

Agilent N2X  
**Ethernet OAM Fault  
Management (Y.1731)  
Emulation Software**

N5585A  
Technical Data Sheet



**The most comprehensive and scalable tool  
to verify the operation, performance and  
scalability of ITU-T Y.1731 fault management  
implementations for Ethernet.**



**Agilent Technologies**

## Key Features

- Emulate Y.1731 OAM frames over Ethernet
- Includes diagnostic test pattern capability
- Operates with other N2X emulations, such as xSTP and LACP
- Easily emulate thousands of Maintenance Entities to characterize Fault Management scalability
- Comprehensive Continuity Check Database with stateful feedback
- Verify Fault Management functionality across multiple MEG levels
- Quantify Link Trace and Loopback latency

## 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 N5585A FM Protocol Emulation software is one component of the N2X Carrier Ethernet test solution, which includes emulation and conformance testing of technologies such as LACP, STP, RSTP, MSTP, BFD, L2oMPLS, VLANs, MEF 9, and MEF 14.

From a user perspective, the N5585A FM Protocol Emulation software includes four devices as shown in figure 1:

- An Ethernet Network OAM topology for Continuity Check Data Base (CCDB) creation and maintenance. It is also responsible for initiating and responding to Continuity Check Messages (CCM); for Loopback Response (LBR) generation; and for Link Trace Response (LTR) generation
- An Ethernet OAM Link Trace Message (LTM) initiator device
- An Ethernet OAM Loopback Message (LBM) initiator device
- An Ethernet OAM Test Message (TST) initiator device

The LTM and LBM initiator devices are not bound to the N2X simulated topology, thereby allowing the user flexibility to initiate messages to real Maintenance Entity Group (MEG) End Points (MEPs) discovered through the Continuity Check protocol or to manually-defined, possibly non-existent, MEG Intermediate Points (MIPs) or MEPs.

The Ethernet OAM topology device simulates one or more MIPs connected in series with one or more MEPs connected to the last MIP device. All MEG points are able to span multiple MEG Levels (MELs). Simulated MIPs are used for depth in Link Trace protocol verification. Simulated MEPs are used for breadth in Loopback protocol verification. The Ethernet OAM topology builder allows the creation of large Managed Ethernet Networks while maintaining sufficient flexibility to allow for the simulation of any topology scenario. This emulation concept is shown in figure 2A.

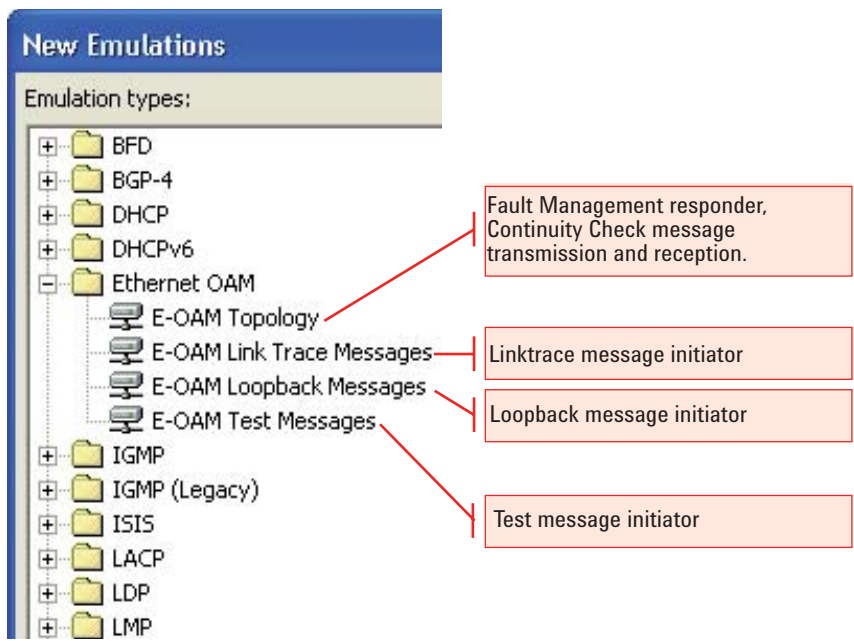


Figure 1 : N2X Ethernet OAM emulation devices

## Product Features

### Emulate Y.1731 OAM frames over Ethernet

Carrier Ethernet services can be implemented over an IEEE 802.3 switched-Ethernet infrastructure. Typically in such a test scenario, the System Under Test (SUT) is a carrier-class Ethernet switch running RSTP/MSTP, and N2X emulates the surrounding switched network, sending and responding to Y.1731 OAM frames. The SUT may also be an MPLS core network with Y.1731 OAM frames transparently tunneled through the core.

