SmartClass™ Ethernet
10M-1G Ethernet Tester

METRO Ethernet Forum **MEMBER**
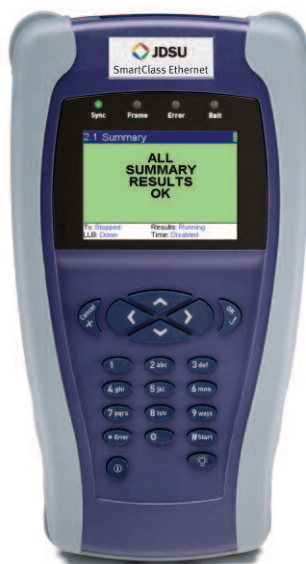
Key Features

- **Generates and measures L2/L3 traffic on up to 1G electrical or optical Ethernet interfaces with VLAN, Q-in-Q tags, or MPLS labels**

- **RFC2544 proves acceptance for Ethernet service level agreements**

- **MPLS Test checks for correct policing and prioritization in MPLS domains using the MPLS option**

- **Physical Layer tests verify integrity of the physical layer to pass traffic before testing throughput**

- **Ethernet Loopback completes the JDSU Ethernet field test portfolio**

Ethernet Services Testing

The SmartClass Ethernet provides an economical 1 G Ethernet test set with optical and electrical interfaces that is an easy-to-use, entry-level Ethernet/IP tester for front-line technicians who support Metro Ethernet networks. The compact, rugged, and battery-operated SmartClass is ideal for technicians turning up Ethernet and Internet Protocol (IP) services in the field.

Technicians can use the SmartClass Ethernet for physical layer cable testing, Layer 2/3 (L2/L3) traffic generation, and full RFC2544 Ethernet testing. The tester serves as a simple loopback device to partner with other Ethernet testers in the JDSU portfolio.

The SmartClass Ethernet now has Multiple Streams and Multiprotocol Label Switching (MPLS) options to allow policy testing in converged triple-play networks, and the Asymmetric RFC2544 option enables easy verification of services with different up and downstream data rates. View the online demonstration of the tester at **www.jdsu.com/smartclass-Ethernetdemo**.

Applications

- Optional Asymmetric RFC2544 mode enables verification of circuits with different up and downstream rates
- Verifies QoS for triple-play networks by simultaneously measuring throughput, latency, jitter, and errors on up to 8 specific VLAN or Q-in-Q tagged traffic flows with the Multiple Streams option
- Available in a loop-only version to save on CAPEX and allows for upgrades in the field to full functionality if needed

| Feature	Functionality
Ethernet/IP Analysis, Filtering, and Traffic Generation	Filters and analyzes incoming traffic to determine throughput and quality of service (QoS) metrics. Generates traffic to ensure that QoS parameters are being met by emulating customer traffic. Use multiple streams to verify correct traffic prioritization.
VLAN, Q-in-Q, and MPLS Support	Checks VLAN, Q-in-Q, and MPLS mappings and prioritizations are set properly in the network.
RFC2544 Traffic Testing	Checks that service level agreements (SLAs) can be met by testing in accordance with this accepted method.
Physical Layer Diagnostics	Checks that circuit is up and connected, and that physical layer is correct. Checks optical link for loss.
Graphical Reporting	Generates professional report for validating or storing service level testing results.
Loopback Testing	Enables a JDSU-compatible low-cost single-ended loopback device for testing across a switched or routed Ethernet network.
Ping and Traceroute Support	Checks for connectivity between locations.

Advanced Testing Applications

Multiple Streams Testing Option

The Multiple Streams option enables the SmartClass Ethernet to simulate eight different sources of traffic from one Ethernet port. Technicians can configure eight independent traffic flows with individual source and destination media access control (MAC) or IP addresses, tagged with configurable VLAN or Q-in-Q identifiers, and set with a user-configurable frame size and a traffic rate. By examining frame loss, throughput, and identifiers per stream a receiving JDSU tester can verify if the network transported the frames with the expected priority and bandwidth or whether frames reached the destination at all. This test gives service providers a cost-effective method for testing the integrity of policies designed to enable the delivery of differentiated services, such as IP triple play.

