Backplane Ethernet Consortium
Clause 73 Auto-Negotiation Test Suite v1.0 Report

UNH-IOL — 121 Technology Drive, Suite 2 — Durham, NH 03824 — +1-603-862-0090
Consortium Manager: Backplane Ethernet Consortium — bpelab@iol.unh.edu — +1-603-862-8050

Vendor X
Company Corporation
123 Pleasant Lane
San Jose, CA 55442

January 27, 2011
Report Rev. 1.0

Enclosed are the results from the Clause 73 Auto-Negotiation Conformance testing performed on:

Device Under Test (DUT):	Super DUT 3000
Hardware Version:	Rev B.
Firmware Version:	N/A
Software Version:	N/A
Miscellaneous:	N/A

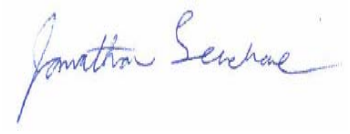
The test suite referenced in this report is available at the UNH-IOL website:

ftp://ftp.iol.unh.edu/pub/ethernet/test_suites/CL73_ANEG/CL73_ANEG_Test_Suite_v1.0.pdf

There were no issues observed during testing.

SAMPLE REPORT

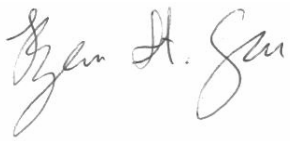
Testing Completed 01/21/2011



Jonathan M. Leverone
jleverone@iol.unh.edu

Digitally signed by UNH-IOL
Date: 2011.08.01 14:06:38 -04'00'

Review Completed 01/31/2011



Brizer St. Cyr,
bstcyr@iol.unh.edu

Digital Signature Information

This document was created using an Adobe digital signature. A digital signature helps to ensure the authenticity of the document, but only in this digital format. For information on how to verify this document's integrity proceed to the following site:

http://www.iol.unh.edu/certifyDoc/

If the document status still indicates "Validity of author NOT confirmed", then please contact the UNH-IOL to confirm the document's authenticity. To further validate the certificate integrity, Adobe 6.0 should report the following fingerprint information:

MD5 Fingerprint: 4B 9E 65 5C 58 2A 39 80 84 EF 7C 0A BC ED 1E BF
SHA-1 Fingerprint: 02 CB 7B 8F F1 EC 59 21 DE 3F A2 1B 66 06 B8 09 12 D9 DD 0E

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 of 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.

Test Setup

All tests were completed using the UNH-IOL CL73 ANEG test system, shown in figure 1.

Test System Hardware	
Real-time DSO	Tektronix DSA72004B
FPGA	Xilinx Virtex 4
Signal Generator	Rhode & Schwartz Signal Generator

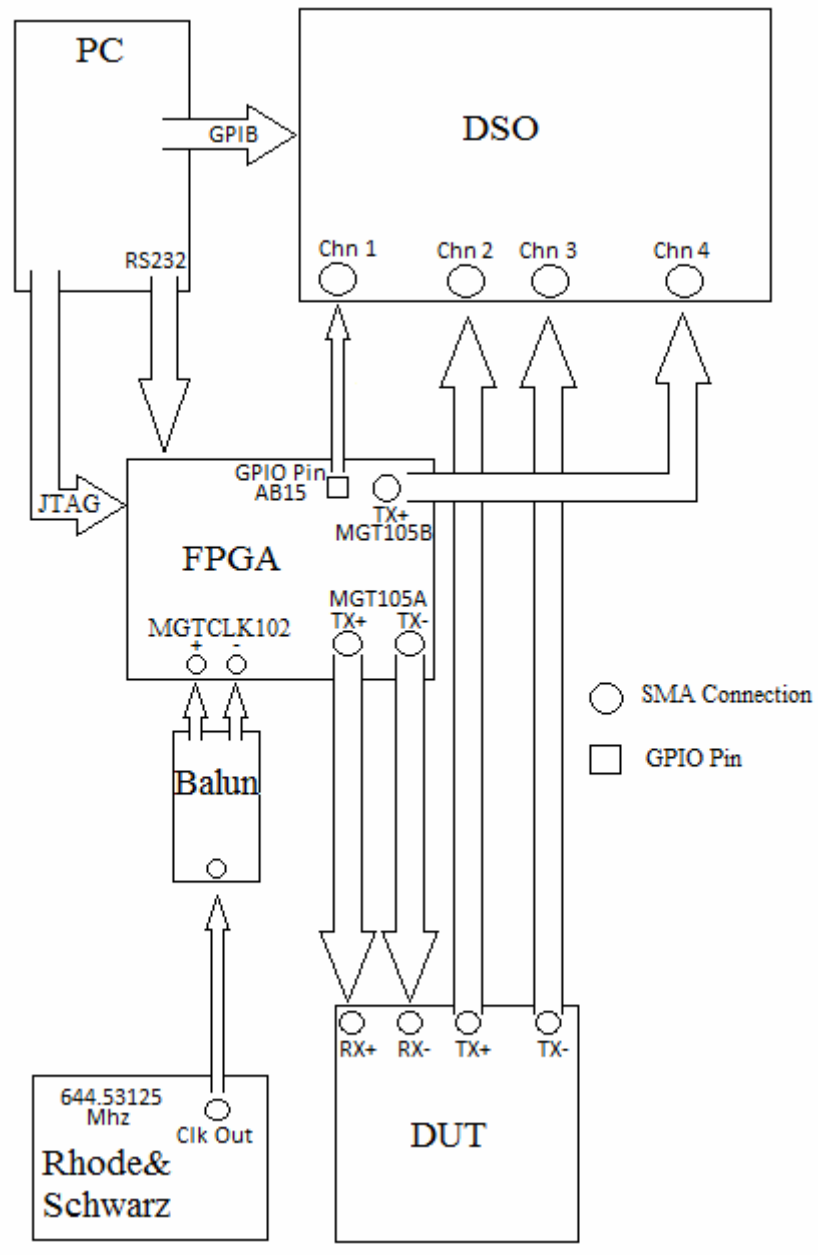


Figure A: CL73 ANEG Test System setup

GROUP 1: DME PAGE TRANSMISSION

Table 1: DME page results summary

		Min	Max	Measured	Units	Test	Figure
	Transmit differential peak-to-peak output voltage	600	1200	780.1	mV	73.1.1	1
T1	Transition period spacing (difference from 3.2ns)	-320	320	-1.49	fs	73.1.2 (a)	2, 3
T2	Clock transition to clock transition (data = 0)	6.2	6.6	6.4	ns	73.1.2 (b)	2, 3
T3	Clock transition to data transition (data = 1)	3.0	3.4	3.2	ns	73.1.2 (c)	2, 3
T4	Transitions in a DME page	51	100	59	–	73.1.5 (a)	2
T5	DME page width	338.8	339.6	339.2	ns	73.1.3	2
T6	DME Manchester violation delimiter width	12.6	13.0	12.8	ns	73.1.4	2

Failures are denoted by parentheses and red text.

Test # and Label	Part(s)	Result(s)
73.1.1 - DME Transmit Differential Peak-to-peak Output Voltage	**a**	**PASS**

Expected Results and Procedural Comments

Purpose: To verify that the peak-to-peak differential output amplitude of the output DME waveform is within the conformance limits.

The DUT's output is observed on the Real-Time DSO, and the width of the Manchester Violation delimiter is measured using post-processing software. The results are averaged over 250 samples.

a. The peak-to-peak differential output amplitude should be between 600 and 1200 mV when measured at TP1.

Comments on Test Results

a. The peak-to-peak differential output amplitude was observed to be 780.1 mV.

Test # and Label	Part(s)	Result(s)
73.1.2 – DME Transition Period Spacing	**a**	**PASS**
	b	**PASS**
	c	**PASS**

Expected Results and Procedural Comments

Purpose: To verify that the spacing between transitions in a DME page is within conformance limits.

