

Agilent N2X
**Ethernet Passive Optical
Networks Performance
Analysis Solution**



N5604A - 4 port Tri-rate Ethernet XR-2 EPON Card
Technical Data Sheet

Rapid performance and protocol compliance verification to ensure the readiness of gigabit Ethernet Passive Optical Network systems to support triple-play services.



Agilent Technologies

Key Features

- **Rapidly isolates performance issues to the Optical Network Unit (ONU) or Optical Line Terminal (OLT)**
- **Verifies synchronization of ONU transmission to assigned transmit windows**
- **Detailed data , Multi-Point Control Protocol (MPCP) and Operations and Maintenance (OAM) analysis to uncover the root causes of performance and interoperability issues**
- **Real-time statistics reveal the performance of the Dynamic Bandwidth Algorithm (DBA)**
- **Per-subscriber statistics show triple-play service performance for each customer**
- **Wire-speed bi-directional capture counts, captures and decodes every upstream and downstream data, MPCP and Ethernet OAM packet for analysis**
- **Analysis tools rapidly analyze bandwidth grants for verification of the DBA**
- **User-extensible decodes decode vendor-specific Ethernet OAM elements**
- **Includes complete traffic generation and analysis capabilities**

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.

The Agilent N2X EPON Performance Analysis Solution is a complete test system that combines end-to-end traffic across a gigabit Ethernet PON with unique "on-PON" measurements, monitoring both the data and control traffic directly on the gigabit EPON.

With the EPON Performance Analysis Solution, test engineers can:

- Rapidly isolate performance issues to the ONU or the OLT
- Examine the synchronization of ONUs to assigned transmit windows;
- Utilize a complete suite of data and control packet triggers, filters, captures and extensible decodes to isolate performance and protocol compliance issues.

With the Agilent N2X EPON Performance Analysis Solution, the complete behavior and performance of a gigabit EPON system can be verified, from the configuration of vendor-specific capabilities in the ONU via Ethernet OAM, through to complete analysis of the Dynamic Bandwidth Algorithm and the ability of the Ethernet PON to deliver triple-play services.

Rapidly Isolate Performance Issues

The Agilent N2X EPON Performance Analysis Solution isolates performance issues to the ONU or the OLT by measuring packet performance metrics directly on the gigabit EPON with the new N5604A EPON Test Card.

Unique "on-PON" measurements with the N5604A reveal packet throughput, loss and latency and correlate these metrics directly to each ONU or to the OLT.

Verify Synchronization

The Agilent N2X EPON Performance Analysis Solution correlates MPCP GATE messages from the OLT with data packets sent by the ONU to ensure that ONUs only transmit during their assigned transmit window. The EPON Performance Analysis Solution can also measure the efficiency of the ONU to maximize utilization of the assigned transmit window, uncovering potential inefficiencies in the gigabit EPON.

Detailed Data and Protocol Analysis

To "dig deep" into the underlying causes of performance and compliance issues, the Agilent N2X EPON Performance Analysis Solution provides a rich set of "on-PON" analysis tools, including filters, triggers, wire-speed packet capture and extensible decodes.

How it Works

The Agilent N2X EPON Performance Analysis Solution rapidly finds gigabit EPON performance issues, synchronization problems and provides the tools to dig deep into the underlying causes.

System Configuration

Figure 1 shows the typical configuration of the EPON Performance Analysis Solution.

Ethernet ports on the Agilent N2X (10/100 or gigabit Ethernet) are connected to the subscriber side of the ONU, and to the network side of the OLT.

The N5604A EPON test card is connected via a star-coupler (available option) to the Ethernet PON ahead of any passive splitters in the system. One fiber from the star-coupler connects to the downstream monitor port while the second fiber connects to the upstream monitor port.

Quickly Set Up End-to-End Traffic

The included end-to-end traffic configuration QuickTest rapidly configures unidirectional or bidirectional end-to-end traffic between the ONUs and the OLT. Ethernet & IP addresses and VLAN tags are quickly configured. Traffic “meshes” between the ONUs and OLT are added: each traffic mesh can represent a different traffic class. The traffic generator is started, and end-to-end measurements are made across the gigabit EPON system under test.

