

# MPM-400G™

## 400G Multi-Protocol Module



## MPA Multi-Protocol Analyzer Modular Test Platform

Specifically designed to meet the test and measurement challenges of developers and early adopters of 400G ASICs, CFP8 optics, transport/switching modules, and service delivery.



### Module Highlights

- 400G test module with native support for 400G CFP8 pluggable optics
- 400G Ethernet testing per IEEE 802.3bs draft specification (16 x 26.5625G/425G) with RS (544, 514) KP4 Forward Error Correction (FEC)
- Provides all the necessary features to test CFP8 modules and the 400GE data pipe
- Advanced and flexible FPGA based test module provides future proof hardware support for emerging standards
- The advanced pluggable hardware module supports easy field installation in deployed MPA chassis with existing 10G and 100G test modules

### Applications

- Comprehensive 400GE test applications for layers 1-3
- Full rate 400GE BERT, throughput and frame loss measurements
- PCS & RS-FEC layer testing with skew generation and analysis
- Service disruption time measurement
- CDAUI-16 16x25G signal integrity testing with multi-lane unframed BERT
- CFP8 & MDIO verification including CFP8 Module Health check feature
- High speed lane clock stressing/analysis and optical power level verification

### CFP8 Interface

- Native support for 1st generation 400G CFP8 modules
- Supports any MSA and IEEE 802.3bs compliant CFP8 module
- Supports CDAUI-16 (16x25G) electrical interface to CFP8

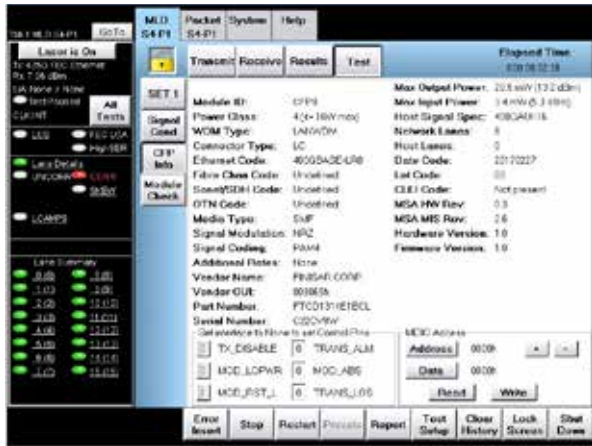
### Supported CFP8 Modules

Interface	Distance	Media	Optical Modulation
400GBASE-SR-16	100M	Parallel MMF MPO connector	16x25G NRZ
400GBASE-FR8	2 km	Duplex SMF LC Connector	8x50G PAM4 LAN-WDM
400GBASE-LR8	10 km	Duplex SMF LC connector	8x50G PAM4 LAN-WDM
16x25G electrical breakout		Electrical	

# 400G Ethernet/IP

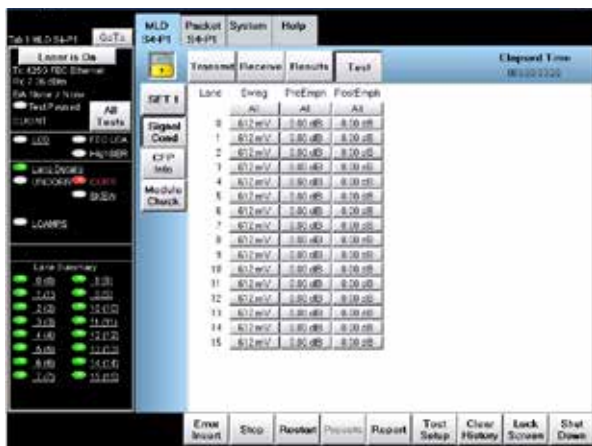
## CFP8 MDIO Testing

- Complete CFP8 MDIO access
- Raw read/write capability for all MDIO registers
- Formal display of commonly used fields
- Module hardware control pin read/write access



