

光アクセスネットワーク装置
相互接続試験
実施要領

HATS 推進会議
(高度通信システム相互接続推進会議)
実施推進部会

光アクセスネットワーク装置 相互接続試験 実施要領

改訂履歴

版	改訂年月日	改訂内容	担当
1.0	2012/12/19	初版	西原,滝澤 大西,草野

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1. 背景及び目的

1.1. 背景

IEEE (Institute of Electrical and Electronics Engineers)によって標準化が進められている、IEEE P1904.1 (システム相互接続対応 Ethernet PON) 仕様は、EPON Optical Line Terminator (OLT)及びEPON Optical Network Unit (ONU)間の相互接続を実現するプロトコルセットを規定する。該プロトコルは、それを実装した装置がマルチベンダ環境を実現することを想定している。その健全な発展と普及を図るためには、技術の可用性を実証すると共に、相互接続に関するさまざまな課題を解決し、その成果を標準に反映する必要がある。

1.2. 目的

前記標準に基づいた製品市場の進展に伴い、EPON 光アクセスシステムの利用促進のため、各製品間での相互接続性の確保が必要不可欠である。IEEE P1904.1 (SIEPON)は、OLT と ONU 間のシステムレベル機能の相互接続をサポートする初の試みであり、規定される要求機能を各システムが適切かつ十分に相互接続試験の実施による接続性の確認が重要である。標準との整合性の観点で各システムの完成度を理解するに当たり、システム間の相互接続試験実施が望まれている。

本ガイドラインは、異なるベンダで製造されたデバイス間の相互接続規定を確認する試験手順を提供する。

この相互接続試験は、HATS 実施推進部会・光アクセスアドホックが運営する。試験では製品間の接続性を確認するだけでなく、EPON のシステムレベルでの相互接続性の完成度の向上に資することを期待する。

1.3. 相互接続試験の範囲

本ガイドラインの範囲は、IEEE が規定する IEEE P1904.1 に基づく装置間の相互接続である。本ガイドラインは、IEEE P1904.1 に規定される幾つかの機能セットの内、パッケージ B と呼ばれる機能セットに関する認証試験を規定した、IEEE P1904.1 Conformance02 に原則として準拠する。本ガイドラインは相互接続試験環境に関する最小限必要とされる手順を提供する。必要並びに要請に応じ、今後新たな機能試験を追加する可能性もある。

2. 試験の前提条件

2.1. 準拠すべき標準

The following referenced documents are indispensable for the application of the standard to be complied for the interoperability test (i.e., they must be understood and used, so each referenced document is cited in text and its relationship to this document is explained). For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments or corrigenda) applies.

IEEE P1904.1TM/D3.0 Draft Standard for Service Interoperability in Ethernet Passive Optical Networks (SIEPON)

2.2. 前提条件

Prior to attending the interoperability test, each participant is requested to conduct a test described in this test guideline using devices at his/her own control and confirm normality which means be able to pass all tests with owning devices and test environment.

3. 試験装置及び試験環境

3.1. 試験装置の機能要件

3.1.1. イントロダクション

This subclause provides definitions of the critical elements of the conformance test setup, namely the Packet Analyzer, Packet Generator, and ODN, which are connected together as defined in more detail in 3.2.

Individual devices are specified in terms of functional requirements and do not impose specific implementation. For test purposes, functions of two or more device described in the following subclause may be combined into a single functional device, as long as the new functional device meets all the requirements outlined below, when connected in the conformance test configuration defined in 3.2.

3.1.2. パケットアナライザ (Packet Analyzer)

The Packet Analyzer is a device, which is connected to the OLT NNI and ONU UNI interfaces in a way defined in more details in 3.2, and supports the following functions:

- captures all packets transmitted by the OLT across the NNI interface towards the metro/aggregation network;
- captures all packets transmitted by the ONU across the UNI interface towards connected CPEs;
- examines the content of the captured OAMPDUs, as defined in IEEE Std 802.3, providing a way to list, display and examine content of individual fields in the captured packets;

3.1.3. パケットジェネレータ (Packet Generator)

The Packet Generator is a device, which is connected to the OLT NNI and ONU UNI interfaces in a way defined in more details in 3.2, and supports the following functions:

- generates a pre-defined number of data packets of pre-configured type, meeting specific packet size distribution and type requirements, as configured on the device using the user interface;
 - provides a user interface for configuration of the following (examples) parameters of the packet stream:
 - number of packets to be generated (specific number, continuous mode, burst mode etc.);
 - type(s) of packets to be generated (OAMPDU, MPCPDU, eOAMPDU, IPv4 packets, IPv6 packets etc.);
 - packet size distribution in case of IP packets, using a predefined or random packet size distribution;
-

- provides a user interface for configuration of specific packet types i.e. constrictions of specific packet types based on configuration of specific fields in the packet through assignment of user-provided values to such fields as EtherType, Size, Payload, VLANs etc.

The Packet Generator is not connected to the ODN and does not influence the loss observed between the OLT_MDI and ONU_MDI interfaces. This device may be connected to the OLT NNI and ONU UNI via copper or fiber links, depending on the interface types supported on the OLT and ONUs under test.

3.1.4. ODN

Testing conformance of the optical distribution network (ODN) with the respective IEEE Std 802.3 requirements is outside of the scope of this conformance plan. Various aspects of physical layer transmission e.g. target sensitivities, launch powers, immunity to dispersion etc. are not part of the conformance tests.

However, to guarantee smooth execution of any conformance tests described in this standard, a set of basic requirements regarding the ODN is needed to make sure that a stable data link can be established between the OLT and ONUs. In this way, optimum operating conditions can be achieved, resulting in a minimum packet loss required by some of the tests.

The target channel insertion loss for the ODN used during the conformance tests under this standard is recommended to range between 15 dB and 20 dB. The ODN can be realized by connecting the splitter with either fiber cables of appropriate length or attenuators to achieve the minimum required channel insertion loss of 15 dB. The recommended split ratio inside the ODN (see 3.2 for more details) is 2:16. The recommended maximum distance between the OLT and the furthest ONU is 20 km, to limit the observed signal dispersion. During the design of the ODN for conformance testing under this standard, the loss introduced by the PON Protocol Analyzer needs to be accounted for.

Special care should be taken to guarantee the minimum channel insertion loss for the ODN, especially in case of 10G-EPON devices subject to conformance tests. Specific requirements for the minimum channel insertion loss for specific PMDs can be found in IEEE Std 802.3, Clause 75 for 10G-EPON devices and Clause 60 for 1G-EPON devices

3.2. 試験構成

3.2.1. イントロダクション

This subclause outlines the common test configuration used by individual conformance test cases defined in Clause 4.

Individual test case covered in Clause 4 may specify their own modified test configurations, as needed, building from the generic test configurations defined in the following subclauses.

3.2.2. 試験系

- (1) Use a dedicated private network which is isolated from a local area network used for general communication.
- (2) Figure 3-1 shows connections among components required for the test.

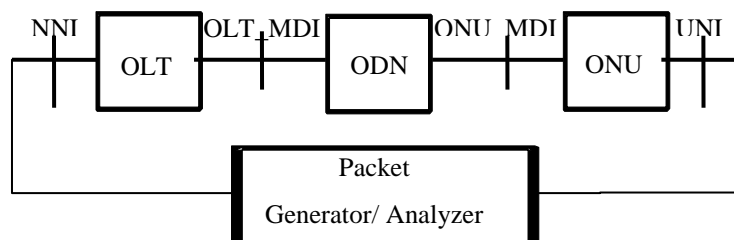


Figure 3-1— Test equipment configuration

4. 相互接続試験

This section consists from; general instruction in Section 4.1 and individual test cases in the followed by section from 4.2 and after.

4.1. インTRODクシヨソ

On the date arranged beforehand, the test must be conducted according to the procedures described in the Section 4.2 and after. It is requested to execute the test following to the listed order of the sections of test case descriptions.

The combination of the participants will be arranged in a round robin manner.

Note that the interoperability test between the products made by the same manufacturer is assumed to have been completed prior to the interoperability test and it is not included in the combination.

4.2. Group DCD: Device and capability discovery

4.2.1. eOAM and capability discovery process 試験

This test case group covers verification of the interoperability for the negotiation flow between OLT and ONU to establish the data channel.