MPLS Testing Option

The MPLS option lets service providers generate traffic with two MPLS labels and priorities. Testing end-to-end with another tester or to a loop lets field technicians verify that traffic is correctly passed through a MPLS domain and reaches its intended destination with the right bandwidth and priority.
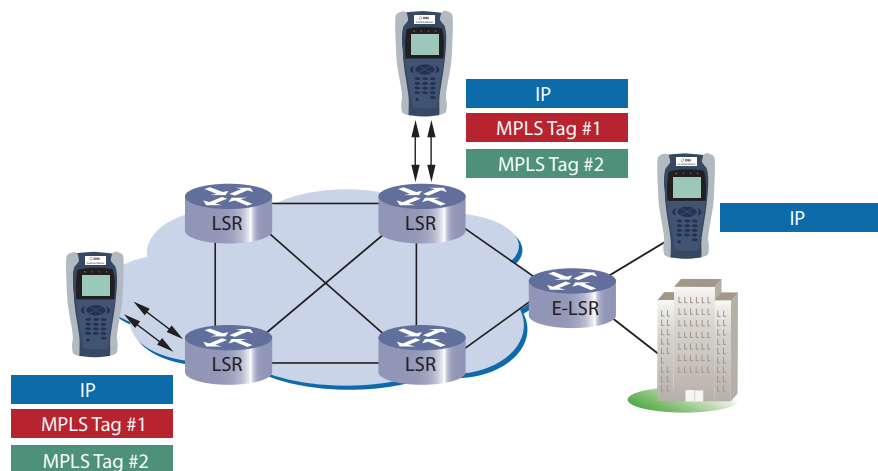
Turning up and Verifying MPLS domains with SmartClass Ethernet MPLS Test Option
Transmit Labeled Traffic into the MPLS domain
Check for the presence of test traffic with the correct labels at other test points
Check for test traffic to arrive at destination Edge label switched router – tag removal
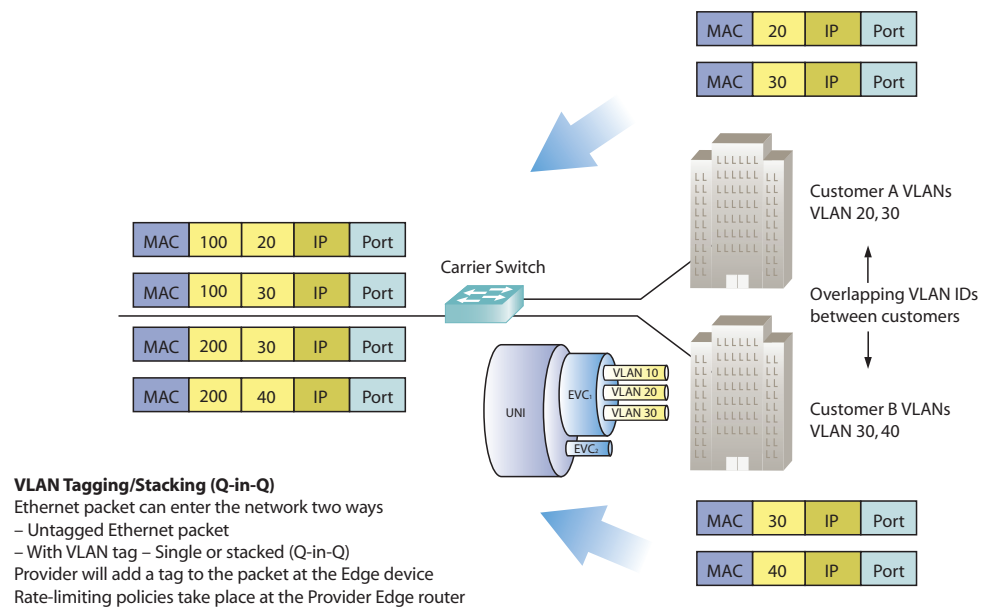Check for Throughput/Packet Loss/Prioritization Errors

