SmartClass™ Triple-Play Services (TPS)

Key Features

- All-in-one tool for broadband services installation, including Copper, POTS, ADSL1/2/2+, IP Data, VoIP, and IP Video testing
- Triple-Play Services testing with QoS/QoE Pass/Fail
- Advanced IP Video analysis, including multiple HDTV streams
- VoIP Phone Emulation using SIP, H.323 signaling protocols, G.711 and G.722 call controls, and others
- Web browser
- Fast and easy CableCheck Copper test with Pass/Fail
- Customizable user interface for optimized test methods and procedures
- Easy file transfer with USB Host 2.0 interface

Applications

- Tests IP Video quality in STB Emulation and Monitor/Through Mode for Broadcast and VoD streams, including VMOS and MDI-MLR
- 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
- POTS dialer
- Tests Triple-Play Services over ADSL2+ or Ethernet 10/100 interface

The JDSU SmartClass Triple Play Services (TPS) Tester is the ideal tool for technicians who install, troubleshoot, and maintain Triple-Play services. The tester lets technicians test copper loop quality, verify asynchronous digital subscriber line (ADSL) signal and performance, and validate customer Internet connections with the integrated Web browser and File Transfer Throughput test. Software options are available for voice over Internet Protocol (VoIP) and IP Video that allow for detailed analysis of Quality of Service (QoS) and Quality of Experience (QoE).

The SmartClass TPS gives field technicians easy access for instrument management, field upgrades of software options, and uploading pre-set configurations or downloading results using a universal serial bus (USB) flash drive. The SmartClass TPS is an intuitive, full range Triple-Play Services tester that is scalable for mass market deployments and future requirements.

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).

The SmartClass TPS IP Video application allows for termination of the IP Video stream anywhere in the Access network using the digital subscriber line (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.

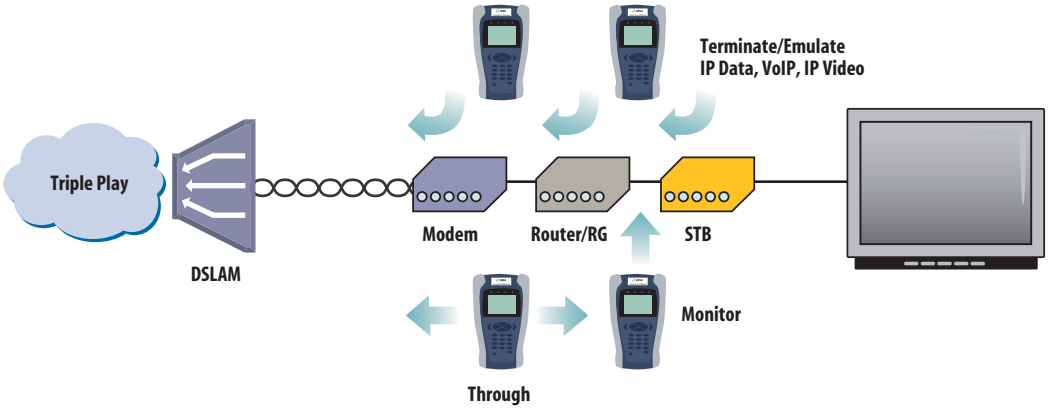

Figure 1 Operate the SmartClass TPS in Through/Monitor Mode and Emulation Mode

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

IP Video Test	What it Tests	Why it is Needed
IPTV Provisioning	Checks for the availability of all channels	IPTV channels may arrive from different video headends and a specific channel may be provisioned incorrectly.
Channel Change	IGMP Latency, RTSP Latency	Channel change time is a critical factor in QoE.
Stream Rates	IPTV stream rates	Bandwidth utilization for IP Video on SDTV and HDTV streams and impact on other services such as IP Data ad VoIP.
IPTV Video, Audio, Data Components	Sub-stream rates, PID, PMT, and PAT errors	Verifies stream components such as delivery of video, audio, and text.
QoS and QoE Pass/Fail	QoS including PCR jitter, IGMP/RTSP Latency, Continuity Error, Error Indicator, and QoE, including MDI-MLR, RTP Loss Distance/Period, and VMOS	Packet loss traditionally creates pixelization and other image disturbances. Second-generation IPTV systems can tolerate packet loss; however, it remains difficult to determine an acceptable level before declaring a massive service failure.

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 termination equipment (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).

