HST-3000

Wideband Copper II (WBII) Service Interface Module (SIM)

Key Features

- Complete copper testing to support VDSL/VDSL2 and triple-play deployments
- Expanded copper testing frequency range
  - TX/RX Tones ranging from 28 kHz to 30 MHz
  - Wideband Noise measurements from +15 to –90 dBm
  - Impulse Noise measurements from +15 to –60 dBm
  - Spectral analysis with spectral masks and band plans up to 30 MHz (–28 to –150 dBm/Hz)
- Wideband copper SIM functionality available in combination with VDSL/VDSL2 test SIMs

The JDSU HST-3000 equipped with the Wideband Copper II (WBII) Service Interface Module (SIM) delivers comprehensive copper testing, including the special requirements of very high-speed digital subscriber line (VDSL), in a rugged, modular platform ideal for field use.

Providers face a significant challenge when implementing VDSL as part of various fiber (FTTx) deployments because the copper plant traditionally has not been qualified to withstand the stringent needs of VDSL service delivery. The new spectrum that VDSL uses expands the use of the installed plant into unfamiliar territory. Early VDSL testing has shown that the plant is susceptible to impulse noise not encountered in the current ADSL usage spectrum. In addition, the detection of short bridged taps, which create a much greater impact on VDSL signals than on asymmetric digital subscriber line (ADSL) signals, becomes much more critical in VDSL testing.

While experts disagree on the merits of pre-qualification of copper loops in preparation for service deployment, until now most have considered any wide-band qualification in ADSL deployments cost prohibitive. However, in VDSL deployments where high-value triple-play services are carried, pre-qualification generally is considered possible and required for the access plant. The HST-3000 incorporates a rugged, weather-resistant design and long battery life that are ideally suited for use in the field and its modularity allows for field upgrades to support new testing requirements. The HST-3000 is easily upgradeable with technologies and advanced options that support the changing needs of service installers and its dynamic configurability allows it to be used by different technicians with different responsibilities to perform a variety of tests. Standard Ethernet, Universal Serial Bus (USB), and serial connections offer flexibility to easily download software and offload captured test data.

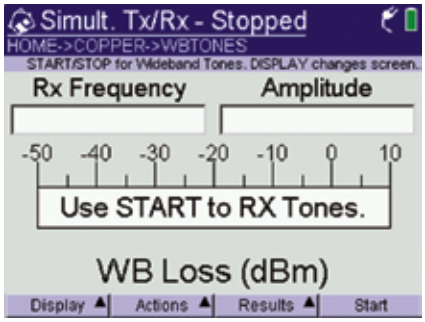
Architecture

Fully compatible with the HST-3000-NG and HST-3000C-NG mainframes, the HST-3000 WBII SIM includes an internal copper measurement board that enhances the functionality of the HST-3000C-NG mainframe copper measurement board and adds limited wideband copper test capability to non-copper test mainframes.

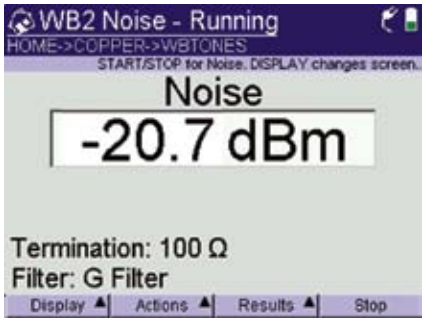
The WBII SIM features dual Tip and Ring (T&R) and Ground interfaces. Due to high-frequency range and measurement sensitivity, this SIM supports special test cables, which can also be used with existing HST-3000C-NG copper test functions. For the most accurate results, use of specially insulated cables for testing higher frequency services such as VDSL2 is recommended.

Multiple views of the HST-3000 WBII SIM

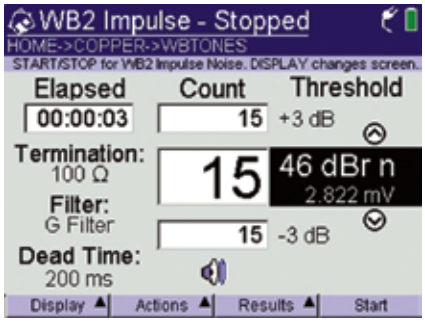
Key Functionality



Toning screen



Noise screen



Impulse Noise and Capture screen

Impedance

The HST supports both 100 and 135 ohms impedance for both TX and RX.

