UNI Signalling Test Software E4214A

The HP Broadband Series Test System Datasheet

Product Overview

The E4214 UNI Signalling Test Software for the Broadband Series Test System (BSTS) provides a comprehensive and fully-configurable test solution for ensuring the proper implementation and operation of ATM UNI signalling. The E4214 provides three key ATM signalling test application areas:

- Speeds up signalling protocol verification via monitoring, protocol stimulus-and-response testing, and user or network emulation at the UNI
- Characterizes signalling performance with rigorous call generation
- Facilitates testing of SVC-based services by setting up virtual channels so that applications can be tested over them

Thanks to the E4214 UNI Signalling Test Software, and its integration with other test modules and software, HP's BSTS is a complete signalling test solution that provides signalling emulation, call setup, call generation, and conformance testing to ensure that ATM call sessions are set up, switched and released properly—even under heavy load conditions.

Signalling Protocol Implementation Verification

The E4214 UNI Signalling test software provides you with the flexibility and configuration control required to test signalling protocol implementations across the User-Network Interface (UNI). Powerful stimulus-and-response capabilities permit the interactive testing of many different switching scenarios and conditions.

Equipped with the E4214 UNI Signalling software, your BSTS can:

- Monitor signalling messages and verify their correct operation by capturing and decoding messages, or displaying them in real-time, with automatic protocol data unit error detection
- Transmit signalling messages and analyze the response to determine how a device or network under test behaves (stimulus-and-response testing)
- Automatically process and exchange signalling messages with powerful layer 2 and layer 3 emulation features

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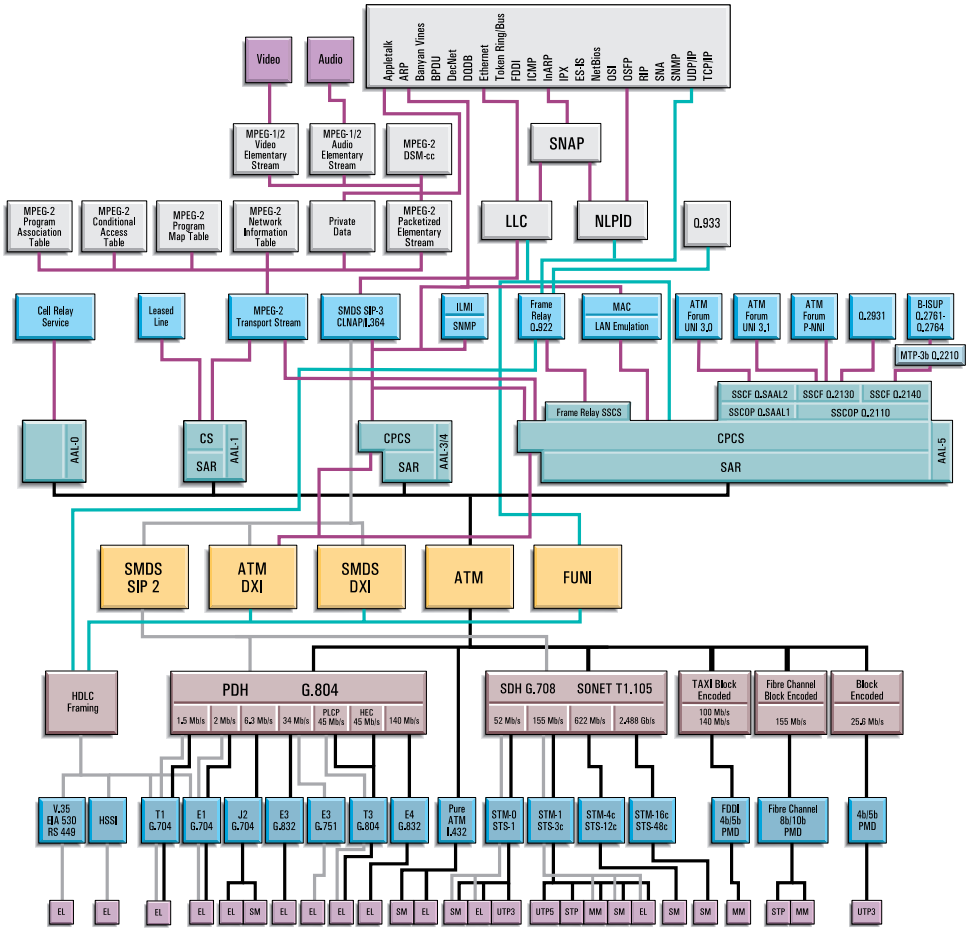

