Multiport UNI Signalling Performance Test Solution

Agilent Technologies Broadband Series Test System

E1600A, E1601A, E1602A
Multiport, Real-World, Performance Test

Agilent E4210B Broadband Series Test System with five Agilent E1600A UNI Signalling Multiport Test modules installed.

The Agilent Technologies E1600A Multiport UNI Signalling Performance test solution generates real-world signalling traffic at high rates and provides continuous real-time measurements across multiple ports. Your Agilent Broadband Series Test System equipped with this solution becomes a powerful tool for determining the signalling capabilities of an ATM switch or network, quickly, easily and reliably.

Through the specification of the call attempt rate, call duration, source and destination addresses, and SETUP parameters you are able to simulate, in a controlled and deterministic fashion, real-world signalling conditions.

An extensive set of measurements and events are provided to allow you to determine the performance of the system under test. All measurements are made in a continuous and real-time fashion to ensure that a reliable and accurate picture of the switch's ATM signalling performance can be made.

Multiport Testing

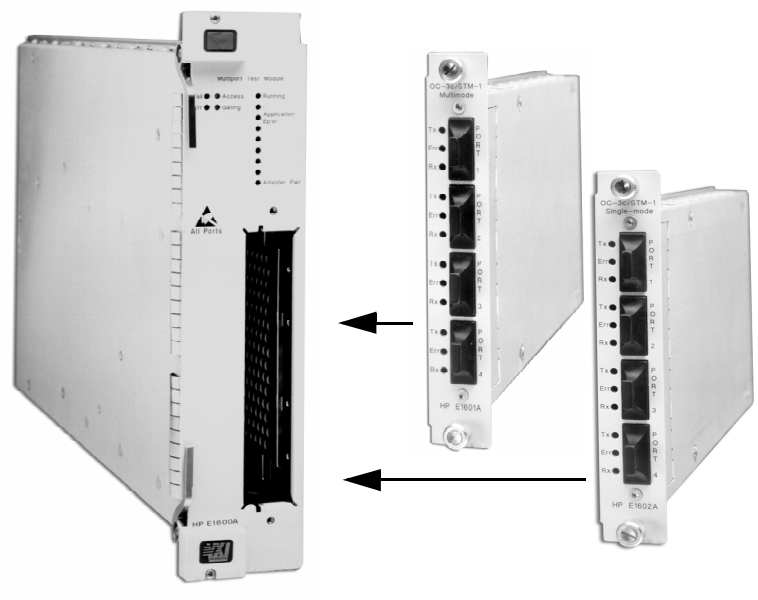
- Configure up to 5 modules (20 ports) in a single integrated test system
- Generate realistic SVC call generation profiles up to a total of 9,000,000 busy hour calls at 2,500 calls/s per system
- Maintain up to 125,000 simultaneous active connections per system
- Stress the Connection Admission Control function with high call volumes and control over traffic contract parameters
- Measure time-correlated SVC call statistics on all ports simultaneously
- Capture, decode and display interleaved, multiport signalling and ILMI PDU captures

Performance Benchmarking

- Maximum active call capacity
- Ratio of accepted, rejected, cleared and unreleased calls to outgoing call attempts
- Ratio of received, accepted, rejected and cleared calls to incoming call attempts
- Distribution of clearing causes for incoming and outgoing call attempts
- Variation of SVC setup and teardown times versus call attempt rates and active call levels

Test Automation

- User Programming Environment simplifies regression test development and ensures repeatability
- Users can integrate their own scripts into test configurations



The Agilent E1601A or Agilent E1602A plug into the Agilent E1600A Multiport Test Module to provide four full-duplex OC-3c connections.

Typical Applications

The solution is ideal for network equipment manufacturers to:

- characterize switch signalling performance
- verify signalling performance targets
- maximize and fine tune switch signalling performance
- differentiate switch capabilities against the competition based on signalling performance
- provide concrete, real-world performance data in order to generate independently verified product performance figures

The solution is also ideal for service providers who need to:

- independently verify signalling performance claims by manufacturers
- independently evaluate the signalling performance of switches under specific load conditions
- decide which switch to use for a specific application or role
- characterize and tune network performance
- guarantee network performance and reliability

Product Components

The Agilent Multiport UNI Signalling Performance Test solution requires a BSTS base and consists of three components:

- Agilent E1600A Multiport Test Module — a dual slot VXI module that provides the core load generation and measurement hardware and incorporates the UNI signalling performance test software.
- Agilent E1601A Quad OC-3c/STM-1 Multimode Port Adapter — This plugs into the Multiport Test Module and provides four full-duplex OC-3c connections.
- Agilent E1602A Quad OC-3c/STM-1 Single-mode Port Adapter— This plugs into the Multiport Test Module and provides four full-duplex OC-3c connections

