# Gigabit Ethernet Consortium
## Clause 4 MAC Conformance Test Suite v4.4 Report

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Enclosed are the results from the Clause 4 MAC Conformance testing performed on:

| | |
|---|---|
| Device Under Test (DUT): | Gigabit Router 9000 |
| Hardware Version: | 24-Port expansion module |
| Firmware Version: | N/A |
| Software Version: | N/A |
| Miscellaneous: | Tested on Port 1, 24 |

The test suite referenced in this report is available at the UNH-IOL website:

ftp://ftp.iol.unh.edu/pub/ethernet/test_suites/MAC/MAC_Test_Suite_v4.4.pdf

| Issues Observed While Testing |
|---|
| 4.1.3 – Reception of Frames Greater than the Maximum Permitted Frame– The DUT was observed to forward untagged frames up to 1522 bytes in length |
| 4.1.4 – Frames with Length Errors – The DUT was observed to forward 64 byte frames that contained invalid length/type fields ranging from 47 to 1500 |

For specific details regarding issues please see the corresponding test result.

Testing Completed 02/08/2006

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## Result Key

The following table contains possible results and their meanings:

| Result | Interpretation |
|---|---|
| **PASS** | The Device Under Test (DUT) was observed to exhibit conformant behavior. |
| **PASS with Comments** | The DUT was observed to exhibit conformant behavior however an additional explanation of the situation is included, such as due to time limitations only a portion of the testing was performed. |
| **FAIL** | The DUT was observed to exhibit non-conformant behavior. |
| **Warning** | The DUT was observed to exhibit behavior that is not recommended. |
| **Informative** | Results are for informative purposes only and are not judged on a pass or fail basis. |
| **Refer to Comments** | From the observations, a valid pass or fail could not be determined. An additional explanation of the situation is included. |
| **Not Applicable** | The DUT does not support the technology required to perform these tests. |
| **Not Available** | Due to testing station or time limitations, the tests could not be performed. |
| **Borderline** | The observed values of the specified parameters are valid at one extreme, and invalid at the other. |
| **Not Tested** | Not tested due to the time constraints of the test period. |

## GROUP 1: Errors During Reception

| Test # and Label | Part(s) | Result(s) |
|---|---|---|
| 4.1.1 – Reception of FCS Errors | **a** | **PASS** |
| | **b** | **PASS** |

**Expected Results and Procedural Comments**

Purpose: To verify that the device under test detects frames with FCS errors and reports a frameCheckError.

a. The DUT should detect the frames with invalid FCS fields, and log a FCS error for each invalid frame in the statistics of the DUT. The reception of the valid request frames should not be affected.
b. The reception of FCS errors should not interfere with the reception of valid MAC frames.

**Comments on Test Results**

a. The DUT did not forward frames with an invalid CRC. It correctly reported these as “Rx CRC error frames”.
b. The reception of FCS did not interfere with the reception of valid MAC frames.

| Test # and Label | Part(s) | Result(s) |
|---|---|---|
| 4.1.2 – Reception of Fragments and Runts | **a** | **PASS** |
| | **b** | **PASS** |
| | **c** | **PASS** |

**Expected Results and Procedural Comments**

Purpose: To verify that the device under test discards collision fragments. In half-duplex and non-burst mode, a frame less than slotTime in length is considered to be a fragment. In full-duplex mode, a frame less than minFrameSize is considered a fragment.

a. While in full duplex mode, the DUT should discard all fragments and runts less than 64 bytes in length. While in half duplex mode, the DUT should discard all fragments and runts less than slotTime in length (4096 bit times). Due to time limitations only a few fragments and runts were tested.
b. The DUT should properly handle each of the sequences listed below (i.e. discard fragments and accept valid frames)
    1. 7 octets of preamble
    2. 7 octets of preamble and SFD
    3. 7 octets of preamble, SFD and the MAC address of the DUT
    4. 7 octets of preamble, SFD, the MAC address of the DUT and the an arbitrary source address
    5. 6 octets of preamble, SFD, and a 511 byte runt
    6. A 512 byte frame, 12 bytes of extension bits, a 42 byte runt, 12 bytes of extension bits and 64 byte frame
    7. A 42 byte runt, 12 bytes of extension bits and a 511 byte frame (full duplex only)
    8. A 64 byte frame extended to 511 bytes
c. The reception of fragments or runts should not interfere with the reception of valid MAC frames.

**Comments on Test Results**

a. All fragments and runts were discarded by the DUT. The DUT reported each fragment as a “Fragments”.
b. The DUT properly handle each frame as listed below.
    1. The DUT discarded the fragment consisting of: 7 octets of preamble
    2. The DUT discarded the fragment consisting of: 7 octets of preamble and SFD
    3. The DUT discarded the fragment consisting of: 7 octets of preamble, SFD and the MAC address of the DUT
    4. The DUT discarded the fragment consisting of: 7 octets of preamble, SFD, the MAC address of the DUT and the an arbitrary source address
    5. The 511 byte frame with 6 octets of preamble and an SFD was accepted
    6. The 512 byte frame and the 64 byte frame were both accepted while the 42 byte runt was discarded
    7. The 511 byte frame was accepted while the 42 byte runt was discarded
    8. The 64 byte frame with 447 bytes of extension was accepted
c. The reception of fragments or runts did not interfere with the reception of valid MAC frames.

