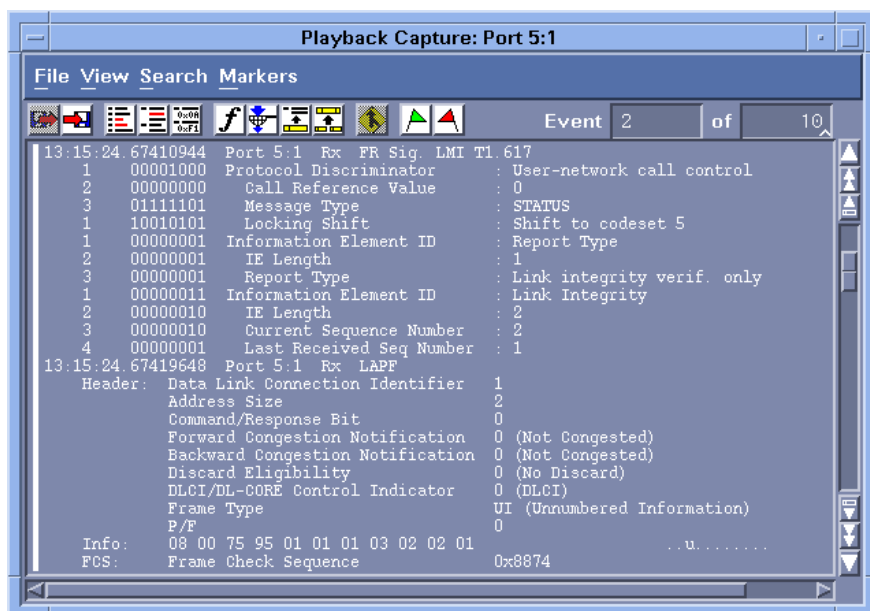# Frame Relay Test Software

Agilent Technologies Broadband Series Test System

E4216A

Product Features

- Extensive PVC testing capability
- LMI Decoding and emulation (heartbeat polling)
- Extensive PDU editing capability
- Runs on T1/E1 and V-Interface Frame Processors and on CPP for ATM/AAL-5
- Can be combined with Frame Relay SVC decodes or LAN decodes

The Agilent Technologies E4216A Frame Relay Test Software decodes and displays frames, as well as generates test traffic (with encoding and decoding of DL-CORE frames).

The decoded English-language display uses the same terminology found in standards documents. Errors are automatically detected and highlighted on-screen, complete with explanatory messages. Traffic can be displayed with a live viewer, captured in memory, or logged to disk. Capture megabytes of traffic, or loop indefinitely and stop when a specified event occurs. For example, capture all traffic sent to a specified data link control identification and stop when a framing error occurs. Captured information can be analyzed off-line with a playback viewer.

The E4216A can execute on any of three hardware modules -- the E4209A Cell Protocol Processor, the E4206A T1/E1 Frame Processor, or the E4207A V-Interface Frame Processor.

For testing native mode Frame Relay over the HSSI interface, the E6279A Frame Relay over HSSI Test Software should be used.

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Key Features

Real-Time Dual-Port Monitoring and Analysis

Powerful dual-port testing monitors both sides of even heavily-loaded links in real-time. You can view frames 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. Timestamps correlate events between ports. Sophisticated filters and triggers let you view only traffic of interest, and catch intermittent events. The E4216A has everything you need to see exactly what happened, and when.

LMI decodes for Q.933 Annex A, T1.617 Annex D, original LMI, and NTT LMI are provided. Encapsulated LAN over Frame Relay (RFC 1490) protocols can be tested using the E4215B LAN Protocols Test Software. LAPF decodes are also included. These are required for Frame Relay SVC operations using the E6278A Frame Relay SVC Protocol Viewer test software.

LMI Heartbeat Polling Emulation

LMI Heartbeat Polling Emulation is available on the E4206A and E4207A frame processor modules. Two simultaneous channels are available and can be supplemented by the LMI UPE program which adds one additional channel.

High-Performance Traffic Generation

Generates up to eight streams with individually-selectable distributions. For load generation purposes, the E4206A and E4207A are scalable in two-port increments by adding extra modules up to a maximum of five modules (10 ports) per BSTS E4200 chassis or 7 modules (14 ports) per BSTS E4210 chassis.

