University of New Hampshire InterOperability Laboratory
Ethernet in the First Mile Consortium

Superseded

As of March 01, 2004 the Ethernet in the First Mile Clause 57 OAM Conformance Test Suite version 0.2 has been superseded by the release of the Clause 57 OAM Conformance Test Suite version 0.3. This document along with earlier versions, are available on the EFM Consortium test suite archive page.

Please refer to the following site for both current and superseded test suites:

http://www.iol.unh.edu/testsuites/efm/

EFM

THE ETHERNET IN THE FIRST MILE

OAM Test Suite V0.2

Technical Document

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MODIFICATION RECORD

- October 23, 2003 Version 0.1 of OAM Test Suite Released
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INTRODUCTION

Overview

The University of New Hampshire's InterOperability Laboratory (IOL) is an institution designed to improve the interoperability of standards based products by providing an environment where a product can be tested against other implementations of a standard. This suite of tests has been developed to help implementers evaluate the functioning of their Clause 57 Operations, Administration, and Maintenance (OAM) based products. The tests do not determine if a product conforms to IEEE Draft Std. 802.3ah v2.2, nor are they purely interoperability tests. Rather, they provide one method to isolate problems within an OAM device. Successful completion of all tests contained in this suite does not guarantee that the tested device will operate with other devices. However, combined with satisfactory operation in the IOL's interoperability test bed, these tests provide a reasonable level of confidence that the Device Under Test (DUT) will function well in most environments.

Organization of Tests

The tests contained in this document are organized to simplify the identification of information related to a test and to facilitate in the actual testing process. 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 by similar functions and further organized by technology. 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. The test is written at the functional level.

References

The references section lists cross-references to the IEEE 802.3 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.

Last Modification
This specifies the date of the last modification to this test.

Discussion
The discussion covers the assumptions made in the design or implementation of the test as well as known limitations. Other items specific to the test are covered here.

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

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 observable results.

Observable Results
The observable results section lists specific items that can be examined by the tester to verify that the DUT is operating properly. When multiple values are possible for an observable result, this section provides a short discussion on how to interpret them. The determination of a pass or fail for a certain test is often based on the successful (or unsuccessful) detection of a certain observable result.

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

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GROUP 1: OAMPDU Reception

Scope: The following tests cover OAM operations specific to OAMPDU Reception.

Overview: These tests are designed to verify that the device under test properly receives valid frames and discards frames with errors and reports these errors if possible. The OAM functions explored are defined in Clause 57 of IEEE 802.3.

Test #57.1.1 - Reception of OAMPDUs with FCS errors

Purpose: To verify that the device under test (DUT) detects frames with frame check sequence (FCS) errors and reports a frameCheckError.

References:

[1] IEEE Std. 802.3-2002 – subclauses 3.2.8, 4.2.3.1, 4.2.4.1.2, 4.2.9, and 46.3.3.1

Resource Requirements:

- A testing station capable of transmitting frames with arbitrary values in the FCS field and capable of monitoring traffic from the DUT.

Last Modification: October 14, 2003

Discussion: A CRC is used by the transmit and receive algorithms to detect any errors generated during the transmission of the frame. The FCS field contains a 4-octet (32-bit) CRC value generated by the transmit algorithm. This value is computed as a function of the contents of the destination address, source address, length/type, LLC data and pad (that is, all fields except the preamble, SFD, and FCS). The receiving MAC sublayer collects bits from the reconciliation layer or the PLS layer. One of the receiving MAC sublayer's functions is to check for invalid MAC frames by checking the Frame Check Sequence (FCS) field. It does so by computing the 32-bit CRC of the received frame and comparing it to the received 32-bit CRC in the FCS field. In case of a mismatch, it should reject the frame.

Test Setup: Connect the device under test (DUT) to the pattern generator and monitor ports of the testing station using the appropriate medium.

Procedure:

Part A:

1. The testing station is instructed to transmit an OAMPDU with an incorrect 32-bit CRC value in the FCS field. This frame should be preceded and followed by a valid frame separated by minimum interFrameGap. The output and statistics of the DUT are observed.

Part B:

1. Repeat *"Part A,"* sending the test OAMPDU frame by itself and not preceded or followed by valid frames.

Observable results:

a. The DUT shall detect and discard the OAMPDU with an invalid value in the FCS field, and, if clause 30 is implemented, log a FCS error.
b. The reception of test frames with invalid FCS fields should not affect the reception of the valid request frames.

Possible Problems: If the management of the DUT does not allow access to counters, then it may not be possible to determine if the DUT properly logged the invalid frames as FCS errors.

Test #57.1.2 - Reception of Fragments and Runts

Purpose: To verify that the device under test (DUT) discards fragments and runts.

References:

[1] IEEE Std. 802.3-2002 – subclauses 4.2.3.3 and 4.2.4.2.2, 4.2.9: *procedure* ReceiveLinkMgmt.

Resource Requirements:

- A testing station capable of transmitting fragments and capable of monitoring traffic from the DUT.

Last Modification: October 14, 2003

Discussion: Although collisions do not exist in an EFM link, it is possible that fragments may be received if the remote transmitter is disabled or the fiber is disconnected, or the remote MAC has a problem such as an underrun condition. Such fragments must be dealt with accordingly and discarded by the receiving MAC.

A "runt" refers to a frame that has a valid 32-bit CRC value but is less than the minFrameSize (64-bytes). The MAC layer should detect and discard runts because they are less than minFrameSize in length.

Test Setup: Connect the device under test (DUT) to the pattern generator and monitor ports of the testing station using the appropriate medium.

Procedure:

Test Frame Descriptions:

Test Frame 1: The well-known destination address
Test Frame 2: Known destination address, source address
Test Frame 3: Known destination address, source address, known Length/Type field
Test Frame 4: Known DA, SA, known Length/Type, known Subtype field
Test Frame 5: Known DA, SA, known L/T, known Subtype, Flags field
Test Frame 6: Known DA, SA, known L/T, known Subtype, Flags, known Information OAMPDU Code field
Test Frame 7: A runt frame that contains DA, SA, L/T, Subtype, Flags, Code, one byte of data of a Local Information TLV, and CRC.

1. The testing station is instructed to transmit Test Frame 1 to the DUT. This test frame is preceded by and followed by valid frames. The output and statistics of the DUT is observed.
2. Step 1 is repeated for Test Frames 2 through 7.
3. Step 1 is repeated for Test Frame 7, increasing the amount of data by one byte through 63 bytes.
4. Repeat steps 1 – 4, without preceding and following the test frames with valid frames.

Observable Results:

a. The fragments should be discarded and the statistics of the DUT may indicate the reception of a fragment.
b. Runt frames should be discarded and the statistics of the DUT may indicate the reception of a runt.
c. The reception of runts and fragments should not affect the reception of valid frames.

Possible Problems: None

Test #57.1.3 - Reception of Minimum OAMPDU Size

Purpose: To verify that the device under test (DUT) can accept frames at least minFrameSize in length.

References:

[1] IEEE Draft Std. 802.3ah v2.2 – subclause 57.4.2

[2] IEEE Std. 802.3-2002 – subclauses 4.2.3.3 and 4.2.4.2.2, 4.2.9: *procedure* ReceiveLinkMgmt.

Resource Requirements:

- A testing station capable of transmitting frames and capable of monitoring traffic from the DUT.

Last Modification: October 14, 2003

Discussion: The minFrameSize is defined as being 64 bytes. Any OAM sublayer must be capable of supporting frames at least minFrameSize in length. Any OAMPDU not containing enough data to meet this requirement will then have pad added at the end of the Data/Pad field but prior to the FCS field as necessary.

Test Setup: Connect the device under test (DUT) to the pattern generator and monitor ports of the testing station using the appropriate medium.

Procedure:

1. The testing station is instructed to transmit an OAMPDU, minFrameSize in length.

Observable Results:

a. The DUT should accept the OAMPDU frame of minFrameSize in length.

Possible Problems: None.

Test #57.1.4 - Reception of Max advertised OAMPDU Size

Purpose: To verify that the device under test (DUT) can accept frames up to the advertised Maximum OAMPDU Size in length.

References:

[1] IEEE Draft Std. 802.3ah v2.2 – Table 57-9 – OAMPDU Configuration field

Resource Requirements:

- A testing station capable of transmitting frames and capable of monitoring traffic from the DUT.

Last Modification: October 14, 2003

Discussion: Each OAM client on a point-to-point link defines the Maximum OAMPDU Size, as the largest OAMPDU that OAM device is capable of receiving. When an OAM client receives the advertised Maximum OAMPDU Size from the remote OAM client, the values is compared to the local Maximum OAMPDU Size. The smaller value is then used as the maximum OAMPDU length for the link.

Test Setup: Connect the device under test (DUT) to the pattern generator and monitor ports of the testing station using the appropriate medium.

Procedure:

1. The testing station is instructed to transmit an OAMPDU, minFrameSize in length, to the DUT. This frame should be preceded and followed by a valid frame separated by minimum interFrameGap. The output and statistics of the DUT are observed.
2. Step 1 is repeated, incrementing the length of the OAMPDU by one octet, until Maximum OAMPDU Size is reached.

Observable Results:

a. The DUT should accept all the OAMPDU frames.
b. The reception of test frames with should not affect the reception of the valid request frames.

Possible Problems: None.

Test #57.1.5 - Reception of Reserved Flags

Purpose: To verify that the device under test (DUT) ignores the value of reserved bits within the Flags field.

References:

[1] IEEE Draft Std. 802.3ah v2.2 – subclauses 57.4.3, Table 57-3 – Flags field

Resource Requirements:

- A testing station capable of transmitting frames with arbitrary values in the Flags field and capable of monitoring traffic from the DUT.

Last Modification: October 14, 2003

Discussion: When receiving a frame, the OAM sublayer of the receiving station interprets the value of the 2-octet long Flags field of the OAMPDU frame. If a value other than zero is encountered in the *reserved* portion of the Flags field, the value within the reserved portion should be ignored. This will ensure compatibility with future use of reserved bits and the OAM protocol.

Also, should a value of 0x3 be observed in the Local Stable and Local Discover flags, by the receiving station, the value should be ignored.

Test Setup: Connect the device under test (DUT) to the pattern generator and monitor ports of the testing station using the appropriate medium.

Procedure:

Part A:

1. The testing station is instructed to transmit an OAMPDU frame with all reserved bits within the Flags field set high.
2. Step 1 is repeated with the test frames preceded and followed by a valid frame, separated by minimum interFrameGap (96 bit-times).

Part B:

3. Part A is repeated with the Local Stable and Local Discovery flags and Remote Stable and Remote Discovery flags set to the value of 0x3.

Observable results:

Part A:

a. The DUT should accept the frame with values for all reserved bits within the Flags field. The DUT however, should not respond to the frame differently as a result of the set bits.
b. The reception of test frames should not affect the reception of the valid request frames.

Part B:

c. The DUT should accept the frame with the value of 0x3 for both the Local and Remote Stable and Discovery flags.

d. The DUT should not be observed to change its value of Local and Remote Stable and Discovery flags.

