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TestPoint 10Gbps

Key Features

- **10 Gigabit Ethernet (GigE) LAN and WAN**
- **10 Gigabit Fibre Channel (FC)**
- **OTN–related rates: OTU2, 11.049G, 11.095G, 11.270G, ODU2 (10.037G)**
- **GFP-F mapped directly into OTU2 and in SONET/SDH (STS-192c/VC-4-64c)**
- **64B/66B PCS (and MAC) capture (10 GigE, 10GFC), editing and playback (10 GigE)**
- **128 traffic streams (MAC/Stacked VLAN, MPLS, IPv4, IPv6, TCP, UDP)**
- **Intrusive monitor mode on OTN and SONET/SDH**

2007 FROST & SULLIVAN
Global Communications Test & Measurement Company of the Year Award

Applications

- 10 Gigabit Ethernet–LAN/WAN
- SONET/SDH
- Digital Wrapper and FEC
- 10G Fibre Channel
- GFP and cHDLC

Compliance

- CSA Certificate of Compliance to CAN/CSA C22.2 No 60950-1 (2003) & ANSI/UL 60950-1 (2003) with CSA Mark for Canada & USA
- CSA CB Certificate of Compliance to EN60950-1, IEC 60950-1 and National Deviations with CE Marking
- Class 1 Laser Product, with compliance to EN 60825, IEC 60825 and FDA/CDRH requirements

The TestPoint 10Gbps module supports 10 Gigabit Ethernet–LAN/WAN and SONET/SDH BERT, which provides PRBS into STS-192c/VC-4-64c, as optional test functionality. It also offers licensed options for 10 Gigabit Fiber Channel (10G FC), GFP and Cisco HDLC. The GFP license offers GFP-F mapped directly into OTU2 and GFP into STS-192c/VC-4-64c. In addition, a hardware option provides Digital Wrapper and Forward Error Correction (FEC) support at the following rates: G.709 ODU2 (10.037Gbps), OTU2 (10.709 Gbps), 11.049 Gbps FEC, 11.095 Gbps FEC, and 11.270Gbps FEC. The default configuration uses an XFP interface.

The TestPoint 10Gbps module has a strong focus on lower-layer testing. The 64B/66B PCS capture and play from buffer feature provides powerful debugging tools for physical layer testing. The 10Gbps module also provides traffic generation of up to 128 streams with multiple protocols for 10Gbps Ethernet testing including VLAN (Q-in-Q), MPLS, IPv4/IPv6, TCP/UDP, ARP/ICMP (Ping).

NOTE: The 10Gbps is available in either modules (TS-30/TS-170) or in configurations (TS-10). The term module is used in this document.

INTERFACE SPECIFICATIONS

XFP			
Optical Connector	LC	LC	LC
Wavelength	850 nm	1310 nm	1550 nm
Optical Output Power (Rx power read)	-4 to -1.1 dBm	-6 to -1 dBm	-1 to +2 dBm
Optical Overload (min)	-1 dBm	0.5 dBm	2 dBm
Sensitivity (min)	-11.1 dBm	-11 dBm	-13.5 dBm
Fixed Optics			
Optical Connector	SC	SC	
Wavelength	1310 nm	1550 nm	
Optical Output Power (Rx power read)	-4 to +1 dBm	-1 to +2 dBm	
Optical Overload (min)	-1 dBm	-1 dBm	
Sensitivity (min)	-15 dBm	-16 dBm	
Clock Out	LVPECL signal, AC coupled on SMA connector		
LAN (Ethernet) Port	RJ-45 (10/100BASE-T)		
Operator Port	RJ-12 into RS-232 serial cable		

LINE RATES

Reports PPM offset on receive interface

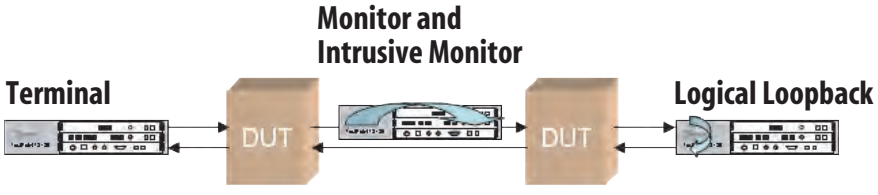
9.95328 Gbps (10GigE WAN and OC-192/STM-64 BERT)
10.037 Gbps (ODU2)
10.3125 Gbps (10GigE LAN)
10.51875 Gbps (10G FC)
10.709 Gbps (OTU2)
11.049 Gbps (10GigE LAN with FEC, no stuff bytes)
11.095 Gbps (10GigE LAN with FEC, stuff bytes)
11.270 Gbps (10G FC with FEC, no stuff bytes)

CLOCKING

Internal (+/- 4.6 ppm accuracy)
Recovered
External via Group Controller (TS-30/170)
Clock rate variations
+/-30 ppm: 10GigE WAN, SONET/SDH, OTU2
+/-110 ppm: 10GigE LAN, 10G FC, 11.XG rates
Clock out (LVPECL, AC coupled on SMA)