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Dual-Port Monitoring Examines Both Sides at Once

When performing full-duplex monitor testing, the BSTS is connected to both the user-side and the network-side devices so that it can monitor all the signalling messages being sent between the two devices. You can view them in real-time, or capture them for further analysis.

The BSTS captures and decodes communications traffic into an English-language display using the same terminology found in standards documents. Errors are automatically detected and highlighted on-screen, complete with explanatory messages.

User data on other virtual channels can be captured and analyzed at the same time that signalling data is captured. A large 16 MB capture memory buffer for each direction is available for extensive analysis of user data. Complete control is available—continuously capture with memory buffer lapping, or trigger on user-defined events.

- *Observe signalling messages sent between two devices across the UNI*

  Dual-port operation allows correlated capture and measurements to be taken on both physical interfaces. This permits the simultaneous analysis of signalling messages from both sides of the full-duplex UNI link.

  Fast hardware-based AAL-5 (SAAL common-part) re-assembly lets you view signalling messages in real-time as they happen, without processing delay.
- *Automatic error detection and isolation*

  Decodes captured layer 2 SSCOP PDUs and layer 3 UNI signalling messages; validates layer 2 SSCOP and layer 3 PDUs.

Stimulus-and-Response Protocol Testing

Designed specifically for the stimulus-and-response methodology used in functional verification, the BSTS allows you to easily define a stimulus and transmit it to the device under test. For UNI signalling protocol verification, you can define your SETUP messages or use the included ones. The device's response can then be analyzed and it behavior determined. Errors are automatically isolated and highlighted, so you have a documented record of anything that went wrong—especially useful when verifying R&D prototypes.

The E4214 can create normal or abnormal protocol behavior on demand to quickly isolate signalling protocol implementation problems. Traffic can easily be captured, created, edited and stored in files for later analysis or transmission. Supports operation on two signalling channels simultaneously.

- *Smart PDU and message editors for SSCOP and signalling protocols; supports ATM Forum 3.0 & 3.1 variants as well as Q.2931, Q.SAAL1 and Q.2110.*

  Create and edit protocol data units; transmit one protocol data unit or link together PDUs to form test sequences. The E4214 includes a set of standard signalling SETUP messages, from both the user and the network sides of the UNI. These messages have preset fields so that you can create signalling messages with the minimal effort. Of course, you can also build your own SETUP messages from scratch.

- *Automatically encode SSCOP or signalling protocol data units into AAL-5 PDUs and segment them into ATM cells*

  Encode protocol data units into their next lower protocol layer, or directly into ATM cells. Encoded PDUs and cells can be edited, errored or resequenced prior to transmission.

- *Great for negative testing*

  Non-conforming messages can be built and sent in order to perform negative testing of equipment response under a variety of error conditions. Traffic data can be captured and stored for off-line analysis or retransmission.

Network-Side and User-Side Emulation

When using the E4214 test software, your BSTS can be used to test either the end system or the network device across the UNI by emulating the peer. When testing a network-side device, such as a switch, the BSTS can automatically mimic the behavior of an ATM end system (such as a workstation) that is connected to the switch. When testing a user-side device, such as a network interface card, the BSTS can be used to mimic the behavior of the network.

