Agilent RouterTester

Multiport BER Test Application

Technical Datasheet

Agilent Technologies' Multiport Bit Error Rate Test Application enables transmission error analysis on networking devices such as OXCs, SONET ADMs and DWDM systems.

Agilent Technologies

Key Features

- **Real time PRBS pattern genera tion and error analysis**
- **SONET / SDH alarm generation and monitoring**
- **Synchronized multiport test system**
- **User definable payload data**
- **Easy to use multiport GUI with statistics collection / graphing**
- **Supported at line rates:**
  - **OC-3c/STM-1,**
  - **OC-12c/STM-4c**
  - **OC-48c/STM-16c**
  - **OC-192c/STM-64c**

Product Overview

Agilent's multiport BER Test application provides Layer 1 SONET / SDH Bit Error Rate Testing on Agilent's RouterTester platform at OC-3c, OC-12c, OC-48c and OC-192c line rates. This solution also provides useful transmission error analysis on core and edge networking equipment such as OXCs, SONET ADMs and DWDM systems.

The BERT application is controlled via an easy to use multiport Graphical User Interface, or alternatively through the Application Programmable Interface. These interfaces allow PRBS traffic to be generated into the SONET / SDH synchronous payload envelope, from which an extensive set of BER statistical measurements are provided.

This solution enables developers of optical networking devices and router manufacturers to test and verify SONET / SDH designs at varying line rates, accelerating time to market.

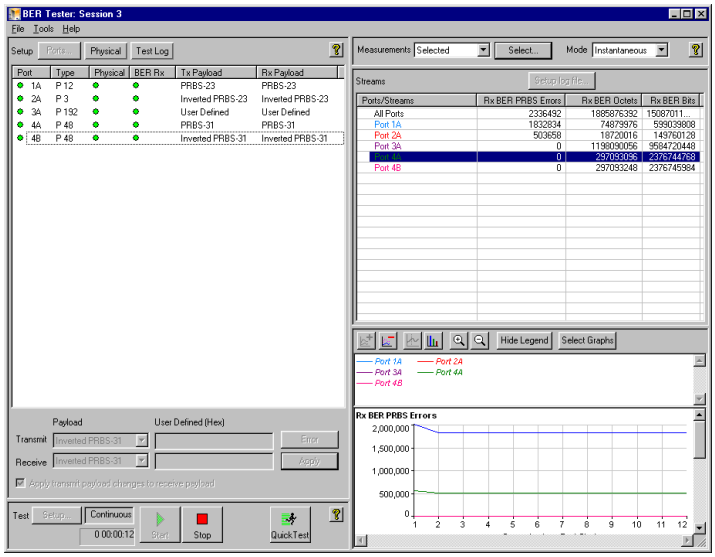
Agilent's multiport BER Test application is based on the same RouterTester platform that supports Agilent's IP and MPLS Performance Analysis and Optical Control Plane Analysis applications.

VSR Interfaces

Agilent's multiport BER Test application also provides support for Very Short Reach (VSR) optical interfaces at the OC-192c line rate, in accordance with the OIF approved parallel multi fiber VSR-1 specification.

VSR is a key technology that provides an alternative to today's expensive interface technologies for high speed interfaces. It is viewed as a critical enabler to dramatically reducing the cost of inter-connecting devices within a network service provider Point-of-Presence (POP) or central office.

The VSR-1 specification uses SONET/SDH framing and is expected to be deployed in network switches, routers, DWDM terminals and SONET/SDH ADMs located within the same POP.



Agilent's multiport BER Test Solution

Configuration

To provide a fully synchronized multiport test system, multiple RouterTester modules of varying line rates are controlled via a fast ethernet hub to a system controller.

Complete test control of Agilent's multiport BER Test application is provided through the user interface software running on the system contoller, and the real-time software running on each RouterTester module.