CONNECTIVITY

Terminal: Source and sink traffic (all rates)
Transparent Monitor: Transparently monitors signal and retransmits unaltered (10 GigE, OTN related rates, SONET/SDH)
Intrusive Monitor: Can inject layer 1 errors and pass traffic unaltered (OTN related rates, SONET/SDH)
Logical Loopback: Used to switch MAC and IP addresses to loop traffic back (10 GigE LAN)



APPLICATIONS

Descriptions of the following applications follow:

10 Gigabit Ethernet:

10GigE LAN: 10 Gigabit Ethernet directly on the line
10GigE WAN: 10 Gigabit Ethernet into SONET/SDH

SONET/SDH:

OC-192/STM-64 (STS-192c/VC-4-64c)

Digital Wrapper and FEC:

OTU2: ITU-T G.709; client can be 10 GigE WAN or SONET/SDH BERT or GFP
11.049G FEC: 10 GigE LAN client; frame structure without fixed stuff
11.095G FEC: 10 GigE LAN client; frame structure with fixed stuff
11.270G FEC: 10G FC client; frame structure without fixed stuff
ODU2: OTU2 frame structure without FEC

10G Fibre Channel:

Point-to-point

GFP:

GFP-F directly in OTU2 (ITU-T G.709 section 17); or in OC-192/STM-64 (STS-192c/VC-4-64c); or in OC-192/STM-64 wrapped in OTU2

cHDLC:

Cisco-HDLC in OC-192/STM-64 (STS-192c/VC-4-64c); or in OC-192/STM-64 wrapped in OTU2

10 GIGABIT ETHERNET

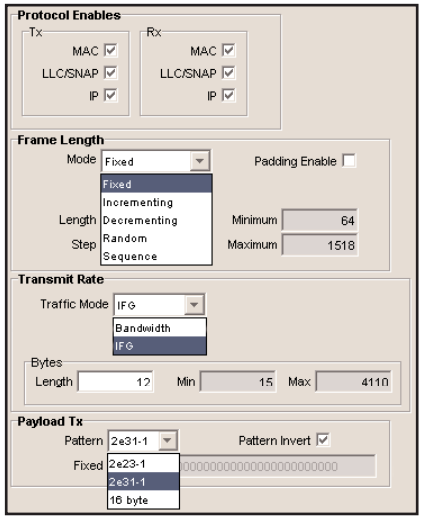
Description covers 10 GigE LAN and WAN.

TRAFFIC SETTINGS

Three modes: Single Stream, Multiple Streams, PCS Play from Buffer

SINGLE STREAM

Used for BERT testing at PCS, MAC, Single/Stacked VLAN, and IPv4 layers.



Send Mode: Continuous / Burst of Frames
Protocol Support: MAC / Single/Stacked VLAN / LLC/SNAP / IPv4. User can set header values. For Destination/Source MAC addresses and VLAN IDs, support of Single / Incrementing value over a Range
Frame Size: Range of 19 to 65535 bytes. Size can be: Fixed / Incrementing / Decrementing / Random / User Sequence (up to 8)

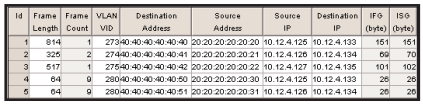
Transmission Rate: Specified as Bandwidth (%, Mbps) or Number of Inter Frame

Gap (IFG) bytes (fixed / random / sequence up to 8; range 8 to 16,777,215 bytes)

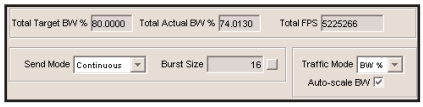
Frame Payload: PRBS 15, 23 or 31 / 16-byte Sequence

MULTIPLE STREAMS

Used for traffic simulation and multi-protocol support.



Id	Frame Length	Frame Count	VLAN VID	Destination Address	Source Address	Source IP	Destination IP	IFG (byte)	ISG (byte)
1	814	1	27340:40:40:40:40:40	20:20:20:20:20:20	10.12.4.125	10.12.4.133	151	151
2	325	2	27440:40:40:40:40:41	20:20:20:20:20:21	10.12.4.126	10.12.4.134	69	70
3	517	1	27540:40:40:40:40:42	20:20:20:20:20:22	10.12.4.127	10.12.4.135	101	102
4	64	9	28040:40:40:40:40:50	20:20:20:20:20:30	10.12.4.125	10.12.4.133	26	26
5	64	9	28040:40:40:40:40:51	20:20:20:20:20:31	10.12.4.126	10.12.4.134	26	26



Maximum Number of Streams: 128

Send Mode: Continuous / Burst of Frames

Protocol Support: MAC / Single/Stacked VLAN / MPLS / IPv4 / IPv6 / TCP / UDP. User can set header values per stream.