A powerful open reference emulation allows interactive or programmatic control for switched-virtual circuit creation and analysis. Each BSTS test port can be used to emulate the response of an ATM end system.

Through use of the emulation options, you can quickly and easily create testing scenarios, perform tests and verify protocol operation from either the network or user side of the UNI. You can access three protocol variations (ITU-T Q.2931 and ATM Forum UNI Specification Versions 3.0 & 3.1) to support the testing of a wide variety of CPE and switching equipment.

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Implementation of the UNI signalling layer, the ATM signalling Service Specific Connection Oriented Protocol (SSCOP) layer, and the Service Specific Coordination Function (SSCF) can be verified, using a range of protocol behavior, call acceptance, delay and timer variations, to ensure the accurate transmission and return of signalling messages.

- *Automatic or interactive control*
  Interactive controls allow you to initiate and monitor the layer 2 connection, set up and release layer 3 calls, monitor calls requested by the system under test, and view summary information about calls in progress.

Layer 3: UNI Signalling	Q.2931	UNI 3.0	UNI 3.1
Layer 2:			
SSCF	Q.2130	Q.SAAL2	Q.2130
SSCOP	Q.2110	Q.SAAL1	Q.2110
AAL	AAL-5	AAL-5	AAL-5

The BSTS platform and the E4214 test software provide access to all protocol stack levels, including physical, ATM, ATM adaptation and signalling layers, simplifying troubleshooting, and allowing you to perform comprehensive, multivendor testing under real-world conditions.

- *Configurable state machines*
  The timers, delays and call acceptance parameters used in the emulation state machines are all configurable. For example, timer durations default to the specified protocol values, but can be modified to create abnormal behavior.
- *Detailed event logging*
  Diagnostic trace statements inform you about events, timer status, and protocol violations. You can select what (if any) trace statements you wish to be generated—great for debugging signalling protocol implementations.

You can easily keep tabs on what's happening by calling up the active SVC display. This table lists all active switched-virtual circuits and shows their assigned VPI/VCI, the call reference, and the call state for each channel.

Call Generation for Signalling Performance Testing

ATM switch vendors must provide accurate capacity data to prospective customers, while network planners need to verify this information to assist in evaluating equipment and designing networks. The signalling performance testing features of the BSTS allow both parties to determine how switching equipment functions under load.

- *Characterize switch performance*
  By continuously setting up and tearing down switched virtual circuits, based on user-specified parameters, switch performance can be characterized under conditions that reflect multi-user demand. Call response times can be determined with accuracy, establishing performance benchmarks and helping guarantee that customer application response expectations can be met.
- *Captured data available for post-processing*
  Actual signalling messages can be viewed in real time, or messages can be captured for later analysis, allowing the comparison of message timestamps. Once a performance range is defined, it can be progressively narrowed until an exact capacity figure is established for the switch under test.

ILMI Address Registration

The E4214A Signalling Test Software can also emulate either the user-side or network-side Interim Local Management Interface (ILMI) procedures for address registration. These procedures are used to dynamically assign an ATM end system address (an ATM address is required before a switched virtual circuit can be established), and are described in the ATM Forum's UNI 3.0 & 3.1 Specifications.

This feature is implemented via a user program. Using the ILMI address registration is simple—just compile it using the included MAKE file, and then run it by clicking on the User Program icon on the E4209 Cell Protocol Processor control panel.

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C Language User Programming Environment

You can automate repetitive testing or create complex test scenarios by developing your own programs with the UNIX® programming environment included with the BSTS. Simply link your programs to the supplied library of test routines. The user programming library supports SSCOP and signalling encoding and decoding functions, transmits SSCOP and signalling protocol data units, and provides programmatic support of all functions available through the graphical user interface. In-depth user and programmers' manuals document test software features and the test routine libraries.

