

HST-3000

Ethernet Service Interface Module (SIM)



Key Features

- Portable test set addresses the needs of Layer 1 thru Layer 7 testing with IPv6 Capability
- Supports Electrical and Optical Ethernet testing in a single module
- Performs traffic generation up to interface line rate and supports automated RFC2544 at Layers 2 to 4 (Eth/IP/TCP/UDP)
- IPv6 option enables installation and troubleshooting of IPv6 networks
- Generates and analyzes traffic with various encapsulation schemes such as VLAN, VLAN Stacking (Q-in-Q), and MPLS
- Dual-port 'Thru Mode' configuration enables live traffic analysis
- PPPoE protocol support for emulation of data traffic in the last mile
- Simplified user interface facilitates ease-of-use and minimizes technicians' learning curves



Introducing next generation Ethernet/IP-based services over carrier-grade Metro Ethernet networks yields increases in both complexity and costs for service providers. These networks facilitate service aggregation and work in concert with different network infrastructures and tunneling technologies (VLANs, MAC-in-MAC, and VPLS/MPLS) that provide common Quality of Service (QoS), traffic engineering, redundancy, and scalability across the service infrastructure. The JDSU HST-3000, equipped with the Ethernet Service Interface Module (SIM) and mainframe's VoIP and IP Video options, addresses the broad requirements for 7-layer testing in a rugged, modular platform that is ideal for field use.

Carrier-grade Metro Ethernet networks are emerging as key components in business (VoIP, Disaster Recovery, Video Conferencing, etc.) and consumer (triple-play) service delivery. Triple-play networks, which transmit voice, video, and data traffic, present a unique set of challenges. Service providers for these network environments are now responsible for delivering a service with the Quality of Experience (QoE) requirement, rather than delivering a Layer 2 or Layer 3 pipe.

These emerging networks pose requirements for the support of the IPv6 protocol, which addresses the limitations of IPv4 networks: insufficient address space for everything over IP, address prefix allocation, complexity of configuration, lack of data security, and lack of adequate QoS measurement. The HST-3000 IPv6 option supports the installation and troubleshooting of the next generation IPv6 networks in transition from IPv4 platforms.

The HST-3000 platform with the Ethernet SIM allows providers to equip their technicians to adequately install and troubleshoot next generation networks, while continuing to support their legacy services in a modular solution.

Product Features

Installation and Troubleshooting of Layer 2 and Layer 3 Services



Figure 1 Layer 2 Traffic Summary Results

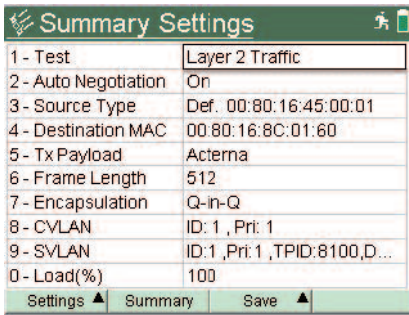


Figure 2 Layer 2 Traffic Summary Setting

To verify that service level agreements (SLAs) are met for Layer 2 offering, the HST-3000 Ethernet SIM allows technicians to generate Ethernet frames with various configurable parameters, such as bandwidth utilization, frame length, and frame payload. These frames can be generated with constant, ramp, or bursty traffic load settings to fully test the Ethernet (Layer 2) service.

Moreover, prior to testing SLAs for Layer 3 offerings, technicians may need to verify that the provisioned path in the network will carry IP traffic to its destination. The first step in verifying this end-to-end connectivity is to perform an IP Ping with the HST-3000 Ethernet SIM. If problems with establishing connectivity to the far end exist, users may want to verify the route between the source and destination host by running the Traceroute application.

Once the network connectivity is verified, the HST-3000 Ethernet SIM features the ability to transmit and receive IP packets with its built-in Layer 3 testing capabilities. These packets have a valid IP header, containing user-defined fields, such as TOS/DSCP prioritization, and source and destination IP address. Since dynamic addressing is supported, the source IP address can be assigned by a DHCP server, if necessary. Basic domain name service (DNS) testing can be performed to ensure that the DNS server is able to resolve the name to the appropriate address. In addition, traffic load settings can be configured for constant, ramp, and bursty traffic in order to simulate different network traffic conditions and to stress and analyze the performance of the link.

