

T-BERD®/MTS-6000A MSAM Specifications



Ethernet

Test Interfaces/Bit Rates

10/100/1000 Mbps electrical	Dual-port capable
100 Mbps Ethernet optical	Dual-port capable
Gigabit Ethernet (Optical)	Dual-port capable
10 GE WAN Phy (9.9 Gbps)	Dual-port capable
10 GE LAN Phy (10.3 Gbps)	Dual-port capable

Interface Type

RJ45
SFP
SFP+
XFP
XFP - Tunable

General

Line-rate traffic Tx and Rx for all interfaces
Single-stream generation/analysis
10-stream generation/analysis per stream
Auto-discovery of test sets

Modes of Operation

Terminate
Monitor
Through (intrusive)
Loopback
Half duplex
Full duplex

Timing

Recovered from Rx
Internal (Stratum 3)
Recovered from external (bits/set)
Frequency offset Tx/Rx

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, 1:7, 3:1, 7:1, 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 (for example, counts)

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 10 k)
User-defined
Jumbo (to 10 k)
EMIX
Random

VLAN

VLAN tagging 802.1q
VLAN tag-editable fields
- Priority
- VID

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 802.1ah

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

Line-rate 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.1711
- Common header label - PW, LSP, section
- CCM generation and analysis
- FFD generation and analysis
- BDI generation and analysis
- FDI generation and analysis
Simultaneous OAM and background-traffic generation

Specifications *cont'd.***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 contolled
Bandwidth specification in Mbps or kbps
Bandwidth granularity
Bandwidth specification in %
Bandwidth utilization accuracy - 0.1%
Burst mode - Burst size - 1 to 2 Mbps 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 bandwidth
Ramp bandwidth
Bursty bandwidth
Flood bandwidth
Traffic generation in Mbps or kbps and % utilization
Bandwidth-configurable based on L1 or L2

TCP Throughput

10/100/1000 Mbps line rate stateful emulation
1 GE line rate stateful emulation
10 GE line rate stateful emulation
Configurable source and destination 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 simultaneous TCP stateful sessions
Supports 4 background streams
Compatible with iPerf

RFC 2544

Asymmetric testing
Symmetric testing
Throughput
Frame loss
Out-of-sequence 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
Definable frame size
Report formats
Graphical results
Total-test-time display

ITU-TY.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 bidirectional testing
Configurable VLAN, priority, addressing, and pass/fail thresholds
Programmable pass/fail thresholds
Graphical results
Screenshot support
Auto-negotiation check
Saved reports
Saved test profiles
Configurable DEI, TPID, TOS/DSCP
Inclusive of L2 Ethernet and IPv4
Integrated TrueSpeed TCP traffic stream with background streams
Asymmetric testing
One-way delay with CDMA receiver

IETF RFC 6349

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 simultaneous TCP stateful sessions
Graphical results and report generation
Configurable file and window sizes
Total-test-time display

Layer 2 Transparency Testing (J-Proof)

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

Specifications *cont'd.***Synchronous Ethernet ITU G.826x**

10 GE Tx/Rx
 1000/100/10 Mbps Electrical Tx/Rx
 100/1000 Mbps Optical Tx/Rx
 Recovered interface timing
 4.6 ppm frequency accuracy
 SSM message decode
 ESMC message capture
 Quality message decode
 Definable SSM PDU rate (pps)
 Background data plane traffic generation

1588v2

1 GE Tx/Rx
 1588v2 master PRC emulation
 1588v2 slave emulation
 Packet delay variation measurements on control-plane traffic
 Generate up to 4 streams of background data plane traffic
 Frame/packet capture and decode via Wireshark
 Layer 2 1588v2 messaging
 Layer 4 1588v2 messaging
 1588v2 delay measurements (Master/Slave)

Loopback

Manual (LLB)
 Automatic
 Local
 Far end

Delay

Round-trip 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 10 Gbps
 Wirespeed capture up to 1000/100/10 Mbps
 Integrated Wireshark on the test set
 256 MB capture buffer
 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 - Q-in-Q, 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 Mbps