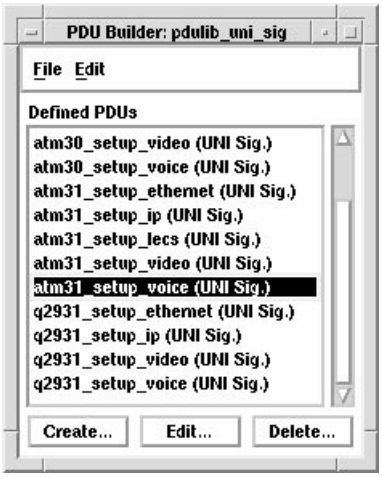
Several sample programs are provided with the E4214 to illustrate specific UNI signalling programming situations; these include:

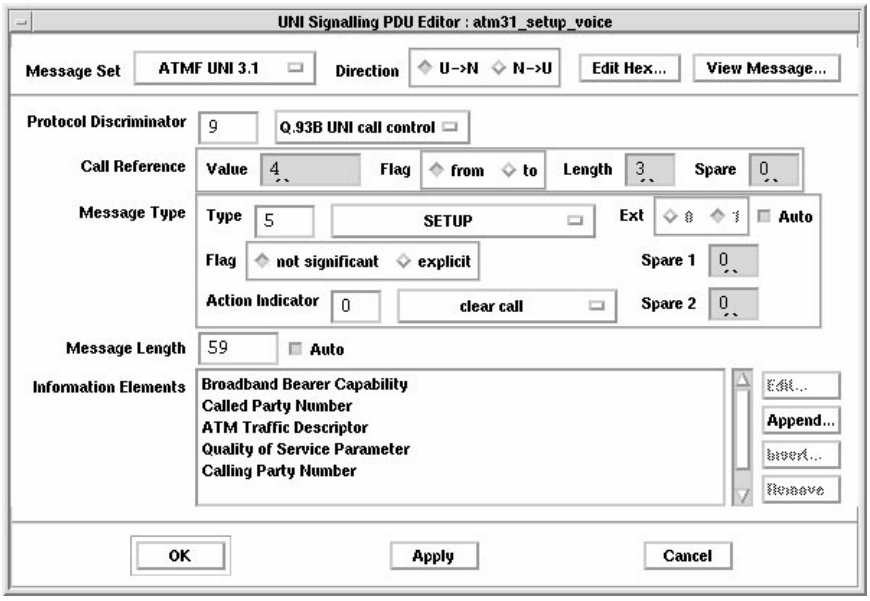
- Accepting and rejecting calls
- Generating signalling loads
- Initiating a call setup
- Responding to a layer 2 link request
- Emulating a SSCOP state machine
- Viewing UNI signalling messages in real-time
- Encoding and sending a UNI signalling message

Application Testing of SVC-based Services

Completely integrated with other Broadband Series Test System dedicated test modules and software, the E4214 can be combined with other BSTS components to obtain additional capabilities. Simulate and perform ATM level measurements (including cell delay and cell loss) for a wide range of traffic types on actual switched virtual circuits. LAN, MPEG-2 digital video and other traffic payload types can be generated and transmitted over switched virtual circuits set up by the BSTS.

This test capability is essential for service providers involved in the transition of PVC-based services to SVC technology, or developing new SVC-based services.