The DUT's output is observed on the Real-Time DSO, and the transition period spacing is measured using post-processing software. The results are averaged over 250 samples.

a. The transition period spacing (interval_timer) should be 3.2 ns ± 0.01% (0.32ps).
b. For data 0's, the clock-to-clock transition spacing should be 6.4 ns ± 0.2 ns.
c. For data 1's, the clock-to-data transition spacing should be 3.2 ns ± 0.2 ns.

Comments on Test Results

Timings below conform to proper values:

Transition Period Spacing (T1, or itnterval_timer)	(difference from 3.2ns) max: 0.025 ps	(difference from 3.2ns) avg: -0.001 ps	(difference from 3.2ns) min: -0.020 ps
Clock-to-clock spacing (T2) (clk –> 0)	max: 6.401 ns	avg: 6.400 ns	min: 6.400 ns
Clock-to-data spacing (T3) (clk –> 1)	max: 3.200 ns	avg: 3.198 ns	min: 3.199 ns

Test # and Label	Part(s)	Result(s)
73.1.3 – DME Page Width	**a**	**PASS**

Expected Results and Procedural Comments

Purpose: To verify that the width of a DME page is within conformance limits.

a. The DUT's output is observed on the Real-Time DSO, and the width of the Manchester Violation delimiter is measured using post-processing software. The results are averaged over 250 samples. The DME page width should be 339.2 ns ± 0.4 ns.

Comments on Test Results

a. The DME page width (T5) was observed to be 339.2 ns.

Test # and Label	Part(s)	Result(s)
73.1.4 – DME Manchester Violation Delimiter Width	**a**	**PASS**
Expected Results and Procedural Comments		
Purpose: To verify that the DME page Manchester Violation Delimiter width is within conformance limits. a. The DUT's output is observed on the Real-Time DSO, and the width of the Manchester Violation delimiter is measured using post-processing software. The results are averaged over 250 samples. The Manchester Violation delimiter width should be 12.8 ns ± 0.2 ns.		
Comments on Test Results		
a. The Manchester Violation delimiter was observed to be 12.8 ns.		

Test # and Label	Part(s)	Result(s)
73.1.5 – DME Base Page Encoding	**a**	**PASS**

Expected Results and Procedural Comments

Purpose: To verify that the DUT transmits valid DME base page data; including an acceptable Selector Field combination, correct ability advertisements in the Technology Ability Field, and transmits proper initial values for the Remote Fault, Acknowledge, Next Page, and FEC Capability bits.

The DUT's output is observed on a Real-Time DSO, and the page contents are decoded using post-processing software.

a. The number of transitions shall be between 51 and 100.
b. The encoding of the DME page shall follow the following statements.
   1. The Selector Field combination should correspond to S[4:0] = 00001.
   2. The Echoed Nonce field should contain logical zeros when Acknowledge is set to logical zero.
   3. The Pause Capabilities field should advertise the proper abilities in C[1:0]. C[2] is reserved and can be either 0 or 1.
   4. The Transmitted Nonce field should contain a pseudo-random number, which remains consistent until a new entry into the ABILITY DETECT state.
   5. The initial value of the Remote Fault bit should be zero.
   6. The initial value of the Acknowledge bit should be zero.
   7. The value of the Next Page bit should be one if the DUT wishes to engage in a Next Page exchange and zero if it doesn't.
   8. The Technology Ability field should advertise the proper abilities as indicated in Table 73-4.
   9. The FEC Capability field should be 1 if the HCD is 10GBASE-KR, 40GBASE-KR4, 40GBASE-CR4, or 100GBASE-CR10, and 0 if the HCD is 1000BASE-KX or 10GBASE-KX4.

Comments on Test Results

a. The number of transitions was 58, depending upon the values of the Transmitted Nonce and bit 49.
b. The DUT was observed to transmit (by default).

Field	Bits	Value	Comments
Selector	D[4:0]	00001	IEEE 802.3
Echoed Nonce	D[9:5]	00000	
Pause Capabilities	D[12:10]	000	
Remote Fault	D[13]	0	
Acknowledge	D[14]	0	
Next Page	D[15]	0	
Transmitted Nonce	D[20:16]	11111	varies
Technology Ability	D[45:21]	00000000000000000000111	1000BASE-KX, 10GBASE-KX4, 10GBASE-KR
FEC	D[47:46]	01	

Test # and Label	Part(s)	Result(s)
73.1.6 – Transmitted Nonce Value	**a**	**PASS**
	b	**Informative**

Expected Results and Procedural Comments

Purpose: To verify that the DUT generates a new transmitted nonce for each entry into the ABILITY DETECT state, and that the distribution of the values is uniform.

Monitor the DUT's transmission, and force the DUT into the TRANSMIT DISABLE state.
a. The Transmitted Nonce value should update for each entry into the ABILITY DETECT state.
b. The distribution of the transmitted nonce values should be uniform between 0 and 2^5–1.

Comments on Test Results

a. The DUT was observed to properly update its Transmitted Nonce value upon each entry into the ABILITY DETECT state.
b. The values appeared to be pseudorandom in nature.

Test # and Label	Part(s)	Result(s)
73.1.7 – Bit 49 value	**a**	**PASS**

Expected Results and Procedural Comments

Purpose: To verify that the value of bit 49 in the transmitted DME page is pseudo-random.

a. Monitor the DUT's transmission, and record the value of bit 49.

Comments on Test Results

a. The DUT was observed to follow the polynomial $x^7 + x^3 + 1$.

Test # and Label	Part(s)	Result(s)
73.1.8 – DME Next Page Generation	**a**	**PASS**

Expected Results and Procedural Comments

Purpose: To verify the DUT transmits properly formatted Next Pages.

a. Cause the DUT to transmit Next Pages and observe the decoded waveforms.

Comments on Test Results

a. The DUT was observed to transmit proper Null Message Pages when requested to perform a Next Page Exchange.

GROUP 2: STATE MACHINE VARIABLES

Test # and Label	Part(s)	Result(s)
73.2.1 – Ability Match	**a**	**PASS**
	b	**PASS**
	c	**PASS**

Expected Results and Procedural Comments

Purpose: To verify that the DUT properly implements ability_match.

a. The DUT should not enter the ACKNOWLEDGE DETECT state after the reception of 3 identical DMEs. For use in later tests, the number of DMEs required by the DUT to enter into the ACKNOWLEDGE DETECT state (n) is recorded.
b. The Acknowledge bit should be set after the reception of 4 complete and matching DMEs, regardless of the value of the received Acknowledge bit.
c. The device is sent (n) DMEs pages. The 1st and 3rd DMEs are identical, and the 2nd and 4th DMEs are identical (assuming n=4), but one bit different than the 1st and 3rd. The DUT should not enter the ACKNOWLEDGE DETECT state. All one-bit differences are tested.

Comments on Test Results

a. The DUT was observed to set its ACK bit upon receipt of 3 identical DME pages.
b. The DUT was observed to set its ACK bit, regardless of the value of the transmitted ACK bit.
c. In all cases, the DUT was observed to properly not set its ACK bit upon receipt of DME pages with alternating content.

Test # and Label	Part(s)	Result(s)
73.2.2 – Nonce Match	**a**	**PASS**
	b	**PASS**

Expected Results and Procedural Comments

Purpose: To verify that the DUT properly implements nonce_match.

a. The DUT should set its Acknowledge bit after the reception of (n) DMEs with a different Transmitted Nonce field value then its own.
b. The DUT should enter TRANSMIT DISABLE upon reception of DMEs with a Transmitted Nonce value that matches its own.

Comments on Test Results

a. The DUT was observed to set its ACK bit when the Transmitted nonce values were not matching.
b. The DUT was observed to enter TRANSMIT DISABLE upon receipt of DME pages with a matching Transmitted Nonce value.