Frame size: Range of 27 to 9600 bytes. Size can be: Fixed / Random Within a Stream

Transmission Rate: BW % / IFG Size in Bytes / Frames/s

Auto-scale BW: Scales bandwidth when total exceeds 100%.

Frame Payload: Fill Byte / Random / Custom (user defined byte-by-byte)

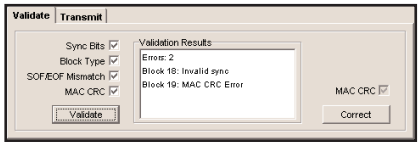
Stream Signature: Used for receive auto-detection

PCS PLAY FROM BUFFER

Used to edit PCS Blocks, inject detailed errors, and create custom low-level patterns.

Send Mode: Continuous / Buffer Burst

d0d1d2d3/d4d5d6d7	01	68	1f	71	0d	b1	9e	c5	ff
f0c1c2c3/c4c5c6c7	10	87		00	00	00	00	00	00
c0c1c2c3/c4c5c6c7	10	1e	00	00	00	00	00	00	00
s0d1d2d3/d4d5d6d7	10	78	55	55	55	55	55	55	d5
d0d1d2d3/d4d5d6d7	01	44	44	44	44	44	44	22	22
d0d1d2d3/d4d5d6d7	01	22	22	22	22	81	00	00	00
d0d1d2d3/d4d5d6d7	01	00	2a	ae	36	0d	3e	40	f3
d0d1d2d3/d4d5d6d7	01	36	67	71	2a	f5	46	0f	05
d0d1d2d3/d4d5d6d7	01	41	13	11	a1	6c	e8	c6	ab
d0d1d2d3/d4d5d6d7	01	e8	a2	18	16	a4	9a	4e	b8
INVALID	11	ff	6f	89	01	f7	d8	7d	e3
d0d1d2d3/d4d5d6d7	01	6d	c8	da	0f	83	2f	be	ee
f0c1c2c3/c4c5c6c7	10	87		00	00	00	00	00	00
c0c1c2c3/c4c5c6c7	10	1e	00	00	00	00	00	00	00
s0d1d2d3/d4d5d6d7	10	78	55	55	55	55	55	55	d5



Protocol Support: Raw Blocks / PCS / MAC

PCS editing: Load from PCS Capture File (auto-delineates MAC frames) / Manual from Scratch

Auto-Validation: Sync Header Bits / PCS Block Type Value / SOF and EOF Mismatch / MAC CRC

Auto-Correction: MAC CRC

File Type: Binary / ASCII. PCS66 format.

CONTROL PLANE

Pause Frames: Single / Continuous with Interval. Pause Timer. Receiver throttles.

ARP: ARP request sent for each unique destination IP address; retry period and count support. ARP Reply sent on port MAC address match.

PING

Send Mode: Continuous / Packet Count

Transmission Period: 1000 to 4,294,967,295 msec

Protocol Support: IPv4 with no VLAN / Single/Stacked VLAN

Data size: 0 to 9572 bytes

Replies: Issued on port IP address match

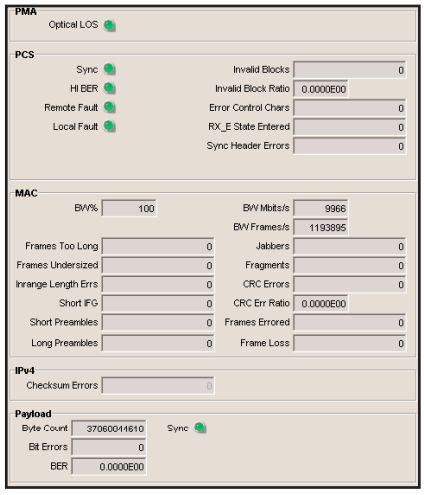
ERROR INJECTIONS

PCS Sublayer: LOS / Remote Fault / Local Fault / Error Control Character / User-Defined 64B/66B Block (single, rates) / Sync Header Error (single, HI BER, Loss of Sync) / 64B/66B Block Type Error (single, rates)

MAC Sublayer: Short Preambles (single stream) / Long Preambles (single stream) / CRC (single, rates in single stream; per-stream in multiple streams)

ERROR MONITORING

PCS Sublayer: LOS / PCS Synchronization / HI BER / Remote



Fault / Local Fault / Invalid 64B/66B Blocks / Sync Header Errors / Error Control Characters / RX_E State

MAC Sublayer: Frames Too Long (> jumbo) / Jabbers / Undersized / Fragments / CRC Errors / Inrange Length Errors (802.3 frames) / Short IFGs (adjustable threshold)

IPv4: Checksum Errors (single stream)

STATISTICS

MAC: Bandwidth (%, Mbps, frames/s) / Frame Count / Octet Count / Unicast Frames / Multicast Frames / Broadcast Frames / Single/Stacked VLAN Tagged Frames / Number of Pause Frames / ARP Frames / MPLS Tagged Frames / Frame Length Bins (including jumbo) / CRC Counts (total and lengths bins) / Short Preamble Count / Long Preamble Count

