

## SmartClass™ Home v3 Inside Wiring and Networks Service Meter



### Key Benefits

- Reduce OpEx by decreasing the time that it takes to install and maintain video services
- Reduce CapEx by combining all necessary tests into one complete, easy-to-use, battery-operated, field optimized test set that can test in the field, at the NID, and in the Home
- Avoid the complexity of copper testing with one-button Pass/Fail CableCheck functionality that includes balance testing and good ground capabilities
- Improve efficiency by saving all test results for further analysis and storage

### Applications

- Synch up over ADSL through VDSL2 to verify that rates are adequate to provide desired services over single or bonded pairs
- Qualify existing copper pairs for xDSL service
- Verify residential, MDU, and SMB internal wiring using coax cable identification through splitters and other coax network elements as well as Noise Immunity test that measures coax shield isolation
- Validate and troubleshoot live HPNA mode B networks
- Perform accurate tests to locate and troubleshoot disruptions for internal network data, voice, and video service over coax, Cat3/Cat5/Cat5e/Cat6 cables
- Verify Ethernet, POTS, and 802.11b/g wireless functionality to ensure trouble-free services

The SmartClass Home v3 handheld service meter enables verification of high-speed digital subscriber line (ADSL-VDSL2) and Home Phoneline Networking Alliance (HPNA) networks as well as the internal wiring at the customer premises for proper operation of voice, video, and data services. Use the SmartClass Home to test xDSL to the side of the premises, HPNA inside the premises, as well as the coax and twisted pair wiring inside of the subscriber's location. The SmartClass Home provides an easy-to-use, accurate, and economical measurement tool for service technicians who install or troubleshoot triple-play services over existing or new networks.

The SmartClass Home includes a unique set of features to completely qualify the subscriber's premises for triple-play services that use xDSL and HPNA technologies as well as the physical media to deliver communication signals throughout the site. Technicians can use the Coax Map feature and the Noise Immunity Test to assess quality and to troubleshoot issues in a coax network. The Active ID can delineate multiple runs of coax in the building even through coaxial splitters. They can use the integrated wiring tools to qualify twisted pairs, including Cat3, Cat5, Cat5e, and Cat6 cables. The SmartClass Home saves time and effort in verifying and troubleshooting inside wiring problems before subscribers notice them.

The SmartClass Home also includes a unique feature set for testing Ethernet data networks in residential and small-to-medium-sized business (SMB) locations. The built-in 802.11b/g wireless feature ensures correct WiFi functionality in and around subscriber locations. Additional features include a fully functional built-in butt-set that can test POTS voice delivery along with wiring identification and toning to locate and identify cables. Combined with an easy-to-use menu structure, the features of the SmartClass Home represent the best all-in-one service and wiring tester available.

**VDSL (Single Pair)** Pass 87%

Pair1: **Showtime** Sync: 23 UpTime: 6

Results	Up	Down
Actual Line Rate (K)	7767	82374
Max Line Rate (K)	7767	85437
Capacity (%)	100	96
Noise Margin (dB)	6.0	9.9
Attenuation (dB)	0.9	0.0
Est. Length (Kft)	--	0.0

SAVE ERRORS ABORT

VDSL synch rates help the user determine if service can be maintained properly at the subscriber's location

**VDSL (Pairs)** Pass 84%

Pair1: **Showtime** Sync: 36 UpTime: 41  
 Pair2: **Showtime** Sync: 48 UpTime: 26

Results	Up	Down
Actual Line Rate (K)	15089	100000
Max Line Rate (K)	15197	158920
Capacity (%)	99	62
Lapse Time (sec)	15	

SAVE ERRORS Pair1&2 ABORT

Bonded test results can be viewed as an aggregate or individually

**HPNA** Pass 84%

**Network Test**

Segment ID → ID	Rate, Mod Mbps	PER	SNR (dB)	Rx pwr (dBm)
3 → 2	128, 16/8	0.00e+00	44.02	-16.96
3 → 1	96, 16/6	0.00e+00	36.76	-33.18
2 → 3	128, 16/8	0.00e+00	42.38	-4.81
2 → 1	112, 16/7	0.00e+00	41.21	-3.40
1 → 3	112, 16/7	0.00e+00	38.34	-21.42
1 → 2	112, 16/7	0.00e+00	44.26	-4.37

SAVE REFRESH STATS

HPNA testing lets users test network metrics between HPNA nodes to verify or troubleshoot HPNA networks