Asymmetric RFC2544 Test Suite Option

Some services are provisioned to have different up and downstream data rates. Testing these services with a loop can only verify service performance of the lowest half of the link. The Asymmetric RFC2544 option provides an automated version of RFC2544 that can determine the maximum throughput, back-to-back frames, frame loss rate, and jitter for each direction of the link independently. This test provides verification of network policies designed to throttle bandwidth on one half of the Ethernet circuit. Two Asymmetric RFC2544-enabled SmartClass units are required to conduct this test.

VLAN Protocol Support

Generating an Ethernet traffic stream with a specific VLAN ID and priority (IEEE 802.1q/802.1p) enables technicians to verify the correct transmission and prioritization of the stream through the network. Additionally support for Q-in-Q (VLAN stacking, or 802.1ad) protocols, allows the generation and analysis of both service provider and customer VLANs. The setting of filters lets users isolate a specific VLAN stream to compare its performance with the total performance of the link. VLAN filtering comes standard; however, generating VLAN frames requires purchasing the Traffic option.

| MAC | 20 | IP | Port |
| MAC | 30 | IP | Port |

Customer A VLANs
VLAN 20, 30

Overlapping VLAN IDs between customers

Customer B VLANs
VLAN 30, 40

Carrier Switch

MAC	100	20	IP	Port
MAC	100	30	IP	Port
MAC	200	30	IP	Port
MAC	200	40	IP	Port

UNI

EVC₁

VLAN 10
VLAN 20
VLAN 30

EVC₂

| MAC | 30 | IP | Port |
| MAC | 40 | IP | Port |

VLAN Tagging/Stacking (Q-in-Q)
Ethernet packet can enter the network two ways
– Untagged Ethernet packet
– With VLAN tag – Single or stacked (Q-in-Q)
Provider will add a tag to the packet at the Edge device
Rate-limiting policies take place at the Provider Edge router

Ping and Traceroute

The Traffic option includes the IP Ping and Traceroute functions, which lets technicians check end-to-end connectivity in a routed network. Traceroute lets users segment a problem further or map the network connections.

10M-1G Ethernet Testing

Loopback Testing

The SmartClass Ethernet is available in a simple L2-L4 loopback device config-uration for other testers in the JDSU portfolio, such as the T-BERD®/MTS-8000, T-BERD®/MTS-6000A, FST-2802, HST-3000, QT-600, and SmartClass Ethernet. A far-end device, such as the T-BERD/MTS-6000A, can command the SmartClass Ethernet to apply a loop and then generate traffic toward it. Technicians can measure parameters, such as round-trip delay and throughput, on the far-end device using the SmartClass Ethernet to loop traffic back. The SmartClass Ethernet Loopback mode enables selected Ethernet traffic to be looped back from a live link, which enables technicians to loop back test traffic only, conduct loopback testing on a live network in the presence of non-test traffic.
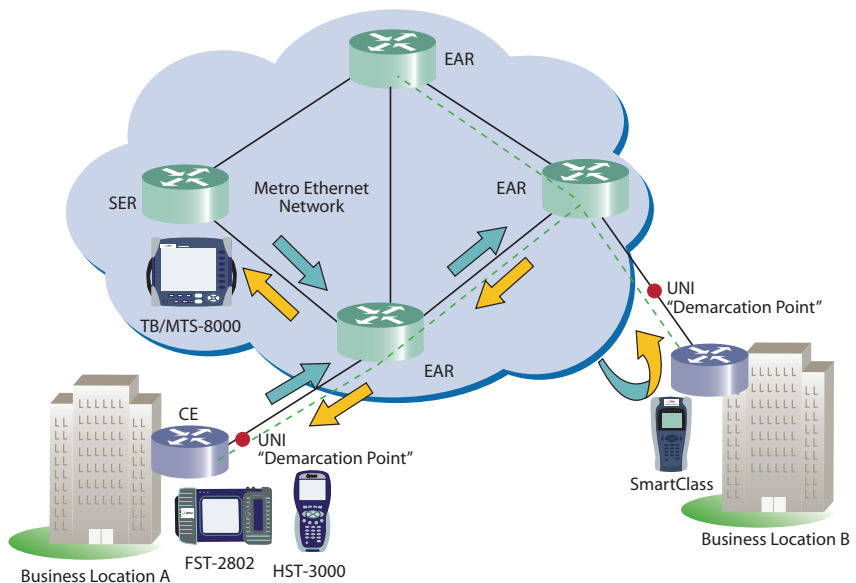
Ethernet and IP Traffic Generation, Analysis, and Filtering