IPv4: Packet Count / ICMP Packets

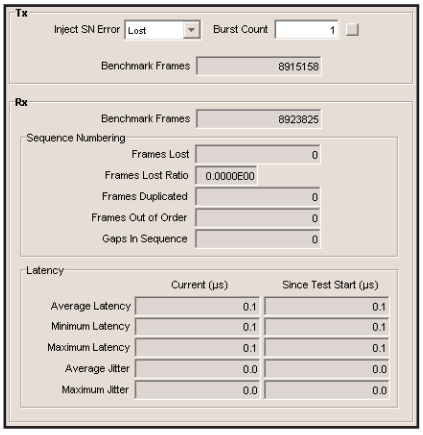
IPv6: Packet Count / ICMP Packets

Per-Stream Statistics: Bandwidth (Mbps, %, frames/s) / Frame Count / Octet Count

LATENCY AND SEQUENCING

In single stream mode

Sequencing: Frame Loss / Out-of-Order / Duplicates. Can inject



errors on transmit.

Timestamping: Latency (min, max, avg over test period and 0.5 sec window; bit forwarding / store and forward) / Packet Jitter. One-way latency measurements available across module in a chassis; requires Group Controller.

FILTERS

MAC: 8 MAC/VLAN filters with Accept/Discard criteria

Pattern Filter: Up to 6 bytes with offset from start of frame

CAPTURES

There are two modes: 64B/66B PCS, and MAC level

PCS

Triggers: Manual / PCS Sync Loss / Invalid 64B/66B Block / Sync

55	d0d1d2d3/d4d5d6d7	01	0c	c3	52	2f	47	14	dc	0a
56	f0c1c2c3/c4c5c6c7	10	87		00	00	00	00	00	00
57	c0c1c2c3/c4c5c6c7	10	1e	00	00	00	00	00	00	00
58	s0d1d2d3/d4d5d6d7	10	78	55	55	55	55	55	55	d5
59	d0d1d2d3/d4d5d6d7	01	44	44	44	44	44	44	22	22
60	d0d1d2d3/d4d5d6d7	01	22	22	22	22	81	00	01	11
61	d0d1d2d3/d4d5d6d7	01	03	ea	00	00	00	01	17	50

Header Error / Remote Fault / Local Fault / Control Code Pattern Match / Block Type Field Match / Block Pattern Match (up to 8 bytes)

Trigger: Point: Start / Middle / End

Display: Trigger Point / 64B/66B Blocks as in figure 49-7 IEEE 802.3ae-2002

Size: 3,355,400 64B/66B Blocks

File Type: Binary / ASCII. PCS66 format.

MAC

Triggers: Manual / CRC error / Undersized Frame / Frame Too

	TS (µs)	Len	Dest Addr	Src Addr	VLAN	T/L	
26	0.8	1024	44 44 44 44 44 44	22 22 22 22 22 22	81 00 01 11	03 EA	00 00 00 0
27	0.0	1024	44 44 44 44 44 44	22 22 22 22 22 22	81 00 01 11	03 EA	00 00 00 0
28	0.0	1024	44 44 44 44 44 44	22 22 22 22 22 22	81 00 01 11	03 EA	00 00 00 0
29	1.7	1024	44 44 44 44 44 44	22 22 22 22 22 22	81 00 01 11	03 EA	00 00 00 0
30	2.5	1024	44 44 44 44 44 44	22 22 22 22 22 22	81 00 01 11	03 EA	00 00 00 0

Long / In-range Length Error

Trigger Point: Start / Middle / End

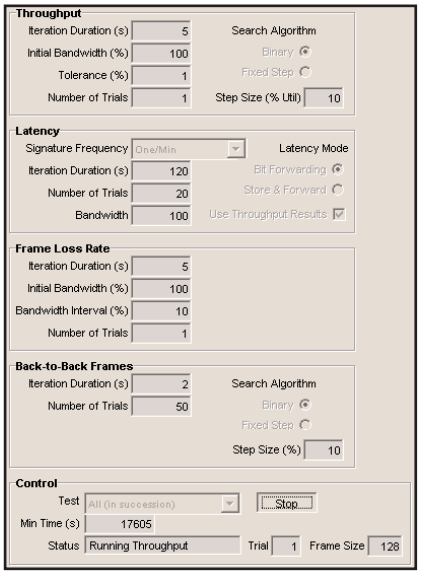
Filters: MAC Filters / Pattern Filter

Display: Trigger Point / Timestamp / MAC Layer Decode

Size: 400,000 Frames / 32.4 Mbytes / Full Frame or Slicing (first 64 bytes)

File Type: Binary (Snoop compatible with Ethereal)

RFC 2544



Standard product feature in GUI/CLI. Provides throughput, latency, frame loss, and back-to-back measurements in single stream mode. Up to 10 frame sizes. Supports function to run all tests in succession. Logs results to file and generates graphics.