Rx Mbps

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

Specifications *cont'd.***Error Counts**

Symbol errors

Code violation

FCS-errored frames

Runts

Jabbers

Oversized frames

Undersized frames

Out-of-sequence frames

Lost frames

IP checksum errors

IP packet-length errors

Packet 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-Layer 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+

XFP

XFP - Tunable

Modes of Operation

Terminate

Monitor

Through (intrusive)

Tributary scan

Drop and insert

Timing

Recovered from Rx

Internal (Stratum 3)

Recovered from external (bits/set)

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

Frequency offset Tx/Rx

Round-Trip Delay Measurement

RTD measurement accuracy

PRBS Pattern $2^{15}-1$, $2^{15}-1$ inverse $2^{20}-1$, $2^{20}-1$ inverse $2^{23}-1$, $2^{23}-1$ inverse $2^{31}-1$, $2^{31}-1$ inverse

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

TU-AIS

TU-LOM

LP-UNEQ

LP-RDI

LP-TIM

LP-PLM

LP-RFI

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

Rx frequency

Rx-frequency deviation

Rx-frequency maximum deviation

Tx frequency

Specifications *cont'd.***Signal Category (Cont'd)**

Electrical input level	
- STS-1	dBdsx, dBm, volts
- STM-1e	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	TIM
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	
S1 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) Category

Pointer transmitted	
Pointer received	
Pointer-justification count	
Pointer-increment count	
Pointer-decrease count	
Pointer-NDF count	
LOP count	
LOP seconds	
B3/V5 BIP count	
B3/V5 BIP-error rate	
REI count	
Pointer transmitted	
Pointer received	
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 seconds	
Pattern-loss count	
Pattern-synchronization-loss seconds	
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	
OOF	
LOF	
MS/Line RDI	
LP RDI	
HP RDI	
MS/Line-REI	
Regenerator trace identifier mismatch	TIM
High-path trace identifier mismatch	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, elapsed test time

OTNG.709**Test Interfaces/Bit Rates**

OTU1	2.7 Gbps
OTU2	10.7 Gbps
OTU1e	11.045 Gbps
OTU2e	11.095 Gbps

Laser Type

SFP	
SFP+	
XFP	
XFP - Tunable	

Modes of Operation

Terminate	
Monitor	

OTN Layer

OTN/ODU framing	
ODU1 in ODU2 multiplexing	
ODU0 multiplexing	
- ODU-0 bulk BERT from an OTU-2	
- ODU-0 1 GE Layer 2 and IPv4 traffic from an OTU-2	
- ODU-0 bulk BERT from an OTU-1	
- ODU-0 1 GE Layer 2 and IPv4 traffic from an OTU-1	
- ODUflex bulk BERT from an OTU-2	
- ODUflex 1 GE Layer 2 from an 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	

Specifications *cont'd.***OTN Layer (Cont'd.)**

Overhead manipulation/analysis
 Service-disruption measurements
 - SD separation/debounce time setting
 - SD threshold time settings
 Payload type (PT) label generation/display
 Transfer delay
 Frequency offset Tx/Rx

PRBS Patterns

2²⁰-1, 2²⁰-1 inverse
 2²³-1, 2²³-1 inverse
 2³¹-1, 2³¹-1 inverse
 Programmable - 32 bit
 ANSI and ITU implementations

Error-Insertion Capability

Single, rate

OTU Error Tx/Rx

FAS
 MFAS
 SM-BIP/BEI
 PM-BIP/BEI
 FEC uncorrectable
 FEC correctable
 TCM1-6 BIP
 TCM1-6 BEI
 Bit error
 Codeword 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 signal fail
 FTFL Fwd signal degraded
 FTFL Bwd signal fail
 FTFL Bwd signal degraded
 TCM1-6 IAE
 TCM1-6 TIM
 TCM 1-6 BDI
 TCM1-6 BIAE

ODU Errors Tx/Rx

FAS
 MFAS
 PM BIP/BEI
 TCM BIP/BEI
 Bit error

ODU Alarms Tx/Rx

LOF
 OOF
 LOM
 OOM
 AIS
 OCI
 LCK
 PM-TIM
 PM-BDI
 FTFL
 FTFL Fwd signal fail
 FTFL Fwd signal degraded
 FTFL Bwd signal fail
 FTFL Bwd signal degraded
 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

10 GE
 1 GE

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 maximum deviation (ppm)
 Rx-frequency (Hz)
 Rx-frequency deviation (ppm)

Interface (Cont'd.)