## Advanced PHY Features

- Per lane user controllable swing, pre & post emphasis signal conditioning settings to stress transceiver interfaces
- Receiver auto-tune mode for best optimization of receive SerDes



## Optical Testing

- Global and per optical lane power output enable/disable
- Received per lane and broadband optical power level monitoring
- User-defined alarm threshold for received optical power level



## Transmit Clock Sources

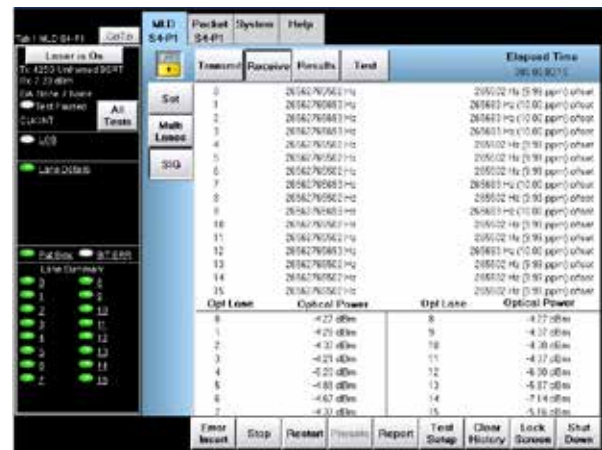
- Chassis: Internal stratum 3
- Chassis: 1.544 MHz, 2.048 MHz, BITS/1.544 Mbps, SETS/2.048 Mbps, 100/120 Ohm RJ-48
- Recovered: from the incoming signal
- External: 8 kHz, 1.544 MHz, 2.048 MHz, 10 MHz, TTL level via 50 Ohm MMCX connector (connector shared with trigger input)

## Line frequency Offset Generation

- Line frequency offset generation +/-120 ppm in steps of 0.1 ppm

## Line Frequency Measurement Capability

- Displays measured transmit line frequency offset in Hz
- Displays measured transmit line frequency offset from external reference clock in both Hz and ppm
- User defined alarm threshold for external transmit reference clock offset measurements
- Provides line frequency measurements in Hz with offset in Hz and ppm. Measures all lanes for Unframed BERT, single lane for 400GE
- User defined alarm threshold for received line frequency measurements



## Module Health Check

Simple one button pass/fail test for verifying all transceiver properties

- Advanced user defined thresholds
- Simple test report includes settings, results and CFP8 Module MDIO information



## 400G Ethernet/IP *cont'd*

### Acceptance Tests

- Module optical power threshold high/low
- Module line frequency generation and tolerance
- Module skew generation and tolerance
- Module BERT performance with PRBS Test pattern selection

### Reference Clock Outputs

- Eye Clock out: 1/170th line rate, 50 Ohm MMCX connector (connector shared with trigger output)
- CFP8 module monitor clock output: 50 Ohm MMCX connector

### Advanced Triggering

- Trigger in: TTL level via 50 Ohm MMCX connector (connector shared with external clock input)
- Trigger out: TTL level via 50 Ohm MMCX connector (connector shared with eye clock out)

## Multi-lane Unframed BERT Testing

Per lane BERT testing for transceiver and equipment characterization and acceptance testing

### Test Patterns

- Modes: 16 x 26.5625G
- PRBS 2<sup>31</sup>-1, 2<sup>23</sup>-1, 2<sup>20</sup>-1, 2<sup>15</sup>-1, 2<sup>11</sup>-1, 2<sup>9</sup>-1 normal or inverted
- Per lane test pattern selection



### Error Generation

- Bit error per lane and global
- Insertion: single, rates from 1E-3 to 1E-10 user defined rates

### Error Measurement

- Per lane loss of pattern sync
- Per lane bit error count, average and current bit error rates

## PCS/RS-FEC layer Generation

### Skew Generation

- Per lane static skew generation

### FEC Lane

- FEC lane marker swapping and rotation

### Error Generation

- FEC Correctable Codeword, single and rates
- FEC Uncorrectable, single and rates

