

Agilent N2X  
**DHCP Protocol  
Emulation Software**

E7887A  
Technical Data Sheet



**N2X provides the most complete and easy-to-use solution for assessing the DHCP performance of broadband access devices such as B-RASs, EARs and IP DSLAMs. These devices can be tested for session scalability, session set-up rate, and traffic forwarding/QoS performance.**



**Agilent Technologies**

## Key Features

- **DHCP client and server protocol emulation**
- **Automatically generate traffic (32K streams/port) using assigned DHCP addresses**
- **DHCP relay agent (Opt 82) emulation**
- **DHCP over VLANs (single or double tagging)**
- **Multiple client types (e.g. DHCP, PPPoX, IGMP) on the same port facilitates realistic 'triple-play' test scenarios**
- **Ability to automatically detect and re-establish dropped DHCP sessions**
- **Works in conjunction with wire-speed traffic generator/analyzer with QoS measurements**
- **Supported on all Ethernet speeds – including 10GbE**

## 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.

Agilent N2X DHCP Protocol Emulation software provides a comprehensive simulation of subscribers who are accessing broadband 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 DHCP clients and servers, and running traffic to these simulated clients, the testing of edge aggregation devices is substantially simplified by eliminating the need to configure a dedicated DHCP server and thousands of individual clients. This 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 DHCP Test Scenario

A typical configuration for testing a B-RAS that acts as a DHCP Relay Agent is shown in Figure 1. Multiple DHCP clients are simulated on Test Port 1. Test Port 2 simulates a DHCP Server that will respond to the DHCP client requests. More complex test configurations can also be used with additional ports to simulate even more clients. Traffic which automatically uses the learned addresses can be generated, and various QoS parameters can be measured (data rate, packet loss, latency).

The basic test steps are as follows:

- Thousands of DHCP clients are simulated on N2X Port 1.
- A DHCP server is configured on N2X Port 2.
- Capture is enabled on both test ports.
- The simulated clients request IP addresses via DHCP.
- The DUT acts as a relay agent. It will add relay agent information to the DHCP messages, and then relay the packets to the DHCP server's unicast address.
- The DHCP server will respond to the DUT.
- The DUT will remove the relay agent information from the DHCP messages, and then broadcast the messages to the simulated clients.
- The N2X will accept the DHCP messages and bind the learned IP addresses.
- The capture buffer on both test ports can be verified to ensure that the DUT is adding/removing the relay agent information and broadcasting/unicasting the messages correctly.

This scenario can be used to measure the following parameters:

- DHCP client capacity of the DUT
- DHCP relay agent performance of the DUT (set-up rate)

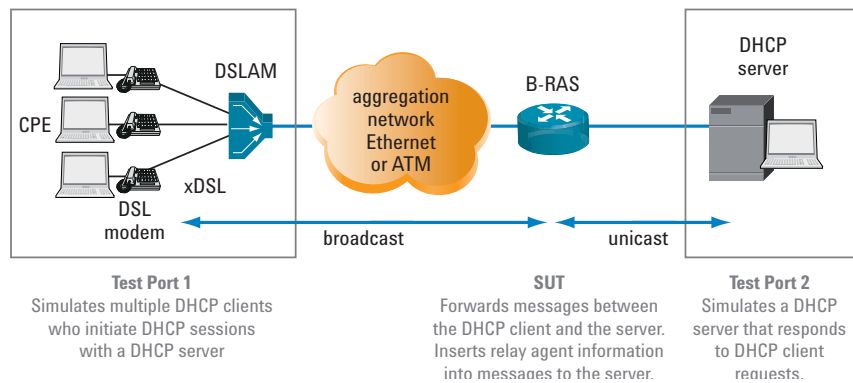


Figure 1: DHCP Relay Agent testing with N2X

## Verify and Stress DHCP

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

- Determine your device's scalability limits by measuring the maximum number of supported DHCP clients
- Set-up thousands of DHCP clients and measure how long it takes to learn (bind) IP addresses
- Simulate both DHCP clients and relay agents (Option 82), and test a DHCP server's operation
- Test DHCP operation with custom options

The N2X makes it easy to test DHCP by emulating DHCP clients, servers, and relay agents – all from an integrated GUI. Don't waste time setting up multiple pieces of equipment when you can configure everything from a single N2X screen!

The E7887A DHCP Protocol Emulation software is supported on Ethernet interfaces with speeds from 10Mb/s up to 10Gb/s. Test your device's traffic aggregation functions by sending traffic from multiple lower-speed interfaces to a higher-speed port.

Troubleshooting DHCP problems is made easier through trace messages and filters that allow you to quickly see the status and message exchange of the DHCP clients.

### Realistic test scenarios

The N2X allows you to test realistic access scenarios. DHCP clients and servers can be created over VLANs or Stacked VLANs. Other protocols, such as IGMP or PPPoE, can be run simultaneously on the same port as DHCP. Relay agents can be emulated by the N2X, or you can test against a real DHCP relay agent. With its integrated traffic, custom options, scalability and 10GbE interface support, the N2X provides the best solution for fully testing DHCP.

N2X allows users to simulate failure test scenarios by automatically re-binding 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.

