



Enabling Australia's Field Technicians to build, troubleshoot and maintain better communications networks.



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FREECALL 1800 680 680

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.

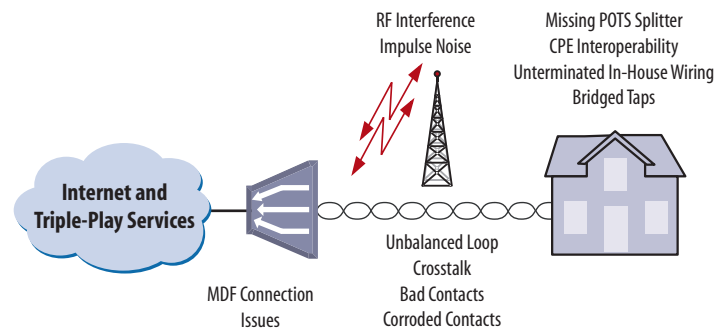


Figure 1: Standard copper qualification may show acceptable results for typical problem areas such as attenuation and noise, but many issues impact copper quality in today's demanding next-generation service environment, particularly unterminated in-house wiring with bridged taps that lead to unexpected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

3

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

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.



6

Specifications

DVOM Measurements

| | |
|---|--|
| AC voltage | 0 to 300 V peak (1% \pm 0.5 V) |
| DC voltage | 0 to 300 RMS (1% \pm 0.5 V) |
| DC current | 0 to 110 mA (1% \pm 0.5 mA) |
| Resistance | 0 to 999 M Ω |
| Resistance accuracy | 0 to 9999 Ω (1% \pm 5 Ω) 10 to 99.9 k Ω (\pm 1%) 100 to 999 k Ω (\pm 3%) 1 to 9.9 M Ω (\pm 3%) |
| Leakage (test voltage 130 V) | 0 to 1 G Ω |
| 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), (\pm 2%) |

Noise and Balance

| | |
|-------------------------------------|--|
| Longitudinal balance | 28 to 95 dB |
| Noise (voice band, C filter/psopho) | 0 to 50 dBmC (equivalent to -90 to -40 dBm) |
| Power (mains) influence | 40 to 120 dBmC (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 M Ω |
| 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 | \pm 2 | 1.5 |
| 200 to 20k | +13 to -50 | 5 to -58 | \pm 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 | \pm 1 | -40 to +6 | 1 | \pm 0.5 |
| 200 to 1,000 | \pm 1 | +6 to +10 | 1 | |
| 1,000 to 20,000 | \pm 1 | +6 to +10 | 1 | \pm 0.5 |

Narrowband Receive

| Frequency Range (Hz) | Frequency Accuracy (Hz) | Level Range (dBm) | Level Resolution (dB) | Level Accuracy (dB) |
|----------------------|-------------------------|-------------------|-----------------------|---------------------|
| 200 to 20,000 | \pm 1 | +13 to -50 | 1 | \pm 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 | \pm 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% \pm 180 Hz | 15 to 10 dBm | 0.1 dBm | Indicator only |
| 10 kHz to 30 MHz | 100 Hz | 0.06% \pm 180 Hz | 10 to -70 dBm | 0.1 dBm | \pm 1 dB |
| 10 kHz to 30 MHz | 100 Hz | 0.06% \pm 180 Hz | -70 to -90 dBm | 0.1 dBm | \pm 2 dB |

Wideband NEXT

| Frequency Range | Level Range | Level Resolution | Level Accuracy |
|------------------|-------------|------------------|----------------|
| 10 kHz to 30 MHz | 0 to 80 dB | 0.1 dBm | \pm 2 dB |

Wideband Noise

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

7

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 51 to 90 | 80 to 140 141 to -175 | 0.1 0.1 | ±1 ±2 |
| F (HDSL) | 35.0 kHz | +10 to 50 51 to 85 | 80 to -140 141 to -170 | 0.1 0.1 | ±1 ±2 |
| G (ADSL) | 150 kHz | +10 to 50 51 to 85 | 80 to -140 141 to -165 | 0.1 0.1 | ±1 ±2 |
| G2 (ADSL2+) | 200 kHz | +10 to 50 51 to 85 | 80 to -140 141 to -160 | 0.1 0.1 | ±1 ±2 |
| J1 (VDSL) J-640K17 | 4.0 MHz | +10 to 50 51 to 70 | 80 to -140 141 to 150 | 0.1 0.1 | ±1 ±2 |
| J2 (VDSL) J-17M25 | 21.0 MHz | +10 to 50 51 to 70 | 80 to -140 141 to 150 | 0.1 0.1 | ±1 ±2 |
| J3 (VDSL) J-17M30 | 24.0 MHz | +10 to 50 51 to 70 | 80 to -140 141 to 150 | 0.1 0.1 | ±1 ±2 |
| J4 (VDSL) J-25M30 | 28.0 MHz | +10 to 50 51 to -80 | 80 to 140 141 to 155 | 0.1 0.1 | ±1 ±2 |
| J6 (VDSL) | 1.0 MHz | +10 to 50 51 to 65 | 80 to 140 141 to 150 | 0.1 0.1 | ±1 ±2 |
| J7 (VDSL) J-20K8 | 600 KHz | +10 to 50 51 to 65 | 80 to 140 141 to 155 | 0.1 0.1 | ±1 ±2 |
| J8 (VDSL) J20K17 | 1.0 MHz | +10 to 50 51 to 65 | 80 to 140 141 to 150 | 0.1 0.1 | ±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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