pattern Slip Seconds</td>
<td>Mapped</td>
</tr>
<tr>
<td>Round Trip Delay</td>
<td>Pattern Synchronization Loss Count</td>
<td>Mapped</td>
</tr>
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</table>

### Mappings

<table>
<thead>
<tr>
<th>E1</th>
<th>T1</th>
<th>64k</th>
</tr>
</thead>
</table>

### Anomaly/Error/Insert/Analysis

<table>
<thead>
<tr>
<th>BPV/Code Error</th>
<th>Frame</th>
<th>Parity</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-Bit Parity</td>
<td>TSE/Bit Error</td>
<td>Single</td>
</tr>
<tr>
<td>Rate</td>
<td>Multiple</td>
<td></td>
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</tbody>
</table>

### Defect/Alarm Insert/Analysis

<table>
<thead>
<tr>
<th>AIS</th>
<th>RDI/FAS Distant</th>
<th>REBE</th>
</tr>
</thead>
<tbody>
<tr>
<td>TS-16 AIS</td>
<td>TS-16 RDI/MFAC Distant</td>
<td></td>
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</table>

### General

<table>
<thead>
<tr>
<th>Frequency Offset +/- 100ppm</th>
<th>Loop Codes Tx NIU, CSU, Line</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rx Compensation - High - 0 ft</td>
<td>Rx Compensation - Low - 450 ft</td>
</tr>
<tr>
<td>Rx Compensation - Low - 900 ft</td>
<td>Service Disruption</td>
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</tbody>
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### Performance Measures

<table>
<thead>
<tr>
<th>G.826</th>
<th>ISM/OOS</th>
</tr>
</thead>
<tbody>
<tr>
<td>G.821</td>
<td></td>
</tr>
<tr>
<td>M.2100</td>
<td></td>
</tr>
<tr>
<td>M.2101</td>
<td></td>
</tr>
<tr>
<td>T1.231</td>
<td></td>
</tr>
<tr>
<td>T1.510</td>
<td></td>
</tr>
</tbody>
</table>

### Results

<table>
<thead>
<tr>
<th>Signal Category</th>
<th>Frame Error Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receive Frequency</td>
<td>Frame Error Seconds</td>
</tr>
<tr>
<td>Receive Frequency Deviation</td>
<td>Far-End Out of Frame Seconds</td>
</tr>
<tr>
<td>Receive Frequency Maximum Deviation</td>
<td>C-Bit Error Rate</td>
</tr>
<tr>
<td>Transmit Frequency</td>
<td>Parity Error Rate</td>
</tr>
<tr>
<td>BPV/Code Rate</td>
<td>Parity Error Seconds</td>
</tr>
<tr>
<td>BPV/Code Count</td>
<td>C-Bit Parity Error Rate</td>
</tr>
<tr>
<td>Electrical Input Level</td>
<td>C-Bit Error Seconds</td>
</tr>
<tr>
<td>Round Trip Delay (ms)</td>
<td>FEBEs</td>
</tr>
<tr>
<td>Frame Synchronization Loss Count</td>
<td>DS2 Frame Synchronization Loss Count</td>
</tr>
</tbody>
</table>

### Logic

<table>
<thead>
<tr>
<th>Bit Error/TSE Count</th>
<th>Bit Error/TSE Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pattern Slips</td>
<td>Pattern Slip Seconds</td>
</tr>
<tr>
<td>Pattern Synchronization Loss Count</td>
<td>Pattern Synchronization Loss Seconds</td>
</tr>
<tr>
<td>Pattern Synchronization Status</td>
<td>E3</td>
</tr>
</tbody>
</table>

### Modes of Operation

<table>
<thead>
<tr>
<th>Terminate</th>
<th>Monitor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thru (Intrusive)</td>
<td>Thru (Intrusive)</td>
</tr>
</tbody>
</table>

### Timing

<table>
<thead>
<tr>
<th>Recovered from Rx</th>
<th>Recovered from External (BITs/SETs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal (Stratum 3)</td>
<td>Recovered from External (BITs/SETs)</td>
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</tbody>
</table>

### Framing

<table>
<thead>
<tr>
<th>Framed</th>
<th>Unframed</th>
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</thead>
</table>

### Test Patterns

<table>
<thead>
<tr>
<th>All 1s</th>
<th>All 0s</th>
<th>2^11-1* (Inverse)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2^20-1* (Inverse)</td>
<td>2^23-1* (Inverse)</td>
<td></td>
</tr>
<tr>
<td>Round Trip Delay</td>
<td>User Programmable (3,..32 bits)</td>
<td></td>
</tr>
<tr>
<td>User Programmable (3,..32 bits)</td>
<td>User Programmable (3,..32 bits)</td>
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### E3

