

# MaxTester 635

SMARTER COPPER QUALIFICATION AND xDSL PERFORMANCE VERIFICATION



A fast, easy-to-use and cost-effective solution for installation and activation of multiplay services over copper/ADSL2+/VDSL2 and Ethernet

## KEY FEATURES AND BENEFITS

Supports single-pair and bonded ADSL2+ and VDSL2, including vectoring and G.INP, thereby enabling service providers to recover and grow wireline revenues

Data testing and Web browser for complete service qualification

Ethernet testing for qualification of FTTx services at the customer premises

IPTV and VoIP test suites for automated quality of service (QoS) testing

SmartR™ features allow users to quickly and accurately determine physical copper circuit quality and locate faults

Adherence to existing methods and procedures is easy with single-ended testing, or via testing to a far-end device (FED), including high-voltage stressed-balance testing; finish up by uploading closeout tests to the cloud

Configurable pass/fail thresholds for automated testing

Designed to face the challenges of the outside plant environment with an IEC IP54 rating

## THE MAXTESTER 600 SERIES



**MAX-610**  
Copper Test Set



**MAX-630**  
xDSL and Multiplay  
Test Set



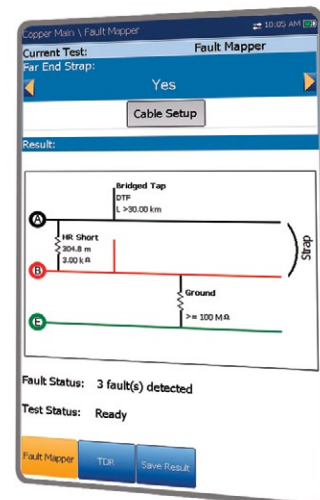
## A NEXT-GENERATION TOOL FOR BROADBAND DEPLOYMENTS

EXFO's MaxTester 635 is the perfect tool for any service provider deploying multiplay services over single-pair or bonded ADSL2+ and/or VDSL2. Its small form factor, rugged design and easy-to-use menus make it the ideal tool for installation and repair technicians. With the MaxTester 635, the testing process is highly automated and technicians close their jobs quickly and efficiently. The large display of the MaxTester 635 makes it even more user-friendly, and when it comes to saving results, it provides technicians with many connectivity options for uploading tests and compiling reports.

## WORK SMARTER WITH THE MaxTESTER 635



Equipped with SmartR™, the MaxTester 635 allows technicians to work smarter, not harder. SmartR is a suite of intelligent and automated tests that allow any technician to quickly and easily get an understanding of the condition of the line under test, as well as to identify and locate a variety of common circuit faults. The Pair Detective feature automatically runs the most common line tests and provides graphical, color-coded results and pass/fail indications to *detect* conditions, including shorts, grounds, opens, battery, splits and imbalances. FaultMapper utilizes time-domain reflectometry (TDR) and resistive fault location (RFL) technology to provide the additional capability of locating service-affecting line faults including bridged taps, shorts, grounds and opens. EXFO's unique SmartR presents results in an easy-to-understand, graphical format, with plain language feedback, making copper troubleshooting easier than ever before.

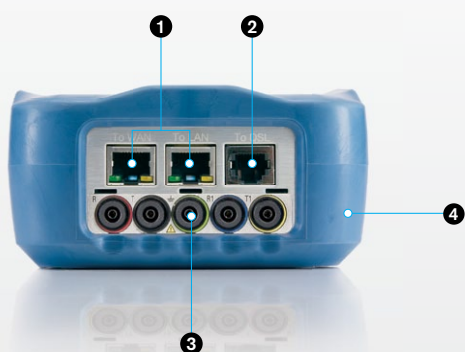


## KEY DSL APPLICATIONS

- › Ensures that the customer has the required bandwidth (downstream and upstream rates) for delivering triple-play services over single-pair or bonded ADSL2+ and VDSL2
- › Validates that the IPTV and data services can operate on the circuit with the required QoS
- › Verifies that the customer's modem/router, equipment and inside wiring are operating correctly
- › Proves data flow between the network and end equipment

## KEY COPPER APPLICATIONS

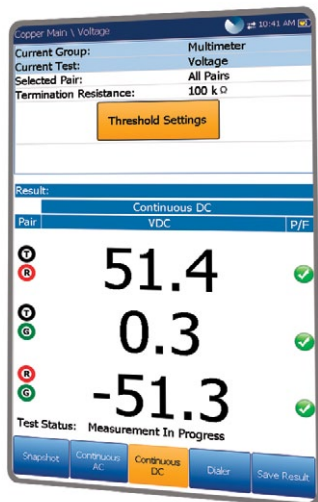
- › Detection of potential bottlenecks on subscriber loops to ensure high-quality, consistent and error-free multiplay services
- › 30 MHz spectrum analysis for circuit qualification in any VDSL2 band plan (8, 12, 17 and 30 MHz)
- › Loop and fault analysis using proven TDR and RFL techniques for VDSL2 or ADSL2+ prequalification
- › Measurement and reporting of suspect voltages, opens, shorts, and balance issues from a single end, or utilizing an FED that can be remote controlled by the MaxTester to put the necessary opens and shorts at the end of the circuit under test



