Easy Copper Testing

Using the Viavi HST-3000C Handheld Services Tester

Viavi Solutions, the industry leader for broadband communications test and measurement solutions, has set the standard for supporting demanding copper-based service deployments with the all-in-one HST-3000C Handheld Services Tester. The HST-3000C's industry-leading copper test features and full complement of IP application voice, video, and data tests help engineers quickly turn up new services or resolve in-home and access network trouble tickets.

This unique test tool can help users quickly find the root cause for service problems in the most demanding, advanced copper infrastructures. Its automated testing and troubleshooting applications can help new engineers find faults quickly and accurately, reducing mean time to repair (MTTR). Double-ended testing (using the HST-3000C and Viavi UltraFED) in one-man-out environments further improves efficiencies in difficult test environments.

Service providers today are under constant pressure to maximize revenue by providing additional services while ensuring high customer quality of experience (QoE). Growing demand for new services like real-time, highly compressed internet protocol television (IPTV) stretch the physical capabilities of copper circuits. Prior to these new wideband services, copper testing was less complex and easier to accomplish, but today's ADSL2+ and VDSL2 deployments demand more from the existing copper infrastructure. Meanwhile, service providers strive to reduce operational expenses with less-experienced field engineers who are untrained to meet these challenges.

Key Benefits

- Industry-leading access network tester with the leading range of copper-to-cutting-edge functionality
- Customizable applications streamline operations to lower operating costs and improve customer service
- Repeatable functionality helps technicians ramp-up faster and resolve issues quickly, reducing repeat rates
- Flexible connectivity let users export results to a PC or back-office system
- Rugged, handheld platform is ideal for field use

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 Viavi scripting and automated test features that simplify testing
- Cost-effective and process-improving "one man out" testing using a far-end device (the Viavi UltraFED)
- Outdoor-readable color screen, robust memory capacity, and advanced processing capabilities

As Figure 1 shows, 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, especially unterminated in-house wiring with bridged taps that lead to unexpected effects when using new frequencies up to 30 MHz.

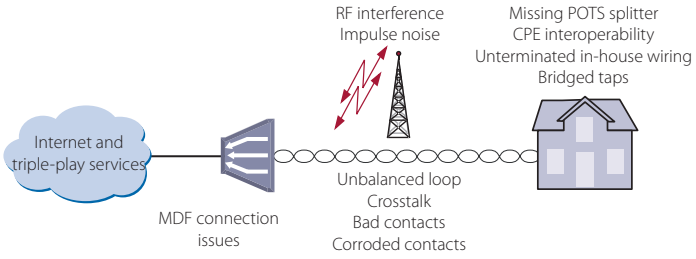

Figure 1. Copper quality issues in today's next-generation service environment

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 trouble-shooting	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

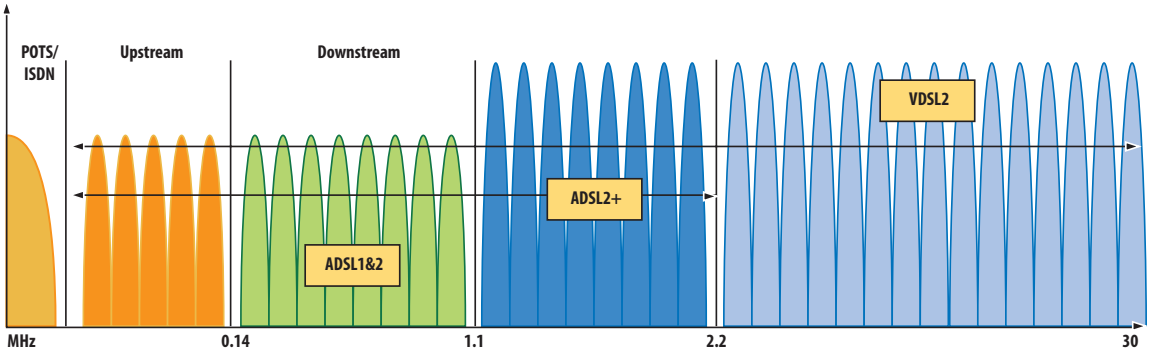

Figure 2. The impact of introducing ADSL 2+ and VDSL2 in copper testing for frequencies up to 30 MHz

As Figure 2 shows, 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 copper loop attenuation to dynamic parameters like 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-3000CBase Unit for Standard Copper Testing (from narrowband to 2.2 MHz)

The HST-3000C offers extended copper testing to quickly and easily pinpoint physical layer problems and includes these features:

- 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 Viavi UltraFED or single-ended loop testing (SELT)

With software options:

- 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

Narrowband to Wideband II Copper Modules (30 MHz)

The Viavi Wideband II (WBII) Module can be used as a stand-alone copper test instrument or combined with multiple digital subscriber line (xDSL) variations to support:

- Asymmetric digital subscriber line (ADSL)1/2/2+
- Very high-speed digital subscriber line (VDSL)1, VDSL2
- Combined with xDSL and copper functions equips the test instrument with tests required 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 for complete copper testing to support ADSL1/2/2+, VDSL1, and VDSL/VDSL2 triple-play deployments:

- Expanded copper testing frequency range
- 25 kHz to 30 MHz transmit/receive (Tx/Rx) tones
- +15 to −90 dBm wideband noise measurements
- +15 to −90 dBm impulse noise measurements 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 Viavi 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 and automated UltraFED control in the HST-3000C
- Dual pair testing
- AC adapter for extended use inside central office/exchange
- Extended battery operation (more than 20 hours of continuous use)

Advanced Troubleshooting Software Options

All software options for enhanced HST-3000C copper test features are field-upgradeable and 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 that field technicians who install and maintain access networks need. Its automation features improve productivity and workforce efficiency, making it ideally suited to support even the most complex and advanced copper access networks.

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

Contact Us **+1 844 GO VIAVI**
(+1 844 468 4284)

To reach the Viavi office nearest you,
visit viavisolutions.com/contacts.

hstcopper-pb-tfs-nse-ae
30149443 901 0514