| Test # and Label | Part(s) | Result(s) |
|---|---|---|
| 4.1.3 – Reception of Frames Greater than the Maximum Permitted Frame Size | **a** | **FAIL** |
| | **b** | **PASS** |
| | **c** | **PASS** |
| | **d** | **PASS** |

**Expected Results and Procedural Comments**

Purpose: To verify that the device under test (DUT) discards frames greater than maxFrameSize.

a. DUT should discard or truncate though not transmit, untagged frames greater than 1518 bytes in length
b. DUT should discard or truncate though not transmit, tagged frames greater than 1522 bytes in length
c. The DUT should discard or truncate and respond to the test frames containing two CRC values. The DUT shall not transmit, untagged frames greater than 1518 bytes in length. If the DUT accepted these test frames and discarded the test frames of the same size in part A, then the DUT must truncate and respond to the test frames of the same size with a valid CRC value in bytes 1515 – 1518 and an invalid CRC in the last 4 bytes of the frame. (Otherwise this would indicate that the DUT improperly checked the CRC value twice, once before truncation and once after.) The DUT may optionally log the test frames as frameTooLong errors.
d. All valid frames preceding and following the test frames should be replied to.

**Comments on Test Results**

a. The DUT was observed to forward untagged frames up to 1522 bytes in length. A device should never transmit an untagged frame greater than 1518 bytes in length. The DUT was observed to discard untagged frames greater than 1522 bytes in length; these frames were reported as “Oversized Frames”.
b. The DUT was observed to discard tagged frames greater than 1522 bytes in length. These frames were reported as “Oversized Frames”.
c. The DUT was observed to discard the 1534 byte untagged frame that contained a valid 1518 byte frame.
d. The reception of the test frames did not interfere with the reception of valid MAC frames.

| Test # and Label | Part(s) | Result(s) |
|---|---|---|
| 4.1.4 – Frames with Length Errors | **a** | **FAIL** |
| | **b** | **PASS** |

**Expected Results and Procedural Comments**

Purpose: To verify that the device under test (DUT) discards frames where the length value in the Length/Type field is larger than the length of the data field.

a. The DUT should discard all frames with invalid length values.
b. All valid frames preceding and following the test frames should be replied to.

**Comments on Test Results**

a. The DUT was observed to forward 64 byte frames that contained invalid length/type fields ranging from 47 to 1500.
b. The reception of the test frames did not interfere with the reception of valid MAC frames.

| Test # and Label | Part(s) | Result(s) |
|---|---|---|
| 4.1.5 – Receive Frames with Excess Pad | **a** | **Informative** |
| | **b** | **PASS** |

**Expected Results and Procedural Comments**

Purpose: To verify that the device under test (DUT) accepts frames with excessive padding and properly removes unnecessary padding.

a. The DUT should accept each test frame and reply with a frame that does not contain padding.
b. All valid frames preceding and following the test frames should be replied to.

**Comments on Test Results**

a. The DUT was observed to forward all 64 byte frames that contained excess pad ranging from 1 to 1454 bytes.
b. The reception of the test frames did not interfere with the reception of valid MAC frames.

| Test # and Label | Part(s) | Result(s) |
|---|---|---|
| 4.1.6 – Jabber Frame Reception and Recovery | **a** | **PASS** |
| | **b** | **PASS** |

**Expected Results and Procedural Comments**

Purpose: To verify that the device under test (DUT) is able to withstand and recover from the reception of worst-case jabber transmissions.

a. The DUT should discard jabber frames.
b. All valid frames preceding and following the test frames should be replied to.

**Comments on Test Results**

a. The DUT was observed to properly discard a 13500 byte jabber frame. This frame was reported as a "frameTooLong" error.
b. The reception of the test frames did not interfere with the reception of valid MAC frames.

| Test # and Label | Part(s) | Result(s) |
|---|---|---|
| 4.1.7 – Start of Frame Delimiter Error Reception and Recovery | **a** | **PASS** |
| | **b** | **PASS** |
| | **c** | **PASS** |

**Expected Results and Procedural Comments**

Purpose: To verify that the device under test (DUT) discards frames which do not contain a valid Start of Frame Delimiter (SFD).

a. The DUT should discard a test frame where the SFD is replaced by another byte of preamble (bit pattern 10101010) in an otherwise valid frame.
b. The DUT should discard a test frame where the bit pattern 10011011 replaces the SFD in an otherwise valid frame.
c. All valid frames preceding and following the test frames should be replied to.

