



Agilent N2X  
**OC-768c POS XS Test  
Card**

E7320B  
Technical Data Sheet



**Industry's first solution to provide a flexible hardware platform that enables OC-768c/STM-256c wire speed packet generation and scalable protocol performance analysis capabilities.**

## Key Features

- **Enables realistic testing of Terabit routers with OC-768c POS interfaces, throughout development and deployment**
- **Industry's highest scalability**
- **Full control over all traffic generation parameters**
- **Unprecedented capture and analysis capabilities**
- **Comprehensive API & Open-Library of Automated Test Scripts**

## Product Overview

The 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 E7320B N2X OC-768c POS XS Test Card is the industry's first test solution for wire-speed traffic generation and internet-scale protocol simulation at 40Gb/s. In conjunction with the N2X Packets & Protocols Application, the E7320B provides the most flexible, comprehensive and easy to use system available to validate the next generation IP/MPLS core networks and Terabit routers.

The foundation of all N2X test cards is a powerful yet flexible traffic generation engine capable of verifying everything from L2 Ethernet Switches through to multi-chassis carrier class routing nodes and networks. The real time traffic generator with multi-profile traffic scheduler and thousands of streams, programmable field modifiers and industry leading test payload provides unparalleled test realism and flexibility to ensure you can generate the traffic to meet any test scenario. Combined with comprehensive real-time layer 1 through to 4 transmit and receive statistics and graphs including packet loss, latency and misordering, N2X is able to verify the data-plane functionality, performance and scalability of your device or network.

Agilent N2X's traffic generator and receiver capabilities are tightly coupled with powerful protocol emulation hardware on all test cards, including the E7320B OC-768 POS XS Test Card. This integration will ensure your devices are tested under the most realistic environment possible and remove the need to manually configure traffic addresses when completing performance measurements. 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 and PIM-SM protocol emulations.

The E7320B N2X OC-768c XS Test Card has one full-duplex optical port which can generate suitably encapsulated IP packets and provide the data capture memory required to enable detailed analysis from a single test session. N2X allows users to set a range of triggers including a specific event threshold as a 'trigger' to initiate or halt capture. Combined with powerful capture analysis software, users can quickly isolate, analyze and debug performance issues.

Agilent N2X test cards offer superior test flexibility and investment protection. They are built using powerful programmable logic technology ensuring test functionality can be continually adapted to ever-changing standards and technologies.

### Functionality

The E7320B N2X OC-768c XS Test Card is a single full-duplex optical port that supports Packet over SONET/SDH, encapsulating IP packets using PPP in HDLC-like framing (as per RFC 1662). It will also support Cisco's HDLC encapsulation of IP packets. The Link Control Protocol (LCP) and IP Control Protocol (IPCP) are supported for parameter negotiation and IP address discovery.

### Industry's Highest Scalability

Agilent N2X generates and analyzes more traffic streams and emulates more peers, sessions and tunnels than any other test tool in the industry. Make simultaneous measurements on 32,000 individual traffic streams and emulate thousands of multi-protocol sessions on each port to quickly identify the performance limitations of your SUT, network or service implementation.

### Full Control over ALL Traffic Generation Parameters

Agilent N2X's innovative "flexible PDU builder" technology delivers the most advanced solution for traffic generation and analysis available. Any type of data-plane frames and packets can be generated, including custom formats. Users can manipulate and define the contents of all protocol fields quickly and easily.

### Unprecedented capture and analysis capabilities

Each N2X OC-768c XS Test Card contains 1024MB of line-rate capture RAM. Agilent N2X allows users to set a specific event threshold as a 'trigger'. This trigger can initiate capture and provides the capacity to quickly isolate, analyze and debug performance issues.

### Comprehensive API & Open-Library of Automated Test Scripts

N2X's automated QuickTests, based on Agilent's Journal of Internet Test Methodologies, makes it easy to perform even the most complex tests. N2X's powerful API allows you to customize scripts to match your specific test needs.

In addition, proprietary scripts can be created using the Tcl/Tk scripting environment. With only a few lines of code, powerful test scenarios can be executed with precision.