Signal-loss count
 Tx clock source
 Tx-frequency maximum 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
 Corrected bit-error rate
 Correctable bit errors
 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

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
 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

Specifications *cont'd.***OTU (Cont'd.)**

PM-BDI count
 PM-BEI count
 PM-BEI-error rate
 PM-TIM seconds
 PM-TIM count
 PM-SAPI
 PM-DAPI
 PM-operator specific

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

OPI

Payload type mismatch seconds
 Payload type

Payload

Pattern-sync-loss seconds
 Pattern-sync losses
 TSE/bit errors
 TSE/bit-error rate

Fibre Channel**Laser Type**

SFP
 SFP+
 XFP

Modes of Operation

Terminate
 Monitor
 Thru

Test Interfaces/Bit Rates

1.0625 or 2.125 Gbps	Dual-port capable
4.25 Gbps	Dual-port capable
8.5 Gbps	Dual-port capable
10.519 Gbps	Dual-port capable

Fibre Channel Features**General**

Flow control
 Login
 Buffer credits

Fibre Channel Login

at "F-port"
 at "N-port"

Fibre Channel Traffic Generation

Transmit traffic profiles
 Constant
 Ramp
 Bursty
 Traffic generation in Mbps 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 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

Fibre Channel Script (RFC-2544-like)**8 G 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**Login Status**

Far-end buffer-to-buffer credits
 Login status
 Tx/Rx ELP accept
 Tx/Rx ELP Ack1
 Tx/Rx ELP reject
 Tx/Rx ELP request

PDH**Test Interfaces**

E4	
DS3	Dual receivers
E3	Dual receivers
E1 balanced	Dual receivers
E1 unbalanced	Dual receivers
T1	Dual receivers

Interface Type

BNC
 Bantam
 RJ48

E4**Modes of Operation**

Terminate
 Monitor
 Thru (Intrusive)

Timing

Recovered from Rx
 Internal (Stratum 3)
 Recoverd from external (bits/sets)

Framing

Framed
 Unframed

Test Patterns

$2^{15}-1^*$ inverse
 $2^{20}-1^*$ inverse
 $2^{23}-1^*$ inverse
 User-programmable
 Round-trip delay
 ANSI and ITU

Mappings

E3
 E1
 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

Specifications *cont'd.***Performance Measures**

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

Results**Signal Category**

Rx frequency
Rx-frequency deviation
Rx-frequency maximum deviation
Tx 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/set)

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
100
1100 (aka Idle)
1010 (aka Blue)
ANSI and ITU

Mappings

E1
T1
64 k

Anomaly/Error/Insert/Analysis

BPV/code error
Frame
Parity
C-bit parity
TSE/bit error
Single
Rate
Multiple

Defect/Alarm Insert/Analysis

AIS
RDI/FAS distant
REBE
TS-16 AIS
TS-16 RDI/MFAC distant

General

Frequency offset ±100 ppm
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	ISM/OOS
G.821	
M.2100	
M.2101	
T1.231	
T1.510	

Results**Signal Category**

Receive frequency
Receive-frequency deviation
Receive-frequency maximum deviation
Transmit frequency
BPV/code rate
BPV/code count
Electrical input level
Round-trip delay (ms)

Frame

Frame-error count
Frame-error rate
Frame-error seconds
Frame-synchronization-loss count
Near-end out-of-frame seconds
Far-end out-of-frame seconds
C-bit format
Rx X-bits
FEAC word

Frame (Cont'd.)