TEST REPORT

Contains 10 Gigabit Ethernet settings, errors, and statistics.

DISRUPTION TIME

Measurement: µsec Resolution

Triggers: LOS / PRBS Sync

OPTICAL TEST PATTERNS

Square Wave: Programmable between 4 and 11 bits

Pseudo-Random: Transmit and receive with block error count

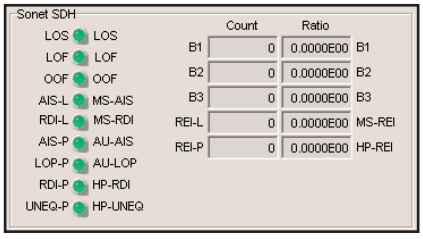
PRBS31: Transmit and receive with error injection and bloc error count

SONET/SDH

CHANNELIZATION

STS-192c / VC-4-64c

ALARMS



LOS / LOF / OOF / AIS-L/MS-AIS / RDI-L/MS-RDI / LOP-P/AU-LOP / AIS-P/AU-AIS / ERDI-P/HP-ERDI / UNEQ-P/HP-UNEQ

ERRORS

Single / Rates for REI-L/MS-REI / REI-P/HP-REI / B1 / B2 / B3

OVERHEADS

Pointer adjustments: Increment/Decrement (single, rates) / NDF count / Pointer Value / SS Bits

Trace Messages: J0 / J1; 1, 16 or 64 bytes

Decoded Bytes: K1 / K2 / S1 / C2

Byte Diagram: User editable Overhead Fields (includes B1, B2, B3 xor masks) in two alternating overhead banks. Interleaving and Injection Counts in Frames / Continuous Injection support

TRAFFIC

10 Gigabit Ethernet Client (10 GigE WAN) / PRBS 15, 23 or 31 / 4-Byte Sequence / GFP-F (requires option)

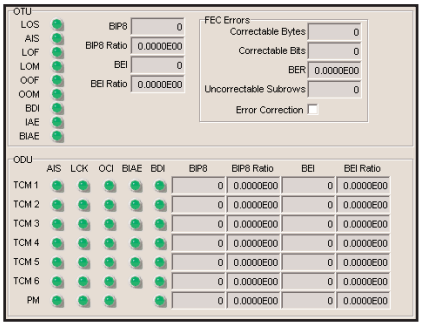
DISRUPTION TIME

Measurement: µsec Resolution

Triggers: LOS / LOF / PRBS Sync

DIGITAL WRAPPER AND FEC

Description covers OTU2, 11.049G FEC, 11.095G FEC, 11.270G FEC, ODU2. Forward Error Correction does not apply to ODU2.



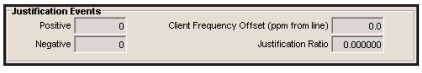
ALARMS

LOS / OOF / LOF / OOM / LOM / OTU-AIS (PN-11) / OTU-IAE / OTU-BDI / OTU-BIAE / ODU-AIS (PM/TCM1-6) / ODU-LCK (PM/TCM1-6) / ODU-OCI (PM/TCM1-6) / ODU-BDI (PM/TCM1-6) / ODU-BIAE (TCM1-6)

ERRORS

Single and rates for OTU-BIP8 / OTU-BEI / ODU-BIP8 (PM/TCM1-6) / ODU-BEI (PM/TCM1-6)

OVERHEADS



Multi Frame Structures: OTU-TTI / ODU-TTI (PM/TCM1-6) / ODU-FTFL / PSI

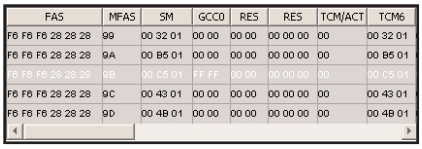
Justification Events: Sync (line-client locked) / Async (range +/- 70 ppm). Reporting of justification event ratio and line-client ppm offset.

Byte Diagram: User editable Overhead Fields / MFAS invert. Injection Count in Frames / Continuous Injection

Overhead PRBS: 3 independent PRBS 15 engines for GCC0-2 / RES (OTU, ODU, OPU) / TCM1-6 / TCM/ACT / EXP

Error Suppression: To optionally suppress incoming errors/alarms: FEC / TCM1-6 Errors / PM Errors / Client Errors

CAPTURES



Triggers: Manual / OOF / LOF / OOM / LOM / OTU-IAE / OTU-BDI / OTU-BIAE / OTU-BIP8 / OTU-BEI / ODU-AIS (PM/TCM1-6) / ODU-LCK (PM/TCM1-6) / ODU-OCI (PM/TCM1-6) / ODU-BDI (PM/TCM1-6) / ODU-BIP8 (PM/TCM1-6) / ODU-BEI (PM/TCM1 6) / ODU-BIAE (TCM1-6) / Positive Justification / Negative Justification / Overhead PRBS Bit Error / Pattern Match (equal, not equal) with Bit-Mask