Toning

Toning functionality enables the transmission of tones through T&R across the frequency range at the desired amplitude with source impedance of 100 or 135 ohms. The hot list of the WBII SIM offers a range of frequencies: 1.1, 2.2, 4, 10, 12, 17.6, and 25 MHz. If users select a frequency from the hot list, they can cycle to other frequencies by simply pushing the left or right arrow. Users can also enter a custom frequency within range.

The Meter View Result screen allows users to receive tones through T&R and shows the frequency and amplitude with either a 100- or 135-ohm termination. The List View displays results as an ongoing list. Users may send over T1/R1 and receive over T/R simultaneously with a selectable TX and RX status view.

Noise

WBII Noise conducts a single-pair measurement of aggregate noise in a frequency band on T&R. The higher the negative number, the lower the average noise power will be. Users may select a filter and a termination of 100 or 135 ohms with the results displayed in dBm.

– Terminations: 100 and 135 ohms

– Filters: G, G2, J-20K8, J-20K12, J-20K17, J-20K30, J-640K17, J-17M25, J-17M30, and J-25M30

– Frequency Range limited by filter selection. See General Specifications for filter information.

Impulse Noise and Capture

Impulse Noise consists of intermittent interference voltages coupled into a pair from electromagnetic fields. These fields may result from inductive load switching, such as compressors or other devices that radiate fields, including lights, microwaves, and televisions. WBII Impulse Noise and Capture is a single-pair measurement on T&R, which counts voltage level threshold crossings. Options include settings for the Threshold in dB or dBrn, termination to 100 or 135 ohms, Dead Time, test duration, and filter selection. Impulse Capture enables users to view an event on the screen that causes a threshold crossing.

– Terminations: 100 and 135 ohms

– Filters: G, G2, J-20K8, J-640K17, J-17M25, J-17M30, J-25M30, and No Filter

– Frequency Range limited by filter selection. See General Specifications for filter information.

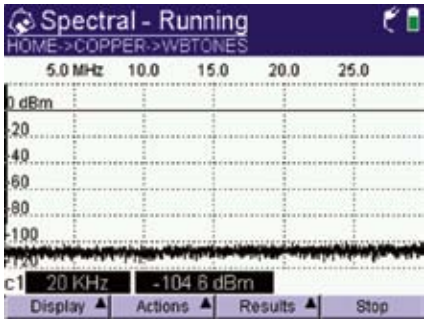
– Dead Time: 10 to 1000 ms

– Settable time periods: 1 to 60 minutes in 1-minute increments, or continuous

– Multiple counters provide a + 3dB delta from main threshold

– Capture: ±10 µs around event

– Capture has no Dead Time, Timer, or Threshold deltas



Spectral Noise screen

Spectral Noise

The WBII SIM allows users to choose a span to view plotted noise through T&R with a 100- or 135-ohm termination and to zoom in on the X or Y axis. Moving the cursor to an event displays the frequency and amplitude of the signal at that point, and the level result is selectable in dBm or dBm/Hz. Views include upstream or downstream VDSL bands, valid technologies, and applicable amateur radio bands, which zoom in on the X and Y axis around the band of interest and place the cursor in the middle.

– Impedance: 100 and 135 ohms

– No filter selection

– Level accuracy:Same as RX Tones for tone at bin center. For off-center tones: –1.4

– Windows: Hanning

Spectrum Analyzer Range (Zoom by Band Plan)

When users zoom based on technology, the WBII SIM adjusts the upper frequency range and cursor location according to center frequency of the technology under test.

