TECH-X FLEX
WIDEBAND COPPER TEST MODULE

Spirent's wideband copper test module for Tech-X Flex® combines a range of functionality normally found in multiple test sets into a single compact module. Tests ranging from Multimeter (DVOM), to insertion loss measurements at 30 MHz, as well as a high precision TDR and RFL make this module a "must have" for any technician involved in maintaining the copper access network. This range of features makes this module ideal for voice (POTS) to VDSL2 copper plant qualification and troubleshooting.

FEATURES & BENEFITS

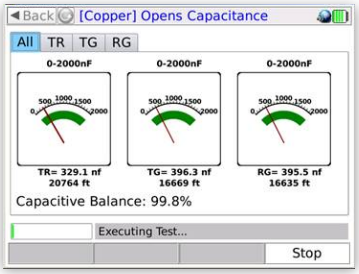
- Comprehensive copper testing in one module allows a single solution—reducing time and capital equipment costs. Powerful copper analysis ensures faults are found and fixed with minimal testing required
- Wideband testing to 30MHz ensures services up to VDSL2 can be properly provisioned and diagnosed
- Advanced Impulse Noise Capture provides detailed analysis which can be used to pinpoint the source of service affecting electrical noise
- Full VGA color display allows color-coded results for quick go/no-go testing. Also ensures TDR and PSD graphs can be seen with ease.
- User-configurable, color-coded pass/fail scripting allows easy verification of process compliance with a single button push

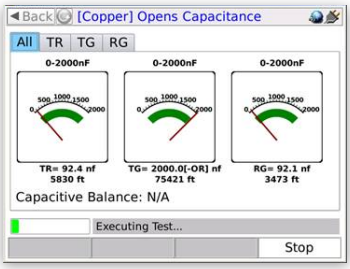
APPLICATIONS

Multimeter (DVOM): Voltage, current, resistance, and capacitance (opens) measurements can be performed to determine loop length, capacitive and resistive balance, current and battery voltage. Furthermore, the Tech-X Flex identifies faults such as opens, shorts, battery crosses, bad splices, and more.

Time Domain Reflectometer (TDR): Tech-X Flex provides a high-precision TDR so that load coils, bridged taps and faults can be found with ease. Fully functional and simple to operate, this TDR reduces time spent trying to locate the fault. Other TDR highlights include:

- High resolution graphical display for easy fault finding and analysis
- Isolation of faults 20,000 feet away
- Auto detection of faults such as opens, short, bridged-taps, and more
- Dual and cross talk operation modes for those situations where different techniques are required
- Zero dead-zone to find close-in faults





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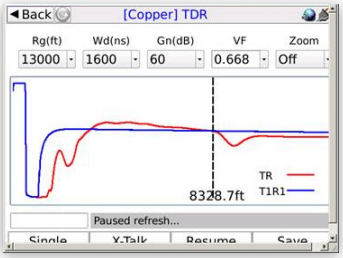
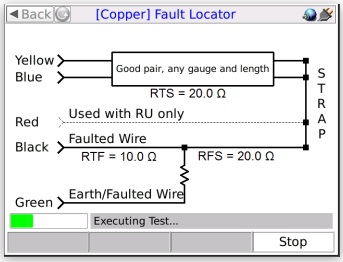
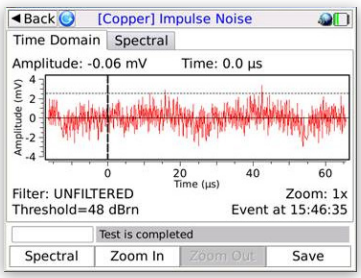