### Configuration and Ordering Details

- E7320B 1-port OC-768 POS XS Test Card (includes chassis)

### Software Compatibility

The E7880B Packets Application license enables the traffic generation and analysis features on the E7320B OC-768c XS Test Card. To take advantage the multi-protocol emulation environment plus integrated traffic & routing features you will require an E7881B Packets & Protocols Application license.

## Technical Specifications

### System Specifications

#### Optical Interface

Connectors	2 x Simplex (transmit and receive) FCPC connectors
Transmit	<ul style="list-style-type: none"> <li>• 1550 nm single-mode PIN based receiver</li> <li>• 1550 nm Class 1 CW Laser Source (C-band compatible)</li> <li>• Compliant with: <ul style="list-style-type: none"> <li>– Telcordia Technologies GR-253 CORE (Issue 3, September 2000)</li> <li>– SDH STM-256c as per ITU-T Rec G.691 (March 1999)</li> <li>– ITU-T G.693 VSR2000-3R2/3/5</li> </ul> </li> </ul>
Transmit Wavelength	<ul style="list-style-type: none"> <li>• 1530 nm (min)</li> <li>• 1555 nm (typ)</li> <li>• 1565 nm (max)</li> </ul>
Output Power	<ul style="list-style-type: none"> <li>• 0 dBm (min)</li> <li>• +3 dBm (max)</li> </ul>
Extinction Ratio	8.2 dB (min)
Spectral Width	1 nm (rms @ -20 dB)
Receive Wavelength	<ul style="list-style-type: none"> <li>• 1290 nm (min)</li> <li>• 1570 nm (max)</li> </ul>
Input Sensitivity	-5 dBm (min @ 10-12 BER)
Maximum Input Power	+3 dBm (min)
Optical Return Loss	27 dB (min)
Safety	<ul style="list-style-type: none"> <li>• Class 1 Laser</li> <li>• Class 3R Emissions per standard IEC60825-1:1993 + 1:1997 + A2:2001</li> </ul>

#### 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: <ul style="list-style-type: none"> <li>– Internally generated,</li> <li>– Recovered from the received SONET/SDH signal, or</li> <li>– Generated by an external transmit reference clock</li> </ul>

#### External Transmit Reference Clock

Connector	Male SMB connector
Nominal Frequency	<ul style="list-style-type: none"> <li>• 10 MHz,</li> <li>• 19.44 MHz</li> <li>• 622.08 MHz</li> </ul>
Offset range	+/- 20ppm
Specification	0 dBm (nominal) terminated in 50 ohm to ground input (+6dBm maximum)

#### Measurement System

Result types	<ul style="list-style-type: none"> <li>• Cumulative: measurements are reported from the start of the measurement interval</li> <li>• Sampled: measurements are reported from the most recently completed sampling interval</li> </ul>
Measurement interval	Range: 1 second to 7 days
Sampling interval	Range: 1 second to 1 hour
Measurement clock	<ul style="list-style-type: none"> <li>• 10 ns resolution</li> <li>• +/- 0.5 ppm/year clock drift</li> <li>• 3 ppm max. difference between systems</li> </ul>
Module Synchronization	All measurements are synchronized across all modules within the test system

### SONET/SDH Layer Specifications

#### Operating Modes

Refer to System Specification Interface for details.

- Terminal (normal)
- Transmit loopback

#### Framing Formats

SONET	Telcordia Technologies GR-253 CORE (Issue 3, September 2000)
SDH	ITU-T G.707-Y.1322 (10/2000) Network Node Interface for The Synchronous Digital Hierarchy, April 2000

#### Scrambling

Frame synchronous scrambler (x 7 +x 6 +1)	<ul style="list-style-type: none"> <li>• On</li> <li>• Off</li> </ul>
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**SONET/SDH Layer Specifications (continued)****Section/Regenerator Section Overhead Octet Generation**

A1, A2	Set to 0xF628 (for all STS-Ns/STM-Ns)
J0/Z0	User selectable Section Trace or Growth mode Section Growth mode (Default), <ul style="list-style-type: none"> <li>• J0 = 0xCCh</li> <li>• Z02 to Z0768 = 0x00h</li> </ul> <p>Section Trace mode functionality differs between SONET and SDH framing formats:</p> <ul style="list-style-type: none"> <li>• SONET: J0 set to 62 byte user defined message (ASCII string) and is automatically terminated CRLF</li> <li>• SDH: J0 set to 15 byte user defined message (ASCII string), Frame delimited by Byte 1 MSB set and CRC-7 calculated over 15 byte message.</li> <li>• Z02 to Z0768 = 0x00h</li> </ul>
B1	Automatically calculated
E1, F1, D1...D3	Unused, set to zero
Undefined octets	Unused, set to zero