Possible Problems: None.

Test #57.1.6 - Reception of Invalid OAMPDU Frame

Purpose: To verify that the device under test (DUT) rejects invalid OAMPDU frames.

References:

- IEEE Draft Std. 802.3ah v2.2 - subclauses 57.2.2
- IEEE 802.1D, 1993 Edition - subclause 3.12.6
- IEEE 802.3, 2002 Edition - subclauses 3.2.3, 3.2.6, 3.2.8 and 3.4

Resource Requirements:

- A testing station capable of transmitting frames with arbitrary values in all fields and capable of monitoring traffic from itself and the DUT.

Last Modification: October 14, 2003

Discussion: When the MAC passes up a frame, the OAM sublayer parses the frame and determines if it is a slow protocol frame, that is, if the two-octet Length/Type field is 88-09. If the Length/Type field is not 88-09, the OAM sublayer passes the frame up to the MAC Client.

If a slow protocol frame is received, the OAM sublayer continues to parse the frame in order to find the subtype. The subtype is an octet field that indicates the slow protocol function. A subtype of 0x03 indicates the OAM function.

When a slow protocol frame indicating the OAM function, henceforth referred to as an OAMPDU frame, is received, the OAM sublayer checks the destination address field. If it is the multicast address reserved for slow protocol transactions (01-80-C2-00-00-02), the OAMPDU is processed.

Furthermore OAMPDU are basic frames and shall not be tagged. This includes but is not limited to QTag Prefix tagging.

Thus the OAM sublayer will only act on OAMPDU frames that have a Length/Type field equal to 88-09, a subtype of 0x03, the multicast address reserved for slow protocol transactions, and if the frame is untagged.

Table 1: Description of frames to be used in this test

Label	Description
Test Frame 1	Properly encapsulated OAMPDU frame with a destination address that is not the well-known multicast address (01-80-C2-00-00-02). The Length/Type field and subtype field are valid.
Test Frame 2	Properly encapsulated OAMPDU frame with the subtype not equal to 0x03, with valid destination address and Length/Type field.
Test Frame 3	Properly encapsulated OAMPDU frame with Length/Type not equal to 88-09, with valid destination address and subtype.
Test Frame 4	Properly encapsulated OAMPDU frame with a qTagPrefix.

Test Setup: Connect the device under test (DUT) to the pattern generator and monitor ports of the testing station using the appropriate medium.

Procedure:

1. The testing station is instructed to transmit Test Frame 1 from Table 1. This test frame is preceded by and followed by valid frames. The output of the DUT is observed and, if accessible, the appropriate counters are read.
2. Repeat step 1 for all test frames described in Table 1.
3. Steps 1 and 2 are repeated, without preceding and following the test frames with valid frames.

Observable results:

a. The DUT should not be observed to respond to or forward any of the Test Frames.
b. The reception of Test Frames should not affect the reception of valid frames.
c. The management entity, if present, should increment all appropriate counters.

Possible Problems: None.

Test #57.1.7 - Reception of TLV with Type 0x00

Purpose: To verify that the device under test (DUT) handles a number of different end of TLV markers.

References:

[1] IEEE Draft Std. 802.3ah v2.2 – subclause 57.5.1, 57.6.3, 57.6.4

Resource Requirements:

- A testing station capable of transmitting OAMPDU frames with manipulated TLVs and capable of monitoring traffic from the DUT.

Last Modification: October 23, 2003

Discussion: When receiving and processing OAMPDU TLVs, Variable Descriptors, or Variable Containers, the detection of a TLV Type field or Variable Branch field value of 0x00 indicates that no more TLVs, Descriptors, or Containers follow. The reception of a Type or Branch field value of 0x00 indicates to the OAM device that all following fields can be ignored.

Test Setup: Connect the device under test (DUT) to the pattern generator and monitor ports of the testing station using the appropriate medium.

Procedure:

Test Frame Description

Test TLV	Type	Length	Value
1	-	-	-
2	0x00	-	-
3	0x00	0x00	-
4	0x00	0x00	0x00…
5	0x00	0x00	Random Value
6	0x00	0x01	-
7	0x00	0x01	0x00…
8	0x00	0x01	Random Value
9	0x00	0x02	-
10	0x00	0x02	0x00…
11	0x00	0x02	Random Value
12	0x00	0x03	-
13	0x00	0x03	0x0000
14	0x00	0x03	0x000000
15	0x00	0x03	0x00000000
16	0x00	0x03	Random Value

1. The testing station is instructed to transmit a valid OAMPDU containing Test TLV 1 preceded and followed at least one valid TLV to the DUT. This test frame is preceded by and followed by valid frames. The output and statistics of the DUT is observed.
2. Step 1 is repeated for Test TLV 2 through 16.
3. Repeat steps 1 and 2, without preceding and following the test frames with valid frames.
4. Step 1 – 3 are repeated with every TLV containing OAMPDU type supported by the DUT.

Observable results:

a. The DUT should accept each test frame regardless of the end of TLV marker. The DUT should ignore any TLV after the end of TLV marker.
b. The reception of test frames should not affect the reception of the valid request frames.

Possible Problems: None

Test #57.1.8 - Reception of TLV with incorrect Length

Purpose: To test that the device under test (DUT) properly discards OAMPDUs containing TLVs with incorrect Length fields.

References:

[1] IEEE Draft Std. 802.3ah v2.2 – subclauses 57.5.1, 57.6.3, 57.6.4

Resource Requirements:

- A testing station capable of transmitting OAMPDU frames with manipulated TLVs and capable of monitoring traffic from the DUT.

Last Modification: October 23, 2003

Discussion: Many OAMPDUs are made up of multiple TLVs. It is the responsibility of the OAM client to be aware of these different TLVs in order to process them correctly. If the OAM client receives a TLV or Variable Container in which the value of the Length field or Variable Width field does not match the known or expected value for the particular value in the Type field or Variable Branch field, the TLV or Variable Container must be ignored. It is then up to the discretion of the OAM client to process or ignore the remainder of the TLVs or Variable Containers in the OAMPDU.

Test Setup: Connect the device under test (DUT) to the pattern generator and monitor ports of the testing station using the appropriate medium.

Procedure:

1. The testing station is instructed to transmit an Information OAMPDU to the DUT containing a valid Local Information TLV with a Length field value of 0x10, followed by a valid Remote Information TLV. This OAMPDU is preceded and followed by valid frames.
2. Step 1 is repeated with a Local Information TLV with a Length field less than the well-known value of 0x10 (0x0F is used for the purpose of this test).
3. Step 1 is repeated with a Local Information TLV with a Length field greater than the well-known value of 0x10 (0x11 is used for the purpose of this test).
4. If supported steps 1-3 are repeated with a Variable Container within a Variable Response OAMPDU.

Observable results:

a. The DUT should accept the OAMPDU and the Local Information TLV should be ignored. The Remote Information TLV may or may not be ignored.
b. The reception of OAMPDUs with invalid TLVs should not affect the reception of valid frames.

Possible Problems: None.

Test #57.1.9 - Reception of TLV with Length field longer than OAMPDU frame

Purpose: To test that the device under test (DUT) properly discards TLVs that don't fit within the OAMPDU frame.

References:

[1] IEEE Draft Std. 802.3ah v2.2 – subclauses 57.5.1, 57.6.3, 57.6.4

Resource Requirements:

- A testing station capable of transmitting OAMPDU frames with manipulated TLVs and capable of monitoring traffic from the DUT.

Last Modification: October 23, 2003

Discussion: Many OAMPDUs are made up of multiple TLVs. It is the responsibility of the OAM client to be aware of these different TLVs in order to process them correctly. If the OAM client receives a TLV or Variable Container in which the value of the Length field or Variable Width field does not match the known or expected value for the particular value in the Type field or Variable Branch field, the TLV or Variable Container must be ignored. Should the length of a TLV or the width of a Variable Container overrun the remaining length of the OAMPDU frame, the OAM client shall ignore the TLV or Variable Container.

Test Setup: Connect the device under test (DUT) to the pattern generator and monitor ports of the testing station using the appropriate medium.

Procedure:

Part A:

1. The testing station is instructed to transmit an OAMPDU of maximum advertised OAMPDU size in length. The output and statistics of the DUT are observed.
2. Step 1 is repeated with the last TLV's Length field value increased by one until the length indicated by the Length field is 0xFF.

Part B:

3. The testing station is instructed to transmit an OAMPDU with two TLVs. The Length of the first TLV shall be larger than the frame. The output and statistics of the DUT are observed.

Part C:

4. If supported Parts A and B are repeated with Variable Containers within Variable Response OAMPDUs.

Observable results:

Part A:

a. The DUT should accept all the TLVs within the first OAMPDU.
b. All successive OAMPDU TLVs should be accepted with the exception of the last TLV within each OAMPDU.

Part B:

a. The DUT should ignore the first and accept the second TLV.

Possible Problems: None.

Test #57.1.10.1 - Reception of Information OAMPDU with Non-zero Reserved Bits

Purpose: To test that the device under test (DUT) properly accepts Information OAMPDUs with Local and Remote Information TLVs with non-zero reserved bits in the State, OAM Configuration, and OAMPDU Configuration fields.

References:

[1] IEEE Draft Std. 802.3ah v2.2 – Table 57-7, Table 57-8, Table 57-9

Resource Requirements:

- A testing station capable of transmitting frames with arbitrary values in all fields and capable of monitoring traffic from itself and the DUT.

Last Modification: October 23, 2003

Discussion: When receiving an Information OAMPDU frame, the OAM sublayer of the receiving station interprets the value of the one-octet State, the one-octet OAM Configuration, and two-octet OAMPDU Configuration fields in both the Local and Remote Information TLVs. If a value other than zero is encountered in the *reserved* portions of these fields, the value within the reserved portion should be ignored. This will ensure compatibility with future use of reserved bits and the OAM protocol.

Test Setup: Connect the device under test (DUT) to the pattern generator and monitor ports of the testing station using the appropriate medium.

Procedure:

Part A:

1. The testing station is instructed to transmit a valid Information OAMPDU with a Local Information TLV in which all reserved bits in the State field are set high.
2. Step 1 is repeated with all reserved bits in the OAM Configuration field set high.
3. Step 1 is repeated with all reserved bits in the OAMPDU Configuration field set high.

Part B:

4. *Part A* is repeated with reserved bits set high in the Remote Information TLV.

Observable results:

Part A and B:

a. The DUT should ignore the reserved bits within the State field and process the Information TLV as any other validly encapsulated Information OAMPDU.
b. The DUT should ignore the reserved bits within the OAM Configuration field and process the Information TLV as any other validly encapsulated Information OMAPDU.
c. The DUT should ignore the reserved bits within the OAMPDU Configuration field and process the Information TLV as any other validly encapsulated Information OMAPDU.

Possible Problems: None.

GROUP 2: Frame Transmission

Scope: The following tests cover OAM operations specific to the transmission of OAMPDU frames.

Overview: These tests are designed to verify that the device under test transmits properly formed OAMPDU frames. The OAM functions explored are defined in Clause 57 of IEEE 802.3.