Pattern Match Fields: FAS / MFAS / GCC0-2 / OTU RES / SM TTI / ODU RES1-3 / TCM/ACT / FTFL / EXP / APS/PCC / TCM1-6 TTI / PM TTI / OPU RES1-3

Trigger Point: Start / Middle / End

Display: Trigger Point / Hex values for all overhead fields

Size: Overhead of 256 frames

File Type: ASCII (csv)

CLIENTS

OTU2: 10 GigE WAN / SONET/SDH BERT / GFP-F (requires option)

ODU2: SONET/SDH BERT

11.049G/11.095G: 10 GigE LAN

11.270G: 10G FC

FEC

Settings: Standard FEC / All-Zeroes FEC. Enable / Disable error correction

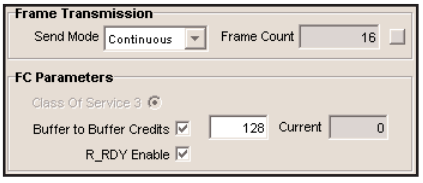
Injection: Single and rates. Control of Errored Sub-Row (including all) / Errored Bytes per Sub-Row / Errored Bits per Byte / Skipped Rows between Errors. Up to 16 symbol errors.

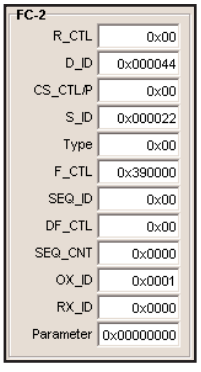
Detection: Number of Correctable Byte Errors / Number of Correctable Bit Errors / Bit Error Rate / Number of Uncorrectable Sub-Rows

10G FIBRE CHANNEL

This covers 10G Fibre Channel point-to-point.

TRAFFIC SETTINGS





Send Mode: Continuous / Burst of Frames

Frame size: Range of 12 to 4104 bytes (multiple of 4, includes SOF & EOF). Size can be: Fixed / Incrementing / Decrementing / Random / User Sequence (up to 8)

Transmission rate: Specified as Bandwidth (%, Mbps) / Number of Inter Frame Gap (IFG) Bytes (fixed / random / sequence up to 8; range 8 to 65535 bytes)

FC-2 Framing: User can set 24-byte header values.

Class Support: Class 3

Flow control: Manual buffer-to-buffer credit setting; range 1 to 4095. Sending of R_RDY may be Enabled / Disabled.

Frame Payload: PRBS 15, 23 or 31 / 16-byte Sequence

LINK INITIALIZATION

Settings: Enable / Disable. LF1 / LF2 state force

Reporting: Active State indicator / LF1 report / LF2 report / Primitive Sequence Protocol Error count / Loss of Sync count / Link Failure count

Capture: Using 64B/66B level capture

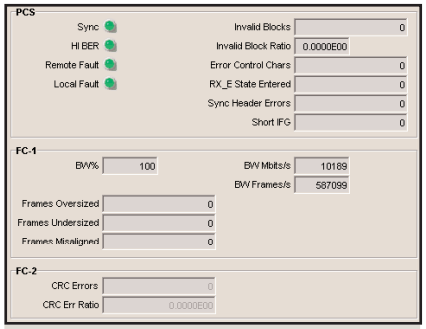
ERROR INJECTIONS

PCS Sublayer: LOS / Remote Fault / Local Fault / Error Control Character / User-Defined 64B/66B Block (single, rates) / Sync Header Error (single, HI BER, Loss of Sync) / 64B/66B Block Type Error (single, rates)

FC-1: Misaligned Frames (non-multiple of 4 bytes size)

FC-2: CRC (single, rates)

ERROR MONITORING



PCS sublayer: LOS / PCS Synchronization / HI BER / Remote Fault / Local Fault / Invalid 64B/66B Blocks / Sync Header Errors / Error Control Characters / RX_E State / Short IFGs (adjustable threshold)

FC-1: Frames Oversized (> 2148 bytes) / Frames Undersized (< 36 bytes) / Frames Misaligned (non-multiple of 4 bytes)

FC-2: CRC Errors

STATISTICS

FC-1: Bandwidth (%, Mbps, frames/s) / Frame Count / Octet Count / Number of R_RDY

LATENCY AND SEQUENCING

Sequencing: Frame Loss / Out-of-Order / Duplicates. Can inject errors on transmit.

Timestamping: Latency (min, max, avg over test period and 0.5 sec window) / Packet Jitter

One-way latency measurements available across module in a chassis; requires Group Controller.

CAPTURES

At the PCS level

Triggers: Manual / PCS Sync Loss / Invalid 64B/66B Block / Sync Header Error / Remote Fault / Local Fault / Control Code Pattern Match / Block Type Field Match / Block Pattern Match (up to 8 bytes)

Trigger Point: Start / Middle / End

Display: Trigger Point / 64B/66B Blocks as in figure 49-7 IEEE 802.3ae-2002

Size: 3,355,400 64B/66B Blocks

File Type: Binary / ASCII. PCS66 format.