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Technical Specifications

Monitoring Features

Multiport Monitoring	Single- or dual-port capability
	Synchronized timestamps correlates events from two physical ports
	Merged live protocol viewer, or playback of captured data, shows activity from both ports integrated into one display
	Large 16 MB capture buffer (with E4209B)
Decode Displays	Summary mode; displays a single line description of each PDU
	Detailed mode; displays a multi-line description of each event with field-by-field decoding; includes header/trailer and payload options
	Hex mode; displays the entire PDU in hexadecimal
	Timestamps; toggle on/off the display of timestamps
	Port identifier; toggle on/off the display of the VXI slot number of the Cell Protocol Processor and line interface module from which the data was captured; also indicates whether the captured data was transmitted or received
Summary Display Contents	UNI Signalling: displays message type, call reference value and call reference flag
	SSCOP: PDU types and N(S)
	AAL-5: length
	AAL-3/4 CPCS: length
	AAL-3/4 SAR: MID, segment type, and sequence number
	ATM: VPI and VCI
UNI Signalling Decode Errors	Missing expected octet
	Illegal repeated items
	Message or IE length too short
	Message or IE length too long
	Unnecessary IE or format present
	Mandatory IE or format missing
	Invalid field value
UNI Signalling Filters	Filtered message type
	Call reference value
	Call reference flag
	Any of the above decode errors
SSCOP Decode Errors	PDU too short
	Unknown PDU type
	PDU alignment error
	PDU length error
	Non-zero reserved field
	Information field too long
	SSCOP-UU field too long
SSCOP PDU Data Filters	Filtered PDU type
	Any of the above decode errors
AAL-5 PDU Data Filters	Invalid CRC-32
	Length field not equal to received length
	Frame length larger than maximum
	Frame length smaller than minimum
	Incorrect pad length
AAL-5 PDU Data Filters	Filtered field
	Any of the above decode errors
ATM Cell Data Decode Errors	Incorrect header error control (HEC)
	Zero VCI but non-zero VPI
	Invalid OAM
ATM Cell Data Filters	Filtered cell type
	Filtered cell field
	Generic flow control value
	Virtual path identifier (VPI)
	Virtual channel identifier (VCI)
	Payload type
	Cell loss priority
	Invalid cell type
	Any of the above decode errors
Bit String Filters	Filter pattern editor allows you to select octets which you wish to match, and enter individual data patterns for each selected octet

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Protocol Simulation

Smart Message Editors	UNI 3.0/3.1 signalling messages
	Q.2931 signalling messages
	Q.2110 SSCOP PDUs
	Q.SAAL1 SSCOP PDUs
Signalling Messages Fields	Message set
	Direction
	Protocol discriminator
	Call reference
	Message type
	Message length
	Information elements and all associated content fields
Q.2110 SSCOP PDU Fields	SSCOP-UU
	Information
	List elements (STAT messages)
	Pad
	Pad length
	Reserved bits
	N(MR)
	N(PS)
	N(R)
	N(S)
	N(SQ)
	Source
Q.SAAL1 SSCOP PDU Fields	N(UU)
	Information
	List elements (STAT messages)
	Pad
	Pad length
	Reserved bits
	N(MR)
	N(PS)
	N(R)
	N(S)
	N(SQ)
	Source

Layer 2 Emulation

Layer 2 Response	Automatic response, or direct control of the SSCOP and SSCF state machines
SSCOP Services	Establish request
	Establish response
	Release
	Send data
	Resynchronize request
	Resynchronize response
	Recover Response
SSCF Services	Establish
	Release
	Send sequenced data
	Send unit data
Configuration Parameters	MaxCC; specifies number of times an unacknowledged connection control PDU can be sent
	MaxPD; specifies how many SD PDUs are sent before a POLL PDU is sent
	Maximum SSCOP information field length
	Maximum length of the UU field in Q.2110 SSCOP PDUs
Receive Window Size	Sets the window size of the SSCOP receiver
Protocol Behavior	Repeat USTAT; toggles on/off the optional transmission of a second USTAT PDU when a new sequence gap is detected as per Q.SAAL1
	USTAT Response to Poll; toggles on/off the optional transmission of a USTAT PDU in response to a POLL PDU if a new sequence gap is detected as per Q.SAAL1
Protocol Behavior	Poll after retransmission; toggles on/off the optional forced expiry of the POLL timer due to the reception of a USTAT as per Q.SAAL1
Modifiable Timers	CC; ensures that the system under test acknowledges a connection control PDU in time; set from 1 to 9,999 sec
	POLL; specifies the time between POLL transmissions; set from 10 to 99,9999 msec

