

Agilent N2X  
**Access Protocol  
Emulation Software**

E7888A  
Technical Datasheet



**The Agilent N2X Access solution is the most scalable, easy-to-use and realistic network solution for assessing the performance of broadband access devices such as B-RASs, DSLAMs, LACs/LNSs and edge routers.**



**Agilent Technologies**

## Key Features

- Fully qualify edge aggregation devices such as B-RAS, DSLAM, LAC, LNS and L2TP Tunnel Switches (L2TS) prior to use in a real network
- Determine whether an edge aggregation device can authenticate subscribers and set up PPP user sessions correctly
- Establish the maximum scalability of edge aggregation devices or a network by setting up thousands of sessions and tunnels
- Determine maximum session or tunnel setup rates and verify the network's ability to handle bursts of session setup requests
- Verify the QoS capabilities by combining access protocol emulation with integrated wire-speed traffic
- Generate and measure traffic over every user session and tunnel

### PPPoX Features

- Highly scalable PPPoE, PPPoA, and PPPoEoA protocol emulations
- Supported with Fast Ethernet, Gigabit Ethernet, 10G Ethernet and OC-3c/12c (STM-1/4c) ATM interfaces
- PPPoE over 802.1q VLANs (single or double-tagged)
- Full QoS measurements on all traffic streams
- Includes LCP, IPCP, PAP and CHAP protocol support
- Ability to act as either PPP initiator (client) or responder (server)
- Ability to automatically detect and re-establish dropped PPP sessions
- Runs concurrently with other access protocols such as DHCP or IMGP (IGMP over PPP)
- Emulate and test TR-101 PPPoE Intermediate Agents

### L2TP Features

- L2TPv2 protocol emulation with integrated wire-speed traffic
- Supported with all Ethernet, POS and ATM interfaces up to 10Gb/s
- Emulate multiple LAC or LNS devices
- Full QoS measurements on all traffic streams
- Traffic automatically configured from control plane information
- Ability to include multiple PPP sessions in an L2TP tunnel

## 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 subsystem

Agilent N2X Access Protocol Software integrates powerful PPPoX and L2TP protocol emulations into a single, integrated solution that provides comprehensive coverage of the protocols used in broadband access networks.

N2X provides the most scalable and easy-to-use solution for assessing the performance of broadband access devices such as B-RASs, DSLAMs, LACs/LNSs and edge routers. These devices can be tested for session scalability, session set-up rate, and traffic forwarding/QoS performance. By emulating PPPoX & L2TP client sessions and running traffic over those sessions, the testing of these edge aggregation devices is substantially simplified by eliminating the need to configure thousands of individual clients.

The Access Protocol Software enables network equipment developers and network service providers to design and maintain large scale, low cost, easy-to-use and automated test beds in a small physical space.

## Example Access Test Scenario

A typical configuration for testing a B-RAS that acts as a termination point for PPPoX sessions as well as a LAC is shown in Figure 1. PPPoX clients are simulated on Test Port 1. Test Port 2 simulates the connection from the edge device (acting as an L2TP Access Concentrator) into the core network, and as such is a termination point for PPP sessions over L2TP tunnels (an LNS). Both ports act as sources and destinations for the IP traffic and measure various QoS parameters (data rate, packet loss, latency). More complex test configurations can also be created with more ports to simulate even more clients.

The basic test steps are as follows:

- Thousands of PPPoX clients are simulated on N2X Port 1
- The simulated clients initiate sessions with the SUT on the relevant link
- Clients respond to authentication requests and go through various PPP establishment phases (LCP, PAP/CHAP, IPCP)
- The SUT accepts the session requests and sessions are established
- Thousands of L2TP tunnels are initiated by the SUT on N2X Port 2 (acting as simulated LNS and session responder)
- N2X accepts the tunnel requests and PPP sessions are established over those tunnels
- N2X sends IP traffic to the SUT on Test Port 1, which in turn forwards the traffic to destination port (Test Port 2) on N2X. Each session is individually tracked for QoS parameters

This scenario can be used to measure the following parameters:

- Session capacity of the SUT
- Session set-up and tear-down rate of the SUT
- Traffic forwarding performance of the SUT

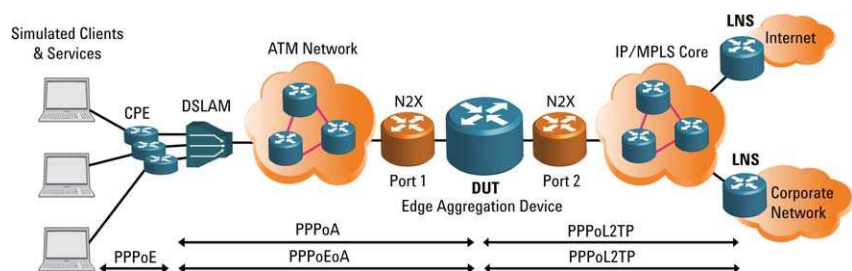


Figure 1: Access testing with Agilent N2X

## Verify and stress protocol implementations

Agilent N2X provides an easy-to-use solution to verify the robustness of the protocol implementations under various stress conditions.