One-Button RFC2544 Automation

One press of a button enables technicians to run an automated test against customizable thresholds. RFC2544 represents a benchmarking methodology for performing the QoS measurements in a switched/routed network. The automated test ensures that the procedure is performed the same way every time, providing consistent and repeatable results, and offering a PDF report with graphical representation of the results.

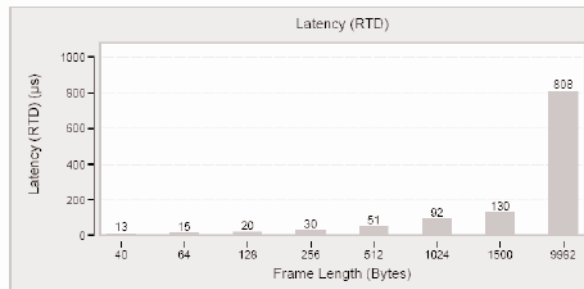


Figure 3 RFC2544 Latency (RTD) Test Results Report

Plt Length (Bytes)	Delay (µs)	Measured Rate (Mbps)	Measured Rate (%)	Measured Rate (pkts/sec)	Pause Detected
40	12.7	100.00	99.996	148803	No
64	14.8	100.00	99.996	122544	No
128	20.0	100.00	99.996	75298	No
256	30.3	100.00	99.995	42515	No
512	50.7	100.00	99.999	22727	No
1024	91.7	100.00	99.998	11770	No
1500	128.8	99.99	99.995	8127	No
9982	808.2	100.00	100.000	1248	No

Cable Diagnostics

On electrical Ethernet circuits, the HST-3000 can display the link speed, link status, cable status, MDI/MDI-X, and distance to fault with one press of a button. To verify connectivity on fiber lines, the HST-3000 Ethernet SIM reports the wavelength and level of the optical signal. These features allow technicians to quickly sectionalize physical layer problems.

Bi-Directional Monitoring/Thru Mode

The dual ports (both optical and electrical) on the HST-3000 Ethernet SIM enable technicians to gain access to circuits under test in order to perform in-service monitoring in both directions. Not only does this simplify sectionalization of the network, it also allows for the analysis of live customer traffic without the use of a splitter.

Encapsulation Support**VLAN Protocol Support**

VLAN tag manipulation allows for the generation of an Ethernet traffic stream with a specific VLAN ID (as per specification IEEE 802.1Q) and VLAN user priority (as per specification IEEE 802.1p). This enables technicians to verify the correct transmission and prioritization of the stream through the network. In addition, VLAN filtering allows technicians to isolate a specific VLAN stream and compare its performance with the total performance of the link. VLAN protocol support is available for both Layer 2, 3, and 4 traffic testing.

VLAN Stacking (Q-in-Q) Support

Service providers are deploying Q-in-Q (VLAN Stacking as per specification IEEE 802.1ad) as a simple cost effective solution to support their customers who utilize VLANs. Q-in-Q is a scalable Layer 2 based solution that isolates and prioritizes customer traffic in the core network while providing up to two times 4096 VLANs in the network. A challenge introduced to service providers by Q-in-Q technology is to ensure that the data reaches its intended destination and the customers' VLAN tags are intact. In order to test Q-in-Q in the networks, the technicians can use the HST-3000 Ethernet SIM to configure up to two VLAN IDs and their priorities. In addition, the test set will filter on tags and monitor Q-in-Q traffic for basic troubleshooting.

MPLS Support

Service providers are deploying Multi Protocol Label Switching (MPLS) in their networks to transport large volumes of data quickly through their core and to provide faster re-route in cases of congestion or path failure. MPLS-enabled switches and routers remove and insert labels to IP packets as they move through the network. Technicians require test equipment that can support maintaining an MPLS network. Using the HST-3000 Ethernet SIM, the technician can perform MPLS throughput testing, monitoring and routing verification. The test set gives the technician the ability to transmit packets with two MPLS labels based on the network configuration and receive up to two MPLS labels for traffic analysis.