Related Product Information

Agilent's OmniBER 718/725 and OmniBER OTN offer SONET/SDH factory test applications up to 2.5Gb/s and 10/10.7Gb/s respectively. For further information on Agilent's OmniBER test solution, visit www.Agilent.com/cm/rdmfg/multiport

Technical Specifications

Product Summary

BERT Patterns	• PRBS 2^{23}-1 • PRBS 2^{31}-1 • Inverted PRBS 2^{23}-1 • Inverted PRBS 2^{31}-1 • 64 bit user defined repeatable pattern
Error Injection	• Manual trigger • Single 64 bit programmable error mask inserted before framing
BER Measurements	• Bit Error Rate • Error seconds • Error Count • Error Rate • Error Ratio • BERT Sync Status (LOPS) • Octet count • Octet rate • Received Bit error BER bits

SONET/SDH Layer Specification

TOH	• TOH generation – A1, A2 etc automatically generated – C2, K1, K2, S1 byte access – J0 - Section trace message or – Z0 - Section growth – Alarm simulation • TOH analysis – C2, K1, K2, S1 monitor – J0 Section trace capture – Alarm & error detection
POH and SPE	• POH generation – J1 Path trace message – Alarm simulation • POH analysis – J1 Path trace capture – Alarm and error detection – B1, B2, B3 error injection

VSR-1 Specification

Interface	• 12 Channel parallel interface that is compatible with OIF-VSR4-01.0 • SONET/SDH Frame Transport • VSR1 Alarm, Error and Status monitoring • VSR1 Alarm and error generation • PCS (Physical Coding Sub-layer) Electrical loop back

System Specifications

E7903A OC-192c/STM-64c (1550nm) Physical interface

Connector	• 1 x Duplex (transmit and receive) SC female connectors per port
Optical interface (Product option: LR1)	• 1550 nm single-mode PIN based receiver • 1550 nm Class 1 single mode EML laser • Compliant with: – Telcordia Technologies GR-1377-CORE (Issue 5, Dec. 1998 - IR-2 intermediate reach OC-192 interface), and – ITU-T G.691 (March, 1999)
Input sensitivity	• –14 dBm (min)
Maximum input power	• –1.0 dBm
Launch distance	• 40,000 m
Average output power	• -1 dBm (min), +2 dBm (max)
Safety	• Class 1 laser • Compliant with: – CDRH, 21 CFR 1040 – IEC 60825-1 (1993)

E7913A OC-192c/STM-64c (1310nm) Physical Interface

Connector	• 1 x Duplex (transmit and receive) SC female connector per port
Optical interface (Product option: Opt IR1)	• 1310 nm single-mode PIN based receiver • 1310 nm Class 1 single mode DFB laser • Compliant with: – Telcordia Technologies GR-1377-CORE (Issue 5, Dec. 1998 - SR-1 short reach OC-192 interface), and – ITU-T G.691 (March, 1999)
Input sensitivity	• –12.0 dBm (min)
Maximum input power	• –0 dBm
Launch distance	• 2,000 m
Average output power	• 0 dBm (max), –4.0 dBm (min)
Safety	• Class 1 laser • Compliant with: – CDRH, 21 CFR 1040 – IEC 60825-1 (1993)

E7916A OC-192c/STM-64c (VSR-1) Physical Interface

Connector	• MTP™ (MPO) ribbon fiber receptacle
Optical interface	• 850nm 12 ribbon fiber
Input sensitivity	• –16 dBm (min)
Maximum input power	• –3 dBm

Launch distance	• 300m
Average output power	• -8 dBm (min), –3 dBm (max)
Safety	• FDA Class 1 • Compliant with: – CFR 21 – IEC 60825-1 (1993)

Interface operation modes

Terminal	• Transmit and receive interfaces operate independently
Transmit loop-back	• Transmitted data is electrically looped back to the receive interface. The optical receive interface is disabled in this mode
Transmit clock source	• The transmit clock source can be: – Internally generated, – Recovered from the received SONET/SDH signal, or – Generated by an external transmit reference clock

External Transmit Reference Clock

Connector	• Male SMB connector
Nominal Frequency	• 622.08 MHz
Offset range	• +/- 20ppm
Specification	• 0 dBm (nominal) terminated in 50 ohm to ground input (6dBm maximum)

