T-BERD®/MTS-4000 Multiple Services Test Platform
Copper Services Module

Key Features

- **Complete copper testing from POTS through full-spectrum VDSL/VDSL2 up to 30 MHz**
- **Time domain reflectometer (TDR) with time-varying gain (TVG)**
- **Spectral analysis to 30 MHz with one-button zoom to VDSL bands and causes of interference**
- **JDSU scripting and automated test features that simplify testing**
- **Wideband copper functionality available in combination with VDSL/VDSL2 test modules**
- **Large, color graphical user interface (GUI) with optional touch screen**

Applications

- Qualifies and troubleshoots twisted pair copper deployments
- Interoperates with the JDSU UltraFed for single-ended closeout testing
- Conducts scripted closeout testing with user-definable Pass/Fail criteria

The JDSU T-BERD/MTS-4000 equipped with the Copper Services Module delivers comprehensive copper testing and addresses the distinct requirements of very high-speed digital subscriber line (VDSL) deployment and maintenance. The T-BERD/MTS-4000 is a rugged, modular platform engineered with a 7-inch color display, long battery life, and weather-resistant design for outstanding performance and reliability in the field. The Copper Services Module brings the functionality to the platform that service providers need to mitigate the significant challenge of VDSL rollout and maintenance in various fiber (FTTx) deployments.

Traditionally, the copper plant has not been qualified to withstand the stringent needs of VDSL service delivery. The new spectrum that VDSL uses introduces more rigorous and stringent requirements than previously seen in the installed plant. VDSL testing has shown that the plant is susceptible to impulse noise not encountered in the current asymmetric digital subscriber line (ADSL) usage spectrum. In addition, the detection of short bridged taps, which create a much greater impact on VDSL signals than on ADSL signals, becomes more critical in VDSL testing. The T-BERD/MTS-4000 Copper Services Module tests to these standards and more to qualify and troubleshoot the copper for service.

The T-BERD/MTS-4000 is easily upgradeable with advanced options that support the industry's changing technologies and the evolving needs of service installers. Its dynamic configurability allows technicians with varying responsibilities to use it to perform a wide range of tests. Standard Ethernet and universal serial bus (USB) or optional Wireless Fidelity (WiFi) and Bluetooth connections offer flexibility to easily download software and offload captured test data to improve workforce productivity and baseline network performance.

Architecture

Fully compatible with the T-BERD/MTS-4000 mainframe, the dual-bay Copper Services Module can be optioned with a VDSL modem to provide support for ADSL1/2/2+, VDSL1, and VDSL/VDSL2 triple-play deployments. The Copper Services Module features dual Tip (A) and Ring (B) (T&R, A&B) and Ground (Earth) interfaces. For the most accurate results, technicians can use specially insulated cables to test higher-frequency services, such as VDSL2.
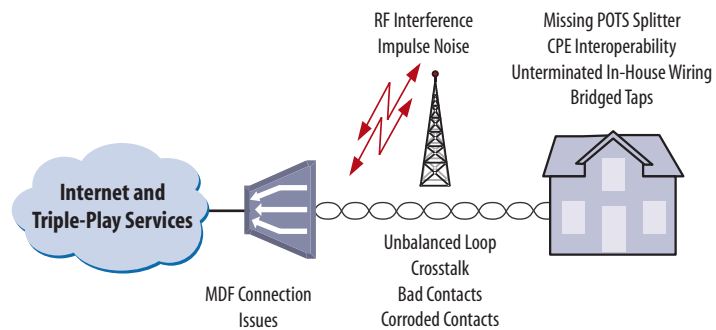

Figure 1: Standard copper qualification may show acceptable results for typical problem areas such as attenuation and noise, but many issues impact copper quality in today's demanding next-generation service environment, particularly unterminated in-house wiring with bridged taps that lead to unexpected effects when using new frequencies up to 30 MHz.

The T-BERD/MTS-4000 large, color GUI makes reading even the most complex copper test results easy.

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Overview of Copper Tests

Today's copper network requires rigorous testing. The T-BERD/MTS-4000 equipped with Copper Services Modules performs these essential tests and more:

Copper Test	Test Function	What it Tests	Why it is Needed	Fault Impact
DVOM	DSL service qualification and troubleshooting	DC/AC voltage, loop current, loop resistance, distance-to-short, leakage	Overall copper health	No DSL synchronization or low data rate
Opens	DSL service qualification and troubleshooting	Capacitance, loop length	Cable damage, loop length acceptable for DSL	The longer the cable, the higher the attenuation, and the lower the data rate
Load Coil	DSL service qualification and troubleshooting	Presence of load coils and location	Load coils act as low-pass filters and must be removed	Load coils prevent DSL service
POTS	DSL with POTS service installation and troubleshooting	Placing a POTS call	Connectivity to exchange	No POTS
Balance	DSL service qualification and troubleshooting	Longitudinal balance, Resistive balance, Capacitive balance	Robustness against noise	Noise decreases the bits-per-tone load/data rate
Noise	DSL service qualification and troubleshooting	Noise with specific band filters	External noise corrupts good data	Noise decreases the bits-per-tone load/data rate
Impulse Noise	DSL troubleshooting	Voltage spikes above specific thresholds	Intermittent effects that cannot be corrected by forward error correction (FEC)	Impulse noise may lead to continuity errors including IPTV pixilation and data retransmission
Loss	DSL service qualification and troubleshooting	Rx/Tx Tones	Attenuation of copper cable	Reduced DSL data rate
SNR	DSL service qualification and troubleshooting	Signal compared to noise level	Enough margin to sustain data rate in changing conditions	Temporary loss of signal or reduced data rate possible
Return Loss	DSL service qualification and troubleshooting	Impedance mismatch	Impedance mismatch—using multiple cable types, causes energy to reflect	Reduced data rate
Near-End Crosstalk (NEXT)	DSL troubleshooting	Noise from near-end	Impact of multiple broadband services in the cable	Reduced data rate
Spectral Analysis	DSL troubleshooting	Spectral noise per frequency	Identify the characteristics of a noise source to fix the problem	Reduced data rate
TDR	DSL troubleshooting	Impedance anomaly and location	Detect and locate faults such as opens, shorts, bridged taps, and wet sections	No sync or reduced data rate
RFL	DSL troubleshooting	Pair under test against a reference using ohmmeter	Resistive fault detection and location	Reduced data rate

Choose the T-BERD/MTS-4000 Function that Meets Your Copper Test Needs

The T-BERD/MTS-4000 offers the broadest and deepest copper access network test capabilities in the industry. It can be configured to deliver:

Standard Copper Testing through Full Spectrum
The T-BERD/MTS-4000 offers extended copper testing to quickly and easily pinpoint physical layer problems.

Basic features include:

– Digital volt-ohm meter (DVOM), measuring AC and DC voltage, current, resistance, and leakage

– Ground check

– Opens measurement

– Signal generator and level meter

– Balance

– Load coil detection

– POTS calls

– Caller identification (CLID) testing

Using Options, the Copper Module also Offers:
– Wideband noise, impulse noise meters, Transmission Impairment Measurement Set [TIMS]; SNR; cross-talk; return loss)

– Graphical spectral analysis (up to 30 MHz)

– Cable fault location with graphical TDR or resistive fault locator (RFL)

Combination Copper/DSL
The Copper Services Module can be configured as a stand-alone copper tester or combined with multiple DSL (xDSL) variants that support:

– ADSL1/2/2+

– VDSL1, VDSL2

– The combination of xDSL and copper functionality provides the capability to install and troubleshoot triple-play services and dispatch copper issues

Combined Copper/DSL/Triple-Play Testing
The Copper Services Module can be equipped with an optional xDSL modem and Triple-Play Services software, which adds the capability to analyze data over the optional modem or the native mainframe Ethernet port and provides:

– Data throughput and Web browser

– VoIP call emulation and monitor

– IPTV (Video) set top box emulation and monitor

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The Right Tool for Today's Copper Tests

The lightweight, rugged, and battery-operated T-BERD/MTS 4000 cost-effectively scales to provide an all-in-one solution for field installation, maintenance, and troubleshooting across a wide range of copper, fiber, and triple-play services test applications. With automation features that improve workforce efficiency, the T-BERD/MTS-4000 is ideally suited to support even the most complex, advanced FTTx networks.

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Specifications

DVOM Measurements

AC voltage	0 to 300 V peak (1% ±0.5 V)
DC voltage	0 to 300 RMS (1% ±0.5 V)
DC current	0 to 110 mA (1% ±0.5 mA)
Resistance	0 to 999 MΩ
Resistance accuracy	0 to 9999 Ω (1% ±5 Ω)
	10 to 99.9 kΩ (±1%)
	100 to 999 kΩ (±3%)
	1 to 9.9 MΩ (±3%)
Leakage (test voltage 130 V)	0 to 1 GΩ

Distance to short distance calculation based on resistance, temperature, and wire gauge

Opens Measurement

Displays the line capacitance or the calculated distance based on selected cable parameters

Distance range	0 to 30 km (0 to 100 kft)
Accuracy	0 to 6 km (20 kft), (±2%)

Noise and Balance

Longitudinal balance	28 to 95 dB
Noise (voice band, C filter/psopho)	0 to 50 dBrnC
	(equivalent to −90 to −40 dBm)
Power (mains) influence	40 to 120 dBrnC
	(equivalent to −50 to +30 dBm)