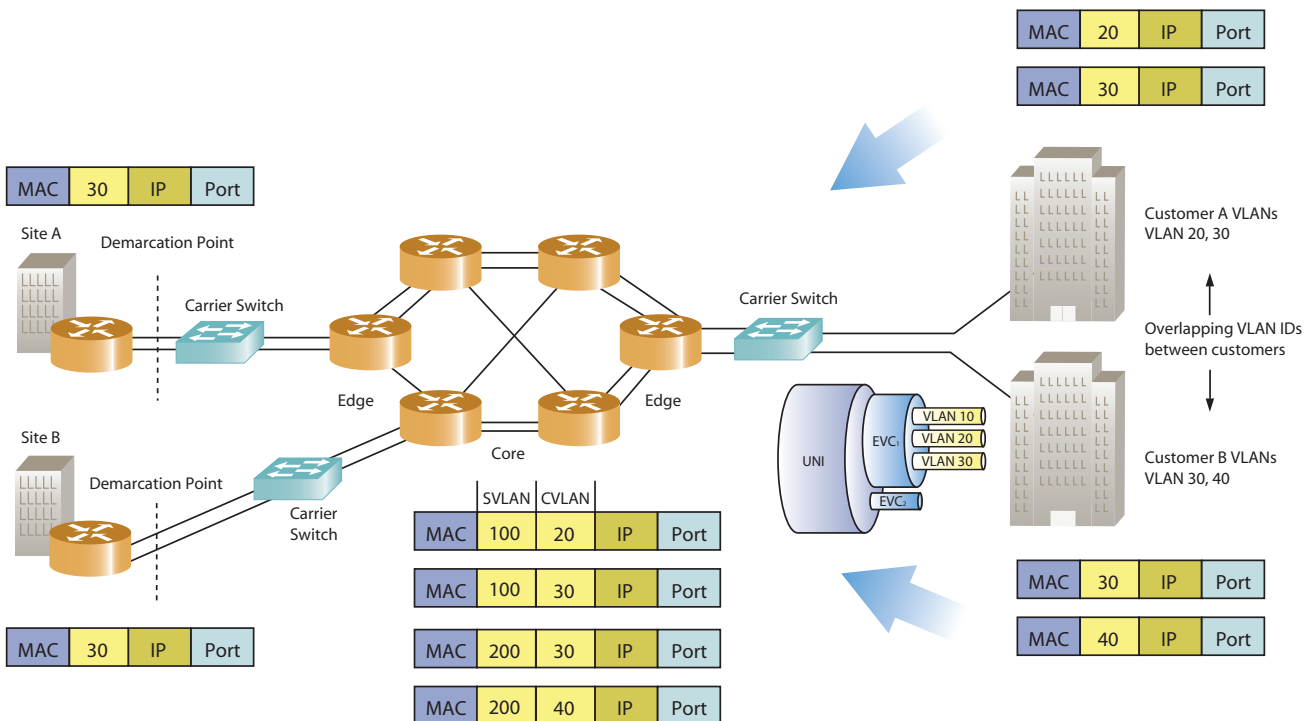


Figure 4 VLAN Stacking in the network

Multiple Streams Option

Many service providers are beginning to deploy different classes of service in order to offer tiered services to customers or to prioritize traffic and effectively manage triple-play networks. This leads to new challenges where the latency and loss may be acceptable for regular traffic, but the higher priority traffic does not meet its required SLA.

In order to test these new networks, technicians can use the Multiple Streams option at Layers 2, 3 and 4 for the HST-3000 Ethernet SIM to oversubscribe the network elements and determine if the various SLAs are met. This is accomplished by using multiple different traffic streams, with differing encapsulation and priorities schemes, and by sending more traffic through the network than the network can handle. The network elements should drop the lower priority traffic, and allow higher priority traffic to pass to the far end at the expense of the lower priority traffic.

IPv6 Option

IPv6 was developed as a way to address the limitations of IPv4: insufficient address space for everything over IP, complexity of address resolution, lack of data security, and lack of adequate QoS measurement.