- 1 Dual Ethernet connectors—sealed against the environment
- 2 DSL connector—sealed against the environment
- 3 Copper connectors
- 4 All-round rubber bumper
- 5 Large 6 inch daylight-visible color LCD
- 6 Interface connections—water and dirt protected
- 7 Innovative and icon-driven user interface
- 8 Handgrip area
- 9 Simple keypad

## SIMPLIFYING FTTx TESTING

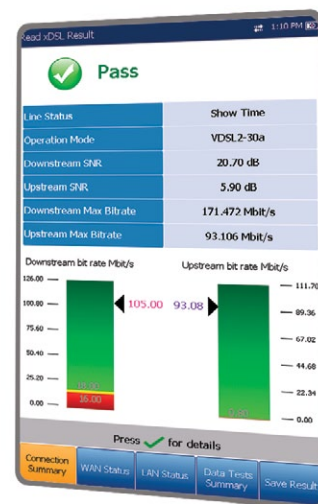
Thanks to its DSL and dual Ethernet ports, the MaxTester 635 is a flexible tool for service providers qualifying services, from the central office or remote terminals to the customer's equipment. The MaxTester 635 also provides powerful troubleshooting applications that can be used in different modes to quickly isolate faults no matter where they are located (network, outside plant, customer equipment or inside wiring). Even in hybrid networks where FTTH is also deployed, the Ethernet ports of the MaxTester 635 can be used inside the home to test at any point where a LAN connection is available.



## COMPREHENSIVE METALLIC TESTING

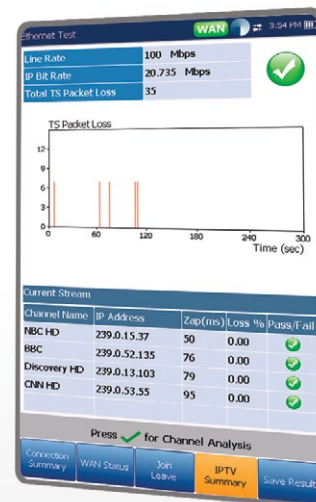
Verification of copper quality is a snap with the copper measurement capabilities of the MaxTester 635. Thanks to its industry-standard AC and DC voltage, resistance (shorts), capacitance (opens), power influence, balance and impulse noise measurements, technicians obtain results that are graphically clear and concise with pass/fail indications.

The MaxTester 635 also features a POTS dialer, an optional TDR with dual-trace comparison capability and an optional resistive fault locator (RFL) for pinpointing loop faults. The optional wideband testing suite allows the qualification of circuits at VDSL2 frequencies of up to 30 MHz and includes PSD, Near End Crosstalk (NEXT), impulse noise and attenuation analysis. Technicians have the option of running single-ended tests, or running tests against an optional FED.



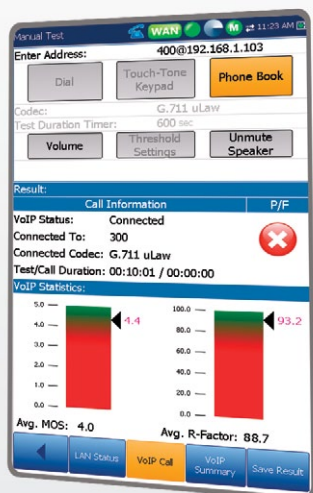
## IPTV TESTING

To boost their revenues, many service providers are using DSL to deliver new multiplay services on their existing networks. Among these services, video (IPTV) is one of the fastest growing and is getting a high level of focus and investment. Knowing that customers are very sensitive when it comes to IPTV QoS (i.e., picture quality due to packet loss, zap time, etc.), technicians must be equipped with the right test sets to quickly and efficiently turn up IPTV services and meet customers' QoS expectations. With this in mind, the MaxTester 635 offers an optional IPTV test suite to provide both expert and entry-level technicians with a simple method to check the operation and quality of the offered video channels.



## VoIP TESTING

The MaxTester provides SIP-based, voice-over-IP (VoIP) performance validation for service turn-up and troubleshooting. The VoIP function allows users to send or receive live VoIP calls to an FTB EXpert VoIP-enabled platform or IP phone. The MaxTester supports industry-recognized quality metrics (e.g., mean opinion score (MOS), R-factor) and performance metrics (e.g., latency, jitter).





