Agilent N2X

2-Port OC-3c/OC-12c/OC-48c ATM/POS/FR XR/XS Test Cards
E7909A, E7909B, E7907A, E7907B

Technical Data Sheet

The leading test solution for IP & MPLS packet and protocol testing over ATM, POS and Frame Relay interfaces.
Key Features

- Dual-port, multi-mode, multi-rate interface card
- Test layers 2 and 3 on the same port at the same time
- Full IPv4 and IPv6 Routing, Multicast, MPLS, and Access protocol support with the industry’s highest scalability
- Supports both LLC and VC-mux (bridged and routed) ATM encapsulations per RFC 2684/1483
- Full Frame Relay support including IETF, Cisco, and Q.933 encapsulations with up to 1,024 PVCs per port
- Up to 32,768 ATM PVCs and traffic streams per port with flexible traffic encapsulations

Product Overview

Agilent N2X is the industry’s most comprehensive test solution for testing the development and deployment of network services for converging network infrastructures. Service providers, network equipment manufacturers (NEMs), and component manufacturers can verify service attributes of entire networks end-to-end, while also isolating problems down to individual networking devices and subsystems. Agilent N2X delivers unparalleled test realism to verify the ultimate performance, scalability and resilience of carrier grade services and infrastructure.

The Agilent N2X OC-3c/OC-12c and OC 48-c ATM/POS/FR XR and XS test cards in conjunction with the N2X Packets and Protocols application provide multiport traffic generation, scalable protocol emulation, and unprecedented performance analysis of today’s IP & MPLS networking devices. From wire-speed traffic generation and analysis, to full emulation of Internet-scale routing topologies using the latest protocols and technologies, Agilent provides the most comprehensive and easy-to-use system available today.

Agilent N2X’s innovative “flexible PDU builder” technology delivers the most advanced solution for traffic generation and analysis available. Any kind of data-plane frames and packets can be generated, including custom formats.

For more complex testing, N2X provides emulation of the most popular routing protocols, including BGP, OSPF, ISIS and RIP and the latest MPLS protocols, including RSVP-TE, LDP/CR-LDP, L2oMPLS (Martini), and VPLS. Multicast protocols can be verified easily with our IGMP, MLD and PIM-SM protocol emulations. For Access networks, PPPoA, PPPoEoA, and L2TP are available.

The powerful Packets and Protocols application enables off-line data and capture analysis, graphing, decodes, and easy diagnosis of erratic or transient network behavior.

Simulated Network on N2X Port

Figure 1: N2X supports simulation of multiple peer routes connected via PVCs to each ATM interface of your SUT. The test port will simulate an ATM “cloud” with many routers connected to the edge of the cloud.
Product Features

Dual-port, multi-mode, multi-rate interface cards

Each interface card provides two-test ports for connection to the SUT. Single-mode or multi-mode optics are supported with duplex SC fibre connectors. Dual-mode OC-3c/OC-12c and OC-48c interface cards are available. The OC-3c/OC-12c cards support ATM, POS or FR capability, providing optimal flexibility in your test system. Each OC-48c port supports POS and FR capability.

Test layers 2 and 3 on the same port at the same time

Generate and analyze ATM cell traffic on one PVC and IP over ATM traffic on another PVC. Switch between layer 2 and layer 3 testing without moving to a different test system.

ATM and SONET-layer test features

The OC-3c/OC-12c ATM/POS Test Card supports capture of ATM cells and reassembled AAL-5 PDUs for protocol analysis, with up to 64 MB of capture RAM per port. The cards also feature SONET/SDH-layer alarm monitoring and generation for debugging and system configuration.

Full IPv4 and IPv6 Routing, Multicast, MPLS, and Access protocol support with the industry’s highest scalability

N2X emulates the entire suite of routing and multicast protocols that are used in networks, including BGP-4, OSPF, IS-IS, RIP, IGMP, PIM, and MSDP, (and their IPv6 variants) enabling the creation of a realistic network cloud around the router under test. With N2X’s Packets and Protocols software application (E7881A), packet-forwarding performance is measured while routes are simultaneously added and withdrawn. MPLS signaling protocols such as RSVP-TE and LDP/CR-LDP are also supported. PWE3 testing is made easy with the L2 VPN application on N2X. And broadband access devices can be qualified using the PPPoA, PPPoEoA, and L2TP protocols.

