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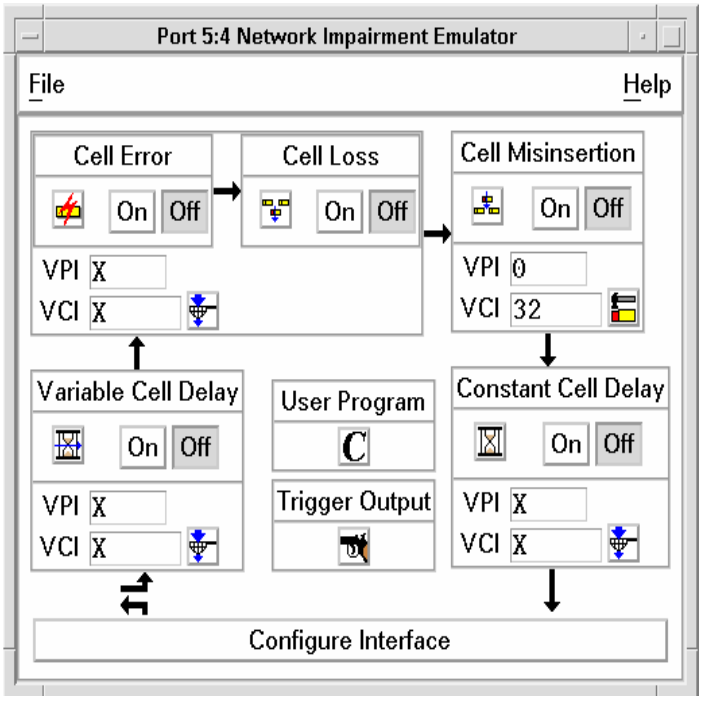
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ATM Network Impairment Emulator

Agilent Technologies Broadband Series Test System

E4219A



Product Features

- Emulates real-world impairments at the click of a mouse
- Several statistical impairment distributions including user-defined
- Wide delay range up to 220 ms of cell delay(+/-3%) & 2.57 ms (+/-3%)of cell delay variation
- C-language user programs for automated testing
- Selectively impair cells based on user-defined cell header field
- Cascadable up to four modules to increase total delay to provide impairments for additional VPI/VCIs

The Agilent Technologies E4219A ATM Network Impairment Emulator module provides the capability to insert five impairment types—cell loss, cell error, cell misinsertion, and cell delay into an ATM cell stream at rates up to 155 Mb/s. You can emulate noisy transmission lines, bufferring delays, satellite hops, traffic policing, switch malfunctions, etc.

At a click of a mouse, you can set up any possible network impairment.

Set cell delay and loss values to emulate a real-world network. Connect the impaired cell stream output to your system under test, and see what happens. Use the Agilent E4219A to find performance tolerances of your ATM network and CPE products, or determine service requirements when planning network capacity.

For example, MPEG is very specific about the amount of jitter it allows. The ATM transport stream can introduce milliseconds of jitter. Combine the Agilent E6271 MPEGscope ATM for the BSTS and the Agilent E4219A to introduce the jitter and verify that equipment can remove jitter effectively. The Agilent E4219A can also be used to verify that the system's error handling and detection capabilities are operational.

Network impairment modules can be cascaded to increase total cell delay and cell delay variation. For higher layer and automated conformance testing, combine the E4219A with E4209 Cell Protocol Processor.

The Agilent E4219 is a powerful tool for network equipment manufacturers, service providers, MPEG equipment manufacturers, R&D labs and CPE vendors, it runs on the industry- standard Agilent Broadband Series Test System.

Agilent Technologies
Innovating the HP Way

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Key Features

Emulates real-world impairments

Inserts constant cell delay, cell delay variation, cell loss, cell error and cell misinsertion into an ATM cell stream.

Impairment distribution

Several statistical distributions, including user-defined, are available for cell error, cell loss, cell delay variation and cell misinsertion.

Wide delay range

- Up to 220 ms (+/-3%) cell delay at 155 Mb/s
- Up to 2.57 ms (+/-3%) cell delay variation at 155 Mb/s

Filter on any cell header

Select impaired cell streams by field filtering on any ATM cell header field.

Cascadable

Cascade up to four modules to increase total delay or provide impairments for additional VPI/VCIs.