IPv6 features an auto-configuration facility, defined in RFC2461, which greatly simplifies address configuration. In “stateless” mode, an IPv6 host will automatically configure itself with a unique link-local address, which enables it to communicate locally on its own subnet. For communication over the Internet, the host is provided with a global address by a local router. Both transactions are completely transparent to the user resulting in a truly plug-and-play environment. IPv6 also supports manual address configuration and DHCPv6 using a “stateful” address configuration in cases where network administrators require tighter control over IP address allocation. The IPv6 option on the HST-3000 Ethernet SIM supports all three configuration schemes for IPv6 traffic testing for 10/100/GigE networks.

The IPv6 option also features Monitor/Thru mode testing in which statistics are gathered and analyzed on live IPv4 and IPv6 traffic by the HST-3000.

Layer 4 (TCP/UDP) Option

Providers are looking for ways to improve their managed services to meet the ever growing carrier-grade Ethernet requirements. Along with their capability to deliver the Layer 3 services, carriers need to be able to measure Layer 4 end-to-end performance and ensure that SLAs are being met. Providers require a field portable test set that that will support end-to-end testing at Layer 2 and through Layer 4. The new Layer 4 option gives technicians the added ability to measure throughput, loss and delay performance statistics. With this option, technicians can configure valid TCP/UDP source and destination ports, and payloads up to full line rate or generate multiple streams with Layer 4 traffic to allow for prioritization on source and destination ports. Technicians can also perform Cable diagnostics and RFC2544 test with Layer 4 traffic application.

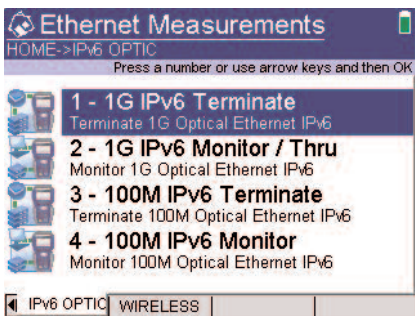


Figure 5 HST-3000 IPv6 Applications

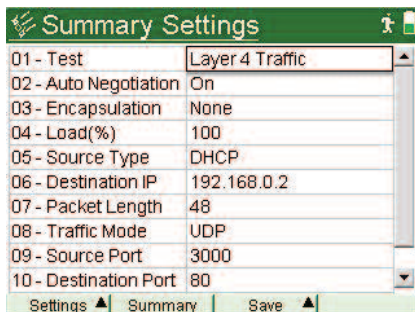


Figure 6 HST-3000 Layer 4 Application Setup

VoIP Option

The HST-3000 with the VoIP option can validate VoIP service connectivity, feature availability, and voice quality. In addition, it provides a comprehensive set of features, including signaling, IP Ping, packet statistic, and Traceroute analysis in order to identify, diagnose, and sectionalize VoIP network and equipment problems.

IP Video Option

The HST-3000 IP Video option is a video test suite specifically designed to meet the needs of the field technicians who are responsible for the provisioning or installation of IP Video services that carry video program content. Test access includes the 2-wire ADSL interface or the Ethernet 10/100 interface at the DSL modem or FTTx residential gateway. The test suite includes set top box (STB) emulation with signaling support for broadcast video (IGMP) and VOD (RTSP). Video transport stream analysis is provided as well as video QoS measurements, including packet jitter, packet loss, IGMP latency, and program clock reference (PCR) jitter analysis.

Flexible and Rugged Design

The HST-3000 incorporates a rugged, weather-resistant design and long battery life that are ideally suited for use in the field. Its modularity allows for field upgrades to support new testing requirements. Standard Ethernet, USB, and serial connections offer flexibility to easily download software and offload captured test data.

Easily configurable, the HST-3000 can be used by different technicians with different responsibilities to perform a wide number of tests. The HST-3000 is easily upgradeable with technologies and advanced options that support the changing needs of service installers.