Measurement System

Result types	• Cumulative: measurements are reported from the start of the measurement interval • Sampled: measurements are reported from the most recently completed sampling interval
Measurement interval	• Range: 1 second to 7 days
Sampling interval	• Range: 1 second to 1 hour
Measurement clock	• 10 ns resolution • +/- 0.5 ppm/year clock drift • 3 ppm max. difference between systems
Module Synchronization	• All measurements are synchronized across all modules within the test system

SONET/SDH Layer Specifications

Operating modes

See Module operation modes for detail	• Terminal (normal) • Receive monitor • Transmit loop-back

Framing Formats

SONET	• STS-192c as per ANSI T1.105.02-1995 and Telcordia Technologies GR-1377-CORE (Issue 5, Dec.1998 - SONET OC-192 Transport System Criteria)
SDH	• STM-64c as per ITU-T Rec. G.707, 1996

Scrambling

Frame synchronous scrambler (x^7+x^6+1)	• On, Default • Off

Section/Regenerator Section Overhead Octet Generation

A1, A2	• Set to 0xF628 (for all STS-Ns/STM-Ns)
J0/Z0	• In Section Growth mode (Default), J0 = 1 and each Z0 octet set based on position in the STS-N frame (e.g. $Z0_2$=2,... $Z0_{192}$ = 192 for STS-192c) • In Section Trace mode, J0 set to 16 byte message (ASCII string, CRLF terminated), Z0 octet as per Section Growth definition above
B1	• Automatically calculated

Line/Multiplexer Section Overhead Octet Generation

H1...H3	• Automatically calculated, including concatenation indicators
B2	• Automatically calculated (for all STS-Ns)
K1/K2	• User-definable 16 bit field, default zero
D4...D12	• Unused, set to zero
S1	• Least significant 4 bits can be set to predefined values, default zero
Z1, Z2	• Unused, set to zero
M1	• Automatically calculated
E2	• Unused, set to zero
All Other Line Overhead Octets	• Unused, set to zero

Path Overhead Octet Generation

J1	• Can be set to a 64 byte message (ASCII string, CRLF terminated
B3	• Automatically calculated
C2	• Automatically calculated as per framing and scrambling format, or user defined
G1	• Path REI bits are automatically calculated (count of errors from B3); path RDI bits are set as per alarm generation
F2 H4 Z3 (SONET)/F3 (SDH) Z4 (SONET)/K3 (SDH) Z5 (SONET/N1 (SDH)	• Unused, set to zero

Alarms

Alarm detection	• Alarm conditions are detected in real-time – Current alarm status is indicated on the user interface and front panel LEDs – Alarm events are reported in a trace log during the measurement interval • Number of errored seconds is reported per alarm type (count of 1s intervals in which the alarm is detected at least once)
Alarm generation	• Alarm conditions can be invoked, one type at a time
SONET alarm types	• LOS • LOF • LOP (detection only at OC-192c) • AIS-L • RDI-L • AIS-P • RDI-P
SDH alarm types	• LOS • LOF • LOP (detection only at OC-192c) • MS-AIS • MS-RDI • AU-AIS • AU-RDI
Line RDI-L/MS-RDI	• Asserted when bits 6, 7, 8 of K2 byte are 110 for 5 consecutive frames • Negated when bits 6, 7, 8 of K2 byte are not 110 for 5 consecutive frames
Path AIS-P/AU-AIS	• Asserted when H1 and H2 bytes and SPE are all ones for 3 consecutive frames • Negated when H1 and H2 bytes are not all ones for 3 consecutive frames
Path RDI-P/AU-RDI (enhanced mode)	• Asserted when any of bits 5, 6 or 7 of the G1 byte is set to 1 for 5 consecutive frames • Negated when any of bits 5, 6 or 7 the G1 byte is set to 0 for 5 consecutive frames • Line REI (M1) errors (not available in OC-3c) • Path REI (G1) errors • B1, B2, B3 error injection

Error Generation and Monitoring

Section BIP-8 (B1) errors Line BIP-8 (B2) errors Path BIP-8 (B3) errors	• Number of occurrences reported • Number of errored seconds reported • Error rate

