GPON Consortium

Dual-mode ONU
Test Suite

Version 1.0

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Modification Report

Version	Date	Editor(s)	Comments
1.0	December 23, 2010	Lincoln Lavoie	Initial release of the Dual-Mode ONU test plan.

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Amit Jain	University of New Hampshire InterOperability Laboratory
Dov Zimring	Google, Inc.
Lincoln Lavoie	University of New Hampshire InterOperability Laboratory

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Introduction

Overview:

The University of New Hampshire InterOperability Laboratory (UNH-IOL) tests networking and data communications products. The university established the laboratory in 1988 with the dual mission of providing a neutral environment to foster multi-vendor interoperability and conformance to data communications networking standards while educating students for future employment in the industry. The laboratory has since grown into one of the industry's premier independent proving grounds for new technologies.

This interoperability test suite has been developed to help implementers verify basic physical layer connectivity between their device(s) and a number of compatible link partners in different modes of operation with a variety of common physical layer configurations. This test suite is designed to uncover potential interoperability issues early in the development process and help focus attention on problems that may require more investigation and conformance testing.

Successful completion of all tests in this test suite does not guarantee that the device under test is compliant with the appropriate specification or that it will interoperate in all environments or scenarios. However, successful completion of these tests should provide a reasonable level of confidence that the device under test will function well in most multi-vendor environments.

Organization of Tests:

Each test contains an identification section that describes the test and provides cross-reference information. The discussion section covers background information and specifies why the test is to be performed. Tests are grouped in order to reduce setup time in the lab environment. Each test contains the following information:

Test number

The Test Number associated with each test follows a simple grouping structure. Listed first is the Test Group Number followed by the test's number within the group. This allows for the addition of future tests to the appropriate groups of the test suite without requiring the renumbering of the subsequent tests.

Purpose

The purpose is a brief statement outlining what the test attempts to achieve. This also includes background information on why one needs to perform such a test to show that the device complies with the standard.

References

The references section lists standards and other documentation that might be helpful in understanding and evaluating the test and results.

Resource requirements

The requirements section specifies the hardware, and test equipment that will be needed to perform the test. The items contained in this section are special test devices or other facilities, which may not be available on all devices.

Test setup

The setup section describes the configuration of the test environment. Small changes in the configuration should be included in the test procedure.

Discussion

The discussion section is optional. It is a general discussion of the test and relevant section of the specification, including any assumptions made in the design or implementation of the test as well as known limitations.

Pretest Conditions
The pretest conditions section describes the conditions of any equipment prior to the start of the test procedure, such as the power state of the DUT, etc.

Procedure
The procedure section of the test description contains the step-by-step instructions for carrying out the test. It provides a cookbook approach to testing, and may be interspersed with test metrics.

Test metrics
The test metrics section lists occurring events that can be examined by the tester to verify that the DUT is operating properly. When multiple values are possible for a specific event, this section provides a short discussion on how to interpret them. The determination of passing or failing a certain test is often based on the successful (or unsuccessful) detection of a certain predetermined event.

Possible problems
This section contains a description of known issues with the test procedure, which may affect test results in certain situations.

References

[1] ITU-T G.984.2, “Gigabit-capable Passive Optical Networks (GPON): Physical Media Dependent (PMD) layer specification” March, 2003.