Specifications

Test Interfaces

Optical Ethernet/IP

100/1000 Mb/s Dual SFP ports

Electrical Ethernet/IP

10/100/1000 Mb/s Dual RJ-45 ports

Test Modes

Terminate

Monitor/Thru (bi-directional monitor)

Ethernet (Layer 2) Specifications

Duplex modes Full, half

Flow control Supported

Traffic generation Constant, ramp, bursty

Payload ATP, BERT

Frame length 64-1526 bytes, user-defined, undersized, jumbo, random

MAC addressing Configurable source and destination MAC addresses

Frame format 802.3 or DIX

ARP mode Enable, disable

VLAN settings ID, priority

Q-in-Q settings TPID, customer VLAN ID, customer VLAN priority, service provider VLAN ID, service provider priority, and service provider, DEI bits

MPLS settings Label, priority, TTL, MPLS Ethertype (Unicast or Multicast), # MPLS Labels (1 or 2)

Bit error testing patterns PRBS (2²³-1, 2³¹-1, and inverted selections), all 1s, all 0s, user-defined

Framed pattern test per NCITS TR-25:1999 CRPAT, CJPAT, CSPAT

Traffic filtering MAC source address, MAC destination address, Frame type/length, VLAN ID, VLAN Priority, SVLAN ID, SVLAN Priority, MPLS Label, MPLS Priority

IP Version 4 (Layer 3) Specifications

Traffic generation Constant, ramp, bursty

Data mode IPoE, PPPoE

IP addressing Configurable source and destination IP addresses, TOS/DSCP

Traffic filtering Source IP address, destination IP address, TOS/DSCP, VLAN ID, VLAN Priority, SVLAN ID, SVLAN Priority, MPLS Label, MPLS Priority

IP Version 6 (Layer 3) Specifications

Traffic generation Constant, ramp, bursty

IP addressing Stateless autoconfiguration, Stateful autoconfiguration, Manual

Traffic filtering Source IP addresses, Source prefix, Destination IP, Destination Prefix Traffic Class Type, VLAN ID, VLAN Priority, SVLAN ID, SVLAN Priority

TCP/UDP (Layer 4) Specifications

Traffic mode TCP, UDP

Port addressing Source, Destination

Multiple Streams Specifications

Number of streams 8

Stream modes Layer 2, Layer 3, Layer 4

Encapsulations VLAN ID, VLAN Priority, SVLAN ID, SVLAN Priority

Cable Testing Specifications

Optical Power measurement, SFP Vendor Name

CAT-5 cable Link speed, link status, crossover/straight, distance to fault, pin mapping, pair length, polarity, skew

Power over Ethernet Indicates if the power supply responds to Class 1 power requests

Key Results

Link status Optical power measurement
Link active
Frame detected
Sync obtained

Configuration status Auto-negotiation link configuration ACK, Auto-negotiation link advertisement status, DHCP lease time, Destination MAC address when using ARP

Link status Bandwidth utilization
Frame rate
Rx/Tx L1, L2, L3, L4 Mb/s
Round trip delay
Service disruption time

Link counts Total received and transmitted frames, pause frames, VLAN frames, unicast frames, multicast frames, broadcast frames, frame length (bins), Errored counts, FCS errored frames, runts, jabbers, undersized frames, OOS frames, lost frames, IP checksum errors, ATP payload error

Conformance with RFC2544 Throughput test
Latency test
Frame loss test
Back-to-back frame test
Packet Jitter test*

*Not in RFC2544 specification

Physical Specifications

Size (h x w x d) 9.5 x 4.5 x 2.75 in. (241 x 114 x 70 mm)

Weight (with battery) 2.7 lbs. (1.23 kg)

Operating temperature 22° F to 122° F (5.5° C to 50° C)

Storage temperature -40° F to 150° F (-40° C to 65.5° C)

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 Specifications

Ruggedness Survives 3 feet (91 cm) drop to concrete on all sides

Water-resistant Splashproof (may be used in heavy rain)

Language English, German, French, Spanish, Italian, Chinese, Turkish

Keypad Typical 12-button keyboard

Ordering Information

HST3000-NG	HST-3000 Mainframe without Copper (Color)
HST3000-NG-BW	HST-3000 Mainframe without Copper Testing (B&W)
HST3000C-NG	HST-3000 Copper Mainframe (Color)
HST3000C-NG-BW	HST-3000 Copper Mainframe (B&W)

Available SIMS (Modules)