The highly scalable PPPoX protocol emulation software supports the link establishment options (LCP Phase) including CHAP/PAP authentication and establishes sessions after proper IPCP negotiation. It provides comprehensive coverage for PPPoE, PPPoA and PPPoEoA protocols.

Each Ethernet and ATM N2X test card can emulate thousands of PPPoX sessions with setup rates of hundreds of sessions per second. XR and XR-2 cards offer moderate protocol scalability and performance, while XS and XS-2 series cards offer very high scalability and performance.

N2X can act as both initiator of and responder to session establishment and also can generate or respond to LCP Echo Requests and keep PPP sessions alive for user-configured durations. N2X can also emulate and test TR-101 PPPoE Intermediate agents.

All protocol options can be configured easily from both the GUI and the Tcl API to allow the user to set up various test scenarios.

- Establish thousands of PPP sessions and measure session set-up and tear-down rate
- Verify a SUT's ability to authenticate sessions using CHAP or PAP
- Abruptly terminate sessions to simulate link down condition and verify the ability of the SUT to handle a flood of LCP Configure Requests.
- Perform session flapping by establishing, terminating and re-establishing sessions on an iterative basis to verify the SUT's ability to manage sessions under flapping at high set-up rates.
- Set up and delete sessions to simulate dynamic changes in the network and verify the SUT's sustainability, with the ability to open larger numbers of re-established sessions.

The Layer 2 Tunneling Protocol (L2TP) Software provides an easy way to test L2TP-based Virtual Private Networks (VPNs) by emulating various L2TP network elements, such as Network Servers (LNSs) and Access Concentrators (LACs).

Agilent N2X can set up thousands of L2TP sessions and tunnels, and can measure important parameters like tunnel establishment time and establishment rate.

N2X simulates real world environments by establishing PPP sessions over L2TP and keeping the sessions alive by periodically sending L2TP Hello Packets. Through establishment of these tunnels and sessions, and by varying control plane parameters, devices supporting L2TP VPNs can be stressed fully to determine their performance under real load conditions.

## Integrated wire-speed traffic generation for measuring QoS

The E7888A Access Protocol software is ideally suited for integrated control and data plane testing.

N2X provides an easy mechanism to generate IP traffic on multiple interfaces to test performance limits of edge devices. The intuitive user interface guides the user to define multiple session pools with varying number of sessions per pool, select ports to be associated with each session, and direct traffic streams (bursty or constant) to the ports assigned. The traffic streams are automatically configured based on the control plane information including IP address, VPI/VCI, VLAN tags, session ID, MAC addresses and synchronized across multiple ports, thus allowing for real-time measurements of QoS parameters such as throughput, packet loss, and latency on per-subscriber basis.

Agilent N2X's flexible PDU Builder enables users to configure any type of traffic to be sent over the PPP sessions and/or L2TP tunnels, including single or double VLAN tagged streams over PPPoE sessions (PPPoEo802.1q and PPPoEoQinQ). Users are also able to generate stateless layer-4 traffic with configurable protocol (TCP, UDP) and complete control over all fields (e.g. source/destination port numbers). It is also possible to run stateful emulations such as IGMP over PPP sessions (IGMPoPPP) – additional IGMP license required.

## **Simulate Real-life Network Conditions**

N2X allows users to establish thousands of sessions and bring down all sessions abruptly to simulate a “link down” condition to:

- Verify if the device under test can manage this situation
- Test further if the device can manage service restoration gracefully when all subscribers immediately try to reconnect

N2X interactive user interface allows users to test under “session flapping” scenarios with sessions being established and deleted repeatedly to simulate real-life conditions and measure the impact of the changes in real-time.

N2X allows users to simulate failure test scenarios by automatically re-initiating sessions that are torn down for various reasons including subscriber line or machine failures and measuring the performance of the network and functionality of the SUTs under these real-life conditions.