## WEB BROWSER

Many telcos require that technicians use a Web browser to confirm service operation or as visual proof to show the customer. Up to now, technicians required a PC in addition to the test set to do this. Thanks to the integrated browser of the MaxTester 635, carrying a laptop to the job location is no longer necessary. The MaxTester 635 is equipped with a browser that allows the user to access websites and load a Web page as part of any automated test, directly from the test set. Just as with any other browser, it can bookmark commonly used URLs and allows the user to save new ones in real time as needed.

## ALL THE RIGHT FEATURES FOR INSTALLATION TECHNICIANS

With its small form factor, the MaxTester 635 can go anywhere the technician needs to go. It is rugged and light, and all connectors are protected from the rain—just what is needed for the demanding outside-plant environment.

### Automated service testing

Thresholds can be set and saved for key copper and DSL parameters as well as for the data and IPTV service tests. When tests are run, users are given a clear graphical pass/fail result so they can quickly move on to the next job or investigate further. Test profiles can easily be transferred between units to ensure that all technicians from the same organization are testing to the same thresholds.

### Easy-to-Use GUI

The next-generation user interface of the MaxTester 635 was designed with first-level technicians in mind. The large display features colored icons and graphics for easy configuration and operation, and is simple to use for both experienced and novice users.

### Results Capture and Connectivity

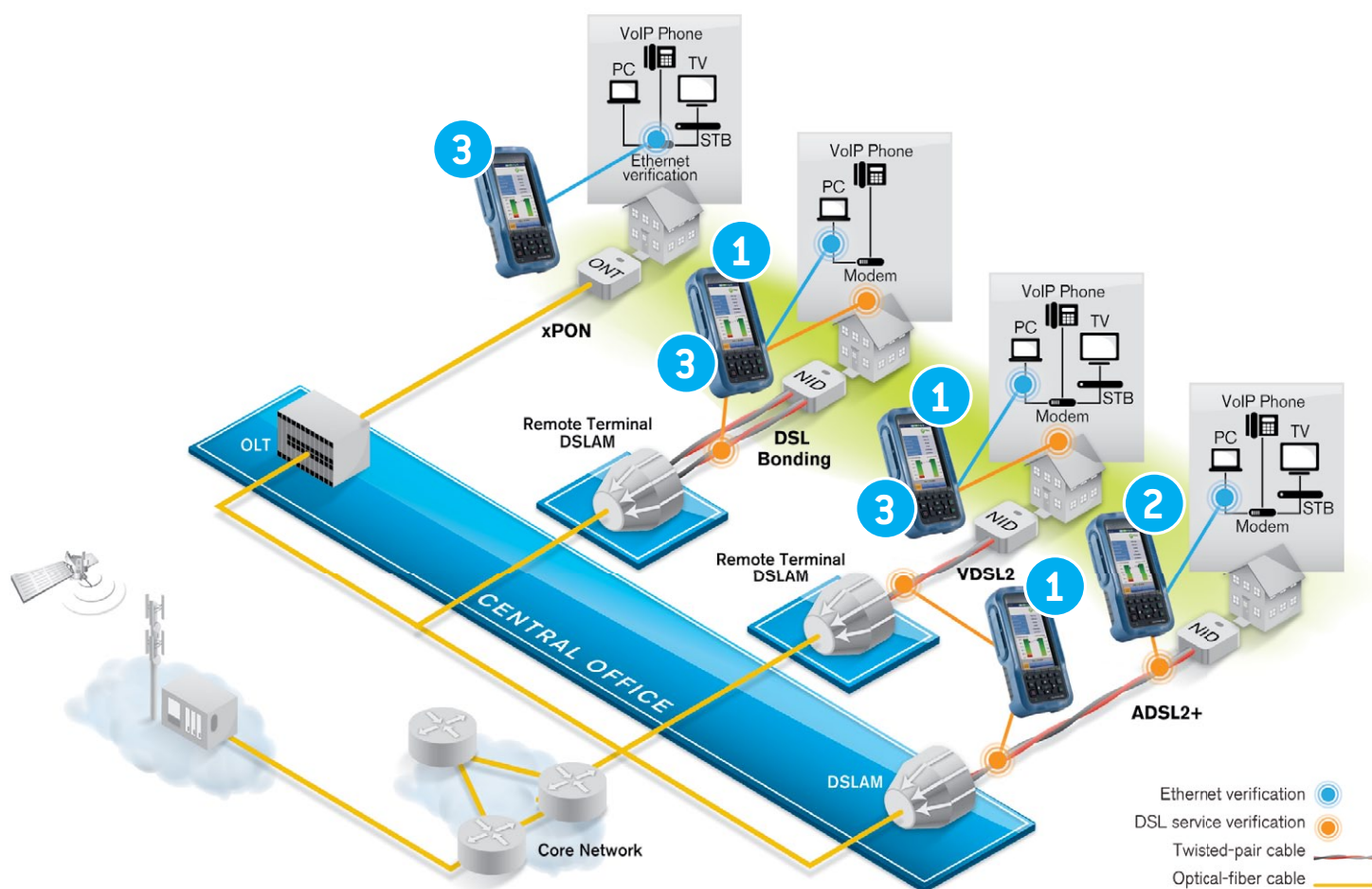
In today's highly competitive environment, QoS is paramount for service providers. The MaxTester 635 allows test reports to be saved and uploaded to the cloud. Therefore, service providers can keep the results on file for future reference and confirm that the required tests have been completed by the technician. With results in the cloud, service providers can perform additional analytics on the collected data.