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Terminate</td>
</tr>
<tr>
<td>Monitor</td>
</tr>
<tr>
<td>Thru (Intrusive)</td>
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### Performance Measures

<table>
<thead>
<tr>
<th>G.826</th>
<th>ISM/OOS</th>
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<tbody>
<tr>
<td>G.821</td>
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</tr>
<tr>
<td>M.2100</td>
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</tr>
<tr>
<td>M.2101</td>
<td></td>
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<tr>
<td>T1.231</td>
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<tr>
<td>T1.510</td>
<td></td>
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</table>

### Results

<table>
<thead>
<tr>
<th>Signal Category</th>
<th>Frame Error Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receive Frequency</td>
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<tr>
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<tr>
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<td>C-Bit Error Rate</td>
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<tr>
<td>Transmit Frequency</td>
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<tr>
<td>BPV/Code Rate</td>
<td>Parity Error Seconds</td>
</tr>
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### Logic

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<tbody>
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<td>User Programmable (3,..32 bits)</td>
<td>User Programmable (3,..32 bits)</td>
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</tr>
<tr>
<td>User Byte</td>
<td>Round Trip Delay</td>
<td>8M FAS Word Error Rate</td>
</tr>
<tr>
<td>-----------</td>
<td>------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>1:1</td>
<td>1:3</td>
<td>8M FAS Bit Error Count</td>
</tr>
<tr>
<td>1:4</td>
<td>1:7</td>
<td>8M FAS Bit Error Rate</td>
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<tr>
<td>ANSI and ITU</td>
<td>64k</td>
<td>8M FAS Word Error Rate</td>
</tr>
</tbody>
</table>

**Mappings**

<table>
<thead>
<tr>
<th>E1</th>
</tr>
</thead>
</table>

**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**

<table>
<thead>
<tr>
<th>G.826</th>
<th>ISM/OOS</th>
</tr>
</thead>
<tbody>
<tr>
<td>G.821</td>
<td></td>
</tr>
<tr>
<td>M.2100</td>
<td></td>
</tr>
</tbody>
</table>

**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 |

**Logic Category**

| TSE/Bit Error Count |
| Pattern Slips |
| Pattern Slip Seconds |
| Pattern Synchronization Loss Count |
| Pattern Synchronization Loss Seconds |
| Pattern Synchronization Status |

** mappings**

| 64k |

**Anomaly/Error Insert/Analysis**

| Code Error |
| FAS Error |
| MFAS Error |
| TSE/Bit Error |
| Single |
| Multiple |
| Rate |

**Defect/Alarm Insert/Analysis**

| AIS |
| RBE |
| TS-16 AIS |
| TS-16 RDI/MFAS Distant |

**General**

| Frequency Offset Tx +/- 100ppm |
| Service Disruption |

**Performance Measures**

<table>
<thead>
<tr>
<th>G.826</th>
<th>ISM/OOS</th>
</tr>
</thead>
<tbody>
<tr>
<td>G.821</td>
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</tr>
<tr>
<td>G.829</td>
<td>ISM/OOS</td>
</tr>
<tr>
<td>M.2100</td>
<td></td>
</tr>
</tbody>
</table>

**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 |
| 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
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)

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

Loop Codes
Loop Code Tx NIU, CSU
Loop Code Emulation NIU, CSU

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

**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 (dBxs)
- 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)**
- Average Frame 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
- MT3
- 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, Maximum)
Throughput (Average, Current, Maximum)
Average Frame Rate (frames/sec)
Average Frame Size (octets)

**CPRI**

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<thead>
<tr>
<th>Test Interfaces/Bit Rates</th>
<th>Dual Port Capable</th>
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<td>61 Gbps optical</td>
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<tr>
<td>9.8 Gbps optical</td>
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<tr>
<td>10137 Gbps optical</td>
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<table>
<thead>
<tr>
<th>Laser Type</th>
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<tbody>
<tr>
<td>SFP</td>
<td></td>
</tr>
<tr>
<td>SFP+</td>
<td></td>
</tr>
<tr>
<td>SFP+ Tuneable</td>
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<table>
<thead>
<tr>
<th>Modes of Operation</th>
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<tbody>
<tr>
<td>Terminate</td>
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<tr>
<td>Monitor/Thru</td>
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<table>
<thead>
<tr>
<th>Timing</th>
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<tbody>
<tr>
<td>Recovered from Rx (Slave)</td>
<td></td>
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<tr>
<td>Internal (Stratum 3) (Master)</td>
<td></td>
</tr>
<tr>
<td>Recovered from External (BITs/SETs) (Master)</td>
<td></td>
</tr>
<tr>
<td>Recovered from 10MHz clock (Master)</td>
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<table>
<thead>
<tr>
<th>CPRI Automation</th>
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<tr>
<td>CPRI Service Activation automated workflow</td>
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<th>CPRI Features</th>
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<td>Optical/Electrical Power Level</td>
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<tr>
<td>Freq Offset Transmit/Receive</td>
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<tr>
<td>CPRI Startup Sequence - Normal or Bypass</td>
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</table>