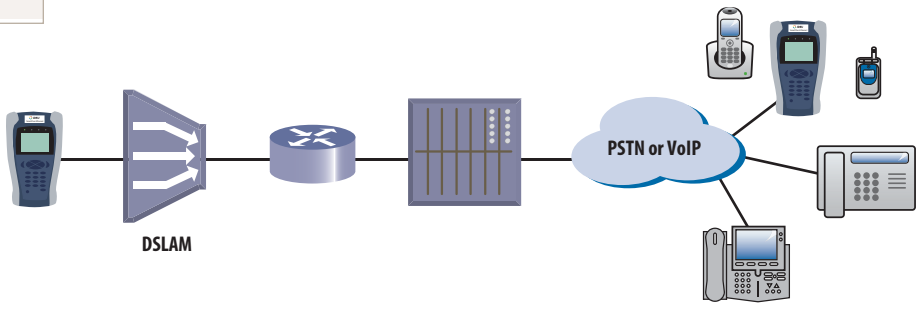

Figure 2 The SmartClass TPS tests VoIP throughout the IP Network Registration with gateway, test calls on and off the network, and measures near- and far-end IP QoS and MOS

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 Throughput application screen

IP Ping screen

IP Data Test

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.

ADSL1/2/2+

Technicians commonly run DSL synchronization tests at every dispatch, making the SmartClass TPS a useful tool that supports DSL tests up to ADSL2+, including G.992.5 INP Amendment 1 and Annex M. It provides a bits-per-tone graph that is key toward identifying disturbers and profile utilization.

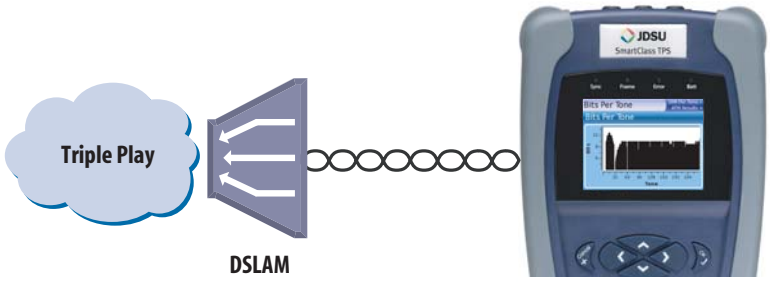

Figure 4 ADSL1/2/2+ key performance indicators and a large bits-per-tone graph

Typical ADSL1/2/2+ tests that today's field technicians require include:

ADSL Test	What it Tests	Why it is Needed
ADSL1/2/2+ 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, HEC, 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.
Asynchronous Transfer Mode (ATM)	ATM Operation, Administration, and Maintenance (OAM) F4 and F5	Checks Virtual Path Identifier/Virtual Channel Identifier (VPI/VCI) provisioning.

Copper Circuit Verification

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.

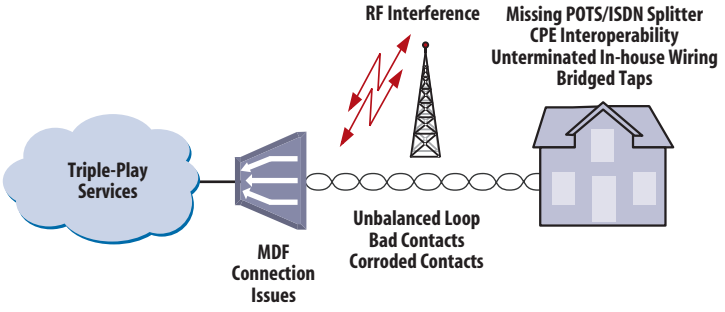

Figure 3 The SmartClass TPS makes Copper testing easy. Using the SmartClass TPS CableCheck script automates copper qualification via single-ended line test (SELT) and provides a Pass/Fail result.

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

Utility screen

Customizable features

Navigating the SmartClass TPS

The SmartClass TPS adopts a new navigation concept. The user interface offers a wide range of personalization features that allow for customization according to job task and preferences (users can increase/decrease font size, move menu items up/down, hide or highlight specific menu selections, and change language options).

Instrument Handling

The SmartClass TPS makes it easy to transfer results and test configuration files using a USB memory device. Add new features and functions to units in the field simply through the use of a USB.

8

Specifications

Configurations

ADSL1/2/2+ Annex A
ADSL1/2/2+ Annex B
Copper/POTS Dialer – ADSL1/2/2+ Annex A
Copper/POTS Dialer – ADSL1/2/2+ Annex B

ADSL Modem

Test Interface
ADSL2+, RJ11
Modem Chipset
Infineon AR7 7200
Standard Compliance
ADSL over POTS Modem (Annex A)
ANSI T1.413-1998, Issue 2
ITU-T G.992.1 Annex A (G.DMT)
ITU-T G.992.2 Annex A (G.lite)
ITU-T G.992.3 Annex A, L (ADSL2)
ITU-T G.992.5 Annex A, M (ADSL2+)
ITU-T G.992.5 Annex L (RE-ADSL)
ITU-T G.992.5 INP Amendment 1
Standard Compliance
ADSL over ISDN Modem (Annex B)
ITU-T G.992.1 Annex B (G.DMT)
ITU-T G.992.2 Annex B (G.lite)
ITU-T G.992.3 Annex B (ADSL2)
ITU-T G.992.5 Annex B (ADSL2+)
ITU-T G.992.5 INP Amendment 1
General Settings
Auto Sync
Auto or manual framing mode
Encapsulation LLC-Snap or VC-MUX
Physical Layer Feature Support
Actual and maximum bit rate capacity
Noise margin
Attenuation
Modern state
TX power
Far vendor ID, revision
Graphical display of BPT (bits-per-tone)
Re-sync counter
Graphical display of SNR (SNR-per-tone)
Fast or interleaved