### Battery-Powered

The MaxTester 635 is equipped with a battery using the latest technology in rechargeable cells. It provides the maximum testing time between charges, even when meeting the high-power demands of VDSL2. When charging is required, technicians can either use the optional 12 VDC vehicle charger or the supplied AC adapter.



## MAXTESTER 635 OPERATIONAL MODES



## 1

## ADSL2+/VDSL2 Terminate Mode

The MaxTester 635 synchronizes with the DSLAM on the circuit in the outside plant or at the NID, allowing authentication and service testing. Technicians can test ADSL2+ and VDSL2 single pair, ADSL2+ and VDSL2 bonding, as well as ADSL2+ PTM modes.

## 2

## xDSL Pass Through Mode

The MaxTester 635 replaces the customer modem or router, synchronizes with the DSLAM, and enables authentication and service testing. It also allows the customer's applications to be used to confirm the correct operation for services such as PC Web access, IPTV viewing, STB operation and VoIP.

## 3

## Ethernet Terminate Mode

The MaxTester 635 automatically synchronizes with 10/100Base-T ports inside the customer premises and allows authentication as well as service testing. In this configuration, the MaxTester 635 can be used in xDSL (FTTN), xPON (FTTH) or Ethernet deployments.

## DSL SPECIFICATIONS

<b>DSL chipset</b>	Broadcom	
<b>Standards compliance</b>	ADSL1/2/2+	ITU-T G.992.5 (ADSL2+ including Annex A, B, J, M) ITU-T G.992.3 (ADSL2 including Annex A, B, J, L) ITU-T G.992.1 (G.DMT including Annex A, B) ITU-T G.994.1 ATIS/ANSI T1.413 Issue 2 IEEE 802.3ah (PTM) ITU-T G.998.x (ATM, Ethernet bonding) ITU-T G.998.4 (G.INP) DT 1 TR 112 U-R2
	VDSL2	ITU-T G.993.2 Annex A, B, Y Profiles: 8a/b/c/d, 12a/b, 17a, 30a Band Plan: 997, 998, US0 IEEE 802.3ah (PTM) ITU-T G.998.2 (Ethernet bonding) ITU-T G.998.4 (G.INP) ITU-T G.993.5 (G.Vector) DT 1 TR 112 U-R2 (U-RV2)
<b>DSL parameters</b>	Maximum attainable bit rates Actual achieved bit rates Actual bonded achieved rates Latency modes: fast, interleaved Data modes: ATM, PTM Capacity (%) Signal-to-noise ratio (SNR) margin Output power Attenuation Bits/bin Attenuation/bin (Hlog/bin) QLN/bin SNR/bin Vendor code, revision	Interleave depth Interleave delay Trellis coding Bit swapping INP Nitro PhyR, G.INP state, performance counters Vectoring state, performance counters Modes: PTM, ATM, Nitro LOS, FEC, CRC, HEC LATN per band SATN per band EWL KLO

