SmartClass™ Triple-Play Services (TPS)

Benefits

- Save money and reduce repeat faults by testing all broadband triple-play services with one tool for copper, fiber, POTS, ADSL2+/VDSL2, IP data, VoIP, and IP video
- Reduce truck rolls, repair faults quicker, and guarantee QoS/QoE with pass/fail tests that correlate triple-play services problems in the application layer to the root cause in the copper physical layer and verify IP video and VoIP quality
- Identify potential copper impairments like disturbers, bad joints, or bridged taps using DSL QLN and Hlog graphs
- Avoid the complexity of copper testing with one-button pass/fail CableCheck functionality that includes balance testing and good ground-check capabilities
- Gain more value and easier handling with one tool that includes a web browser, multiple HDTV streams, VoIP emulation G.722 call controls, fiber test, results file transfer, a customizable user interface, and field upgrades via USB Host 2.0 interface

Applications

- Tests IP video quality in STB emulation and Monitor/Through mode for Broadcast and VoD streams, including VMOS
- Assesses VoIP packet stream quality using MOS and R-Factor
- Tests IP data connectivity via web browser and throughput rate using FTP or HTTP as well as network delay
- Verifies copper circuit for triple-play services
- Tests optical power level
- POTS dialer

The JDSU SmartClass Triple-Play Services (TPS) helps field technicians who roll out broadband access networks and services deliver a pristine copper access infrastructure that can support triple-play services and meet critical quality of service (QoS) and quality of experience (QoE) requirements.

This **all-in-one** tool can test copper, fiber, asymmetrical and very-high-speed digital subscriber lines (ADSL2+/VDSL2), Internet protocol (IP) data, voice over IP (VoIP), and IP video with straightforward pass/fail results and detailed analysis of physical- and application-layer-related problems.

The SmartClass TPS verifies the physical health of the access copper loop, digital subscriber line (DSL) performance, and QoS/QoE of triple-play services to ensure that field technicians have successfully completed the installation and repair job.

Operators and service providers can more quickly locate and repair faults and, thus, guarantee their service quality.

IP Video

The SmartClass TPS can test multiple standard- (SDTV) and high-definition television (HDTV) streams regardless of compression format (Motion Picture Experts Group 2 [MPEG-2], MPEG-4p10/H.264 or VC-1, and others) and automatically detects the stream type with the Broadcast Auto feature.

The SmartClass TPS IP Video application allows for termination of the IP video stream anywhere in the access network using the DSL or Ethernet terminal equipment (TE) interface. The Monitor and Through mode of the SmartClass TPS also allows for identification of faulty equipment.

Key performance indicators for real-time protocol (RTP), the correlation to DSL errors, along with an optional video mean opinion score (VMOS) test gives the SmartClass TPS the ability to truly measure network QoS and QoE.

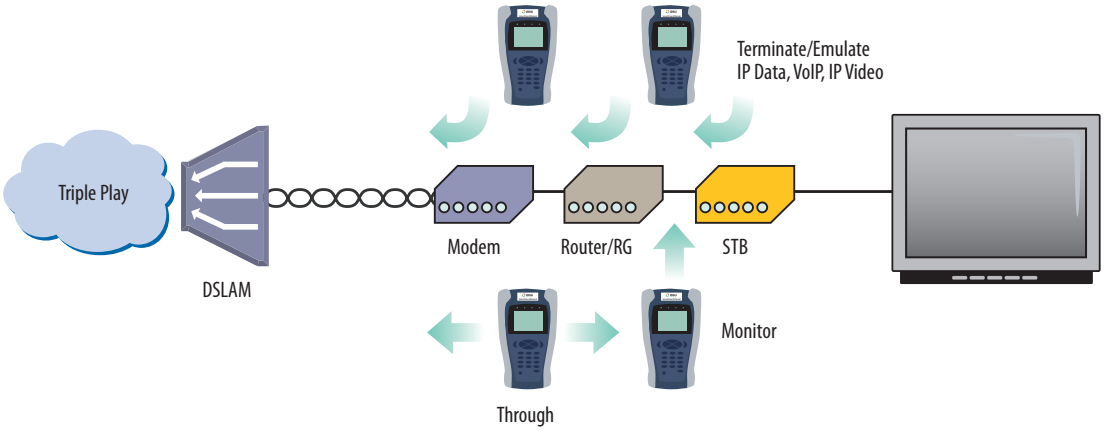
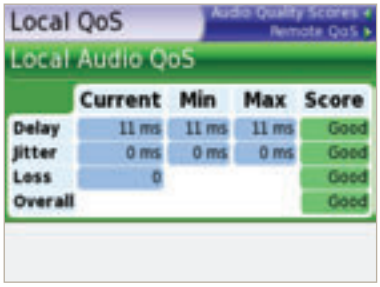