Key Features

High Performance

- Generates signalling load up to 750 call setups, or 500 call setups and teardowns per second per module
- On a single module the test load can be flexibly distributed from one through to all four ports
- Generates up to 25,000 simultaneous active calls per module
- Up to 5 modules per system

Real-World Testing

- Up to 20 ports in one system to simulate a large number of UNI interfaces
- Generates constant, stepped or random-burst call initiation profiles
- Generates calls with fixed, random or infinite call durations
- Sequential or random end-station address selection

UNI Standards

- Supports ATM Forum UNI 3.0, 3.1, and 4.0
- ILMI for address registration and polling
- Point-to-point connections

Performance Statistics

- Detects and collects signalling errors and events in real-time
- Calls successfully established, calls attempted, calls active, calls outstanding, calls rejected
- Minimum, maximum, average call setup time
- Minimum, maximum, average call teardown time
- RELEASE cause distribution
- Signalling protocol error monitoring
- Physical, ATM and AAL alarm and error monitoring

Correlated Measurements

- Tests running across up to 20 ports can be started at the touch of a button
- Measurements, PDU capture and events are synchronised across all ports and logged with a common timestamp

Programmability

- C based API for test automation
- Statistics logged to disk in ASCII format for easy post-test analysis
- Session and module configuration save and restore
- User-definable script invoked at end of test to allow for easy integration into existing regression test system
- User-configurable pass/fail indication integrated into standard GUI

Investment Protection

- Cost effective port adapters mean that you do not need to replace the whole module when connecting to a different physical layer
- Integrates into existing BSTS systems. You do not need to buy a new system
- Consistent with existing BSTS GUI and system
- Complete functional, conformance, and now, performance testing in the one system

Scaleability

- Seamless scaleability of the test system means that you are able to match the performance increases of the SUT over time

Configuration and Use with Other BSTS Line Interfaces, Hardware Modules and Test Software

Minimum BSTS system requirements

- Agilent E4200B or Agilent E4210B with V743 PA-RISC Controller with 32 MB memory and a minimum of a 2 GB hard drive
- HP-UX 10.20 operating system

Note

- The Agilent E4200B (five user slots) supports a maximum of two Agilent E1600A Multiport Test Modules. The Agilent E4210B (11 user slots) supports a maximum of five Multiport Test Modules. Multiport Test Modules and CPP/LIF combinations can operate in the same chassis.

Warranty and Support Options

Hardware

All BSTS hardware components are warranted for a period of three years. Products must be returned to an authorized Agilent service center for service. At the time of purchase, you may select warranty option W01, a no-charge option which converts the standard three year return to Agilent warranty to a one year on-site warranty.

Software

Agilent Broadband Series Test System software and firmware products are supplied on transportable media such as diskette, 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.

Product Numbers

- **E1600A** Multiport Test Module incorporating UNI Signalling Performance Test software
- **E1601A** Quad OC-3c/STM-1 Multimode Port Adapter
- **E1602A** Quad OC-3c/STM-1 Single-mode Port Adapter
- **E4200B** BSTS Form-7 Transportable Base
- **E4210B** BSTS Form-13 Mainframe Base

Agilent E1600A Multiport Test Module Incorporating the UNI Signalling Performance Test Software

Introduction

The UNI signalling performance test application provides "real world" signalling load generation and signalling performance analysis on the Agilent Broadband Series Test System.

Performance

The module's performance can be focused on a single port or distributed arbitrarily across all ports of the port adapter.

Signalling Performance

Call establishments	• 750 (calls/s) (setup, connect, conn_ack)
Cyclic calls	• 500 (calls/s) (setup, connect, conn_ack, release, rel_complete)
Simultaneously active calls	• 25,000

Signalling Parameters

Module-wide

Signalling channels per port	• 1
Supported Protocols	• ATM Forum UNI 3.0 • ATM Forum UNI 3.1 • ATM Forum UNI 4.0
Protocol Timers	• T301 T302 T303 T304 T308 T309 • T310 T313 T316 T317 T322 T331 • T397 T398 T399
Automatic L3 RESTART generation	• Enable/disable

Per Port

Signalling VP/VC	• Full VPI/VCI range (default = 0/5)
Peak Cell Rate (PCR)	• 0.02% to100% of line rate
Address formats	• E.164 native • NSAP DCC • NSAP ICI • NSAP E.164

Local Ports Address Specification

A unique ATM address must be assigned to each port so that they can act as endpoints in ATM signalling dialogs. Both Manual and ILMI address assignment is supported.