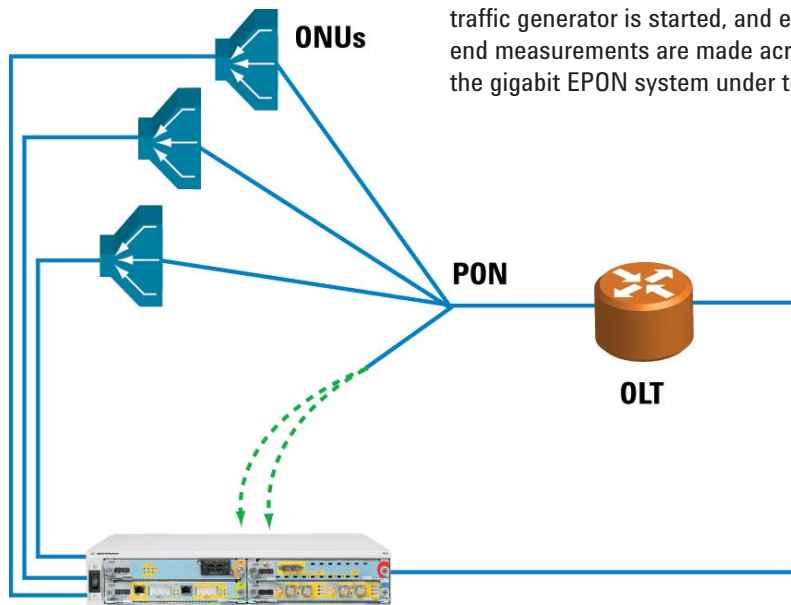


Figure 1: Typical EPON configuration

Measure Dynamic Bandwidth Algorithm Behavior

The Agilent N2X places test payloads into the packets transmitted through the Ethernet PON. The N5604A EPON Monitor card can monitor these packets in real time and display real-time statistics.

As a result, the behavior of the Ethernet PON can be determined at multiple points:

- The latency of packets buffered at the ONU as they wait for a transmit opportunity
- Packets lost at the ONU if the ONU does not receive a transmit timeslot;
- Packet latency and loss through the OLT before transmission into the network.

Wire-Speed, Bi-Directional Capture

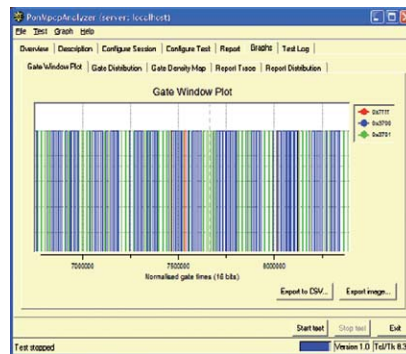
Filters and triggers can be easily set up to capture packets with a specified LLID, to capture MPCP or Ethernet OAM packets, or to capture all traffic between an ONU and OLT.

After capturing packets, the contents of capture are time stamped and fully decoded. The extensible packet decoder can even be configured to decode proprietary TLV elements of Ethernet OAM messages.

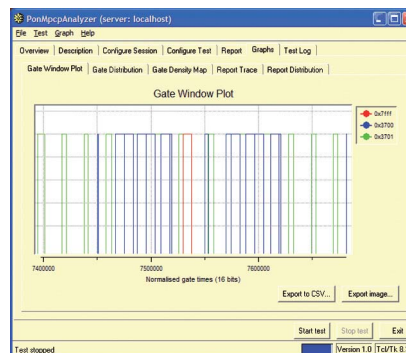
Advanced DBA Analysis and Visualization

An advanced QuickTest provides a unique set of tools for analyzing the behavior of the DBA of a gigabit EPON system.

After capturing packets, the captured data from both directions is analyzed to build a visual graph of the bandwidth allocated to each ONU. This gives a rapid visualization of the allocated bandwidth and a quick means for determining if an ONU is “starved” of bandwidth



You can drill down (zoom in) to specific areas of interest. For example, you can examine the time between grants to determine the time between transmissions amongst different ONUs.



More Features

Decode Vendor Specific OAM Fields

Ethernet OAM provides support for “Organization specific” OAM PDUs, information elements and event reporting. Many ONU/OLT manufacturers utilize these organization specific extensions to configure specific capabilities within the ONU.

The OAM decodes in the EPON Performance Analysis Solution can be extended by the user to decode the vendor specific OAM fields.

Also Includes Complete Traffic Capabilities

The N5604A EPON Test Card also contains the complete feature set of the N5551A 4-port Tri-rate Ethernet XR-2 Test Card.

Configuration and Ordering Details

A complete gigabit EPON test system consists of end-to-end packet generation test cards and the N5604A EPON test card for monitoring.

To configure a system, choose an end-to-end packet generation test card option from one of the N2X XP, XR or XS Ethernet cards.

And, choose the EPON test card to monitor directly on the EPON system:

- N5604A 4x Tri-rate/SFP Ethernet XR-2 EPON Card

Finally, choose options. Option 004 and 005 are required to monitor an EPON link:

- Option 001 1000Base-SX SFP
- Option 002 1000Base-LX SFP
- Option 003 1000Base-ZX SFP
- Option 004 1000Base-BX10-U SFP
- Option 005 1000Base-PX20-D SFP

Contact your local Agilent field engineer for further product configuration information.