### xDSL Testing

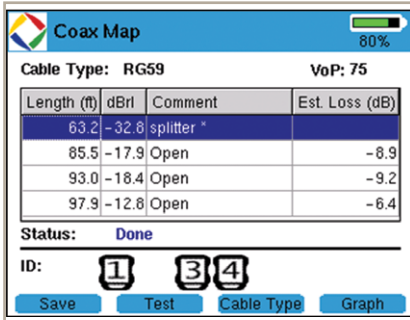
The SmartClass Home has a built-in ADSL through VDSL2 modem that supports single or bonded pairs, similar to the one built into the subscriber's residential gateway or xDSL modem, allowing it to synch up with the local Digital Subscriber Line Access Multiplexer (DSLAM) and establish the best attainable communication rates. Determining what the subscriber's drop can accommodate is critical, because various disturbers can be present on it. The xDSL synch test conducted with the SmartClass Home v3 can perform measurements of the subscriber's connection and display rates. Also, while maintaining an xDSL synch, the SmartClass Home will show whether xDSL errors have occurred on the line since testing began. These results let technicians best determine if the subscriber's network path can carry bandwidth-intensive services such as video, voice, and data, over the xDSL connection or if they must perform additional troubleshooting.

### HPNA Network Testing

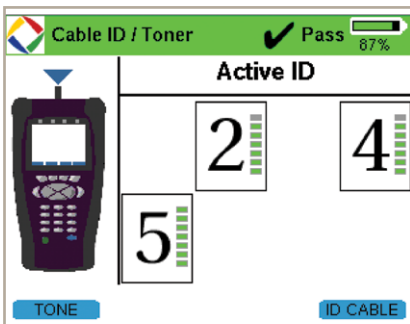
HPNA, a technology standard developed by the HomePNA™ Alliance, builds on Ethernet and allows all the components of a home network to connect and integrate over an unpredictable wiring topology. The HPNA communication is used to pass information around a home to other HPNA-connected devices. In HPNA mode, the SmartClass Home connects to and communicates with other HPNA-capable devices, or nodes, operating in spectral mode B on the same network.

Establishing itself as a network node on a live HPNA network enables the SmartClass Home to test each of the various nodes on the network. SmartClass Home allows users to segment problem node paths, node-to-node communication issues, or to verify correct functionality of the whole network. The SmartClass Home lets users verify that HPNA networks are operating within expected service quality metrics and set up Pass/Fail limits to help simplify testing.

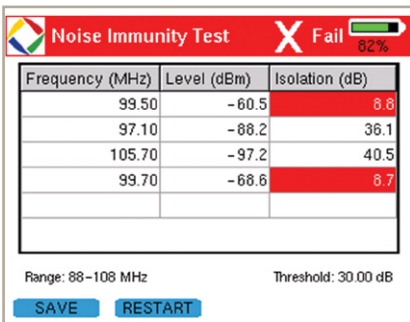
## 3



The Coax Map test lets technicians locate and trouble-shoot problematic segments of coaxial cable



Cable ID mode with Active IDs enables technicians to identify connections for each segment of coaxial cable



The NIT helps users locate isolation issues in coax cable to identify which legs contain faults that could allow ingress into the coax network

### Coaxial Cable Testing

Coax is gaining popularity as the medium of choice for transferring communications in and around customer premises. Whether the technology is broadcast or IP video, data over coax technologies, or whole-home digital video recorder (DVR) services, the SmartClass Home can ensure proper connection of the inside coaxial plant. The SmartClass Home also helps technicians detect and eliminate unwanted coaxial elements such as hidden splitters, bad barrels, and damaged cables.

#### Coax Map

The Coax Map feature of the SmartClass Home is a single-ended coax physical layer test based on frequency domain reflectometry (FDR), a powerful technique used in analyzing RF transmission lines. The Coax Map test measures signal quality as it passes through the transmission line by identifying impairments that cause standing waves.

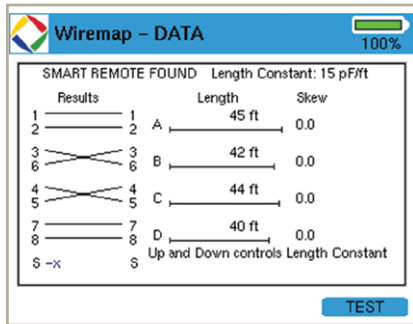
#### Coax Active Identification

The SmartClass Home helps technicians quickly identify which cable goes to which room in a house. Using the Cable ID mode, technicians can determine coax wire endings for each room with a coax run. A common problem occurs when an unexpected splitter exists in the middle of the coax run. However, the Active IDs of the SmartClass Home work through splitters to display multiple IDs, which helps to locate the wall outlet or outlets that are connected via a splitter network.