Test #57.2.1 - Transmission of Properly Encapsulated OAMPDUs

Purpose: To verify that the device under test (DUT) transmits all supported OAMPDUs properly.

References:

[1] IEEE Draft Std. 802.3ah v2.2 – subclauses 57.4.2, 57.4.3, Table 57-3, Table 57-7, Table 57-9, 57.4.3.2, 57.4.3.5, 57.4.3.3, 57.4.3.4, 57.4.3.6

Resource Requirements:

- A testing station capable of transmitting frames with arbitrary values in all fields and capable of monitoring traffic from itself and the DUT.

Last Modification: October 14, 2003

Discussion: IEEE Draft Std. 802.3 v2.2 defines the frame format for all Operations Administration, and Maintenance Protocol Data Units (OAMPDUs) and TLVs used by the OAMPDUs, for proper operation of the OAM protocol. It is advised that organizations not deviate from the rules that govern proper OAMPDU construction.

Test Setup: Connect the device under test (DUT) to the pattern generator and monitor ports of the testing station using the appropriate medium.

Procedure:

Part A:

1. The DUT is instructed to source an OAMPDU.

Part B:

2. If supported, the DUT is instructed to transmit an Event Notification OAMPDU.

Part C:

3. If supported, the DUT is instructed to transmit a Loopback Control OAMPDU.

Part D:

4. If supported, the DUT is instructed to transmit a Variable Request OAMPDU.

Part E:

5. If supported, the DUT is instructed to transmit a Variable Response OAMPDU.

Part F:

6. If supported, the DUT is instructed to transmit an Organization Specific OAMPDU.

Observable results:

Part A:

a. The DUT should be observed to source all OAMPDUs with the reserved bits of the Flags field set to zero.
b. The DUT should not be observed to source any OAMPDU with both the Local Stable and Local Discovery flags set high.
c. The DUT should not be observed to source any OAMPDUs with reserved values in the Code field.
d. The DUT should not be observed to source any OAMPDUs with any tags including but not limited to QTag Prefixes.
e. The DUT should be observed to transmit all Information OAMPDUs with Local and Remote Information TLVs with both State and OAMPDU Configuration fields reserved bits set to zero.

Part B:

f. The DUT should be observed to transmit all Event Notification OAMPDUs with one or more Link Event TLVs.

Part C:

g. The DUT should be observed to transmit all Loopback Control OAMPDUs with the first byte of data containing a Loopback Command field and no other data.

Part D:

h. The DUT should be observed to transmit all Variable Request OAMPDUs with one or more Variable Descriptors.

Part E:

i. The DUT should be observed to transmit all Variable Response OAMPDUs with one or more Variable Descriptors.

Part F:

j. The DUT should be observed to transmit all Organization Specific OAMPDUs with the first three bytes of data containing an Organizationally Unique Identifier (OUI).

Possible Problems: None.

Test #57.2.2 - Transmission of Information OAMPDUs Proper Revision Field Value

Purpose: To verify that the device under test (DUT) properly starts and increments the Revision field within both the Local and Remote Information TLVs in all Information OAMPDUs.

References:
[1] IEEE Draft Std. 802.3ah v2.2 – subclauses 57.5.2.1, 57.5.2.2

Resource Requirements:
- A testing station capable of transmitting frames with arbitrary values in all fields and capable of monitoring traffic from itself and the DUT.

Last Modification: October 14, 2003

Discussion: The Local Information TLV contains a Revision field used to help the remote OAM device determine whether or not the TLV contains any new information that needs to be parsed. Each time the configuration of the local OAM changes an Information OAMPDU is sent with a Local Information TLV indicating these changes and an incremented Revision field. A received Information TLV with a previously seen value in the Revision field can be ignored. The OAM Discovery process shall start with an Information OAMPDU containing a Local Information TLV with the Revision field set to zero.

Test Setup: Connect the device under test (DUT) to the pattern generator and monitor ports of the testing station using the appropriate medium.

Procedure:
Part A:
1. Before the OAM Discovery process starts the testing station is instructed to send the DUT an Information TLV with a Revision field set to zero.

Part B:
2. Before the OAM Discovery process starts the testing station is instructed to send the DUT an Information TLV with a Revision field set to a non-zero value.

Part C:
3. Step 1 is repeated.
4. The OAM configuration of the DUT is changed.

Part D:
5. Step 1 is repeated.
6. The testing station is instructed to send an Information OAMPDU reflecting a change made to its configuration.

Observable Results:

Part A and B:

a. The DUT should be observed to transmit an Information OAMPDU with a Local Information TLV with the Revision field set to zero. The Remote Information TLV shall also contain a Revision field set to zero.

Part C:

b. The DUT should be observed to transmit an Information OAMPDU reflecting new OAM configuration information and an incremented Revision field within the Local Information TLV.

Part D:

c. The DUT should be observed to transmit an Information OAMPDU reflecting the new OAM configuration information and an incremented Revision field within the Remote Information TLV.

Possible Problems: None.

Test #57.2.3.1 - Transmission of Event Notification OAMPDUs Increments Sequence Number

Purpose: To verify that the device under test (DUT) increments the sequence number on all unique Event Notification OAMPDUs transmitted.

References:
[1] IEEE Draft Std. 802.3ah v2.2 – subclause 57.4.3.2

Resource Requirements:
- A testing station capable of transmitting frames with arbitrary values in all fields and capable of monitoring traffic from itself and the DUT.

Last Modification: October 14, 2003

Discussion: Since an Ethernet link is a best effort transport; any packet sent along the segment may become corrupt and discarded. In order to help ensure a particular Event Notification OAMPDU is received at the remote OAM sublayer, duplicate Event Notification OMAPDUs may be transmitted across the link. To keep a receiving OAM device from parsing and interpreting repeated Event Notification OAMPDU a sequence number proceeds the first Event TLV. This sequence number should be incremented only on the transmission of unique Event Notification OAMPDU.

Test Setup: Connect the device under test (DUT) to the pattern generator and monitor ports of the testing station using the appropriate medium.

Procedure:
1. The testing station is instructed to send a continuous stream of errored packets in a manner to cause the DUT to transmit an Event Notification OAMPDU.
2. The testing station is then instructed to stop sending errored packet.
3. The testing station is instructed to send a continuous stream of errored packets in a manner to cause the DUT to transmit an Event Notification OAMPDU.

Observable Results:
a. If the DUT supports duplicate Event Notification OAMPDUs, the DUT should be observed to send duplicate Event Notification OAMPDUs with the same sequence number.
b. The DUT should increment the sequence number in the second Event Notification OAMPDU.

Possible Problems:
- The DUT may not support duplicate Event Notification OAMPDUs.

Test #57.2.3.2 - Transmission of Event Notification OAMPDUs Duplicates in Succession

Purpose: To verify that the device under test (DUT) transmits all duplicate Event Notification OAMPDUs in succession.

References:

[1] IEEE Draft Std. 802.3ah v2.2 – subclause 57.4.3.2

Resource Requirements:

- A testing station capable of transmitting frames with arbitrary values in all fields and capable of monitoring traffic from itself and the DUT.

Last Modification: October 14, 2003

Discussion: Since an Ethernet link is a best effort transport; any packet sent along the segment may be become corrupt and discarded. In order to help ensure a particular Event Notification OAMPDU is received at the remote OAM sublayer, duplicate Event Notification OMAPDUs may be transmitted across the link. It is recommended that duplicate Event Notification OAMPDUs be sent without any intervening Event Notification OAMPDU.

Test Setup: Connect the device under test (DUT) to the pattern generator and monitor ports of the testing station using the appropriate medium.

Procedure:

1. The testing station is instructed to send a continuous stream of errored packets in a matter to cause the DUT to transmit an Event Notification OAMPDU.

Observable Results:

a. If the DUT supports duplicate Event Notification OAMPDUs, the DUT should be observed to send duplicate Event Notification OAMPDUs with the same sequence number and without any intervening Event Notification OAMPDUs between them

Possible Problems:

- The DUT may not support duplicate Event Notification OAMPDUs.

Test #57.2.3.3 - Transmission of Event Notification OAMPDUs with Identical Event TLVs

Purpose: To verify that the device under test (DUT) does not transmit the same Event TLV within different Event Notification OAMPDUs.

References:

[1] IEEE Draft Std. 802.3ah v2.2 – subclause 57.4.3.2

Resource Requirements:

- A testing station capable of transmitting frames with arbitrary values in all fields and capable of monitoring traffic from itself and the DUT.

Last Modification: October 14, 2003

Discussion: Event Notification OAMPDUs use Event TLVs to report link events to a remote OAM device. To keep a receiving OAM device from parsing and interpreting repeated Event Notification OAMPDU a sequence number proceeds the first Event TLV. It is recommended that the same Event TLV (reporting the same event condition) not be used in multiple Event Notification OAMPDUs.

Test Setup: Connect the device under test (DUT) to the pattern generator and monitor ports of the testing station using the appropriate medium.

Procedure:

1. The testing station is instructed to continuously send errored packets to the DUT in a manner as to cause the DUT to transmit an Event Notification OAMPDU.
2. The testing station is instructed to stop the transmission of errored packets.
3. The testing station is instructed to continuously send errored packets to the DUT in a manner as to case the DUT to transmit a different Event Notification OAMPDU.

Observable Results:

a. The DUT should be observed to transmit two Event Notification OAMPDUs with different sequence numbers and no identical Event TLV within both.

Possible Problems:

- The DUT may not support duplicate Event Notification OAMPDUs.

Test #57.2.4.1 - Transmission of Variable Response OAMPDUs within One Second of Request

Purpose: To verify that the device under test (DUT) transmits a Variable Response OAMPDU within one second of reception of the Variable Request.

References:

[1] IEEE Draft Std. 802.3ah v2.2 – subclause 57.4.3.4, Table 57-14, Annex 30A

Resource Requirements:

- A testing station capable of transmitting frames with arbitrary values in all fields and capable of monitoring traffic from itself and the DUT.

Last Modification: October 14, 2003

Discussion: OAM provides a mechanism to poll or query a capable remote OAM device of its MIB variables with the use of Variable Request and Variable Response OAMPDUs. This is beneficial in gathering statistical information from a peer OAM device. Each Variable Response OAMPDU contains one or more Variable Containers, which contain MIB attributes, objects, and/or packages. A Variable Response OAMPDU should not take longer than one second to be generated as a result of a Variable Request OAMPDU

Test Setup: Connect the device under test (DUT) to the pattern generator and monitor ports of the testing station using the appropriate medium.

Procedure:

1. The testing station is instructed to send a Variable Request OAMPDU with a Variable Descriptor containing a request for a MIB attribute the DUT contains.

Part B:

2. The testing station is instructed to send a Variable Request OAMPDU with a Variable Descriptor containing a request for a MIB attribute that does not exist.

Observable Results:

Part A:

a. The DUT should be observed to transmit a Variable Response OAMPDU with a Variable Contain within one second of the reception of the Variable Request OAMPDU.

