Accredited Standards Committee*
National Committee for Information Technology Standards (NCITS)

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Date: March 29, 2000
Reply to: John Lohmeyer

To: T10 Membership
From: John Lohmeyer
Subject: Parallel SCSI Working Group Meeting -- March 27-28, 2000
Milpitas, CA

Agenda

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        4.5.6 Expander Topics [Ham]
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        4.5.8 The zero offset problem for receiver equalization (00-201) [Bridgewater]
        4.5.9 Next Meeting Testing Data [Penokie]
5. SPI-4 Protocol Topics
    5.1 Margin Control (99-264) [Lamers]
    5.2 Flow Control & Read Streaming (00-142) [Lamers]
    5.3 PPR Message Enhancements (99-283) [Lamers]

6. Expanders and Domain Validation Topics
    6.1   SCSI out of band communications method (99-213) [Petty]
7. New Business
8. Meeting Schedule
9. Adjournment

Results of Meeting

1. Opening Remarks

John Lohmeyer, the T10 Chair, called the meeting to order at 1:00 p.m., Monday, March 27, 2000. He thanked Larry Lamers of Adaptec for hosting the meeting.

As is customary, the people attending introduced themselves and a copy of the attendance list was circulated.

2. Approval of Agenda

The draft agenda was approved with the following changes:

    4.2.4   Training Patterns Modeling Results (00-193) [Penokie] <added>
    4.5.1   Driver Precompensation with Receiver Filtering for Ultra4 (00-175) [Smith] <changed to:>
    4.5.1   Precompensation and test measurements (00-194) [Maniloi]
    4.5.2   320 data transfer rates on 25 meter cables (00-153) [McGarrah] <deleted>
    4.5.3   640 data transfer rates, a first look (00-154) [McGarrah] <deleted>
    4.5.5   Pre-Emphasis Experimental Data (99-167) [Gasparik] <deleted>

During the course of the meeting, the following agenda items were added/revised:

    4.3.2   Clock Frequency Restrictions for Fast-160 [Evans]
    4.3.3   Fast-160 Driver and Receiver Masks (00-198) [Aloisi]
    4.4.3   Ultra320 SCSI vs. Ultra160 SCSI Eye Diagram Data (00-169) [Brown] <changed to:>
    4.4.3   Ultra320 into fully populated 10-slot backplane (00-195) [Brown]
    4.5.4   Receiver Equalization (00-168) [Brown] <changed to:>
    4.5.4   Comments on adaptive filtering for Ultra320 SCSI (00-196) [Brown]
    4.5.7   Eye window amplitude (00-200) [Bridgewater]
    4.5.8   The zero offset problem for receiver equalization (00-201) [Bridgewater]
    4.5.9   Next Meeting Testing Data [Penokie]

3. Attendance and Membership

Attendance at working group meetings does not count toward minimum attendance requirements for T10 membership. Working group meetings are open to any person or organization directly and materially affected by T10's scope of work. The following people attended the meeting:

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        Name            S      Organization        Electronic Mail Address
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Mr. Lawrence J. Lamers  P   Adaptec, Inc.            ljlamers@ieee.org
Mr. Vincent Bastiani    A#  Adaptec, Inc.            bastiani@corp.adaptec.com
Mr. Wally Bridgewater   A#  Adaptec, Inc.            wally@eng.adaptec.com
Mr. Tariq Abou-Jeyab    O   Adaptec, Inc.            tajeyab@corp.adaptec.com
Mr. Lee Hearn           V   Adaptec, Inc.            lee_hearn@corp.adaptec.
                                                     com
Mr. Bart Raudebaugh     P   Ancot Corp.             bart@ancot.com
Ms. Christine           V   Berg Electronics        cmulroney@fciconnect.com
Mulrooney
Mr. Bill Galloway       P   BREA Technologies, Inc.  billg@breatech.com
Mr. Robert C. Elliott   P   Compaq Computer Corp.    Rob_Elliott@compuserve.
                                                     com
Dr. William Ham         A   Compaq Computer Corp.    bill.ham@digital.com
Mr. Keith Childs        V   Compaq Computer Corp.
Mr. Charles Tashbook    P   Dallas Semiconductor     charles.tashbook@dalsemi.
                                                     com
Mr. Eugene Lew          P   Fujitsu                 elew@fcpa.fujitsu.com
Mr. Sam Ray             V   IBM                     str@us.ibm.com
Mr. George O. Penokie   P   IBM Corp.               gop@us.ibm.com
Mr. Brian Schuh         V   IBM Corp.               bschuh@us.ibm.com
Mr. Dennis Moore        P   KnowledgeTek, Inc.      dmoore@ix.netcom.com
Mr. John Lohmeyer       P   LSI Logic Corp.         lohmeyer@t10.org
Mr. Frank Gasparik      V   LSI Logic Corp.         frank.gasparik@lsil.com
Mr. Alan Littlewood     V   LSI Logic Corp.         alanl@lsil.com
Mr. William Petty       V   LSI Logic Corp.         william.petty@lsil.com
Mr. Brian Day           V   LSI Logic Corp.         brian.day@lsil.com
Mr. Keith Maloney       V   LSI Logic Corp.         keith.maloney@lsil.com
Mr. Dennis Rehm         V   LSI Logic Corp.         dennis.rehm@lsil.com
Mr. Mark Strauss        V   Lucent Technologies     msstrauss@lucent.com
Mr. Makesh              V   Lucent Technologies     makesh@lucent.com
KoMaudarauan
Mr. Richard Moore       A#  QLogic Corp.            r_moore@qlc.com
Mr. Ting Li Chan        V   QLogic Corp.            t_chan@qlc.com
Mr. Mark Evans          P   Quantum Corp.           mark.evans@quantum.com
Mr. Russ Brown          V   Quantum Corp.           russ.brown@quantum.com
Mr. Bruce Leshay        V   Quantum Corp.           bleshay@tdh.qntm.com
Mr. Ken Erickson        V   Quantum Corp.           ken.erickson@quantum.com
Mr. Duncan Penman       V   Quantum Corp.           duncan_penman@quantum.com
Mr. Hollis Poche        V   Quantum Corp.           hollis.poche@quantum.com
Mr. Gene Milligan       P   Seagate Technology      Gene_Milligan@notes.
                                                     seagate.com
Mr. Daniel (Dan) F.     O   Seagate Technology      daniel_f_smith@notes.
Smith                                               seagate.com
Mr. Mayank R. Patel     V   Seagate Technology      mayank_r_patel@notes.
                                                     seagate.com
Mr. Umesh Chandra       V   Seagate Technology      umesh_chandra@notes.
                                                     seagate.com
Mr. Bruce Maniloi       V   Seagate Technology      bruce_maniloi@notes.
                                                     seagate.com
Mr. John Masiewicz      V   Seagate Technology      john_masiewicz@notes.
                                                     seagate.com
Mr. Ron Roberts         V   Sierra-Pac Technology   rkroberts@aol.com
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Mr. Paul D. Aloisi      P  Texas Instruments       Paul_Aloisi@ti.com
Mr. Donald R. Getty     A# Texas Instruments       donald_getty@ti.com
Mr. Mike Kosco          V  Texas Instruments       mike@mvbuilders.com
Mr. John T. Wilson      V  Texas Instruments       jwilson@dal.asp.ti.com


45 People Present


Status Key:  P   -  Principal
             A,A# -  Alternate
             O   -  Observer
             L   -  Liaison
             V   -  Visitor
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4. SPI-4 Physical Topics

4.1 Free Running Clock

4.1.1   SPI-4 clocking proposal (99-262) [Petty]

Bill Petty asked that this item be deferred to a subsequent meeting.

4.1.2   ISI Compensation Selection [Penokie]

George Penokie presented a hand-drawn foil with a matrix of possible requirements on equalization and precompensation. He suggested that the results might shed some light on possible ways to resolve this issue. He asked for a per-company vote with each company allowed to vote Yes, No, or Abstain on each row.

Bill Ham argued that these features should not be optional. It is hard to design systems for optional features at the physical layer.

The voting was:

```
Driver       Receiver
Pre-Comp     Equalizer    Yes    No     Abstain
--------     ---------    ---    --     -------

Silent       Silent       0      12     1

Mandatory    Silent       6      5      2

Silent       Mandatory    4      6      3

Mandatory    Optional     6      5      1

Mandatory    Mandatory    4      6      1

Optional     Mandatory    4      7      1
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It was suggested that the voting might be more reveling if each company was allowed only one Yes vote. The results of this 'vote' were:

```
Driver       Receiver
Pre-Comp     Equalizer    Yes
--------     ---------    ---

Silent       Silent       0

Mandatory    Silent       4

Silent       Mandatory    1

Mandatory    Optional     4

Mandatory    Mandatory    3

Optional     Mandatory    1
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There was a short discussion of the significance of these two votes and it was agreed that we should wait until the next meeting before doing any more voting. Several people observed that more data is needed.