Spectral Monitoring

ADSL2+ and VDSL2 allow more flexibility for customized DSL services but the spectrum is difficult to control, especially for VDSL2 with multiple upstream and downstream bands and profile shaping up to frequencies of 30 MHz. The HST-3000 can test VDSL2 performance and also test the Power Spectrum Density (PSD) of live DSL circuits:

– Connect to live xDSL circuits and test the used spectrum

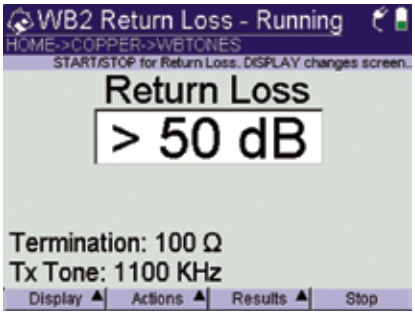
– Check spectrum is within regulatory obligations

– Verify "shaped profiles" for outdoor VDSL2 DSLAMs

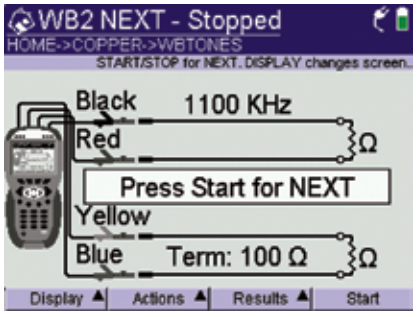
– Test spectrum during xDSL training cycle

– Compare out-of-service spectrum with live DSL spectrum

Example of HST-3000 performing Spectral Monitoring



Return Loss screen



NEXT screen

SNR screen

Return Loss

Return Loss is a single-pair measurement of impedance on T&R compared to the source at frequency, which is used to determine the matching characteristics of the line. A mismatched line reflects transmitted signals back toward the source. The farther from the source impedance (above or below), the lower the result in dB will be. Users may select an impedance of 100 or 135 ohms and a transmit amplitude of 0, +5, or +10 dB. The result displays in dB on a graphed sweep or a spot result for a single frequency.

– Impedances: 100 and 135 ohms

– No filter selection

Near-End Crosstalk

Crosstalk between adjacent pairs occurs primarily as a result of capacitive or inductive coupling, which leads to interference on the circuit, thus reducing the signal-to-noise ratio (SNR). Near-end crosstalk (NEXT) is a two-pair measurement with transmit on T1 and R1 and receive on T&R. The test determines pair-to-pair coupling at the same end of the circuits using the local transmitter. The higher the result in dB, the less crosstalk or coupling there is between the pairs. Users may set the source impedance/termination and the frequency of the test signal. The result displays in dB on a graphed sweep or a spot result for a single frequency.

– TX Level: 0 dB

– Impedances: 100 and 135 ohms

– No filter selection

Signal-to-Noise Ratio

SNR is a single-pair measurement on T&R that measures the noise immunity of a circuit by comparing the good signal-to-noise power using a spot frequency. This measurement looks for a signal, and when it finds it compares the level of that signal with the average noise surrounding it. The higher the result in dB, the more margin there is between the signal and the noise. The closer the noise is to the signal, the lower the result. Users may select a filter and a termination of 100 or 135 ohms. The result displays in dB. This test requires a signal source of an appropriate amplitude and frequency at the far end.

– Terminations: 100 and 135 ohms

– Filters: G, G2, J-20K8, J-20K12, J-20K17, J-20K30, J-640K17, J-17M25, J-17M30, and J-25M30

– Frequency Range limited by filter selection. See General Specifications for filter information

– Noise and signal level accuracy same as WBII Noise

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Specifications

Physical

Size (h x w x d)	241 x 114 x 70 mm (9.5 x 4.5 x 2.75 in)
Weight (with battery)	1.23 kg (2.7 lbs)
Operating temperature	–5.5 to 50°C (22 to 122°F)
Storage temperature	–40 to 65.5°C (–40 to 150°F)
Battery life	10 hrs. typical usage
Charging time	7 hrs. from full discharge to full charge
Operating humidity	10 to 80% relative humidity
Storage humidity	10 to 95% relative humidity
Display	3.8" diagonal, 1/4 VGA, Color Active Matrix with backlight (readable in direct sunlight)

General

Ruggedness	Survives 91 cm (3 ft) drop to concrete on all sides
Water-resistant	Splashproof (may be used in heavy rain)
Languages	English, German, French, Spanish, Italian, Chinese, Turkish
Keypad	Typical 12-button keyboard