Manual Address Assignment

User defined	• Enter a complete ATM address for each port
Random	• The application randomly assigns addresses

ILMI Address Assignment

User defined	• Enter the user part

ILMI Address Assignment

Random	• The application randomly assigns the user part

ILMI Configuration

ILMI channels per port	• 1
VP/VC	• Full VPI/VCI range (default = 0/16)
Keep Alive protocol	• Automatically supported
Coldstart	• Can be manually generated on a per port basis

Destination Address Specification

The user can specify the set of destination addresses and call sequence for call initiation on each port.

Generated Call Mix

Call type	• Point-to-Point
Destinations per port	• 128
Call sequencing	• Sequential • Random

Signalling Load

Call Initiation Profile

Constant	• Rate (calls/s)
Stepped	• Initial rate (calls/s) • Step size (calls/s) • Step duration (s) • Final rate (calls/s)
Random Burst	• Minimum rate (calls/s) • Maximum rate (calls/s) • Minimum duration (s) • Maximum duration (s) • Minimum gap (s) • Maximum gap (s)

Call Duration

Fixed	• All calls are held active for the same duration as specified by the user • Range 1 s to 12 hrs. Default is 10 s.
Random	• Calls are held active for a random duration (within the specified min. and max.) • Min. and max. range is 1 s to 12 hrs. Min. default is 10 s. Max. default is 60 s.
Infinite	• Calls remain active until cleared externally or a RESTART occurs

SETUP Message Customization

For each port users can specify the contents of the SETUP message.

Information Elements

Configurable via GUI	• ATM Traffic Descriptor • Broadband Bearer Capability • QoS Parameters

Information Elements

Configurable via file	• AAL Parameters • Broadband Higher Layer Information • Broadband Lower Layer Information • Called Party Subaddress • Calling Party Subaddress • Broadband Sending Complete • Transit Network Selection • End to End Transit Delay

Additional Module-wide Parameters

Test Configuration

Test Description	• Brief description of the configuration that is included in all saved data files to aid identification
Call Attempt Limit	• Limit on the total number of call attempts to be made by the module during a single test. When this limit is reached during a test, call generation activity is halted on all ports
Reference clock	• Internal Stratum-3 oscillator • Recovered (from the line)
Framing	• STS-3c • STM-1

Statistics

Measurements are made port by port and collected on a per second basis

Measurement Types

Current (Cur)	• Current (last measurement period) • Final value of a measurement at the end of the last completed one-second measurement interval
Cumulative (Cum)	• Value of a measurement accumulated since the beginning of the current integration period up to the end of the last completed one-second measurement interval
Relative (Rel)	• Value of a measurement at the end of the last completed one-second measurement interval relative to its value at the end of the previous one-second measurement interval

System Group

Elapsed Time	• Total elapsed time since the test was started

PHY Group

PhyErrSec.Cum	• PHY layer errored seconds

ATM Group

AtmErrSec.Cum	• ATM layer errored seconds

AAL Group

Aal5CrcErr.Cum	• AAL5 CRC32 errors detected
Aal5LenErr.Cum	• AAL5 length errors detected
Aal5CpiErr.Cum	• AAL5 CPI errors detected

Signalling - General Group

CallsActive.Cur	• Calls initiated by this module or another party which are in the Active state by the end of the period
AttemptsToGo.Cur	• Call attempts remaining until the user defined call attempt limit is reached and the test terminated
Cleared.Rel Cleared.Cum	• Calls cleared by this module in the current interval (i.e. transitioned from the Release_Request state to the Null state)
ClearPending.Cur	• Calls awaiting clearing confirmation (i.e. in the Release_Request state)
ErrL2Msg.Rel ErrL2Msg.Cum	• SAAL/SSCOP protocol errors due to bad or inopportune messages received in the current interval
ErrL3Msg.Rel ErrL3Msg.Cum	• Signalling protocol errors due to bad or inopportune messages received in the current interval
ClrCause.Cum	• Number of times a particular CAUSE value was received in call clearing messages
ClrCauseClass.Cum	• Number of times a particular CAUSE class was received in call clearing messages
MinTeardownTime.Cur MaxTeardownTime.Cur AvgTeardownTime.Cur MinTeardownTime.Cum MaxTeardownTime.Cum AvgTeardownTime.Cum	• Time between entering the Release_Request state and exiting that state as a result of receiving a REL_COMPLETE message • Measurements are made to 1 μs resolution

Signalling - Outbound Calls Group

Attempts.Rel Attempts.Cum	• Calls initiated by this module (i.e. attempts to transmit a SETUP) in the current interval
Connected.Rel Connected.Cum	• Calls initiated by this module which are established in the current interval (i.e.transitions from either the Call_Initiated or the Outgoing_Call_Proceeding states to the Active state)
Failed.Rel Failed.Cum	• Pending calls that timed out (T303 or T310) prior to being connected