HST3000-4WLL	4-Wire Local Loop SIM
HST3000-AR2A-TI	ADSL2+ TI (ATU-R, Annex A) SIM
HST3000-AR2A	ADSL1/2/2+ (ATU-R, Annex A) SIM
HST3000-AR2B	ADSL1/2/2+ (ATU-R, Annex B) SIM
HST3000-AR2B-TI	ADSL2+ TI (ATU-R, Annex B) SIM
HST3000-ARB	Annex B ATU-R SIM
HST3000-ARCA	ATU-R/C Dual Mode SIM, AoPOTS SIM
HST3000-ARCB	ATU-R/C Dual Mode SIM, AoISDN SIM
HST3000-ARCE	ADSL (ATU-R) SIM
HST3000-BLK	Blank SIM
HST-BRA	ETSI (Euro) ISDN BRA SIM
HST3000-BRI	ISDN BRI SIM
HST3000-CAR	Copper (ATU-R) SIM
HST3000-CAR2A	ADSL1/2/2+ with Copper (ATU-R, Annex A) SIM
HST3000-CAR2A-TI	Copper, ADSL2+ TI (ATU-R, Annex A) SIM
HST3000-CAR2B	ADSL1/2/2+ with Copper (ATU-R, Annex B) SIM
HST3000-CAR2B-TI	Copper, ADSL2+ TI (ATU-R, Annex B) SIM
HST3000-CARB	Annex B Copper/ATU-R SIM
HST3000-CARCA	Copper and ATU-R/C Dual Mode SIM, AoPOTS
HST3000-CARCB	Copper and ATU-R/C Dual Mode SIM, AoISDN
HST3000-CARCE	Copper and ATU-R (Annex A) SIM, CE Marked
HST3000-CSHHV	G.SHDSL, 380V SPAN, DVOM SIM
HST3000-CSH4	Copper, 4-Wire G.SHDSL (STU-R/C, Annex A/B) SIM
HST3000-CSHCE	G.SHDSL and Copper SIM
HST3000-CT1	T1 and Copper SIM
HST3000-CU	Dual T/R/G Interface to Copper Test SIM
HST3000-CUCE	Copper only SIM, CE Marked SIM
HST3000-CUVDSL-CNXT	VDSL and Copper with Connexant Chipset SIM

HST3000-CUVDSL-IK	VDSL and Copper with Ikanos Chipset SIM
HST3000-CUVDSL-INF	VDSL and Copper with Infineon Aware Chipset SIM
HST3000-DC	Datacom SIM
HST3000-E1	E1 SIM
HST3000-E1-DC	E1/Datacom SIM
HST3000-ETH	10/100/1000 Ethernet SIM
HST-GSH	G.SHDSL SIM
HST3000-GSHCE	2-Wire G.SHDSL SIM
HST3000-T1	Dual TX/RX Bantam T1 Interface and T1 SIM
HST3000-T3	Dual TX/RX Bantam T1 Interface, and Dual RX/Single TX BNC DS3 Interface/and DS3 SIM
HST3000-VDSL-CNXT	VDSL with Connexant Chipset SIM
HST-3000-VDSL-CNXT-WB2	VDSL and Copper (up to 30 MHz) with Connexant Chipset SIM
HST3000-VDSL-IK	VDSL with Ikanos Chipset SIM
HST-3000-VDSL-IK-WB2	VDSL and Copper (up to 30 MHz) with Ikanos Chipset SIM
HST3000-VDSL-INF	VDSL with Infineon Aware Chipset SIM
HST-3000-VDSL-INF-WB2	VDSL and Copper (up to 30 MHz) with Infineon Aware Chipset SIM
HST3000-WB2	Wide Band 2 (up to 30 MHz) Copper Test SIM

Software Options

HST3000-BLUETOOTH	Bluetooth Wireless Software Option
HST3000-DSL2	ADSL2 and ADSL2+ Software Option
HST3000-FR	Frame Relay Software Option
HST3000-FTP	FTP Software Option
HST3000-IPV6	IPv6 Software Option
HST3000-MPLS	MPLS Software Option
HST3000-MSTR	Multiple Streams Software Option

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

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