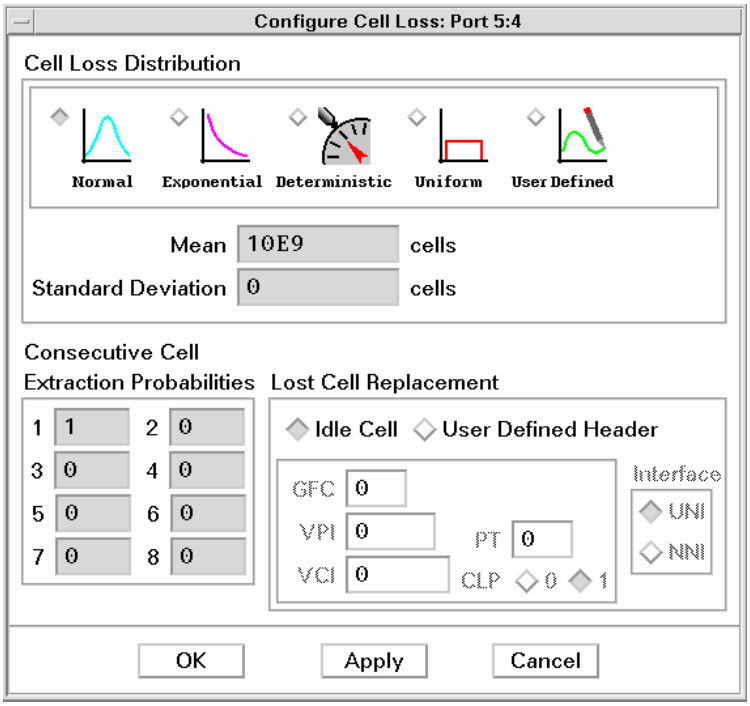
Applicable Standards

Impairments

- ITU-T Recommendation I.356, B-ISDN ATM Cell Layer Cell Transfer Performance, 1993

ATM

- ITU-T Recommendation I.361 B-ISDN ATM Layer Specification, 1993
- ITU-T Recommendation I.150 B-ISDN ATM Functional Characteristics, 1993



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

The E4219A ATM Network Impairment Emulator can emulate impairments with all BSTS ATM-based line interfaces at rates up to 155 Mb/s.

Product Numbers

- **E1616A** 1.5/45 Mb/s (DS1/DS3) Line Interface
- **E4201A** 2.048 Mb/s (E1)Line Interface
- **E1613A** 6.3 Mb/s (J2) Electrical Line Interface
- **E1614A** 6.3 Mb/s (J2) Optical Line Interface
- **E1619B** 25.6 Mb/s (4B/5B) Line Interface
- **E1610A** 34 Mb/s (E3) Line Interface
- **E1617A** 52 Mb/s (STS-1/STM-0) Optical Line Interface
- **E1612A** 155 Mb/s (STS-3c/STM-1) Electrical Line Interface
- **E1697A** 155 Mb/s (STS-3c/STM-1) Optical Line Interface
- **E4203A** 155 Mb/s Protocol Line Interface
- **E4205A** 155 Mb/s (UTP-5) Line Interface

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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.

Impairment Emulation

Impairment Independent Parameters

Channel Parameters

Total Bandwidth	• Up to 149.76 Mb/s
Modes	• UNI or NNI
Empty Cell Definition	• Idle or unassigned

ATM Header Matching or Misinsertion Values

VCI	• Any value 0 to 65536
VPI	• Any value 0 to 255 (UNI) or 0 to 4095 (NNI)
GFC	• Any value 0 to 15
Payload Type	• Any value 0 to 7
Cell Loss Priority	• Any value 0 to 7
Cell Type	• ATM

Variable Cell Delay

Variable cell delays are caused by congestion, cell blocking and multiplexing. Delays can be specified in milliseconds or multiples of four cells; delay scales as a function of line rate. There is an initial delay associated with the data path of the E4219A which should be calibrated as described in the product documentation.

Distribution Parameters

Binomial	• User-specified mean & standard deviation
Geometric	• User-specified mean
User Defined	• User-specified X,Y pairs representing desired probability density function

Variable Cell Delay Range

To quickly estimate maximum cell delay variation in seconds, divide 392,624 bits (926 cells x 53 octets per cell x 8 bits per octet) by line rate. Note that this calculation ignores any additional framing bits.

CDV	• 0 to 926 cells

Constant Cell Delay

Constant cell delay results from fixed network delays, such as lengthy transmission distances and switching delays.

Constant Cell Delay Range

To quickly estimate maximum constant cell delay in seconds, divide 33,553,664 bits (79,136 cells x 52 octets per cell x 8 bits per octet) by line rate. Note that this calculation ignores any additional framing bits.

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Cell Error

Cell errors are caused by bit errors caused by line noise. Errored bytes are selected from the payload according to the specified distribution. The E4219A modules can introduce up to four consecutive bit errors. The header cannot be errored. Errors can be specified in terms of cells or bytes.