The protocol data unit (PDU) editor and library functions let you easily create, edit, save, and load PDUs and PDU sequences from files for later re-use. You can edit 2-, 3- and 4-octet DL-CORE PDUs with smart fill-in the blank editing screens. Time-saving features such as pull-down menus, field labelling, radio button bit selection, data patterns, and automatic CRC calculation make PDU editing fast and simple.

Extensive Real-Time Measurements

When testing on a Frame Processor (FP), i.e E4206A or E4207A , make over 150 different real-time statistical measurements, including frame rate, committed information rate (CIR), excess information rate (EIR) policing measurements, delay, and lost frames.

When testing on the Cell Protocol Processor (CPP), make pattern count and statistical ATM measurements.

Test Both Sides of Frame based/ATM Interworking Devices

Combine the E4206A or E4207A with other modules from the BSTS' extensive range of line interfaces and test software applications, to test both sides of a Frame based / ATM interworking device or function -- on one tester!

Friendly User-Interface Makes Complex Testing Easy

The state-of-the-art graphical user interface makes it easy to set up, run, save and restore tests. Includes a C-language user programming environment to automate testing or create extremely complex test scenarios.

Typical Applications

Equipment manufacturers and network operators who provide frame based equipment or frame based/ATM internetworking devices need to verify that:

- Protocol implementations are functionally verified as meeting design specifications and interoperating standards
- Equipment and services are stress-tested to verify that they perform well under heavy loads, especially those which result from conditions such as very short frame lengths

The combination of an E4206A or E4207A Frame Processor, or CPP/LIF combinations and E4216A Frame Relay Test Software facilitates testing these aspects through error isolation and traffic-generation functions.

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User Programming Environment

You can automate repetitive testing or create complex test scenarios by developing your own programs with the UNIX®-based C-language programming environment included with the BSTS. User programs can be run on an E4206A or E4207A Frame Processor and/or an E4209A Cell Protocol Processor.

Simply link your programs to the supplied library of test routines. The user programming library supports FR-SSCS, DL-CORE, ATM, and AAL-5 PDU encoding and decoding functions, transmits and captures 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.

E4200/E4210 Broadband Series Test System (BSTS)

The E4200/E4210 Broadband Series Test System (BSTS) is well suited to R&D engineering, product development, field trials and quality assurance. The industry-standard R&D performance and conformance tester that offers the most transmission and protocol technologies on a single platform, the BSTS is ideal for Frame Relay/ATM interworking testing.

You can test both sides of an interworking function or device with a single BSTS, since timestamps and statistics are synchronized between all modules in a BSTS chassis, allowing correlation of events and times between physical ports.

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

The E4216A Frame Relay Test Software requires a BSTS chassis with UNIX® controller, and one of the following configurations:
- E4206A T1/E1 Frame Processor
- E4207A V-Interface Frame Processor
- E4209A/B Cell Protocol Processor and a Line Interface Module.

Warranty & Support Options

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

This test software has no components requiring calibration.

Product Numbers

- **E4206A** T1/E1 Frame Processor
- **E4207A** V-Interface Frame Processor
- **E4215B** LAN Protocols Test Software
- **E4216A** Frame Relay Test Software
- **E6278A** Frame Relay SVC Protocol Viewer
- **E6279A** Frame Relay over HSSI Test Software
- **E7840A** Bellcore Frame Relay/ATM Interworking Test Suite
- **E4209A/B** Cell Protocol Processor
- **E4200A/B** BSTS Form-7 Transportable Chassis
- **E4210A/B** BSTS Form-13 Mainframe Chassis

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Technical Specifications

Generic Capabilities

LMI protocol variants	- T1.617 Annex A - Q.933 Annex D - Original LMI (Group of 4) - NTT including CLLM
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 format - Timestamps: Toggle on/off the display of timestamps - Port identifier: Toggle on/off the display of the VXI slot number of the module from which the data was captured; also indicates whether the captured data was transmitted or received
Summary Display Contents	- Event header - Most significant error in PDU (if any) - DL-CORE/LAPF information, including DLCI (data link connection identifier), FECN (forward explicit congestion notification), BECN (backward explicit congestion notification), and discard eligibility (DE) bits
Detailed Display Contents	- Field-by-field decode of each header and trailer field