### Includes ITU-T diagnostic test pattern capability

Ethernet Test Signal function (ETH-Test) is used to perform one-way on-demand diagnostic tests. The N2X FM emulation allows the sending of a data test pattern with pseudo-random bit sequence (PRBS) with or without checksum.

### 'On-the-fly' simulation of network faults

The N5581A FM emulation allows the user to enable and disable Maintenance Entities interactively, while the test is running. This includes the ability to send Alarm Indication Signals (AIS) while suppressing Continuity Checks, Loopback Responses, and Link Trace Responses. This interactive capability is essential in order to emulate and measure the impact of realistic network faults.

A server (sub) layer may be disabled or administratively locked causing the N2X emulation to periodically send AIS or Locked Signal (LCK) messages respectively, until the administrative/ diagnostic condition is removed.

As shown in figure 2B, a key test scenario is to verify that AIS notification generated at test port B on N2X, propagates up through the DUT levels and is detected at test port A on N2X.

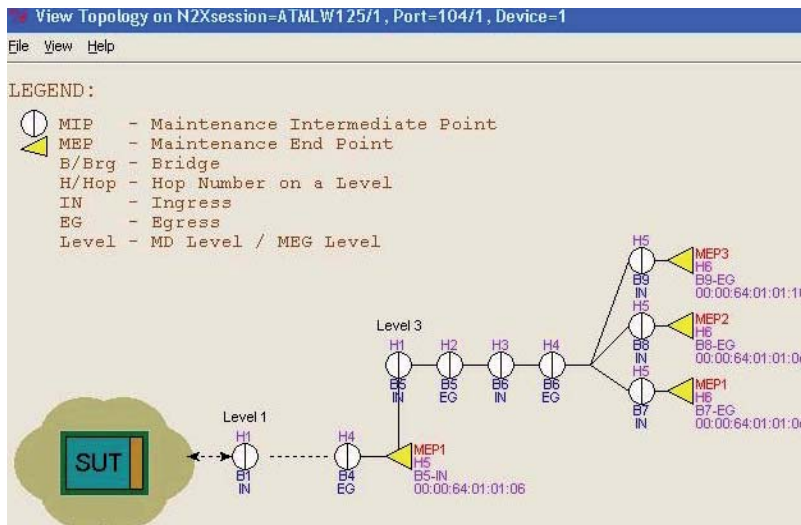


Figure 2A: Pictorial representation of a simulated Ethernet OAM topology as displayed by N2X emulation.

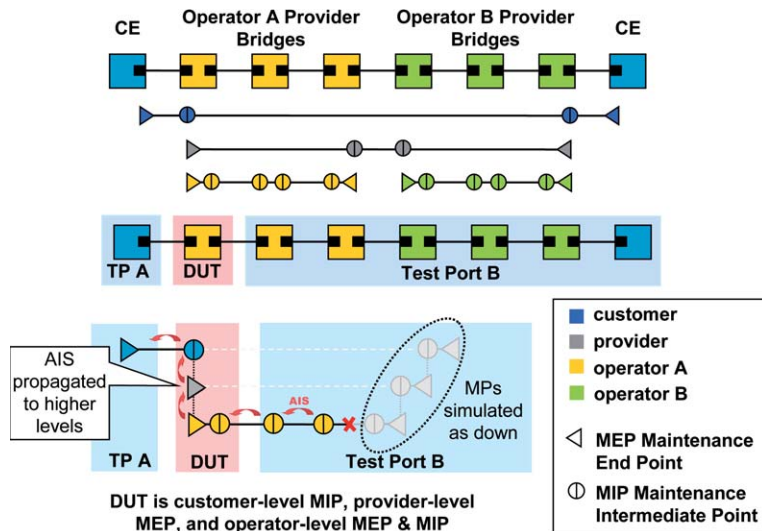


Figure 2B: N2X emulates multiple MIPs and MEPs spanning multiple MEG levels.

