SCSI signal modeling study group (SSM) 00-380r0
October 11,12, 2000
Santa Cruz, CA

Subject: Draft minutes for the SSM working group on October 11, 12, 2000 in Santa Cruz, CA

This was the next meeting to address the general subject of modeling for parallel SCSI. Paul Aloisi of TI led the meeting. Bill Ham of Compaq took these minutes. There was a good attendance from a broad spectrum of the industry. Umesh Chandra of Seagate hosted the meeting.

Last approved minutes: 00-302r1.

1. AGENDA SSM MEETING

2. Introductions

Paul Aloisi opened the meeting and conducted the introductions and reviewed the meeting purpose. He thanked Larry Barnes of LSI Logic for hosting the meeting.

3. Attendance

Attendance at working group meetings does not count toward attendance requirements for T10 plenaries.

The following folks were present:

Name	Company	E-Mail
Paul Aloisi	TI	Paul_Aloisi@TI.com
Larry Barnes	LSI	larry.barnes@lsil.com
Joe Basista	C&M	jbasista@cm-corp.com
Umesh Chandra	Seagate	umesh_chandra@notes.seagate.com
Jason Chou	Foxconn	JasonC@foxconn.com
Robert Christopher	IBM	bobchris@us.ibm.com
Zane Daggett	Hitachi	zdaggett@hcm.hitachi.com
Steve Gasparovic	EDA (IO2GO)	steve@io2go.com
Don Getty	TI	donald_getty@ti.com
Bill Gintz	Zeus	wcgintz@ix.netcom.com
Chuck Grant	Madison Cable	cgrant@madisoncable.com
Bill Ham	Compaq	bill_ham@ix.netcom.com
Lee Hearn	Adaptec	lee_hearn@corp.adaptec.com
Thom Kreusel	HP	thom_kreusel@hp.com
David MacQuown	Adaptec	david_macquown@corp.adaptec.com
Bruce Manildi	Seagate	bruce_manildi@notes.seagate.com
Richard McMillan	Adaptec	Richard_mcmillan@corp.adaptec.com
Martin Ogbuokiri	Molex	mogbuokiri@molex.com
Bill Troop	IBM	troop@us.ibm.com
Richard Uber	Quantum	richard.uber@quantum.com
Greg Vaupotic	Amphenol Spectra-Strip	greg.vaupotic@snet.net

4. Agenda development

The agenda shown was that used.

5. Approval of previous minutes

The minutes of the last meeting were reviewed and minor changes were made. Bill Ham moved and Paul Aloisi seconded that the draft minutes be approved. Motion passed unanimously. This document will be posted as document 00-218r1.

6. Action item review

The action items were reviewed with the status indicated in the action item section of the minutes.

7. Administrative structure

The present administrative structure for SSM is:

Paul Aloisi, TI, chair
Larry Barnes, LSI Logic, Vice chair
Bill Ham, Compaq, Secy

8. Presentation Policy

This item is included for easy reference and will be retained in future minutes.

It is the policy of the SSM working group that all material presented at the SSM working group shall be made available electronically and posted on the T10 web site.

Material presented at the meeting should be uploaded to the T10 web site two weeks prior to the meeting. Alternatively the material may be electronically supplied to the chair or secretary at the meeting where the material is presented at the discretion of the chair.

Material should be free from any statement of confidentiality or restriction of use and should not contain any pricing or product scheduling information.

9. Document review - Barnes

Larry Barnes conducted a detailed review of rev 02 of the SSM document. The revised document will be created as rev 03.

10. Presentations

10.1 Twisted flat - Umesh Chandra, Seagate

Deferred to next meeting.

10.2 Cable extraction data, Chuck Grant, Umesh, Madison, Seagate cable media round robin 2

Deferred to next meeting.

10.3 Backplane verification investigation, Umesh Chandra, Seagate

Umesh described some swept frequency S12 measurement results that used baluns with 122 ohm L pads as the connection to the backplane. A 2 port VNA was used. Complex frequency responses were found over the range 1 to 200 MHz. This data will be posted on the T10 web site.

10.4 Twisted flat modeling (transition region) - Bob Gannon, JPM

[This material is retained from the last minutes as the item is still active and Bob was not present at this meeting.]

