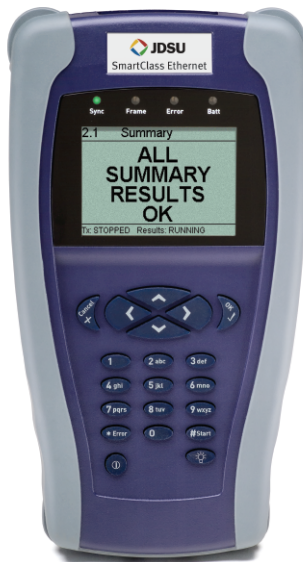


10/100/1000 and Gig-E Testing

SmartClass™ Ethernet

Key Features

- Proves acceptance for Service Level Agreements (SLAs) via industry-standard RFC 2544 test; ensures repeatable and reliable results so providers can reduce operating expenses by quickly turning up circuits or detecting problems
- Measures quality of service (QoS) parameters including throughput, latency, jitter, and error ratio with the capability to do so on a specific VLAN or Q-in-Q tag to allow fast analysis of triple-play networks
- Available in either a full tester or a loopback-only configuration. This allows the same loopback function of a fully featured test set at a fraction of the cost. Both versions are interoperable with the JDSU carrier Ethernet portfolio to enable capex reduction
- Provides comprehensive physical tests to validate error free cable and fiber connections and data layer tests to verify circuits can accurately pass data or IP traffic
- Designed for front-line technicians with little Ethernet or IP experience; provides an easy-to-use interface in 10 languages and comes complete with training information

Ethernet Services Testing

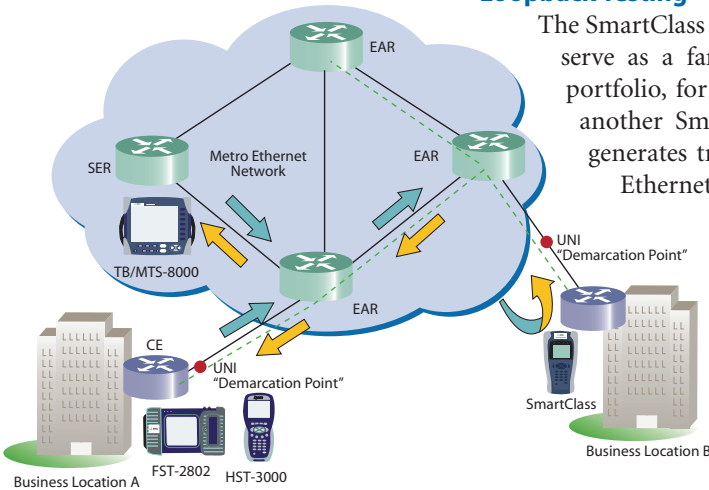
SmartClass Ethernet offers a unique, economical combination of feature-specific functionality, while providing an easy-to-use, cost-effective Ethernet solution for physical layer cable testing, layer 2 and layer 3 traffic generation, and full RFC-2544 testing. Rugged, battery-operated, and application-specific, this test tool enables field technicians to turn up Ethernet and IP services by running an RFC-2544 test or by following a set of methods and procedures. It is configurable as either a far-end loopback device only or a full RFC-2544 compliant traffic generator. The SmartClass Ethernet is designed for front-line technicians who may not have experience dealing with emerging Metro Ethernet technologies yet need a solution for Ethernet and IP testing. Available in 10 languages, the tool may be configured as an optical or electrical only test set.

Feature	Functionality
Loopback Testing	Enables a low cost single ended loopback device for latency and RFC 2544 testing across a network
Ethernet and IP analysis and filtering	Filter and analyze incoming traffic to determine customer throughput and QoS
Physical Layer Diagnostics	Check that circuit is up and connected and physical layer is correct
Graphical Reporting	Professional Report Generation for validating or storing Service Level testing results
VLAN support including Q-in-Q support	Check VLAN and Q-in-Q mappings and prioritizations are properly set in network
Optical Power Measurements and traffic generation	Check optical link for loss and QoS parameters
Ethernet and IP Traffic Generation	Check to ensure that QoS parameters are being met by emulating customer traffic
Ping and Traceroute support	Check that connectivity exists between locations
RFC 2544 traffic testing	Check that full Service Level Agreements are being met by testing to an international standard

10/100/1000 and Gig-E Testing

Loopback Testing

The SmartClass Ethernet comes standard with functionality that allows it to serve as a far-end loopback device for another test set in the JDSU portfolio, for example the MTS-8000, FST-2802, HST-3000, QT-600 or another SmartClass Ethernet. In this application the far end device generates traffic toward the SmartClass Ethernet, and the SmartClass Ethernet loops back this traffic so that parameters such as latency and throughput can be measured across a network. In addition, the SmartClass Ethernet allows the user to set up specific Ethernet traffic to be looped back, based on a specified VLAN, MAC, or IP address. This capability enables a technician to only loop back test traffic, meaning the loopback testing can occur on a live link while non-test traffic is present in the network.