**Comments on Test Results**

a. The DUT was observed to discard the frame with 8 bytes of preamble and no SFD.
b. The DUT was observed to discard the frame with 7 bytes of preamble and 10011011 in place of a SFD.
c. The reception of the test frames did not interfere with the reception of valid MAC frames.

| Test # and Label | Part(s) | Result(s) |
|---|---|---|
| 4.1.8 – Frames with Alignment Errors | **a** | **Not Applicable** |
| This test is not applicable at 1000Mb/s. | | |

| Test # and Label | Part(s) | Result(s) |
|---|---|---|
| 4.1.9 – Preamble Error Reception and Recovery | **a** | **PASS** |
| | **b** | **PASS** |
| | **c** | **PASS** |
| | **d** | **PASS** |

**Expected Results and Procedural Comments**

Purpose: To verify that the device under test (DUT) accepts frames which contain errors with preamble.

a. The DUT should accept a frame, which has preamble replaced with:
10101010 10101010 00000000 00000000 00000000 00000000 00000000 10101011
b. The DUT should accept a frame, which has preamble replaced with:
10101010 10101010 01111111 11111111 11111111 11111111 11111111 10101011
c. The DUT should accept a frame, which has preamble replaced with:
10101010 10101010 10101010 10101010 10101010 10101000 10101111 10101011
d. All valid frames preceding and following the test frames should be replied to.

**Comments on Test Results**

a. The DUT was observed to accept the frame with preamble replaced with above-mentioned sequence.
b. The DUT was observed to accept the frame with preamble replaced with above-mentioned sequence.
c. The DUT was observed to accept the frame with preamble replaced with above-mentioned sequence.
d. The reception of the test frames did not interfere with the reception of valid MAC frames.

## GROUP 2: Encapsulation and De-capsulation

| Test # and Label | Part(s) | Result(s) |
|---|---|---|
| 4.2.1 – Transmit proper SFD and preamble | **a** | **PASS** |
| **Expected Results and Procedural Comments** | | |
| Purpose: To verify that the device under test (DUT) properly encapsulates a frame with preamble and SFD, and that the combination of the two is 8 bytes.<br><br>The DUT should always encapsulate frames with a combined 8 bytes of preamble and SFD. | | |
| **Comments on Test Results** | | |
| a. The DUT was not observed to transmit any frames without a combined 8 bytes of preamble and SFD. | | |

| Test # and Label | Part(s) | Result(s) |
|---|---|---|
| 4.2.2 – Transmission of Minimum interFrameGap | **a** | **PASS** |
| **Expected Results and Procedural Comments** | | |
| Purpose: To verify that the device under test (DUT) enforces the minimum interFrameGap (IFG) of 96 bit times.<br><br>The DUT should not transmit frames separated by less than minimum IFG, even under the most stressful situations. | | |
| **Comments on Test Results** | | |
| a. The DUT was not observed to violate the minimum IFG of 96 bit times. For a group of ten frames sent to the DUT, the DUT was observed to reply to these frames by transmitting all replies with an IFG of 96 bit times. | | |

| Test # and Label | Part(s) | Result(s) |
|---|---|---|
| 4.2.3 – Transmit proper length with the Length/Type Field | **a** | **PASS** |
| **Expected Results and Procedural Comments** | | |
| Purpose: To verify that the device under test (DUT) properly calculates the length of the data in the Data/Pad field.<br><br>The DUT should transmit 802.3 Ethernet frames with a length value equal to the amount of data in the Data/Pad field. If the frame is greater than minFrameSize that frame should not contain pad. | | |
| **Comments on Test Results** | | |
| a. The DUT was observed to transmit frames with length values ranging from 46 to 1500. | | |

| Test # and Label | Part(s) | Result(s) |
|---|---|---|
| 4.2.4 – Compute and transmit proper CRC | **a** | **PASS** |
| **Expected Results and Procedural Comments** | | |
| Purpose: To verify that the device under test (DUT) correctly calculates the CRC-32 value for the frame being transmitted and assigns it to the FCS field.<br><br>The CRC-32 value transmitted by the DUT should match the value calculated by the testing station. | | |
| **Comments on Test Results** | | |
| a. The CRC calculated by the DUT was verified to be correct by 2 different testing platforms. | | |

| Test # and Label | Part(s) | Result(s) |
|---|---|---|
| 4.2.5 – Receive variable preamble | **a** | **PASS** |
| **Expected Results and Procedural Comments** | | |
| Purpose: To verify that the device under test (DUT) accepts frames with varied amounts of preamble.<br><br>The DUT should accept frames with 2 to 64 bytes of preamble and an SFD. | | |
| **Comments on Test Results** | | |
| a. The DUT was observed to accept frames with 2 to 64 of preamble and an SFD. | | |

| Test # and Label | Part(s) | Result(s) |
|---|---|---|
| 4.2.6 – Receive all Frame Sizes | **a** | **PASS** |
| | **b** | **PASS** |
| **Expected Results and Procedural Comments** | | |
| Purpose: To verify that the device under test (DUT) accepts all valid sized frames.<br><br>a. The DUT should accept all valid untagged frames from minFrameSize (64 bytes) to maxUntaggedFrameSize (1518 bytes).<br>d. If VLAN tagging is supported, the DUT should accept all tagged frames from minFrameSize (64 bytes) to maxUntaggedFrameSize + qTagPrefixSize (1522 bytes) | | |
| **Comments on Test Results** | | |
| a. The DUT was observed to forward all untagged frames ranging from minFrameSize to maxUntaggedFrameSize.<br>b. The DUT was observed to forward all tagged frames ranging from minFrameSize to maxUntaggedFrameSize + qTagPrefixSize. | | |

| Test # and Label | Part(s) | Result(s) |
|---|---|---|
| 4.2.7 – Reception of minimum interFrameGap | **a** | **PASS** |
| **Expected Results and Procedural Comments** | | |

Purpose: To verify that device under test (DUT) is capable of receiving frames separated by a minimum interFrameGap

The DUT should accept two frames separated by minimum IFG (96 bit times).