Miscellaneous

Load coil detection/count	0 to 3 coils
Caller ID day, name, phone number, raw data	
Phone feature pulse or DTMF phone	

TDR (optional)

Very Short range	0 to 305 m (1 kft)
Short range TDR	0 to 600 m (0 to 2 kft)
Medium range TDR	30 m to 2.5 km (100 ft to 8 kft)
Long range TDR	300 m to 5 km (1 to 16 kft)
Extended range	3 to 8 km (10 to 25 kft)
Vp range (velocity of propagation)	0.300 to 0.999 Gain/zoom
HORZ (distance)	manual
VERT (amplitude)	manual or automatic TVG

Graphical display, dual-trace display, and cursor operation for comparison with stored traces

Resistive Fault Location (optional)

Test methods single pair and separate pair hookup

Fault size (RF)	0 to 20 MΩ
Fault location accuracy	0 to 99 Ω (0.1% +0.1 Ω +RF/10 M)
	100 to 999 Ω (0.2% +0.1 Ω+RF/3.5 M)
	Loop size up to 7000 Ω

Spectral Noise

Frequency Range (Hz)	Level Range (dBm)	Level Range (dBm/Hz*)	Level Accuracy (dB)	Resolution (Hz)
10 to 1500	+30 to −80	+28 to −82	±2	1.5
200 to 20k	+13 to −50	5 to −58	±2	15

dB,/Hz = dBm − 10 log (FFT bin bandwidth)

Narrowband Transmit

Frequency Range (Hz)	Frequency Accuracy (Hz)	Level Range (dBm)	Level Resolution (dB)	Level Accuracy (dB)
200 to 20,000	±1	−40 to +6	1	±0.5
200 to 1,000	±1	+6 to +10	1	
1,000 to 20,000	±1	+6 to +10	1	±0.5

Narrowband Receive

Frequency Range (Hz)	Frequency Accuracy (Hz)	Level Range (dBm)	Level Resolution (dB)	Level Accuracy (dB)
200 to 20,000	±1	+13 to −50	1	±0.5

Wideband Transmit

Frequency Range	Frequency Resolution	Frequency Accuracy	Level Range	Level Resolution	Level Accuracy
10 kHz to 30 MHz	1 kHz	0.05%	15 to −40 dBm	1 dBm	±1 dB

Wideband Receive

Frequency Range	Frequency Resolution	Frequency Accuracy	Level Range	Level Resolution	Level Accuracy
10 kHz to 30 MHz	100 Hz	0.06% ±180 Hz	15 to 10 dBm	0.1 dBm	Indicator only
10 kHz to 30 MHz	100 Hz	0.06% ±180 Hz	10 to −70 dBm	0.1 dBm	±1 dB
10 kHz to 30 MHz	100 Hz	0.06% ±180 Hz	−70 to −90 dBm	0.1 dBm	±2 dB

Wideband NEXT

Frequency Range	Level Range	Level Resolution	Level Accuracy
10 kHz to 30 MHz	0 to 80 dB	0.1 dBm	±2 dB

Wideband Noise

Filter	Level Range (dBm)	Level Resolution (dB)	Level Accuracy (dB)
E (ISDN)	+10 to −50	0.1	±1
	−51 to −90	0.1	±2
F (HDSL)	+10 to −50	0.1	±1
	−51 to −85	0.1	±2
G (ADSL)	+10 to −50	0.1	±1
	−51 to −85	0.1	±2
G2 (ADSL2+)	+10 to −50	0.1	±1
	−51 to −85	0.1	±2
J1 (VDSL)	+10 to −50	0.1	±1
J-640K17	−51 to −70	0.1	±2
J2 (VDSL)	+10 to −50	0.1	±1
J-17M25	−51 to −70	0.1	±2
J3 (VDSL)	+10 to −50	0.1	±1
J-17M30	−51 to −70	0.1	±2
J4 (VDSL)	+10 to −50	0.1	±1
J-25M30	−51 to −80	0.1	±2
J6 (VDSL)	+10 to −50	0.1	±1
J-20K12	−51 to −65	0.1	±2
J7 (VDSL)	+ 10 to −50	0.1	±1
J-20K8	−51 to −65	0.1	±2
J8 (VDSL)	+10 to −50	0.1	±1
J20K17	−51 to −65	0.1	±2
J9 (VDSL)	+10 to −50	0.1	±1
No Filter	−51 to −55	0.1	±2

