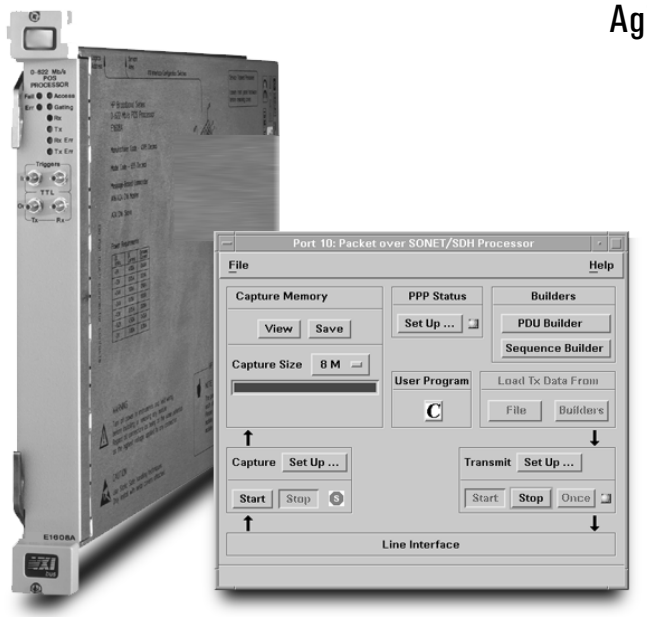
155 Mb/s, 622 Mb/s Packet over SONET/SDH Processor

Agilent Broadband Series Test System

Agilent E1608A



155 Mb/s, 622 Mb/s Packet over SONET/SDH Processor

Product Features

- Complete Layer-2 testing and Layer-2/3 analyzer statistics with total control of transmit payload down to bit level
- Support for HDLC, PPP, MAPOS, and SRP encapsulations with real-time $x^{43}+1$ scrambling and descrambling
- 0-100% transmit & receive bandwidth
- Capture filtering with 32 octet pattern matcher
- Automated connection to device under test using PPP link negotiation & IP address registration
- Native LAN support (encodes and decodes)
- Intensive SONET/SDH testing at OC-3c/STM-1c and OC-12c/STM-4c rate
- Full line rate transmit and receive of IP packets

The Agilent Technologies E1608A Packet over SONET/SDH Processor provides users of the Broadband Series Test System (BSTS) with a tool to evaluate the traffic management characteristics of POS/SDH switch-routers interfaces.

Such characteristics are central to the compliance and interoperability of network hardware.

Key Features

Generation and transmission of IP packets

Off-line configuration utilities allow you to create a POS data file with user-defined encapsulation parameters and variable interframe gaps. Full control down to the octet allows complete testing of Layer-2 POS implementations. This file can be transmitted either once or continually with hardware performing real-time scrambling and SONET/SDH framing.

Capture and analysis of IP packets

On the receive interface, you can perform optional payload descrambling, capturing of POS data using basic triggers or capture filters, and upload the file for off-line analysis. Some of the statistics provided by the off-line analyzer are:

- IP header checksum errors
- IP packet length errors
- total frames
- frames/sec (packet throughput)

Real-time scrambling/descrambling of SONET/SDH payload

Unique to the BSTS solutions, support for programmable real-time scrambling/descrambling to $X^{43}+1$ of the entire SONET/SDH payload is available as per the latest addendum to RFC 2615 (obsoletes RFC 1619)/1662.

Native LAN Support

The Agilent POS solutions provide full support for the classic LAN protocols including: IP, TCP, UDP and ICMP. An extensive PDU editor is available for each of these protocols which gives access to all protocol fields and automatically highlights protocol errors. In addition, full decode support is provided for over 100 LAN protocols from the following protocol suites:

- TCP/IP
- Microsoft LAN Manager
- Appletalk
- Banyan/VINES
- DECnet
- IBM/SNA
- Xerox/XNS
- Novell/IPX
- ISO
- Sun
- X Windows

POS Functional Testing

Functional Testing of POS Hardware Designs

The following three test examples can be performed to verify correct behavior of the hardware design. The tests require the behavior of the equipment under test to be monitored while it receives packets with different traffic or payload patterns.

- Payload Pattern #1: Send maximum stuffing-ratio traffic

An IP/PPP packet that contains all 7D or 7E octet values will result in a doubling of the payload size after insertion into the HDLC frame. A sequence of such packets will cause maximum stress on the stuffing and de-stuffing circuits.