Part B:

b. The DUT should be observed to transmit a Variable Response OAMPDU with a Variable Contain indicating an error within one second of the reception of the Variable Request OAMPDU.

Possible Problems:

- The DUT may not support the transmission Variable Response OAMPDUs.

Test #57.2.4.2 - Transmission of Variable Response OAMPDUs within Error Indication

Purpose: To verify that the device under test (DUT) transmits a Variable Response OAMPDU within proper error indication.

References:
[1] IEEE Draft Std. 802.3ah v2.2 – subclause 57.4.3.4, Table 57-14, Annex 30A

Resource Requirements:
- A testing station capable of transmitting frames with arbitrary values in all fields and capable of monitoring traffic from itself and the DUT.

Last Modification: October 14, 2003

Discussion: OAM provides a mechanism to poll or query a capable remote OAM device of its MIB variables with the use of Variable Request and Variable Response OAMPDUs. This is beneficial in gathering statistical information from a peer OAM device. Each Variable Response OAMPDU contains one or more Variable Containers, which contain MIB attributes, objects, and/or packages.

If an OAM device capable of Variable Responses cannot return one or more attributes for an object or package the local OAM device can do one of two things:
1. Return a Variable Error for each attribute that cannot be returned and return those attributes that can.
2. Return a Variable Error for the entire object or package

Test Setup: Connect the device under test (DUT) to the pattern generator and monitor ports of the testing station using the appropriate medium.

Procedure:
Part A:
1. The testing station is instructed to send a Variable Request OAMPDU with a Variable Descriptor containing a request for a MIB package in which the DUT cannot return all attributes.

Part B:
2. The testing station is instructed to send a Variable Request OAMPDU with a Variable Descriptor containing a request for a MIB object in which the DUT cannot return all attributes.

Observable Results:
Part A and B:
a. The DUT should be observed to either return a Variable Error for all attributes it could not return or return a Variable Error for the entire package or objcect.

Possible Problems:

- The DUT may not support the transmission Variable Response OAMPDUs.
- The DUT may not support MIB packages or objects with attributes it cannot return.

Test #57.2.4.3 - Transmission of Variable Response OAMPDUs with Action in Variable Container

Purpose: To verify that the device under test (DUT) does not transmit Variable Response OAMPDUs with Variable Containers, which contain MIB actions.

References:
[1] IEEE Draft Std. 802.3ah v2.2 – Table 57-14, Annex 30A

Resource Requirements:
- A testing station capable of transmitting frames with arbitrary values in all fields and capable of monitoring traffic from itself and the DUT.

Last Modification: October 14, 2003

Discussion: OAM provides a mechanism to poll or query a capable remote OAM device of its MIB variables with the use of Variable Request and Variable Response OAMPDUs. This is beneficial in gathering statistical information from a peer OAM device. Each Variable Response OAMPDU contains one or more Variable Containers, which contain MIB attributes, objects, and/or packages. A Variable Container at no time shall contain a MIB action.

Test Setup: Connect the device under test (DUT) to the pattern generator and monitor ports of the testing station using the appropriate medium.

Procedure:
1. The testing station is instructed to send a Variable Request OAMPDU with a Variable Descriptor containing a request for a MIB action.

Observable Results:
a. The response from the DUT is not defined, but the DUT should not be observed to transmit a Variable Container, which contains a MIB action.

Possible Problems:
- The DUT may not support the transmission of Variable Response OAMPDUs.

Test #57.2.5 - Transmission of Variable Request or Loopback Control by Passive Device

Purpose: To verify that the device under test (DUT) does not transmit Variable Response OAMPDUs or Loopback Control OAMPDUs while in Passive mode.

References:

[1] IEEE Draft Std. 802.3ah v2.2 – Table 57-14, Annex 30A

Resource Requirements:

- A testing station capable of transmitting frames with arbitrary values in all fields and capable of monitoring traffic from itself and the DUT.

Last Modification: October 14, 2003

Discussion: OAM devices operating in Passive mode are restricted from initiating operations in which the local device would be taking an active role. As a result devices operation in Passive mode cannot initiate Variable Requests or Loopback operation.

Test Setup: Connect the device under test (DUT) to the pattern generator and monitor ports of the testing station using the appropriate medium.

Procedure:

1. The device under test (DUT) is configured to operate in Passive mode.
2. The DUT is instructed to transmit a Variable Request OAMPDU.
3. Step 2 is repeated with a Loopback Control OAMPDU.

Observable Results:

a. The DUT should not be observed to transmit a Variable Request OAMPDU.
b. The DUT should not be observed to transmit a Loopback Control OAMPDU.

Possible Problems:

- The DUT may not support the transmission of Variable Request OAMPDUs.
- The DUT may not support the transmission of Loopback Control OAMPDUs.

GROUP 3: OAM Discovery Process

Scope: The following tests cover OAM operations specific to the OAM Discovery process.

Overview: These tests are designed to verify that the device under test, functions properly and adheres to the rules governing the discovery of a remote OAM entity on the link as defined in Clause 57 of IEEE 802.3.

Test #57.3.1 - Mode Selection and Transmit Ability

Purpose: To verify that the device under test (DUT) successfully selects either Active or Passive mode and follows the defined transmit rules.

References:

[1] IEEE Draft Std. 802.3ah v2.2 – subclause 57.3.2.1, 57.3.2.2, Figure 57-5, Figure 57-6, 57.3.3.1.1, 57.3.3.1.2

Resource Requirements:

- A testing station capable of transmitting frames with arbitrary values in all fields and capable of monitoring traffic from itself and the DUT.

Last Modification: October 15, 2003

Discussion: OAM provides a link partner discovery process, which is used to convey state and configuration information (such as current local multiplexer operation and Maximum OAMPDU Size) as well as OAM capabilities (such as OAM Loopback capable). The discovery process also ensures that two Passive mode OAM devices cannot establish an OAM link.

When OAM is enabled the device is configured for either Active or Passive mode operation. Active devices enter the ACTIVE_SEND_LOCAL state and initiate the OAM Discovery process by transmitting Information OAMPDUs with Local Information TLVs. Passive devices however enter the PASSIVE_WAIT state and wait for the initiation from an Active device.

Test Setup: Connect the device under test (DUT) to the pattern generator and monitor ports of the testing station using the appropriate medium.

Procedure:

Part A:

1. If supported, the device under test (DUT) is configured for Active mode operation and instructed to reset the OAM Discovery process.
2. The DUT is instructed to explicitly transmit 5 Information OAMPDU frames.
3. The DUT is instructed to explicitly transmit 5 non-Information OAMPDU frame.

Part B:

4. If supported, Part A is repeated with the DUT configured for Passive mode operation.

Observable results:

Part A:

a. The DUT should be observed to transmit OAMPDUs at a rate of no fewer than once per second. All Information OAMPDUs should contain a Local Information TLV.
b. The DUT should be observed to transmit the 5 explicitly requested Information OAMPDU frames. All Information OAMPDUs should contain a Local Information TLV.
c. The DUT should not be observed to transmit the 5 explicitly requested non-Information OAMPDUs.

Part B:

d. The DUT should not be observed to transmit any OAMPDUs.

Possible Problems:

- If the DUT does not support Active mode operation, Part A cannot be performed.
- If the DUT does not support Passive mode operation, *Part B* cannot be performed.

Test #57.3.2 - Mode Selection and Receive Ability

Purpose: To verify that the device under test (DUT) successfully selects either Active or Passive mode and follows the defined receive rules.

References:
[1] IEEE Draft Std. 802.3ah v2.2 – subclause 57.3.2.1, 57.3.2.3, Figure 57-5, Figure 57-7

Resource Requirements:
- A testing station capable of transmitting frames with arbitrary values in all fields and capable of monitoring traffic from itself and the DUT.

Last Modification: October 15, 2003

Discussion: OAM provides a link partner discovery process, which is used to convey state and configuration information (such as current local multiplexer operation and Maximum OAMPDU Size) as well as OAM capabilities (such as OAM Loopback capable). The discovery process also ensures that two Passive mode OAM devices cannot establish an OAM link.

When OAM is enabled the device is configured for either Active or Passive mode operation. Active devices enter the ACTIVE_SEND_LOCAL state and initiate the OAM Discovery process by transmitting Information OAMPDUs with Local Information TLVs. Passive devices however enter the PASSIVE_WAIT state and wait for the initiation from an Active device. Regardless of the mode of operation at this early stage of the OAM Discovery process, devices can only accept Information OAMPDU from the remote OAM device.

Test Setup: Connect the device under test (DUT) to the pattern generator and monitor ports of the testing station using the appropriate medium.

Procedure:
Part A:
1. If supported, the device under test (DUT) is configured for Active mode operation and instructed to reset the OAM Discovery process.
2. The testing station is instructed to explicitly transmit 5 non-Information OAMPDUs.
3. The testing station is instructed to explicitly transmit 5 Information OAMPDUs.

Part B:
4. If supported, Part A is repeated with the DUT configured for Passive mode operation.

Observable results:
Part A:
a. The DUT should be observed to transmit OAMPDUs at a rate of no fewer than once per second.
b. The DUT should not be observed to respond to the 5 non-Information OAMPDU frames.
c. The DUT should be observed to respond to the 5 Information OAMPDU frames.

Part B:

d. The DUT should not be observed to transmit any OAMPDUs.
e. The DUT should not be observed to respond to the 5 non-Information OAMPDU frames.
f. The DUT should be observed to respond to the 5 Information OAMPDU frames.

Possible Problems:

- If the DUT does not support Active mode operation, Part A cannot be performed.
- If the DUT does not support Passive mode operation, Part B cannot be performed.

Test #57.3.3 - Remote State Valid

Purpose: To verify that the device under test (DUT) successfully selects either Active or Passive mode and follows the defined receive rules.

References:

[1] IEEE Draft Std. 802.3ah v2.2 – subclause 57.3.2.1, 57.3.2.2, 57.3.2.3, Figure 57-5, Figure 57-6, 57.3.3.1.1, 57.3.3.1.2

Resource Requirements:

- A testing station capable of transmitting frames with arbitrary values in all fields and capable of monitoring traffic from itself and the DUT.

Last Modification: October 15, 2003

Discussion: OAM provides a link partner discovery process, which is used to convey state and configuration information (such as current local multiplexer operation and Maximum OAMPDU Size) as well as OAM capabilities (such as OAM Loopback capable). The discovery process also ensures that two Passive mode OAM devices cannot establish an OAM link.

When OAM is enabled the device is configured for either Active or Passive mode operation. Active devices enter the ACTIVE_SEND_LOCAL state and initiate the OAM Discovery process by transmitting Information OAMPDUs with Local Information TLVs. Passive devices however enter the PASSIVE_WAIT state and wait for the initiation from an Active device. Regardless of the mode of operation at this early stage of the OAM Discovery process, devices can only accept Information OAMPDU from the remote OAM device.

Once an Information OAMPDU from the remote OAM device is received and accepted the device enters the SEND_LOCAL_REMOTE_1 state and all subsequent Information OAMPDUs transmited by the local OAM device should have a Remote Information TLV following the Local Information TLV.