## MULTIPLAY TESTING SPECIFICATIONS

<b>Test interfaces</b>	VDSL2 ADSL1/2/2+ Ethernet 10/100 BT	
<b>Encapsulation methods</b>	RFC 2684 supporting bridged Ethernet (IPoE) IPoA (RFC 1577)	PPPoE (RFC 2516) PPPoA/LLC and PPPoA/VC-MUX (RFC 2364)
<b>Operating modes</b>	DSL Terminate Modem Replacement (DSL to Ethernet) Pass Through	Ethernet Terminate Ethernet/Ethernet Pass Through
<b>Login format</b>	User name and password using PAP/CHAP	
<b>Connectivity support</b>	LAN/WAN status DNS, gateway DHCP client/server, DHCP vendor class NAT	VLAN ID, VLAN tagging VPI/VCI IP release
<b>Ping test</b>	Ping destination Number of pings Packet size Timeout Results	Gateway, IP address or URL 1 to 99 32 to 1200 bytes (32 is default) 1 to 10 seconds Packets sent/received, average round-trip delay (ms)
<b>Traceroute test</b>	Traceroute destination Timeout Packet size Number of hops Results	Gateway, IP address or URL In seconds, default is 1 s, maximum is 10 s 32 bytes 1 to 32 (default is 30) Indicates IP address of hop and round-trip time in milliseconds (ms)
<b>FTP test</b>	Address Direction Results	IP or URL Upload and/or download Time, kB transferred, bit rate in kbit/s
<b>Web browser (software option)</b>	Address Bookmarks	IP address or URL User-definable
<b>VoIP testing (software option)</b>	Protocol support Codecs Interface support Parameter/functionality	SIP G.711 $\mu$ -Law, G.711 A-Law ADSL1/2/2+, VDSL2, Ethernet Test duration timer MOS (current, average) R-Factor (current, average) Latency (current, average, maximum) Jitter (current, average, maximum) Packets (lost, total)
<b>IPTV testing (software option)</b>	Supported video standards  Operating modes  IPTV parameters/functionality	MPEG2, MPEG4 part 2 and 10 (H.264/AVC), Microsoft Mediaroom/WM9/VC1  DSL Terminate Ethernet Terminate  IGMP join/leave requests with STB emulation Automatic tests to join/leave and analyze up to five simultaneous streams Programmable channel list for storage of commonly used channels Bandwidth usage per channel IGMP packet and rate information per line and channel Multicast/unicast RTP/UDP IP stream support Key IP video QoS parameters, packet loss, zap time, PID statistics Graphical results Transport

COPPER SPECIFICATIONS<sup>a, b, c</sup>

## Transmitter characteristics

Frequency range (200 Hz to 20 kHz)	Frequency resolution	1-Hz steps
	Frequency uncertainty (accuracy)	$\pm(50 \text{ ppm} + 1 \text{ Hz})$
	Level range (dBm)	-20 to 10 at 600 $\Omega$
	Level resolution	0.1 dB
	Level uncertainty (accuracy)	$\pm 1 \text{ dB}$
	Impedance ( $\Omega$ )	600
Frequency range (20 kHz to 2.2 MHz)	Frequency resolution	1-kHz steps
	Frequency uncertainty (accuracy)	$\pm(50 \text{ ppm} + 100 \text{ Hz})$
	Level range (dBm)	-20 to 10 at 100 $\Omega$
	Level resolution	0.1 dB
	Level uncertainty (accuracy)	$\pm 1 \text{ dB}$
	Impedance ( $\Omega$ )	100, 120, 135, 150
Frequency range (2.2 MHz to 30 MHz)	Frequency resolution	1-kHz steps
	Frequency uncertainty (accuracy)	$\pm(50 \text{ ppm} + 100 \text{ Hz})$
	Level range (dBm)	-20 to 0 at 100 $\Omega$
	Level resolution	0.1 dB
	Level uncertainty (accuracy)	$\pm 1 \text{ dB}$
	Impedance ( $\Omega$ )	100, 120, 135, 150

## Receiver characteristics

Reception frequency range	Reception frequency range	200 Hz to 20 kHz 20 kHz to 30 MHz
	Frequency uncertainty range (accuracy)	$\pm(50 \text{ ppm} + 1 \text{ digit})$
	VF reception level range (dBm)	-90 to 15 at 600 $\Omega$
	VF level uncertainty (accuracy)	200 Hz to 20 kHz -90 dBm to -50 dBm, uncertainty (accuracy) $\pm 2 \text{ dB}$ -50 dBm to 15 dBm, uncertainty (accuracy) $\pm 1 \text{ dB}$
	WB reception level range (dBm)	-90 to 15 at 100 $\Omega$ and 135 $\Omega$
	WB level uncertainty (accuracy)	20 kHz to 2.2 MHz -90 dBm to -50 dBm, uncertainty (accuracy) $\pm 2 \text{ dB}$ -50 dBm to 15 dBm, uncertainty (accuracy) $\pm 1 \text{ dB}$  2.2 MHz to 30 MHz -90 dBm to -50 dBm, uncertainty (accuracy) $\pm 2 \text{ dB}$ -50 dBm to 15 dBm, uncertainty (accuracy) $\pm 1 \text{ dB}$
	Impedance ( $\Omega$ )	100, 120, 135, 150, 600

