Copper Testing Made Easy
Using the JDSU HST-3000C Handheld Services Tester

Key Features

- Complete copper testing from plain old telephone service (POTS) to full-spectrum Very High Speed Digital Subscriber Line (VDSL2+) at 30 MHz
- Unique fault-finding Time Domain Reflectometer (TDR) with time-varying gain (TVG) and auto identification
- Flexible hardware and software options to suit all requirements
- Custom JDSU scripting and automated test features that simplify testing
- Cost-effective and process-improving "one man out" testing using a far-end device (the JDSU UltraFED)
- Outdoor-readable color screen, robust memory capacity, and advanced processing capabilities

Benefits

- Industry-leading access network tester with the leading range of copper-to-cutting-edge functionality
- Customizable applications that create operational efficiencies that lower operating costs and improve customer service
- Repeatable functionality enables technicians to ramp-up quicker and resolve issue quickly, resulting in reduced repeat rates
- Flexible connectivity enables user to export results to a PC or back-office system
- Provides a rugged, handheld platform ideal for field use

Service providers today compete in a market where constant pressure exists to maximize revenue through additional service offerings while simultaneously ensuring high customer quality of experience (QoE). As the demand for new services such as real-time, highly compressed Internet Protocol Television (IPTV) grow, they stretch the physical capabilities of copper circuits. Prior to these new wideband service offerings, copper testing was less complex and more easily accomplished, but today ADSL2+ and VDSL2 deployments demand more from the existing copper infrastructure. At the same time, service providers are striving to reduce operational expenses using less-experienced field engineers who are untrained for these challenges.

JDSU, the industry leader in broadband communications test and measurement solutions, has set the standard for supporting the demanding copper-based service deployments with the all-in-one HST-3000C Handheld Services Tester. From its industry-leading copper test features to its full complement of IP application test suites for voice, video, and data, the HST-3000C turns up new service or quickly resolves trouble tickets in the home and throughout the access network. The HST-3000C is a unique test tool that will quickly find the root cause of service problems in the most demanding and advanced copper infrastructures. With automated testing and troubleshooting applications, the HST-3000C can help new engineers find faults quickly and accurately—reducing mean time to repair (MTTR). Double-ended testing in "one man out" environments (using the HST-3000C and JDSU UltraFED) further improves efficiencies in difficult test environments.
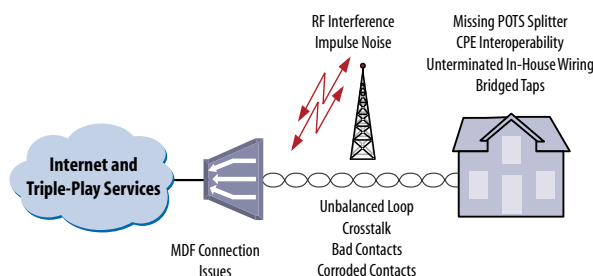
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Figure 1: Standard copper qualification may show acceptable results for typical problem areas such as attenuation and noise, but many issues impact copper quality in today's demanding next-generation service environment. Chief among them is unterminated in-house wiring with bridged taps that lead to unexpected effects when using new frequencies up to 30 MHz.

Overview of Copper Tests

Today's copper network requires tests that challenge the capabilities of even the best field teams. Typical tests required in today's advanced copper network include:

| 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 any load coils and location	Load coils act as lowpass 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 degreases the bits-per-tone load/data rate
Impulse Noise	DSL troubleshooting	Voltage spikes above specific thresholds	Intermittent effects not corrected with forward error correction (FEC)	Impulse noise may lead continuity errors, including IPTV pixelization 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
Far-End Crosstalk (FEXT)	DSL troubleshooting	Noise from far-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
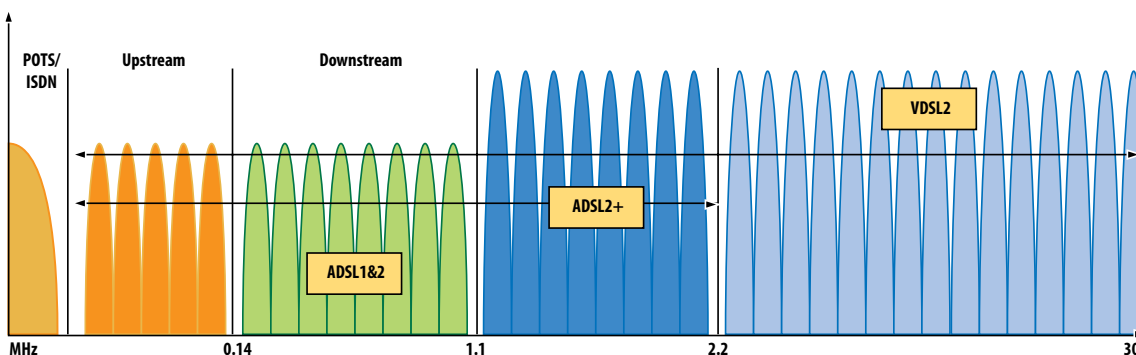
Figure 2: Copper testing becomes far more challenging with the introduction of ADSL2+ and VDSL2, because frequencies expand to unknown territories. Test requirements move beyond static copper characteristics with attenuation of the copper loop to dynamic parameters such as impulse noise and RF interference. Unterminated in-house wiring with bridged taps can show unexpected effects using high frequencies up to 30 MHz.