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<thead>
<tr>
<th>Signal Generation and Monitoring</th>
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<td>L1 - PRBS Pattern Inserted in Hyperframe Structure</td>
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<tr>
<td>L2 - PRBS Pattern Inserted in CPRI Basic Frame</td>
<td></td>
</tr>
<tr>
<td>L2 - PRBS Pattern Inserted in CPRI Antenna-carrier (AxC) Group</td>
<td></td>
</tr>
<tr>
<td>L2 Test Waveform Inserted in CPRI Antenna-carrier (AxC) Group</td>
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<thead>
<tr>
<th>Interface Type</th>
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<tbody>
<tr>
<td>Master</td>
<td></td>
</tr>
<tr>
<td>Slave</td>
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<tr>
<td>Selectable CPRI Protocol Verion</td>
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<table>
<thead>
<tr>
<th>Control and Management (C&amp;M) Channel</th>
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<tbody>
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<td>Ethernet</td>
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<tr>
<td>HDLC</td>
<td></td>
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<tr>
<td>Selectable C&amp;M Channel Rate</td>
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<table>
<thead>
<tr>
<th>Service Disruption Measurements</th>
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<td>SD Separation/Debounce Time Setting</td>
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<td>SD Threshold Time Settings</td>
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<tr>
<th>Round-Trip Delay Measurement</th>
<th></th>
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<td>RTD Measurement Accuracy</td>
<td></td>
</tr>
<tr>
<td>PRBS Patterns</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PRBS Patterns</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2^15-1, 2^15-1 Inverse</td>
<td></td>
</tr>
<tr>
<td>2^20-1, 2^20-1 Inverse</td>
<td></td>
</tr>
<tr>
<td>2^23-1, 2^23-1 Inverse</td>
<td></td>
</tr>
<tr>
<td>2^31-1, 2^31-1 Inverse</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Defects/Alarms Generation/Analysis</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>LOS</td>
<td></td>
</tr>
<tr>
<td>LOF</td>
<td></td>
</tr>
<tr>
<td>SDI</td>
<td></td>
</tr>
<tr>
<td>RAI</td>
<td></td>
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<table>
<thead>
<tr>
<th>Results Accuracy</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 ns</td>
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<table>
<thead>
<tr>
<th>Signal Category</th>
<th></th>
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<tbody>
<tr>
<td>Signal Losses</td>
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</tr>
<tr>
<td>Sync Loss Seconds</td>
<td></td>
</tr>
<tr>
<td>Optical Rx Overload</td>
<td></td>
</tr>
<tr>
<td>Optical Rx Level (dBm)</td>
<td></td>
</tr>
<tr>
<td>Receive Frequency</td>
<td></td>
</tr>
<tr>
<td>Receive Frequency Deviation</td>
<td></td>
</tr>
</tbody>
</table>

16 VIAVI T-BERD®/MTS-S800 Specifications
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
RAI Seconds
SDI
SDI Seconds
Running Disparity Errors
Running Disparity Error Rate

**RRH Testing (available for ALU RRH)**
RRH SW version
RRH serial number
RRH SFP information
RRH CPRI Reset
RRH Alarm Insertion

**OBSAI**

### Test Interfaces/Bit Rates
- **768 Mbps Optical**: Dual Port Capable
- **1.5 Gbps Optical**: Dual Port Capable
- **31 Gbps Optical**: Dual Port Capable
- **61 Gbps Optical**: Dual Port Capable

### Laser Type
- **SFP**
- **SFP+**
- **SFP+ 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
- 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
  - Receive 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
- Code Violation Rate
- Code Violation Seconds
- K30.7 Words
- Frame Sync Losses
Jitter O.172

General Features
- Generate and measure Jitter on electrical interfaces
- DS1, E1, DS3, E3, E4, STMn