Wideband II Measurement

Result	Range	Res.	Accuracy
RX Tones	25 kHz to 17.6 MHz	100 Hz	±1000 dB
	17.7 to 30 MHz	100 Hz	±1600 dB
0 to –5 dBm	25 to 50 kHz	1 dB	±2 dB
0 to –69 dBm	51 to 100 kHz	1 dB	±1.5 dB
+15 to –69 dBm	100 kHz to 30 MHz	0.1 dB	±1 dB
–70 to –90 dBm	25 kHz to 30 MHz	0.1 dB	±2 dB
TX Tones	25 kHz to 30 MHz	1000 Hz	±0.01%
0 to –5 dBm	25 to 50 kHz	1 dB	±2 dB
0 to –40 dBm	51 to 100 kHz	1 dB	±1.5 dB
+14 to –40 dBm	100 kHz to 9.99 MHz	1 dB	±1.0 dB
+14 to –40 dBm	10 to 30 MHz	1 dB	±1.5 dB
WB Noise			
with G filter	15 to –50 dBm	0.1 dB	±1 dB
	–51 to –85 dBm	0.1 dB	±2 dB
w/ other filters	15 to –50 dBm	0.1 dB	±1 dB
	–51 to –75 dBm	0.1 dB	±2 dB
Impulse Noise with any filter	32 to 105 dBrn (–58 to +15 dBm)	1 dB	±2 dB threshold
Return Loss		0.1 dB	
Freq. Range	50 kHz to 10 MHz		±1.5 dB for results between 0 and 10 dB
TX Range	0, 5, and 10 dB		±2.5 dB for results between 11and 25 dB
Termination	100/120/135 Ω		
NEXT			
Freq. Range	25 kHz to 30 MHz	1000 Hz	
Level	0 to 80 dB	0.1 dB	±2 dB at crosstalk
Termination	100/135 Ω		0 to 50 dB
SNR			
Freq. Range	25 kHz to 30 MHz		
Level	0 to 50 dB	0.1 dB	±2 dB for results between 5 and 40 dB
Termination	100/135 Ω		
Balance	0 to 60 dB	1 dB	±2 dB

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Specifications (Cont)

Wideband II Measurement

Filter	Lower 3 dB	Upper dB	Measurement	Specification
No Filter	50 kHz	35 MHz	Impulse	None
G Filter (ADSL)	50 kHz	1.1 MHz	SNR Noise Impulse	IEEE Std 743-1995 Complies above 50 kHz
G2 Filter (ADSL2+)	20 kHz	2.2 MHz	SNR Noise Impulse	None
J-20K8 Filter (VDSL2-8)	25 kHz 25 kHz 25 kHz	8.5025 MHz 8.5025 MHz 8.5025 MHz	SNR Noise Impulse	None
J-20K12 Filter (VDSL/VDSL2-12)	25 kHz 25 kHz	12.0025 MHz 12.0025 MHz	SNR Noise	None
J-20K17 Filter (VDSL2-17)	25 kHz 25 kHz	17.0025 MHz 17.0025 MHz	SNR Noise	None
J-20K30 Filter (VDSL2-30)	25 kHz 25 kHz	30.0025 MHz 30.0025 MHz	SNR Noise	None
J-640K17 Filter	640 kHz 640 kHz 400 kHz	17.6 MHz 17.6 MHz 17.6 MHz	SNR Noise Impulse	None
J-17M25 Filter	17.6 MHz 17.6 MHz 17.6 MHz	25 MHz 25 MHz 25 MHz	SNR Noise Impulse	None
J-17M30 Filter	17.6 MHz 17.6 MHz 17.6 MHz	30 MHz 30 MHz 30 MHz	SNR Noise Impulse	None
J-25M30 Filter	25 MHz 25 MHz 25 MHz	30 MHz 30 MHz 30 MHz	SNR Noise Impulse	None

Ordering Information

Base Unit

HST3000-NG	HST-3000 Mainframe without Copper (Color)
HST3000C-NG	HST-3000 Copper Mainframe (Color)

Available SIMS (Modules)