The SmartClass Ethernet offers a 1 G optical and a 10/100/1000 Mb/s electrical Ethernet port that can be optioned to provide Ethernet and IP traffic transmit capabilities. The Traffic Option lets technicians generate Ethernet or IP frames with configurable parameters, such as bandwidth utilization, frame length, and frame payload with varying traffic speeds and flow types. Configure IP packets with different destination IP addresses, source IP address, type of service (TOS)/Differentiated Services Code Point (DSCP) field, and MPLS labels or virtual local area network (VLAN) tags. Use the Dynamic Host Configuration Protocol (DHCP) server to assign the IP address of the tester to prevent IP address clashes.
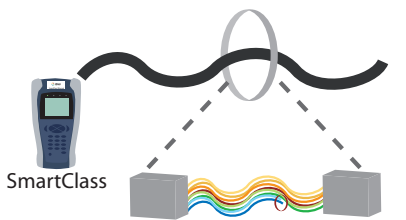
The SmartClass Ethernet can transmit traffic to measure throughput of the network, latency, loss, jitter (RFC3393) and packet/frame errors—characteristics necessary to verify QoS is set to correctly deliver the Ethernet service according to the customer's service level agreement, which can also prove network capability for transporting real-time applications such as IP voice and video traffic.

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Optical Option

The SmartClass Ethernet comes as standard with a 1Gb/s line rate RJ45 electrical connection. Additionally, the unit may be ordered with the small form-factor, pluggable (SFP) port enabled so the unit can generate line rate optical Ethernet traffic. The SmartClass Ethernet can support SX, LX, ZX, BX, and coarse wavelength division multiplexing (CWDM) interfaces at 1000 Mb/s.

RFC2544 Automated Test

To verify that they are meeting SLAs, service providers often run a full suite of tests at turn-up known as the RFC2544, which are wrapped into an easy-to-use auto test on the SmartClass Ethernet. With one button press, technicians can configure the link with their saved settings and tests against customizable thresholds, thus performing the test the same way every time with consistent, repeatable results.

Physical Layer Diagnostics

On electrical Ethernet circuits, the SmartClass Ethernet can display the link speed, link status, cable status, media dependent interface/media dependent interface crossover (MDI/MDIX) type, and distance-to-fault with one button press. To verify connectivity on fiber links, it reports the power level of the optical signal. These features let technicians quickly identify physical layer problems.

Graphical Reporting

All test results are safely stored within the SmartClass Ethernet unit and can be easily retrieved and turned into a report using JDSU Download Manager software, included with each unit. Save reports in an Excel® spreadsheet, text, or PDF format. Test reports graphically show end customers network performance test results or can document information about network performance for internal use.

SmartClass

Detects problem as open 50 m away on pair 4
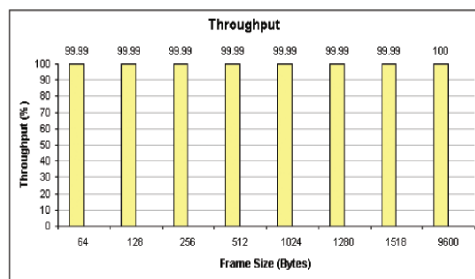
Frame Length (Bytes)	Cfg Rate (Mbps)	Measured Rate (Mbps)	Measured Rate (%)	Measured Rate (frms/sec)	Pause Detected
64	100.00	100.00	99.99	148789.00	No
128	100.00	100.00	99.99	84448.00	No
256	100.00	100.00	99.99	45284.00	No
512	100.00	100.00	99.99	23493.00	No
1024	100.00	100.00	99.99	11972.00	No
1280	100.00	100.00	99.99	9614.00	No
1518	100.00	100.00	99.99	8127.00	No
9600	100.00	100.00	100	1300.00	No