Test # and Label	Part(s)	Result(s)
73.2.3 – Acknowledge Match	**a**	**PASS**
	b	**PASS**

Expected Results and Procedural Comments

Purpose: To verify that the DUT properly implements acknowledge_match.

a. The DUT is sent (n) DMEs without the ACK bit set, and a certain amount of DMEs with the ACK bit set, but otherwise identical. Where (n) is the value found in test #73.2.1 to cause the DUT to enter the ACKNOWLEDGE DETECT state. The DUT should obtain an acknowledge match and enter the COMPLETE ACKNOWLEDGE state after the reception of 3 such DMEs with the ACK bit set. For use in later tests, the number of DMEs required by the DUT to enter into the COMPLETE ACKNOWLEDGE state (m) is recorded.
b. The DUT is sent (n) identical DMEs without the ACK bit set, then another identical DME, but with the ACK bit set, then a DME that is one bit different, and finally a DME identical to the first DME with the ACK bit set. In this way, the DUT does not see three consecutive DMEs with the ACK bit set and thus should not determine acknowledge_match=TRUE. The DUT should never enter the COMPLETE ACKNOWLEDGE state, and should send out DMEs with the Acknowledge bit set until page_test_max_timer expires. Following the DMEs should be a gap of 'break_link_timer' until DME transmission resumes. All one-bit differences are tested.

Comments on Test Results

a. The DUT was observed to properly enter the COMPLETE ACKNOWLEDGE state after the reception of 3 DME pages with the ACK bit set that are identical to (n) DME pages previously sent.
b. In all cases, the DUT was observed to properly enter the TRANSMIT DISABLE state upon the receipt of (m) DME pages with alternating content.

Test # and Label	Part(s)	Result(s)
73.2.4 – Ack Nonce Match	**a**	**PASS**
	b	**PASS**

Expected Results and Procedural Comments

Purpose: To verify that the DUT properly implements ack_nonce_match.

a. The DUT should enter the COMPLETE ACKNOWLEDGE state after receiving three DMEs with the Acknowledge bit set to logic one and an Echoed Nonce field that matches its Transmitted Nonce.
b. The DUT should stop sending DMEs for approximately break_link_timer upon reception of the pages with an invalid Echoed Nonce field, and then restart its Base Page transmission.

Comments on Test Results

a. The DUT was observed to enter the COMPLETE ACKNOWLEDGE state after the reception of 3 DME pages with the ACK bit set and ack_nonce_match=true.
b. The DUT was observed to enter the TRANSMIT DISABLE state after the reception of DME pages with an invalid Echoed Nonce field.

Test # and Label	Part(s)	Result(s)
73.2.5 – Consistency Match	**a**	**PASS**
	b	**PASS**

Expected Results and Procedural Comments

Purpose: To verify that the DUT performs a consistency match test on received DME pages.

a. The DUT should enter COMPLETE ACKNOWLEDGE after reception of 4, 5, 6, or 7 DME pages with the ACK bit set, as well as having valid nonce, and echoed nonce fields.
b. The DUT is sent (n) DMEs without the ACK bit set and then (m) DMEs with the ACK bit set. The transmitted abilities in the first set of (n) DMEs differ from those in the second set of (m) DMEs. Where (n) is the value found in test #73.2.1 and where (m) is the value found in test #73.2.3. The DUT should cease transmitting DMEs immediately once the inconsistent DMEs are received. All one bit different combinations are tested.

Comments on Test Results

a. The DUT was observed to enter the COMPLETE ACKNOWLEDGE state after receiving 5 identical DMEs with the ACK bit set.
b. In all cases, the DUT properly detected consistency_match=false and terminated transmission of DMEs, even if a DME page was being transmitted.

Test # and Label	Part(s)	Result(s)
73.2.6 – Ack Finished	**a**	**PASS**

Expected Results and Procedural Comments

Purpose: To verify that the DUT properly sends 6 to 8 (inclusive) DMEs before setting ack_finished=true.

a. After COMPLETE ACKNOWLEDGE state has been entered, the DUT should send out 6 to 8 (inclusive) DMEs containing its Link Codeword (defined as remaining_ack_cnt) before setting ack_finished=true and entering the AN GOOD CHECK state.

Comments on Test Results

a. The DUT transmitted 8 additional DME pages with ACK bit set before it attempted to establish a link.

Test # and Label	Part(s)	Result(s)
73.2.7 – Break Link Timer	**a**	**PASS**

Expected Results and Procedural Comments

Purpose: To verify that the DUT ceases transmission of DME pages within an acceptable timeframe.

a. The DUT is sent a series of validly formed DME pages with a transmitted nonce equal to the DUTs transmitted nonce. Of 10 gaps observed, the minimum gap between the last DME sent from the DUT to the resumption of DMEs from the DUT, is observed. The DUT's break_link_timer should be in the range 60 to 75 ms.

Comments on Test Results

a. The DUT's break_link_timer value was observed to be 68 ms, which is within the conformant range.

Test # and Label	Part(s)	Result(s)
73.2.8 – Link Fail Inhibit Timer	**a**	PASS
	b	PASS
	c	**PASS**

Expected Results and Procedural Comments

Purpose: To verify that the DUT will defer for the proper amount of time before attempting to verify the status of the link determined by the Auto-Negotiation process.

a. The DUT is sent a sequence of DMEs designed to cause it to enter the AN GOOD CHECK state and resolve a 1000BASE-KX link. Upon entering this state, the DUT should cease DME transmissions and source a 1000BASE-KX link signal for the duration of link_fail_inhibit_timer. At this point, since it has not received a valid link from the Link Partner, it should determine that link_status=fail, and should cease sending a 1000BASE-KX link signal as it proceeds to the TRANSMIT DISABLE state. The DUT's link_fail_inhibit_timer should lie in the range 40 to 50 ms.
b. Repeat part ("a") advertising 10GBASE-KX4 instead of 1000BASE-KX. The DUT should cease DME transmissions and source a 10GBASE-KX4 link signal for the duration of link_fail_inhibit_timer. At this point, since it has not received a valid link from the Link Partner, it should determine that link_status=fail, and should cease sending a 10GBASE-KX4 link signal as it proceeds to the TRANSMIT DISABLE state. The DUT's link_fail_inhibit_timer should lie in the range 40 to 50 ms.
c. Repeat part ("a") advertising 10GBASE-KR instead of 1000BASE-KX. The DUT should cease DME transmissions and source a 10GBASE-KR link signal for the duration of link_fail_inhibit_timer. At this point, since it has not received a valid link from the Link Partner, it should determine that link_status=fail, and should cease sending a 10GBASE-KR link signal as it proceeds to the TRANSMIT DISABLE state. The DUT's link_fail_inhibit_timer should lie in the range 500 to 510 ms.

Comments on Test Results

a. The DUT's link_fail_inhibit_timer was observed to be 43.2ms for 1000BASE-KX.
b. The DUT's link_fail_inhibit_timer was observed to be 43.3ms for 10GBASE-KX4.
c. The DUT's link_fail_inhibit_timer was observed to be 501ms for 10GBASE-KR.

Test # and Label	Part(s)	Result(s)
73.2.9 – Auto-Negotiation Wait Timer	**a**	**PASS**

Expected Results and Procedural Comments

Purpose: To verify that the implemented value of autoneg_wait_timer is within the specified range.

a. The DUT is sent valid signaling, at a speed supported by the device, continuously and the delay between the cessation of DMEs and the transmission of valid link signaling from the DUT is measured. The minimum observed value of this interval is taken as the value for autoneg_wait_timer. The DUT's autoneg_wait_timer should be in the range of 25 to 50 ms.

Comments on Test Results

a. The DUT's autoneg_wait_timer was observed to be 33ms.