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
Through (intrusive)

Timing

Recovered from Rx
Internal (Stratum 3)
Recovered from external (bits/set)

Framing

Framed
Unframed

Test Patterns

All 1s
All 0s
2047
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

Specifications *cont'd.***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 ± 100 ppm
 Tx LBO - 0 dB loss
 Tx LBO - 6 dB loss
 National bit support - On/off
 Service disruption

Performance Measures

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

Results**Signal Category**

Tx frequency
 Rx frequency
 Rx-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
 Through (intrusive)

Timing

Recovered from Rx
 Internal (Stratum 3)
 Recovered from external (bits/set)

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 ± 100 ppm
 Service disruption

Performance Measures

G.826 ISM/OOS
 G.821
 G.829 ISM/OOS
 M.2100

Results**Signal Category**

2 Mbps receive frequency
 2 Mbps reference frequency
 2 Mbps receive-frequency deviation
 2 Mbps receive-frequency maximum deviation
 2 Mbps transmit frequency
 Electrical-input level
 Code-error count
 Code-error rate
 Round-trip delay (ms)
 Timing slips
 Frame slips
 APS switch time

Logic Category

TSE/bit-error count
 TSE/bit-error rate
 Pattern slips
 Pattern-slip seconds
 Pattern-synchronization-loss count
 Pattern-synchronization status

Alarm Category

FAS/frame synchronization
 MFAS synchronization
 CRC synchronization
 AIS
 RDI
 Power-loss count
 2 Mbps alarm

Frame Category

FAS bit-error count
 FAS bit-error rate
 FAS word-error count
 FAS word-error rate
 Nonframe-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/set)

Specifications *cont'd.***Framing**

Unframed
SF
ESF
SLC-96

Test Patterns

63
511
511 QRSS
2047 QRSS
2047
All 1s
All 0s
2¹⁵-1* inverse
2²⁰-1* inverse
2²³-1* inverse
QRSS
User-programmable (3...32 bits)
User byte
Bridged tap
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

64 k
56 k

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, 7.5, 15, 22.5 dB loss
Service disruption

Loop Codes

Loop-code Tx NIU, CSU
Loop-code emulation NIUm CSU
HDSL loop-code Tx
- CO-to-customer direction
- Customer-to-CO direction
User-defined loop-code support

Results**Signal Category**

Rx frequency
Reference frequency
Rx-frequency deviation
Rx-frequency maximum deviation
Tx frequency
Simplex current
Receive level Vp, dBdsx, 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

CPRI**Test Interfaces/Bit Rates**

614 Mbps optical Dual-port capable
1.2 Gbps optical Dual-port capable
2.4 Gbps optical Dual-port capable
3.1 Gbps optical Dual-port capable
4.9 Gbps optical Dual-port capable
6.1 Gbps optical Dual-port capable
9.8 Gbps optical Dual-port capable

Laser Type

SFP
SFP+
Tuned SFP

Modes of Operation

Terminate
Monitor/Through

Timing

Recovered from Rx (slave)
Internal (Stratum 3) (master)
Recovered from external (bits/sets) (master)
Recovered from 10 MHz clock (master)

CPRI Features

Optical/electrical power level
Frequency offset Tx/Rx
CPRI startup sequence - normal or bypass

PRBS Generation and Monitoring

Unframed
L1 - Pattern inserted in hyperframe structure
L2 - Pattern inserted in CPRI basic frame

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 setting

Round-Trip Delay Measurement

RTD measurement accuracy

PRBS Patterns

2¹⁵-1, 2¹⁵-1 inverse
2²⁰-1, 2²⁰-1 inverse
2²³-1, 2²³-1 inverse
2³¹-1, 2³¹-1 inverse
Delay
Live
Digital word
ANSI and ITU implementations

Specifications *cont'd.***Anomaly/Errors Generation**

Bit

Code

K30.7

Insert - Single

Insert - Rate

Defects/Alarms Generation/Analysis

LOS

LOF

SDI

RAI

Results**Signal Category**

Signal losses

Sync-loss seconds

Optical Rx overload

Optical Rx level (dBm)

Rx frequency

Rx-frequency deviation

Rx-frequency maximum deviation

Tx frequency

Tx-frequency deviation (Hz)

Tx-frequency deviation (ppm)

Tx-frequency maximum deviation (ppm)