**Comments on Test Results**

a. The DUT was observed to accept both frames that were separated by a minimum IFG.

| Test # and Label | Part(s) | Result(s) |
|---|---|---|
| 4.2.8 – Compute and Transmit Proper Extension | **a** | **PASS** |
| **Expected Results and Procedural Comments** | | |

Purpose: To verify that the device under test (DUT) transmits frames with the correct amount of extension.

The DUT should transmit frames less than slotTime in length with [slotTime – frame size] worth of extension bits.

**Comments on Test Results**

a. The DUT was observed to transmit the correct amount of extension.

| Test # and Label | Part(s) | Result(s) |
|---|---|---|
| 4.2.9 – Receive Frames with Extension | **a** | **PASS** |
| | **b** | **PASS** |
| **Expected Results and Procedural Comments** | | |

Purpose: To verify that the device under test (DUT) accepts frames with carrier extension.

a. The DUT should accept all frames with extension as long as they are greater than minFrameSize in length.
   1. 64-byte frame with 448 bytes of extension
   2. 64-byte frame with 1454 bytes of extension
   3. 65-byte frame with 1 byte of extension
   4. 256-byte frame with 256 bytes of extension
   5. 256-byte frame with 1000 bytes of extension
   6. 511-byte frame with 1 byte extension
   7. 512-byte frame with 1006 bytes of extension
   8. 1517-byte frame with 1 byte extension

a. All valid frames preceding and following the test frames should be replied to.

**Comments on Test Results**

a. The DUT was observed to accept all frames with extension.
b. The reception of the test frames did not interfere with the reception of valid MAC frames.

## GROUP 3: Full Duplex

| Test # and Label | Part(s) | Result(s) |
|---|---|---|
| 4.3.1 – Does not Defer | **a** | **Not Available** |
| **Expected Results and Procedural Comments** | | |
| Purpose: To verify that the device under test (DUT) does not defer to carrier sense while in full duplex mode.<br><br>The DUT should not defer the transmission of a frame in waiting to a long carrier event while in full duplex mode. | | |
| **Comments on Test Results** | | |
| This test is currently under development. | | |

| Test # and Label | Part(s) | Result(s) |
|---|---|---|
| 4.3.2 – No Collisions | **a** | **PASS** |
| **Expected Results and Procedural Comments** | | |
| Purpose: To verify that no collisions occur when the device under test (DUT) is in full duplex mode.<br><br>The DUT should not detect and enforce a collision when frames are being transmitted and received simultaneously in full duplex mode. | | |
| **Comments on Test Results** | | |
| a. No collisions or collision fragments were observed. | | |

| Test # and Label | Part(s) | Result(s) |
|---|---|---|
| 4.3.3 – No Extension | **a** | **PASS** |
| **Expected Results and Procedural Comments** | | |
| Purpose: To verify that the device under test (DUT) does not add extension to valid frames that are less than slotTime when in full duplex mode.<br><br>In full-duplex mode transmitted frames have only to meet minFrameSize in length. As a result carrier extension is not necessary to provide a means by which the slotTime can be increased. It is, therefore, unnecessary to transmit extension while in full-duplex mode. | | |
| **Comments on Test Results** | | |
| a. No extension was observed. | | |

| Test # and Label | Part(s) | Result(s) |
|---|---|---|
| 4.3.4 – No Bursting | **a** | **PASS** |
| **Expected Results and Procedural Comments** | | |
| Purpose: To verify that the device under test (DUT), while in full duplex mode, does not go into burst mode when it has acquired the medium and there are still frames to send.<br><br>Burst mode is only applicable to half-duplex mode of operation. In full duplex mode, once a frame has been successfully transmitted, another frame may be transmitted without the transmitting station contending for the medium because the station only needs to defer to its own transmission to enforce minimum interFrameGap. | | |
| **Comments on Test Results** | | |
| a. No bursts were observed. | | |

## GROUP 4: Collision Behavior

| Test # and Label | Part(s) | Result(s) |
|---|---|---|
| 4.4.1 – Collisions During Preamble and SFD within slotTime | **a** | **Informative** |
| | **b** | **Informative** |

**Expected Results and Procedural Comments**

Purpose: To verify that the device under test (DUT) properly detects and enforces collisions that occur during the transmission of preamble and SFD while within slotTime.

a. The DUT should detect the collision, complete transmission of preamble and SFD, and transmit a 32-bit jam pattern.
b. The DUT should attempt to retransmit the frame involved in the collision.

**Comments on Test Results**

a. The DUT detected the collision event, completed transmission of preamble and SFD, transmitted destination address, transmitted a 32-bit jam pattern (0xAAAAAAAA) followed by Idle.*
b. The DUT was observed to retransmit the frame.