Terms, Definitions and Abbreviations

Definitions

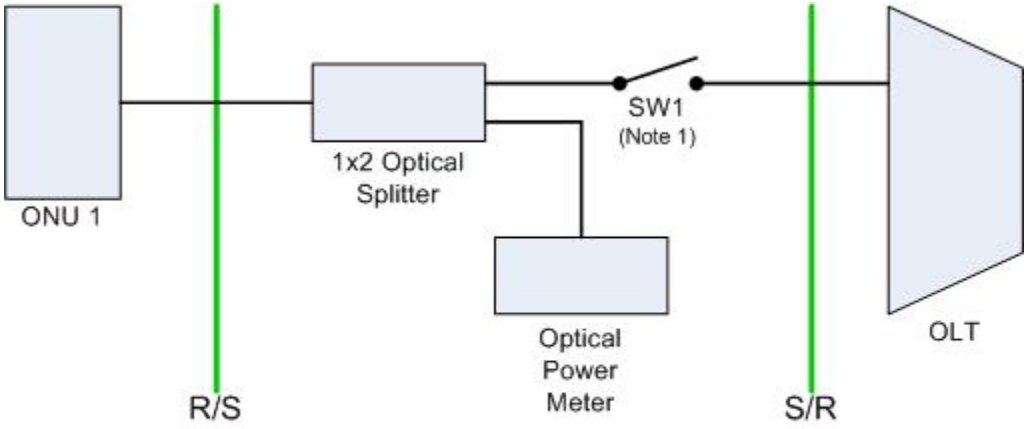
C-tag	Typically the inner VLAN tag, according to IEEE 802.1ad, with the TPID field equal to 0x8100.
C-TPID	The TIPD field used within the C-Tag.
C-VID	The VLAN ID field (VID) used within the C-Tag.
GPON Interface	The interface at reference points S/R and R/S as specified in ITU-T G.984.1. This is a PON-specific interface that supports all the protocol elements necessary to allow transmission between OLT and ONUs.
GPON Network	An OLT connected using an Optical Distribution Network (ODN) to one or more ONUs or ONTs. A GPON network is a subset of the Access Network.
OLT	Optical Line Termination (OLT): A device that terminates the common (root) endpoint of an ODN, implements a PON protocol, such as that defined by G.984, and adapts PON PDUs for uplink communications over the provider service interface. The OLT provides management and maintenance functions for the subtended ODN and ONUs.
ONT	Optical Network Termination (ONT): A single subscriber device that terminates any one of the distributed (leaf) endpoints of an ODN, implements a PON protocol, and adapts PON PDUs to subscriber service interfaces. An ONT is a special case of an ONU.
ONU	Optical Network Unit (ONU): A generic term denoting a device that terminates any one of the distributed (leaf) endpoints of an ODN, implements a PON protocol, and adapts PON PDUs to subscriber service interfaces. In some contexts, an ONU implies a multiple subscriber device.
Q-tag	Typically a single VLAN tag, defined according to IEEE 802.1q, with the TPID field equal to 0x8100.
Q-TPID	The TIPD field used within the Q-Tag.
Q-VID	The VLAN ID field (VID) used within the Q-Tag.
S-tag	Typically the outer most VLAN tag, according to IEEE 802.1ad, with the TPID field equal to 0x88A8 (support for setting TPID=0x8100, or other values, is optional).
S-TPID	The TIPD field used within the S-Tag.
S-VID	The VLAN ID field (VID) used within the S-Tag.
U Interface	U interface is a short form of expressing one or more of the interfaces defined in this Technical Report or in TR-101 at the U reference point. It is also essentially equivalent to a subscriber-facing interface at the access node.
V Interface	V interface is a short form of expressing one or more of the interfaces defined in TR-101 at the V reference point. It is also essentially equivalent to a network-facing interface at the access node.

Abbreviations

GPON	Gigabit-capable Passive Optical Network
ODN	Optical Distribution Network
OLT	Optical Line Termination
OMCI	ONU Management and Control Interface
ONT	Optical Network Termination
ONU	Optical Network Unit
PON	Passive Optical Network
QoS	Quality of Service
VBES	VLANs for Business Ethernet Services
VID	VLAN ID
VLAN	Virtual LAN

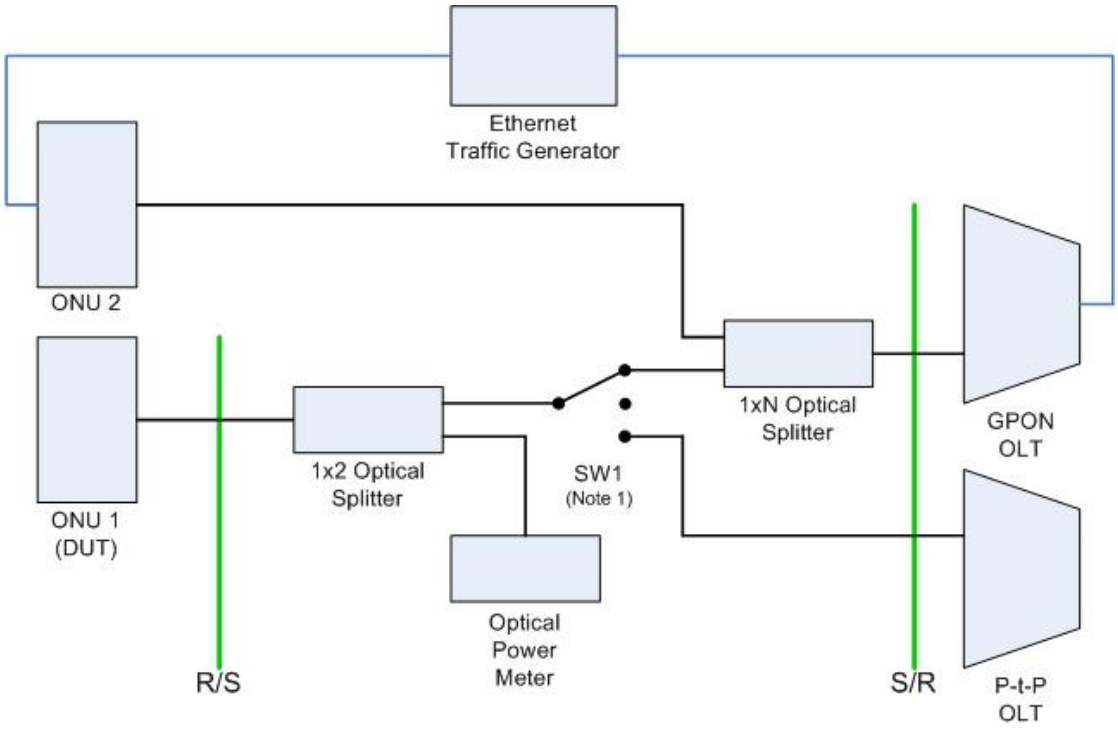
Test Setups

Test Setup 1: Generic test setup



Note 1: The switch depicted is a logical function, and might be implemented simply by disconnecting the fiber.