Figure 1. Operate the SmartClass TPS in Through/Monitor mode and Emulation mode

VoIP



VoIP Audio QoS screen

The SmartClass TPS is the ideal test tool to quickly place a VoIP call and verify the associated mean opinion score (MOS) value. The DSL or Ethernet TE interface allows for testing VoIP anywhere in the access network. The SmartClass TPS includes an Auto Answer mode in which the unit automatically responds to an incoming call. JDSU provides a wide range of signaling protocols for the SmartClass TPS, including SIP, H.323, MGCP, SCCP, and voice decoding (G.711, G.722, G.723, G.726, and G.729).

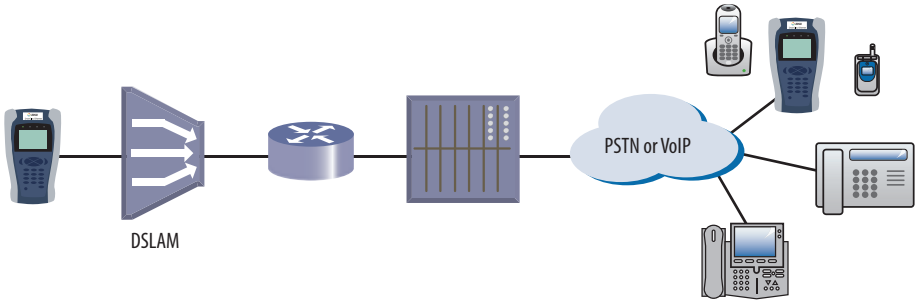


Figure 2. The SmartClass TPS tests VoIP throughout the IP network registration with gateway, test calls on and off the network, and measures near- and far-end IP QoS and MOS

Typical VoIP tests that today's field technicians require include:

VoIP Test	What it Tests	Why it is Needed
Service setup/provisioning	Registration with gateway: SIP, H.323, MGCP, SCCP	User setup and server availability. VoIP clients and servers allow complex setups.
Connectivity beyond signaling gateway	Placing test calls on and off network	Call connection from VoIP-to-VoIP and VoIP-to-Public Switched Telephone Network (PSTN).
Call quality	MOS, near- and far-end QoS with packet loss, jitter, delay, and R-Factor	Tests how VoIP calls are transferred through the network and received at the customer premises.

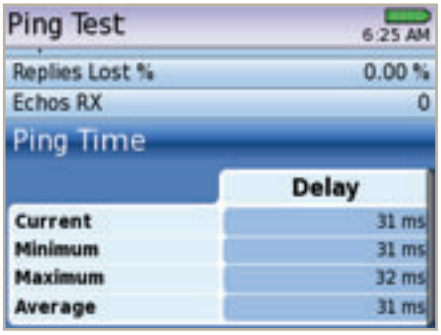
IP Data

IP Data Throughput application screen

Internet subscribers demand reliable connectivity at the same time as new applications are introduced that require higher performance on data throughput and network delay times. DSL error protection using interleaver delay and error recovery mechanisms, for instance for IP video, counteract time-sensitive data throughput using transmission control protocol (TCP)/IP with acknowledgement and retransmission. The SmartClass Triple-Play Services tester lets technicians quickly test Internet connectivity with the optional web browser and file transfer protocol/hypertext transfer protocol (FTP/HTTP) Throughput as key reference tests for a TCP/IP application. Mature tests like IP ping delay are still necessary, especially for real-time applications such as online gaming.