TEST REPORT

Contains 10G FC settings, errors, and statistics.

OPTICAL TEST PATTERNS

Square Wave: Programmable between 4 and 11 bits

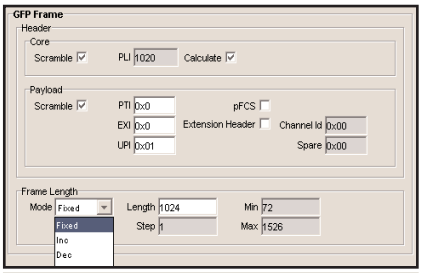
Pseudo-Random: Transmit and receive with block error count

PRBS31: Transmit and receive with error injection and block error count

GFP

There are three possible mappings for GFP-F: as direct OTU2 client (ITU-T G.709 section 17); in OC-192/STM-64 (STS-192c/VC-4 64c); or in OC-192/STM-64 wrapped in OTU2.

TRAFFIC SETTINGS



Send mode: Continuous / Burst of Frames

Header Settings: PLI (auto-calculate on/off) / PTI / EXI / UPI / pFCS (on/off) / Linear Extension Header (on/off) / Channel ID / Spare. cHEC error correction on/off on receive.

Protocol support: MAC / Single/Stacked VLAN. User can set header values.

Scrambler: Core Header Scrambler (enable/disable); Payload Header Scrambler (enable/disable)

Frame Size: Range of 33 to 65535 bytes (GFP frame). Size can be: Fixed / Incrementing / Decrementing / Random.

Transmission Rate: Specified as Bandwidth (Mbps) / Number of GFP Idle Frames (fixed / random; range 0 to 65535 bytes)

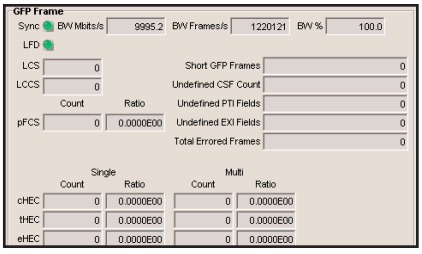
Frame Payload: PRBS 15, 23 or 31 / 4-byte Sequence

ERROR INJECTIONS

GFP: Loss of Client Signal (LCS) / Loss of Client Character Synchronization (LCCS) / Short GFP Frame / pFCS (single, rates) / Idle GFP Frame (single, 16-bit xor mask) / Core Header (single, rates; 16-bit xor mask) / Type Header (single, rates; 16-bit xor mask) / Extension Header (single, rates; 16-bit xor mask)

MAC: CRC (single, rates)

ERROR MONITORING



GFP: Loss of Frame Delineation (LFD) / LCS Count / LCCS Count / Short GFP Frames / Undefined fields (Client Signal Fail, PTI, EXI) / pFCS Errors / Single-Bit cHEC Errors / Multi-Bit cHEC Errors / Single-Bit tHEC Errors / Multi-Bit tHEC Errors / Single-Bit eHEC Errors / Multi-Bit eHEC Errors

MAC: Frames Too Long (> jumbo) / Jabbers / Undersized / Fragments / CRC Errors / Inrange Length Errors (802.3 frames)

STATISTICS

GFP: Bandwidth (Mbps, %, frames/s) / Frame Count / Octet Count / Management Frame Count / GFP Idle Frame Count

MAC: Frame Count / Octet Count / Unicast Frames / Multicast Frames / Broadcast Frames / Single/Stacked VLAN Tagged Frames / Frame Length Bins (including jumbo) / CRC Counts (total and lengths bins)

FILTERS

Pattern Filter: Up to 6 bytes with offset from start of GFP frame

CAPTURES

		GFP Core Header		GFP Payload Header					
TS	Len	PLI	cHEC	P/P/E	UPI	tHEC	Ext	eHEC	Dest A
126.9	1501	05 D9	A5 A1	00	01	10 21			44 44 44 44
122.2	1502	05 DA	95 C2	00	01	10 21			44 44 44 44
117.5	1503	05 DB	85 E3	00	01	10 21			44 44 44 44
0.0	16	05 DC	E5 05	00	01	10 21			44 44 44 44

Triggers: Manual / GFP LFD / Single-Bit cHEC Error / Multi-Bit cHEC Error / tHEC Error / eHEC Error / pFCS Error / Management Frame / Large GFP Frame (with threshold) / MAC CRC Error

Trigger Point: Start / Middle / End

Filters: Pattern Filter / Exclude GFP Idle option

Display: Trigger point / Timestamp / GFP and MAC Layer Decode

Size: 700,000 frames / 32.4 Mbytes / Full Frame or Slicing (first 64 bytes)

File Type: Binary (Snoop) / ASCII

cHDLC

cHDLC is Cisco-HDLC. Two possible mappings: in OC-192/STM-64 (STS-192c/VC-4-64c); or in OC-192/STM-64 wrapped in OTU2.