Choose the HST-3000C Function that Meets Your Copper Test Needs

The HST-3000C offers the broadest and deepest copper access network tester and the industry's best legacy-to-cutting-edge functionality:

HST-3000C Base Unit for Standard Copper Testing

The HST-3000C offers extended copper testing to quickly and easily pinpoint physical layer problems. The base unit features include:

- Digital volt-ohm meter (DVOM), measuring AC and DC voltage, current, resistance, and leakage
- Opens measurement
- Signal generator and level meter
- Balance
- Load coil detection
- Caller identification (CLID) testing
- POTS calls
- Automated testing with the JDSU UltraFED or single-ended loop testing (SELT)

Using software options, the base unit also offers:

- Noise and impulse noise meters (Transmission Impairment Measurement Set [TIMS]; SNR; cross-talk; return loss)
- Graphical spectral analysis (up to 3.6 MHz)
- Cable fault location with graphical TDR or resistive fault locator (RFL)
- Wideband TIMS

The HST-3000C base unit tests from narrowband to 2.2 MHz

Copper Modules from Narrowband up to Wideband II (30 MHz)

The JDSU Wideband II (WBII) Module can be a stand-alone copper tester or combined with multiple Digital Subscriber Line (xDSL) variants that support:

- Asymmetric digital subscriber line (ADSL)1/2/2+
- Symmetric high-speed digital subscriber line (G.SHDSL) 2/4-wire
- Very high-speed digital subscriber line (VDSL)1, VDSL2
- Combined with xDSL and copper functions equips the test instrument with the tests needed to install and troubleshoot triple-play services and dispatch copper issues

WBII for VDSL2 Testing (30 MHz)

In addition to its stand-alone features, the WBII Service Interface Module (SIM) is available in combination with VDSL/VDSL2 test SIMs and provides complete copper testing to support ADSL1/2/2+, VDSL1, and VDSL/VDSL2 triple-play deployments:

- Expanded copper testing frequency range
- Transmit/receive (Tx/Rx) tones ranging from 25 kHz to 30 MHz
- Wideband Noise measurements from +15 to –90 dBm
- Impulse Noise measurements from +15 to –90 dBm and ±3 dB sub-thresholds, timestamp
- Impulse noise capture
- Short-range high-resolution TDR
- Specific VDSL2 band plan filters
- Spectral analysis to 30 MHz (–28 to –150 dBm/Hz), one-button zoom to VDSL bands and causes of interference, maximum hold functionality
- Wideband return loss, SNR, NEXT

UltraFED for "One Man Out" Testing

The JDSU UltraFED is a low-cost and easy-to-use far-end device for pre-qualifying and locating faults in copper circuits for very high bandwidth services. Key features include:

- Full copper qualification and troubleshooting from voiceband (300 Hz, POTS) to VDSL2 up to 30 MHz
- Through mode testing
- Manual UltraFED control in the HST-3000C
- Dual pair testing
- AC adapter for extended use inside central office/exchange
- Extended battery operation (greater than 20 hours of continuous use)

Software Options for Advanced Troubleshooting

All software options for the HST-3000C are field-upgradeable. Software options to enhance the HST-3000C copper test features include:

- Transmission Impairments option
- Wideband (WB) option
- Spectral Noise Software option
- TDR
- RFL

The Right Tool for Today's Copper Tests

Lightweight, rugged, and battery-operated, the HST-3000C cost-effectively scales to provide an all-in-one solution for field installation, maintenance and troubleshooting across a wide range of copper test applications.

The modular design of the HST-3000C meets the full range of test applications required by field technicians responsible for access network service installation and maintenance. With automation features that improve productivity and workforce efficiency, the HST-3000C is ideally suited to support even the most complex and advanced copper access networks.

Contact JDSU today to learn how to equip your field technicians with the HST-3000C—the right field test tool for the converged services world.