Test Setup 2: Mode switching test setup



Note 1: The switch depicted is a logical function, and might be implemented simply by disconnecting or changing the fiber.

Group 1: Non-interference Tests

Scope:
Dual-mode ONUs are a special category of systems supporting protocols for both passive optical networks and point-to-point optical networks, although not simultaneously. The ONU must detect the type of optical network to which it is connected before transmitting any upstream optical signals. This is necessary to ensure the ONU does not interfere with the upstream stream signaling of a passive optical network by transmitting upstream point-to-point signals.

Notes:

- None

Test 1.1 Quiet startup

Purpose: The purpose of this test is to verify the ONU does not transmit any upstream optical signaling or power upon startup.

References:
- [1] ITU-T G.984.2, Section 8.2.3.2

Resource requirements:
- None

Test setup:

- Test Setup 1: Generic test setup

Discussion:
When the ONU is first initialized, it must not transmit any upstream optical signaling or power.

Pretest Conditions:
1. The ONU must be reset to a factory default condition.
2. The ONU must be powered off.
3. SW1 in Test Setup 1: Generic test setup must be open.

Procedure:
1. Connect the ONU to the test setup shown in Test Setup 1: Generic test setup.
2. Zero the optical power meter as necessary.
3. Monitor the measured optical power.
4. Power on the ONU.

Test metrics:
1. The ONU must not transmit any optical power into the ODN.

Possible Problems:
- None

Test 1.2 Quiet after loss of optical link

Purpose: The purpose of this test is to verify the ONU stops transmitting any optical signals or power when the downstream link is lost.

References:
- [1] ITU-T G.984.2, Section 8.2.3.2

Resource requirements:
- OLT and ONT should be connected through the ODN, such that the optical receivers are operating in roughly the middle of their range.

Test setup:

- Test Setup 1: Generic test setup

Discussion:
If the ONU detects a loss of downstream signaling, the ONU must immediately stop transmitting any upstream signaling.

Pretest Conditions:
1. The ONU is powered on.
2. SW1 in Test Setup 1: Generic test setup must be closed.
3. The ONU should be linked to the OLT.

Procedure:
1. Connect the ONU to the test setup shown in Test Setup 1: Generic test setup.
2. Verify the optical power meter is able to measure the upstream power from the ONU.
3. Monitor the measured optical power.
4. Open SW1.

Test metrics:
1. The ONU must stop transmitting upstream power once SW1 is open.

Possible Problems:
- None

Test 1.3 Mode switching

Purpose: The purpose of this test is to verify the ONU is able to switch between and link to both point-to-point and GPON connections without impacting either network.

References:

- [1] ITU-T G.984.2, Section 8.2.3.2

Resource requirements:

- OLT and ONT should be connected through the ODN, such that the optical receivers are operating in roughly the middle of their range.

Test setup:

- Test Setup 2: Mode switching test setup

Discussion:

If the ONU detects a loss of downstream signaling, the ONU must immediately stop transmitting any upstream signaling.

Pretest Conditions:

1. The ONU is powered on.
2. The ONU should be connected/linked to the P-t-P OLT, SW1 in the "bottom" position.
3. ONU2 should be ranged and activated on the GPON.
4. Attenuators must be used as necessary to ensure the optical receivers of all systems are operating roughly in their midpoints.
5. The Ethernet traffic generator should be transmitting upstream/downstream frames through the GPON over ONU2.

Procedure:

1. Connect the ONU to the test setup shown in Test Setup 2: Mode switching test setup.
2. Verify the optical power meter is able to measure the upstream power from the ONU.
3. Monitor the measured optical power.
4. Note the current number of BIP errors on the GPON for ONU2.
5. Change SW1 to the "middle" position, i.e. the ONU is not connected to either OLT.
6. Monitor the upstream optical power.
7. When the ONU stops transmitting upstream optical power, change SW1 to the "top" position, i.e. the ONU is connected to the GPON OLU.
8. Verify the GPON OLT is able to activate and range the ONU.
9. Change SW1 to the "middle" position, i.e. the ONU is not connected to either OLT.
10. Monitor the upstream optical power.
11. When the ONU stops transmitting upstream optical power, change SW1 to the "bottom" position, i.e. the ONU is connected to the P-t-P OLT.
12. Verify the ONU is able to link with the P-t-P OLT.
13. Repeat steps 4 through 11 four (4) additional times, for a total of five (5) links to each OLT.
14. Check the current number of BIP errors on the GPON for ONU2.

Test metrics:

1. Each time SW1 is placed in the middle connection, the ONU must stop transmitting any upstream optical power.
2. Each time the ONU is connected to either OLT, the ONU must establish and active P-t-P or GPON connection.
3. ONU2 and the GPON system must not drop any upstream or downstream Ethernet frames flowing over the GPON.
4. The OLT must not record any BIP errors for ONU2 as a result of the connection/disconnection of ONU1.

Possible Problems:

- None