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	KEEP-ALIVE; measures the time between a final POLL and the STAT response before entering the IDLE phase; set from 1 to 9,999 sec
	IDLE; measures a period in the idle phase during which the tester does not poll the system under test; set from 1 to 9,999 sec
	NO RESPONSE; used to detect broken layer 2 connections; set from 1 to 9,999 sec
Diagnostic Trace Statements	
	On state change
	On timer expiry
	On protocol violation
	On signal trace
Signalling Emulation Performance	
	Two signalling virtual channels per CPP
	Up to four CPPs can be cascaded to a single line interface to support eight signalling virtual channels on a single line interface
	Approximately 700 to 900 PDUs/s at the SSCOP/SSCF layer

Layer 3 Emulation

Layer 3 Response	Automatic emulation, or interactive control
Interactive Functions	Call setup
	Call release
	Add/drop channels to a UNI 3.0/3.1 point-to-multipoint connection
	Restart channels which have been set up
	Establish/release SSCOP link
Protocol Behavior	Toggle optional Q.2931 symmetric call operation on or off
	Toggle optional Q.2931 SETUP message responses (CALL PROCEEDING and ALERTING) on or off, and specify delay
	Toggle optional STATUS ENQUIRY message each time a link is reset on or off (as per Q.2931 and UNI 3.1)
Call Acceptance Control	Accept all call setup requests, or only those from specified ATM addresses or range of addresses
	Specify which VPI/VCI virtual channels are assigned to SVCs (network side)
	Add a value from 0 to 65,535 ms to the Q.2931 transit delay information element
Modifiable Timers	T303; Tracks the time during which a Q.2931 ALERTING, CONNECT, RELEASE COMPLETE or CALL PROCEEDING message must be received after a SETUP message is sent
	T308; tracks the time during which a RELEASE or RELEASE COMPLETE message must be received after a RELEASE message is sent
	T309; tracks the time during which the layer 2 connection must be re-established after the SAAL connection terminates
	T310; tracks the time during which an ALERTING, CONNECT or RELEASE message must be received after a CALL PROCEEDING message is received
	T313 (user side); Tracks the time during which a CONNECT ACKNOWLEDGE must be received after a CONNECT message is sent

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	T316; tracks the time during which a RESTART ACKNOWLEDGE must be received after a RESTART message is sent
	T322; tracks the time during which a STATUS, RELEASE or RELEASE COMPLETE message must be received after a STATUS ENQUIRY message has been sent
Modifiable Point-to-Multipoint Timers & Delays	
	T398; tracks the time during which a DROP PARTY ACKNOWLEDGE or RELEASE message must be received after a DROP PARTY message is sent
	T399; tracks the time during which an ADD PARTY ACKNOWLEDGE, ADD PARTY REJECT or RELEASE message must be received after an ADD PARTY message is sent
	Delay before sending an ACKNOWLEDGEMENT or REJECT response after receiving an ADD PARTY message can be set from 0.0 to 99.9 seconds
Timer Controls	Set maximum number of T316 expiries
	Set maximum number of T322 expiries
	Toggle Retransmit SETUP on T303 expiry on/off
	Toggle Send Cause IE on T308 or T398 expiry on/off
	Toggle UNI 3.0 T309 implementation on/off
Delays	ADD PARTY response delay; from 0.0 to 99.9 seconds
	SETUP message response delay
Diagnostic Trace Statements	On state change
	On timer expiry
	On protocol violation
	On signal receipt
Active SVC Table	Table display shows assigned VPI/VCI, call reference, number of active parties in point-to-multipoint call, and call state for each channel
Message Size	Up to 4096 bytes; typical UNI signalling messages are usually well below 256 bytes
Signalling Emulation	Two signalling virtual channels per CPP
Performance	Up to four CPPs can be cascaded to a single line interface to support eight signalling virtual channels on a single line interface
	Automatic traffic shaping of emulation responses, user-selectable from 16 kb/s or 38 cells/second to full line rate, or send 100% line rate burst of AAL-5 frames

Call Generation

The E4214's robust call generation capability allows you to load a switch or other device to determine its signalling processing delay, throughput, and other performance characteristics.