4.2.1.1. 試験環境及び構成

Test configuration per 3.2.2 shall be used to complete this test case.

4.2.1.2. 試験概要

This test verifies DUTs compliance with;

OAM discovery process defined in IEEE Std 1904.1, 12.2.2, including the sequence, format and values of *Information OAMPDU* generated by DUTs.

Specifically, the following conditions are tested:

- Successful completion of OAM discovery process with a correct *Local Information TLV*.

4.2.1.3. 試験手順及び期待される結果

Start of Test

1. Initial configuration and provisioning

- 1.1.** Connect all equipment as defined in the test setup configuration per 4.2.1.1.
- 1.2.** Power on DUTs, allow DUTs to complete IEEE Std 802.3 MPCP discovery process.

2. Successful IEEE Std 802.3 Clause57 OAM discovery process

- 2.1.** The OAM discovery process defined in IEEE Std 802.3, Clause 57 is executed.
-

Expected result 1: *The OAM discovery process shall succeed. OLT and ONU shall keep OAM link for 60 seconds.*

End of Test

4.3. Group UVM/TVM: ONU/OLT VLAN mode

4.3.1. UVM/TVM 試験

This test case group covers verification of the interoperability for the data transmission associated with the following VLAN modes, as defined in IEEE Std 1904.1, 7.2.2.1, namely:

- ONU Tagging VLAN mode; and
- OLT Translation VLAN mode.

4.3.1.1. 試験環境及び構成

Test configuration per 3.2.2 shall be used to complete this test case.

ONU with one or more UNI ports is connected to the packet generator/analyzer. Individual ports are designated as UNI_x , where x corresponds to the port number, as reported by ONU. OLT is connected to the packet generator/analyzer via the NNI port.

For the purpose of this test, ONU and OLT are configured to operate in the following configurations.

ONU configurations:

- Authentication: disabled
- Encryption: disabled
- VLAN mode: ONU Tagging VLAN mode
- VLAN based multicast filtering: disabled
- MAC address based multicast filtering: disabled

OLT configurations:

- Authentication: disabled
- Encryption: disabled
- VLAN mode: OLT Translation VLAN mode
- VLAN based multicast filtering: disabled
- MAC address based multicast filtering: disabled

The provisioning for ONU and OLT may use vendor-specific mechanisms and are outside the scope of this test case.

Authentication and Encryption are not used by ONU and OLT, and are not tested in this test case. In this test, ONU and OLT do not perform authentication after the registration process and data transmission between ONU and OLT is done without encryption, as defined in IEEE Std 802.3.

The packet generator is configured to generate flows of Ethernet frames with or without VLAN tags. The flows of Ethernet frames are shown in Table 4-1 for the upstream direction and Table 4-2 for the downstream direction. Each flow consists of K packets (K=2000). The size of each Ethernet frame is 1000 octets. The order of frames belonging to different flows in the aggregated stream is not specified.

Table 4-1 Test flow in the upstream direction for packet generator

#	DA	SA ^a	VLAN0-VID
1	0x00-00-00-22-22-00	0x00-00-00-11-11-UNI _N	not present

^{a)} The lowest octet in the MAC is derived from the UNI_N port number, represented in a 1 octet-wide format. For example, for UNI₁, the MAC is equal to 0x00-00-00-11-11-01, for UNI₂₁, the MAC is equal to 0x00-00-00-11-11-15.

Table 4-2 Test flow in the downstream direction for packet generator

#	DA ^b	SA	VLAN0-VID ^a
1	0x00-00-00-11-11-UNI _N	0x00-00-00-22-22-00	0x2-00

^{a)} The remaining fields in the VLAN0 tag shall use IEEE Std 802.1Q-compliant values (default values)

^{b)} The lowest octet in the MAC is derived from the UNI_N port number, represented in a 1 octet-wide format. For example, for UNI₁, the MAC is equal to 0x00-00-00-11-11-01, for UNI₂₁, the MAC is equal to 0x00-00-00-11-11-15.

4.3.1.2. 試験概要

This test verifies the interoperability for the data transmission between ONU and OLT when configured in the specific VLAN modes. Specifically, the following conditions are tested:

- Interoperability for the upstream and downstream data transmission when ONU is operating in the ONU Tagging VLAN mode, and OLT is operating in the OLT Translation VLAN mode, per IEEE Std 1904.1, 7.2.2.1.