Overhead Octet Real-Time Decode

Automatic Protection Switching (APS) octets (K1/K2)	• Received 16 bit value is displayed in HEX

Synchronization status (S1) value Path signal label (C2) value	• Received octet values are decoded for display
Section trace (J0) message	• Trace messages are decoded and displayed as 16 byte strings (ASCII text, CRLF terminated)
Path trace (J1) message	• Trace messages are decoded and displayed as 64 byte strings (ASCII text, CRLF terminated)

Overhead Octet Real-Time Decode

Automatic Protection Switching (APS) octets (K1/K2)	• Received 16 bit value is displayed in HEX
Synchronization status (S1) value Path signal label (C2) value	• Received octet values are decoded for display
Section trace (J0) message	• Trace messages are decoded and displayed as 16 byte strings (ASCII text, CRLF terminated)

Overhead Octet Real-Time Decode

Automatic Protection Switching (APS) octets (K1/K2)	• Received 16 bit value is displayed in HEX
Synchronization status (S1) value Path signal label (C2) value	• Received octet values are decoded for display
Section trace (J0) message	• Trace messages are decoded and displayed as 16 byte strings (ASCII text, CRLF terminated)
Path trace (J1) message	• Trace messages are decoded and displayed as 64 byte strings (ASCII text, CRLF terminated)

VSR-1 Physical Interface Specifications

Transmit

Patch cord configuration	• Normal/Reversed
Generate 8b/10b code violations	• Selected single channel for continuous LOSyn generation • Multiple (up to 2) selected channels for continuous MLOSyn generation
CRC-16	• Selected channel CRC inversion
Tx Out Of Frame (OOF)	• Tx OOF alarm detection and errored seconds • Tx OOF alarm generation

Receive

Configuration	• Enable/disable automatic channel protection switch in LOSyn state • Enable/disable CRC correction
Alarm and Status detection	• Alarm conditions are detected in real-time – Current alarm status indicated on user interface and through API – Alarm events are reported in trace log during the measurement period – Number of errored seconds is reported. • VSR-1 link status summary (GUI only) • Patch cord reversal • Loss of Multi-channel synchronization MLOSyn (more than 1 channel) • Loss of channel synchronization LOSyn • 8b/10b code violations • Rx Out of Frame detection (Rx OOF)
Error detection (sum of all channels)	• CRC-16 error • Uncorrected CRC-16 error • Corrected CRC-16 error

Mechanical Specifications

Module Details

Size	• 441 mm (width) x 390 mm (depth) x 88 mm (height) (OC-192c) • 441 mm (width) x 390 mm (depth) x 44mm (height) (OC-48c, OC-12c, OC-3c)
Weight	• 7.0 kg (OC-192c) • 4.8 Kg (OC-48c, OC-12c, OC-3c)
Supply voltage	• 85 to 264 Volts AC only (OC-192c) • 100 to 240 Volts AC only (OC-48c, OC-12c, OC-3c)
Supply frequency	• 47 to 63Hz (OC-192c) • 50 to 60 Hz (OC-48c, OC-12c, OC-3c)
Power consumption	• 363 watts maximum (OC-192c) • 150 watts maximum (OC-48c) • 120 watts maximum (OC-12c, OC-3c)
Input current	• Less than 4.5 amps RMS, measured at 85 VAC (OC-192c) • Less than 3.0 amps RMS, measured at 85 VAC (OC-48c, OC-12c, OC-3c)
Input protection	• Non-user serviceable, internally located 5 amp, anti-surge AC input line fuse.
Inrush current	• 35 amps peak (Vin = 230 VAC, one cycle, 25°C.). Current internally limited by thermistor.
Power factor	• 0.95 W/VA (Per EN61000-3-2).
Rear connectors	• Ethernet: – RJ-45 • Clock line connectors (input/output): – SMA • Event lines (input/output): – Twin BNC • External trigger input/external trigger output: • BNC