This payload pattern also tests the effectiveness of the flow control mechanism between the POS line card and the router's egress or ingress buffer.

- Payload Pattern #2: Vary the inter-frame gap by octet increments

This test effectively introduces a "phase shift" of the octet-synchronous HDLC frame as it is presented to wide-bus architectures and will pick up problems in the pack-and-rotate circuits.

For example, in a POS line card with a 32-bit architecture, there are four different octet phases to be verified.

- Payload Pattern #3: Send minimum-size packets at full rate

This determines the maximum rate of FCS calculations that can be performed. It is also a good overall test of the POS line card's HDLC frame-handling capacity.

Link Initialization

Both the LCP (Link Control Protocol) and IPCP (IP Control Protocol) initialization procedures must complete successfully before any user data will be forwarded across the link. Because PPP is handled by software, it can generally be by-passed or disabled at the hardware testing stage.

However, for system testing, this layer must be working correctly. This is particularly the case when conducting field trials on POS equipment from multiple vendors.

Configuration and Use With Other BSTS Modules and Applications

The minimum configuration required to test 155Mb/s and 622Mb/s POS interfaces is as follows:

- Agilent E1608A POS Processor
- Either
  - E1697A Optical Line Interface (for testing at 155 Mb/s), or
  - E1618A Optical Line Interface (for testing at 622 Mb/s)
- Agilent Broadband Series Test System chassis

The Agilent E1608A requires the following system configuration:

- 1 x V743 HP-UX controller running at 64 MHz or 100 MHz and:
  - a minimum of 32 Mb RAM (not recommended)
  - 64 Mb RAM (recommended), or
  - 128 Mb RAM
- minimum 2 GB SCSI hard drive

Since the Agilent BSTS 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 suit your specific needs. Remember that you can always add extra software or modules at any time.

Warranty & Support Options

Hardware

All BSTS hardware components are warranted for a period of 3 years. Products must be returned to an authorized Agilent service center for service.

Software

Agilent 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 Agilent Broadband Series Test System, the software/firmware media has the same warranty period as the product.

Ordering Information

The BSTS Packet over SONET/SDH solutions are sold as bundles for either 155 Mb/s or 622 Mb/s. However, individual product numbers can also be ordered to supplement your existing BSTS solutions.

Product Numbers

Agilent E4200B/4210B Option 050
The 622 Mb/s (OC-12c/STM-4c) POS Test Solution

Consists of the following:

- **E1608A** 0-622 Mb/s POS Processor
- **E1618A** 622 Mb/s Optical Line Interface

Agilent E4200B/4210B Option 055
The 155 Mb/s (OC-3c/STM-1) POS Test Solution

Consists of the following

- **E1608A** 0-622 Mb/s POS Processor
- **E1697A** 155 Mb/s Optical Line Interface

Technical Specifications

Summary of Module Test Features

E1608A 155Mb/s, 622Mb/s Packet over SONET/SDH Processor module

- Packet Over SONET/SDH, SONET/SDH POH and SPE/VC testing
- Used in conjunction with the Agilent E1618A 622 Mb/s Optical Line Interface or E1697A 155Mb/s Optical Line Interface

General:

Supports RFC 2615 (obsoletes RFC-1619) & RFC-1662

Transmit:

- Real time scrambling to RFC-1662
- 0-100% bandwidth
- Full control over transmit payload
- POH Error and alarm simulation
- SONET/SDH POH builder
- POH octet editor (Including C2 - protocol type field)
- Path trace message generation

Receive:

- Real time descrambling to RFC-1662
- 0-100% bandwidth acceptance
- Full analysis over captured payload to IP
- Capture SPE contents, frames only or pattern matched frames
- Pattern matching to 32 octets on SPE or octet destuffed frames
- C2 protocol type field display
- Path trace message display

Additional Modules

• E1618A 622Mb/s Optical Line Interface	• For detailed specifications on the SONET/ SDH Functionary available on the E1618A 622Mb/s Optical Line Interface, please refer to Agilent Publication number 5966-1444E
• E1697A 155Mb/s Optical Line Interface	• For detailed specifications on the SONET/ SDH functionary available on the E1697A 155Mb/s Optical Line Interface please refer to Agilent Publication number 5966-1444E