**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	Path Trace mode functionality differs between SONET and SDH framing formats: <p>SONET: J1 set to 62 byte user defined message (ASCII string) and is automatically terminated CRLF</p> <p>SDH: J1 set to 15 byte user defined message (ASCII string), Frame delimited by Byte 1 MSB set and CRC-7 calculated over 15 byte message.</p>
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	Unused, set to zero
H4	
Z3 (SONET)/F3 (SDH)	
Z4 (SONET)/K3 (SDH)	
Z5 (SONET)/N1 (SDH)	

**Alarms**

Alarm detection	<ul style="list-style-type: none"> <li>• Alarm conditions are detected in real-time</li> <li>• Current alarm status is indicated on the user interface and front panel LEDs</li> <li>• Alarm events are reported in a trace log during the measurement interval</li> <li>• Number of errored seconds is reported per alarm type (count of 1s intervals in which the alarm is detected at least once)</li> </ul>
Alarm generation	Alarm conditions can be invoked, one type at a time
SONET alarm types	<ul style="list-style-type: none"> <li>• LOS</li> <li>• LOF</li> <li>• LOP</li> <li>• AIS-L</li> <li>• RDI-L</li> <li>• AIS-P</li> <li>• RDI-P</li> </ul>
SDH alarm types	<ul style="list-style-type: none"> <li>• LOS</li> <li>• LOF</li> <li>• LOP</li> <li>• MS-AIS</li> <li>• MS-RDI</li> <li>• AU-AIS</li> <li>• AU-RDI</li> </ul>

## SONET/SDH Layer Specifications (continued)

### Error monitoring

Section BIP-8 (B1) errors	<ul style="list-style-type: none"> <li>Number of occurrences reported</li> <li>Number of errored seconds reported</li> </ul>
Line BIP-8 (B2) errors	<ul style="list-style-type: none"> <li>Error rate</li> </ul>
Path BIP-8 (B3) errors	
Line REI (M1) errors	
Path REI (G1) errors	

### Overhead Octet Real-Time Decode

Automatic Protection Switching (APS) octets (K1/K2)	Received 16 bit value is displayed in hex
Synchronization status (S1) value	Received octet values are decoded for display
Path signal label (C2) value	Received octet values are decoded for display
Section trace (J0) message	<p>Section Trace mode functionality differs between SONET and SDH framing formats:</p> <ul style="list-style-type: none"> <li>SONET: 62 byte message (ASCII string) displayed when terminated CRLF</li> <li>SDH: 15 byte message (ASCII string), displayed when Byte 1 MSB set and correct CRC-7 calculated over 15 byte message.</li> </ul>
Path trace (J1) message	<p>Section Trace mode functionality differs between SONET and SDH framing formats:</p> <ul style="list-style-type: none"> <li>SONET: 62 byte message (ASCII string) displayed when terminated CRLF</li> <li>SDH: 15 byte message (ASCII string), displayed when Byte 1 MSB set and correct CRC-7 calculated over 15 byte message.</li> </ul>

## Link Layer Specifications

### OC-768c POS Framing

Encapsulation	<p>IP datagrams are encapsulated using:</p> <ul style="list-style-type: none"> <li>PPP in HDLC-like framing, as per IETF RFC 1662, or</li> <li>Cisco HDLC (Ethertype protocol field)</li> </ul>
FCS	<ul style="list-style-type: none"> <li>32 bit FCS length</li> <li>Negotiated between test port and device under test</li> </ul>
Frame spacing	Frames can be transmitted continuously with a minimum one flag octet between frames