ADSL Errors
LOS (Loss of Sync)
LOF (Loss of Frame)
LOP (Loss of Power)
CRC (cyclic redundancy check)
HEC (header error correction)
FEC (forward error correction)
ATM
OAM F4/F5 near and far loopbacks
ATM Statistics
ATM OAM F4/F5 near and far loopback count
UP/DN good and idle cell count
Bad HEC cell count
Dropped cell count
TX/RX PDUs
TX/RX AAL5 bytes
TX/RX total error count
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
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
ADSL1/2/2+ modem, RJ11
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
FTP/HTTP Throughput
Setup Transfer Direction Upload or Download, specify port number, URL, FTP or HTTP, File Size in Bytes, Upload Pattern Random or AA55
Results Connection Status, Bytes TX, Transfer Rate in kb/s or Mb/s, Total Transfer Time, Pre-Transfer Time, Start Transfer Time, Name Lookup Time, Connection Time, Redirection Count, HTTP Code, Header Size, Request Size

VoIP

Test Interface
10/100 Ethernet, RJ45
ADSL1/2/2+ modem, RJ11

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 kb/s)
ITU-T G.722 64K
ITU-T G.723.1 (ACELP/5.3, 6.3 kb/s)
ITU-T G.726 (ADPCM/32 kb/s)
ITU-T G.729a (GS-ACELP/8 kb/s)
User-selectable silence suppression, jitter buffer
User-selectable transmit source (live voice conversation, tone transmit, IP Voice announcement)
DTMF in-band

LAN Settings
User-selectable calling alias
User-selectable IP address, static, or DHCP
User-selectable subnet mask, gateway, and DNS server
User-selectable or default MAC address
VLAN configurable – IEEE.802.1p/q
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
ADSL1/2/2+ modem, RJ11

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 MPEG2-TS/UDP
Broadcast MPEG2-TS/RTP/UDP
Broadcast RTP/UDP
Broadcast Rolling Stream
TSP MPEG2-TS/(RTP)/UDP
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
MDI Lost	Current/Average/Max
MDI MLR	Current/Average/Max

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

Additional IP Video Software Options

VMOS Software Option (requires IP Video)

Video MOS	PID/Class
R-Factor	PID/Class

Copper Test

Test	*Range*	*Resolution*	*Accuracy*
AC Volts	0 – 300 Peak	1 V	2% ±1 V
DC Volts	0 – 300 (VDC + Peak AC)	1 V	2% ±1 V
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 µ		
DC Current			
	1 – 110 mA	1 mA	±2% ±1 mA
Longitudinal Balance			
	35 – 70 dB	1 dB	2 dB
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 Specifications

DSL	6-pin modular (RJ11)
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

Permissible Ambient Temperature

Nominal range of use	±0 to +50°C (±32 to 122°F)
Storage and transport	–30 to +60°C (–22 to 140°F)

Humidity

Operating humidity	10 to 90%

Physical Specifications

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 display

CE Marked

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 #	*Description*	*Web*	*VoIP*	*MOS*	*IP Video*	*VMOS*
ADSL2+ Annex A						
SCTP-A-P8	SmartClass Triple-Play Silver Package (A)	X	X	X	X	
SCTP-A-P15	SmartClass TPS Web and Video Best Value Package (A)	X			X	
SCTP-A-P19	SmartClass TPS Web and VoIP Silver Package (A)	X	X	X		
Copper, ADSL2+ Annex A						
SCTPC-A-P9	SmartClass Triple-Play Complete Package (A)	X	X	X	X	X
SCTPC-A-P16	SmartClass TPS Web and Video Gold Package (A)	X			X	X
ADSL2+ Annex B						
SCTP-B-P8	SmartClass Triple-Play Silver Package (B)	X	X	X	X	
SCTP-B-P15	SmartClass TPS Web and Video Best Value Package (B)	X			X	
SCTP-B-P19	SmartClass TPS Web and VoIP Silver Package (B)	X	X	X		
Copper, ADSL2+ Annex B						
SCTPC-B-P9	SmartClass Triple-Play Complete Package (B)	X	X	X	X	X
SCTP-B-P16	SmartClass TPS Web and Video Gold Package (B)	X			X	X

Software Options

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

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)

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