Frame Relay Display Filters

DL-CORE/LAPF	- Data link connection identifier (DLCI) can be specified - Command/Response (C/R) bit, Forward explicit congestion notification (FECN) bit, Backward explicit congestion notification (BECN) bit, Discard eligibility (DE) bit - Address length of 2, 3 or 4 octets - Filter D/C = 0 or D/C = 1, DL-CORE Control - LAPF frame type (I, S, or U frames) - LAPF invalid frame type - LAPF information field not permitted error - LAPF FRMR error - LAPF CLLM error - DL-CORE aborted frames (FP only) - DL-CORE non-octet aligned frames (FP only) - DL-CORE FCS errors (FP only) - DL-CORE address size (too small or too large) - LAPF/DL-CORE frame size (too small or too large)

LMI Decodes	- LMI Message type - LMI missing expected octet - LMI message or information element (IE) length (too short or too long) - LMI unnecessary IE or format is present - LMI mandatory IE or format is missing - LMI invalid field value
LMI Emulation	- Stimulate LMI Heartbeat Polling in GUI - Support T1.617, T617a, Q.933 - 2 simultaneous channels on selectable DLCI s - Live status monitoring and PVC services - Supported only on Frame Processor modules
DL-CORE PDU Editor Fields	- Command/response (C/R) bit - Forward explicit congestion notification (FECN) bit - Backward explicit congestion notification (BECN) bit - Discard eligibility (DE) bit - Data link connection identifier (DCLI) - Data link connection identifier (DCLI) size - Control information - Information field (payload) - Frame check sequence (FCS) - FP only

Frame Processor Capabilities

Real-Time Dual-Port Monitoring

Multiport Monitoring	- Dual-port mode - Synchronized timestamps correlate events from two physical ports - Protocol viewer works with live traffic or plays back captured data - 4 MB capture buffer per port
Modes	- Passive monitor - Network termination (emulate network) - Terminal equipment (emulate user)
Decode Errors	- Aborted frames - Frame does not have an integral number of octets - Frame is too large - Frame is too small - Address size is too large - Address size is too small - Less than 3 octets between address and end flag - Invalid frame check sequence (FCS) or cyclical redundancy check (CRC-16)

BOP Filters	• Frame check sequence (FCS) errors
	• Aborted frames
	• Non-octet aligned frames
	• Block frames
	• Layer 1 events
	• Trace statements
BOP Triggers	• Frame check sequence (FCS) errors
	• Aborted frames
	• Non-octet aligned frames
	• Capture buffer full
	• Time of day
	• External trigger input
Pattern Matching	• Passes or blocks frames which match a 64-byte user-defined pattern
Trigger Actions	• Start/stop collecting statistics
	• Start/stop capture
	• Generate a trace statement
	• Display a message
	• Notify user program
	• Pulse external trigger output
Trigger Controls	• Delayed trigger activation
	• Specify delay in frames of 0 to 100 milliseconds
BOP Measurements	• Bits per second
	• Number of frames
	• Frames per second
	• Minimum, average and maximum frame length
	• Number of aborted frames
	• Number of non-octet-aligned frames
	• Number of frames matching a user-defined 64-byte pattern
	• Number of frame check sequence (FCS) errors
Frame Relay Range Measurements	• Average delay measured in μs
	• Maximum delay measured in μs
	• Number of frames
	• Number of lost frames
	• Bits per seconds
Frame Relay Link Measurements	• Frames with FECN = 1
	• Frames with BECN = 1
	• Frames with DE = 1
	• Short frames
	• Long frames
	• Frames with invalid headers
	• Frames per address length

Frame Relay DLCI Measurements	• Number of frames
	• Frames per second
	• Frames inside/outside the excess information rate (EIR)
	• Frames within the committed information rate (CIR)
	• Frames with BECN = 1, DE = 0, DE = 1, and/or FECN = 1
	• User bits per second
	• User bits per second within EIR, outside EIR, within CIR
	• User bits per second with DE = 0, DE = 1