PPPo- and SONET-layer test features

The POS Test Cards support capture of PPP headers and IP packets for protocol analysis, with up to 64 MB of capture RAM per port. The cards also feature SONET/SDH-layer alarm monitoring and generation for debugging and system configuration.

High Protocol Performance & Scalability XS Test Cards

N2X XS POS/ATM/FR test cards offer industry leading protocol performance and scalability. When multiple XS test cards are combined in a complete N2X test system, you easily reach and exceed performance and scalability limits of devices being tested, ensuring that the most demanding real-world network conditions can be met.
**Product Numbers**
- E7907A - 2-Port OC-3c/12c ATM/POS/FR XR Test Card
- E7907B - 2-Port OC-3c/12c ATM/POS/FR XS Test Card
- E7909A - 2-Port OC-48c POS/FR XR Test Card
- E7909B - 2-Port OC-48c POS/FR XS Test Card

- Optics options:
  - Option 001 Single Mode Intermediate Reach Optics
  - Option 002 Multimode Optics

**Software Compatibility**
The E7880B Packets License enables the traffic generation and analysis features on the XR & XS test cards. XR and XS cards can take advantage of the multi-protocol emulation environment plus integrated traffic & routing features available in the E7881B Packets & Protocols license.

**Technical Specifications**

### Optical Interface

<table>
<thead>
<tr>
<th>OC-3c/12c (STM-1/4c)</th>
<th>OC-48c (STM-16c)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Connector</strong></td>
<td>Two duplex SC connectors</td>
</tr>
<tr>
<td><strong>Single Mode</strong></td>
<td>Single mode</td>
</tr>
<tr>
<td>- 1310 nm receiver</td>
<td>1310 nm receiver</td>
</tr>
<tr>
<td>- 1310 nm Class 1 laser transmitter</td>
<td>1310 nm Class 1 laser transmitter</td>
</tr>
<tr>
<td>- Compliant with Telcordia GR-253-CORE intermediate reach and ITU-T G.957 S-4.1 short-haul specifications (for OC-12c/STM-4c)</td>
<td>Compliant with Telcordia GR-253-CORE short reach (for OC-48c) and ITU-T G.957 intra-office (for STM-16c) specifications</td>
</tr>
<tr>
<td><strong>Multimode</strong></td>
<td>Single mode</td>
</tr>
<tr>
<td>- 1310 nm receiver</td>
<td>1310 nm receiver</td>
</tr>
<tr>
<td>- 1310 nm LED transmitter</td>
<td>1310 nm LED transmitter</td>
</tr>
<tr>
<td>- Compliant with ATM Forum 822.08 Mb/s Physical Layer Specification (AF-PHY-0046.000)</td>
<td>Compliant with ATM Forum 822.08 Mb/s Physical Layer Specification (AF-PHY-0046.000)</td>
</tr>
</tbody>
</table>

### Input Power

<table>
<thead>
<tr>
<th>OC-3c/12c</th>
<th>OC-48c</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Single Mode</strong></td>
<td><strong>Single Mode</strong></td>
</tr>
<tr>
<td>Minimum: -28 dBm</td>
<td>Minimum: -15 dBm</td>
</tr>
<tr>
<td>Maximum: -7 dBm</td>
<td>Maximum: -8 dBm</td>
</tr>
<tr>
<td><strong>Multimode</strong></td>
<td><strong>Multimode</strong></td>
</tr>
<tr>
<td>Minimum: -28 dBm</td>
<td>Minimum: -19.5 dBm</td>
</tr>
<tr>
<td>Maximum: -11 dBm</td>
<td>Maximum: -14 dBm</td>
</tr>
</tbody>
</table>