Typical IP Data tests that today's field technicians require include:

IP Data Test	What it Tests	Why it is Needed
User authentication	IPoE, PPPoE, IPoA, or PPPoA login	Customer service turn-up
Web browser	Connect to any website	Differentiate between network problems and web server downtimes and isolates customer PC as point of failure
IP ping and traceroute	Delay time through the network and routing	Network delay is crucial, especially with high-interaction applications, such as gaming.
FTP/HTTP throughput	Upload and download rates	DSL profile parameters, such as INP and delay and network aggregation issues, determine user-experienced data speeds.



IP Ping screen

ADSL2+/VDSL2

Technicians commonly run DSL synchronization tests at every dispatch, making the SmartClass TPS a useful tool that supports DSL tests for ADSL1/2/2+ or VDSL2. It provides a bits-per-tone graph that is key toward identifying disturbers and profile utilization.

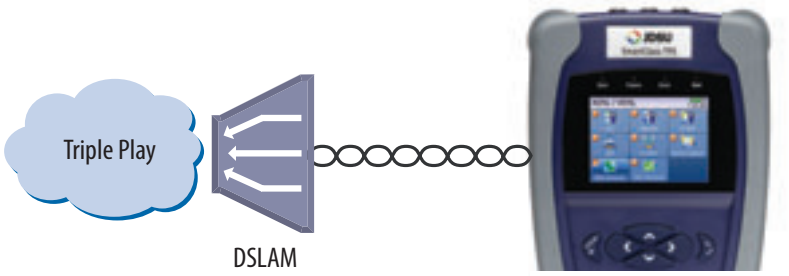


Figure 3. ADSL2+ and VDSL2 key performance indicators and a large bits-per-tone graph

Typical ADSL2+/VDSL2 tests that today's field technicians require include:

DSL Test	What it Tests	Why it is Needed
ADSL2+/VDSL2 synchronization test	Synchronization in Auto mode or dedicated profile	Connection and provisioning problems.
Customer data rate upgrade	Maximum DSL rate	Applications such as IP video require more bandwidth.
Margin and attenuation	Signal-to-noise ratio margin (SNRM) and loop attenuation	Copper circuits are exposed to environmental changes. Adequate noise margin maintains the line. Higher attenuation results in lower SNR.
DSL errors	CRC, FEC, LOS, LOF, LOP	DSL errors will transfer to application layers such as IP video.
Bits per tone (BPT)	Number of BPT	Identifies disturbers/interferers.
Hlog	Loop attenuation component of the channel transfer function (during the modem training phase)	Can detect bridged taps, degraded contacts and bad joints
Quiet line noise (QLN)	External noise floor of the DSL line	Shows frequency of potential disturbers/ interferers on the DSL line

Copper

The SmartClass TPS provides an automatic one-button CableCheck function with pass/fail results for important copper test parameters, even in environments that produce a high level of noise and interference. Using the CableCheck test sequence, SmartClass TPS users can secure accurate test results with minimal training and identify obvious copper faults such as a misconnection or copper loops that are too long.

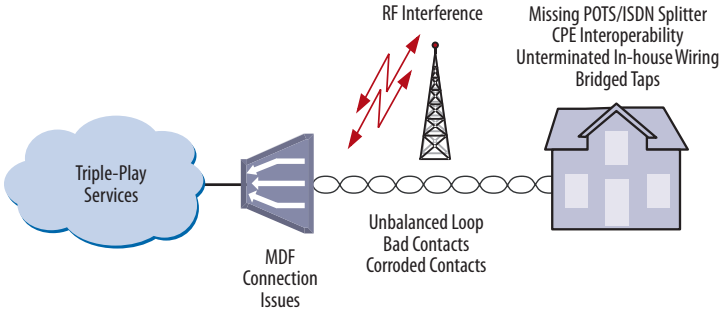


Figure 4. The SmartClass TPS makes copper testing easy. Using the SmartClass TPS CableCheck script automates copper qualification via single-ended line test (SELT) and provides a pass/fail result.

Basic tests required in today's copper network include:

Copper Test	What it Tests	Why it is Needed
Digital volt-ohm meter (DVOM)	DC/AC voltage, loop current, loop resistance, distance-to-short, leakage	Overall copper health, risk of no DSL synchronization
Opens	Capacitance, loop length	Cable damage, loop length acceptable for DSL
Balance	Longitudinal balance, resistive balance, capacitive balance	Robustness against noise, otherwise reduced bits-per-tone
Load coil	Presence of load coils and location	Load coils act as low-pass filters and must be removed for DSL to work

POTS Dialer

The SmartClass TPS reduces the number of test tools a technician needs to carry by also providing an integrated plain old telephone service (POTS) dialer. Using the POTS dialer, technicians can verify that the line is working and does not conflict with the customer's broadband equipment due to an eventual missing or defective POTS splitter.