## POTS dialer

DTMF	0 - 9, #, *
Phonebook	25 entries

## Digital multimeter (DMM)

Test type	Snapshot and continuous
Impedance selection (for voltage measurement)	100 k $\Omega$ , 1 M $\Omega$

Measurement	Range	Resolution	Uncertainty (accuracy)
DC voltage	0 to 400 V	0.1 V for 0 to 99.9 V	$\pm( 1 \%  + 0.5 \text{ VDC})$
		1 V for 100 V to 400 V	
AC voltage	0 to 280 Vrms	0.1 V for 0 to 99.9 V	$\pm(1 \% + 0.5 \text{ VAC})$
		1 V for 100 V to 280 V	
Isolation resistance (stress/leakage)	0 to 1 G $\Omega$ , auto-ranging 1 k $\Omega$ to 99 M $\Omega$ 100 M $\Omega$ to 999 M $\Omega$	Three digits	$\pm(2 \% + 1 \text{ digit})$ $\pm(5 \% + 1 \text{ digit})$
Resistance	0 to 100 M $\Omega$ 0 to 999 $\Omega$ 1 k $\Omega$ to 100 M $\Omega$	Three digits	$\pm(1 \% + 5 \Omega)$ $\pm(2 \% + 1 \text{ digit})$
Capacitance	0.1 nF to 2 $\mu\text{F}$	Four digits	$\pm(2 \% + 50 \text{ pF})$
DC current	0 to 110 mA	0.1 mA	$\pm( 2 \%  + 1 \text{ mA})$
AC current	0 to 110 mA	0.1 mA	$\pm( 2 \%  + 1 \text{ mA})^d$
Station Ground	0 to 1 M $\Omega$	Up to three digits	$\pm(1 \% + 3 \Omega)$ $\pm(2 \% + 1 \text{ digit})$
	0 to 999 $\Omega$ 1 k $\Omega$ to 1 M $\Omega$		

## NOTES

- a. Subject to change without notice.  
b. Typical, at 23 °C  $\pm$  3 °C, on batteries, with no type B USB connection.  
c. Specifications based on 24 AWG (PE 0.5 mm) cabling.  
d. From 10 mA to 110 mA.



**COPPER SPECIFICATIONS<sup>a, b, c</sup> (continued)**

Isolation resistance (stress/leakage) (continued)	Source	50 to 125 VDC (current safely limited to 0.5 mA)
	Soak timer (s)	1 to 60
VF noise measurement	Frequency range	200 Hz to 20 kHz
	Level range (dBm)	-90 to 20
	Resolution (dB)	0.1
	Uncertainty (accuracy)	-90 dBm to -50 dBm, uncertainty (accuracy) $\pm 2$ dB -50 dBm to +20 dBm, uncertainty (accuracy) $\pm 1$ dB
	Filters	ITU: none, psophometric, P-notched, 3.4 kHz, D-filter, 15 kHz ANSI: none, C-message, C-notched, 3.4 kHz, D-filter, 15 kHz
	Impedance	600 $\Omega$
VF impulse noise	Low threshold (dBm)	-40 to 0, in 1 dB steps
	Mid threshold	Low threshold plus separation
	High threshold	Mid threshold plus separation
	Separation (dB)	1 to 6, in 1 dB steps
	Dead time (ms)	125
	Filters	None, 3 kHz flat, C-message, psophometric, notched and D filter (IEEE 743-1995)
	Counter	Maximum 999 for each threshold
	Timer	Maximum 100 hours
Power influence (noise to ground)	Noise range (dBm)	-60 to 10
	Uncertainty (accuracy)	-60 dBm to -50 dBm $\pm 2$ dB -50 dBm to 10 dBm $\pm 1$ dB
VF longitudinal balance	Frequency (Hz)	1004
	Level range (dB)	0 to 100
	Level uncertainty (accuracy) (dB)	$\pm 1$
	Impedance	600 $\Omega$
Time-domain reflectometer (TDR)	Modes	Fully automatic operation with location of most significant event(s)
	Distance range (m)	0 to 6700 (0 ft up to 22 000 ft)
	Pulse width	15 ns to 20 $\mu$ s
	Amplitude	7.5 V p-p on cable, 9 V p-p open circuit
	Velocity of propagation (VOP)	0.400 to 0.999
	Distance uncertainty (accuracy) <sup>d</sup> (m)	$\pm(0.5 \text{ m} + 1 \% \times \text{distance})$
	Units	Meters and feet
Load coil detection	Count	Up to 5
	Plot (kHz)	Up to 10
	Distance range (m)	Up to 8000 (up to 27 000 ft)
Near End Crosstalk (NEXT)	Frequency Range	10 kHz to 30 MHz
	Level Range	0 to 90 dB
	Level Resolution	0.1 dB
	Level uncertainty (accuracy)	2.2 MHz: $\pm 2.0$ dB, from 0 to 90 dB 8 MHz: $\pm 2.0$ dB, from 0 to 80 dB 12 MHz: $\pm 2.0$ dB, from 0 to 75 dB 17.6 MHz: $\pm 3.0$ dB, from 0 to 75 dB 30 MHz: $\pm 3.0$ dB, from 0 to 68 dB
	Terminations	100, 120, 135, 150 $\Omega$