Distribution Parameters

Normal	• User-specified mean error interval from 5 to 2E10 cells or 1000 to 1E12 bytes with user-specified deviation
Exponential	• User-specified mean error interval from 5 to 2E10 cells or 1000 to 1E12 bytes
Deterministic	• User-specified cell error rate from 5E-11 to 2E-1; byte error rate from 1E-12 to 1E-3
Uniform	• User-specified lower error interval limit of 5 cells or 1000 bytes; user-specified upper error interval limit of 2E10 cells or 1E12 bytes
User Defined	• User-specified X,Y pairs representing error intervals from 5 to 20^{37}-1 cells or 1000 to 2^{32}-1 bytes with associated probability from 0.0 to 1.0

Cell Loss

Cell loss results from such network problems as buffer overflow, switch malfunction, traffic policing, and uncorrectable header errors. The E4219A module can introduce bursts of up to eight consecutive cell losses. Lost cells can be replaced either by idle cells or by cells with user defined headers.

Distribution Parameters

Normal	• User-specified mean error interval from 1000 to 1E12 cells with user-specified standard deviation
Exponential	• User-specified mean error interval from 1000 to 1E12 cells
Deterministic	• User-specified cell error rate from 1E-12 to 1E-13
Uniform	• User-specified lower error interval limit of 1000 cells • User-specified upper error interval limit of 1E12 cells
User Defined	• User-specified X,Y pairs representing error intervals from 1000 to 2^{32}-1 cells with associated probability from 0.0 to 1.0

Cell Misinsertion

Cell misinsertion is caused by transmission errors and situations where an undetected header error matches an existing VPI/VCI. The header of the misinserted cell can be fully specified by the user. The first two and last two payload octets of the misinserted cell can be independently specified. A fill pattern for payload bytes 3-46 can also be specified.

Distribution Parameters

Normal	• User-specified mean error interval from 1000 to 1E12 cells with user-specified standard deviation
Exponential	• User-specified mean error interval from 1000 to 1E12 cells
Deterministic	• User-specified cell error rate from 1E-12 to 1E-13
Uniform	• User-specified lower error interval limit of 1000 cells • User-specified upper error interval limit of 1E12 cells
User Defined	• User-specified X,Y pairs representing error intervals from 1000 to 2^{32}-1 cells with associated probability from 0.0 to 1.0

External Triggers

External TTL trigger pulses may be output through the connector on the E4219A front panel. This allows the module to work in conjuction with other hardware. Triggers can be output under the following circumstances.

Variable Cell Delay	• The delay value changes
Cell Misinsertion	• A cell has been misinserted by the module
Cell Error	• A byte or cell has been errored by the module
Cell Loss	• A cell has been lost by the module
Constant Cell Delay	• A cell has been delayed by the module
Incoming	• The module detects an incoming non-empty cell
Outgoing	• The module detects an outgoing non-empty cell

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Configuration Modes

Terminated	• Default interface mode • Cells received through the cell bus from the module are inpaired by the E4219A, then looped back through the cell bus to the same module
Cascaded	• Default interface mode when the test application includes another module located to the left of the E4219A on the VXI (i.e. a CPP) • Use two or more E4219A modules to create very lengthly delays or apply different impairments to other virtual channels or paths • Cells received through the cell bus from the module on the right pass through the E4219A without sampling or modification • Cell received through the cell bus from the module on the left are impaired by the E4219A, then sent through the cell bus to the next module on the right
Disabled	• This mode is used when the E4219A is to be temporarily removed from the application without having to stop the application and start a new one • Cells received through the cell bus from modules to the right or left pass through the E4219A without modification.

Imput and Output

I/O Connectors

Trigger Out	• TTL output • BNC socket
Test Out	• TTL output • BNC socket

LED Status Indicators

Failed	• Red – Lights during startup; if the module passes the self-test, the light turns off; otherwise it stays lit
Access	• Green – Module is currently being accessed by the VXI control bus
CDV	• Green – Variable cell delay impairments are enabled • Red – A change in delay has been introduced by the module
Cell Error	• Green – Cell error impairments are enabled • Red – A byte or cell has been errored by the module
Call Drop	• Green – Cell loss impairments are enabled • Red – A cell has been lost by the module
Cell Misinsertion	• Green – Cell misinsertion impairments are enabled • Red – A cell has been misinserted by the module
Cell Delay	• Green – Constant cell delay impairments are enabled • Red – A cell has been delayed by the module

Size & Weight

Size	• 1 slot, C-size VXI card
Weight	• 1.3 kg (2.9 lb) nominal

Operating Environment

Operating temperature	• 0° to 55° C
Storage temperature	• -40° to 75° C
Humidity	• 50 to 95% RH over 25° to 40° C
Safety	• Conforms with EN 61010:1993/IEC 1010-1:1990 + A1
EMC	• Conforms with EN 55011:1991/CISPER 11:1990 (Group 1, Class A) • EN 50082-1:1992 • IEC 801-2:1991 • IEC 801-3:1984 • IEC 801-4:1988

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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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