Call Set-Up Capacity	Up to 130 calls per second
	Up to 468,000 busy hour call attempts
Call Set-Up	Continuously
Distributions	Burst
Options	Number of active calls to be maintained at one time
	Interval between last call release and new call set-up
Call Set-Up Sequences	Create call set-up sequences using the PDU Builder
	Each sequence can contain more than 1,000 call set-up messages
	Up to 256 active calls can be maintained
	Set up multipoint calls to as many as 256 addresses
Statistics	Number of call attempts
	Number of successful calls

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Applicable Standards & Recommendations

Signalling AAL	ITU-T Recommendation Q.2100, B-ISDN Signalling ATM Adaptation Layer (SAAL) Overview Description, 1994
	ITU-T Recommendation Q.2110, B-ISDN ATM Adaptation Layer - Service Specific Connection Oriented Protocol (SSCOP), 1994
	ITU-T Recommendation Q.2130, B-ISDN Signalling ATM Adaptation Layer - Service Specific Coordination Function for Support of Signalling at the User Network Interface (SSFC AT UNI), 1994
	ITU-T Recommendation Q.SAAL.0, B-ISDN Signalling ATM Adaptation Layer Overview Description, May 1993
	ITU-T Recommendation Q.SAAL.1, Service Specific Connection Oriented Protocol (SSCOP) Specification, May 1993
	ITU-T Recommendation Q.SAAL.2, Service Specific Coordination Function (SSCF) for Signalling at the User-to-Network Interface (UNI), June 1993
Layer 3 UNI Signalling	ITU-T Q.2931, Broadband Integrated Services Digital Network (B-ISDN) - Digital Subscriber Signalling System No. 2 (DSS 2) - User-Network Interface (UNI) - Layer 3 Specification for Basic Call/Connection Control, October 1994.
	ATM User-Network Interface Specification Version 3.0, The ATM Forum, September 1993.
	ATM User-Network Interface Specification Version 3.1, The ATM Forum, September 1994.

Configuration, Warranty & Ordering Information

Configuration & Use With Other BSTS Line Interfaces, Hardware Modules & Test Software

Configuration

The E4214 UNI Signalling Test Software is used with a BSTS line interface (LIF) module and an E4209 Cell Protocol Processor (CPP) module. The use of two LIF/CPP pairs permits the capture of both sides of full duplex signalling protocol exchanges across the UNI, or to emulate two devices. Emulating two devices is especially useful when testing a switch, as one emulated device can originate a call while the second acts as the destination.

Performance specifications shown in this publication were measured using a 64 MHz V743 single-slot UNIX® controller as included with the E4200 and E4210 Version B chassis, and an E4209B Cell Protocol Processor.

Use with Optional Test Software

The UNI Signalling Test Software can also be used with the E4212 AAL Test Software to obtain additional traffic generation, capture filtering and real-time statistics capabilities.

Conformance Testing

Signalling implementations can vary significantly from vendor to vendor, creating interoperability problems. Optional off-the-shelf executable test suites available for the BSTS can automatically test conformance, or the correct behavior of signalling protocol implementations.

HP's signalling conformance test suites use the E4214's low layer emulation to offer literally hundreds of pre-programmed test cases for incoming and outgoing call set-up and tear-down, call release and a wide variety of error situations. These test suites reflect all aspects set out in the ATM User-Network Interface Specification Versions 3.0 & 3.1.

Once initiated by the user, HP's time-saving conformance test suites run without further operator intervention and generate a pass/fail report summarizing the results of all selected test cases.