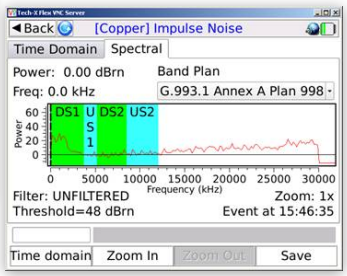


Resistance Fault Locator (RFL): RFL analysis finds high-resistance faults that normally cannot be found by a TDR. Loop resistance, insulation resistance, and accurate location of ground and battery faults are easily found with a touch of a button. An automated Kupfmuller analysis feature is also included to locate double leg faults that normally require two separate measurements. This is a real time saver yet extremely simple to use

WideBand service testing to 30MHz: With the increasing push to provide high-speed services for Triple Play deployments happening worldwide, network operators are opting for an ADSL2+ or VDSL2 delivery of these services in an FTTN environment. To qualify and troubleshoot the copper pair for its suitability to carry VDSL2 requires a test set capable of testing over the full 30MHz frequency band. Tech-X Flex provides this capability as standard in its single copper test module. These tests include insertion loss, longitudinal balance, weighted and impulse noise measurements.

Advanced Impulse Noise Detection: Impulse Noise problems are common to service providers everywhere yet there are very few tools that can be used to get to the source of the problem and those that do exist are usually prohibitively expensive for field technicians to carry around. Typically, the only commonly available tool was an impulse noise counter which is able to indicate the presence of impulse noise. This is of limited use to the technician because it doesn't identify the source of the noise, so it alone has limited value in the customer with reliable service. However, the Tech-X Flex has the ability to make an impulse noise capture in the frequency or time domain once an event has occurred. This helps greatly in being able to identify the source of the problem and therefore rid the customer of their problem.





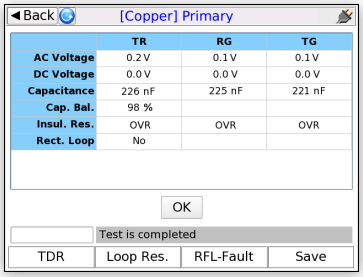
Installation of Voice Services: Various features such as drawing dial-tone, C-Message noise, VF loss and DVOM tests enable field technicians to ensure the voice (e.g. POTS) service meets service criteria after the copper pair has been conditioned. Various test numbers such as quiet termination, milliWatt and "drop battery" can be stored in the unit for automatic dialling before the measurement is made. Using the built-in speaker, the field technician can listen to various tones being received.

In-Band Controllable Remote Unit: The Tech-X Flex has an optional Remote Unit, simplifying field testing of wideband insertion loss measurements. Once placed on the correct pair, the remote unit reduces truck rolls and time consumed waiting for other technicians to complete a job. This unit can be remotely configured via the line under test and DTMF tones to perform various measurements. For example, the Remote Unit can be instructed to send wideband tones for the Tech-X Flex to receive. Lastly, once the trouble has been fixed, the field technician remotely configures a through mode and immediately places the customer back in service.

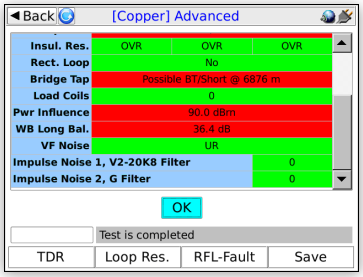
The Remote Unit also operates as a far end strap when running the RFL test. The Tech-X Flex will automatically command the Remote Unit to open and short the pair as necessary in order to obtain the required measurements.

Auto Test Scripts: Auto Test Scripts provide access to a set of automatic scripts that run a sequence of tests, designed to quickly qualify a Copper Access connection. There are two types of test scripts—*Primary Test Script* and *Advanced Test Script*.

The *Primary Test Script* provides a series of Multimeter tests to test and/or qualify a line for POTS voice services. The script should be run with the tip (A), ring (B), and ground (E) leads connected and all legs unterminated at the far end.



The *Advanced Test Script* provides a series of Multimeter tests generally designed to test and/or qualify a line for wideband service delivery, such as VDSL. The script should be run with the tip (A), ring (B), and ground (E) leads connected and all legs unterminated at the far end.