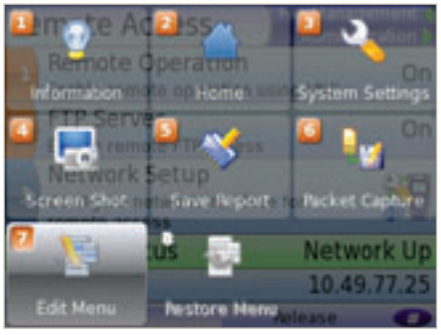
Copper Test	What it Tests	Why it is Needed
POTS	Placing a POTS call	Connectivity to exchange and determining if POTS is available

Optical Power Meter screen

Fiber

For various fiber (FTTx) installations, field technicians can use the SmartClass TPS together with the JDSU MP-60 USB Optical Power Meter (OPM) to ensure that fiber cable attenuation falls within pass/fail limits and without fault before connecting it to the optical network transport (ONT).

Fiber Test	What it Tests	Why it is Needed
Optical power level	Optical power level with pass/fail and reference values	Optical loss must be within budget at ONT site

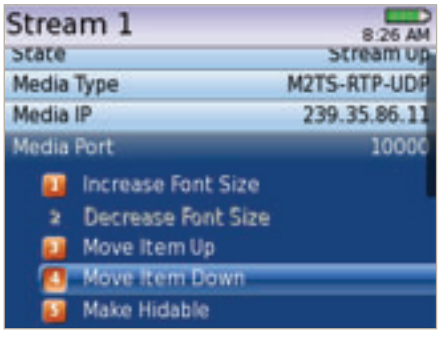


Utility screen

Navigating the SmartClass TPS

The SmartClass TPS adopts a new navigation concept with a user interface that offers a wide range of personalization features, allowing users to customize it based on job task and preferences. They can increase or decrease the font size, move menu items up or down, hide or highlight specific menu selections, and change language options.

With remote operation included, training users becomes easy and also provides additional value when coaching users remotely or on-site troubleshooting.



Customizable features

Instrument Handling

The SmartClass TPS makes transferring results and test configuration files easy using a USB memory device or directly accessing the file manager on the test instrument through the embedded FTP server. Result files are available in .pdf, .csv, and .html file formats.

Technicians can also easily add new features and functions to units while in the field using a USB or FTP.

Specifications

Configurations

ADSL1/2/2+ and VDSL2
ADSL1/2/2+ and VDSL2
Copper/POTS Dialer – ADSL1/2/2+ and VDSL2
Copper/POTS Dialer – ADSL1/2/2+ and VDSL2

DSL Modem

Test Interface
ADSL2+/VDSL2, RJ45

Modem Chipset
Broadcom 6368

VDSL Standard Compliance
ITU-T- G.993.2 VDSL2 Annex A, B
Profiles: 8a/8b/8c/8d, 12a/12b, 17a
Band Plan 997 and 998, U0 Band

ADSL Standard Compliance
ITU-T G.992.1 Annex A (G.DMT)
ITU-T G.992.3 Annex A, L (ADSL2)
ITU-T G.992.5 Annex A, M (ADSL2+)
ANSI T1.413-1998, Issue 2
ITU-T G.992.5 INP Amendment 3

General Settings and Features
Auto Sync
Auto or Manual Framing mode
PTM mode for ADSL2+ and VDSL2
ATM mode for ADSL2+ and VDSL2
Dual latency path support in VDSL2

Modem Summary Results
Modem state
Actual and maximum attainable bit rate (payload), capacity
SNR margin
Attenuation

DSL Errors
CRC (cyclic redundancy check)
FEC (forward error correction)
LOS (loss of sync)
LOF (loss of frame)

DSL Signal
Sync counter
TX power
Trained path
Vendor code
Vendor revision

Graphical Results
BPT (bits-per-tone)
SNR (SNR-per-tone)
Hlog
QLN (quiet line noise)