### PPP

- Supports the Link Control Protocol and the IP Control Protocol
- Rejected packets are counted by protocol type
- Configurable parameters:
  - Restart Timer (default 3 seconds)
  - Max-terminate (default 2)
  - Max-configure (default 10)
  - Max-failure (default 5)
- LCP negotiation parameters:
  - Maximum-Receive-Unit (default 1500)
  - Magic-Number (default is randomly chosen)
- FCS (32 bit supported only)
- IPCP negotiation parameters:
  - IP Address
    - 1 + X43, after HDLC framing.
  - Scrambling can be enabled or disabled
- 10 octets for PPP, so as to encapsulate a minimum PPP frame size of 3 octets
- 29 octets for IP, so as to encapsulate a minimum-IP frame size of 20 octets

### Scrambling/Descrambling

### Minimum HDLC frame size (including 7E flag)

## HDLC Real-Time Transmit Statistics

Frames transmitted	Count of total frames transmitted
Maximum frames transmitted	The maximum sample value measured during the current measurement interval

## HDLC Real-Time Receive Statistics

Frames received	Count of all HDLC frames received, including FCS errors, aborted frames and invalid frames
Maximum frames received	The maximum sample value measured during the current measurement interval
FCS errors	Count of HDLC frames received with an invalid FCS
Aborted frames	Count of HDLC frames that end with the frame abort sequence 0x7D 0x7E
Invalid frames	Count of HDLC frames received with an address field or control field not equal to the preset values, or length too short (i.e. less than or equal to 8 octets)

## Mechanical Specifications

### Physical

Width	45.4 cm (17.87") Note: When mounted in EIA Standard 19" rack must be supported by full depth tray
Depth	49.0 cm (19.29")
Height	8.89 cm (3.50" = 2U)
Weight	15 kg

### Electrical

AC Voltage	100 to 120 V nominal 200 to 240 V nominal
Frequency	47 to 63 Hz
Power Consumption	630 W max

### Environmental Operating Conditions

Location	Indoor use only Altitude up to 2000m
Operating Temperature	5 °C to 35°C
Storage Temperature	-40 °C to 70° C
Cooling requirements	Air vents must remain unobstructed (minimum clearance 3 inches/7.62 cm). Inlet air temperature must not exceed the operating temperature limits.
Humidity	Maximum relative humidity 80% for temperatures up to 31 °C decreasing linearly to 50% relative humidity at 40 °C - non-condensing.
Safety	Installation category: II Pollution degree: 2

### Front Panel

Power	On/Off Rocker Switch
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## Rear Panel

### Connectors

Power	Male AC power receptacle
MDI	RJ-45. 100 Mb/s Ethernet (to PC controller)
MDI-X	RJ-45. 100 Mb/s Ethernet (to next chassis)
Daisy-chain Out	Male D-shell. Event/clock connections to next chassis
Daisy-chain In	Male D-shell. Event/clock connections from previous chassis
External Trigger In	Female BNC. Trigger input from external device
External Trigger Out	Female BNC. Trigger output to external device

### LED Indicators

LINK	Ethernet Link
ACT	Ethernet Activity

### 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	Green when a HDLC frame or Ethernet frame is transmitted. Does not indicate integrity of the transmitted SONET SPE.
Rx	Green when a HDLC frame or Ethernet frame is received. Indicates integrity of the SONET SPE and HDLC framing.

## 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)
- For complete compliance information refer to Declaration of Conformity E7900-91300

### 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 55011:1991 (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 61000-3-3:1995 / IEC 1000-3-3:1994, Section 3: Limitation of voltage fluctuations and flicker

### Electrical (safety)

- IEC 61010-1:1990 + A1:1992 + A2 :1995 / EN 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

Optical transmitter and receiver	<ul style="list-style-type: none"> <li>• Telcordia Technologies GR-253-CORE (Issue 3, September 2000)</li> <li>• SDH STM-256c as per ITU-T Rec. G.691 (March, 1999)</li> <li>• ITUT G.693 VSR2000-3R2/3/5</li> </ul>
SONET/SDH	<ul style="list-style-type: none"> <li>• Telcordia Technologies GR-253-CORE (Issue 3, September 2000)</li> <li>• ITUT G.707-Y.1322 (10/2000) Network Node Interface for The Synchronous Digital Hierachy, April 2000.</li> </ul>
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)

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## 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  
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Printed in USA February 2, 2006

5989-1530EN