Technical Specifications

Physical layer specifications

Connectivity

Port Density & connection type	<ul style="list-style-type: none"> 4 – 10/100/1000 RJ-45 electrical and SFP Ethernet ports
Connection type	<ul style="list-style-type: none"> Supports SFP (SFF-8074i v1.0) RJ-45 (tri-rate) Auto-detect of MDI/MDI-X and auto-

Interface Operation Modes

Terminal	<ul style="list-style-type: none"> Normal operation – transmit and receive interfaces operate independently
Transmit oop-back	<ul style="list-style-type: none"> Transmitted data is electrically looped back to the receive interface. The optical receive interface is disabled in this mode. (SFP interface only)
Monitor	<ul style="list-style-type: none"> Received data is looped back to the transmit interface. Received data is also copied into the test port where all real time Rx measurements are made. Capture and subsequent analysis are also fully functional in this mode. (SFP interface only)

Transmit Clock Sources

Clock source	<ul style="list-style-type: none"> Internally generated based on chassis system reference
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Front Panel Indicators

Ethernet Indicators (for each optical and electrical interface)	<ul style="list-style-type: none"> Link: Green - Ethernet framing is detected on the receive interface and link has been established with a link partner. Activity: Green - Data is transmitted or received
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Alarms and Errors

Real-Time Alarm Detection	<ul style="list-style-type: none"> Current module status is indicated on the user interface and front panel LEDs Alarm events are reported in a trace log during the measurement interval Number of errored seconds is reported per alarm type (count of 1s intervals in which the alarm is detected at least once)
Error monitoring	<ul style="list-style-type: none"> For the selected Ethernet statistics the following parameters are recorded: <ul style="list-style-type: none"> Number of individual occurrences of the event Number of seconds during which at least one event occurred Statistics are User selectable, dependant on the application. These may include, but are not limited to, the following: Frames transmitted, Valid frames received, Octets transmitted, Octets received, Runts, Short events, Jumbo frames, Jabbers, FCS errored frames, ARP frames, Flow control frames, VLAN tagged frames.

Link layer specifications

Auto-negotiation

The Test Card supports auto-negotiation. This may be disabled independently on each port

PAUSE Frames

The Test Card can generate, count and respond to PAUSE frames.

Measurement System

Measurements are synchronized across all cards within the test system

Result types	<ul style="list-style-type: none"> • Cumulative: <ul style="list-style-type: none"> - Measurements are reported from the start of the measurement interval • Sampled: <ul style="list-style-type: none"> - Measurements are reported from the most recently completed sampling interval • Measurement Interval: <ul style="list-style-type: none"> - 1 second to 7 days • Sampling Interval: <ul style="list-style-type: none"> - 1 second to 1 hour • Measurement clock: <ul style="list-style-type: none"> - 20 ns resolution +/-0.5 ppm/year clock drift • 3 ppm max. difference between systems
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Real-time Statistics

Unless otherwise specified all statistics are on a per port basis.

Glossary

Short event	<ul style="list-style-type: none"> • A sequence of bytes of insufficient length to form a valid Ethernet frame (<18 bytes)
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Runt	<ul style="list-style-type: none"> • A frame with less than 64 bytes (excluding preamble) and a valid FCS.
Long frame	<ul style="list-style-type: none"> • A frame longer than 1522 bytes (or 9022 for jumbo frames) with a valid FCS.
Jumbo frame	<ul style="list-style-type: none"> • A frame between 1519 and 9022 bytes with a valid FCS and an Ethertype of 0x8870.
Jabber frame	<ul style="list-style-type: none"> • A frame longer than 1522 bytes (or 9022 for jumbo frames) with an invalid FCS.
Pattern Match	<ul style="list-style-type: none"> • Count of frames matching specified fields in the header
PPIC (Packet Payload Integrity Check).	<ul style="list-style-type: none"> • The PPIC field contains a 16-bit CRC calculated over the "protected payload". The "protected payload" refers to any of the following: IP packet payload (default) MPLS frame payload L2 frame payload User-defined

General Statistics

Per Port Stats	<ul style="list-style-type: none"> • Tx and Rx % line use • Misdirected packets • Error rate
Per Stream Stats	<ul style="list-style-type: none"> • Rx and Tx stream packets and octets • Misordered packets
Per Stream & Port Stats	<ul style="list-style-type: none"> • Tx and Rx test packets and octets • Expected Rx packets • Throughput • Packets not received • Average latency • Minimum/maximum latency • PPIC violations (ie. Count on payload error)
Ethernet	<ul style="list-style-type: none"> • Tx and Rx frame and Octet counts • Tx and Rx Throughput • Tx and Rx MAC control frames • Short events received • Runt frames received • Tx & Rx long frames • Jabber frames received • Tx & Rx invalid FCS frames