### Operates with other N2X emulations, such as xSTP and LACP

The N2X FM emulation is aware of other N2X emulations that are operating concurrently. For example, the Multiple Spanning Tree Protocol (MSTP) emulation is Ethernet OAM-aware and blocks Y1731 OAM frames if a port or Multiple Spanning Tree Instance (MSTI) is in the discarding state. N2X can also generate and receive Y1731 OAM frames over Link Aggregation bundles. This is important as it allows a link-trace to be performed following a link failure in the Link Aggregation Group (LAG), in order to confirm that the failover has actually occurred and to measure end-to-end path latency on the standby link.

### Easily emulate thousands of Maintenance Entities to characterize FM scalability

As shown in figure 3, the N5581A emulation architecture allows for rapid and easy creation of realistic scaled topologies. N2X can simulate individual bridges or entire server (sub) layers.

Tests are easily scaled up using multiple interfaces, multiple emulated devices, and multiple Ethernet OAM topology instances, to gauge performance under worst-case conditions and to measure the impact of fault management overhead on subscriber traffic, DUT processing capability, and other DUT resources.

The user can visualize the simulated topology either in a tabular manner, or via a pictorial representation, as shown in figure 2A.

### Comprehensive Continuity Check Database with stateful feedback

For each test port, N2X builds a comprehensive Continuity Check Database (CCDB) and maintains state (START/OK/FAILED) for each connectivity on that port. Connectivities are either manually entered or discovered through the reception of CCMs. Failure to receive a CCM for an expected connectivity within the configured time-out period triggers the generation of Remote Defect Indicator (RDI) in all subsequent CCMs that are transmitted. All Continuity Check information is viewable in the CCDB in columns that can be individually hidden or shown and used for event sorting. Statistics are maintained by the CCDB on detected errors.

Enable/Disable support for the various CFM protocols and features

Topology Builder defaults to containing a single MEG level

Increase levels by adding items to the MEG level set

MAC address automatically assigned for all simulated managed ports

Multiple MEPs may be simulated on the last (typically the highest) MEG level

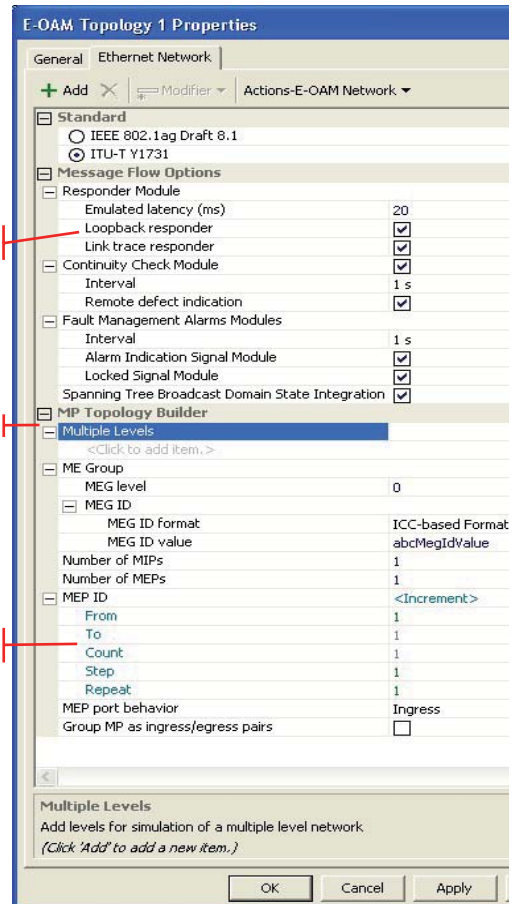


Figure 3: Rapidly and easily create scaled topologies

In a typical test scenario, N2X surrounds the SUT with thousands of emulated MEG points. The user can then examine the SUT's CCDB to ensure that the SUT was aware of the relevant remote MEPs and their associated states.