Test Setup: Connect the device under test (DUT) to the pattern generator and monitor ports of the testing station using the appropriate medium.

Procedure:

Part A:

1. If supported, the device under test (DUT) is configured for Active mode operation and instructed to reset the OAM Discovery process.
2. The testing station is instructed to explicitly transmit 5 Information OAMPDUs.

Part B:

3. If supported, Part A is repeated with the DUT configured for Passive mode operation.

Observable results:

Part A and B:

a. The DUT should be observed to transmit OAMPDUs at a rate of no fewer than once per second. All Information OAMPDUs should contain both Local and Remote Information TLVs.

Possible Problems:

- If the DUT does not support Active mode operation, Part A cannot be performed.
- If the DUT does not support Passive mode operation, Part B cannot be performed.

Test #57.3.4 - Local Satisfied

Purpose: To verify that the device under test (DUT) successfully selects either Active or Passive mode and follows the defined receive rules.

References:

[1] IEEE Draft Std. 802.3ah v2.2 – subclause 57.3.2.1, 57.3.2.2, 57.3.2.3, Figure 57-5, Figure 57-6, 57.3.3.1.1, 57.3.3.1.2

Resource Requirements:

- A testing station capable of transmitting frames with arbitrary values in all fields and capable of monitoring traffic from itself and the DUT.

Last Modification: October 15, 2003

Discussion: OAM provides a link partner discovery process, which is used to convey state and configuration information (such as current local multiplexer operation and Maximum OAMPDU Size) as well as OAM capabilities (such as OAM Loopback capable). The discovery process also ensures that two Passive mode OAM devices cannot establish an OAM link.

Once the local OAM device is in the SEND_LOCAL_REMOTE_1 state and aware that the remote OAM device is operational, the configuration of the local device is compared to the remote device's configuration. If the configuration is acceptable to the DUT it will go into the SEND_LOCAL_REMOTE_2 state, where all subsequent Information OAMPDUs transmitted shall contain the Local Stable flag set low and the Local Discovering flag set high. If the configuration is not acceptable, the DUT will stay in the SEND_LOCAL_REMOTE_1 state and transmit Information OAMPDUs with both the Local Stable and Local Discovering flags set low.

Test Setup: Connect the device under test (DUT) to the pattern generator and monitor ports of the testing station using the appropriate medium.

Procedure:

Part A:

1. The device under test (DUT) is instructed to reset the OAM Discovery process.
2. The testing station is instructed to explicitly transmit an Information OAMPDU with an acceptable configuration in the Local Information TLV.

Part B:

3. Part A is repeated with an Information OAMPDU with an unacceptable configuration in the Local Information TLV.

Observable results:

Part A:

a. The DUT should be observed to transmit OAMPDUs at a rate of no fewer than once per second. All Information OAMPDUs should contain both Local and Remote Information TLVs and the Local Stable flag should be set low while the Local Discovering flag set high.

Part B:

b. The DUT should be observed to transmit OAMPDUs at a rate of not fewer than once per second. All Information OMAPDUs should contain both Local and Remote Information TLVs and both Local Stable and Local Discovering flags set low.

Possible Problems:

- The standard does not specify what configurations will be deemed acceptable to an OAM device. The above procedure is intentionally vague. The vendor should be contacted to obtain the proper configuration requirements if possible.

Test #57.3.5 - Remote Stable or Local Unsatisfied

Purpose: To verify that the device under test (DUT) successfully selects either Active or Passive mode and follows the defined receive rules.

References:

[1] IEEE Draft Std. 802.3ah v2.2 – subclause 57.3.2.1, 57.3.2.2, 57.3.2.3, Figure 57-5, Figure 57-6, 57.3.3.1.1, 57.3.3.1.2

Resource Requirements:

- A testing station capable of transmitting frames with arbitrary values in all fields and capable of monitoring traffic from itself and the DUT.

Last Modification: October 15, 2003

Discussion: OAM provides a link partner discovery process, which is used to convey state and configuration information (such as current local parser operation and Maximum OAMPDU Size) as well as OAM capabilities (such as OAM Loopback capable). The discovery process also ensures that two Passive mode OAM devices cannot establish an OAM link.

When the local OAM device is in the SEND_LOCAL_REMOTE_2 state and transmitting Information OAMPDUs with the Local Stable flag set low and the Local Discovery flag set high, the local OAM device waits for the remote OAM device to send the same. If the configuration is acceptable by the remote OAM device and it sends all subsequent Information OAMPDUs with the Local Stable flag set low and the Local Discovering flag set high, the DUT enters the SEND_ANY state and transmits frames with Local Stable set high and Local Discovery set low. In this state the DUT may transmit any OAMPDU it wishes. If the local OAM device becomes unsatisfied with the configuration of the remote OAM device, it returns to the SEND_LOCAL_REMOTE_1 state. In this state the local device goes back to transmitting Information OAMPDUs with both Local and Remote Information TLV and both Local Stable and Local Discovery are set low.

Test Setup: Connect the device under test (DUT) to the pattern generator and monitor ports of the testing station using the appropriate medium.

Procedure:

Part A:

1. The device under test (DUT) is instructed to reset the OAM Discovery process.
2. The testing station is instructed to transmit an Information OAMPDU with an acceptable configuration in the Local Information TLV.
3. The testing station is instructed to an Information OAMPDU with the Local Stable flag set low and the Local Discovering flag set high.
4. The DUT is instructed to transmit non-Information OAMPDUs.

Part B:

5. The DUT is instructed to reset the OAM Discovery process.

6. The testing station is instructed to transmit an Information OAMPDU with an acceptable configuration in the Local Information TLV.
7. The testing station is then instructed to transmit an Information OAMPDU with an unacceptable configuration in the Local Information TLV.

Observable results:

Part A:

a. The DUT should be observed to transmit OAMPDUs at a rate of no fewer than once per second. All Information OAMPDUs should contain both Local and Remote Information TLVs and the Local Stable and Remote Stable flags should be set high while the Local and Remote Discovering flags set low.
b. The DUT should be observed to transmit non-Information OAMPDUs.

Part B:

c. The DUT should be observed to transmit OAMPDUs at a rate of not fewer than once per second. All Information OMAPDUs should contain both Local and Remote Information TLVs and both Local Satisfied and Local Discovering flags set low.

Possible Problems:

- The standard does not specify what configurations will be deemed acceptable to an OAM device. The above procedure is intentionally vague. The vendor should be contacted to obtain the proper configuration requirements if possible.

Test #57.3.6 - Remote Unstable or Local Unsatisfied

Purpose: To verify that the device under test (DUT) successfully selects either Active or Passive mode and follows the defined receive rules.

References:

[1] IEEE Draft Std. 802.3ah v2.2 – subclause 57.3.2.1, 57.3.2.2, 57.3.2.3, Figure 57-5, Figure 57-6, 57.3.3.1.1, 57.3.3.1.2

Resource Requirements:

- A testing station capable of transmitting frames with arbitrary values in all fields and capable of monitoring traffic from itself and the DUT.

Last Modification: October 15, 2003

Discussion: OAM provides a link partner discovery process, which is used to convey state and configuration information (such as current local parser operation and Maximum OAMPDU Size) as well as OAM capabilities (such as OAM Loopback capable). The discovery process also ensures that two Passive mode OAM devices cannot establish an OAM link.

If the local OAM device is in the SEND_ANY state and transmitting Information OAMPDUs indicating that local and remote discovery is complete and either the local or remote OAM becomes unsatisfied with the link the local OAM device does one of the following. If the local OAM device become unsatisfied with the configuration the local OAM device should return to the SEND_LOCAL_REMOTE_1 state. Here the local OAM device will transmit Information OAMPDUs with both Local and Remote Information TLVs and both Local Stable and Local Discovering flags set low. If the remote OAM device become unsatisfied with the configuration the local OAM device should return to the SEND_LOCAL_REMOTE_2 state. Here the local OAM device will transmit Information OAMPDUs with both Local and Remote Information TLVs, the Local Stable flag set high, and the Local Discovery flag set low.

Test Setup: Connect the device under test (DUT) to the pattern generator and monitor ports of the testing station using the appropriate medium.

Procedure:

Part A:

1. The device under test (DUT) is instructed to reset the OAM Discovery process.
2. The testing station is instructed to transmit an Information OAMPDU with an acceptable configuration in the Local Information TLV.
3. The testing station is instructed to an Information OAMPDU with the Local Stable flag set high and the Local Discovering flag set low.
4. The testing station is instructed to transmit an Information OAMPDU with both Local Stable and Local Discovering flags set low.

Part B:

5. The device under test (DUT) is instructed to reset the OAM Discovery process.

6. The testing station is instructed to transmit an Information OAMPDU with an acceptable configuration in the Local Information TLV.
7. The testing station is instructed to an Information OAMPDU with the Local Stable flag set high and the Local Discovering flag set low.
8. The testing station is instructed to transmit an Information OAMPDU with an unacceptable configuration in the Local Information TLV.

Observable results:

Part A:

a. The DUT should be observed to transmit OAMPDUs at a rate of no fewer than once per second. All Information OAMPDUs should contain both Local and Remote Information TLVs and the Local Stable flag should be set high while the Local Discovering flag set low.

Part B:

b. The DUT should be observed to transmit OAMPDUs at a rate of not fewer than once per second. All Information OMAPDUs should contain both Local and Remote Information TLVs and both Local Satisfied and Local Discovering flags set low.

NOTE: Information OAMPDUs with the Local Satisfied set low and the Local Discovering set high indicate the Local OAMPDU has not completed the configuration analysis. Continue monitoring the link.

Possible Problems:

- The standard does not specify what configurations will be deemed acceptable to an OAM device. The above procedure is intentionally vague. The vendor should be contacted to obtain the proper configuration requirements if possible.

Test #57.3.7 - Local Link Status Fail or Local Link Timer Done

Purpose: To verify that the device under test (DUT) successfully remains in the LINK_FAULT state when a link fault condition exists.

References:

[1] IEEE Draft Std. 802.3ah v2.2 – subclause 57.3.2.1, 57.3.2.2, 57.3.2.3, Figure 57-5, Figure 57-6, 57.3.3.1.1, 57.3.3.1.2

Resource Requirements:

- A testing station capable of transmitting frames with arbitrary values in all fields and capable of monitoring traffic from itself and the DUT.
- A testing station capable of disabling its transmitter.

Last Modification: October 15, 2003

Discussion: OAM provides a link partner discovery process, which is used to convey state and configuration information (such as current local parser operation and Maximum OAMPDU Size) as well as OAM capabilities (such as OAM Loopback capable). The discovery process also ensures that when a device loses either the OAM or physical link, it continues to transmit OAMPDUs indicating that a fault condition exitst.

Test Setup: Connect the device under test (DUT) to the pattern generator and monitor ports of the testing station using the appropriate medium.

Procedure:

Part A:

1. The device under test (DUT) is instructed to reset the OAM Discovery process.
2. The testing station is instructed to go through the necessary steps to complete the OAM Discovery Process.
3. The testing station is instructed to stop the transmission of OAMPDUs to the DUT.