Data Mode Selection
PTM, ATM, Auto

ATM Results
Cell count user (RX/TX), OAM (RX/TX), Bad (RX), Dropped (RX)
HEC, OCD, LCD Errors

Network

Data Modes
Bridged Ethernet
IPoE
IPoA
PPPoE
PPPoA

MAC Setting
Factory default, user-defined

IP
WAN/LAN status
Gateway/DNS
Static or DHCP
DHCP server on LAN
DHCP user class
DHCP vendor class
IP release/renew
DNS support WAN and LAN

WAN/LAN Results
IP address, Net mask, Gateway, DNS, MAC address

PPP/IP Connectivity
BRAS: PAP/CHAP
IPCP
NAT
PPPoA, PPPoE, IPoA, IPoE, Bridged
RFCs 2364, 2516, 1483, 2684

10/100 Ethernet TE

Test Interface
10/100 Ethernet, RJ45

Data Modes
IPoE, PPPoE, Data Off

MAC Setting
Factory default, user-defined

IP Setup
LAN status
Gateway/DNS
Static or DHCP
DHCP user class
DHCP vendor class
IP release/renew
DNS support

LAN Results
IP address, Net mask, Gateway, DNS, MAC address

VLAN (on Ethernet 10/100)
Tag on/off
VLAN interface count 1, 2, 3
ID selection 0 – 4095
Priority selection 0 – 7

Ethernet Results
Link status, RX/TX bytes, RX/TX frames, RX/TX errors

IP Data

Test Interface
10/100 Ethernet, RJ45
ADSL2+/VDSL2, RJ45

Ping and UDP Statistics
Echoes sent/received, Ping delay (cur/ave/max/min), Lost count/percentage, packet size
Supports IP address or DNS name destination

Traceroute ICMP and UDP Statistics
Hop count, name lookup, and IP address of hops
Supports IP address and DNS address destination

File Transfer Throughput Test

Transfer protocol	FTP, HTTP
Transfer direction	download, upload
HTTP authentication type	none, basic, digist
Save downloaded file	yes, no
Concurrent download	disabled, 1, 2, 3
Auto repeat	disabled, enabled

Results on status, byte transferred, total transfer rate, total transfer time, pretransfer time, start transfer time, nake lookup time, connection time, redirection count, HTTP code, header size, request size

Additional IP Data Test Software Option

Web connectivity through browser
Proxy server

Specifications *Cont'd.*

VoIP

Test Interface
10/100 Ethernet, RJ45
ADSL2+/VDSL2, RJ45

Supported Signaling Protocols
H.323 ITU-T H.323 version 3 fast connect
H.323 ITU-T H.323 version 3 full connect
SIP RFS 3621
MGCP

Supported Codec Configuration
ITU-T G.711 u-law/A-law (PCM/64 kbps)
ITU-T G.722 64K
ITU-T G.723.1 (ACELP/5.3, 6.3 kbps)
ITU-T G.726 (ADPCM/32 kbps)
ITU-T G.729a (GS-ACELP/8 kbps)
User-selectable silence suppression, jitter buffer
User-selectable transmit source (live voice conversation, tone transmit, IP voice announcement)
DTMF in-band

General VoIP Settings
User-selectable calling alias
User-selectable or default MAC address
STUN Server

Gateway Settings
User-selectable static or no gatekeeper direct connect mode
Supports inbound and outbound calls, with or without gatekeeper support

Reported Results – VoIP
Call Stats
Full incoming call statistics, including IP address, far-end alias, far-end name, RTCP availability/ports, codec and rate, call signaling support, silence suppression enabled, and call duration
Throughput Audio
Sent/received in bytes and packets, out-of-sequence packets, remote packets
Audio Delay
Network, encoding, packetization, buffering, and total delay
Local QoS
Audio packets lost
Audio overall QoS current/Min/Max/QoS
Voice Stream
Packet delay, packet jitter, packet loss, overall QoS

Additional VoIP Software Options

MOS Software Option (requires VoIP)
Audio Quality

Call quality R-Factor	Current/Min/Max/Average
Line quality R-Factor	Current/Min/Max/Average
R-Factor G.107	Current/Min/Max/Average
R-Factor burst	Current/Min/Max/Average
R-Factor gap	Current/Min/Max/Average
CQ MOS	Current/Min/Max/Average
LQ MOS	Current/Min/Max/Average
PQ MOS	Current/Min/Max/Average