### Integration of Loopback and Link Trace with CCDB

The Maintenance Entity destination for Loopback and Link Trace may be manually specified or easily copied from MEPs in the CCDB. Selection of MEPs from the CCDB allows large numbers of realistic connectivity checks to be undertaken to characterize FM scaled performance.

### Verify FM functionality across multiple MEG levels

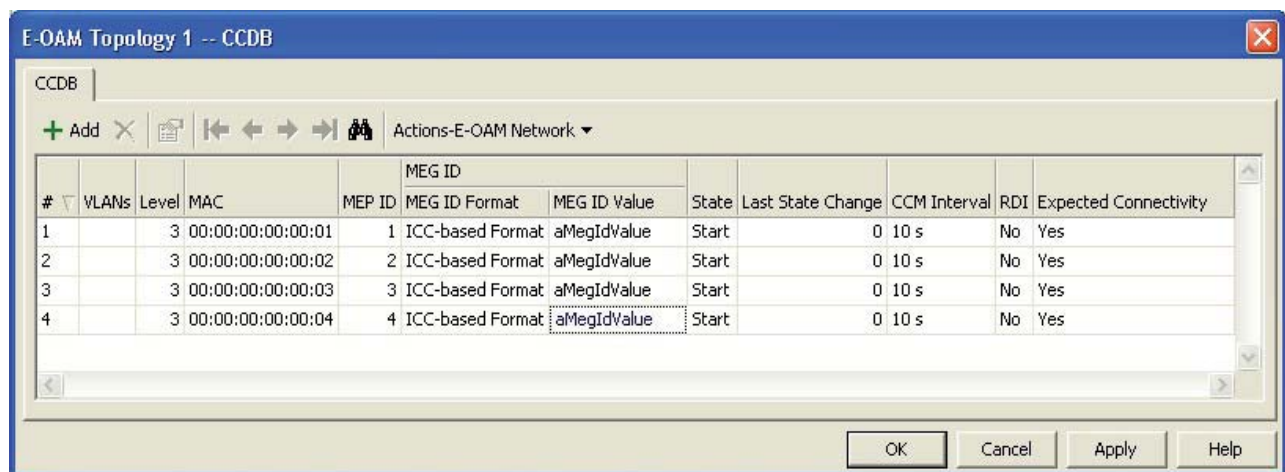
Ethernet OAM topology may be simulated across multiple MEG levels (Customer, Provider, and Operator). The simulated topology is easy to configure, and can be readily expanded across multiple Maintenance Entity Group Levels to ensure test realism.

### Quantify Link Trace and Loopback latency

Fundamental FM metrics are Link Trace and Loopback latency. N2X measures the average, minimum and maximum values of key parameters and presents them to the user. This enables verification that the DUT can respond rapidly and accurately under normal conditions and also under load, as well as validation of the DUT's own reporting of round-trip frame latency.

### Perform Negative Testing via flexible XML PDU builder

Essential to interoperability testing is the establishment of DUT behaviour in the event of an unexpected or malformed PDU. N2X's flexible XML-based PDU builder allows the user (via the GUI) to easily create and transmit a non-conforming FM frame.



The screenshot shows a software window titled "E-OAM Topology 1 -- CCDB". Inside, there is a table with columns for #, VLANs, Level, MAC, MEP ID, MEG ID (Format and Value), State, Last State Change, CCM Interval, RDI, and Expected Connectivity. The table contains four rows of data, all with a State of "Start" and Expected Connectivity of "Yes".

#	VLANs	Level	MAC	MEP ID	MEG ID		State	Last State Change	CCM Interval	RDI	Expected Connectivity
					MEG ID Format	MEG ID Value					
1		3	00:00:00:00:00:01	1	ICC-based Format	aMegIdValue	Start		0 10 s	No	Yes
2		3	00:00:00:00:00:02	2	ICC-based Format	aMegIdValue	Start		0 10 s	No	Yes
3		3	00:00:00:00:00:03	3	ICC-based Format	aMegIdValue	Start		0 10 s	No	Yes
4		3	00:00:00:00:00:04	4	ICC-based Format	aMegIdValue	Start		0 10 s	No	Yes

Figure 4: Ethernet OAM Continuity Check Database displaying Remote MEP.