CPRI Counts

Word sync loss events

Word sync loss seconds

Code word count Tx/Rx

Frame count Tx/Rx

Error Stats

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 seconds

Remote LOS

Remote LOF seconds

Remote LOF

RAI

RAI seconds

SDI seconds

SDI

OBSAI**Test Interfaces/Bit Rates**

3.1 Gbps optical

Dual-port capable

6.1 Gbps optical

Dual-port capable

Laser Type

SFP

SPF+

Tuned SFP

Modes of Operation

Terminate

Monitor/Through

Timing

Recovered from Rx (slave)

Internal (Stratum 3) (master)

Recovered from external (bits/sets) (master)

Recovered from 10 MHz clock (master)

OBSAI Features

Optical/electrical power level

Frequency offset Tx/Rx

PRBS Generation and Monitoring

Unframed

L1 - Pattern inserted in frame structure

Interface Type

Master

Slave

Selectable number of message groups in master frame

Selectable number of message slots in message group

Selectable number of idle bytes after message group

Round-Trip Delay Measurement

RTD measurement accuracy

PRBS Patterns

D6.6 D25.6

 $2^{23}-1$, $2^{23}-1$ inverse $2^{31}-1$, $2^{31}-1$ inverse

Delay

Anomaly/Errors Generation

Bit

Code

Insert - Single

Insert - Rate

Results**Signal Category**

Signal losses

Sync-loss seconds

Optical Rx overload

Optical Rx level (dBm)

Rx frequency

Rx-frequency deviation

Rx-frequency maximum deviation

Tx frequency

Tx-frequency deviation (Hz)

Tx-frequency deviation (ppm)

Tx-frequency maximum deviation (ppm)

OBSAI Counts

Code word count Tx/Rx

Frame count Tx/Rx

Error Stats

Code violations

Code violation rate

Code violation seconds

K30.7 words

Frame sync losses

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)

Specifications *cont'd.***Jitter O.172****General Features**

Generate and measure jitter
on electrical interfaces DS1, E1, DS3,
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
- Set user-definable band

Select common jitter mask

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 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 1 PPS signal

Measure wander on 1 G optical Ethernet interface

Selectable peak-time offset threshold

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

Time deviation (TDEV)

Reference clock for 1 pps wander 1 pps reference signal

Reference clock for GigE optical wander 2 MHz reference signal

Cables for 1 pps wander

NextGen SONET/SDH**Test Interfaces/Bit Rates**

OC-3

OC-12

STM-4

OC-48

STM-16

OC-192

STM-64

Laser Type

SFP

SFP+

XFP

XFP - Tunable

Modes of Operation

Terminate

Monitor

Timing

Recovered from Rx

Internal (Stratum 3)

Recovered from external (bits/set)

Recovered from 10 MHz clock

SONET/SDH Features

VCAT - High order

VCAT - Low order

LCAS emulation/analysis

Differential delay measurement

Maximum VCAT group size

GFP-F

Ethernet client

Maximum Ethernet client size 1 GB

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

Programmable - 32 bit

ANSI and ITU implementations

Anomaly/Errors Generation

GFP-Idle-frame error

GFP-Short-frame error

GFP-Core-header error

GFP-Type-header error

GFP-EXI error

GFP-PFI error

GFP-PLI error

FCS

B1

B2

B3

Anomaly/Errors Generation (Cont'd.)

HP-REI

MS-REI, LP-BIP

LP-REI

Insert - Single

Insert - Rate

Defects/Alarms Generation/Analysis

GFP-CSF alarm

GFP-LFD alarm

LOM2 alarm

LOS

LOF

RS-TIM

MS-AIS

MS-RDI

AU-LOP

AU-AIS

HP-UNEQ

HP-RDI

HP-TIM

HP-PLM

TU-LOP

TU-AIS

TU-LOM

LO-UNEQ

LP-RDI

LP-TIM

LP-PLM

LP-RFI

SDH Mappings

VC4 Bulk, AU-4-4c, AU-4-16c, AU-4-64c

VC12

VC4

VC3

GFP-F

Ethernet

SONET Mappings

STS-1, STS-3c, STS-12c, STS-48c, STS-192c

VT1.5

GFP-F

Ethernet

Results**Signal Category**

Signal present

Signal-loss count

Signal-loss seconds

Rx frequency

Rx-frequency deviation

Rx-frequency maximum deviation

Tx frequency

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

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Specifications *cont'd.***Regenerator/Section OH Category (Cont'd.)**