Voice and video quality rating based on packet metrics thresholds set by user
MOS rating and R-Factor

Signaling Software Option (requires VoIP)
skinny Cisco client protocol (SCCP)

IP Video

Test Interface
10/100 Ethernet, RJ45
ADSL2+/VDSL2, RJ45

Modes
Terminate, Monitor

Set Top Box Emulation
IGMPv2 and v3 emulation client
IGMP message status/decode status/error message
RTSP emulation client

Service Selection
Broadcast auto
Broadcast MPEG2-TS/UDP
Broadcast MPEG2-TS/RTP/UDP
Broadcast RTP/UDP
Broadcast rolling stream
Broadcast TTS/UDP
Broadcast TTS/RTP/UDP
RTSP MPEG2-TS/(RTP)/UDP
RTSP MPEG2-TS/(RTP)/TCP
RTSP RTP/UDP
RTSP RTP/TCP

Video Source Address Selection
IP address and port number
IP address, port number, and VoD URL extension
RTSP port select
RTSP vendor select

Video Analysis is Per Video Stream
Simultaneous Stream Support
3 terminate, 3 monitor

Packet Loss Statistics

Loss QoS	Threshold Selection, Current/History
Continuity errors	Count
Continuity errors	Current/Max Count %
RTP packets lost	Count
RTP packets lost	Current/Max Count %
RTP loss distance errors	Current/Max/Total
RTP loss period errors	Current/Max/Total
Minimum RTP loss distance	
Maximum RTP loss period	
Total RTP OOS	Count
Total RTP headers errors	Count

Packet Jitter Statistics

Jitter QoS	Threshold Selection, Current/History
PCR jitter	Current/Average/Max
RTP jitter	Current/Max
MDI delay factor	Current/Average/Max
MDI buffer size	Current/Average/Max

Latency Results

Latency	Threshold Selection, Current/History
IGMP latency	ms
RTSP latency	ms
Maximum latency	ms

Video Stream Data Results

Total	Current/Min/Max/Average
IP	Current/Min/Max/Average
Video	Current/Min/Max/Average
Audio	Current/Min/Max/Average
Data	Current/Min/Max/Average
Unknown	Current/Min/Max/Average

Stream Quality
Error indicator QoS

Error indicator	Count
Sync errors	Count
PAT errors	Count
PMT errors	Count
PID timeouts	Count

Service name
Program name

PID Analysis (each stream)
PID number
PID type (video, audio, data, unknown)
PID description

Signaling Protocol Message Decode
IGMP messages
RTSP messages

Standards
RFS 2236, IGMP
RFC 2326, RTSP
ISO (IEC 13818), video transport stream and analysis
ETSI TR 10-290 V2.1, video measurements
TFC 1483; 2684, ATM AAL5
RFC 2364, PPPoAAL5

Layer Correlation
Combined result view for DSL LOS, DN (downstream) CRC, DN FEC, Ethernet RX errors, RX dropped, video continuity error, video RTP lost, video loss distance total, video loss period total

Specifications *Cont'd.*

Additional IP Video Software Options

VMOS Software option (requires IP video)	
Video Relative MOS	PID/Class
Video Absolute MOS	PID/Class
Audio MOS	PID/Class
AV MOS	PID/Class

Fiber Test

Optical Power Meter

USB optical power meter	MP-60
Min/Max/Average optical power level	dBm, mW
Selectable pass/fail threshold	
Reference value	