4.2 Training Patterns

4.2.1   Ultra320 SCSI Calibration Protocol (00-133) [Leshay]

Bruce Leshay presented 00-133r2, Ultra320 SCSI Calibration Protocol. Bruce noted an error on slide 8 where '100ns' should have been '200ns'.

There was some discussion regarding the startup of DATA OUT phase (slide 9) beginning before the assertion of the REQ signal by the target. Instead the initiator begins transmitting ACK pulses approximately 90 ns after it detects that the C/D, I/O, and MSG signals are in the correct state for DATA OUT phase.

The question of whether the free-running clock should be paused during the 50 ns data-line pause was left open until the next meeting. Bill Petty was given an action item to investigate this issue and give the response to Bruce Leshay as soon an possible.

4.2.2   Proposal for training pattern to be included in SPI-4 (00-132) [Evans]

Mark Evans asked that this item be deferred to a subsequent meeting.

4.2.3   Proposed Training for Skew Compensation (00-174) [Bastiani]

Wally Bridgewater presented 00-174, Proposed Training for Skew Compensation. Wally asked for an additional training pattern that would be specific to his implementation of equalization. Some concern was expressed over how many vendor-specific training patterns might be needed.

4.2.4   Training Patterns Modeling Results (00-193) [Penokie]

George Penokie presented 00-193, Training Patterns Modeling Results. His conclusion was that the impact of training on system throughput is low. He recommended that SPI-4 require training once per direction per connection, to be remembered throughout that connection only.

George projected his spreadsheet on the screen and showed the effect of changing various parameters as requested by several people who were present.

George Penokie moved that we recommend the summary section 00-193r0 be incorporated into SPI-4. Bruce Leshay seconded the motion. The motion passed 15:0:0.

4.3 Timings

4.3.1   Proposal for Fast-160 to be included in SPI-4 (99-295) [Milligan]

Gene Milligan presented portions of 99-295r3, Proposal for Fast-160 to be included in SPI-4. Several updates were made and Gene agreed to prepare a rev 4 document.

4.3.2   Clock Frequency Restrictions for Fast-160 [Evans]

George Penokie suggested that Fast-160 have a restricted frequency range on the clock period, rather than just being a maximum frequency. This would simplify both skew compensation and filter design. There was general agreement that such a restriction is a good idea. Gene Milligan noted that deleting some occurrences of 'or greater' from his proposal (99-295) should accomplish this goal and agreed to do so in the next revision of it.

4.3.3   Fast-160 Driver and Receiver Masks (00-198) [Aloisi]

Paul Aloisi presented 00-198r0, Fast-160 Driver and Receiver Masks. Paul suggested that the various Fast-160 proposals should be written in a similar format. This proposal also included masks for Fast-320, which some people judged to be premature.

4.4 Test Configurations

4.4.1   Use of eye measurements (00-126) [Bastiani]

Vince Bastiani asked that this item be deferred to a subsequent meeting.

4.4.2   ISI Measurements (99-337) [Bridgewater/Bastiani]

Vince Bastiani asked that this be deleted from the agenda.

4.4.3   Ultra320 into fully populated 10-slot backplane (00-195) [Brown]

Russ Brown presented 00-195, Ultra320 into fully populated 10-slot backplane. This presentation showed the benefits of equalization with an existing backplane.

4.4.4   Requirements for Measuring Receive Signals in SPI-4 and beyond (00-149) [Ham]

Bill Ham asked that this item be deferred to a subsequent meeting.

4.4.5   Receiver Input Voltage Budget for Eye Patterns (00-158) [Bridgewater]

This item was not covered separately from item 4.5.7.

4.5 Other SPI-4 Physical Topics

4.5.1   Precompensation and test measurements (00-194) [Maniloi]

Bruce Maniloi presented 00-194r0, Presentation on precompensation and test measurements. The data presented supports the case that precompensation alone is adequate for Fast-160.