POS Features

Encapsulations & Scrambling

Supported encapsulations	• PPP • HDLC • MAPOS • User defined
Scrambling	Real time scrambling and descrambling of data as per RFC1662 • Transmit scrambling {on | off} • Receive descrambling {on | off}

PPP Link Negotiation Protocol

Link control	Operations available through the PPP state machine • Active link setup • Passive link setup • Link teardown • FCS for LCP and IPCP negotiation {FCS-16 | FCS-32}
LCP options supported	Settable options for the Link Control Protocol • (MRU) Maximum Receive Unit size settable: 0 to 65 535 • Magic Number{on | off} • (PFC) Protocol Field Compression {on | off} • (ACFC) Address & Control Field Compression {on | off} • FCS alternatives{FCS-16 | FCS-32}
IPCP Options supported	Settable options for the IP Control Protocol • Set own IP Address: any value except 0.0.0.0 • Accept peer IP Address: any value except 0.0.0.0

Traffic Generation

Traffic is loaded into a transmit buffer from a file containing space-delimited ASCII Hex data. This buffer is replayed to generate the transmit data stream.

Data Generator Features

Transmit buffer size	• Loaded from POS data file • 1,048,552 octets
Available transmit bandwidth	• Data bandwidth: 0% to100% • Ctrl-Esc ratio: 0% to100%
Transmit buffer operations	Controls for the transmission of transmit buffer contents • Off (Sends all 0x7E data) • Continuous • Once

POS Data File Compiler Features and Controls

POS compiler controls	**Command line options** • FCS: 16 or 32 • HDLC Compression: on or off • Protocol field size: 8 or 16 bits • PPP Compression: on or off • Repeat definition throughout output file: on or off **Per-frame PPP encapsulation parameters** • PPP protocol field (8 bit): 0 to 0xFF • PPP protocol field (16 bit): 0 to 0xFE FF • Pad byte value: 0 to 255 • Pad size: 0 to 1 000 000 • Address field: 0 to 0xFF • Control field: 0 to 0xFF • Inter-frame gap: 1 to 1 048 549 • Ctrl-Esc Percentage: 0% to 100% **Off line POS data file IP compiler controls** • Number of frame descriptors: 0 to 350 000
Transmit buffer operations	**Per-frame IP Descriptor control parameters** • IP Version: 0 to 15 • Precedence bits: 0 to 7 • TOS delay bit: 0 or 1 • TOS throughput bit: 0 or 1 • TOS reliability bit: 0 or 1 • TOS future use bits: 0 to 3 • Identification: 0 to 65 535 • Reserved bit: 0 or 1 • Don't fragment bit: 0 or 1 • More fragments bit: 0 or 1 • Fragmentation offset: 0 to 8 191 • TTL Time To Live: 0 to 255 • IP Protocol: 0 to 255 • Source Address: 0 to 255 for all octets • Destination Address: 0 to 255 for all octets • Payload fill value: 0 to 0xFF • Payload size: 0 to 65 515

Integrated Protocol Builder and Encodes

Specification of Traffic Stream Payload	**PDU builders for the following protocols:** • IPv4 • TCP • UDP • ICMP • Sequence Builder • Concatenates PDUs into sequences

Traffic Analysis

Data is captured and then saved to a file for off-line analysis using the in-built POS data file analyzer.

Capture Buffer Features

Capture buffer size	Selectable: • 128K, 1M, 4M or 8M
Capture system bandwidth	• Acceptable used bandwidth on input: 0 to 100% • Acceptable Ctrl-Esc bandwidth on input: 0 to 100%
Capture buffer trigger points	• Start of buffer
Capture filter	• Capture line data (every octet) • Reduce extra framing octets (reduce inter frame gaps) • Capture pattern-matched frames only
Pattern Matcher	• Pattern matches all frames • 32-octet based pattern matcher • {0|1|x}-selectable for each bit • Pattern match save/restore • Pattern match on line data or octet-destuffed data

POS Data File Analyzer Features and Controls

Command line options	• FCS: 16 or 32 • HDLC Compression: on or off • Protocol field size: 16 or 32 • PPP Compression: on or off
Layer-2 capture statistics	• Number of data bytes (excluding Ctrl-Esc octets) • Number of Framing Octets (0x7E) • Number of valid Ctrl-Esc octets • Number of valid frames • Number of invalid frames • Numbers of FCS errors • Number of Address field mismatches • Number of Control field mismatches • Number of Protocol field mismatches
Layer-3 capture statistics	• Number of Invalid PDUs (IP datagram too small) • Number of Errored PDUs • Version field mismatch • Header length field error • Total length field error • Flags field error • TTL field error • Header checksum error