Part B:

4. The DUT is instructed to reset the OAM Discovery process.
5. The testing station is instructed to go through the necessary steps to complete the OAM Discovery Process.
6. The testing station is instructed to disable its transmitter.

Observable results:

Part A and B:

a. The DUT should be observed to transmit Information OAMPDUs only.
b. All Information OAMPDUs should have the Link Fault critical event flag set high.
c. All Information OAMPDUs should not contain Information TLVs.
d. Information OAMPDU should be transmitted at a rate of once per second.

Possible Problems:

- If the DUT does not support unidirectional operation, this test cannot be performed.

GROUP 4: Multiplexer Operation

Scope: The following tests cover OAM operations specific to the multiplexing and transmission of MAC client and OAM client frame provided within OAM.

Overview: These tests are designed to verify that the device under test functions properly and adheres to the transmission of MAC client and OAM client frame rules as defined in Clause 57 of IEEE 802.3.

Test #57.4.1 - Expiration of pdu_timer

Purpose: To verify that the device under test (DUT) after one second of no requests to transmit an OAMPDU follows the proper procedures.

References:
[1] IEEE Draft Std. 802.3ah v2.2 – subclause 57.3.3.1.1, Figure 57-6, Figure 57-5

Resource Requirements:
- A testing station capable of transmitting frames with arbitrary values in all fields and capable of monitoring traffic from itself and the DUT.
- A testing station capable of disabling its transmitter.

Last Modification: October 14, 2003

Discussion: The OAM sublayer multiplexes MAC client frames with OAM client OAMPDU frames before passing all frames down to the lower layers. However to keep the OAM Discovery process from restarting, an OAM device must transmit an OAMPDU at least once per second. As a result the OAM sublayer injects an OAMPDU into the stream of transmitted frames regardless of whether the OAM client wishes to transmit an OAMPDU.

The OAM Discovery process however does add a restriction, if the local OAM device is operating in Passive mode and has yet to receive an Information OAMPDU from the remote Active mode OAM device, the local OAM device may not transmit any OAMPDUs.

Test Setup: Connect the device under test (DUT) to the pattern generator and monitor ports of the testing station using the appropriate medium.

Procedure:
Part A:
1. The device under test (DUT) is instructed to reset the OAM Discovery process.
2. The testing station is instructed transmit an Information OAMPDU to the DUT.

Part B:
3. The DUT is instructed to reset the OAM Discovery process.
4. The testing station is instructed to go through the necessary steps to complete the OAM Discover process.

Part C:
5. The DUT is instructed to reset the OAM Discovery process.
6. The receive path of the DUT is disconnected.
7. Wait for local_lost_link_timer to expire (5 seconds).

Part D:
8. The DUT is instructed to complete the OAM Discovery process with the testing station.
9. The DUT is instructed to explicitly transmit an OAMPDU to the testing station.

Part E:
10. If supported the DUT is configured for Passive mode operation and is instructed to reset the OAM Discovery process.

Observable results:

Part A - C:

i. The DUT should not be observed to transmit OAMPDUs at a rate fewer than once per second.

ii. The DUT should be observed to transmit the explicitly request OAMPDU.

Part D:

iii. The DUT should be observed to wait one second before the transmission of any other OAMPDU after the transmission of the explicitly requested OAMPDU.

Part E:

iv. The DUT should not be observed to transmit any OAMPDUs.

Possible Problems:

- If the DUT does not support Passive mode operation, *Part E* cannot be performed.

Test #57.4.2 - Valid OAMPDU Requests

Purpose: To verify that the device under test (DUT) transmits OAMPDUs as a result of valid requests.

References:
[1] IEEE Draft Std. 802.3ah v2.2 – subclause 57.3.3.1.2, Figure 57-6, Figure 57-5

Resource Requirements:
- A testing station capable of transmitting frames with arbitrary values in all fields and capable of monitoring traffic from itself and the DUT.

Last Modification: October 14, 2003

Discussion: The OAM sublayer multiplexes MAC client frames and OAM client OAMPDU frames before passing frames down to the lower layers. The OAM sublayer is bound by rules governing the transmission of slow protocol frames. As a result the OAM sublayer must not transmit more than 10 OAMPDUs per second. If the DUT has observed a critical link event, the link is considered less than optimal and the DUT is permitted to transmit OAMPDUs at a rate of more than 10 per second.

Test Setup: Connect the device under test (DUT) to the pattern generator and monitor ports of the testing station using the appropriate medium.

Procedure:
Part A:
1. The device under test (DUT) is instructed to reset the OAM Discovery process.
2. The testing station is instructed to go through the necessary steps to complete the OAM Discover process.
3. The DUT in instructed to explicitly transmit 100 OAMPDUs with the Critical event flag set high.
4. Step 3 is repeated with the Link Fault and Dying Gasp event flags set high.

Part B:
5. The DUT is instructed to reset the OAM Discovery process.
6. The testing station is instructed to transmit an Information OAMPDU to the DUT.
7. The DUT is instructed to explicitly transmit 100 OAMPDUs.

Part C:
8. The DUT in instructed to reset the OAM Discovery process.
9. The testing station is instructed to go through the necessary steps to complete the OAM Discover process.
10. The DUT is instructed to explicitly transmit 100 OAMPDUs.

Observable results:

Part A:

v. The DUT should be observed to transmit all 100 OAMPDUs with no regard to the 10 per second rate limit.

Part B and C:

vi. The DUT should be observed to transmit all 100 OAMPDUs but at a rate of no more than 10 per second.

Possible Problems:

- 100 OAMPDUs may be more frames than the DUT can queue. If OAMPDU frames are dropped the number of OAMPDUs should be reduced.

Test #57.4.3 - Invalid Requests are Ignored

Purpose: To verify that the device under test (DUT) does not transmit OAMPDUs as a result of invalid requests.

References:
[1] IEEE Draft Std. 802.3ah v2.2 – subclause 57.3.3.1.4, Figure 57-6, Figure 57-5

Resource Requirements:
- A testing station capable of transmitting frames with arbitrary values in all fields and capable of monitoring traffic from itself and the DUT.
- A testing station capable of disabling its transmitter.

Last Modification: October 14, 2003

Discussion: The local OAM device's current state within the OAM Discovery process heavily influences what OAMPDU requests are considered valid by the OAM sublayer. The OAM sublayer is bound by rules governing the transmission of slow protocol frames. As a result the OAM sublayer must not transmit more than 10 OAMPDUs per second. Any attempt to generate more than 10 OAMPDUs per second is looked upon as an invalid request.

An OAM device is allowed to generate critical link event OAMPDUs once the OAM Discovery process has completed. Any attempt to generate an OAMPDU with one or more critical link event flags set high prior to the OAM Discovery process has completed is looked upon as an invalid request.

Test Setup: Connect the device under test (DUT) to the pattern generator and monitor ports of the testing station using the appropriate medium.

Procedure:
Part A:
1. The device under test (DUT) is instructed to reset the OAM Discovery process.
2. The testing station is instructed to go through the necessary steps to complete the OAM Discover process.
3. The DUT in instructed to explicitly transmit 15 OAMPDUs.

Part B:
4. The DUT is instructed to reset the OAM Discovery process.
5. The testing station is instructed to send the DUT an Information OAMPDU.
6. The DUT in instructed to explicitly transmit 15 OAMPDUs.

Part C:
7. The DUT is instructed to reset the OAM Discovery process.
8. The receive path of the DUT is disconnected.
9. Wait for local_lost_link_timer to expire (5 seconds).
10. The DUT is instructed to explicitly transmit 15 OAMPDUs.

Part D:
11. The DUT is instructed to reset the OAM Discovery process.

12. The testing station is instructed to transmit an Information OAMPDU to the DUT.
13. The DUT is instructed to explicitly transmit 10 OAMPDUs with the Critical event flag set high.
14. Step 13 is repeated with the Link Fault and Dying Gasp flags set high.

Part E:

15. The DUT is instructed to reset the OAM Discovery process.
16. The receive path of the DUT is disconnected.
17. Wait for local_lost_link_timer to expire (5 seconds).
18. The DUT is instructed to explicitly transmit 10 OAMPDUs with the Critical event flag set high.
19. Step 18 is repeated with the Link Fault and Dying Gasp flags set high.

Part F:

20. If supported, the DUT is configured for Passive mode operation and the OAM Discovery process is reset.
21. The DUT is instructed to explicitly transmit 10 OAMPDUs.
22. The DUT is instructed to explicitly transmit 10 OAMPDUs with the Critical event flag set high.
23. Step 22 is repeated with the Link Fault and Dying Gasp flags set high.

Observable results:

Part A - C:

a. The DUT should not be observed to transmit more than 10 OAMPDUs per second.

Part D - F:

b. The DUT should not be observed to transmit any of the explicitly requested OAMPDUs.

Possible Problems:

- If the DUT does not support Passive mode operation, *Part F* cannot be performed.

GROUP 5: Loopback Operation

Scope: The following tests cover OAM operations specific to the optional remote loopback functionality provided within OAM.

Overview: These tests are designed to verify that the device under test, whether the local OAM device initiating the loopback command or the remote OAM device adhering to the loopback command, functions properly and adheres to the rules defined in Clause 57 of IEEE 802.3.

For the purposes of the following tests the term Active OAM shall describe the OAM device that initiates, controls, and ultimately exits the loopback mode of operation. The term Passive OAM shall describe the OAM device that has been remotely set to loopback mode. It is understood that a local OAM device in Active mode may be placed in loopback mode by a remote Active OAM device, however that local OAM device will act as a Passive device for the term of the loopback operation.

Note: Loopback operation is an optional function of the Clause 57 OAM. Devices that do no support loopback should ignore the tests found in Group 5.

Test #57.5.1.1 - Initiation - Active OAM Stops Responding to Non-OAMPDUs

Purpose: To verify that the device under test (DUT) when initiating the loopback operation stops responding to non-OAMPDU frames.

References:
[1] IEEE Draft Std. 802.3ah v2.2 – subclauses 57.2.11.1, 57.3.1.2, Figure 57-6, Figure 57-7

Resource Requirements:
- A testing station capable of transmitting frames with arbitrary values in all fields and capable of monitoring traffic from itself and the DUT.

Last Modification: October 14, 2003

Discussion: OAM provides a data link layer frame-level loopback mechanism that can be remotely controlled by an OAM device. When an OAM device is initiating the loopback operation, it must first stop the reception of any non-OAMPDU sent to it from the remote OAM device before transmitting a Loopback Control OAMPDU with the Enable Remote Loopback command.

The OAM sublayer does this by setting its local_par_action to DISCARD, sinking all received non-OAMPDU frames and passing all OAMPDUs to the OAM client. This ensures that any looped back frame will not be received by the MAC client and reintroduced into the network, while allowing OAMPDUs to reach the OAM client and keep the OAM Discovery process from restarting. The OAM sublayer then transmits a Loopback Control OAMPDU with the Loopback Command field indicating the Enable Remote Loopback command (0x01).