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The ability to automatically determine compliance to standard test suites saves considerable time in developing and validating your own tests, especially in quality assurance or other applications where they may be repeatedly used.

Warranty & Support Options

HP Broadband Series Test System software and firmware products are supplied on transportable media such as disk, CD-ROM or integrated circuits. The warranty covers physical defects in the media, and defective media is replaced at no charge during the warranty period. When installed in an HP Broadband Series Test System, the software/firmware media has the same warranty period as the product.

This test software has no components requiring calibration.

Documentation Included

User's Guide
Programmer's Guide
Product release notice

Product Numbers

E4214A	B-ISDN UNI Signalling Test Software; supplied on CD-ROM; includes documentation
E4214A #QA0	Scheduled software updates
E7823A	UNI 3.0 Signalling Conformance Test Suite for the Network Side, Part 1
E7833A	UNI 3.1 Signalling Conformance Test Suite for the Network Side, Part 1
E7833B	UNI 3.1 Signalling Conformance Test Suite for the Network Side, Complete Test Suite
E7834A	UNI 3.1 Signalling Conformance Test Suite for the User Side

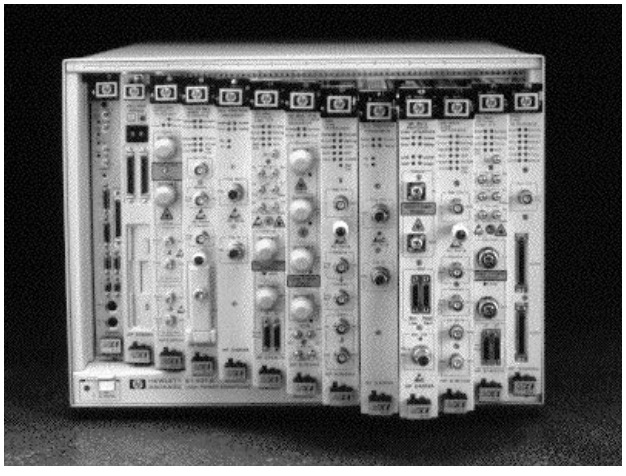
For More Information

Related HP Literature

For an introduction to the modular Broadband Series Test System, please request the *BSTS Product Catalog*, HP publication 5965-4721E.

Your local HP field engineer will help you select the best test system configuration to meet your needs. The BSTS Product Ordering Guide, HP publication 5964-0393E, details the configuration process. Since the Broadband Series Test System is a flexible and modular ATM/B-ISDN test platform, you can maximize the return on your test equipment investment by selecting a chassis, line interfaces, dedicated hardware modules, and test software that suits your specific needs. Remember that you can always add extra software or modules at any time.

HP E4200B BSTS Form 7 Transportable Chassis



HP E4210B BSTS Form 13 Mainframe Chassis

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Santa Clara, CA 95052-8059
1-800-452-4844

Canada:

Hewlett-Packard Canada Ltd.
5150 Spectrum Way
Mississauga, Ontario L4W 5G1
905-206-4725

Europe:

Hewlett-Packard
International Sales Europe
Geneva, Switzerland
+41-22-780-4111

Japan:

Hewlett-Packard Japan Ltd.
Measurement Assistance Center
9-1, Takakura-Cho, Hachioji-Shi
Tokyo 192, Japan
(81) 426-48-3860

Latin America:

Hewlett-Packard
Latin America Region Headquarters
5200 Blue Lagoon Drive, 9th Floor
Miami, Florida 33126 U.S.A.305-267-4245, 305-267-4220

Australia/New Zealand:

Hewlett-Packard Australia Ltd.
31-41 Joseph Street
Blackburn, Victoria 3130
Australia
131-347 Ext. 2902

Asia Pacific:

Hewlett-Packard Asia Pacific Ltd.
17-21/F Shell Tower, Time Square
1 Matherson Street, Causeway Bay
Hong Kong
(852) 2599-7070

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