Test # and Label	Part(s)	Result(s)
73.2.10 – Data Detect Timer	**a**	**PASS**
	b	**PASS**

Expected Results and Procedural Comments

Purpose: To verify that the DUT detects Manchester data transitions within proper spacing and refuses Manchester data transitions with spacing outside the acceptable range.

a. The value of data_detect_min_timer should be between 1.6 and 3.0 ns.
b. The value of data_detect_max_timer should be between 3.4 and 4.8 ns.

Comments on Test Results

a. The DUT's data_detect_min_timer was observed to be 1.6 ns.
b. The DUT's data_detect_max_timer was observed to be 4.8 ns.

Test # and Label	Part(s)	Result(s)
73.2.11 – Clock Detect Timer	**a**	**PASS**
	b	**PASS**

Expected Results and Procedural Comments

Purpose: To verify that the DUT detects Manchester clock transitions within proper spacing and refuses Manchester clock transitions with spacing outside the acceptable range.

a. The value of clock_detect_min_timer should be between 4.8 and 6.2 ns.
b. The value of clock_detect_max_timer should be between 6.6 and 8.0 ns.

Comments on Test Results

a. The DUT's clock_detect_min_timer was observed to be 4.9 ns.
b. The DUT's clock_detect_max_timer was observed to be 7.9 ns

Test # and Label	Part(s)	Result(s)
73.2.12 – Page Test Timer	**a**	**Informative**
	b	**Informative**

Expected Results and Procedural Comments

Purpose: To verify that the DUT accepts DME pages with proper spacing and refuses those with spacing outside of the acceptable range.

a. The value of page_test_min_timer should be between 305 and 330 ns.
b. The value of page_test_max_timer should be between 350 and 375 ns.

Comments on Test Results

a. This test is in development.
b. This test is in development.

Test # and Label	Part(s)	Result(s)
73.2.13 – Rx Bit Count	**a**	**PASS**
	b	**PASS**

Expected Results and Procedural Comments

Purpose: To verify that the DUT properly counts bits in the received pages.

a. The DUT is sent (n) DMEs without the ACK bit set, but with less than 50 clock pulses. The pages are formatted such that the clock and data pulses are within the acceptable limits found in tests 73.2.10 & 73.2.11, and that the total length of the page is within the acceptable limit as found in test 73.2.12. The DUT should enter the ACKNOWLEDGE DETECT state after the reception of (n) complete and matching DMEs, regardless of the value of rx_bit_cnt.
b. The DUT is sent (n) DMEs without the ACK bit set, but with greater than 50 clock pulses. The pages are formatted such that the clock and data pulses are within the acceptable limits found in tests 73.2.10 & 73.2.11, and that the total length of the page is within the acceptable limit as found in test 73.2.12. The DUT should enter the ACKNOWLEDGE DETECT state after the reception of at (n) complete and matching DMEs, regardless of the value of rx_bit_cnt.

Comments on Test Results

a. The DUT was observed to enter the ACKNOWLEDGE DETECT state when rx_bit_cnt=49
b. The DUT was observed to enter the ACKNOWLEDGE DETECT state regardless of the value of rx_bit_cnt.

Test # and Label	Part(s)	Result(s)
73.2.14 – Pulse Too Long	**a**	**PASS**
	b	**Informative**

Expected Results and Procedural Comments

Purpose: To verify that the DUT properly implements pulse_too_long.

a. The DUT should not set its Acknowledge bit after receiving a DME with a transition that is spaced more than 20 ns from the previous transition followed by (n-1) valid DMEs.
b. The DUT should set its Acknowledge bit after receiving a valid DME followed by a DME with a long pulse, followed by (n-2) valid DMEs.

Comments on Test Results

a. The DUT was observed to properly not enter ACKNOWLEDGE DETECT.
b. The DUT was observed to enter ACKNOWLEDGE DETECT, indicating that it ignored the pulse too long.

Test # and Label	Part(s)	Result(s)
73.2.15 – Pulse Too Short	**a**	**PASS**
	b	**PASS**

Expected Results and Procedural Comments

Purpose: To verify that the DUT properly implements pulse_too_short.

a. The DUT should not set its Acknowledge bit following a DME with a transition that is spaced less than 1.6 ns from the previous transition followed by (n-1) valid DMEs.
b. The DUT should set its Acknowledge bit after receiving a valid DME followed by a DME with a short pulse, followed by (n-2) DMEs.

Comments on Test Results

a. The DUT was observed to properly enter the ACKNOWLEDGE DETECT state after receiving DME pages that contain a transition less than 1.6 ns from the previous.
b. The DUT was observed to properly enter the ACKNOWLEDGE DETECT state after receiving DME pages that contain a transition less than 1.6 ns from the previous.

Test # and Label	Part(s)	Result(s)
73.2.16 – Detect MV Pair	**a**	**PASS**
	b	**PASS**

Expected Results and Procedural Comments

Purpose: To verify that the DUT properly implements detect_mv_pair.

a. The DUT should set its Acknowledge bit after the reception of (n) valid DMEs.
b. The DUT is sent a series of (n) DME pages, omitting the first Manchester Violation in the first DME page transmitted. The DUT should not set its Acknowledge bit to logic one, indicating that detect_mv_pair was not set to true.

Comments on Test Results

a. The DUT was observed to properly enter the ACKNOWLEDGE DETECT state.
b. The DUT was observed to not set its Acknowledge bit to logic one, and properly remain in the ABILITY DETECT state.

Test # and Label	Part(s)	Result(s)
73.2.17 – np_rx	**a**	**PASS**
	b	**PASS**

Expected Results and Procedural Comments

Purpose: To verify that the DUT properly implements np_rx.

a. The DUT is sent a series of DME pages with the NP and ACK bits set such that it enters the COMPLETE ACKNOWLEDGE state, followed by valid Next Pages, all of which have the NP bit cleared to 0. The DUT should continue to send DME pages until both its and the link partners Next Page bits equal 0.
b. The DUT is sent a series of DME pages with the NP and ACK bits set such that it enters the COMPLETE ACKNOWLEDGE state, followed by valid Next Pages with the NP bit set to 1 until the DUT sets its NP to zero, followed by an additional Next Page with the NP bit set to 0. The DUT should continue to send DME pages until both its and the link partners Next Page bits equal 0.

Comments on Test Results

a. The DUT was observed to properly transmit Next Pages until receiving a Next Page with the NP bit cleared to 0.
b. The DUT was observed to properly transmit Next Pages until receiving a Next Page with the NP bit cleared to 0.

Test # and Label	Part(s)	Result(s)
73.2.18 – Toggle TX	**a**	**PASS**
	b	**PASS**

Expected Results and Procedural Comments

Purpose: To verify that the DUT properly implements toggle_tx.

a. The value of the toggle bit in the first Next Page should have the opposite value of bit D11 in the DUT's Base Page.
b. The value of the Toggle bit of the Next Page transmitted by the DUT's should always take the opposite value of the Toggle bit of the previous Next Page (if the previous value was a 0, it should be a 1, and vice versa).

Comments on Test Results

a. The DUT was observed to properly send Next Pages with the opposite value of bit D11 in the DUT's Base Page.
b. The DUT was observed to properly alternate bit D11 during a Next Page Exchange.

Test # and Label	Part(s)	Result(s)
73.2.19 – Toggle RX	**a**	**PASS**

Expected Results and Procedural Comments

Purpose: To verify that the DUT properly implements toggle_rx.

a. The DUT should not set its ACK bit upon reception of pages with an improper Toggle bit value, but should remain in the NEXT PAGE WAIT state. Upon reception of pages with proper Toggle bit values the DUT should complete the Next Page exchange and begin sourcing appropriate link signaling.

Comments on Test Results

a. The DUT was observed to properly remain in the NEXT PAGE WAIT state until receiving a Next Page with a proper Toggle bit value.