*With devices that have internal signal delays that are close to the maximum delays defined by the standard, it may be impossible to create a collision where the jam is transmitted directly after the SFD. Unfortunately without access to the GMII it is not possible at this time to determine that whether or not this is a result of signal delays or a possible issue with deference. Regardless the device was never observed to detect a collision in preamble or SFD (i.e. transmit a fragment consisting of nothing but preamble, SFD and jam).

| Test # and Label | Part(s) | Result(s) |
|---|---|---|
| 4.4.2 – Collisions in Data within slotTime | **a** | **PASS** |
| | **b** | **PASS** |

**Expected Results and Procedural Comments**

Purpose: To verify that the device under test (DUT) properly detects and enforces collisions that occur during the transmission of data while with slotTime.

a. The DUT should detect the collision, cease transmission of data and transmit a 32-bit jam pattern.
b. The DUT should attempt to retransmit the frame involved in the collision.

**Comments on Test Results**

a. The DUT was observed to detect the collision, cease transmission of data and transmit a 32-bit jam pattern.
b. The DUT was observed to retransmit the frame.

| Test # and Label | Part(s) | Result(s) |
|---|---|---|
| 4.4.3 – Collisions in Data Outside of slotTime while Not Bursting | **a** | **PASS** |
| | **b** | **PASS** |

**Expected Results and Procedural Comments**

Purpose: To verify that the device under test (DUT) properly detects and enforces collisions that occur during the transmission of data outside of slotTime while not in burst mode.

a. The DUT should detect the late collision, cease transmission of data and transmit a 32-bit jam pattern.
b. The DUT should not attempt to retransmit the frame involved in the collision, because a device may not attempt to retransmit after a late collision at 1000Mb/s.

**Comments on Test Results**

a. The DUT was observed to detect the collision, cease transmission of data and transmit a 32-bit jam pattern.
b. The DUT did not attempt to retransmit the frame involved in the collision.

| Test # and Label | Part(s) | Result(s) |
|---|---|---|
| 4.4.4 – Collisions during Extension within slotTime | **a** | **PASS** |
| | **b** | **PASS** |

**Expected Results and Procedural Comments**

Purpose: To verify that the device under test (DUT) properly detects and enforces collisions that occur during the transmission of carrier extension within slotTime.

a. The DUT should detect the collision, cease transmission of extension bits and transmit a 32-bit jam pattern that consists of extension error bits.
b. The DUT should attempt to retransmit the frame involved in the collision.

**Comments on Test Results**

a. The DUT was observed to detect the collision, cease transmission of extension bits and transmit 32-bits of extension error bits.
b. The DUT was observed to retransmit the frame.

| Test # and Label | Part(s) | Result(s) |
|---|---|---|
| 4.4.5 – Collision during Preamble and SFD outside of slotTime (Burst Mode) | **a** | **PASS** |
| | **b** | **PASS** |

**Expected Results and Procedural Comments**

Purpose: To verify that the device under test (DUT) properly detects and enforces collisions that occur during the transmission of preamble and SFD outside of slotTime. This may only occur in burst mode while outside of the initial frame.

a. The DUT should properly transmit all frames in the burst prior to the frame involved in the collision. Upon detecting a collision during preamble or SFD the DUT should complete transmission of preamble and SFD and transmit a 32-bit jam pattern.
b. The DUT should not attempt to retransmit the frame involved in the collision, because a device may not attempt to retransmit after a late collision at 1000Mb/s.

**Comments on Test Results**

a. The DUT was observed to properly transmit all frames in the burst prior to the frame involved in the collision. The DUT was observed to detect the collision, complete transmission of preamble and SFD, and transmit a 32-bit jam pattern.
b. The DUT did not attempt to retransmit the frame involved in the collision.

| Test # and Label | Part(s) | Result(s) |
|---|---|---|
| 4.4.6 – Collisions during Data outside of slotTime (Burst Mode) | **a** | **PASS** |
| | **b** | **PASS** |

**Expected Results and Procedural Comments**

Purpose: To verify that the device under test (DUT) properly detects and enforces collisions that occur during the transmission of data outside of slotTime and outside the initial frame in burst mode.

a. The DUT should properly transmit all frames in the burst prior to the frame involved in the collision. Upon detecting a collision during data the DUT should cease transmitting data and transmit a 32-bit jam pattern.
b. The DUT should not attempt to retransmit the frame involved in the collision, because a device may not attempt to retransmit after a late collision at 1000Mb/s.

**Comments on Test Results**

a. The DUT was observed to properly transmit all frames in the burst prior to the frame involved in the collision. The DUT was observed to detect the collision, cease transmitting data and transmit a 32-bit jam pattern.
b. The DUT did not attempt to retransmit the frame involved in the collision.

| Test # and Label | Part(s) | Result(s) |
|---|---|---|
| 4.4.7 – Collisions during Data outside of slotTime (Burst Mode) | **a** | **PASS** |

**Expected Results and Procedural Comments**

Purpose: To verify that the device under test (DUT) properly detects and enforces collisions that occur during the transmission of IFG (extension bits) within a burst.

The DUT should properly transmit all frames but should discontinue transmitting in burst mode after a collision that occurs during IFG. The DUT may transmit the remaining frames in a separate burst or individually.