Front Panel LED Indicators

Power	• Green when module has power
Status	• Yellow to indicate module start-up, green to indicate that a test application is running, red to indicate a module error
Module	• Numerical module identifier
Laser	• Red when output laser is on
Signal	• Green when a valid optical receive signal is detected (opposite of LOS condition) • Flash green when External clock reference is not detected
LOF/LOP	• Yellow when a Loss of Frame or Loss of Pointer condition exists at the receiver
AIS/RDI	• Yellow when a Line/MS AIS, Line/MS RDI, Path AIS or Path RDI condition exists at the receiver
Tx	• Not used
Rx	• Not used

Environmental Operating Conditions

Operating temperature	• 0^{o} C to 45^{o} C
Storage temperature	• -40^{o} C to 70^{o} C
Humidity	• 50% to 95% relative humidity at 25^{o}C to 40^{o} C

Regulatory Compliance

Electrical (Electromagnetic Compliance - EMC)

- As per EN 61326-1:1997 + A1:1998 / IEC 61326-1:1997 + A1:1998 Electrical equipment for measurement, control and laboratory use
- EMC Directive 89/336/EEC (including 93/68/EEC)

Immunity standards

- EN 61000-4-2:1995 / IEC 61000-4-2:1995 + A1:1998, Section 2: Electrostatic discharge test
- EN 61000-4-3:1995 / IEC 1000-4-3:1995, Section 3: Radiated electromagnetic field test
- EN 61000-4-4:1995 / IEC 1000-4-4:1995, Section 4: Electrical fast transient/burst test
- EN 61000-4-5:1995 / IEC 1000-4-5:1995, Section 5: Surge immunity test
- EN 61000-4-6:1996 / IEC 1000-4-6:1996, Section 6: Radiated electromagnetic field test
- EN 61000-4-11:1994 / IEC 1000-4-11:1994, Section 11: Voltage dips, short interruptions, voltage variations immunity test

Emission standards

- CISPR 11:1990 / EN 5501:1991 (electrical disturbance): Limits and methods of measurement of electromagnetic disturbance characteristics of industrial, scientific and medical radio frequency equipment. This equipment meets Group 1, Class A limits
- EN 61000-3-2:1995 / IEC 1000-3-2:1995, Section 2: Limits for harmonic current emissions
- EN 61000-3-3:1994 / IEC 1000-3-3:1994, Section 3: Limitation of voltage fluctuations and flicker

Electrical (safety)

- IEC 61010-1:1990 + A1:1992 + A2: 1995 / IEN 61010-1:1993 + A2:1995, Canada: CSA C22.2 No. 1010.1:1992 (including amendment 2: 1997: Safety requirements for electrical equipment for measurement, control, and laboratory use
- Low voltage directive 73/23/EEC

Optical (safety)

- Complies with IEC 825/CDRH Class 1, and 21 CFR 1040 - Class 1 Laser Products Applicable Standards

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Agilent's RouterTester system

Agilent's RouterTester system offers a powerful and versatile test platform to address the evolving test needs of metro/edge platforms, core routers and optical switches. RouterTester provides Network Equipment Manufacturers and Service Providers with the industry's leading tools for wire speed, multiport traffic generation and performance analysis of today's networking devices.

Warranty and Support

Hardware Warranty

All RouterTester and QA Robot hardware is warranted against defects in materials and workmanship for a period of 3 years from the date of shipment.

Software Warranty

All RouterTester and QA Robot software is warranted for a period of 90 days. The applications are warranted to execute and install properly from the media provided. This warranty only covers physical defects in the media, whereby the media is replaced at no charge during the warranty period.

Software Updates

With the purchase of any new system controller Agilent will provide 1 year of complimentary software updates. At the end of the first year you can enroll into the Software Enhancement Service (SES) for continuing software product enhancements.

Support

Technical support is available throughout the support life of the product. Support is available to verify that the equipment works properly, to help with product operation, and to provide basic measurement assistance for the use of the specified capabilities, at no extra cost, upon request.

Ordering Information

To order and configure the test system consult your local Agilent field engineer.

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
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(31 20) 547-2323

United Kingdom
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Japan:

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www.agilent.com/comms/RouterTester

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