## **Easy-to-use graphical user interface**

Testing of edge devices has been substantially simplified by eliminating the need to configure and manage thousands of individual clients. Users can quickly and easily emulate thousands of concurrent PPPoX and L2TP sessions with the concept of a Session Pools and generate traffic over those sessions with the integrated traffic generator that automatically configures traffic streams based on the control plane parameters.

Agilent N2X’s flexible PDU Builder, multi-protocol emulation environment and interactive user interface makes N2X the most realistic solution capable of simulating an environment accurately reflecting the complexity and volatility of live networks.

## **Capture and Protocol Decode**

Problem isolation and troubleshooting had been made simple through the N2X comprehensive capture and protocol-decode analyzer. This functionality enables users to investigate measurements offline that expose performance and functional issues of a System Under Test (SUT). Users can investigate issues in more detail than can be provided in real-time and display a comprehensive protocol decode view of the captured data.

Analyzing data provides a graphical representation of an entire capture buffer. It enables users to can select a point of interest, such as a spike in latency, and then drill down by re-analyzing the location around the selected point, until the packet of interest has been isolated.

## **Tcl application programming interface**

Automation of test scenarios is made simple through Agilent’s easy-to-use application programming interface (API). The Tcl-based API enables the user to create automated test sequences or pre-defined test configurations. Tcl scripts can run on the N2X System Controller, a remote PC, or Unix workstation attached to the Controller via a TCP/IP connection.

## Technical Specifications

This section contains the protocol-specific parameters are configurable through the GUI or the Tcl/Tk scripting environment.

### PPPoX Configurable Parameters

- Number of sessions
  - Session lifetime
  - Session initiation rate
  - Starting source IP address and increment
- PPPoE & PPPoEoA**
- Service name
  - Number of sessions per source MAC address
  - Starting source MAC address and increment
  - Initial Ack timeout
  - Maximum Tx retries
- PPPoA & PPPoEoA**
- Starting VPI & VCI
  - VPI & VCI increment
  - Encapsulation (LLC or VC-mux)
  - PPPoE to PVC mapping mode (1:1 or many:1)
    - applies to PPPoEoA only
- LCP Options**
- MRU (bytes)
  - LCP echo request interval (seconds)
  - Max-Configure
  - Max-Terminate
  - Max-Failure
  - Restart timer
- Authentication**
- None, PAP or CHAP
  - Username (optionally unique per session)
  - Password (optionally unique per session)
  - Base domain name (optionally unique per session)

### L2TP Configurable Parameters

- Identity (LAC or LNS)
- Tester & SUT IP addresses
- SUT authentication
- Shared secret
- Maximum Tx retries
- Hello interval (seconds)
- Number of calls (sessions) per tunnel
- Receive window size
- Initial Ack timeout (seconds)
- Source UDP port
- Called number
- Bearer type

### Control Plane Statistics

Statistics can be displayed and saved, independently for tunnels and sessions.

- PPP Sessions**
- Attempted
  - Failed
  - Established
  - Deleted

**PPP Session Timing**

- Session establishment time
- Session establishment rate
- Session lifetime (min/max/average)

**PPPoE Packets**

- PADI packets received & transmitted
- PADO packets received & transmitted
- PADR packets received & transmitted
- PADS packets received & transmitted
- PADT packets received & transmitted

**PPP Packets**

- LCP Configure Request received & transmitted
- LCP Configure Ack received & transmitted
- LCP Configure Nak received & transmitted
- LCP Configure Reject received & transmitted
- LCP Terminate Request received & transmitted
- LCP Terminate Ack received & transmitted
- LCP Echo Request received & transmitted
- LCP Echo Reply received & transmitted
- IPCP Configure Request received & transmitted
- IPCP Configure Ack received & transmitted
- IPCP Configure Nak received & transmitted
- IPCP Configure Reject received & transmitted
- CHAP Challenge received & transmitted
- CHAP Response received & transmitted
- CHAP Success received & transmitted
- CHAP Failure received & transmitted
- PAP Authenticate Request received & transmitted
- PAP Authenticate Ack received & transmitted
- PAP Authenticate Nak received & transmitted

**L2TP Packets**

- SCCRQ received & transmitted
- SCCRQ received & transmitted
- SCCCN received & transmitted
- ICRQ received & transmitted
- ICRP received & transmitted
- ICCN received & transmitted
- OCRQ received & transmitted
- OCRP received & transmitted
- OCCN received & transmitted
- CDN received & transmitted
- ZLBAck received & transmitted
- Hello received & transmitted
- StopCCN received & transmitted

**L2TP Sessions**

- Attempted
- Failed
- Established
- Deleted

**L2TP Tunnel Timing**

- Tunnel establishment time (min/max/average)
- Tunnel establishment rate
- Tunnel lifetime (min/max/average)

**L2TP Session Timing**

- Session establishment time (min/max/average)
- Session establishment rate
- Session lifetime (min/max/average)

### Data Plane Statistics

All standard N2X data plane QoS statistics are supported. Refer to E7880A datasheet for more details.