Throughput Test Results

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Specifications and Features

Interfaces

Electrical Ethernet/IP
100/100/1000 Mbps   Single RJ45
Optical Ethernet/IP
1000 Mbps   SFP Interface
Modes of Operation
Traffic, Streams, RFC2544, Asymmetric RFC2544, Loopback, Pattern, Ping, Traceroute, Cable Test, and Optical Power Measurements

Traffic Testing

Link Configuration
Duplex Modes   Full/Half
Flow Control
Auto-negotiation
Traffic Generation
Ethernet
Constant, Ramp, Bursty, Flood
Configurable source and destination MAC address, frame format, frame length (including undersized and jumbo frames), VLAN ID, VLAN priority, frame payload, utilization %, configurable SVLAN ID, SVLAN priority, SVLAN DEI, SVLAN TPI, CVLAN ID, CVLAN priority
IP
Constant, Ramp, Bursty, Flood, Ping, Traceroute configurable source and destination IP address, subnet mask, default gateway, TTL, packet length (including undersized and jumbo frames), packet payload, utilization %, TOS/DSCP configurable DHCP server address for static or dynamic addressing ARP support, MPLS Ethertype, 2 MPLS labels, MPLS ID, MPLS priority, MPLS TTL, MPLS ARP enable/disable
Ethernet Streams
Constant
Per stream configurable source and destination MAC address, frame format, frame length (including undersized and jumbo frames), VLAN ID, VLAN priority, frame payload, utilization %, configurable SVLAN ID, SVLAN priority, SVLAN DEI, SVLAN TPI, CVLAN ID, CVLAN priority
IP Streams
Constant
Per stream configurable source and destination IP address, subnet mask, default gateway, TTL, packet length (including undersized and jumbo frames), packet payload, utilization %, TOS/DSCP configurable DHCP server address for static or dynamic addressing ARP support, fill byte, VLAN ID, VLAN priority, frame payload, utilization %, configurable SVLAN ID, SVLAN priority, SVLAN DEI, SVLAN TPI, CVLAN ID, CVLAN priority

Traffic Filtering

MAC source and destination address, SVLAN ID, SVLAN priority, SVLAN TPI, CVLAN ID, CVLAN priority source and destination IP addresses, prefix length, TOS/DSCP fields

RFC2544 and Asymmetric RFC2544 Automated Testing

Throughput
Latency (RTD)
Frame Loss
Back-to-back Frame
Jitter

Bit Error Testing Patterns

Layer 2 (Framed) Bit Error Patterns
PRBS (2^{23-1}, 2^{31-1}, and inverted selections)
All Ones, All Zeros, User Defined
Framed Pattern NCITS TR-25:1999
Long continuous random test pattern (CRPAT)
Long continuous jitter test pattern (CJPAT)
Long compliant supply noise pattern (CSPAT)

Key Results

Link Status
Link active
Frame detected
Sync obtained
Configuration Status
Auto-negotiation link configuration ACK
Auto-negotiation link advertisement status
Destination MAC address, when using ARP
Link Stats
Bandwidth utilization, frame rate, RX/TX L1 Mbps, RX/TX L2 Mbps, round-trip delay, service disruption time, CVLAN ID, SVLAN ID, CVLAN priority, SVLAN priority, Avg and Max packet jitter
Link Counts
Total received and transmitted frames, pause frames, VLAN frames, unicast frames, multicast frames, broadcast frames, frame length (Bins)
Error Counts
FCS errored frames, runts, jabbers, undersized frames, OOS frames, lost frames, IP checksum errors, IP packet length errors, JDSU payload errors
Multiple Stream Results
Summary: status, sync, link active, errors
IP Config Status: IP source and destination, subnet mask, gateway addresses per stream
Link Stats: bandwidth utilization, frame rate, RX/TX L1 Mbps, RX/TX L2 Mbps, service disruption time