HST3000-CUCE	Copper only SIM, CE Marked
HST3000-AR2A-T1	ASDL2+ T1 (ATU-R, Annex A)
HST3000-AR2A	ADSL1/2/2+ (ATU-R, Annex A)
HST3000-AR2B	ADSL1/2/2+ (ATU-R, Annex B)
HST3000-AR2B-T1	ADSL2+ T1 (ATU-R, Annex B)
HST3000-CAR2A	ADSL1/2/2+ with Copper (ATU-R, Annex A)
HST3000-CAR2A-T1	Copper, ADSL2+ T1 (ATU-R, Annex A)
HST3000-CAR2B	ADSL1/2/2+ with Copper (ATU-R, Annex B)
HST3000-CAR2B-T1	Copper, ADSL2+ T1 (ATU-R, Annex B)
HST3000-CARB	Annex B Copper/ATU-R
HST3000-CARCA	Copper and ATU-R/C Dual Mode, AoPOTS
HST3000-CARCB	Copper and ATU-R/C Dual Mode, AoISDN
HST3000-CARCE	Copper and ATU-R (Annex A), CE Marked
HST3000-WB2	Wide Band 2 (up to 30 MHz) Copper Test
HST3000-VDSL-CNXT	VDSL with Connexant Chipset
HST-3000-VDSL-CNXT-WB2	VDSL and Copper (up to 30 MHz) with Connexant Chipset
HST3000-VDSL-IK	VDSL with Ikanos Chipset
HST-3000-VDSL-IK-WB2	VDSL and Copper (up to 30 MHz) with Ikanos Chipset
HST3000-INF-VDSL	VDSL with Infineon Aware Chipset
HST-3000-INF-VDSL-WB2	VDSL and Copper (up to 30 MHz) with Infineon Aware Chipset
HST3000-ETH	10/100/1000 Ethernet
HST3000-CT1	T1 and Copper
HST3000-DC	Datacom
HST3000-E1	E1
HST3000-E1-DC	E1/Datacom
HST3000-4WLL	4-Wire Local Loop
HST3000-T1	Dual TX/RX Bantam T1 Interface and T1
HST3000-T3	Dual TX/RX Bantam T1 Interface, and Dual RX/Single TX BNC DS3 Interface/and DS3
HST-BRA	ETSI (Euro) ISDN BRA
HST3000-BRI	ISDN BRI
HST3000-CSHCE	G.SHDSL and Copper
HST-GSH	G.SHDSL
HST3000-GSHCE	2-Wire G.SHDSL
HST3000-CSH4	Copper, 4-Wire G.SHDSL (STU-R/C, Annex A/B)
HST3000-BLK	Blank

Software Options

HST3000-BLUETOOTH	Bluetooth Wireless
HST3000S-WEB	Web Browser
HST3000-REMOP	Remote Operation
HST3000-SCRIPT	Scripted Test
HST3000-DSL2	ADSL2 and ADSL2+
HST3000S-IP	Advanced IP Suite—PING and Through Mode Support
HST3000S-IP-Video	IP Video Analysis
HST3000S-VMOS	Video MOS Analysis
HST3000-MSTV	Microsoft IPTV Video Analysis
HST3000-VT100	VT100 Emulation
HST3000S-VOIP	VoIP Software Analysis
HST3000S-H.323	H.323 VoIP Signaling
HST3000S-MGCP	SCCP MGCP VoIP Signaling
HST3000S-MOS	VoIP Mean Opinion Score
HST3000S-SCCP	SCCP VoIP Signaling
HST3000S-SIP	SIP VoIP Signaling
HST3000-UNISTIM	VoIP Signaling Call Controls for UNISTIM
HST3000-OPTETH	Optical Ethernet
HST3000-IPV6	IPv6
HST3000-MPLS	MPLS
HST3000-MSTR	Multiple Streams
HST3000-TCPUDP	TCP/UDP
HST3000-FTP	FTP
HST3000-WBTONES	WB TIMS
HST3000-PCMTIMS	TIMS (PCM)
HST3000-PCMSIG	Signaling (PCM)
HST3000-SPE	Spectral Noise
HST3000-RFL	RFL
HST3000-TDR	TDR
HST3000-PRI	ISDN PRI (NC Standard)
HST3000-ST	Basic Rate ISDN S/T (ANSI)
HST3000-T1DDS	DDS-T1
HST3000-TxIMP	Transmission Impairments
HST3000-FR	Frame Relay
HST3000-PS	Pulse Shape

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 30149044 003 0512 HSTCOPPERSIM.DS.ACC.TM.AE May 2012