## Applicable Standards

PPP Challenge Handshake Authentication Protocol (CHAP) - RFC 1994

- The PPP Internet Protocol Control Protocol (IPCP) - RFC 1332
- Layer 2 Tunneling Protocol (L2TPv2) - RFC 2661
- PPP Authentication Protocols (PAP) - RFC 1334
- The Point-to-Point Protocol (PPP) - RFC 1661
- PPP over AAL5 (PPPoA) - RFC 2364
- A Method for Transmitting PPP over Ethernet (PPPoE) - RFC 2516
- Multiprotocol Encapsulation over AAL-5 (Ethernet over ATM)- RFC 2684
- Migration to Ethernet-Based DSL Aggregation (DSL Forum TR-101)

## Configuration and Ordering Details

To use the E7888A Access Protocol Emulation software following Agilent N2X hardware and software is required.

### Hardware

A N2X system is required with:

- System controller
- Chassis
- Interface cards

E7888A Access Protocol Emulation software is supported on all N2X XR XR-2, XS, and XS-2 cards. The N2X XS series cards offer up to 2 times the protocol scalability of the XR cards.

E7888A Access Protocol Emulation software is NOT supported on N2X XP cards.

### Software

Required software packages are as follows:

- E7881A/B Traffic and Protocol Emulation Software
- The E7829A DHCP, IGMP, PPPoX and L2TP emulation bundle includes the E7888A Access Protocol license and the two are therefore mutually exclusive. The E7829A DHCP, IGMP, PPPoX and L2TP emulation bundle includes the E7888A Access Protocol license and the two are therefore mutually exclusive.

### Related Software

- E7828A IGMP Emulation Software License
- E7829A DHCP, IGMP, PPPoX and L2TP emulation bundle
- E7887A DHCP Emulation Software License
- E7896A DHCPv6 Emulation Software License
- E7897A MLD Emulation Software License
- E7898A IPv6 Access Protocol Bundle (DHCPv6 + MLD)

Your local Agilent field engineer can provide more details on how to order and configure a test system.

## Online Help

An extensive online help system provides complete descriptions and detailed usage instructions for every component of N2X. Dialog-level, context-sensitive help provides rapid access to the relevant sections of the online help.

## Acronyms

<b>API</b>	Application Programming Interface
<b>CHAP</b>	Challenge Handshake Authentication Protocol
<b>GUI</b>	Graphical User Interface
<b>IP</b>	Internet Protocol
<b>IPCP</b>	Internet Protocol Control Protocol
<b>L2TP</b>	Layer Two Tunneling Protocol
<b>LCP</b>	Link Control Protocol
<b>PAP</b>	Password Authentication Protocol
<b>PPP</b>	Point-to-Point Protocol
<b>PPPoA</b>	PPP over ATM
<b>PPPoE</b>	PPP over Ethernet
<b>PPPoX</b>	PPP over Any Link Layer (ATM, Ethernet or L2TP)
<b>QoS</b>	Quality of Service
<b>SUT</b>	System Under Test
<b>Tcl</b>	Tool Command Language
<b>VC</b>	Virtual Circuit
<b>VCI</b>	Virtual Circuit Identifier
<b>VLAN</b>	Virtual LAN
<b>VP</b>	Virtual Path
<b>VPI</b>	Virtual Path Identifier

## 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.

## Software and Support Agreement

To protect your investment in the Agilent N2X, every new system includes an initial 12-month comprehensive system-based warranty and Software and Support Agreement (SSA).

Renewing Agilent support services ensures uninterrupted technical support and software upgrades, giving you confidence in N2X throughout the life of your system.

The N2X technical support portion of your SSA includes assistance with product operation and measurements, and verification that the N2X equipment is in correct working order.

## 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.

## Ordering Information

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

## Sales, Service and Support

N2X must be serviced by an approved Agilent Technologies service centre, please contact us for more information.

### United States:

Agilent Technologies  
Test and Measurement Call Center  
P.O. Box 4026  
Englewood, CO 80155-4026  
1-800-829-4444

### 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  
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) 269-7500  
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: (64-4) 802-6881

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