Test # and Label	Part(s)	Result(s)
73.2.20 – Single Link Ready	**a**	**Not Tested**
	b	**Not Tested**

Expected Results and Procedural Comments

Purpose: To verify that the DUT properly implements single link ready.

a. The DUT is sent valid 1000BASE-KX signaling for 100 ms. The DUT should set single_link_ready=true and enter the AN GOOD CHECK.
b. The DUT is sent valid 1000BASE-KX signaling for 20 ms. The DUT should set single_link_ready=false, enter the PARALLEL DETECTION FAULT and ABILITY DETECT states, and resume DME transmissions.

Comments on Test Results

a. This test is in development.
b. This test is in development.

GROUP 3: ARBITRATION STATE DIAGRAM

Test # and Label	Part(s)	Result(s)
73.3.1 – ABILITY DETECT	**a**	**PASS**
	b	**PASS**
	c	**PASS**
	d	**PASS**

Expected Results and Procedural Comments

Purpose: To verify that the DUT properly exits ACKNOWLEDGE DETECT under the appropriate conditions.

a. The DUT is sent (n) DME pages to the DUT all with the Acknowledge bit not set and the Transmitted Nonce Field not equal to the DUTs Transmitted Nonce field. Upon detection of ability_match=true and nonce_match=false, the DUT should enter the ACKNOWLEDE DETECT state and begin sending DME pages with the ACK bit set.
b. The DUT is sent (n) DME pages, all with a Transmitted Nonce value that is equal to the Transmitted Nonce value used by the DUT. Upon detection of ability_match=true and nonce_match=true, the DUT should enter the TRANSMIT DISABLE state and cease all transmissions.
c. The DUT is sent valid 1000BASE-KX signaling. Upon detection of link_status[KX]=true, it should enter the LINK STATUS CHECK state and cease DME page transmissions.
d. The DUT is sent valid 10GBASE-KX4 signaling. Upon detection of link_status[KX4]=true, it should enter the LINK STATUS CHECK state and cease DME page transmissions.

Comments on Test Results

a. The DUT was observed to enter the ACKNOWLEDGE DETECT state.
b. The DUT was observed to enter the TRANSMIT DISABLE state.
c. The DUT was observed to bring up a 1000BASE-KX link.
d. The DUT was observed to bring up a 10GBASE-KX4 link.

Test # and Label	Part(s)	Result(s)
73.3.2 – TRANSMIT DISABLE	**a**	**PASS**

Expected Results and Procedural Comments

Purpose: To verify that the DUT properly exits TRANSMIT DISABLE under the appropriate conditions.

a. The DUT is sent (n) DME pages with the Acknowledge bit not set, and with a Transmitted Nonce field equal to the Transmitted Nonce field of the DUT to cause the DUT to enter the TRANSMIT DISABLE state. After entering TRANSMIT DISABLE, the DUT should enter the ABILITY DETECT state after break_link_timer_done equals true.

Comments on Test Results

a. The DUT was observed to restart DME transmission, which indicates re-entry into ABILITY DETECT, after break_link_timer_done=true.

Test # and Label	Part(s)	Result(s)
73.3.3 – ACKNOWLEDGE DETECT	**a**	**PASS**
	b	**PASS**
	c	**PASS**
	d	**PASS**

Expected Results and Procedural Comments

Purpose: To verify that the DUT properly exits ACKNOWLEDGE DETECT under the appropriate conditions.

a. Send the DUT (n) DME pages with the Acknowledge bit not set, followed by (m) DME pages with the Acknowledge bit set and the Echoed Nonce field set to the value of the DUTs Transmitted Nonce field, but otherwise identical to the initial DME pages. The DUT should enter the COMPLETE ACKNOWLEDGE state and send 6 to 8 more DME pages with the ACK bit set before transmitting valid link signaling (ack_finished=true).
b. Send the DUT (n) DME pages with the Acknowledge bit not set, followed by (m) DME pages with the Acknowledge bit set, but are one bit different from the first group. All pages in the second group should be the identical. Repeat using all one bit different DMEs.
c. Send the DUT (n) DME pages with the Acknowledge bit not set, followed by (m) DME pages with the Acknowledge bit set, the Echoed Nonce field set to any value other than the value of the DUTs Transmitted Nonce field, but otherwise identical to the initial DME pages. The DUT should enter the TRANSMIT DISABLE state and cease all transmissions.
d. Send the DUT (n) DME pages with the Acknowledge bit not set to put the DUT into the ACKNOWLEDGE DETECT state. The DUT should enter the TRANSMIT DISABLE state after page_test_max_timer expires.

Comments on Test Results

a. The DUT was observed to enter COMPLETE ACKNOWLEDGE and transmit 6 additional DMEs with the ACK bit set before transmitting link signaling.
b. In all cases, the DUT was observed to properly enter the TRANSMIT DISABLE state after receiving DMEs with alternating content.
c. The DUT was observed to enter the TRANSMIT DISABLE state after receiving DMEs with an invalid Echoed Nonce field.
d. The DUT was observed to enter the TRANSMIT DISABLE state after page_test_max_timer expired.

Test # and Label	Part(s)	Result(s)
73.3.4 – COMPLETE ACKNOWLEDGE	**a**	**PASS**
	b	**PASS**

Expected Results and Procedural Comments

Purpose: To verify that the DUT properly exits COMPLETE ACKNOWLEDGE under the appropriate conditions.

a. Send the DUT a series of (n) DME pages with the Acknowledge bit not set, followed by (m) DME pages with the Acknowledge bit set, to put the DUT into the COMPLETE ACKNOWLEDGE state. If np_rx=1, send Null Message pages until the DUT has finished Next Page transmission. The DUT should enter the AN GOOD CHECK state and begin transmitting valid link signaling.
b. Send the DUT enough valid DME pages with the Next Page and ACK bits set to put the DUT into the COMPLETE ACKNOWLEDGE state. The DUT should enter the NEXT PAGE WAIT state and begin sending its first Next Page.

Comments on Test Results

a. The DUT was observed to properly enter the AN GOOD state after ack_finished was set equal to true.
b. The DUT was observed to properly enter the NEXT PAGE WAIT state.

Test # and Label	Part(s)	Result(s)
73.3.5 – AN GOOD CHECK	**a**	**Not Tested**
	b	**PASS**
	c	**PASS**

Expected Results and Procedural Comments

Purpose: To verify that the DUT properly exits AN GOOD CHECK under the appropriate conditions.

a. Send the DUT a series of (n) DME pages with the Acknowledge bit not set, followed by (m) DME pages with the Acknowledge bit set to put the DUT into the COMPLETE ACKNOWLEDGE state. If necessary, send the DUT as many Null Message pages as needed to put the DUT into the AN GOOD CHECK state. Send the DUT valid link signaling according to the DUT's and Traffic Generator's HCD. The DUT should enter the AN GOOD state and establish a valid link.
b. Send the DUT a series of (n) DME pages with the Acknowledge bit not set, followed by (m) DME pages with the Acknowledge bit set to put the DUT into the COMPLETE ACKNOWLEDGE state. If necessary, send the DUT as many Null Message pages as needed to put the DUT into the AN GOOD CHECK state. The DUT should enter the TRANSMIT DISABLE state and cease all transmissions.
c. Repeat step 1, transmitting DME pages with the technology ability field bits cleared. The DUT should enter the TRANSMIT DISABLE state and cease all transmissions.

Comments on Test Results

a. This test is in development.
b. The DUT was observed to enter the TRANSMIT DISABLE state and cease all transmission.
c. The DUT was observed to enter the TRANSMIT DISABLE state and cease all transmission after receiving DMEs advertising no technologies.