### Output Power

<table>
<thead>
<tr>
<th>OC-3c/12c</th>
<th>OC-48c</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Single Mode</strong></td>
<td><strong>Single Mode</strong></td>
</tr>
<tr>
<td>Minimum: -15 dBm</td>
<td>Minimum: -15 dBm</td>
</tr>
<tr>
<td>Nominal: -11 dBm</td>
<td>Nominal: -11 dBm</td>
</tr>
<tr>
<td>Maximum: -8 dBm</td>
<td>Maximum: -8 dBm</td>
</tr>
<tr>
<td><strong>Multimode</strong></td>
<td><strong>Multimode</strong></td>
</tr>
<tr>
<td>Minimum: -19.5 dBm</td>
<td>Minimum: -19.5 dBm</td>
</tr>
<tr>
<td>Nominal: -17 dBm</td>
<td>Nominal: -17 dBm</td>
</tr>
<tr>
<td>Maximum: -14 dBm</td>
<td>Maximum: -14 dBm</td>
</tr>
</tbody>
</table>

**Safety**
- Complies with IEC 825/CDRH Class 1

**Measurement System**

<table>
<thead>
<tr>
<th>Result Types</th>
<th>Measurement Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cumulative</td>
<td>Range: 1 second to 7 days</td>
</tr>
<tr>
<td>Sampled</td>
<td>Range: 1 second to 1 day</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sampling Interval</th>
<th>Measurement Clock</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 ns resolution</td>
<td>+/- 0.5 ppm/year clock drift</td>
</tr>
<tr>
<td>3 ppm max. difference between cards</td>
<td></td>
</tr>
</tbody>
</table>

**Interface Synchronization**
- All measurements are synchronized across all cards and modules within the Router Tester system

**External Reference Clock**

<table>
<thead>
<tr>
<th>Connector</th>
<th>Input</th>
<th>Impedance</th>
<th>Frequency</th>
<th>Duty Cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMB</td>
<td>0 dBm (nominal)</td>
<td>50 to ground</td>
<td>19.44 MHz (nominal)</td>
<td>50% +/- 5%</td>
</tr>
</tbody>
</table>

**Framing**

<table>
<thead>
<tr>
<th>Encapsulation</th>
<th>IP datagrams are encapsulated using:</th>
</tr>
</thead>
<tbody>
<tr>
<td>PPP</td>
<td>PPP in HDLC-like framing, as per IETF RFC 1662, or Cisco HDLC (EtherType protocol field)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FCS</th>
<th>Negotiated between test port and device under test</th>
</tr>
</thead>
<tbody>
<tr>
<td>16 or 32 bit length</td>
<td>32-bit length (only)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Frame spacing</th>
<th>Frames can be transmitted continuously with a minimum one flag octet between frames</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>PPP configurable parameters</th>
<th>Restart Timer (default 3 sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max-terminate (default 2 sec)</td>
<td>Max-configure (default 10 sec)</td>
</tr>
<tr>
<td>Max-failure (default 5 sec)</td>
<td></td>
</tr>
</tbody>
</table>
Minimum frame size

- 12 octets for HDLC, so as to encapsulate a minimum FR frame size of 5 octets
- 29 octets for IP, so as to encapsulate a minimum IP frame size of 20 octets

Error Generation

- HDLC aborted frames
- HDLC FCS errors

Capture

- Full capture of complete frames including FCS

HDLC Real-Time Transmit Statistics

- Frames transmitted
- Octets transmitted (before octet stuffing)
- Octets transmitted (after octet stuffing)
- HDLC transparency efficiency (percentage)

HDLC Real-Time Receive Statistics

- Frames received
- Octets received (before octet destuffing)
- Octets received (after octet destuffing)
- FCS errors
- Aborted frames
- Invalid frames

Per-PVC Statistics

- Test packets (PDUs) received
- Test octets received
- Received test packet throughput
- Received test packet average latency