Signalling - Outbound Calls Group

Initiated.Rel Initiated.Cum	• SETUPs actually launched in the current interval (i.e. number of transitions into the Call_Initiated state)
Pending.Cur	• Calls in either the Call_Initiated or the Outgoing_Call_Proceeding states at the end of the interval
Rejected.Rel Rejected.Cum	• Pending calls cleared prior to being successfully established (i.e. received RELEASE prior to CONNECT)
LastConnectTime.Cur	• Time between sending the first SETUP and the most recently received CONNECT • Measurements made to 1 ms resolution
MinSetupTime.Cur MaxSetupTime.Cur AvgSetupTime.Cur MinSetupTime.Cum MaxSetupTime.Cum AvgSetupTime.Cum	• Time between entering the Call_Initiated state and entering the Active state • Measurements made to 1μs resolution

Signalling - Inbound Calls Group

Accepted.Rel Accepted.Cum	• Inbound calls accepted (i.e. transitions into Active state) in the current interval
InPending.Cur	• Calls in the any of the Call_Present, Incoming_Call_Proceeding or the Connect_Request states at the end of the interval
Received.Rel Received.Cum	• Valid SETUPs received in the current interval (i.e. transitions into the InPending state)
InRejected.Rel InRejected.Cum	• Pending calls cleared prior to being successfully established (i.e. sent RELEASE or RELEASE_COMPLETE rather than CONNECT)

Events

Asynchronously occurring events can be selected for logging.

Event Data

Timestamp	• Accurate to one millisecond
Port number	• Identifies the event's source port
Identifier	• Uniquely identifies the type of event
Parameter	• Integer parameter

Loggable Events

System Control Group	• Test started • Test stopped • Post-test script started • Post-test script completed • Post-test script aborted • Test call attempts limit reached • Call attempt rate set to N • Cells discarded
System Errors Group	• Module out of buffers • Statistics logfile full • Event logfile full • Module call initiation limit reached • Module open call limit reached • Missed events • Missed measurement updates
ILMI Group	• ILMI Coldstart initiated • ILMI errored second
L2 Group	• L2 link up • L2 link down • L2 protocol errored second
L3 Group	• L3 protocol errored second • L3 RESTART initiated
Physical Group	• Transmitter (on/off) • Receiver alarm (on/off)

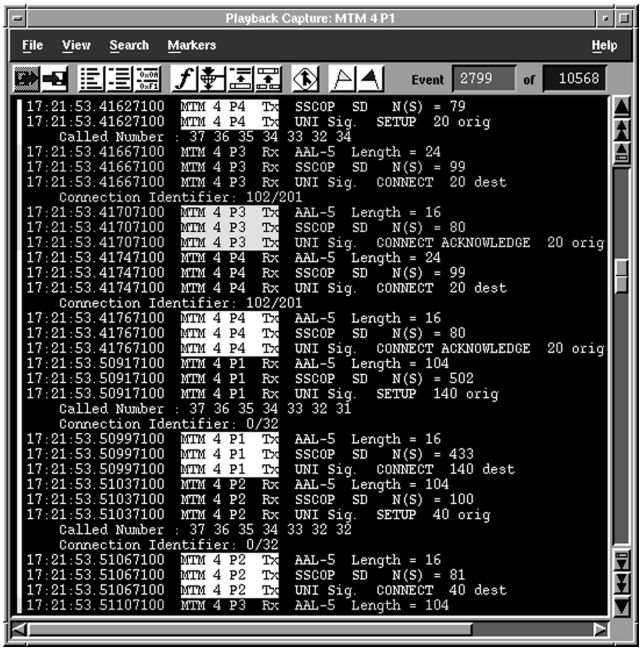
Logging

Measurements and events from the system are logged on a per port basis to user specified files on the controller. These results are saved in ASCII format suitable for importing into post-analysis packages such as spreadsheet, database or graphing tools.

The user can configure the maximum size of the logfiles and specify which statistics and events to log.

Pass/Fail Analysis

The user can specify a command that is invoked once the test has completed. The command can analyze the test results and return a pass or fail indication to the application. The pass/fail outcome is displayed in the GUI.



Integrated Playback Capture Viewer.

Module Control

The user is able to invoke the following asynchronous actions on a port-by-port basis either before, during or after a test.