High-Performance Traffic Generation

Traffic Streams and Controls	• Generate up to eight simultaneous streams
	• Selectable throughput in kb/s and percent load for each stream
	• Constant, burst or random traffic distributions with distribution parameters individually selectable for each stream
Protocol Traffic Options	• Overwrite the data link connection identification (DLCI) in 2-octet DL-CORE headers with user-specified values
	• Increment DLCI over a specified range
Traffic Options	• Embed 48-bit timestamps (Stream 1 only)
	• Embed 32-bit sequence numbers
	• Truncate frame length to specified number of octets
	• Increment frame length over a specified range
	• Randomly select frame length from within a specified range

Cell Protocol Processor Capabilities

Real-Time Dual-Port Monitoring

Multiport Monitoring	• Dual-port mode (two CPP/LIF pairs are required)
	• Synchronized timestamps correlates events from two physical ports
	• Protocol viewer works with live traffic or plays back captured data
	• 8 MB capture buffer per port
Modes	• UNI and NNI modes
Decode Errors	• Frame is too large
	• Frame is too small
	• Address size is too large
	• Address size is too small
	• Less than 3 octets between address and end flag

Frame Relay Test Software
E4216A

Pattern Matchers	• Pattern length: One cell
	• Editing forms: ATM cells and DL-CORE PDUs
	• Match tests: Normal or inverted
	• Bit matching: 0, 1, or don't care
	• 8 patterns
Triggers	• User defined events can be programmed to trigger automatic responses.
	• Triggers can be used separately or logically ORed.
Actions	• Start or stop capturing data
	• Increment or reset a counter
	• Start, stop or reset a timer
	• Exert an external trigger
	• Drop and insert
	• Transmit traffic
Events	• Cell received
	• Pattern match
	• SAR or CRC error
	• Counter maximum limit of 65535 reached
	• Timer max limit of 256 msec reached
	• External trigger input detected
Cell Measurements	• Cell count: Total number of cells received
	• Unassigned cells: Total number of unassigned cells received
	• Channel count: Total number of cells received in channels 1 to 4
	• Reassemblies: Total number of reassemblies in channels 1 to 4
	• Errored cells: Total erroneous cells received for: AAL-5 PDUs with trailer errors in channels 1 or 2; CRC errors in channel 3
	• Matches total number of current event or pattern matches

High-Performance Traffic Generation

Traffic Streams and Controls	• Generate up to eight simultaneous streams
	• Selectable throughput in percent load for each stream
	• Constant, Burst, Poisson, and Sawtooth traffic distribution with distribution parameters individually selected for each stream

User Programming

LMI Emulation	• UPE program is supplied with test software to emulate LMI according to either T1.617 Annex D, Q.933 Annex A or Original (Group of 4) LMI, can be used in addition to GUI based LMI Emulation

Sample Programs	• T1/E1 port setup
	• V-Interface port setup
	• Delay measurement
	• Lost frame, delay measurements, and payload integrity check for Frame Relay / ATM interworking

Applicable Standards

ATM cells	• ITU Recommendation I.361 (11/95) - B-ISDN ATM layer specification
AAL-5	• ITU Recommendation I.363 (03/93), Section 6 - B-ISDN ATM adaptation layer (AAL) specification
DL-CORE	• ITU Recommendation Q.922 (02/92) - ISDN data link layer specification for frame mode bearer service
LAPF	• ITU Recommendation Q.921 (03/93) - ISDN user-network interface - data link layer specification
	• ITU Recommendation Q.922 (02/92) - ISDN link layer specification for frame mode bearer service
FR-SSCS	• Frame Relay Forum FRF.5 FR/ATM Network Interworking Implementation Agreement
LMI	• ITU Recommendation Q.933 Annex A
	• ANSI T1.617 Annex D; Integrated Service Digital Network (ISDN) -- Digital Subscriber Signalling System No. 1 (DSS1) -- Signalling Specification for Frame Relay Bearer Service, June 18, 1991
	• Frame Relay Specification with Extensions, Based on Proposed T1S1 Standards, Document Number 001- 208966 Revision 1.0 September 18, 1990; Digital Equipment Corporation, Northern Telecom Inc., and StrataCom, Inc.
	• NTT: Technical Reference of Frame Relay Interface Ver. 1 November, 1993

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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.

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