**Comments on Test Results**

a. The DUT was observed to exit burst mode upon detecting a collision during IFG. All frames were properly transmitted by the DUT.

## GROUP 5: Deference Process

| Test # and Label | Part(s) | Result(s) |
|---|---|---|
| 4.5.1 – Defer to Carrier Sense while Frame Waiting | **a** | **Not Available** |
| **Expected Results and Procedural Comments** | | |
| Purpose: To verify that the device under test (DUT) defers to carrier sense when it has a frame waiting to be transmitted.<br><br>While in half duplex, the DUT should delay the transmission of a frame in waiting until the completion of a long carrier event | | |
| **Comments on Test Results** | | |
| This test is currently under development. | | |

| Test # and Label | Part(s) | Result(s) |
|---|---|---|
| 4.5.2 – Deference after Collision | **a** | **Not Available** |
| **Expected Results and Procedural Comments** | | |
| Purpose: To verify that the device under test (DUT) continues to observe the deference process when it is attempting to retransmit after a collision.<br><br>After a collision has occurred, in half duplex, the DUT should delay any retransmission attempts until carrier sense is no longer asserted. | | |
| **Comments on Test Results** | | |
| This test is currently under development. | | |

| Test # and Label | Part(s) | Result(s) |
|---|---|---|
| 4.5.3 – InterFrame Spacing | **a** | **Not Available** |
| **Expected Results and Procedural Comments** | | |
| Purpose: To verify that the device under test (DUT) observes the 2/3 rule for interFrameSpacing.<br><br>While in half duplex, the DUT should cause a collision to occur if carrier sense is assert during interFrameSpacingPart2, which should be at least the last third of IFS but may be as large as IFS (96 bit times). By observing when the DUT starts causing collisions it is possible to determine the size of interFrameSpacing parts 1 and 2. The interFrameSpacingPart1 of the DUT should not be greater than 2/3 of IFS (64 bit times). | | |
| **Comments on Test Results** | | |
| This test is currently under development. | | |

## GROUP 6: Backoff

| Test # and Label | Part(s) | Result(s) |
|---|---|---|
| 4.6.1 – Retransmission Attempt Limit | **a** | **PASS** |
| **Expected Results and Procedural Comments** | | |

Purpose: To verify that the device under test (DUT) allows a maximum of 15 attempts for retransmission after a collision.

After a collision has occurred the DUT should attempt to retransmit the frame involved in the collision. Should multiple collisions occur during the attempted transmission of a frame, the DUT should continue to attempt to retransmit the frame until the number of attempts equals attemptLimit (16). The DUT should, therefore, not attempt to transmit a frame more than 16 times (initial attempt + 15 retransmission attempts).

**Comments on Test Results**

a. The DUT did not attempt to retransmit a frame more than 15 times after multiple collisions. Upon multiple collisions the testing station captured a total of 16 collision fragments.

| Test # and Label | Part(s) | Result(s) |
|---|---|---|
| 4.6.2 – Truncated Binary Exponential BackOff Test | **a** | **PASS** |
| | **b** | **PASS** |
| **Expected Results and Procedural Comments** | | |

Purpose: To verify that the device under test (DUT) correctly calculates the time to wait before attempting retransmission of a frame.

a. The combined average backOff time for each backOff attempt should not be more aggressive than the expected average for that attempt.
b. The variable 'r' should be a uniformly distributed random number in the range of $[0, 2^k - 1]$ where k=min(n,10).

**Comments on Test Results**

a. The average backoff for the retransmission attempts was not observed to be significantly more aggressive than the allowable range.
b. According to the histogram data we can say with over a 99% Confidence level that the backoff times chosen were uniformly distributed over the standard specified backoff rangess. For further information please refer to the enclosed histograms. If you would like a copy of the gathered data please let us know.

## GROUP 7: Frame Bursting

| Test # and Label | Part(s) | Result(s) |
|---|---|---|
| 4.7.1 – Interframe Fill | **a** | **PASS** |
| **Expected Results and Procedural Comments** | | |
| Purpose: To verify that the device under test (DUT) transmits the proper number of extension bits between frames within a burst.<br><br>The DUT should transmit 12 bytes of extension bits between frames in a burst. | | |
| **Comments on Test Results** | | |
| a. The DUT was observed to transmit 12 bytes of extension bits between each frame in a burst. | | |

| Test # and Label | Part(s) | Result(s) |
|---|---|---|
| 4.7.2 – Burst Limit | **a** | **Informative** |
| **Expected Results and Procedural Comments** | | |
| Purpose: To verify that the device under test (DUT) enforces the burst timer of 64Kb (65536).<br><br>When the DUT is transmitting frames while in Burst Mode and the burst timer expires, the DUT should complete transmission of the current frame and then exit Burst Mode. | | |
| **Comments on Test Results** | | |
| a. The DUT was not observed to transmit bursts burstLimit in length. Therefore, it could not be determined whether or not the DUT transmitted bursts that exceeded burstLimit minus one (65535 bits), plus header size (64 bits), plus maxFrameSize (12144 bits), which is the maximum carrier event. | | |

| Test # and Label | Part(s) | Result(s) |
|---|---|---|
| 4.7.3 – Receive Frame Bursts | **a** | **PASS** |
| | **b** | **PASS** |

**Expected Results and Procedural Comments**

Purpose: To verify that the device under test (DUT) accepts frame bursts while in full duplex mode.

a. The DUT should accept each frame in the following bursts:
   1. 512 byte frame, 12 bytes of extension bits, and a 64 byte frame
   2. 64 byte frame with 448 bytes of extension, 12 bytes of extension bits, and a 64 byte frame
   3. 64 byte frame, 12 bytes of extension bits, and a 64 byte frame
   4. Five 1518 byte frames, 482 byte frame and another 1518 byte frame (each separated by 12 bytes of extension bits)
b. All valid frames preceding and following the test frames should be replied to.