**NOTES**

- Subject to change without notice.
- Typical, at 23 °C  $\pm$  3 °C, on batteries, with no type B USB connection.
- Specifications based on 24 AWG (PE 0.5 mm) cabling.
- Qualified up to 300 m (1000 ft) and does not include the uncertainty due to VOP.

**COPPER SPECIFICATIONS<sup>a, b, c</sup> (continued)**

Power spectral density (PSD)	Test type	Continuous with peak-hold
	Vertical scale	15 dBm/Hz to -140 dBm/Hz or 20 dBm to -90 dBm
	Horizontal scale	4.3125 kHz to 17 MHz, in 4.3125 kHz steps or 8.625 kHz to 30 MHz, in 8.625 kHz steps
	Noise filters	None or E, F, G, ADSL2+, VDSL2-8, VDSL2-12, VDSL2-17 and VDSL2-30
Wideband impulse noise	Threshold	-50 dBm (40 dBm) to 0 dBm (90 dBm) in 1 dB steps
	Counter maximum	65 000 000
	Test duration	Maximum 100 hours
	Uncertainty (accuracy) (dB)	±2
	Noise filters	None or E, F, G, ADSL2+, VDSL2-8, VDSL2-12, VDSL2-17 and VDSL2-30
Wideband longitudinal balance	Level range (dB)	0 to 50 up to 2.2 MHz 0 to 40 up to 12 MHz
	Level resolution (dB)	0.1
	Level uncertainty (accuracy) (dB)	±2 (up to 2.2 MHz)
	Frequency uncertainty (accuracy) (ppm)	±(50 ppm + 1 digit)
	Frequency scale	ADSL/2+: 20 kHz to 2.2 MHz VDSL/VDSL2-12: 20 kHz to 17.6 MHz
Single-ended frequency response (attenuation) <sup>d</sup>	Distance range (m)	100 m to 5000 m (300 ft to 16000 ft)
	Frequency range (Hz)	4.3 kHz to 30 MHz
	Frequency uncertainty (accuracy)	± (50 ppm + 1 digit)
	Level uncertainty (accuracy) (dB)	± 2.0 dB typical for 2.2 MHz and 8 MHz ranges ± 3.0 dB for VDSL2-12 and VDSL2-17 ± 4.0 dB for VDSL2-30 ranges
	Resolution (dB)	0.1
	Horizontal scale (MHz)	ADSL2+ = 2.208, VDSL2-8, VDSL2-12 = 12, VDSL2-17 = 17.66, VDSL2-30 = 30
	Vertical scale (dB)	0 to +100
Resistive fault location (RFL)	Test type	Single pair (two wire) and separate good pair (four wire)
	Fault detection (MΩ)	0 to 20
	Resolution	Three digits
	Loop resistance (kΩ)	10 maximum
	Multiple cable sections	Five (includes gauge and temperature setting)
	Fault location	Total resistance, near-end to fault resistance, fault to strap resistance (three significant digits, least significant digit 0.1 Ω) Total length, distance to fault, distance from fault to strap (three significant digits, least significant digit 1 m)
	Uncertainty (accuracy)	±(0.1 Ω + 1 % x RTS)
Stressed Balance	Level Range	0 to 82 dBmC
	Resolution	0.1 dBmC
	Longitudinal Excitation	135 VDC (0 dBm, ±1 dB reproducibility)

**NOTES**

- a. Subject to change without notice.  
b. Typical, at 23 °C ± 3 °C, on batteries, with no type B USB connection.  
c. Specifications based on 24 AWG (PE 0.5 mm) cabling.  
d. Specification based on 1 kft 24 AWG cabling. Range depends on cable type and condition.