Test # and Label	Part(s)	Result(s)
73.3.6 – NEXT PAGE WAIT	**a**	**PASS**
	b	**PASS**

Expected Results and Procedural Comments

Purpose: To verify that the DUT properly exits NEXT PAGE WAIT under the appropriate conditions.

a. Use a traffic generator to send enough valid DME page with the Next Page bit set to put the DUT into the NEXT PAGE WAIT state. Send the DUT (n) Next Pages with the Toggle bit set to the opposite value with each page. The DUT should enter the ACKNOWLEDGE DETECT state and begin sending DME pages with the ACK bit set.
b. Use a traffic generator to send enough valid DME page with the Next Page bit set to put the DUT into the NEXT PAGE WAIT state. The DUT should enter the TRANSMIT DISABLE state and cease all transmissions.

Comments on Test Results

a. The DUT was observed to properly enter the ACKNOLWEDGE DETECT state from the NEXT PAGE WAIT state after receiving Next Pages with the ACK bit set and the Toggle bit set to a value opposite of its value in the previous Next Page.
b. The DUT was observed to properly enter TRANSMIT disable after receiving an_receive_idle=true while in NEXT PAGE WAIT.

Test # and Label	Part(s)	Result(s)
73.3.7 – LINK STATUS CHECK	**a**	**PASS**
	b	**PASS**
	c	**PASS**
	d	**PASS**

Expected Results and Procedural Comments

Purpose: To verify that the DUT properly exits LINK STATUS CHECK under the appropriate conditions.

a. The DUT is sent 1000BASE-KX signaling for at least 50 ms. The DUT should enter the AN GOOD CHECK state and establish a valid 1000BASE-KX link.
b. The DUT is sent 10GBASE-KX4 signaling for at least 50 ms. The DUT should enter the AN GOOD CHECK state and establish a valid 10GBASE-KX4 link.
c. The DUT is sent valid 1000BASE-KX signaling for less than 50 ms.. The DUT should enter the ABILITY DETECT state via the PARALLEL DETECTION FAULT state and restart DME base page transmission.
d. The DUT is sent valid 10GBASE-KX4 signaling for less than 50 ms.. The DUT should enter the ABILITY DETECT state via the PARALLEL DETECTION FAULT state and restart DME base page transmission.

Comments on Test Results

a. The DUT was observed to establish a 1000BASE-KX link.
b. The DUT was observed to establish a 10GBASE-KX4 link.
c. The DUT was observed to properly not establish a 1000BASE-KX link, indicating a PARALLEL DETECTION FAULT.
d. The DUT was observed to properly not establish a 10GBASE-KX4 link, indicating a PARALLEL DETECTION FAULT.

Test # and Label	Part(s)	Result(s)
73.3.8 – AN GOOD	**a**	**PASS**
Expected Results and Procedural Comments		
Purpose: To verify that the DUT properly exits AN GOOD under the appropriate conditions. a. The DUT is sent enough DME pages to enter the AN GOOD state. Upon detection of link_status[HCD]=FAIL, the DUT should enter the TRANSMIT DISABLE state and cease all transmissions.		
Comments on Test Results		
a. The DUT was observed to establish a link at its' HCD.		

GROUP 4: DME PAGE RECEPTION

Test # and Label	Part(s)	Result(s)
73.4.1 – IDLE	**a**	**PASS**
	b	**PASS**

Expected Results and Procedural Comments

Purpose: To verify that the DUT properly exits the IDLE state under the appropriate conditions.

a. Send the DUT (n) valid DME pages. The DUT should enter the ACKNOWLEDGE DETECT state and begin sourcing DME pages with the ACK bit set.
b. Send the DUT (n) DME pages, omitting the first Manchester Violation. The DUT should remain in the ABILITY DETECT state and continue to send its base page without the ACK bit set.

Comments on Test Results

a. The DUT was observed to enter ACKNOWLEDGE DETECT.
b. The DUT was observed to remain in the ABILITY DETECT state.

Test # and Label	Part(s)	Result(s)
73.4.2 – DELIMITER DETECT	**a**	**PASS**
	b	**Informative**
	c	**PASS**
	d	**PASS**
	e	**PASS**

Expected Results and Procedural Comments

Purpose: To verify that the DUT properly exits the DELIMITER DETECT state under the appropriate conditions.

a. The DUT is sent a pair of Manchester Violations separated by more than page_test_max_timer, followed by (n-1) valid DME pages.
b. The DUT is sent a pair of Manchester Violations separated by less than page_test_min_timer, followed by (n-1) valid DME pages.
c. The DUT is sent a DME page containing a transition that is spaced more than 20 ns from the previous transition, followed by (n-1) valid DME pages.
d. The DUT is sent a DME page containing a transition that is spaced less than 1.6ns from the previous transition, followed by (n-1) valid DME pages.
e. The DUT is sent (n) valid DME pages.

Comments on Test Results

a. The DUT was observed to properly remain in ABILITY DETECT and not acknowledge.
b. The DUT was observed to remain in the ABILITY DETECT state.
c. The DUT was observed to remain in the ABILITY DETECT state after reception of pages with transitions spaced more than 20 ns apart.
d. The DUT was observed to remain in the ABILITY DETECT state.
e. The DUT was observed to enter the ACKNOWLEDGE DETECT state and begin sourcing DME pages with the ACK bit set.

Test # and Label	Part(s)	Result(s)
73.4.3 – DME CLOCK	**a**	**PASS**
	b	**PASS**
	c	**PASS**
	d	**PASS**

Expected Results and Procedural Comments

Purpose: To verify that the DUT properly exits the DME CLOCK state under the appropriate conditions.

a. The DUT is sent a valid DME page, followed by a DME page with the first data 0 having transitions spaced greater than clock_detect_max_timer apart. The DUT should remain in the ABILITY DETECT state and continue to send its base page without the ACK bit set.
b. The DUT is sent a valid DME page, followed by a DME page with the first data 1 having transitions spaced at less than data_detect_min_timer, followed by (n-2) valid DME pages. The DUT should enter the ACKNOWLEDGE DETECT state and begin sending its base page with the ACK bit set.
c. The DUT is sent a valid DME page, followed by a DME which contains only 10 bits but is otherwise properly formatted, followed by (n-1) valid DME pages. The DUT should enter the ABILITY DETECT state and begin sending its base pages with the ACK bit set.
d. The DUT is sent two valid DME pages, followed by a cessation of transmission for at least page_test_max_timer, followed by two more valid DME pages which match the first two transmitted. The DUT should remain in ABILITY DETECT state and continue to send its base page without the ACK bit set.

Comments on Test Results

a. The DUT was observed to properly remain in the ABILITY DETECT state.
b. The DUT was observed to properly enter the ACKNOWLEDGE DETECT state.
c. The DUT was observed to properly enter the ACKNOWLEDGE DETECT state.
d. The DUT was observed to properly remain in the ABILITY DETECT state.

Test # and Label	Part(s)	Result(s)
73.4.4 – DME DATA_1	**a**	**PASS**
	b	**PASS**
	c	**PASS**

Expected Results and Procedural Comments

Purpose: To verify that the DUT properly exits DME DATA_1 under the appropriate conditions.

a. The DUT is sent (n) valid DME pages, all having the last bit set to 1 to cause the DUT to enter the DME DATA_1 state, followed by a valid Manchester Violation. The DUT should enter the ACKNOWLEDGE DETECT STATE and begin sending its base page with the ACK bit set.
b. The DUT is sent a valid DME page, followed by a DME page having the first clock transition after the first data 1 transition spaced more than clock_detect_max_timer from the previous clock transition., followed by (n-2) valid DME pages. The DUT should remain in the ABILITY DETECT state and continue to send its base page without the ACK bit set.
c. The DUT is sent a valid DME page, followed by a DME page with the last bit being a 1, followed by a gap such that the total length of the DME page + gap is at least page_test_max_timer, followed by (n-2) valid DME pages. The DUT should remain in the ABILITY DETECT state and continue to send its base page without the ACK bit set.