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]
- 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(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 1 pps wander
- Reference Clock for 1G SyncE Optical, T1, E1, 2 MHz, & 10 MHz wander

Cables for 1 ppps Wander

Wander Analysis Tool
- Offline analysis of captured/imported TIE measurements

Maximum Peak-to-Peak TIE (MTIE) [s]
- TDEV (Time Deviation)
- Frequency Offset (ppm)
- Drift Rate (ppm/s)

Masks
- ANSI: SMC holdover (T1105.109)
- ETSI: SEC (ETS 300 462-5-1)
  - SEC network IF (ETS 300 462-3-1)
  - SSU network IF (ETS 300 462-4-1)
  - SSU network IF (ETS 300 462-3-1)
- GR253: SMC transient

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.8271)
- Wander Generation (G.8272)
- DTE Noise Generation (G.8273.2 constant temp.)
- DTE Noise Generation (G.8273.2 variable temp.)

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
- Configurable device name

Supported H.323 Parameters
- H.323 ID
- Bearer Capability including Unrestricted Digital, Speech & 3.1K Audio
- Configurable Calling & Called Party Number Plans and Number Types
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 per frame 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

### Primary Rate ISDN

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<td>NT Emulation</td>
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<td>D-Channel Signaling Decodes</td>
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<tr>
<td>Call Control</td>
<td>National SESS N-I</td>
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<tr>
<td>D-Channel Rate</td>
<td>64 k</td>
</tr>
<tr>
<td>Call Type</td>
<td>Data</td>
</tr>
<tr>
<td>Channel Number</td>
<td>1 to 24</td>
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<tr>
<td>D-Channel Rate</td>
<td>56 k</td>
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</tbody>
</table>

### Primary Rate E1 ISDN

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<th>Test Access</th>
<th>E1</th>
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<td>NT Emulation</td>
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<tr>
<td>D-Channel Signaling Decodes</td>
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</tr>
<tr>
<td>Codec μ-law, A-law</td>
<td></td>
</tr>
</tbody>
</table>

### Call Control

| 1TR6 |
| 1TR67 |
| EDS-1 |
| VN3 |
| VN4 |
| VN6 |
| TPH1962 |
| Q.SIG |
| Q.931 |
| TN-1R6 |
| SwissNet-3 |
| CorNet-N |
| CorNet-NQ |
| DREX |
| Alcatel |
| QSIG |

### Services
- Speech 31 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

<table>
<thead>
<tr>
<th>Test access</th>
<th>T1</th>
</tr>
</thead>
<tbody>
<tr>
<td>E&amp;M Signaling</td>
<td></td>
</tr>
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<td></td>
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</table>

### Fractional T1/E1

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<thead>
<tr>
<th>Test Access</th>
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</thead>
<tbody>
<tr>
<td>Fractional T1</td>
<td>n x 64 k</td>
</tr>
<tr>
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<td>n x 56 k</td>
</tr>
<tr>
<td>Contiguous Channels</td>
<td></td>
</tr>
<tr>
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</tr>
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<td>V.54 Loop Codes Support</td>
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<td>Insert VF Tones</td>
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### 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 512 SPTS and 32 MPTS and a video analyzer that supports 16 SPTS and 1 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 RFC3352, 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

### Triple Play Automated Test Script

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<td>TE Emulation</td>
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<td>D-Channel Signaling Decodes</td>
<td></td>
</tr>
<tr>
<td>Call Control</td>
<td>National SESS N-I</td>
</tr>
<tr>
<td>D-Channel Rate</td>
<td>64 k</td>
</tr>
<tr>
<td>Call Type</td>
<td>Data</td>
</tr>
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<td>Channel Number</td>
<td>1 to 24</td>
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User Frequency
Quiet Tone
Holding Tone
Three Tone
Frequency Sweep
Impulse Noise
Rx Frequency
Level (dBm)
DC Offset mV

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 & 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

OTDR Solution for FTTH & 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
- Output power: -3.5 dBm typical

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: 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: 6m maximum
Pulse width: 3ns to 20µs
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
Optical Spectrum Analyzer

Wavelength accuracy: ±0.5 nm
Wavelength range: From 1260 to 1625 nm
Spectral measurement (several can be selected)
Adapter type: FC, SC, LC or ST (Note: One or several can be selected)
Connector type: PC

Mobile Backhaul Service Activation

Optical Spectrum Analyzer 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: 35dB
Event Dead Zone:
- at 1310/1550/1625 nm: 1.5m maximum
Attenuation Dead Zone:
- at 1310/1550/1625 nm: 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 5 VDC 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

**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

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