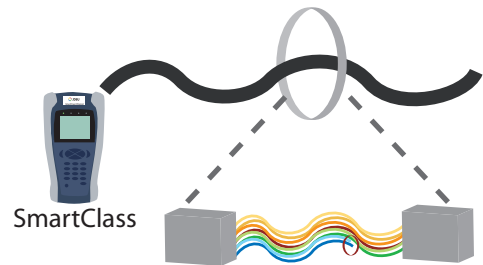


Ethernet and IP Traffic Analysis and Filtering

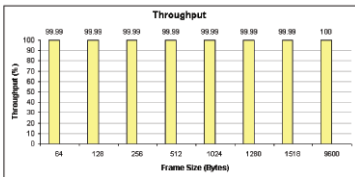
The SmartClass Ethernet measures the QoS parameters of a link. With the capability to measure throughput, latency, loss, and errors, the SmartClass can test and validate a link for service level agreements. With the recent addition of jitter measurements as per RFC 3393, SmartClass Ethernet has been enhanced to measure the jitter characteristics of a network as well allowing for further testing of triple-play applications such as voice and video traffic.

Physical Layer Diagnostics

On electrical Ethernet circuits, the SmartClass Ethernet can display the link speed, link status, cable status, MDI/MDIX type, and distance-to-fault with one button press. To verify connectivity on fiber links, the tool reports the power level of the optical signal. These features allow technicians to quickly sectionalize physical layer problems.



Detects problem as open 50m away on pair 4



Frame Length (Bytes)	Cfg Rate (Mbps)	Measured Rate (Mbps)	Measured Rate (%)	Measured Rate (frames/sec)	Pause Detected
64	100.00	100.00	99.99	149769.00	No
128	100.00	100.00	99.99	68446.00	No
256	100.00	100.00	99.99	45364.00	No
512	100.00	100.00	99.99	23493.00	No
1024	100.00	100.00	99.99	11923.00	No
1280	100.00	100.00	99.99	9614.00	No
1518	100.00	100.00	99.99	8127.00	No
9000	100.00	100.00	100	1300.00	No

Throughput Test Results

Graphical Reporting

The SmartClass Ethernet is not only convenient for testing, it is also easy-to-use for the storage of results. A free offline download utility can connect to the SmartClass via USB and allow users to download results from the unit. These results can then be uploaded automatically to an Excel® spreadsheet or saved as a pdf document. This ability to quickly and easily consolidate test results can be used as a graphical way to prove to the end customer that a service level agreement is being met or as a method to share information between technicians about network performance.

Advanced Testing Applications



SmartClass Ethernet Traffic Option

Throughput and RTD measurements

Whether through the optical or electrical port, the SmartClass Ethernet can be optioned to provide technicians with Ethernet and IP traffic transmit capabilities. The Traffic Option allows generation of Ethernet or frames with various configurable parameters, such as bandwidth utilization, frame length, and frame payload at variable traffic speeds and flow types. The user may elect to generate IP packets with different user enterable fields, such as destination IP address, source IP address, TOS/DSCP field, and time-to-live. With support for dynamic addressing, the source IP address can be assigned by a DHCP server, if necessary. The user can use these transmit capabilities to emulate customer traffic and check that QoS and service level agreements are being met.

Ping and Traceroute

Prior to testing throughput in a routed network, technicians may need to verify that the provisioned path in the network will carry IP traffic to its destination. The first step in verifying this end-to-end connectivity is to perform an IP Ping. If the user needs to segment a problem further or map the network connections, the SmartClass Ethernet can be used to perform Traceroute testing.

RFC 2544 Automated Test

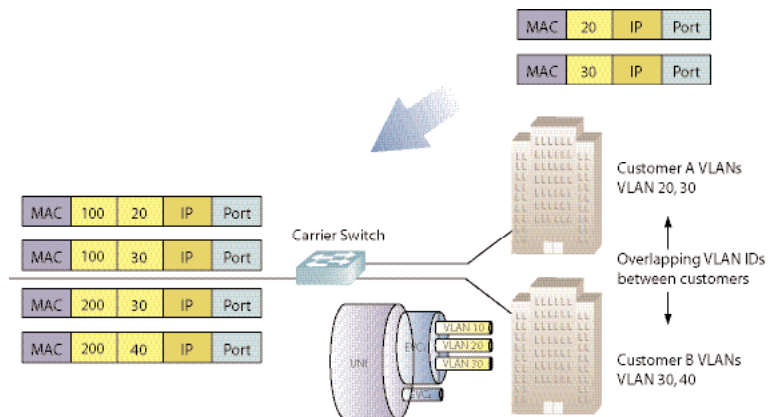
To verify that SLAs are met, service providers often run a full suite of tests at turn-up. This set of standard tests, known as the RFC 2544, is wrapped into an easy-to-use auto test on the SmartClass Ethernet. With a single button press, the link is configured with the technician's saved settings and tested against customizable thresholds. This ensures that the test is performed the same way every time, providing consistent, repeatable results.