Frame Relay Specifications

Traffic Generation & Analysis

- Encapsulation: HDLC
- FCS: 32- or 16-bit length
- Scrambling/Descrambling: 1 + X^43, after HDLC framing.
- Frame spacing: Configurable minimum interframe gap (1 to 256)
- Max PVCs: Tx: 1024 per port
- PVC encapsulations: IETF IPv4, IPv6, MPLS
- LCP negotiation parameters: Max-Receive-Unit (default 4700)

Physical Layer (SONET/SDH) Specifications

- OC-3c/12c (STM-1/4c)
- OC-48c (STM-16c)

Configuration Options

- Framing: SDNET or SDH
- Scrambling: On/Off
- Descrambling: On/Off
- Clock source: Internal, Recovered, or External
- Adjustable SONET Clock: Not Applicable, -30 to +30 ppm
- Port mode: Full duplex, Receive monitor, or Transmit loopback
- User-definable overhead fields: C2 (Path Signal), K1/K2 (Automatic Protection Switching), S1 (Synchronization Status), J0 or Z0 (Section Trace or Growth)
Alarm Indications

- Loss of Signal (LOS)
- Loss of Frame (LOF)
- Loss of Pointer (LOP)
- AIS-L/MS-AIS
- RDI-L/MS-RDI
- AIS-P/AU-AIS
- RDI-P/Path RDI

Alarm Generation

- Loss of Frame (LOF)
- Loss of Pointer (LOP)
- AIS-L/MS-AIS
- RDI-L/MS-RDI
- AIS-P/AU-AIS
- RDI-P/Path RDI

Real-time Statistics

- Section BIP-8 (B1) Errors
- Line BIP-8 (B2) Errors
- Path BIP-8 (B3) Errors

Mechanical Specifications

<table>
<thead>
<tr>
<th></th>
<th>OC-3c/12c (STM-1/4c)</th>
<th>OC-48c (STM-16c)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physical</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Width</td>
<td>206mm</td>
<td>206mm</td>
</tr>
<tr>
<td>Depth</td>
<td>313mm</td>
<td>313mm</td>
</tr>
<tr>
<td>Height</td>
<td>30mm</td>
<td>30mm</td>
</tr>
<tr>
<td>Weight</td>
<td>875g</td>
<td>910g</td>
</tr>
<tr>
<td><strong>Electrical</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power consumption</td>
<td>40W max</td>
<td>60W max</td>
</tr>
<tr>
<td><strong>Environmental</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating temperature</td>
<td>0 °C to 40 °C</td>
<td></td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-40 °C to 70 °C</td>
<td></td>
</tr>
<tr>
<td>Humidity</td>
<td>Maximum relative humidity 80% for temperatures up to 31°C decreasing linearly to 50% relative humidity at 40°C – non condensing</td>
<td></td>
</tr>
</tbody>
</table>

Regulatory Compliance

**Electromagnetic Compatibility**
- Canada: ICES-001:1998a
- This equipment is designed to operate in a controlled electromagnetic environment, ie where RF transmitters such as mobile telephones may not be used in close proximity

**Electrical Safety**
- CAN/CSA C22.2 No. 1010.1:1992
- UL3101-1:1993 / UL3111-1:1994

**Optical Safety (when fitted with optical interfaces cards)**
- IEC 60825-2:2000
- CFR title 21 part 1040.10 and 1040.11

**Front Panel**

<table>
<thead>
<tr>
<th></th>
<th>OC-3c/12c (STM-1/4c)</th>
<th>OC-48c (STM-16c)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ext Clk</td>
<td>External 19.44 MHz clock input (SMB)</td>
<td></td>
</tr>
<tr>
<td>Test Ports</td>
<td>Duplex SC</td>
<td>Duplex LC</td>
</tr>
<tr>
<td></td>
<td>Single mode or multimode</td>
<td>Single mode</td>
</tr>
</tbody>
</table>