There was considerable discussion about the relative merits of transmit precompensation vs. receiver equalization with no immediate closure. It was suggested that this issue might be more easily resolved if we could agree on some worst-case configurations.

George Penokie observed that if SPI-4 were to specify a minimum transmit precompensation level and it were to also include a mandatory training pattern for receiver equalization, then the decision to include (or not include) receiver equalization could be optional in SPI-4 devices.

4.5.2   320 data transfer rates on 25 meter cables (00-153) [McGarrah]

Mark Evans asked that this item be deleted from the agenda.

4.5.3   640 data transfer rates, a first look (00-154) [McGarrah]

Mark Evans asked that this item be deleted from the agenda.

4.5.4   Comments on adaptive filtering for Ultra320 SCSI (00-196) [Brown]

Russ Brown presented 00-196, Comments on adaptive filtering for Ultra320 SCSI.

4.5.5   Pre-Emphasis Experimental Data (99-167) [Gasparik]

Frank Gasparik asked that this item be deleted from the agenda.

4.5.6   Expander Topics [Ham]

Bill Ham presented 00-199, Proposal for expander requirements, domain validation basic integrity check, and related target requirements. He edited the document on screen with input from the group, producing revision 0. He stated an intention to prepare a revision 1, which would include a few more changes too extensive to do online.

4.5.7   Eye window amplitude (00-200) [Bridgewater]

Wally Bridgewater presented 00-200r0, Eye window amplitude. Wally said that precompensation mitigates the overdrive requirement. Thus we can reduce the overdrive requirement from 100 millivolts to 80 millivolts. Or if we leave it at 100 millivolts, we will have increased margin for the chip.

4.5.8   The zero offset problem for receiver equalization (00-201) [Bridgewater]

Wally Bridgewater presented 00-201, the zero offset problem for receiver equalization. He described an implementation of an equalizer circuit that he has been investigating. He is concerned that large amounts of equalization will introduce significant noise.

4.5.9   Next Meeting Testing Data [Penokie]

George Penokie asked that those with concerns about equalization or precompensation state their concerns so that the proponents can have an opportunity to address those concerns. The equalizer concerns were:

   1. Effects of offset in the equalizer circuit which are included in the eye mask (inject the offset before the equalizer circuit).
   2. What was the procedure that Russ used to determine "worst-case" crosstalk?
   3. Effects of crosstalk to/from a signal going the opposite direction from the data (ACK or REQ).
   4. Can the testers of equalizers run with longer patterns?

The precompensation concerns were:

1. Understand the difference of test setup vs. real silicon
2. Effects of crosstalk to/from a signal going the opposite direction from the data (ACK or REQ)
3. Does pre-comp increase common mode signal?
4. Does the power of the driver increase?
5. Ensure testing done with worst-case crosstalk.
6. Does pre-comp increase driver capacitance?

5. SPI-4 Protocol Topics

5.1 Margin Control (99-264) [Lamers]

Larry Lamers asked that this item be moved to the Commands, Architecture, and Protocol working group agenda in May. He also asked for reflector discussion on this topic.

5.2 Flow Control & Read Streaming (00-142) [Lamers]

Larry Lamers asked that this item be moved to the Commands, Architecture, and Protocol working group agenda in May. He also asked for reflector discussion on this topic.

5.3 PPR Message Enhancements (99-283) [Lamers]

Larry Lamers asked that this item be moved to the Commands, Architecture, and Protocol working group agenda in May. He also asked for reflector discussion on this topic.

6. Expanders and Domain Validation Topics

6.1 SCSI out of band communications method (99-213) [Petty]

Bill Petty asked that this item be deferred to a subsequent meeting.

7. New Business

There was no new business.

8. Meeting Schedule

The next meeting of the Parallel SCSI Working Group will be Wednesday, April 26, 2000 commencing at 1:00 p.m. until 6 p.m. and continuing Thursday, April 27, 2000 at 9:00 a.m. until 5:00 p.m. at the Embassy Suites (719-599-9100) in Colorado Springs, CO hosted by LSI Logic.

The subsequent meetings of this group are May 16 starting at 9 a.m. in Nashua, NH and Thursday, June 15, 2000 commencing at 9:00 a.m. and continuing Friday, June 16, 2000 in Chicago, IL.

9. Adjournment

The meeting was adjourned at 4:29 p.m. on Tuesday March 28, 2000.