Port Actions

Abort Pass/Fail command	• Abort the pass/fail command that is invoked on completion of the test
ILMI Coldstart	• Generate an ILMI Coldstart
Layer 3 RESTART	• Generate a Layer 3 RESTART
Layer 2 Establish/Release	• Establish or Release the Layer 2 logical link
Transmitter On or Off	• Turn the transmitter on or off on the port adapter

Capture/Decode

Capture depth	• 20,000 PDUs total across all ports
Capture channels	• Signalling and ILMI on each port
Timestamp accuracy	• 100 μs
Controls	• Enable/Disable capture per port • Start/Stop/Clear/View
Decode	• AAL-5, SSCOP, ILMI, UNI 3.0/3.1/4.0

UPE C-Library

The user can control the module through an application running on the system controller.

Application Specific UPE Functions

Configuration	• Load configuration from a named file • Register addresses (via ILMI)

Application Specific UPE Functions

Status	• Get Adapter type • Get Adapter port status • Get L2 status • Get L3 status • Get ILMI status • Get Test status
Control	• Start • Stop • Establish L2 • Release L2 • Generate L3 RESTART • Generate ILMI coldstart • Transmitter On/Off
Results	• Save test summary results to a named file.

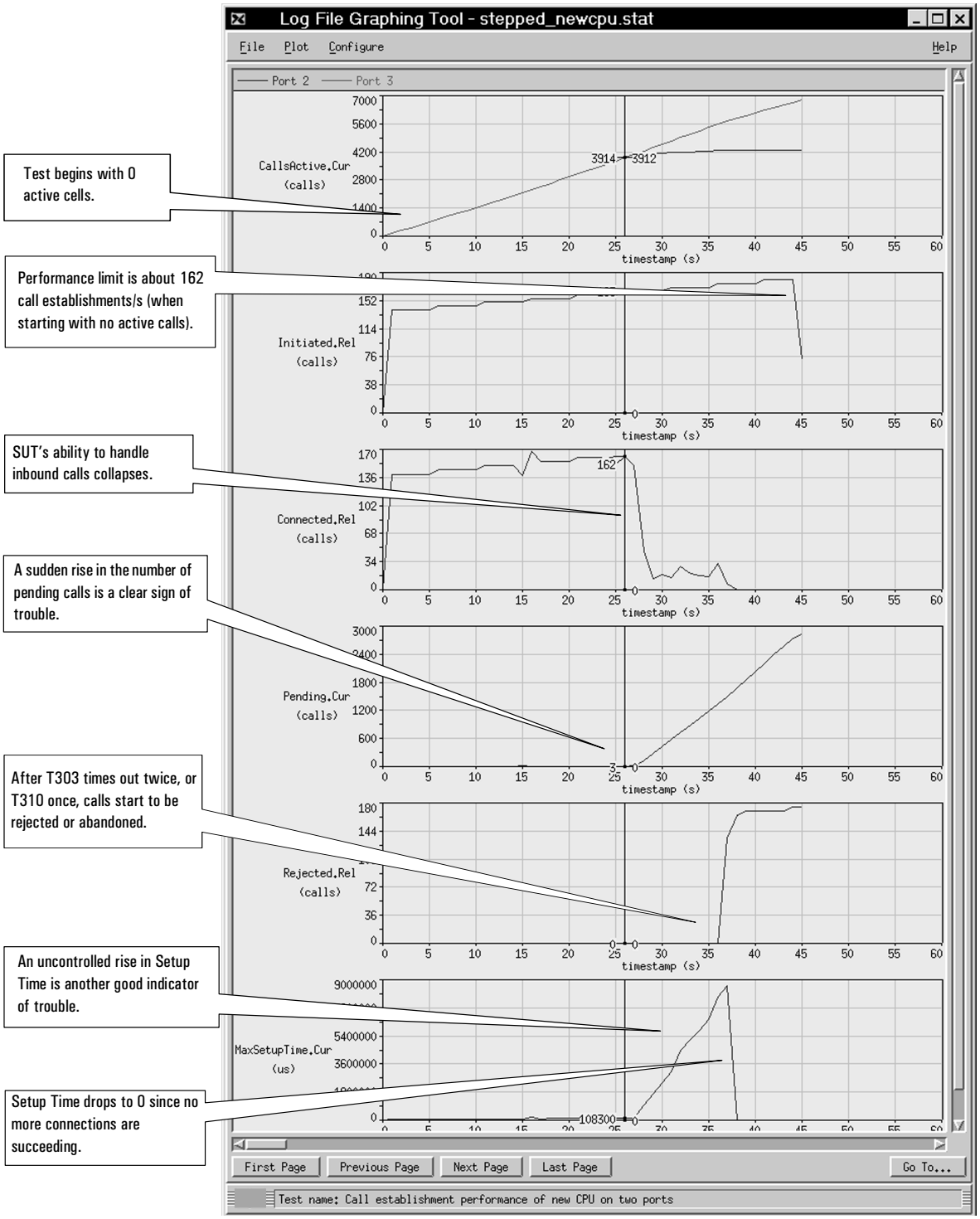
Physical Specifications

Dimensions

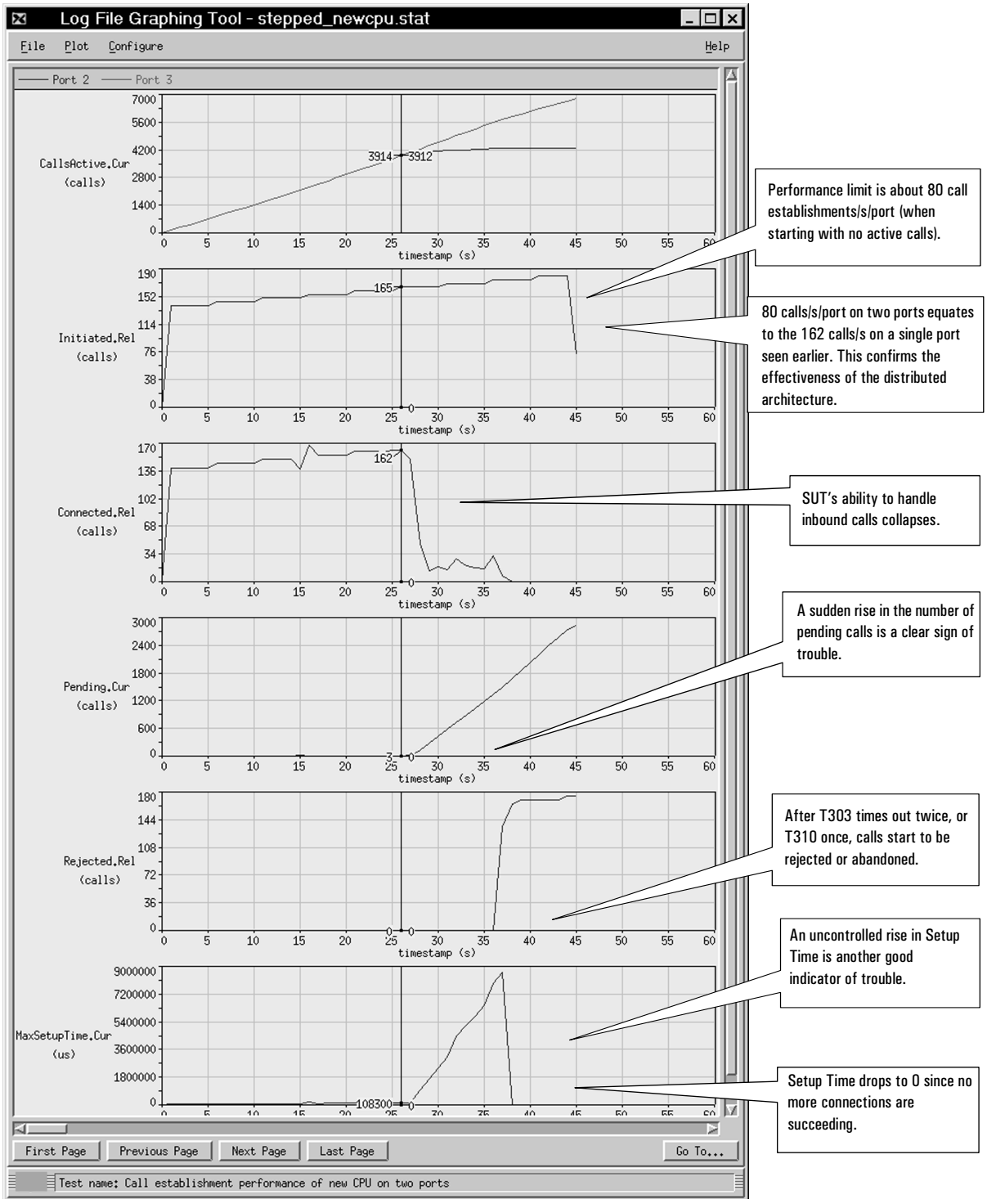
Size (H x W x D)	• 260 x 60 x 365 mm • Dual slot VXI C-size module
	•
Weight	• 2.2 kg

Environmental

Operating Temperature	• 5 to 45 ^{o}C
Storage Temperature	• - 40 to 65 ^{o}C
Humidity	• 10% to 90% (non-condensing)



Dual port test: unidirectional call establishment only (Port 3 calling Port 2).



Quad port test: unidirectional call establishment only (Port 1 calling Port 3, Port 2 calling Port 4).