Comments on Test Results

a. The DUT was observed to properly enter the ACKNOWLEDGE DETECT state.
b. The DUT was observed to properly remain in the ABILITY DETECT state.
c. The DUT was observed to properly remain in the ABILITY DETECT state.

GROUP 5: FUNCTIONALITY

Test # and Label	Part(s)	Result(s)
73.5.1 – Parallel Detection Function	**a**	PASS
	b	PASS

Expected Results and Procedural Comments

Purpose: To verify that the DUT properly implements the parallel detection function.

a. The DUT is sent 1000BASE-KX signaling for at least 50 ms. The DUT should enter the AN GOOD CHECK state and establish a valid 1000BASE-KX link.
b. The DUT is sent 10GBASE-KX4 signaling for at least 50 ms. The DUT should enter the AN GOOD CHECK state and establish a valid 10GBASE-KX4 link.

Comments on Test Results

a. The DUT was observed to establish a 1000BASE-KX link.
b. The DUT was observed to establish a 10GBASE-KX4 link.

Test # and Label	Part(s)	Result(s)
73.5.2 – Renegotiation Function	**a**	PASS

Expected Results and Procedural Comments

Purpose: To verify that the DUT starts a re-negotiation upon the reception of a link_status=FAIL from the resolved highest common denominator (HCD) technology.

a. The DUT is sent a series of DME pages that advertise a set of capabilities compatible with the DUT, such that it establishes a link. Break the link, and verify the DUT starts a re-negotiation.

Comments on Test Results

a. The DUT was observed to properly re-negotiate.

Test # and Label	Part(s)	Result(s)
73.5.3 – Priority Resolution Function	**a**	**PASS**
	b	**Informative**

Expected Results and Procedural Comments

Purpose: To verify that the device under test properly configures the highest common denominator (HCD) technology for the transmitted technologies in a link code word.

a. The DUT is sent a series of DME pages using an Ethernet selector field that advertise a set of abilities compatible with the DUT. The DUT should resolve a link at the highest priority possible. Repeat this procedure for all possible combinations of the first five bits of the technology ability field.
b. The DUT is sent a series of DME pages using a non-Ethernet selector field that advertise a set of abilities compatible with the DUT. The DUT should resolve a link at the highest priority possible.

Comments on Test Results

a. The DUT was observed to properly begin signaling after reception of DME pages with technologies it supports.
b. INFORMATIVE: The DUT was observed to enter complete acknowledge and bring up a link upon reception of DME pages with non-Ethernet selector fields.

Test # and Label	Part(s)	Result(s)
73.5.4 – Remote Fault Bit	**a**	**Not Tested**
	b	**Not Tested**
	c	**Not Tested**

Expected Results and Procedural Comments

Purpose: To verify that the DUT implements link_loss_timer within 50 ms and 150 ms.

a. If the DUT supports the Remote Fault function, then cause the DUT to indicate by any means. Once a remote fault has been caused, the Remote Fault bit should be set in all DMEs that are transmitted.
b. The DUT is sent a series of (n) DME pages, with the Acknowledge bit not set. The DUT should have the RF bit set when it sends DME pages with the ACK bit set, and when the DUT restarts Auto-Negotiation, the RF bit should still be set.
c. The DUT is sent a series of (n) DME pages with the Acknowledge bit not set, followed by (m) DME pages with the Acknowledge bit set and a valid Echoed Nonce field. When the DUT restarts Auto-Negotiation, the RF bit should not be set.

Comments on Test Results

a. This test is in development.
b. This test is in development
c. This test is in development.

Test # and Label	Part(s)	Result(s)
73.5.5 – Selector Field Combinations	**a**	**PASS**
	b	**PASS**

Expected Results and Procedural Comments

Purpose: To verify that the DUT accepts DMEs with the Selector Field set to a reserved combination or any other defined combination.

a. The DUT is sent a series of (n) DME pages, with the Acknowledge bit not set using valid Selector field combinations. The DUT should enter the ACKNOWLEDGE DETECT state.
b. The DUT is sent a series of (n) DME pages with the Acknowledge bit not set, followed by (m) DME pages with the Acknowledge bit set and a valid Echoed Nonce field, using valid Selector field combinations. The DUT should enter the COMPLETE ACKNOWLEDGE state.

Comments on Test Results

a. The DUT was observed to properly enter the ACKNOWLEDGE DETECT state.
b. The DUT was observed to properly enter the COMPLETE ACKNOWLEDGE state.

Test # and Label	Part(s)	Result(s)
73.5.6 – Technology Ability Field Bits	**a**	**PASS**
	b	**PASS**

Expected Results and Procedural Comments

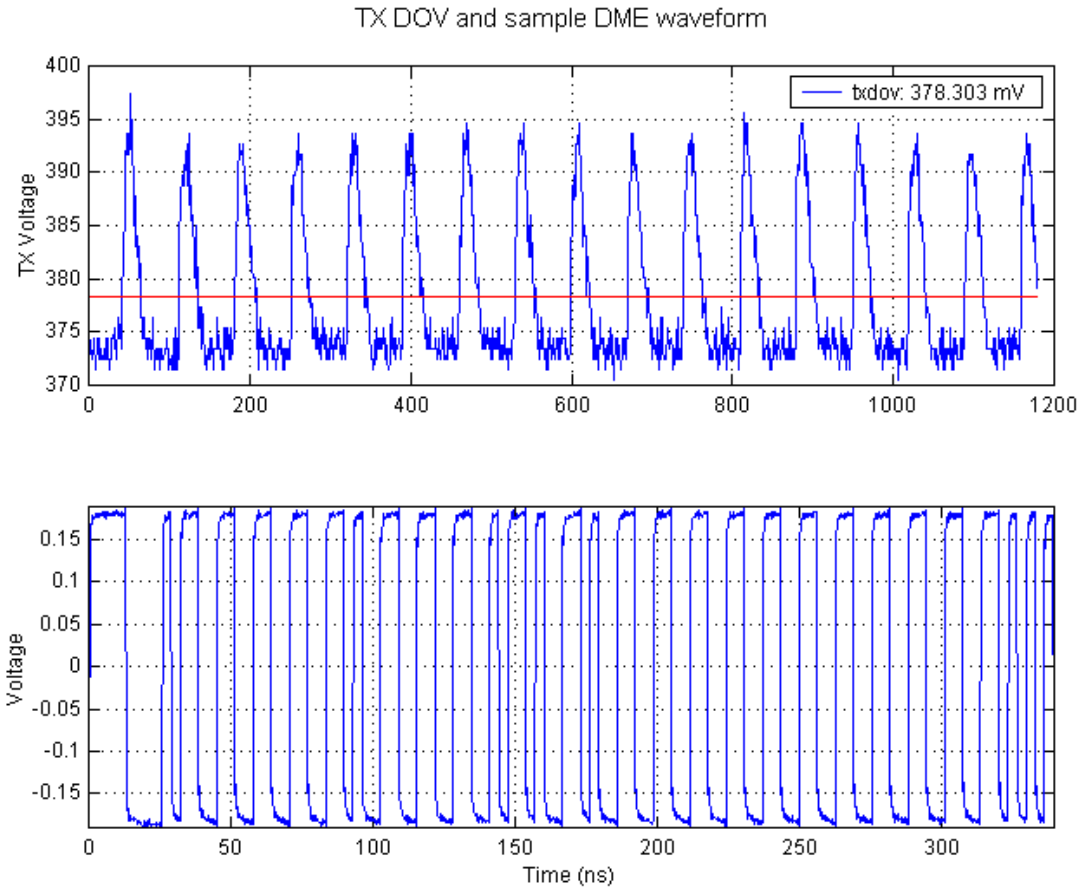
Purpose: To verify that the DUT accepts DMEs with different combinations of the Technology Ability Field bits set to logic one.