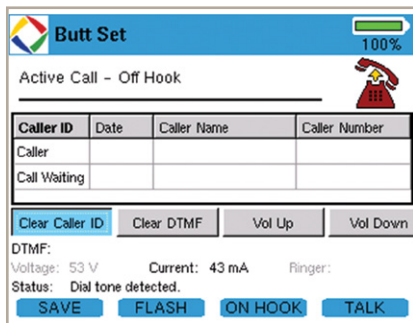
#### Noise Immunity Test

The Noise Immunity Test (NIT) provides good indications of coaxial cable shielding issues. Problems arise when the inside coax has staples, sheared jacketing, an exposed stinger, or an unterminated end present. The NIT increases a technician's chance of catching impairments before subscribers experience service degradation. The NIT measures the signal strength of local FM carriers and compares it to the same measurement on the cable to determine the isolation of the coax to off-air ingress.

## 4



Twisted Pair Wire Map helps technicians find impairments and incorrect wiring in phone and Ethernet cables



The built-in butt-set lets technicians verify and troubleshoot POTS voice issues

### Twisted Pair Testing

The SmartClass Home provides a suite of twisted pair measurements to ensure the correct connections and wiring of POTS and Ethernet cables.

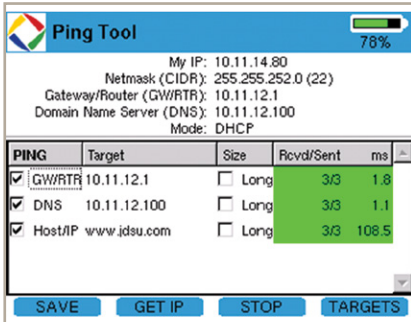
### Twisted Pair Wire Mapping

The Twisted Pair Wire Map provides details about the cable length, distance to opens and shorts, skew, and the connection mapping of each wire when used with the SmartRemote. This information lets technicians quickly locate improper wire connections and the presence of physical layer issues. The SmartClass Home can map different types of twisted pair cables such as Cat5/5e/6 Ethernet and straight or Cat3 phone wiring.

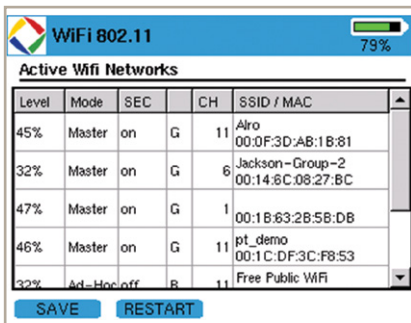
### Butt-Set

The SmartClass Home has a built-in butt-set with speaker phone that helps technicians quickly verify voice communications and troubleshoot POTS issues. The results indicate voltage and current on the line as well as the number dialed and the status of the POTS line. Technicians can store a list of frequently called numbers for easy dialing. The butt-set provides call waiting and displays the caller ID for incoming calls. The speaker phone lets technicians listen for dial tone or voice and talk during calls without a separate headset.

## 5



Ping mode lets technicians verify connectivity around and outside the customer premises



Wireless 802.11b/g test lets users verify that the subscriber's wireless network will work at a particular location or troubleshoot wireless 802.11b/g connectivity issues

## Ethernet

The SmartClass Home includes a suite of Ethernet connectivity tests to help users quickly identify connectivity issues on customer premises equipment (CPE) connected to the network.

### Port Discovery

The Port Discovery test displays the established link rate on the Ethernet connection between the SmartClass Home and a router. It also displays the available rates and the signal-to-noise ratios (SNRs) of each active twisted pair. This information helps technicians pinpoint connection issues between the CPE devices and the premises router.

### Ping

Ping tests let technicians verify network connectivity to a particular Internet Protocol (IP) or Universal Resource Locator (URL) address. They can also verify that a particular location can reach either the Internet or a specific server on the network, which lets technicians avoid using customer equipment or a laptop to perform simple connectivity tests.