Optical Option

The SmartClass Ethernet comes standard with a line rate RJ-45 electrical connection that goes up to a full gigabit speed. Additionally, the unit may be ordered with a fully functional SFP port capable of generating line rate optical Ethernet traffic. Through this the SmartClass Ethernet can support SX, LX, ZX, BX, and CWDM interfaces at 1000 Mbps.

VLAN Protocol Support

The SmartClass Ethernet supports generation of an Ethernet traffic stream with a specific VLAN ID (as per specification 802.1q) and VLAN user priority (as per specification 802.1p). This enables technicians to verify the correct transmission and prioritization of the stream through the network. Additionally, the SmartClass Ethernet supports Q-in-Q (VLAN stacking or 802.1ad) protocols, allowing the technician to generate and analyze both provider and customer VLANs. In addition, its filtering ability allows technicians to isolate a specific VLAN stream and compare its performance with the total performance of the link. Though VLAN filtering is standard, to generate VLAN frames the traffic option must be purchased.



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

Specifications & Features
Interfaces
Electrical Ethernet/IP

100/100/1000 Mbps Single RJ-45

Optical Ethernet/IP

1000 Mbps SFP Interface

Modes of Operation

Traffic, RFC 2544, Loopback, Ping, Traceroute, Cable Test, and Optical Power Measurements

Traffic Testing
Link Configuration

Duplex Modes Full/Half

Flow Control

Autonegotiation

Traffic Generation
Ethernet Traffic Generation

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 Traffic Generation

Constant, Ramp, Bursty, Flood, Ping, TraceRoute

Configurable Source and Destination IP Address, Packet Length, Packet Payload, Utilization %, TOS/DSCP

Configurable DHCP server address for static or dynamic addressing

ARP support

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

RFC 2544 Automated Testing

Throughput Test

Latency Test

Frame Loss Test

Back to Back Frame Test

Bit Error testing Patterns
Layer 2 (Framed) Bit Error Patterns

 PRBS (2²³⁻¹, 2³¹⁻¹, and inverted selections)

All 1s, All 0s, 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, Rx/Tx L3 Mbps, Round Trip Delay, Service Disruption Time, CVLAN ID, SVLAN ID, CVLAN Priority, SVLAN Priority, Avg Packet Jitter, 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, Acterna Payload Errors

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 h of typical usage

Supports sleep mode (Instant-On, Auto power off after 2hrs)

AC line operation via external adapter/charger

AC converter provides country specific adaptor support

(USA, UK, Australia, Europe)

Charging time, internal: 4 h from empty to full

Language Support

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

General Specifications
Permissible Ambient Temperature

Nominal range of use 0°C to +50°C

Storage and transport -10°C to +60°C

Humidity

Operating humidity 10% to 90%

Physical Specifications

Size (H x W x D) 230 x 120 x 50 mm

Weight, including batteries <1 kg (2 lbs)

Display 240 x 160 monochrome display

Configurations
Packages

CSC-ETHLP-P1 electrical only loopback configuration

CSC-ETHLP-P2 optical and electrical loopback configuration

CSC-ETHLP-P3 optical and electrical loopback with accessories (SX and LX SFPs and multimode + singlemode fibers with LC+SC connectors)

CSC-ETHTR-P1 electrical traffic configuration

CSC-ETHTR-P2 optical and electrical traffic configuration

CSC-ETHTR-P3 optical and electrical traffic with accessories (SX and LX SFPs and multimode + singlemode fibers with LC+SC connectors)

Accessories

CSC-OPT optical option

CSC-TRF traffic option

AC-SFP-1000LX 1000LX SFP

AC-SFP-1000SX 1000SX SFP

AC-SFP-1000ZX 1000ZX SFP

AC-SFP-1000BX1 1310nm TX, 1490nm RX, Singlemode SFP

AC-SFP-1000BX2 1490nm TX, 1310nm RX, Singlemode SFP

AC-SFP-CWDM-1 1471nm CWDM SFP

AC-SFP-CWDM-2 1491nm CWDM SFP

AC-SFP-CWDM-3 1511nm CWDM SFP

AC-SFP-CWDM-4 1531nm CWDM SFP

AC-SFP-CWDM-5 1551nm CWDM SFP

AC-SFP-CWDM-6 1571nm CWDM SFP

AC-SFP-CWDM-7 1591nm CWDM SFP

AC-SFP-CWDM-8 1611nm CWDM SFP+ assorted cables