## GENERAL SPECIFICATIONS

Display	TFT LCD with backlight 152 mm (6 in) diagonal 800 x 480 resolution, WVGA
Test connections	RJ11 for ADSL2+/VDSL2 Five-color banana connector for T/A, R/B, G, T1/A1, R1/B1 RJ45 for Ethernet 10/100 WAN RJ45 for Ethernet 10/100 LAN
Results management	> 2 GB internal memory Single and bulk file export to USB memory devices FTP upload
Temperature range operating storage	0 °C to 40 °C (32 °F to 104 °F) -20 °C to 60 °C (-4 °F to 140 °F)
Humidity	5 % to 95 % relative, non-condensing
Shock	1 m (39 in) drop per GR-196-CORE
Altitude	3000 m (9842 ft)
Input power	9-24 VDC, 2 A, 18 W via 90-220 VAC adapter or 12 V vehicle adapter
Battery	Internal rechargeable lithium polymer, with battery-state and level indications, adjustable auto-power down
Safety	CE and CSA marked
Size (H x W x D)	254 mm x 124 mm x 62 mm (10 in x 4 <sup>7</sup> / <sub>8</sub> in x 2 <sup>7</sup> / <sub>16</sub> in)
Weight (with battery)	1.9 kg (4.2 lb)
Water/dust ingress	Designed to comply with IP54
Differential voltage protection	354 VRMS or 1000 VDC max
Common mode voltage protection	354 VRMS or 1000 VDC
Voltage detection	> 20 V will trigger alarm message
Self-test	Routine on power-up
Connectivity	Two USB 2.0 client ports One USB Type B host port Optional Wi-Fi support
Languages	English, French, Spanish

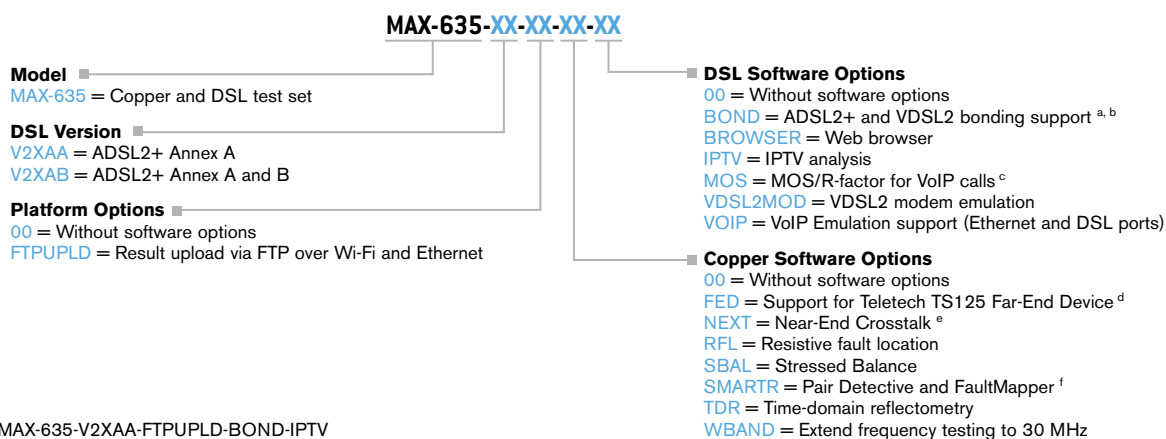
## STANDARD ACCESSORIES

DSL test cables: RJ14 to RJ11 and telco clip with bed of nails (ACC-RJ11-TC), or RJ14 to RJ11 and 4 mm plugs with crocodile clips (ACC-RJ11-4MM)
Copper test cable: Three-color (black, red, green) 4 mm banana plugs terminated with telco clips (ACC-M3COLR), or Three-color (black, red, green) 4 mm banana plugs terminated with shrouded crocodile clips (ACC-M4MM) RFL strap (ACC-STRP)
Certificate of compliance
AC adapter (GP-2146)
Soft carrying case (GP-10-072)

## OPTIONAL ACCESSORIES

Copper test cables: Yellow/blue banana connectors to telco clips (ACC-MTCYB) or Yellow/blue banana connectors to 4 mm plugs/croc clips (ACC-M4MMYB)
DSL bonded test cables: RJ14 to dual RJ11 (ACC-BD-RJ) and RJ14 to four telco clips with bed of nails (ACC-BD-TC), or RJ14 to four 4 mm plugs with crocodile clips (ACC-BD-4MM)
RJ45 Ethernet cable (ACC-RJRJ-UTP)
USB host/client cable (GP-2053)
12 V vehicle charger (GP-2205)
Form fitting, protective soft glove with shoulder strap (ACC-LGLOVE)
16 GB USB memory stick (GP-2144)
Headset (GP-1002)
Wi-Fi Pico Adapter (GP-2093)
Teletch TS125 Far-End Device (TS125)

## ORDERING INFORMATION



### Notes

- a. VDSL2 bonding requires VDSL2MOD option.
- b. ADSL2+ bonding or ATM bonding not available with V2XAB.
- c. VoIP option required.
- d. Teletch TS125 Far-End Device sold separately.
- e. Requires the WBAND option.
- f. Includes TDR option.

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