**Comments on Test Results**

a. In full duplex mode, the DUT was observed to accept all frames in each burst. In half duplex mode, the DUT was observed to accept all frames in each burst as long as the initial frame in the burst was at least slotTime (512 bytes) in length.
b. The reception of the test frames did not interfere with the reception of valid MAC frames.

| Test # and Label | Part(s) | Result(s) |
|---|---|---|
| 4.7.4 – Reception of Bursts with Initial Frame Less than slotTime | **a** | **PASS** |

**Expected Results and Procedural Comments**

Purpose: To verify that the device under test (DUT) properly discards all frames in a burst received prior to slotTime. In half duplex mode, the first frame in a burst is required to be slotTime in length. The receive MAC should discard all frames received before slotTime is reached because the inner loop of the *BitReceiver* is not exited until slotTime is reached and a frame ends; all data bits received up till that point are concatenated onto each other, even if they span multiple frames.

The test bursts sent to the DUT and the results can be found below.

**Comments on Test Results**

a. The DUT discarded bursts in which the initial frame was less than slotTime in length. In addition, the DUT was observed to discard the second frame in a burst when less than 11 bytes of extension separated it from the initial frame. The DUT was observed to handle each burst as indicated below:

| # | Test Burst | Behavior |
|---|---|---|
| 1 | 500 byte frame, 12 bytes of extension, 64 byte frame | Discarded both frames |
| 2 | 501 byte frame, 12 bytes of extension, 64 byte frame | Replied to first frame |
| 3 | 510 byte frame, 12 bytes of extension, 64 byte frame | Replied to first frame |
| 4 | 511 byte frame, 12 bytes of extension, 64 byte frame | Replied to both frames |
| 5 | 64 byte frame, 447 bytes of extension, 64 byte frame | Discarded both frames |
| 6 | 64 byte frame, 448 bytes of extension, 64 byte frame | Replied to first frame |
| 7 | 64 byte frame, 458 bytes of extension, 64 byte frame | Replied to first frame |
| 8 | 64 byte frame, 459 bytes of extension, 64 byte frame | Replied to both frames |
| 9 | 64 byte frame, 12 bytes of extension, 435 byte frame, 12 bytes of extension, 64 byte frame | Replied to last frame only |
| 10 | 64 byte frame, 12 bytes of extension, 436 byte frame, 12 bytes of extension, 64 byte frame | Replied to last frame only |
| 11 | 46 byte frame, 12 bytes of extension, 512 byte frame, 12 bytes of extension, 64 byte frame | Replied to last frame only |
| 12 | 64-byte frames each separated by 12 bytes of extension | Replied to last frame only |