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COPPER SPECIFICATIONS				
	RANGE	RESOLUTION	ACCURACY	ADDITIONAL INFORMATION
DC Voltage	0 – ±300V	0.1V	±2% ±1 digit	**Impedance:** 100 kΩ
AC Voltage	0 – 250V	0.1V	±2% ±1 digit	**Impedance:** 100 kΩ
Resistance	0 – 2 kΩ 2 – 20 kΩ 20 – 200 kΩ 200 k – 2 MΩ 2 M – 20 MΩ	1Ω 10Ω 100Ω 1 kΩ 10 kΩ	±2% ±1Ω ±2% ±10Ω ±2% ±100Ω ±2% ±1 kΩ ±2% ±10 kΩ	
Insulation Resistance	10 – 100 kΩ 100 kΩ – 1 MΩ 1 MΩ – 10 MΩ 10 MΩ – 100 MΩ 100 MΩ – 2 GΩ	100Ω 1 kΩ 10 kΩ 100 kΩ 1 MΩ	±2% ±2% ±2% ±2% ±5%	**Voltages:** 30, 50, 95, 250, 500V (all ±)
Loop Resistance	0 – 10 kΩ	1Ω	±2% ±1Ω	Voltages: +/-95V
Open/Capacitance Meter	0 – 2000 nF	0.1 nF	±2% ±1 digit	
Loop Current	0 – 150 mA	1 mA	2% ±1 digit	**Load:** 430Ω
VF TESTS				
Noise Metallic	0 – 90 dBrnC	1 dB	±2 dB	**Filter:** C Message
VF Longitudinal Balance	300 Hz – 4 kHz 0 – 65 dB 65 – 80 dB	0.1 dB 0.1 dB	±1.0 dB ±2.0 dB"	Impedance: 600Ω
Pl Noise Balance	O – 90 dBrn	0.1 dB	±2 dB	**C-message, Psophometric, and D filter support**
VF Receive Tones	300 Hz – 4 kHz -40 dBm — +10 dBm	0.1 dB	±2Hz ±1.0 dB	Output level: 0 dBm from remote device Impedance: 600Ω
VF Transmit Tones	300 Hz – 4 kHz -30 dBm – +10 dBm	0.1 dB	±2Hz ±1.0 dB	Impedance: 600Ω
VF SNR	300 Hz – 4 kHz 0 – 90 dB	0.1 dB	±2Hz ±1.0 dB	Requires Spirent's Remote Unit
WIDEBAND TESTS				
WB Longitudinal Balance	10 kHz – 30 MHz 0 – 50 dB	0.1 dB	±5.0 dB	Impedance: 100Ω or 135Ω
Wideband Insertion Loss	10 kHz – 30 MHz 0 – 90 dB	0.1 dB	±1.0 dB	**Output Level:** 0 dBm from remote device **Impedance:** 100Ω or 135Ω
WB Weighted Noise	Varies according to the selected filter, see Supported Noise Filters	0.1 dB	±1 dB	Impedance: E and F Filters: 135Ω All other: 100Ω
WB SNR	10 kHz – 30 MHz 0 – 50 dB	0.1 dB	±1.0 dB	Requires Spirent's Remote Unit
WB Impulse Noise	Varies according to the selected filter, see Supported Noise Filters	0.1 dB	±1.0 dB	Impedance: E and F Filters: 135Ω All other: 100Ω • Time duration up to 24 hours • Maximum of 8 noise events recorded per second • Triggered Capture to display details in spectral or time domain
Power Spectral Density (18 MHz Test)		0.1 dBm 4.3125 kHz		
Power Spectral Density (30 MHz Test)	+20 to – 140 dBm/Hz	0.1 dBm 8.625 kHz	±1.0 dB	**Impedance:** 100Ω, 135Ω or Hi-Z Resolution specs are with zoom enabled
Time Domain Reflectometry (TDR)	300 ft. / 100m 1,300 ft. / 400m 3,000 ft. / 1km 6,500 ft. / 2km 13,000 ft. / 4km 20,000 ft. / 6km	0.2 ft. / 0.05m 0.7 ft. / 0.2m 1.6 ft. / 0.5m 3.3 ft. / 1.0m 6.4 ft. / 2.0m 7.6 ft. / 2.5m	±2% of range or better	**Vertical Sensitivity:** 90 dB in steps of 6 dB Selectable Pulse Widths of 5, 34, 235 and 1600 ns. Resolution specs are with zoom enabled **Other features include:** AutoTDR Single, Dual and X-Talk modes