### Alarm Generation

- Per lane FEC alignment marker loss
- FEC LOA
- High SER

## PCS/RS-FEC Layer Analysis

### FEC Lane

- FEC lane identification

### Skew Analysis

- Per lane skew analysis in bit time and picoseconds
- User defined alarm threshold for received skew measurement



### Error Measurement

Supports counts, current and average error rates

- FEC Correctable Codeword
- FEC Correctable Symbol
- FEC Uncorrectable
- 64B/66B code

### Alarm Measurement

- Per lane FEC alignment marker loss
- FEC LOA
- High SER

## Ethernet/IP

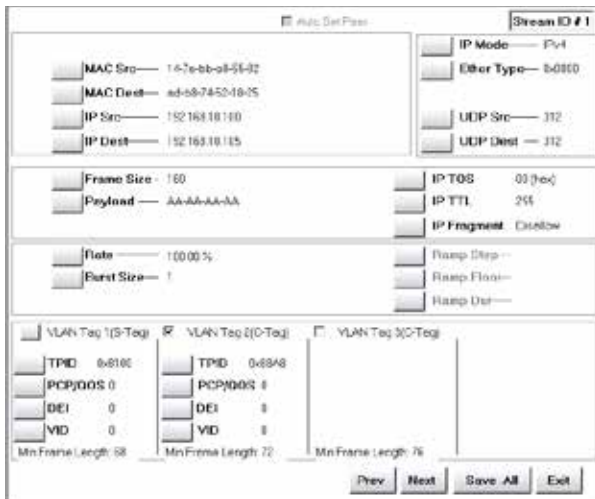
### Traffic Generation/Test Stream Flow

Test flow is generated with a signature field in the beginning of the UDP payload area for traceability and measurement purposes

- MAC/IP/UDP formatted traffic generation
- IP Version: IPv4 or IPv6
- MAC/IP/UDP source and destination addressing
- User defined Ethernet Type, Traffic Class, Hop Limit, Flow label fields
- Frame sizes: 64 to 16,000 bytes
- Test Pattern: Variable
- VLAN tags up to 4 levels with user defined TPID, PCP/QOS, DEI, VID
- MPLS tags up to 4 levels with user defined label, TC, S(bottom), TTL

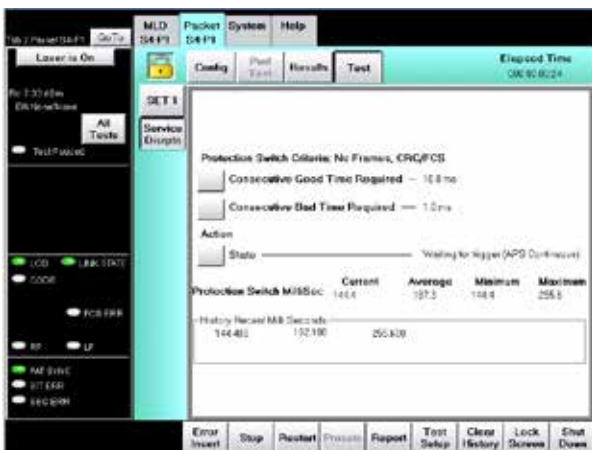
### Traffic Rate Generation

- Full rate generation<sup>1</sup> and analysis
- Constant rate by % BW and Mbps
- Ramp by % BW or Mbps
- Burst



### Service Disruption Time (SDT) Measurement

- Event Triggers: Ethernet frame disruption, FCS error
- Event threshold: consecutive SD time required, measurement clearing time
- Single or continuous measurements
- Reports SDT min, max, and average values in milliseconds
- Displays the last measurement plus 10 historical events, last 250 events saved in test report



### RFC 2544 Testing

Supports standardized and user-defined thresholds/values including graphical results<sup>1</sup>