# Annex A: Test Setup 1

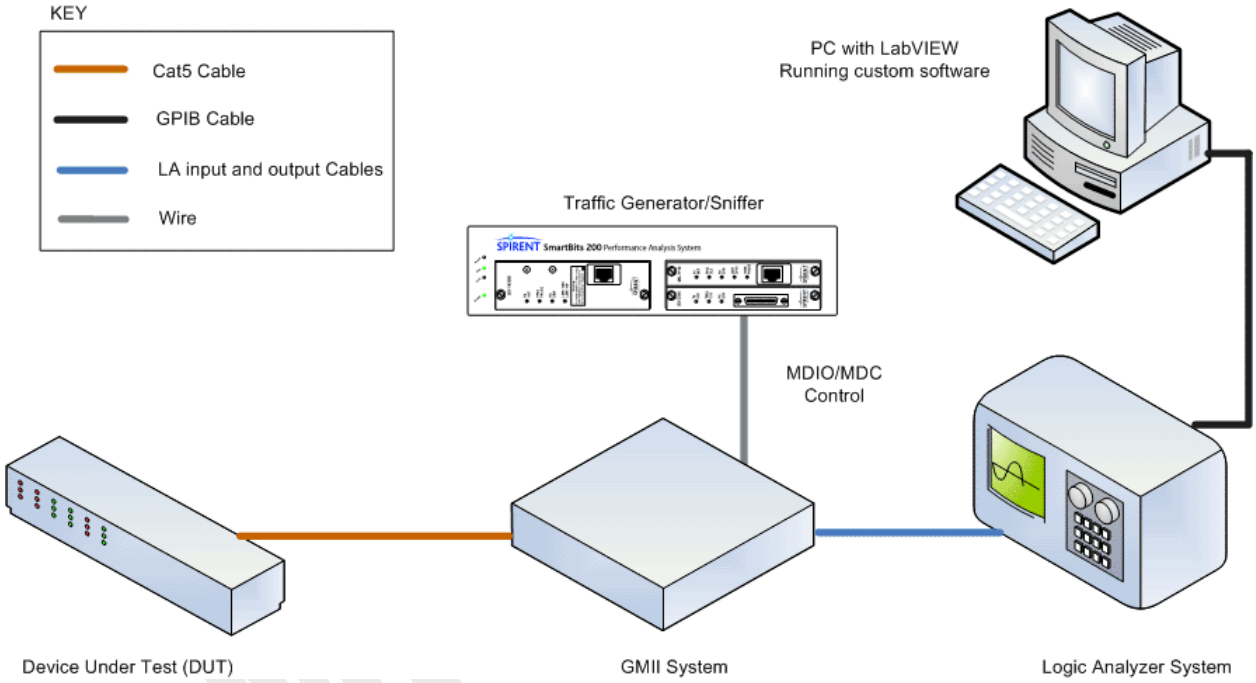
### Test Equipment

The following test equipment was used in performing Clause 4 MAC testing:

| Testing Equipment | Brand and Version Information |
|---|---|
| PC Requirements | Win2K with LabVIEW 7.1 and GPIB interface |
| Software | Spirent SmartWindows v8.00.162 |
| Traffic Generator/Sniffer | Smartbits 200 Chassis Firmware Revision 6.69.0007 with SX-7210 100Mb Ethernet MII Module v6.69 0007 |
| Logic Analyzer | Agilent 1672G Logic Analyzer |
| TIger/GMII System | GMII System |

### Test Configuration

The following configuration was used in performing Clause 4 MAC testing:



## Annex B: Test Setup 2

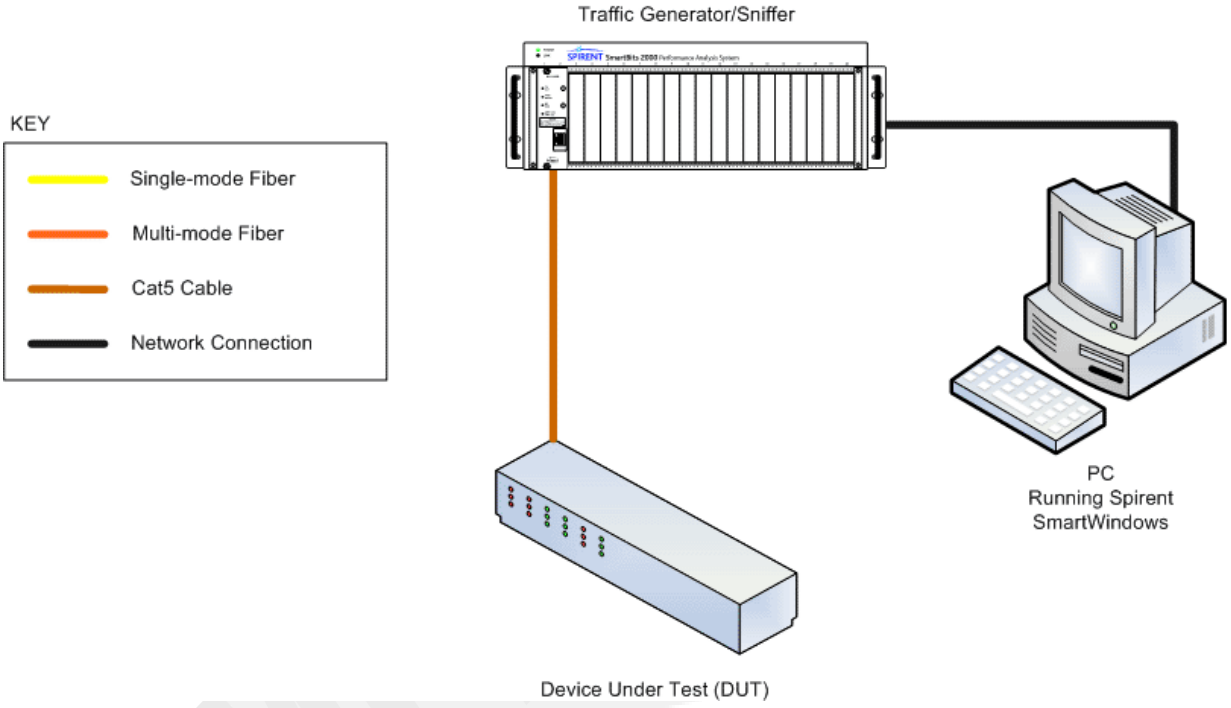
### Test Equipment

The following test equipment was used in performing Clause 4 MAC testing:

| Testing Equipment | Brand and Version Information |
|---|---|
| PC Requirements | Win2K |
| Software | Spirent SmartWindows UNH-IOL Custom Software (Automated MAC v0.99) |
| Traffic Generator/Sniffer | Smartbits 2000 Chassis v8.00.162 Firmware Revision 6.69 0007 with GX-1420B 1000BASE-T module v1.04.004 |

### Test Configuration

The following configuration was used in performing Clause 4 MAC testing:




## Annex C: TBEBO Histograms

Please refer to the following pages for TBEBO Histograms.