Agilent E1601A Quad OC-3c/STM-1 Multimode Port Adapter

Description

The Agilent E1601A Quad OC-3c/STM-1 Multimode Port Adapter provides basic physical layer connectivity for the Agilent E1600A Multiport Test Module. The port adapter plugs into the Multiport Test Module.

The port adapter provides SONET/SDH framing for the ATM cells generated in the transmit direction. The Synchronous Payload Envelope is aligned to a fixed pointer value, Section, Line and Path BIPs are calculated, the frame synchronous scrambler pattern is applied and the framing pattern is inserted.

In the receive direction frame alignment is achieved using the A1A2 framing pattern. Descrambling is applied. Pointer processing is carried out in order to align to the Synchronous Payload Envelope. If present, ATM cells are then extracted, descrambled and passed to the Multiport Test Module.

General

The interface provided by the port adapter complies with the ATM Forum UNI 3.1 Specification.

Input and Output

Ports

Number	• 4
Style	• Full Duplex

Optical Receiver

Input	• 1300 nm multimode PIN photodetector as per ANSI T1E1.2 (Multimode T_B Interface)
Sensitivity	• - 30 dBm (average)
Maximum Input Power	• - 14 dBm (average)
Connector	• Duplex SC

Optical Transmitter

Output	• 1300 nm multimode LED as per ANSI T1E1.2 (Multimode T_B Interface)
Average Launch Power	• -14 to - 20 dBm
Connector	• Duplex SC
Safety	• Complies with EN60825

LED Status Indicators

Transmitter active	• Red LED indicating that the transmitter is active
Signal	• Green LED indicating a compliant input is being received
Error	• Yellow LED indicating an error or alarm is being received

Operating Modes

Full Duplex (Terminal mode)	• Independent transmitter and receiver operation

Timing Modes

Timing source

Internal	• Internal Stratum 3 oscillator
Rx Recovered (default)	• Each port's transmit clock is derived from the received signal of that port

Formats

Framing Formats

SONET	• STS-3c as per ANSI T1.105.00, and Bellcore GR-CORE-253
SDH	• STM-1 as per ITU-T G.707

Scrambling

SONET	• Frame synchronous scrambler as per Bellcore GR-CORE-253 and ITU-T G.707
SDH	• Self Synchronizing Scrambler (SSS) as per ITU-T Rec I.432

Overhead Data

SONET/SDH Overhead Generation

SONET	• STS-3c as per ANSI T1.105.00, and Bellcore GR-CORE-253
SDH	• STM-1 as per ITU-T G.707

Alarm and Error Generation

SONET/SDH Alarm Control

Loss of Signal	• On/off
RDI-L/MS-RDI	• Generated automatically when AIS-L/MS-AIS or incoming section defect detected
REI-L/MS-REI	• Generated automatically from B2 error count
RDI-P/P-RDI	• Generated automatically when incoming VC server or trailer signal failure detected or when LOCA occurs
REI-P/P-REI	• Generated automatically from B3 error count

Alarm and Error Detection

SONET/SDH Measurements

Physical Alarm	• Errored second

The Physical Alarm is a summation of the following SONET/SDH and ATM conditions. If any one of these conditions occur then the physical alarm is indicated.

Alarm conditions

BIP Errors	• Section/RS-BIP errors detected • Line/MS-BIP errors detected • Path BIP errors detected
LOS (alarm)	• Loss of Signal
LOF (alarm)	• Loss of Frame
OOF (error)	• Out of Frame
Line-AIS/MS-AIS (alarm)	• SONET: Line-AIS condition detected • SDH: MS-AIS condition detected
Line-RDI/MS-RDI (alarm)	• SONET: Line-RDI condition detected • SDH: MS-RDI condition detected
LOP (alarm)	• Loss of pointer synchronization
Path AIS (alarm)	• Path AIS condition detected
Path-RDI (alarm)	• Path RDI condition detected
LOCA (alarm)	• Loss of Cell Alignment
HEC Error	• Header Error Control error (multi-bit)

Safety and EMC

The port adapter complies with the EN60825-1, EN61010-1, EN55011 and EN50082-1 safety and EMC standards.

Physical Specifications

Dimensions

Size (H x W x D)	• 160 x 26 x 235 mm • Plugs into an Agilent E1600A module
Weight	• 0.45 kg

Environmental

Operating Temperature	• 5 to 45 ^{o}C
Storage Temperature	• - 40 to 70 ^{o}C
Humidity	• 10% to 90% (non-condensing)

Agilent E1602A Quad OC-3c/STM-1 Single-mode Port Adapter

Description

The Agilent E1602A Quad OC-3c/STM-1 Single-mode Port Adapter provides basic physical layer connectivity for the Agilent E1600A Multiport Test Module. The port adapter plugs into the Multiport Test Module.