Severely errored seconds	
OOF seconds	
Section trace mismatch	TIM
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	
S1 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) Category

Pointer transmitted	
Pointer received	
Pointer-just count	
Pointer-increment count	
Pointer-decrement count	
Pointer-NDF count	
LOP count	
LOP seconds	
B3/V5 BIP count	
B3/V5 BIP-error rate	
REI count	
Pointer transmitted	
Pointer received	

Low-Path Category (Cont'd.)

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 seconds	
Pattern-loss count	
Pattern-synchronization-loss seconds	
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	
OOF	
LOF	
MS/Line RDI	
LP RDI	
HP RDI	
MS/Line-REI	
Regenerator trace identifier mismatch	TIM
High path trace identifier mismatch	TIM
Low path trace identifier mismatch	TIM
Loss of multiframe	TU-12, TU3, 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 Lower-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 and 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

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, elapsed test time

Services**VoIP Testing**

10/100/1000 Mbps electrical Ethernet interfaces
1 GE optical Ethernet interface
10 GE optical Ethernet interface
SIP, Cisco SCCP, and H.323 fast connect

SIP Parameters

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

SCCP Parameters

Selectable Cisco phone emulation supporting at least 15 models
Configurable device name

H.323 Parameters

H.323 ID
Bearer capability including unrestricted digital, speech, and 3.1 K audio
Configurable calling and 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 thresholds pass/fail
Mean Opinion Score results (MOS)
Graphical summary results including Ethernet, transport and content
Transaction log including call log and protocol signaling

Specifications *cont'd.***Triple-Play Automated Test Script**

- 10/100/1000 Mbps electrical Ethernet interfaces
- 1 GE optical Ethernet interface
- 10 GE optical Ethernet interface
- More than 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
- Two configurable data streams with individual constant or ramp traffic and configurable frame sizes including random frames

IPTV

- 10/100/1000 Mbps electrical Ethernet interfaces
- 1 GE optical Ethernet interface
- 10 GE optical Ethernet interface
- Single- and multiple-program transport stream (SPTS/MPTS) formats
- Video explorer capable of detecting 512 SPTSs and 32 MPTSs and a video analyzer that supports 16 SPTSs 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 RFC 3357, results per-transport stream and per PID
- Measure ICC latency and R-UDP latency
- Microsoft Television (MSTV) Support
- Internet Group Management Protocol (IGMP) support

Primary Rate ISDN

Test access	T1
TE emulation	
NT emulation	
D-channel signaling decodes	
Call control	National
	SESS
	NI-1
D-Channel rate	64 k
	56 k
Call type	Data
	Voice
	3.1 k audio
Channel number	1 to 24
D-channel rate	56 k

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	
Noncontiguous channels	
V.54 Loop-code support	

Voice Frequency

Test access - T1	
Listed to an audio call	
Insert VF tones	404, 1004, 1804, 2713, and 2804 Hz
User frequency	
Quiet tone	
Holding tone	
Three tone	
Frequency sweep	
Impulse noise	
Rx frequency	
Level (dBm)	
DC offset mV	

Datacom**Test Interfaces****Datacom****X.21**

Connector	15-pin D-type
Emulate DTE or DCE with X or S timing	
Receiver input termination	unterminated or 78/100/124 Ω
Data rates	5 bps to 20 Mbps synchronous with X
Cable length dependent with S	
Supported signaling leads	C and I

RS232/V.24

Connector	25-pin D-type
Emulate DTE or DCE with TT or ST timing	
Data rates	5 bps to 256 kbps synchronous
	5 bps to 128 kbps asynchronous
Supported signaling leads	CTS, RTS, DSR, DTR, RLSD, RI

EIA530/530A

Connector	25-pin D-type
Emulate DTE or DCE with TT or ST timing	
Signal formats and input terminations	
Balanced unterminated or 78/100/124 Ω terminated	
Unbalanced	
Data rates	
Balanced	5 bps to 20 Mbps synchronous
Unbalanced	5 bps to 256 kbps synchronous
Supported signaling leads	RTS, CTS, DSR, DTR, RLSD, LL, RL, TM