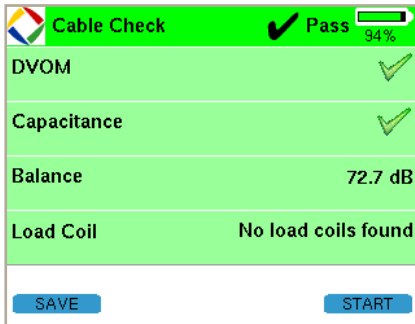
### Hub Flash

Hub Flash test is an additional Ethernet test available on the SmartClass Home intended for locations with multiple Ethernet connections running to a central device. The Hub Flash will cause the port light to flash on the hub/switch/router indicating that the SmartClass is connected. This simple identification method lets technicians quickly determine which port is connected to a particular run.

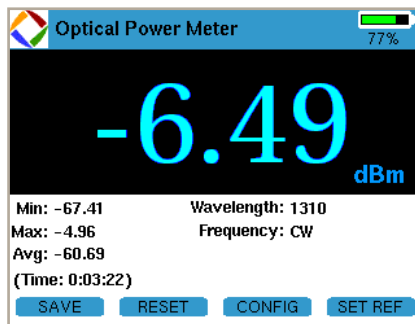
## Wireless 802.11b/g

The SmartClass Home provides optional WiFi wireless 802.11b/g testing capabilities to show the secure set identification (SSID), configured channel, 802.11 modulation, mode, and signal strength at the test location of each wireless 802.11b/g network in the area. It also indicates whether the network is secure or vulnerable to security threats. This capability lets technicians properly set up the subscriber's network and troubleshoot wireless connectivity or issues with web surfing speed.

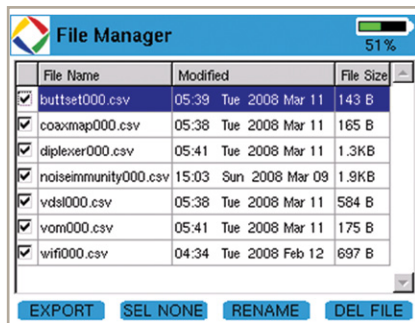
## 6



Cable check test results



The OPM ensures that fiber cable attenuation falls within pass/fail limits



File Manager is used to rename, delete, or export result files from the SmartClass unit

## Copper

The SmartClass Home 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 Triple-Play Service (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. Basic tests include digital volt-ohm meter, opens, balance, and load coil, which eliminate technicians having to carry separate tools.

## Fiber

Field technicians can use the SmartClass Home together with the JDSU MP-60 USB Optical Power Meter (OPM) for various fiber (FTTx) installations to ensure that fiber cable attenuation falls within Pass/Fail limits before connecting it to the optical network transport (ONT).

## File Manager/Job Manager

Users can save the results for almost all tests for archival and future review. The unit saves the results in the common .csv format which can be opened using various spreadsheet and other applications. Files can be exported via a common universal storage bus (USB) flash storage device. The SmartClass Home can hold thousands of result files that can be removed, renamed, and exported from the unit easily using the built-in File Manager application.

## Specifications and Features

### Available Configurations

xDSL synch, HPNA testing, Physical layer testing (coax and twisted pair), Ethernet, Butt-Set, Wireless 802.11b/g WiFi

### Physical Test Interfaces

Coax F-connector for coax mapping, NIT, and HPNA  
 RJ11 for POTS and HPNA testing  
 RJ11 for phone wiring and dry pair testing  
 RJ45 for Cat5/6 wiring and Ethernet testing  
 RJ45 for VDSL line testing  
 RJ45 for through mode VDSL testing  
 Connector LEDs for easy connector identification

### xDSL

#### Test Interface

ADSL/VDSL2

Single/Bonded

#### Modem Chipset

Broadcom 96368

#### VDSL Standard Compliance

ITU-T G.993.2VDSL2 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 A, B (G.DMT)  
 ITU-T G.992.3 A, B, L (ADSL2)  
 ITU-T G.992.5 Annex A, B, M (ADSL2+)  
 ANSI T1.413-1998, Issue 2  
 ITU-T G.992.5 INP Amendment 3

#### Physical Layer Features

Link state  
 Actual line rate  
 Maximum line rate

Capacity

Noise margin

Est. length

#### Bonded Pair Features

Actual line rate  
 Maximum line rate  
 Capacity  
 Lapse time

#### xDSL Errors (displays the number of occurrences)

Forward error correction (FEC)  
 Cyclic redundancy check (CRC)  
 Severely errored frame (SEF)  
 Loss of sight (LOS)  
 Line errors

### HPNA

#### Coppergate CG3110 Chipset

Supports only Spectral Mode B: 12-28 MHz;  
 2, 4, 8, 16 MBauds

#### Standard Compliance

ITU-T G.995.4

#### Settings

Configurable Host of Client mode  
 Configurable Band plan  
 Configurable IP settings