The port adapter provides SONET/SDH framing for the ATM cells generated in the transmit direction. The Synchronous Payload Envelope is aligned to a fixed pointer value, Section, Line and Path BIPs are calculated, the frame synchronous scrambler pattern is applied and the framing pattern is inserted.

In the receive direction frame alignment is achieved using the A1A2 framing pattern. Descrambling is applied. Pointer processing is carried out in order to align to the Synchronous Payload Envelope. If present, ATM cells are then extracted, descrambled and passed to the Multiport Test Module.

General

The interface provided by the port adapter complies with the ATM Forum UNI 3.1 Specification.

Input and Output

Ports

Number	• 4
Style	• Full Duplex

Optical Receiver

Input	• 1300 nm PIN photodetector as per ITU-T G.957 (Short Haul), GR-253-CORE (Intermediate Reach), ANSI T1E1.2 (Single-mode U_B and T_B Interfaces)
Sensitivity	• - 31 dBm (average)
Max Input Power	• -8 dBm (average)
Connector	• Duplex SC

Optical Transmitter

Output	• 1300 nm Class 1 laser as per ITU-T G.957 (Short Haul), GR-253-CORE (Intermediate Reach), ANSI T1E1.2 (Single-mode U_B and T_B Interfaces)
Average Launch Power	• - 8 to - 15 dBm
Connector	• Duplex SC
Safety	• Class 1 laser. Complies with FDA Standard 21 CFR Ch1 and EN60825

LED Status Indicators

Transmitter active	• Red LED indicating that the transmitter is active
Signal	• Green LED indicating a compliant input is being received
Error	• Yellow LED indicating an error or alarm is being received

Operating Modes

Full Duplex (Terminal mode)	• Independent transmitter and receiver operation

Timing Modes

Timing Source

Internal	• Internal Stratum 3 oscillator
Rx Recovered (default)	• Each port's transmit clock is derived from the received signal of that port

Formats

Framing Formats

SONET	• STS-3c as per ANSI T1.105.00, and Bellcore GR-CORE-253
SDH	• STM-1 as per ITU-T G.707

Scrambling

SONET	• Frame synchronous scrambler as per Bellcore GR-CORE-253 and ITU-T G.707
SDH	• Self Synchronizing Scrambler (SSS) as per ITU-T Rec I.432

Overhead Data

SONET/SDH Overhead Generation

SONET	• STS-3c as per ANSI T1.105.00, and Bellcore GR-CORE-253
SDH	• STM-1 as per ITU-T G.707

Alarms and Error Generation

SONET/SDH Alarm Control

Loss of Signal	• On/off

SONET/SDH Alarm Control

RDI-L/MS-RDI	• Generated automatically when AIS-L/MS-AIS or incoming section defect detected
REI-L/MS-REI	• Generated automatically from B2 error count
RDI-P/P-RDI	• Generated automatically when incoming VC server or trailer signal failure detected or when LOCA occurs
REI-P/P-REI	• Generated automatically from B3 error count

Alarm and Error Detection

SONET/SDH Measurements

Physical Alarm	• Errored second

The Physical Alarm is a summation of the following SONET/SDH and ATM conditions. If any one of these conditions occur then the physical alarm is indicated.

Alarm Conditions

BIP Errors	• Section/RS-BIP errors detected • Line/MS-BIP errors detected • Path BIP errors detected
LOS (alarm)	• Loss of Signal
LOF (alarm)	• Loss of Frame
OOF (error)	• Out of Frame
Line-AIS/MS-AIS (alarm)	• SONET: Line-AIS condition detected • SDH: MS-AIS condition detected
Line-RDI/MS-RDI (alarm)	• SONET: Line-RDI condition detected • SDH: MS-RDI condition detected
LOP (alarm)	• Loss of pointer synchronization
Path AIS (alarm)	• Path AIS condition detected
Path-RDI (alarm)	• Path RDI condition detected
LOCA (alarm)	• Loss of Cell Alignment
HEC Error	• Header Error Control error (multi-bit)

Safety and EMC

The port adapter complies with the EN60825-1, EN61010-1, FDA Standard 21 CRF Ch1, EN55011 and EN50082-1 safety and EMC standards.

Physical Specifications - Agilent E1602A

Dimensions

Size (H x W x D)	• 160 x 26 x 235 mm • Plugs into an Agilent E1600A module
Weight	• 0.45 kg

Environmental

Operating Temperature	• 5 to 45 ^{o}C
Storage Temperature	• - 40 to 70 ^{o}C
Humidity	• 10% to 90% (non-condensing)

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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.

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

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