### Integrated wire-speed traffic generation for measuring QoS

The E7887A DHCP Protocol Emulation software is ideally suited for integrated access 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 allows the user to quickly define multiple device pools of DHCP clients. Traffic streams (bursty or constant) can be sent from each of the clients. The traffic streams are automatically configured based on the IP addresses learned via DHCP. Real-time measurements of QoS parameters such as throughput, packet loss, and latency can be made on a per-subscriber basis.

Agilent N2X's flexible PDU Builder enables users to configure any type of traffic to be sent from the DHCP clients, including single or double VLAN tagged traffic. Users are also able to generate stateless layer-4 traffic with configurable protocols (TCP, UDP) and have complete control over all fields (e.g. source/destination port numbers).

### Easy-to-use graphical user interface

Testing of edge aggregation 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 DHCP clients with the concept of a Device Pool and generate traffic from each of these clients with the integrated traffic generator that automatically configures traffic streams based on the control plane parameters. DHCP servers can also be emulated through the same N2X GUI.

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.

## Applicable Standards

- Dynamic Host Configuration Protocol - RFC 2131
- DHCP Options and BOOTP Vendor Extensions - RFC 2132

## Configuration and Ordering Details

To use the E7887A DHCP Protocol Emulation software, the following Agilent N2X hardware and software is required.

### Hardware

A N2X system is required with:

- System controller
- Chassis
- Interface cards

E7887A Access Protocol Emulation software is supported on all N2X Ethernet XR cards and XS cards. The N2X XS-2 cards offer over two times the protocol scalability of the XR-2 cards.

E7887A Access Protocol Emulation software is NOT supported on N2X XP cards.

### Software

Required software packages are as follows:

- E7881B Packets and Protocols Application Software

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>B-RAS</b>	Broadband Remote Access Server
<b>DHCP</b>	Dynamic Host Configuration Protocol
<b>DSLAM</b>	Dynamic Subscriber Link Aggregation Multiplexer
<b>DUT</b>	Device Under Test
<b>EAR</b>	Ethernet Aggregation Router
<b>GbE</b>	Gigabit Ethernet
<b>GUI</b>	Graphical User Interface
<b>IGMP</b>	Internet Group Management Protocol
<b>IP</b>	Internet Protocol
<b>LAC</b>	L2TP Access Concentrator
<b>LNS</b>	L2TP Network Server
<b>PDU</b>	Protocol Data Unit
<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>TCP</b>	Transmission Control Protocol
<b>UDP</b>	User Datagram Protocol
<b>VLAN</b>	Virtual LAN

## Technical Specifications

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

### DHCP Client Configurable Parameters

<b>Ethernet Subinterface</b>	Local MAC address VLAN ID (two VLAN tags may be stacked)
<b>DHCP Options</b>	DISCOVER options REQUEST options INFORM options
<b>Timers</b>	Setup interval (msec) Retransmit timeout (sec) Retransmit attempts Release interval (msec)

### DHCP Client Relay Agent Parameters

<b>Relay Agent Option</b>	Circuit ID Circuit ID suffix Remote ID Remote ID suffix
<b>Addressing</b>	Relay Agent Ethernet address Relay Agent IP address

### DHCP Server Configurable Parameters

<b>Lease Time (sec)</b>	
<b>Addressing</b>	Local MAC address IP address VLAN ID (two VLAN tags may be stacked)
<b>IP Address Pool</b>	Starting IP address Network Mask Increment
<b>DHCP Options</b>	OFFER options ACK options MAC addresses to ignore MAC addresses to which a NAK PDU will be sent

### DHCP Statistics

<b>DHCP Client and Server Statistics</b>	<ul style="list-style-type: none"> <li>• Discover received &amp; transmitted</li> <li>• Offer received &amp; transmitted</li> <li>• Request received &amp; transmitted</li> <li>• Decline received &amp; transmitted</li> <li>• Ack received &amp; transmitted</li> <li>• Nak received &amp; transmitted</li> <li>• Release received &amp; transmitted</li> <li>• Inform received &amp; transmitted</li> <li>• Force received &amp; transmitted</li> </ul>
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<b>DHCP Client Statistics</b>	<ul style="list-style-type: none"> <li>• DHCP Sessions attempted</li> <li>• DHCP Sessions established</li> <li>• DHCP Sessions renewed</li> <li>• DHCP Sessions rebooted</li> <li>• DHCP Sessions released</li> <li>• DHCP Sessions expired</li> <li>• DHCP Sessions failed</li> <li>• Packets Retransmitted</li> <li>• Maximum retransmit attempts</li> <li>• Discover response (min/max/average)</li> <li>• Request response (min/max/average)</li> <li>• Establishment time (min/max/average)</li> <li>• DHCP sessions established (count/percentage/rate)</li> </ul>
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<b>DHCP Server Statistics</b>	<ul style="list-style-type: none"> <li>• IP addresses allocated</li> <li>• DHCP Relay Agents</li> </ul>
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### Data Plane Statistics

All standard N2X data plane QoS statistics are supported. Refer to the E7881B datasheet for more details.

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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.

## 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:

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