Copper Test

Test	*Range*	*Resolution*	*Accuracy*
AC Volts	0 – 300 Peak	1 V	2% ±1 V
DC Volts	0 – 300	1 V	2% ±1 V
	(VDC + Peak AC)		
Resistance			
	0 – 999 Ω	1	2% ±2.5 Ω
	1 – 9.99 kΩ	10	2% ±2.5 Ω
	10 – 99.9 kΩ	100	2% ±2.5 Ω
	100 – 999 kΩ	1 k	2% ±2.5 Ω
	1 – 9.9 MΩ	10 k	6.5% ±2.5 Ω
	10 – 100 MΩ	100 k	6.5% ±2.5 Ω
Leakage			
	0 – 999 Ω	1	2% ±2.5 Ω
	1 – 9.99 kΩ	10	2% ±2.5 Ω
	10 – 99.9 kΩ	100	2% ±2.5 Ω
	100 – 999 kΩ	1 k	2% ±2.5 Ω
	1 – 9.9 MΩ	10 k	6.5% ±2.5 Ω
	10 – 100 MΩ	100 k	6.5% ±2.5 Ω
Distance to Short			
	0 – 30 k ft/10 km	1 ft/1 m	
Capacitance/Opens			
	0 – 2,999 ft/999 m	1 ft/0.1 m	2.5% ±45 pF
	0 – 44.9 nF		
	3 k ft/1 km – 66 k ft/20 km	1 ft/0.1 m	2.5% ±45 pF
	45 nF – 1.04 µF		
DC Current			
	1 – 110 mA	1 mA	±2% ±1 mA
Longitudinal Balance			
	35 – 70 dB	1 dB	2 dB
	35 – 120 dB		

Good Ground Check to verify Longitudinal Balance results

Load Coil Counter

0 – 27 k ft/8230 m	up to 5	±1

POTS Dialer

DTMF or Pulse Dial mode

General

Power Supply

Battery	Li-Ion internal rechargeable, field replaceable 4400 mAh
Operating time	greater than 4 hours
Auto power down (adjustable)	
Charging time	approx. 6 hours
AC line operation	via external adapter/car charger

Connector

DSL	8-pin modular (RJ45)
Ethernet	8-pin modular (RJ45)
T/A, R/B, Ground	2 mm recessed banana
POTS	8-pin modular (RJ45)
USB	USB 2.0
Headset	s/b 2.5 mm audio jack

Connectivity

USB flash drive
Remote access through FTP
Remote operation

Permissible Ambient Temperature

Nominal range of use	±0 to +40°C (±32 to 122°F)
Storage and transport	–30 to +60°C (–22 to 140°F)

Humidity

Operating humidity	10 to 90%

Physical

Size (H x W x D)	230 x 120 x 70 mm (9.05 x 4.72 x 2.75 in)
Weight, including batteries	<1.1 kg (2.5 lb)
Display	320 x 240 LCD color
CE marked	

11

Ordering Information

Available Packages

The SmartClass TPS can be ordered in full configuration for high-end triple-play test demands, or it can be scaled down for specific needs and applications.
All packages include IP data support for FTP/HTTP throughput, traceroute, and IP ping test. The unit is delivered standard in a carrying case with test leads.

		Software Options Included				
Order No.	***Description***	***Web***	***VoIP***	***MOS***	***IP Video***	***VMOS***
ADSL2+/VDSL2						
SCTP-V-P1	SmartClass TPS VDSL Silver package					
SCTP-V-P3	SmartClass TPS Web Silver package	X				
Copper, ADSL2+/VDSL2						
SCTPC-V-P1	SmartClass TPS VDSL Gold package					
SCTPC-V-P3	SmartClass TPS Web Gold package	X				
SCTPC-V-P8	SmartClass TPS Web and Video Gold package	X			X	X
SCTPC-V-P11	SmartClass Triple-Play Gold package	X	X	X	X	X

Software Options*

SCTP-WEB	Web Browser option
SCTP-VOIP	VoIP option includes SIP, H.323, and MGCP signaling
SCTP-SCCP	SCCP Signaling option (requires VoIP option)
SCTP-MOS	MOS option for VoIP (requires VoIP option)
SCTP-IPVIDEO	IP Video option
SCTP-VMOS	VMOS option for IPTV (requires IP Video option)

** Software options are factory installed with day of initial delivery or are field upgradeable on installed units.*

Test & Measurement Regional Sales

NORTH AMERICA
TEL: 1 866 228 3762
FAX: +1 301 353 9216

LATIN AMERICA
TEL: +1 954 688 5660
FAX: +1 954 345 4668

ASIA PACIFIC
TEL: +852 2892 0990
FAX: +852 2892 0770

EMEA
TEL: +49 7121 86 2222
FAX: +49 7121 86 1222

WEBSITE: www.jdsu.com/test

 30168392 002 1011 SMCLASSTPSVDSL.DS.TFS.TM.AE October 2011