**LED Indicators**

<table>
<thead>
<tr>
<th></th>
<th>OC-3c/12c (STM-1/4c)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status</td>
<td>4-digit display to indicate card status and numerical identification</td>
</tr>
<tr>
<td>LASR</td>
<td>Red when output laser is on</td>
</tr>
<tr>
<td>SGNL</td>
<td>Green when a valid optical receive signal is detected</td>
</tr>
<tr>
<td>TX</td>
<td>Green when an HDLC frame is transmitted</td>
</tr>
<tr>
<td>RX</td>
<td>Green when an HDLC frame is received</td>
</tr>
<tr>
<td>155</td>
<td>Green when the port is operating at OC-3c/STM-1 speed</td>
</tr>
<tr>
<td>622</td>
<td>Green when the port is operating at OC-12c/STM-4c</td>
</tr>
<tr>
<td></td>
<td>Not applicable</td>
</tr>
<tr>
<td></td>
<td>Not applicable</td>
</tr>
<tr>
<td></td>
<td>Not applicable</td>
</tr>
<tr>
<td></td>
<td>Not applicable</td>
</tr>
</tbody>
</table>
LOF/LOP
- Yellow when a Loss of Frame or Loss of Pointer condition exists at the receiver
- Not applicable

AIS/RDI
- Yellow when a Line/MS AIS, Line/MS RDI, Path AIS or Path RDI condition exists at the receiver
- Not applicable

### Applicable Standards

<table>
<thead>
<tr>
<th></th>
<th>OC-3c/12c</th>
<th>OC-48c</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(STM-1/4c)</td>
<td>(STM-16c)</td>
</tr>
</tbody>
</table>

#### Optical Transmitter and Receiver

**SONET**
- OC-12c Single Mode: Telcordia GR-253 CORE Intermediate Reach Specifications (Issue 2, Rev 2, Jan 1999) - IR intermediate reach OC-12 interface specification
- OC-12c Multimode: ATM Forum 622.08 Mbps Physical Layer Specification (af-phy-0046.000, Jan 1996)

**SDH**
- ITU-T G.957 (06/99) S-4.1 Short Haul Specifications
- ITU-T G.957 (06/99) I-16 intra-office STM-16 interface specification

**SONET/SDH**
- STS-3c/STS-12c as per ANSI T1.105 and Telcordia GR-253 CORE (Issue 2, Rev 2, Jan 1999)
- STS-48c as per ANSI T1.105 and Telcordia GR-253 CORE (Issue 2, Rev 2, Jan 1999)
- STM-1/STM-4c as per ITU-T Rec. G.707/G.708 (03/1996)
- STM-16c as per ITU-T Rec. G.707/G.708 (03/1996)

### Protocols

**Packet over SONET/SDH**
- IETF RFC 2615, PPP over SONET/SDH

**PPP/HDLC**
- IETF RFC 1662, PPP in HDLC-like Framing

**Link Control Protocol**
- IETF RFC 1661, The Point-to-Point Protocol (PPP)

**IP Control Protocol**
- IETF RFC 1332, The PPP Internet Protocol Control Protocol (IPCP)
Agilent N2X

Agilent's N2X multi-service tester combines leading-edge services with carrier grade infrastructure testing and emulation. The N2X solution set allows network equipment manufacturers and service providers to more comprehensively test new services end-to-end, resulting in higher quality of service and lower network operating costs.

Warranty and Support

Hardware Warranty
All N2X hardware is warranted against defects in materials and workmanship for a period of 1 year from the date of shipment.

Software Warranty
All N2X 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 and Support Agreement (SSA) contract 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.

Sales, Service and Support

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.
2660 Matheson Blvd. E
Mississauga, Ontario
L4W 5M2
1-877-894-4414

Europe:
Agilent Technologies
European Marketing Organisation
P.O. Box 999
1180 AZ Amstelveen
The Netherlands
(31 20) 547-2323

United Kingdom
07004 666666

Japan:
Agilent Technologies Japan Ltd.
Measurement Assistance Center
8-1, 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) 269-7508
Fax: (305) 267-4286

Asia Pacific:
Agilent Technologies
19/F, Cityplaza One, 1111 King’s Road,
Taikoo Shing, Hong Kong, SAR
Tel: (852) 3197-7777
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: (64-8) 892-6881

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