Link Counts

Total received and transmitted frames, pause, VLAN, Q-in-Q, unicast, multicast, broadcast, spanning tree frames, RX/TX frame bytes, frame length (Bins), RX collisions, TX collisions, TX late collisions, TX defers

Error Stats

FCS errored frames, runts, jabbers, undersized frames, lost frames, frame loss ratio, IP checksum errors, IP packet length errors, JDSU payload errors

Per Stream Results

Bandwidth utilization (Avg, Current, Min, Max), RX Acterna frames, L1 RX Mbps, L2 RX Mbps, delay (Current, Avg), packet jitter (Avg), lost frames, frame loss ratio

Physical Testing

Link speed, link status, cable status, MDI/MDIX, distance to fault, pin mapping, pair length, polarity, skew
Optical power measurement (dBm)

Power Supply

4 AA field-replaceable batteries (NiMH and Alkaline)
Battery operating time approx. 4 hrs of typical usage
Supports sleep mode (instant-on, auto power off after 2 hrs)
AC line operation via external adapter/charger
AC converter provides country specific adaptor support (USA, UK, Australia, Europe)
Charging time, internal: 4 hrs from empty to full

Language Support

The SmartClass Ethernet supports Simplified Chinese, English, French, German, Italian, Japanese, Korean, Portuguese, Russian, and Spanish

General

Permissible Ambient Temperature
Nominal range of use   0 to +50℃
Storage and transport   −10 to +60℃
Humidity
Operating humidity   10 to 90%
Physical
Size (H x W x D)   230 x 120 x 50 mm (9-1/16 x 4-3/4 x 2 in)
Weight, including batteries   <1 kg (2 lb)
Display   320 x 240 pixel color

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Ordering Information

Packages

CSC-ETHLP-P1	Electrical only loopback
CSC-ETHLP-P2	Optical and electrical loopback
CSC-ETHLP-P3	Optical and electrical loopback with accessories (SX and LX SFPs and multimode + single-mode fibers with LC+SC connectors)
CSC-ETHTR-P1	Electrical traffic
CSC-ETHTR-P2	Optical and electrical traffic
CSC-ETHTR-P3	Optical and electrical traffic with accessories (SX and LX SFPs and multimode + single-mode fibers with LC+SC connectors)

Accessories

CSC-OPT	Optical Option
CSC-TRF	Traffic Option
CSC-MPLS	MPLS Option
CSC-MPLS-U1	MPLS Field Upgrade*
CSC-ASY	Asy. RFC2544 Option
CSC-ASY-U1	Asy. RFC2544 Field Upgrade*
CSC-MSTR	Multiple Streams Option
CSC-MSTR-U1	Multiple Streams Field Upgrade*
AC-SFP-1000LX	1000LX SFP
AC-SFP-1000SX	1000SX SFP
AC-SFP-1000ZX	1000ZX SFP
AC-SFP-1000BX1	1310 nm TX, 1490 nm RX, Single mode SFP
AC-SFP-1000BX2	1490 nm TX, 1310 nm RX, Single mode SFP
AC-SFP-CWDM-1	1471 nm CWDM SFP
AC-SFP-CWDM-2	1491 nm CWDM SFP
AC-SFP-CWDM-3	1511 nm CWDM SFP
AC-SFP-CWDM-4	1531 nm CWDM SFP
AC-SFP-CWDM-5	1551 nm CWDM SFP
AC-SFP-CWDM-6	1571 nm CWDM SFP
AC-SFP-CWDM-7	1591 nm CWDM SFP
AC-SFP-CWDM-8	1611 nm CWDM SFP + assorted cables

* -U1 part codes apply for only Release 3 and above SmartClass Ethernet Units. To find out how to upgrade a unit, go to www.jdsu.com.