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COPPER SPECIFICATIONS (CONTINUED)				
	RANGE	RESOLUTION	ACCURACY	ADDITIONAL INFORMATION
Resistance Fault Locator (RFL)	**Location Range:** 0 – 39,000 ft./12km **Resistance fault range:** 0– 20 MΩ		**3-wire:** ±0.2% **4-wire:** ±0.2%	Murray and Kupfmuller techniques available
Remote Unit				Open Pair Short Pair In-service/Through mode Pair to ground Tone Generation (70 Hz to 2.5 MHz) Output Level: 0dBm

SUPPORTED NOISE FILTERS				
FILTER	POWER RANGE (dBrn)*	MINIMUM THRESHOLD (dBrn)*	FREQUENCY RANGE	ADDITIONAL NOTES
(None)	65 – 110	35	Up to 30 MHz	Available for general purpose analysis of the line.
E	30 – 110	0	As specified by IEEE Std. 743-1995	Typically used for DDS and ISDN services.
F	40 – 110	10	As specified by IEEE Std. 743-1995	Typically used for HDSL services.
G	50 – 110	20	As specified by IEEE Std. 743-1995	Typically used for ADSL services.
A2+	55 – 110	25	20 kHz – 2.2 MHz	Typically used for ADSL2+ services.
V2-20K8	60 – 110	30	25 kHz – 8.5025 MHz	Available for different VDSL/VDSL2 bands and band plans, as appropriate.
V2-20K12	60 – 110	30	25 kHz – 12.0025 MHz	
V2-20K17	60 – 110	30	25 kHz – 17.0025 MHz	
V2-20K30	65 – 110	35	25 kHz – 0.0025 MHz	
V2-640K17	60 – 110	30	640 kHz – 17.6 MHz	The V2-640K17 filter extends its lower range to 400 kHz for impulse noise testing only.
V2-17M25	60 – 110	30	17.6 MHz – 25 MHz	
V2-17M30	60 – 110	30	17.6 MHz – 30 MHz	
V2-25M30	65 – 110	25	25 MHz – 30 MHz	

*The **Minimim threshold** indicates the absolute minimum threshold that you can set for the Impulse Noise test, for the respective filter. While these values are provided for flexibility, it is generally recommended that you use values within the normal **Power range** instead, because a lower value makes it more likely that ordinary noise will be mistaken for impulse noise. The lower the value, the more skill is required of the operator to properly interpret results.

SPIRENT SERVICES

Spirent Global Services provides a variety of professional services, support services and education services—all focused on helping customers meet their complex testing and service assurance requirements. For more information, visit the Global Services Website at www.spirent.com or contact your Spirent sales representative.

ORDERING INFORMATION		
PRODUCT NUMBER	PRODUCT NAME	DESCRIPTION
T5000	Tech-X Flex	With 10/100 Ethernet interface for IP Ping, Traceroute, DHCP/Static Addressing.
T5640	WB Copper Module	Provides WB Copper test functionality to 30MHz. Includes DVOM/VF, TDR, RFL, PSD and WB measurements.
T5645	Copper Far End Unit (FEU)	A remote device used in conjunction with the Tech-X Flex Copper module, to provide Shorts, Grounds, Opens, Termination, Tones on a cable pair for testing at a distant location.

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