## Technical Specifications.

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

### Configuration Parameters

#### Ethernet OAM Topology Device

<b>Emulated Maintenance Entity Topology</b>	<ul style="list-style-type: none"> <li>• Number of Maintenance Entity Groups (MEGs)</li> <li>• Maintenance Entity Groups Level (per MEGs)</li> <li>• Maintenance Entity Groups ID (per MEGs)                             <ul style="list-style-type: none"> <li>– MEG ID format (ICC-based format)</li> <li>– MEG ID value</li> </ul> </li> <li>• Emulate Server (sub) layers (per MEG)</li> <li>• Number of MIPs (per MEG)</li> <li>• Number of MEPs (last MEG)</li> <li>• MEG End Point ID (per MEG)</li> <li>• MEG Point Latency emulation (msec)</li> <li>• Enable/Disable Emulated Link</li> </ul>
<b>CCDB – Expected Remote MEPs</b>	<ul style="list-style-type: none"> <li>• MEG End Point ID</li> <li>• MAC address</li> <li>• MEG Level</li> <li>• MEG ID                             <ul style="list-style-type: none"> <li>– MEG ID format (ICC-based format)</li> <li>– MEG ID value</li> </ul> </li> <li>• Expected Connectivity</li> </ul>
<b>Continuity Check Messages</b>	<ul style="list-style-type: none"> <li>• Enable/Disable</li> <li>• Interval: 100ms, 1sec, 10sec, 1min, 10min</li> <li>• RDI Flag</li> </ul>
<b>Loopback Replies</b>	<ul style="list-style-type: none"> <li>• Enable/Disable</li> <li>• Emulated Latency</li> </ul>
<b>Link Trace Replies</b>	<ul style="list-style-type: none"> <li>• Enable/Disable</li> <li>• Emulated Latency</li> </ul>
<b>Alarm Indication Signal</b>	<ul style="list-style-type: none"> <li>• Enable/Disable</li> <li>• AIS interval</li> </ul>
<b>Administrative Lock Signal</b>	<ul style="list-style-type: none"> <li>• Enable/Disable</li> <li>• LCK Interval</li> </ul>

#### Message Initiator Device

<b>Loopback Messages</b>	<ul style="list-style-type: none"> <li>• Enable/Disable Loopback message</li> <li>• Destination MAC address (unicast or multicast)</li> <li>• MEG Level</li> <li>• Enable/Disable Optional TLVs</li> </ul>
<b>Link Trace Messages</b>	<ul style="list-style-type: none"> <li>• Enable/Disable Link Trace message</li> <li>• Destination MAC address</li> <li>• MEG Level</li> <li>• Enable/Disable Optional TLVs</li> </ul>

#### Test Messages

- Enable/Disable Test message
- Destination MAC addresses
- MEG Level
- Enable/Disable Test TLV
- Test Pattern type
  - Null signal without CRC-32
  - Null signal with CRC-32
  - PRBS  $2^{31}-1$  without CRC-32
  - PRBS  $2^{31}-1$  with CRC-32

#### Message Flow

- Burst Size
- Burst Delay
- Renew period (msec)
- Response timeout (msec)

### Statistics

#### Receive

- Total FM packets
- Total Link Trace Message packets
- Total Link Trace Reply packets
- Total Loopback Message packets
- Total Loopback Reply packets
- Total Continuity Check Message packets
- Total Alarm Indication signals
- Total Administrative Lock signals
- Total Test Message packets
- Total Automatic protection switching
- Total Maintenance communication channel
- Total Experimental OAM message
- Total Experimental OAM reply
- Total Vendor specific OAM message
- Total Vendor specific OAM reply

#### Transmit

- Total FM packets
- Total Link Trace Message packets
- Total Link Trace Reply packets
- Total Loopback Message packets
- Total Loopback Reply packets
- Total Continuity Check Message packets
- Total Alarm Indication signals
- Total Administrative Lock signals
- Total Test Message packets

#### Other

- Loss of Continuity Events
- Number of CCM received from non-existent MEP ID
- Unexpected CC Period
- Alarm conditions
- Administrative Lock conditions