SRP Data File Analyzer Features and Controls

Command Line Options	• SRP: Enable SRP statistics • LSB FCS: FCS in the SRP packet is transmitted with the least significant byte first • Ignore source Address: The value of the source address is ignored for Control packets
Framing Statistics	• Number of Data bytes • Number of frame fill bytes • Number of valid Control-Escape bytes • Number of invalid Control-Escape bytes • Number of valid frames • Number of invalid frames • Number of FCS field errors
SRP Statistics	• Number of parity errors • Number of frames with Time To Live field errors • Number of short frames • Number of long frames • Number of data frames • Number of keep alive frames • Number of control frames • Number of frames with unknown mode • Number of multicast frames • Number of SRP frames with SRP control packets • Number of SRP frames with IP packets • Number of SRP frames with ARP packets • Number of SRP frames with unknown packets • Number of SRP control frames with topology discovery frames • Number of SRP control frames with APS packets • Number of SRP control frames with unknown packets • Valid frame rate (frames/sec) • Invalid frame rate (frames/sec)

Protocol Analysis

Integrated Protocol Decode Engine and Viewer

DARPA/IETF	**BGP** - RFC1105; Border Gateway Protocol; June 1989 **BGP-4** - RFC1771; A Border Gateway Protocol 4; March 1995 **BOOTP** - RFC951; Bootstrap Protocol; September 1985 **DHCP** - RFC2131; Dynamic Host Configuration Protocol; March 1997 **DLSW** - RFC1795; Data Link Switching Protocol v1.0; April 1995 **EGP** - RFC904; Exterior Gateway Protocol; April 1984 **HTTP** - RFC1945; Hypertext Transfer Protocol; May 1996 **ICMP** - RFC792; Internet Control Message Protocol; September 1981 **IGMP** - RFC1112; Internet Group Management Protocol; August 1989 **IGRP** - Charles L. Hedrick Rutgers University NJ; August 1991 **IGP** - RFC823; Internet Gateway Protocol; DARPA; September 1982 **IP** - RFC791; Internet Protocol; September 1981 **IPV6** - RFC1883; Internet Protocol Version 6; December 1995 **NTP** - RFC1119; Network Time Protocol (version 2); September 1989 **OSPF** - RFC1247; OSPF Version 2; July 1991 **RIP** - RFC1058; Routing Information Protocol; Xerox; June 1988 **RTP** - RFC1889; A Transport Protocol for Real-Time Applications; January 1996 **RTCP** - RFC1889; Real-Time Control Protocol; January 1996 **UDP** - RFC768; User Datagram Protocol; August 1980 **SMTP** - RFC821; Simple Mail Transfer Protocol; August 1982 **TCP** - RFC793; Transmission Control Protocol; September 1981 **TFTP** - RFC783; Trivial File Transfer Protocol (revision 2); June 1981 **TIMED** - Time Daemon Protocol; Sun **X11** - X Open; X-Window Protocol, X11 R4
AppleTalk	**DDP** - Datagram Delivery Protocol; AppleTalk Phase 1; June 1989
Banyan Vines	**VINES** - Banyan Vines Protocol; Banyan
Berkeley Services	**RLOGIN** - RFC1282 Remote Login Protocol; December 1991 **RSHELL** - Remote Shell Protocol; University of California, Berkeley **REXEC** - Remote Execution Protocol; University of California, Berkeley
Cisco	**EIGRP** - Enhanced IGRP; Cisco