It is understood that stopping the reception of MAC client frames as a result of the loopback operation may be a cause of frame loss at either OAM device.

Test Setup: Connect the device under test (DUT) to the pattern generator and monitor ports of the testing station using the appropriate medium.

Procedure:
Part A:
1. The testing station is instructed to transmit 10 valid MAC frames to the device under test (DUT).
2. The DUT is instructed to initiate the loopback operation and transmit a Loopback Control OAMPDU with the Enable Remote Loopback command before Step 1 has completed.

Part B:
3. The testing station is instructed to transmit 10 valid OAMPDU frames to the device under test (DUT).
4. The DUT is instructed to initiate the loopback operation and transmit a Loopback Control OAMPDU with the Enable Remote Loopback command before Step 3 has completed.

Observable results:

Part A:

a. The DUT should be observed to respond to some of the valid MAC frames sent by the testing station.
b. The DUT should be observed to stop responding to the valid MAC frames before transmitting a Loopback Control OAMPDU with a Loopback Command field set to the Enable Remote Loopback command (0x01).

Part B:

c. The DUT should be observed to respond to all 10 OAMPDU frames sent by the testing station.
d. The DUT should be observed to transmit a Loopback Control OAMPDU with a Loopback Command field set to the Enable Remote Loopback command (0x01).

Possible Problems:

e. If the DUT can only be configured for Passive mode operation, then this test cannot be performed.

Test #57.5.1.2 - Initiation - Passive OAM Stops Responding to Non-OAMPDUs

Purpose: To verify that the device under test (DUT) when accepting the initiation of the loopback operation stops responding to non-OAMPDUs.

References:

[1] IEEE Draft Std. 802.3ah v2.2 – subclauses 57.2.11.1, 57.2.11.6, 57.3.1.2, Figure 57-6, Figure 57-7

Resource Requirements:

- A testing station capable of transmitting frames with arbitrary values in all fields and capable of monitoring traffic from itself and the DUT.

Last Modification: October 14, 2003

Discussion: OAM provides a data link layer frame-level loopback mechanism that can be remotely controlled by an OAM device. When an OAM device is responding to the initiation of the loopback operation, it has one second to stop the transmission of MAC client frames and loopback any received non-OAMPDU transmission from the remote OAM device. Once done, the local OAM device, still constrained by the one-second limit, must then send an Information OAMPDU indicating this new configuration to the remote OAM device.

Upon the reception of a Loopback Control OAMPDU with the Enable Remote Loopback command, the local OAM sublayer sets its local_mux_action to DISCARD, sinking or queuing all transmissions of non-OAMPDU frames, and sets its local_par_action to LB, looping back all received non-OAMPDUs while passing all OAMPDUs to the OAM client. This ensures that any non-OAMPDU will be looped back and while allowing OAMPDUs to reach the OAM client. The local OAM device then transmits an Information OAMPDU with these changes reflected in the State field of the Local Information TLV.

It is understood that stopping the transmission of MAC client frames as a result of the loopback operation may be a cause of frame loss at either OAM device.

Test Setup: Connect the device under test (DUT) to the pattern generator and monitor ports of the testing station using the appropriate medium.

Procedure:

Part A:

1. The device under test (DUT) is instructed to transmit 10 valid MAC frames to the testing station.
2. The testing station is instructed to initiate the loopback operation and transmit a Loopback Control OAMPDU preceded and followed by 10 valid MAC frames before Step 1 has completed.

Part B:

3. The device under test (DUT) in instructed to transmit 10 valid OAMPDU frames to the testing station.

4. The testing station is instructed to initiate the loopback operation and transmit a Loopback Control OAMPDU preceded and followed by 10 valid OAMPDU frames before Step 3 has completed.

Observable results:

Part A:

a. The DUT should be observed to transmit some of the valid MAC level frames but should stop within one second of reception of the Loopback Control OAMPDU.
b. The DUT should be observed to stop responding to the valid MAC frames sent to it by the testing station within one second of reception of the Loopback Control OAMPDU and begin looping the frames back to the testing station.
c. The DUT should be observed to send an Information OAMPDU with the State field of the Local Information TLV indicating the change to its local_par_action and local_mux_action within one second of reception of the Loopback Control OAMPDU.

Part B:

d. The DUT should be observed to transmit all of the OAMPDU frames.
e. The DUT should be observed to receive all OAMPDU frames preceding and following the Loopback Control OAMPDU sent by the testing station.
f. The DUT should be observed to send an Information OAMPDU with the State field of the Local Information TLV indicating the change to is local_par_action and local_mux_action.

Possible Problems: None.

Test #57.5.1.3 - Initiation - Simultaneous Initiation

Purpose: To verify that the device under test (DUT) when simultaneously initiating the loopback operation with another OAM device follows the recommended procedures.

References:
[1] IEEE Draft Std. 802.3ah v2.2 – subclause 57.2.11.1

Resource Requirements:
- A testing station capable of transmitting frames with arbitrary values in all fields and capable of monitoring traffic from itself and the DUT.

Last Modification: October 14, 2003

Discussion: OAM provides a data link layer frame-level loopback mechanism that can be remotely controlled by an OAM device. If an Active OAM device initiates loopback operation and while waiting for the confirmation Information OAMPDU from the remote OAM device receives a Loopback Control OAMPDU with the Enable Remote Loopback command instead, the local OAM device is recommended to adhere to the following procedures:

1. If the local OAM device has a higher source address than the remote OAM device, it is to enter loopback operation, at the control of the remote OAM device.
2. If the local OAM device has a lower source address than that of the remote OAM device, it is to ignore the Loopback Control OAMPDU and continue waiting for the Information OAMDPU from the remote OAM device.

This ensures that both devices will not simultaneously place the remote OAM device into loopback mode.

Test Setup: Connect the device under test (DUT) to the pattern generator and monitor ports of the testing station using the appropriate medium.

Procedure:
Part A:

1. The DUT is instructed to initiate the loopback operation and transmit a Loopback Control OAMPDU with the Enable Remote Loopback command (0x01) to the testing station.
2. The testing station is instructed to initiate the loopback operation and transmit a Loopback Control OAMPDU with the Enable Remote Loopback command (0x01) and a source address larger than that of the DUT.

Part B:

3. The DUT is instructed to initiate the loopback operation and transmit a Loopback Control OAMPDU with the Enable Remote Loopback command (0x01) to the testing station.
4. The testing station is instructed to initiate the loopback operation and transmit a Loopback Control OAMPDU with the Enable Remote Loopback command and a source address smaller than that of the DUT.

Observable results:

Part A:

a. The DUT should be observed to respond to the test station with an Information OAMPDU with a State field within the Local Information TLV indicating the local_mux_action set to DISCARD and local_par_action set to LB.

Part B:

b. The DUT should be observed to ignore the Loopback Control OAMPDU and continue to wait for the Information OAMPDU from the remote OAM device.

Possible Problems: None.

Test #57.5.2.1 - During - Active OAM Sends OAMPDUs at least Once a Second

Purpose: To verify that the device under test (DUT) when controlling the loopback operation transmits an OAMPDU at least once a second.

References:

[1] IEEE Draft Std. 802.3ah v2.2 – subclauses 57.2.11.2, 57.3.1.2, Figure 57-6, Figure 57-7

Resource Requirements:

- A testing station capable of transmitting frames with arbitrary values in all fields and capable of monitoring traffic from itself and the DUT.

Last Modification: October 14, 2003

Discussion: OAM provides a data link layer frame-level loopback mechanism that can be remotely controlled by an OAM device. When an OAM device has the remote OAM device looping frames back, the local OAM device is still bound by the rules governing the restart of the OAM Discovery process. As a result the local OAM device must still send at least one OAMPDU per second.

Test Setup: Connect the device under test (DUT) to the pattern generator and monitor ports of the testing station using the appropriate medium.

Procedure:

1. The device under test (DUT) is instructed to initiate loopback operation and transmit a Loopback Control OAMPDU with the Enable Remote Loopback command (0x01) to the testing station.
2. The testing station is instructed to respond with an Information OAMPDU with the State field of the Local Information TLV indicating the local_mux_action set to DISCARD and the local_par_action set to LB.

Observable results:

a. The DUT should be observed to transmit OAMPDUs at a rate of at least once per second.

Possible Problems:

- If the DUT can only be configured for Passive mode operation, then this test cannot be performed.

Test #57.5.2.2 - During – Passive OAM Sends OAMPDUs at least Once a Second

Purpose: To verify that the device under test (DUT) when looping frames back to the remote OAM device, transmits an OAMPDU at least once a second.

References:

[1] IEEE Draft Std. 802.3ah v2.2 – subclauses 57.2.11.2, 57.3.1.2, Figure 57-6, Figure 57-7

Resource Requirements:

- A testing station capable of transmitting frames with arbitrary values in all fields and capable of monitoring traffic from itself and the DUT.

Last Modification: October 14, 2003

Discussion: OAM provides a data link layer frame-level loopback mechanism that can be remotely controlled by an OAM device. When an OAM device is looping frames back to the remote OAM device, the local OAM device is still bound by the rules governing the restart of the OAM Discovery process. As a result the local OAM device must still send at least one OAMPDU per second.

Test Setup: Connect the device under test (DUT) to the pattern generator and monitor ports of the testing station using the appropriate medium.

Procedure:

1. The testing station is instructed to initiate loopback operation and transmit a Loopback Control OAMPDU with the Enable Remote Loopback command (0x01) to the device under test (DUT).
2. The DUT is instructed to respond with an Information OAMPDU with a State field of the Local Information TLV indicating the local_mux_action set to DISCARD and the local_par_action set to LB.

Observable results:

a. The DUT should be observed to transmit OAMPDUs at a rate of at least once per second.

Possible Problems: None.

Test #57.5.2.3 - During – Active OAM Accepts OAMPDUs while in Loopback

Purpose: To verify that the device under test (DUT) when controlling loopback operation accepts OAMPDUs and discards non-OAMPDUs.

References:

[1] IEEE Draft Std. 802.3ah v2.2 – subclauses 57.2.11.2, 57.3.1.2, Figure 57-6, Figure 57-7

Resource Requirements:

- A testing station capable of transmitting frames with arbitrary values in all fields and capable of monitoring traffic from itself and the DUT.

Last Modification: October 14, 2003

Discussion: OAM provides a data link layer frame-level loopback mechanism that can be remotely controlled by an OAM device. When an OAM device has the remote OAM device looping frames back, the local OAM device must still be capable of processing incoming OAMPDUs in order to keep the OAM Discovery process from restarting and to gather any information from the statistics of the remote OAM device via the reception of Variable Response OAMPDUs (if supported). The DUT however should discard any non-OAMPDU frame to keep the MAC client from re-introducing the frame into the network.

Test Setup: Connect the device under test (DUT) to the pattern generator and monitor ports of the testing station using the appropriate medium.

Procedure:

1. The device under test (DUT) is instructed to initiate loopback operation and transmit a Loopback Control OAMPDU with the Enable Remote Loopback command (0x01) to the testing station.
2. The testing station is instructed to respond with an Information OAMPDU with the State field of the Local Information TLV indicating the local_mux_action set to DISCARD and the local_par_action set to LB.
3. The testing station is instructed to transmit OAMPDUs to the DUT.