- Throughput/Latency
- Frame Loss
- Back to Back Burst tests

### Error Generation

Supports single and rate generation<sup>1</sup>

- Test pattern bit and sequence errors
- IP Checksum

### Alarm Generation

- Remote and local fault alarms
- Auto reply to local fault

## Results

### Result Filtering

- Results can be filtered by VLAN tag TPID

### Transmit and Receive Port Counts

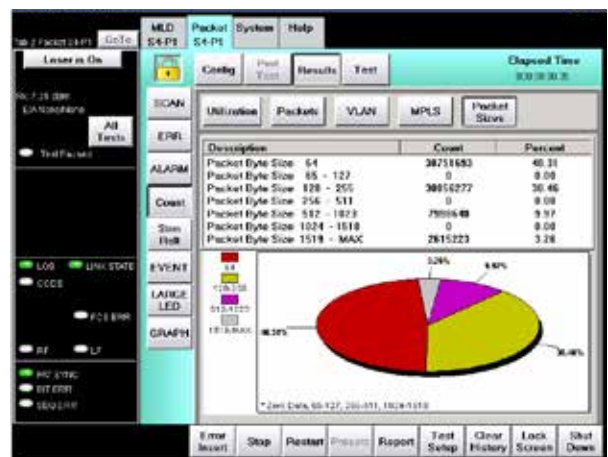
- Packets, packets/second, bytes, Mbps, % BW
- VLAN packets, MPLS packets
- IPv4 & IPv6 packets

### Receive Port Counts

- TCP, UDP, IGMP, ICMP packets
- Broadcast, multicast, unicast
- Jumbo, super jumbo packets (greater than 9000 bytes)

### Distribution Results

- VLAN distribution by tag level and quality of service level
- MPLS distribution by tag level and traffic class
- Packet size distribution for 64, 65-127, 128-255, 256-511, 512-1023, 1024-1518, 1519-max byte ranges with support for counts, percentage and graphing



### Utilization Counts

- Total, IPv4, IPv6, VLAN, MPLS binning
- Current, min, max, and average % BW, Mbps, and packets per second statistics for generated and received traffic

**Errors**

Displays counts, errored seconds, current and average error rates

- Code, undersized, invalid FCS, invalid IP

**Alarms**

- Loss of link, local fault, remote fault

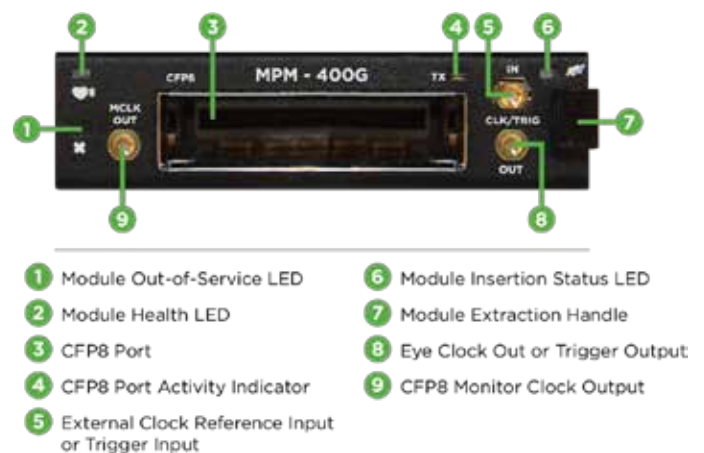
**Test Stream Results**

- Transmitted and received packet counts, byte counts and rate in %BW
- Test stream sequence errors, bit errors and lost frame counts in errored seconds, current and average rates
- User-defined pass/fail threshold alarm from sequence errors, bit errors and lost frames
- Latency min, max, and average measurements in microseconds
- Packet jitter min, max, and average measurements in microseconds



**Test Profiles**

Supports save and restore of test profiles



**Results**

- LEDs and detailed statistical counters
- Graphs and Histograms
- Event log history showing event, count, day/time, and duration for last 1,000 events
- Flexible test reporting options including PDF



**Notes:**

1. 100% full rate generation on selected packet sizes.



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