### General Connection Status

Link status  
 Operating mode  
 HPNA version  
 Device list including indication of test set and host  
 Device MAC identification  
**HPNA Network Results**  
 Segment specific rate, constellation, and baud  
 Segment specific packet error rate (PER)  
 Segment specific SNR  
 Segment specific receive power

### Cable ID and Toning

#### Cable ID Features

Supports coax, Cat3/Cat5/Cat6 cable  
 Test via F-connector, RJ11, or RJ45  
 Supports 8 ID devices on each interface

#### Toning Features

Sends four types of tones on all leads  
 Constant High pitch (976 Hz)  
 Constant Low pitch (651 Hz)  
 High pitch then a low pitch  
 Low pitch with a short high pitch

### Coax Mapping

#### Settings

Support any cable coax type with configurable velocity of propagation (VOP) and cable compensation

#### Features

Measures cable length in feet (up to 500 ft at  $\pm 5$  ft)  
 Measures return loss in dBrl (up to 20 dBrl at  $\pm 2$  dB)

#### Cable Events Identified

Open, splitter, low-quality splitter, barrel/splice

### Noise Immunity Test

#### Features

Measures cable shield isolation vs. settable threshold (def 30 dB)

#### Specifications

Test frequency of 88 to 108 MHz

### Active Identification

#### Features

Identifies coax cables through most coax network elements  
 Identifies multiple IDs attached to the branch of coax being tested

#### Specifications

IDs with up to 15 dB of signal loss between unit and ID

### Wiring Tool

#### General Features

Supports Cat3, Cat5/6, coax cable  
 Detects power present on cables being tested  
 Measures cable length based on capacitance setting  
 Detects opens, shorts, and crossed pairs and display wires mapping

### Dry Pair

#### General Features

Identifies resistive opens and shorts on dry twisted pair  
 Reports AC voltage presence or DC voltage presence on dry twisted pair (up to 120 VDC, 120 Vrms AC)

#### Copper Test

##### Test Range Resolution Accuracy

AC Volts 0 – 300 Peak 1 V 2%  $\pm 1$  V

DC Volts 0 – 300 1 V 2%  $\pm 1$  V

(VDC + Peak AC)

#### Resistance

0 – 999 W 1 2%  $\pm 2.5$  W

1 – 9.99 kW 10 2%  $\pm 2.5$  W

10 – 99.9 kW 100 2%  $\pm 2.5$  W

100 – 999 kW 1 k 2%  $\pm 2.5$  W

1 – 9.9 MW 10 k 6.5%  $\pm 2.5$  W

10 – 100 MW 100 k 6.5%  $\pm 2.5$  W

#### Leakage

0 – 999 W 1 2%  $\pm 2.5$  W

1 – 9.99 kW 10 2%  $\pm 2.5$  W

10 – 99.9 kW 100 2%  $\pm 2.5$  W

100 – 999 kW 1 k 2%  $\pm 2.5$  W

1 – 9.9 MW 10 k 6.5%  $\pm 2.5$  W

10 – 100 MW 100 k 6.5%  $\pm 2.5$  W

#### 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%  $\pm 45$  pF

0 – 44.9 nF

3 k ft/1 km – 66 k ft/20 km 1 ft/0.1 m 2.5%  $\pm 45$  pF

45 nF – 1.04 m

#### DC Current

1 – 110 mA 1 mA  $\pm 2\% \pm 1$  mA

#### Longitudinal Balance

35 – 70 dB 1 dB 2 dB

Good Ground Check to verify Longitudinal Balance results

#### Load Coil Counter

0 – 27 k ft/8230 m up to 5  $\pm 1$

### WiFi

#### Features

Detects all available WiFi (802.11b/g) networks  
 Reports power level, operating mode, security setting, 802.11 version, channel, SSID, and MAC

### Ethernet Testing

#### Features

Supports 10/100 Mbps testing over RJ45 interface

#### Port Discovery

Identifies Ethernet setting on port

Displays link rate

Reports pair skew

Reports frequency offset in ppm

#### Ping Test

Supports manual or DHCP IP configuration

Reports packets sent and received

Reports average test packet delay

**Specifications and Features (Continued)**
**Butt-Set**
**North American POTS Butt-Set Only**
**Features**

Supports loop start dial tone POTS testing on twisted pair  
 Supports receiving a call  
 Supports line monitor mode with DTMF decode  
 Supports caller ID, call waiting, with caller ID errors  
 Microphone and speakerphone support  
 Measures voltage from 0 to 105 V,  $\pm 4\%$   
 Measures loop current from 14 to 108 mA  $\pm 4\%$