Observable results:

a. The DUT should be observed to accept OAMPDU and act upon them as necessary.
b. The DUT should be observed to discard and not respond to any looped back frame.

Possible Problems:

- If the DUT can only be configured for Passive mode operation, then this test cannot be performed.

Test #57.5.2.4 - During – Passive OAM Accepts OAMPDUs while in Loopback

Purpose: To verify that the device under test (DUT) when looping back frames back to the remote OAM device can accept and respond to OAMPDUs.

References:

[1] IEEE Draft Std. 802.3ah v2.2 – subclauses 57.2.11.2, 57.3.1.2, Figure 57-6, Figure 57-7

Resource Requirements:

- A testing station capable of transmitting frames with arbitrary values in all fields and capable of monitoring traffic from itself and the DUT.

Last Modification: October 14, 2003

Discussion: OAM provides a data link layer frame-level loopback mechanism that can be remotely controlled by an OAM device. When an OAM device is looping frames back to the remote OAM device, the local OAM device must be capable of accepting and processing OAMPDUs in order to keep the OAM Discovery process from restarting and to report any information from the statistics of the local OAM device via the reception of Variable Request OAMPDUs.

Test Setup: Connect the device under test (DUT) to the pattern generator and monitor ports of the testing station using the appropriate medium.

Procedure:

1. The testing station is instructed to initiate loopback operation and transmit a Loopback Control OAMPDU with the Enable Remote Loopback command (0x01) to the device under test (DUT).
2. The DUT is instructed to respond with an Information OAMPDU with the State field of the Local Information TLV indicating the local_mux_action set to DISCARD and the local_par_action set to LB.
3. The testing station is instructed to transmit OAMPDUs to the DUT.

Observable results:

a. The DUT should be observed to accept OAMPDU and act upon them as necessary.

Possible Problems: None.

Test #57.5.2.5 - During - LoopBack Test Frames

Purpose: To verify that the device under test (DUT) when looping frames back to the remote OAM device does so properly.

References:
[1] IEEE Draft Std. 802.3ah v2.2 – subclauses 57.2.11.2, 57.3.1.2, Figure 57-6, Figure 57-7

Resource Requirements:
- A testing station capable of transmitting frames with arbitrary values in all fields and capable of monitoring traffic from itself and the DUT.

Last Modification: October 14, 2003

Discussion: OAM provides a data link layer frame-level loopback mechanism that can be remotely controlled by an OAM device. When an OAM device is looping frames back to the remote OAM device, the local OAM device is to do so without altering any field of the loopback test frame.

Since the OAM sublayer resides above the MAC and MAC Control sublayers, frames destined for these layers will not be looped back. Also any errored frames (e.g. invalid CRC) should not be passed up by the MAC and therefore should not be looped back.

Test Setup: Connect the device under test (DUT) to the pattern generator and monitor ports of the testing station using the appropriate medium.

Procedure:
Part A:
1. The testing station is instructed to initiate loopback operation and transmit a Loopback Control OAMPDU with the Enable Remote Loopback command (0x01) to the device under test (DUT).
2. The DUT is instructed to respond with an Information OAMPDU with the State field of the Local Information TLV indicating the local_mux_action set to DISCARD and the local_par_action set to LB.
3. The testing station is instructed to transmit 10 ICMP Echo Request frames to be looped back by the DUT.

Part B:
4. Steps 1 and 2 are repeated.
5. The testing station is instructed to transmit a MAC Control frame to the DUT.

Part C:
6. Steps 1 and 2 are repeated.
7. The testing station is instructed to transmit a loopback test frame with an invalid CRC in the FCS field.

Observable results:

Part A:

a. The DUT should be observed to transmit the ICMP Echo Request frames back to the testing station. These frames should be identical to the ICMP Echo Request frames transmitted by the testing station; this includes the same Destination and Source MAC addresses.

Part B:

b. The DUT should be observed to accept the MAC Control frame and not loop the frame back to the testing station.

Part C:

c. The DUT should be observed to discard the frame with an invalid CRC in the FCS field, and, if clause 30 is implemented, log a FCS error.

Possible Problems: None.

Test #57.5.3.1 - Exiting - Active OAM Sends Loopback Control OAMPDU

Purpose: To verify that the device under test (DUT) when controlling loopback operation exit loopback mode properly.

References:

[1] IEEE Draft Std. 802.3ah v2.2 – subclauses 57.2.11.2, 57.3.1.2, Figure 57-6, Figure 57-7

Resource Requirements:

- A testing station capable of transmitting frames with arbitrary values in all fields and capable of monitoring traffic from itself and the DUT.

Last Modification: October 14, 2003

Discussion: OAM provides a data link layer frame-level loopback mechanism that can be remotely controlled by an OAM device. When an OAM device wishes to exit loopback mode, the local OAM device should send a Loopback Control OAMPDU with the Loopback Command field set to Disable Remote Loopback command (0x02). This will notify the remote OAM device that loopback operation is no longer required.

Test Setup: Connect the device under test (DUT) to the pattern generator and monitor ports of the testing station using the appropriate medium.

Procedure:

1. The device under test (DUT) is instructed to initiate loopback operation and transmit a Loopback Control OAMPDU with the Enable Remote Loopback command (0x01) to the testing station.
2. The testing station is instructed to respond with an Information OAMPDU with State field of the Local Information TLV indicating the local_mux_action set to DISCARD and the local_par_action set to LB.
3. The DUT is instructed to transmit 10 valid frames to be looped back by the DUT.
4. The DUT is instructed to exit loopback operation and transmit a Loopback Control OAMPDU with the Disable Remote Loopback command (0x02) to the testing station.

Observable results:

a. The testing station should be observed to loopback the 10 valid frames to ensure that both OAM devices are in loopback mode.
b. The DUT should be observed to transmit a Loopback Control OAMPDU with the Loopback Command field set to the Disable Remote Loopback command (0x02) in order to exit loopback mode.
c. The DUT should be observed to still sink or discard all non-OAMPDU frames sent to it by the testing station.

Possible Problems:

- If the DUT can only be configured for Passive mode operation, then this test cannot be performed.

Test #57.5.3.2 - Exiting - Passive OAM Sends Information OAMPDU

Purpose: To verify that the device under test (DUT) when looping frames back to the remote OAM device is told to stop, it does so properly.

References:

[1] IEEE Draft Std. 802.3ah v2.2 – subclauses 57.2.11.2, 57.2.11.6, 57.3.1.2, Figure 57-6, Figure 57-7

Resource Requirements:

- A testing station capable of transmitting frames with arbitrary values in all fields and capable of monitoring traffic from itself and the DUT.

Last Modification: October 14, 2003

Discussion: OAM provides a data link layer frame-level loopback mechanism that can be remotely controlled by an OAM device. When an OAM device is looping frames back to the remote OAM device, and receives a Loopback Control OAMPDU with the Loopback Command field set to the Disable Remote Loopback command (0x02), the local OAM device has one second to respond with an Information OAMPDU indicating a local_mux_action and local_par_action set to FWD. This is done before the local OAM sublayer actually sets the parameters to FWD. This is done to keep the local OAM device from transmitting frames that may be discarded by the remote OAM device because it has yet to see the confirmation Information OAMPDU.

Test Setup: Connect the device under test (DUT) to the pattern generator and monitor ports of the testing station using the appropriate medium.

Procedure:

1. The testing station is instructed to initiate loopback operation and transmit a Loopback Control OAMPDU with the Enable Remote Loopback command (0x01) to the device under test (DUT).
2. The DUT is instructed to respond with an Information OAMPDU with the State field of the Local Information TLV indicating the local_mux_action set to DISCARD and the local_par_action set to LB.
3. The testing station is instructed to transmit 10 ICMP echo request to be looped back by the DUT.
4. The DUT is instructed to transmit 100 valid frames to the testing station.
5. The testing station is instructed to exit loopback operation and transmit a Loopback Control OAMPDU with the Disable Remote Loopback command (0x02) to the device under test (DUT).

Observable results:

a. The DUT should be observed to loopback the 10 valid frames to ensure that both OAM devices are in loopback mode.

b. The DUT should be observed to transmit the 100 valid frames directly after the reception of the Loopback Control OAMPDU with the Disable Remote Loopback command (0x02).
c. The DUT should be observed to transmit an Information OAMPDU with the State field of the Local Information TLV indicating the local_mux_action and local_par_action set to FWD within one second of receiving the Loopback Control OAMPDU with the Disable Remote Loopback command (0x02).

Possible Problems: None.

Test #57.5.3.3 - Exiting - Active OAM Stops Loopback Operation

Purpose: To verify that the device under test (DUT) when exiting loopback mode receives non-OAMPDUs.

References:
[1] IEEE Draft Std. 802.3ah v2.2 – subclauses 57.2.11.2, 57.3.1.2, Figure 57-6, Figure 57-7

Resource Requirements:
- A testing station capable of transmitting frames with arbitrary values in all fields and capable of monitoring traffic from itself and the DUT.

Last Modification: October 14, 2003

Discussion: OAM provides a data link layer frame-level loopback mechanism that can be remotely controlled by an OAM device. When an OAM device has started the process of exiting loopback mode and is waiting for a confirmation Information OAMPDU from the remote OAM device, the local OAM device should still discard and not respond to frames from the remote OAM device. However once an Information OAMPDU confirming the exit of loopback operation is received, the local OAM device sets its local_mux_action and local_par_action to FWD. This allows the local OAM device to receive non-OAMPDU frames.

Test Setup: Connect the device under test (DUT) to the pattern generator and monitor ports of the testing station using the appropriate medium.

Procedure:
1. The device under test (DUT) is instructed to initiate loopback operation and transmit a Loopback Control OAMPDU with the Enable Remote Loopback command (0x01) to the testing station.
2. The testing station is instructed to respond with an Information OAMPDU with the State field of the Local Information TLV indicating the local_mux_action set to DISCARD and the local_par_action set to LB.
3. The DUT is instructed to transmit 15 valid frames to be looped back by the DUT.
4. The DUT is instructed to exit loopback operation and transmit a Loopback Control OAMPDU with the Disable Remote Loopback command (0x02) to the testing station.
5. The testing station is instructed to transmit an Information OAMPDU with the State field of the Local Information TLV indicating the local_mux_action and local_par_action set to FWD, preceded and followed by 10 valid non-OAMPDU frames.

Observable results:
a. The DUT should be observed to loopback the 15 valid frames to ensure that both OAM devices are in loopback mode.
b. The DUT should be observed to discard the 10 valid non-OAMPDU frames preceding the Information OAMPDU with the State field of the Local Information TLV indicating the local_mux_action and local_par_action set to FWD.

c. The DUT should be observed to accept the 10 valid non-OAMPDU frames following the Information OAMPDU with the State field of the Local Information TLV indicating the local_mux_action and local_par_action set to FWD.

Possible Problems:

- If the DUT can only be configured for Passive mode operation, then this test cannot be performed.