MIL-STD-188c

25-pin D-type connector	
Emulate DTE or DCE with TT or ST timing	
Signal formats and input terminations unbalanced	
Data rates	5 bps to 64 kbps synchronous and recovered
Supported signaling leads	RTS, CTS, DSR, DTR, RLSD, LL, RL, TM, RI

RS449/V.36 and MIL-188-114

37-pin and 25-pin D-type connectors	
Emulate DTE or DCE with TT or ST timing	
Signal formats and input terminations	
- RS422 and MIL-188-114 balanced unterminated	
- 78/100/124 terminated	
- RS423 and MIL-188-114 unbalanced	
Data rates	
- RS422/balanced	5 bps to 20 Mbps synchronous
- RS423/unbalanced	5 bps to 64 kbps synchronous
Supported signaling leads	RS, CS, DM, TR, RR, LL, RL, TM, IC

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Specifications *cont'd.***V.35**

34-pin Winchester using an adapter cable to 25-pin

D-type connector

Emulate DTE or DTC with TT (306) or ST timing

Receiver input termination 124 Ω

Data rates 5 bps to 15 Mbps synchronous

Note: Due to propagation delay (cable length dependencies), users may have to invert their clock.

Supported signaling leads RTS, CTS, DSR, DTR, RLSD, RL, LL, TM, CI

Conditioned Diphas

2 BNC connectors 1 Tx and 1 Rx (via plug-in interface module)

Selectable-input termination 58, 135, or bridge (>2000)

Single-ended operation 58 Ω

Differential operation 135 or bridge

Automatic compensation Up to 30 dB of cable loss

Valid signal indication Signal valid if > ± 90 mV

Transmit timing selectable from internal synthesizer or recovered from receiver interface

Data rates 1.2 to 4608 kbps

Clock and data encoding

- Diphas (Manchester)

- Conditioned diphas (differential Manchester)

Key Functionality**BER Test Patterns**

Mark (all ones)

Space (all zeros)

1:1

63

511

2047

2047R (reversed)

2047RI (reversed and inverted)

2[^]15-1*2[^]20-12[^]23-1*

QRSS

User byte pattern

QBF1 (FOX)

Long user (1,2,3)

Delay

All zeros

1:3

1:4

1:7

3:1

7:1

Note: Supports both ANSI and ITU variations of these patterns.*Transmit Clock Sources**

Internal from synthesizer

Recovered from test interface (with the Recovered Clock option)

External BNC (via clock adapter cable)

Internal Clock Synthesizer5 Hz to 20 MHz, ± 1 Hz resolution, 1.5 ppm accuracy, 1 ppm per year aging**Error Insertion**

Bit error(s) single and rate (1E-3 through 1E-7)

Pattern Slip Insertion

Single-bit insertion

Signaling Lead Control

Emulate DTE RTS, DTR, (LL), (RL)

Emulate DCE RLSD (RR), DSR (DM), CTS, RI

Self Loop

All test interfaces will loop transmit to receive for the purpose of validating the instrument and the selected test interface.

Asynchronous Operation

Parity selection Odd, even, and none

Data bits 5, 6, 7, or 8 bits

Stop bits 1, 1.5, or 2 bits

In-band flow control

Out-of-band flow control

Key Results**BERT Category**

Delay

Pattern losses

Pattern slips

Bit errors

Bit error rate

Interval BER

Total blocks

Block errors

Block error rate

Interval block error rate

Character errors (async only)

Signal Category

Transmitter clock frequency

Receiver clock frequency

Clock-in frequency

Clock-out frequency

Receiver clock loss

Data loss

Pattern sync loss

Transmitter clock losses

G.821

Errored seconds

Percentage errored seconds

Error-free seconds

Percentage error-free seconds

Severely errored seconds

Percentage severely errored seconds

Available seconds

Percentage avail seconds

Unavailable seconds

Time Category

Date

Time

Elapsed seconds

Elapsed time

Test & Measurement Regional Sales

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