DECnet	**CTERM** - Network Command Terminal; DECnet Phase IV; Digital **DAP** - Data Access Protocol; DECnet Phase IV - Version 4; Digital **DNAR** - DNA Routing Protocol; Phase IV; Digital **NICE** - Network Information and Command Exchange Protocol; DECnet Phase IV; Digital NSP - DNA Network Service Protocol; Phase IV; Digital **SCP** - DNA Session Control Protocol; Phase IV - Version 1.0; Digital
IBM/SNA	**SMB** -Server Message Block, MS, Intel; November 1990
ISO	**DAP** - ISO 9594; X.500; CCITT; December 1990 **CLNP**- ISO 8473: Connectionless Network Service: December 1988
Microsoft LAN Manager/X	**LMX_DG** - RFC1001; Microsoft LAN Manager Datagram Service; March 1987 **LMX_NS** - RFC1001; Microsoft LAN Manager Name Service; March 1987 **LMX_SS** - RFC1001; Microsoft LAN Manager Session Service; March 1987
Novell Netware	**IPXDIAG** - Diagnostics Protocol; Novell **NCP** - NetWare Version 3.x and 4.x; Novell **NLSP** - Netware Link Services Protocol; Novell
Sun	**NFS** - RFC1094; Network File System Protocol; Sun; March 1989 **RPC** - RFC1057; Remote Procedure Call Protocol; Sun; June 1988
Xerox /XNS	**ECHO** Echo Protocol; Xerox **ERROR** - Error Protocol; Xerox **IDP** - Internetwork Datagram Protocol; Xerox **IPX** Internet Packet Exchange Protocol; Novell **RIP** - RFC1058; Routing Information Protocol; Xerox; June 1988 **SPX** - Sequence Packet Exchange Protocol; Novell

Electrical & Mechanical Specification

VXI Module

Size	• 1 slot C-size VXI card
Weight	• 2.0 kg nominal
Power Dissipation	• 79 Watts (max)
Backplane Connectors	• P1, P2
Addressing	• Logical and servant addressing

Front Panel LED Indicators

Tx	• On: module is transmitting data continuously • Off: module tranmitter is off
Rx	• Not used in release 1.0 and 2.0
Rx Err	• Not used in release 1.0 and 2.0
Tx	• Not used in release 1.0 and 2.0

Environmental Operating Conditions

Operating Temperature	• $0^{o}C$ to $45^{o}C$ • Jitter transfer specification maintained over the range $10^{o}C$ to $55^{o}C$
Storage Temperature	• $-40^{o}C$ to $70^{o}C$
Humidity	• 0% to 95% relative humidity from $25^{o}C$ to $40^{o}C$

Agilent Technologies Broadband Series Test System

The Agilent Technologies BSTS is the industry-standard ATM/BISDN test system for R&D engineering, product development, field trials and QA testing. The latest leading edge, innovative solutions help you lead the fast-packet revolution and reshape tomorrow's networks. It offers a wide range of applications:

- ATM traffic management and signalling
- Packet over SONET/SDH (POS)
- switch/router interworking and performance
- third generation wireless tesing
- complete, automated conformance testing

The BSTS is modular to grow with your testing needs. Because we build all BSTS products without shortcuts according to full specifications, you'll catch problems other test equipment may not detect.

www.Agilent.com/comms/BSTS

United States:
Agilent Technologies
Test and Measurement Call Center
P.O. Box 4026
Englewood, CO 80155-4026
1-800-452-4844

Canada:
Agilent Technologies Canada Inc.
5150 Spectrum Way
Mississauga, Ontario
L4W 5G1
1-877-894-4414

Europe:
Agilent Technologies
European Marketing Organisation
P.O. Box 999
1180 AZ Amstelveen
The Netherlands
(31 20) 547-9999

Japan:
Agilent Technologies Japan Ltd.
Measurement Assistance Center
9-1, Takakura-Cho, Hachioji-Shi,
Tokyo 192-8510, Japan
Tel: (81) 426-56-7832
Fax: (81) 426-56-7840

Latin America:
Agilent Technologies
Latin American Region Headquarters
5200 Blue Lagoon Drive, Suite #950
Miami, Florida 33126
U.S.A.
Tel: (305) 267-4245
Fax: (305) 267-4286

Asia Pacific:
Agilent Technologies
19/F, Cityplaza One, 1111 King's Road,
Taikoo Shing, Hong Kong, SAR
Tel: (852) 2599-7889
Fax: (852) 2506-9233

Australia/New Zealand:
Agilent Technologies Australia Pty Ltd
347 Burwood Highway
Forest Hill, Victoria 3131
Tel: 1-800-629-485 (Australia)
Fax: (61-3) 9272-0749
Tel: 0-800-738-378 (New Zealand)
Fax: (64-4) 802-6881

Specifications subject to change.

5968-2046E 04/00 Rev E

Agilent Technologies
Innovating the HP Way