**General**
**Power Supply**

Field replaceable, rechargeable lithium ion battery  
 Operating time approximately 4.5 hrs continuous (typical)  
 Charging time, internal 4-5 hrs from empty to full charge  
 DC input 12 V, 1.25 A  
 100/240 V, 50/60 Hz auto-sensing AC adapter for line operation and charging

**Permissible Ambient Temperature**

Nominal range of use  $-5$  to  $+50^{\circ}\text{C}$  ( $23$  to  $+120^{\circ}\text{F}$ )  
 Storage and transport  $-30$  to  $+60^{\circ}\text{C}$  ( $-22$  to  $\pm 140^{\circ}\text{F}$ )

**Humidity**

Operating humidity 10 to 80% RHNC

**Physical Specifications**

4 in 320x240 high visibility color display  
 USB 2.0 interface for upgrades and data transfer  
 Full telephone keypad for fast access and dialing

**Ordering Information**

Model	Part Number	Description
SmartClass Home V3	SC-Home-V3	xDSL, HPNA, and inside wiring test tool for coax and twisted pair with included butt-set, WiFi, and Ethernet verification tools
SmartClass Home HPNA	SC-Home-HPNA	HPNA, and inside wiring test tool for coax and twisted pair with included butt-set, WiFi, and Ethernet verification tools

**Accessories**

Active IDs 1-8	SC-HOME-IDSET-V3 CB-5CLIP-BON	Active IDs 1-8 for identifying single or multiple coax run locations. Works through splitters. RJ-45 to telco clips (5) bonded DSL cable CB Bonded RJ to RJ bonded DSL cable
6-pin Banjo	SCHM6PINADAPTER	6-pin adapter—6-pin banjo—Breaks out POTS connection for use with alligator clips
Toning Wand	SCHMTONERTRACER	Toner Tracer wand TT100
Vehicle Charger	SCHMCARCHGR 12	VDC vehicle charger adapter

**Replacement Accessories**

	SCDVOMTELCOCLIPS	DVOM Mini Banana to telco clips
Coax Resistive IDs	SCHMCOAXRESID	Replacement coax resistive IDs 1-8 for locating single coax runs
Active IDs 1-8	SC-HOME-IDSET-V3	Active IDs 1-8 for identifying single or multiple coax run locations. Works through splitters.
Ethernet Resistive IDs	SCHMRJ45RESID	Replacement RJ45 resistive IDs 1-8 for locating single Ethernet runs
Phone Resistive IDs	SCHMRJ11RESID	Replacement RJ11 resistive IDs 1-8 for locating single POTS runs
Phone Patch Cable	SCHMRJ11 PATCH	Replacement RJ11 8-in patch cable
Ethernet Patch Cable	SCHMRJ45PATCH	Replacement RJ45 12-in patch cable
Phone to Coax Adapter	SCHMRJ11TOCOAX	Replacement RJ11-to-coax adapter cable for toning
Strand Hook	SCHMSTRANDHOOK	Replacement Stand Hook—clip to hold or hang unit
Smart Remote	SCHMSMARTREMOTE	Replacement SmartRemote—yellow RJ11 and RJ45 used to map out twisted pair connections
NIT Antenna	SCHMANTENNA	Replacement antenna for NIT calibrating off-air FM frequencies
Large Carrying Case	SC-HOME-BAG-V3	Replacement large carrying case for unit and accessories
Replacement Battery	SCHMLIONBATT4	Standard lithium ion battery for replacement or spare
Replacement Charger	SCHMCHARGER	Replacement AC charger—power supply and cable
Replacement Sleeve	SCHMSLEEVE	Replacement protective canvas sleeve to cover the unit

**Test & Measurement Regional Sales**

<b>NORTH AMERICA</b> TEL: 1 866 228 3762 FAX: +1 301 353 9216	<b>LATIN AMERICA</b> TEL: +1 954 688 5660 FAX: +1 954 345 4668	<b>ASIA PACIFIC</b> TEL: +852 2892 0990 FAX: +852 2892 0770	<b>EMEA</b> TEL: +49 7121 86 2222 FAX: +49 7121 86 1222	<a href="http://www.jdsu.com/test">www.jdsu.com/test</a>
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