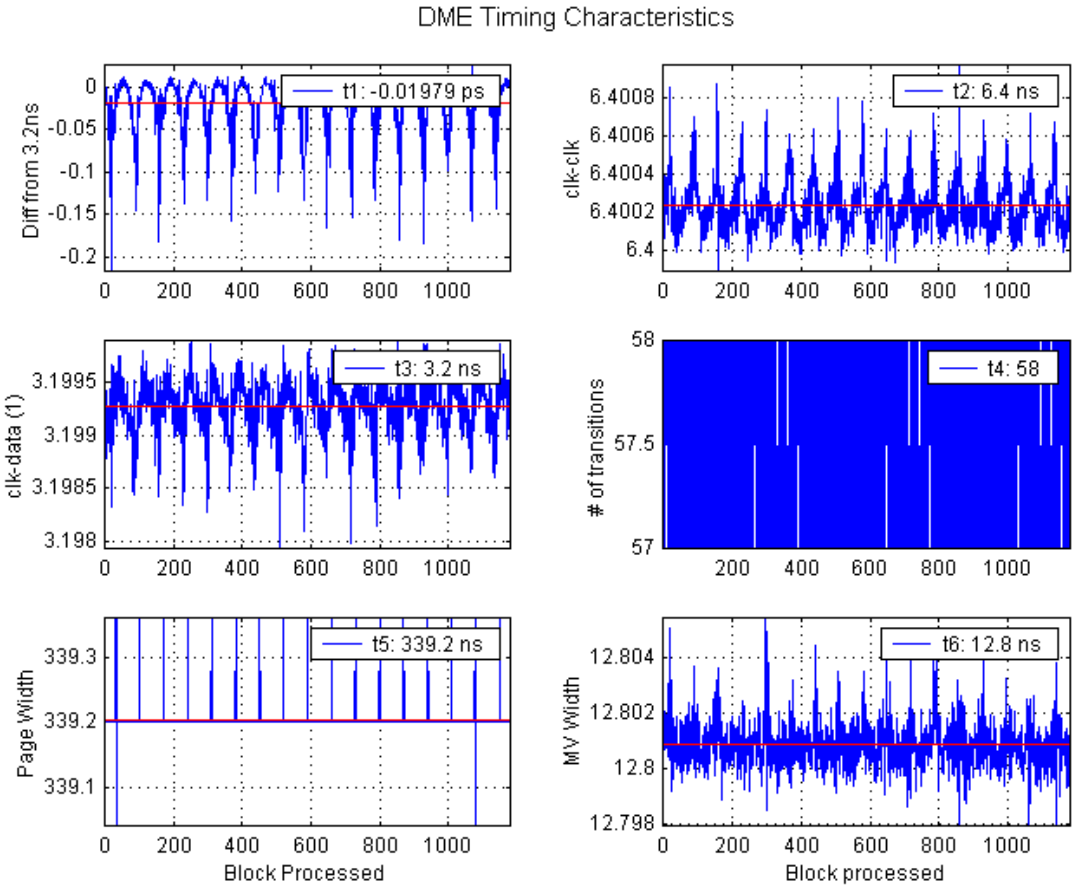
a. The DUT is sent a series of (n) DME pages, with the Acknowledge bit not set and bit A0 set to logic one to put it into the ACKNOWLEDGE DETECT state. Repeat, setting bits A1-A24 to logic one, one bit at a time. The DUT should enter the ACKNOWLEDGE DETECT state regardless of the technology ability field values.
b. The DUT is sent a series of (n) DME pages with the Acknowledge bit not set, followed by (m) DME pages with the Acknowledge bit set, a valid Echoed Nonce field, and bit A0 set to logic one. Repeat, setting bits A1-A24 to logic one, one bit at a time. The DUT should enter the COMPLETE ACKNOWLEDGE state regardless of the technology ability bit values.

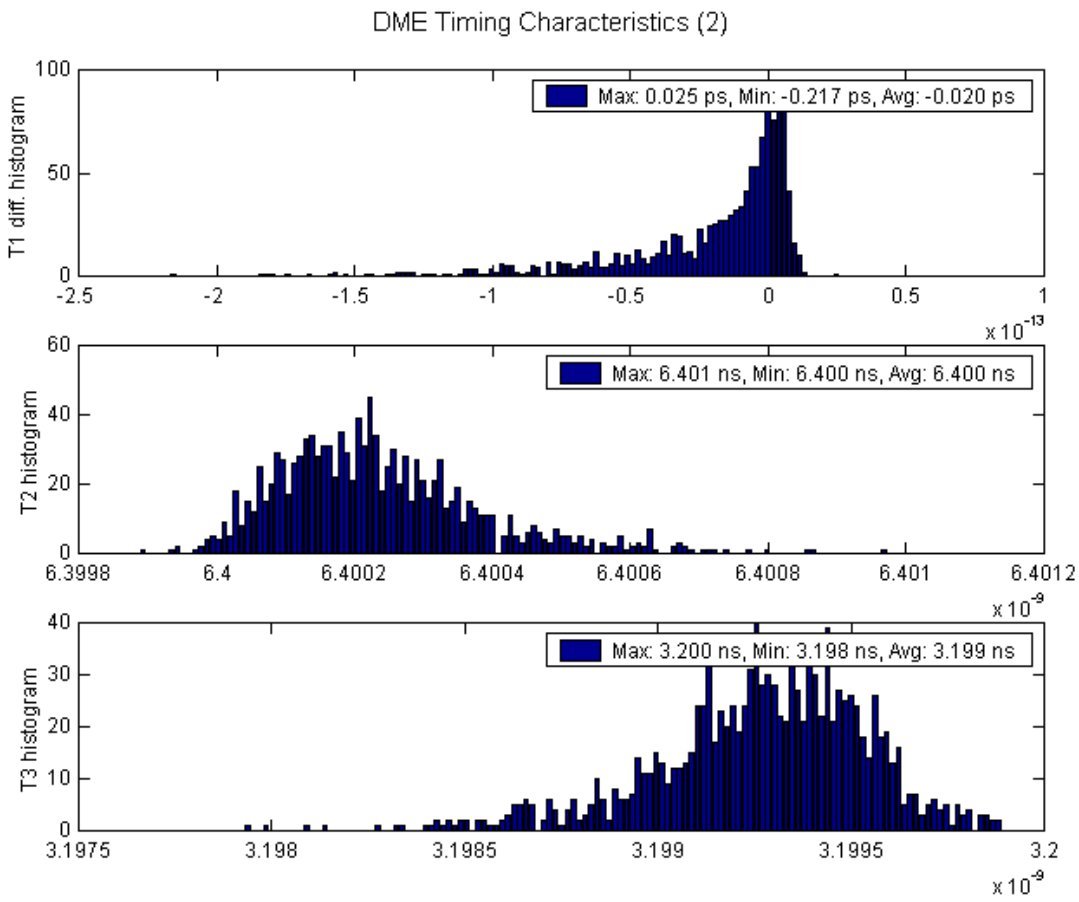
Comments on Test Results

a. The DUT was observed to properly enter the ACKNOWLEDGE DETECT state.
b. The DUT was observed to properly enter the COMPLETE ACKNOWLEDGE state.

APPENDIX A: SUPPLEMENTAL FIGURES




DME Timing Characteristics
t1: -0.01979 ps
Diff from 3.2ns
t2: 6.4 ns
clk-clk
t3: 3.2 ns
clk-data (1)
t4: 58
# of transitions
t5: 339.2 ns
Page Width
Block Processed
t6: 12.8 ns
MV Width
Block processed


DME Timing Characteristics (2)
T1 diff. histogram
Max: 0.025 ps, Min: -0.217 ps, Avg: -0.020 ps
x 10^-13
T2 histogram
Max: 6.401 ns, Min: 6.400 ns, Avg: 6.400 ns
x 10^-9
T3 histogram
Max: 3.200 ns, Min: 3.198 ns, Avg: 3.199 ns
x 10^-9