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Specifications

Wideband Impulse Noise

Filter	Center Frequency	Level Range (dBm)	Level Range (dBm)	Level Resolution (dB)	Level Accuracy (dB)
E (ISDN)	7.0 kHz	+10 to −50	80 to 140	0.1	±1
		51 to 90	141 to −175	0.1	±2
F (HDSL)	35.0 kHz	+10 to 50	80 to −140	0.1	±1
		51 to 85	141 to −170	0.1	±2
G (ADSL)	150 kHz	+10 to 50	80 to −140	0.1	±1
		51 to 85	141 to −165	0.1	±2
G2 (ADSL2+)	200 kHz	+10 to 50	80 to −140	0.1	±1
		51 to 85	141 to −160	0.1	±2
J1 (VDSL)	4.0 MHz	+10 to 50	80 to −140	0.1	±1
J-640K17		51 to 70	141 to 150	0.1	±2
J2 (VDSL)	21.0 MHz	+10 to 50	80 to −140	0.1	±1
J-17M25		51 to 70	141 to 150	0.1	±2
J3 (VDSL)	24.0 MHz	+10 to 50	80 to −140	0.1	±1
J-17M30		51 to 70	141 to 150	0.1	±2
J4 (VDSL)	28.0 MHz	+10 to 50	80 to 140	0.1	±1
J-25M30		51 to -80	141 to 155	0.1	±2
J6 (VDSL)	1.0 MHz	+10 to 50	80 to 140	0.1	±1
		51 to 65	141 to 150	0.1	±2
J7 (VDSL)	600 KHz	+10 to 50	80 to 140	0.1	±1
J-20K8		51 to 65	141 to 155	0.1	±2
J8 (VDSL)	1.0 MHz	+10 to 50	80 to 140	0.1	±1
J20K17		51 to 65	141 to 150	0.1	±2
J9 (VDSL)	1.0 MHz	+10 to 50	80 to 140	0.1	±1
No Filter		51 to 55	141 to 145	0.1	±2

Wideband Spectral Noise

Frequency Range	Level Range	Level Range	Level Resolution	Level Accuracy
10 kHz to 30 MHz	+10 to −90 dBm	35 to −140 dBm/Hz	0.1 dBm	±2 dB

Wideband SNR

Frequency Range	Level Range	Level Resolution	Level Accuracy
10 kHz to 30 MHz	0 to 50 dB	0.1 dBm	±2 dB

Wideband Return Loss

Frequency Range	Level Range	Level Resolution	Level Accuracy
10 kHz to 10 MHz	0 to 50 dB	0.1 dBm	±2 dB
10 kHz to 10 MHz	30 to 50 dB	0.1 dBm	Indicator only

Wideband Balance

Frequency Range	Frequency Spacing	Level Range	Level Resolution	Level Accuracy
10 kHz to 2.2 MHz	1 kHz	10 to 60 dB	0.1 dB	±1 dB
10 kHz to 2.2 MHz	1 kHz	>60 dB	0.1 dB	Indicator only
2.21 MHz to 30 MHz	5 kHz	10 to 60 dB	1 dB	±2 dB
2.21 MHz to 30 MHz	5 kHz	>60 dB	1 dB	Indicator only

Wideband Filter Ranges Used for WB SNR, WB Noise, and WB Impulse Noise

Filter	Spec	Lower 3 dB	Center Frequency	Upper 3 dB	Comments
E Filter	IEEE Std 743-1995	1 kHz	7 kHz	50 kHz	
F Filter	IEEE Std 743-1995	4.9 kHz	35 kHz	245 kHz	
G Filter	IEEE Std 743-1995	20 kHz	150 kHz	1.1 MHz	
G2 Filter (aka J5)	None	20 kHz	200 kHz	2.2 MHz	
J1 Filter	None	640 kHz	4.0 MHz	17.664 MHz	J-640K17
J2 Filter	None	17.664 MHz	21.0 MHz	25 MHz	J-17M25
J3 Filter	None	17.664 MHz	24.0 MHz	30 MHz	J-17M30
J4 Filter	None	25 MHz	28.0 MHz	30 MHz	J-25M30
J6 Filter	None	20 kHz	1.0 MHz	12.2 MHz	J-20K12
J7 Filter	None	20 kHz	600 kHz	8.5 mHz	J-20K8
J8 Filter	None	20 kHz	1.0 MHz	17.0 MHz	J-20K17
No Filter (aka J9)	None	20 kHz	1.0 MHz	30.0 MHz	J-20K30

Specifications

Over-Voltage Protection Specifications

Mode	Working Voltage	Trip Voltage
All	250 VDC, 175 VAC RMS	350 VDC, 250 VAC +20%

Ordering Information

4000-CU	Copper Services Module
4000-CU-VDSL-INF	Copper Service Module with Infineon VDSL/ADSL Interface
4000-TDR	Time Domain Reflectometer/Reflective Fault Locator
4000-WBTONES	Wideband Tones/Spectral Analysis

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