TRAFFIC SETTINGS

Two modes: Single Stream, Multiple Streams

SINGLE STREAM

Used for BERT testing.

Send Mode: Continuous / Burst of Frames

Protocol Support: IPv4 (can also support MAC / Single/Stacked VLAN directly in HDLC). User can set header values including Address / Control / Protocol.

Frame Size: Range of 9 to 65535 bytes. Size can be: Fixed / Incrementing.

FCS Size: CRC-32

Transmission Rate: Specified as Number of Flags (fixed) between 1 and 65535

Frame Payload: PRBS 15, 23 or 31 / 16-byte Sequence

MULTIPLE STREAMS

Used for traffic simulation and multi-protocol support.

	Frame Length	Frame Count	Source IP	Destination IP	BW % Target	BW % Actual	Flags (byte)	ISF (byte)
1	811	1	10.12.4.125	10.12.4.133	20.0000	11.2621	272	273
2	319	4	10.12.4.125	10.12.4.134	20.0000	17.7531	108	108
3	512	2	10.12.4.125	10.12.4.135	20.0000	14.2302	172	173
4	841	1	10.12.4.125	10.12.4.136	20.0000	11.6782	282	283
5	1441	1	10.12.4.125	10.12.4.137	20.0000	20.0000	483	484

Maximum Number of Streams: 128

Send Mode: Continuous / Burst of Frames

Protocol Support: MPLS / IPv4 / TCP / UDP. User can set header values per stream (HDLC Address / Control / Protocol values are global).

Frame size: Range of 37 to 9600 bytes. Size is fixed within a stream.

FCS Size: CRC-32

Transmission Rate: BW % / Number of flags in Bytes / Frames/s

Auto-scale BW: Scales bandwidth when total exceeds 100%.

Frame Payload: Fill Byte / Random / Custom (user defined byte-by-byte)

Stream Signature: Used for receive auto-detection

CONTROL PLANE

SLARP: Filters out SLARP packets from data stream.

ERROR INJECTIONS

Abort (single) / FCS (single)

ERROR MONITORING

FCS Errors / Frames Too Short (threshold) / Frames Too Long (threshold) / Address Mismatches / Control Mismatches / Abort Errors / Invalid Control Sequences / IPv4 Checksum Errors (single stream)

STATISTICS

Bandwidth (%, Mbps, frames/s) / Frame Count / Octet Count / SLARP Packet Count / IPv4 Packet Count (single stream)

ORDERING INFORMATION

10Gbps Module

N530-0164	10Gbps Module (XFP version)

Options

OPT 0160-14	10G LAN/WAN/SONET/SDH
OPT 0160-16	10G LAN/SONET/SDH (full concatenation)
OPT 0160-17	10G LAN/WAN/SONET/SDH & 10G Fibre Channel
OPT 0160-33	10G LAN/SONET/SDH & 10G Fibre Channel
OPT 0160-15	10G Fibre Channel
OPT 0160-05	10G GFP (requires OPT 0160-03 for GFP in OTU2)
OPT 0160-07	10G cHDLC
OPT 0160-03	10G G.709 Digital Wrapper / FEC (OTU2, 11.049G, 11.095G)
OPT 0160-30	10G ODU2 10.037Gbps (requires OPT 0160-03)
OPT 0160-06	10G FEC 11.27G Extended Rate (requires OPT 0160-03)

All options are field upgradeable except OPT 0160-03 which is a factory upgrade

Interfaces

OPT 0164-11	10Gbps 1310nm XFP Optics
OPT 0164-12	10Gbps 1550nm XFP Optics
OPT 0164-13	10Gbps 850nm XFP Optics
OPT 0164-91	No XFP Optics Requested

TS-10 10Gbps Configuration

N550-0225	TS-10 with 10Gbps Configuration (XFP version)

Options

OPT 0221-14	10G LAN/WAN/SONET/SDH
OPT 0221-16	10G LAN/SONET/SDH (full concatenation)
OPT 0221-17	10G LAN/WAN/SONET/SDH & 10G Fibre Channel
OPT 0221-33	10G LAN/SONET/SDH & 10G Fibre Channel
OPT 0221-15	10G Fibre Channel
OPT 0221-05	10G GFP (requires OPT 0221-03 for GFP in OTU2)
OPT 0221-07	10G cHDLC
OPT 0221-03	10G G.709 Digital Wrapper / FEC (OTU2, 11.049G, 11.095G)
OPT 0221-30	10G ODU2 10.037Gbps (requires OPT 0221-03)
OPT 0221-06	10G FEC 11.27G Extended Rate (requires OPT 0221-03)

All options are field upgradeable except OPT 0221-03 which is a factory upgrade

Interfaces

OPT 0225-11	10Gbps 1310nm XFP Optics
OPT 0225-12	10Gbps 1550nm XFP Optics
OPT 0225-13	10Gbps 850nm XFP Optics
OPT 0225-91	No XFP Optics Requested

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