4.3.1.3. 試験手順及び期待される結果

Start of Test

1 Initial configuration and provisioning

- 1.1 Connect all equipment as defined in the test setup configuration per 4.3.1.1.
- 1.2 Configure the PON-VID value to 0x100 for ONU, as defined in IEEE Std1904.1, 7.2.2.1.4. Configure the user-side VID value to 0x100 and the network-side VID value to 0x200 for the given LLID for OLT, as defined in IEEE Std 1904.1, 7.2.2.1.5.
- 1.3 Reboot ONU or connect the PON link between ONU and OLT to allow ONU to register at OLT.

2 VLAN mode configuration tests, upstream direction

- 2.1 Start the packet analyzer. Start the packet generator in the upstream direction, transmitting the test flow per Table 4-1 simultaneously across each UNI_N on ONU towards NNI on OLT. Allow the packet generator to complete its data trace for all UNI_N.

Expected result 1: *Packet analyzer connected to NNI on OLT shall receive the following number and type of packets for each of frame flows from each UNI_N, as defined in Table 4-3:*

- *K frames for each of frame flows per UNI on ONU.*

Table 4-3— Packets received by the packet analyzer in the upstream direction

#	DA	SA ^b	VLAN0-VID ^a
1	0x00-00-00-22-22-00	0x00-00-00-11-11-UNI _N	0x2-00

^{a)} The remaining fields in the VLAN0 tag shall use IEEE Std 802.1Q-compliant values (default values)

^{b)} The lowest octet in the MAC is derived from the UNI_N port number, represented in a 1 octet-wide format. For example, for UNI₁, the MAC is equal to 0x00-00-00-11-11-01, for UNI₂₁, the MAC is equal to 0x00-00-00-11-11-15.

3 VLAN mode configuration tests, downstream direction

- 3.1 Start the packet analyzer. Start the packet generator in the downstream direction, transmitting the test flow per Table 4-2 across NNI towards each UNI_N on ONU. Allow the packet generator to complete its data trace for all UNI_N.

Expected result 2: *Packet analyzer connected to each UNI_N on ONU shall receive the following number and type of packets for each of frame flows, as defined in Table 4-4:*

- K frames for each of frame flows per UNI on ONU.

Table 4-4— Packets received by the packet analyzer in the downstream direction

#	DA ^a	SA	VLAN0-VID
1	0x00-00-00-11-11- UNI_N	0x00-00-00-22-22-00	not present

^{a)} The lowest octet in the MAC is derived from the UNI_N port number, represented in a 1 octet-wide format. For example, for UNI_1 , the MAC is equal to 0x00-00-00-11-11-01, for UNI_{21} , the MAC is equal to 0x00-00-00-11-11-15.

End of Test

4.4. 試験の結果判定

第 4.2 章～第 4.3 章の試験手順に記載される“Expected Result”を満足した場合、合格とする。

4.5. 試験結果のとりまとめ

期待値を記載する各試験ステップにおいて、試験結果を本書末尾に添付されている 別紙 光アクセスネットワーク装置相互接続試験結果 チェックリスト に記録すること。試験実施中に確認された失敗並びにエラーとその詳細（現象、状況、原因、対応策等）につき、別紙に記載すること。

被験者が再試験を希望する場合、その要望につき別紙のノート欄に記載すること。

5. 結果の取り扱いと今後の検討課題

5.1. 結果の取り扱い

参加者より提供された相互接続試験の結果については、HATS 実施推進部会・光アクセスアドホックが収集し取りまとめる。取りまとめた試験結果は、試験効率、手順、方法、運用、等の相互接続試験の改善に役立てるために使用される。

原則として整理した試験結果につき、参加者の合意の基、公開する場合がある。

相互接続試験実施時に生じた、試験ガイドラインに対する要望・提案については、その採否を判断する機関である HATS 実施推進部会・光アクセスアドホックに随時報告のこと。

5.2. その他

試験により確認された標準規定内容の問題等については、適宜標準化活動へのフィードバックを検討する。