Ethernet PON	<ul style="list-style-type: none"> • Rx EPON frames • Rx Preamble CRC8 Error Frames • Rx Preamble SLD (start of LLID delimiter) Error Frames • Rx MPCP MAC Control Frames • Rx MPCP Report Frames • Rx MPCP Gate Frames • Rx MPCP Register Frames • Rx MPCP Register ACK Frames • Rx MPCP Register Request Frames
VLAN	<ul style="list-style-type: none"> • Tagged Tx and Rx frame and Octet counts
MPLS	<ul style="list-style-type: none"> • Tx and Rx packets
IPv4	<ul style="list-style-type: none"> • Tx and Rx packet and octet counts • Header checksum errors • Fragmented packet count • Throughput
IPv6	<ul style="list-style-type: none"> • Tx and Rx packet and octet counts • Throughput counts
User Defined Statistics	<ul style="list-style-type: none"> • Powerful features allow statistics collection on a per stream, per-MPLS tag, per-VLAN tag or other user-defined-index basis

Physical and Environmental

Physical	<ul style="list-style-type: none"> • Width 206 mm • Depth 313 mm • Height 31.0 mm • Weight 1.5 kg
Electrical	<ul style="list-style-type: none"> • Power consumption 50W

Environmental

Operating temperature	<ul style="list-style-type: none"> • 5 °C to 40 °C
Storage temperature	<ul style="list-style-type: none"> • -40 °C to 70 °C
Maximum Relative Humidity	<ul style="list-style-type: none"> • Maximum relative humidity 80% for temperatures up to 31 °C, decreasing lineally to 50% relative humidity at 40 °C (non-condensing)

Regulatory Compliance

Electrical (Electromagnetic Compliance - EMC)	<ul style="list-style-type: none"> • As per IEC 61326-1:1997 + A1:1998 / EN 61326-1:1997 + A1:1998. • Electrical equipment for measurement, control and laboratory use.(Class A) • EMC Directive 89/336/EEC (including 93/68/EEC) • For complete compliance information refer to Declaration of Conformity E7900-91300 (Tested for regulatory compliance with Agilent Technologies SFPs).
Electrical (Safety)	<ul style="list-style-type: none"> • IEC 61010-1:1990 + A1:1992 + A2:1995 / EN 61010-1:1993 + A2:1995. Safety requirements for electrical equipment for measurement, control, and laboratory use • Low voltage directive 73/23/EEC
Optical (Safety)	<ul style="list-style-type: none"> • Complies with IEC 60825/CDRH Class 1, and 21 CFR 1040 - Class 1 Laser Products when equipped with Agilent HFBR-5601 or HFCT-5611 Gigabit Interface Converters

Applicable Standards

PCS/MAC	<ul style="list-style-type: none"> • IEEE 802.3
Address Resolution Protocol	<ul style="list-style-type: none"> • IETF RFC 826 An Ethernet Address Resolution Protocol
IP IEEE 802 Networks	<ul style="list-style-type: none"> • IETF RFC 1042
Ethernet PON	<ul style="list-style-type: none"> • IEEE 802.3ah

Application Programming Interface

An Application Programming Interface (API) is provided through the Tool command Language (Tcl). The API is intended to automate configuration tasks, create repeatable test sequences, or to integrate the test system into a larger test system. The scripting language is Tcl/Tk. Tcl/Tk comes bundled with the E7880A Traffic Generation and Analysis software.

An API client may run directly on the RouterTester System Controller, or may run on any other PC or UNIX workstation connected to the System Controller via a TCP/IP connection. API clients communicate with the System Controller via an included package of Tcl commands.

All functions available through the GUI are available via the API. Any changes made through the API are automatically reflected on the GUI.

Interface Card Specific Information

All measurements are per physical interface port.

		<ul style="list-style-type: none"> • N5604A
		<ul style="list-style-type: none"> • 4-port Tri-rate Ethernet XR-2 EPON Card
Maximum number of stream groups		<ul style="list-style-type: none"> • 8192
Maximum number of traffic streams		<ul style="list-style-type: none"> • 32,768
Maximum number of counters		<ul style="list-style-type: none"> • 24,576
Minimum transmit layer 2 frame length (bytes)		<ul style="list-style-type: none"> • 5
Maximum transmit layer 2 frame length (bytes)		<ul style="list-style-type: none"> • 65,703
Maximum receive layer 2 frame length	1000Base-T	<ul style="list-style-type: none"> • 65,535
	1000Base-X	<ul style="list-style-type: none"> • 65,535
	100Base-T	<ul style="list-style-type: none"> • 16,000
	10Base-T	<ul style="list-style-type: none"> • 13,000

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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
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
9-1, Takakura-Cho, Hachioji-Shi,
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Fax: (64-4) 802-6881

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