**Emulation Status (per-instance)****Ethernet Network Device**

<b>CCDB</b>	<ul style="list-style-type: none"> <li>• Number of Remote MEPs</li> <li>• Number of Remote MEPs in START State</li> <li>• Number of Remote MEPs in OK state</li> <li>• Number of Remote MEPs in FAILED state</li> <li>• Remote MEG End Point ID</li> <li>• Remote MAC address</li> <li>• Remote MEG Level</li> <li>• Remote MEG ID <ul style="list-style-type: none"> <li>– MEG ID format (ICC-based format)</li> <li>– MEG ID value</li> </ul> </li> <li>• Remote MEP State</li> <li>• Remote MEP last state change</li> <li>• Remote MEP Continuity Check interval</li> <li>• Remote MEP RDI State</li> </ul>
<b>Emulated Maintenance Entity Topology</b>	<ul style="list-style-type: none"> <li>• Maintenance Entity Type (MIP / MEP)</li> <li>• MEP Behavior (Ingress / Egress)</li> <li>• MEG Level</li> <li>• Hop Number (per level)</li> <li>• Bridge Number (per level)</li> <li>• MAC Address</li> <li>• MEP ID</li> <li>• Admin State</li> </ul>

**Loopback Message Device**

	<ul style="list-style-type: none"> <li>• Loopback round trip latency (Min, Max, Average)</li> <li>• Number of MEPs in Loopback Idle State</li> <li>• Number of MEPs in Loopback Waiting State</li> <li>• Number of MEPs in Loopback Received State</li> <li>• Number of MEPs in Loopback Failed State</li> </ul>
<b>MEP Loopback Reply</b>	<ul style="list-style-type: none"> <li>• Source MAC Address</li> <li>• LBM transaction ID</li> </ul>

**Link Trace Message Device**

- Link Trace round trip latency (Min, Max, Average)
- Number of MEs in the trace path
- Number of MEPs in Link Trace Idle State
- Number of MEPs in Link Trace Waiting State
- Number of MEPs in Link Trace Received State
- Number of MEPs in Link Trace Failed State

**Link Trace Reply List**

- Source MAC Address
- LTM Transaction ID
- Reply TTL

**Emulation Status (per-port)**

<b>CCDB (Per Remote MEP)</b>	<ul style="list-style-type: none"> <li>• Remote MEP State</li> <li>• Remote MEP Last state change</li> <li>• Remote MEP CCM Interval</li> </ul>
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**Alarms**

- Remote Defect Indicator (RDI) Flag

## Applicable Standards

- ITU-T Y.1731 OAM functions mechanisms for ethernet based networks

## Configuration and Ordering Details

### Hardware

To use the N5585A E-OAM Fault Management (FM) Emulation software, the following Agilent N2X hardware and software are required.

A N2X system is required with:

- System controller
- Chassis
- One or more Ethernet Test Cards

The N5585A E-OAM CFM Emulation software is supported on all N2X XR, XR-2, XS and XS-2 Ethernet test cards.

The N5585A software is NOT supported on N2X XP or XP-2 test cards.

### Software

Required software packages:

- E7881B Packets and Protocols Application Software

Optional software packages:

- N5718A CFM Conformance Test Suite Software (IEEE 802.1ag)

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

## Related Products

### Agilent Network Tester



The Agilent Network Tester N4192A is a highly scalable and flexible solution for performance testing of Layer 4-7 devices. As a companion to N2X, the NetworkTester provides real-world, stateful application layer traffic generation over PPP sessions, enabling developers to verify the end-user experience and performance of applications running over a broadband network. It also supports 802.1x, IPsec and IPsecv6 access protocols. Each connectivity on that port. Connectivities are either manually entered or discovered through the reception of ETH-CC frames. Failure to receive an ETH-CC for an expected connectivity within the configured time-out period triggers the generation of Remote Defect Indicator (RDI) in all subsequent ETH-CC frames that are transmitted. All Continuity Check information is viewable in the CCDB in columns that can be individually hidden or shown and used for event sorting. Statistics are maintained by the CCDB on detected errors.

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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:

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Englewood, CO 80155-4026  
1-800-452-4844

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