Bob continued his discussion of using the Ansoft tool for twisted flat to flat using an IDC connector. At the last meeting the choice for modeling sections were determined to be non-optimal. In the revised attempts concentration was on the flat wire to twisted wire parts. This assumes that there is an abrupt transition between the flat and twisted.

One notable effect was imbalance in some outputs. This was probably due to having different loads on the driving sources in the model and should be easily fixed.

Since much of the work for the flat media and twisted planar media has already been done as a result of this transition modeling effort. Greg Vaupotic agreed to “write descriptions showing how to electromagnetically model flat (planar) cable, both twist section and flat section. He will list known concerns for group resolution.”

At this point the basic modeling process for the flat to twisted transition region has been completed except for final verification. The next step will be to address the PC board to connector transition.

Bob still needs to supply input for the document for the transition region.

There is still no proposal concerning how to approach the round cable to connector transition region.

10.5 Periodic Structures in transmission lines, Larry Barnes, LSI Logic

Larry presented the same information as presented in the PIP meeting. This information will be uploaded to the T10 web site.

10.6 Accuracy of models IBIS, HSPICE, measurement, Barnes

A discussion of accuracy was led by Larry Barnes.

www.eigroup.org/ibis/default.html

The following documents that can be found on this web site were discussed in some detail.

Acc spec.pdf (Accuracy spec)
handbook.pdf
report.pdf

It is strongly suggested that anyone involved with creating/using IBIS methodology read, understand, and heed the content in these documents.

11. Matrix development for SSM

The following summarizes the present position for the SSM matrix. This matrix is a concise description of the methodology to be used for the respective areas of the point to point SCSI bus segment. Several of the areas were significantly modified at this meeting. Note that the multidrop areas have not yet been identified.

This section contains some repeated information from the last minutes as it continues to be relevant and current.

11.1 Transceiver chips: owner, Dean Wallace (need new owner)

Interface is at packaging pins

Model types: Behavioral only (because it is the only transportable type)
Data patterns: TBD
ISI compensation: required but not presently believed compatible with IBIS capability – this means that IBIS will have to be enhanced.
Single line required - cross talk from non SCSI sources not considered in the model, SCSI line cross talk is not significant within the transceiver. Therefore multiline models are not required for transceivers. (Possible risk with some package types.)

11.2 Bus segment termination: owner, Paul Aloisi / Don Getty

No new content information.

Interface is at package pins
Model types: Either circuit or behavioral
Terminator type: multimode
Single line only

11.3 Host bus adapter / target board (transceiver board): owners, Lee Hearn / Matt Schumacher

Interface is at transceiver board connectors used for the SCSI link (at the board side of the connector - not including the connector), transceiver chip pins, terminator chip pins, unused connectors are part of the board
Model types: Circuit
PCB construction: edge, broadside, dielectric type / thickness, vias, pads, discontinuities
Single line, multiline

11.4 Mated connectors: owner, Martin Ogbuokiri

No new content information.

Interface is at transceiver board and the beginning of the cable assembly transition region
Model types: Circuit
Connector types: VHDCI, SCA-2, HD68
Mounting style: thru hole, SMT,
single line, multiline

Connector models are in place at the Molex web site and pointers are now in place on the T10 site.

11.5 Transition regions: owners, Bob Gannon, Greg Vaupotic

Interfaces are at the connector termination and the uniform media
Model types: circuit
Construction types: twisted flat, round fanout, laminated round, IDC flat?
Single line multi-line

A start was made in this area – see Bob Gannon presentation above.

11.6 Uniform cable media: owner, Jie Fan, Zane Daggett, Greg Vaupotic

Interfaces are at the beginning of the cable assembly transition region on either end.
Model types: circuit
Cable types: flat, round shielded, round unshielded twisted flat?
Single line, multiline

11.7 Backplane: owner, Larry Barnes

Interfaces: connectors mounted on the backplane, directly mounted components, (this subject is still not settled)
Model types: circuit
PCB construction: edge, broadside, dielectric type / thickness, vias, pads, discontinuities
Single line, multiline

Issue: how to handle the unmated connectors on the backplane. Two sub issues: (1)lack of existence of unmated connector models and (2) convergence of the simulation with dangling open circuits. The latter can be handled by adding a high value resistance to the open circuit to "fool" the simulator.

11.8 Cable assemblies, owner TBD

Interfaces: connectors
Model types: circuit (possible combination of circuit and behavioral)
Constructions: point to point, multidrop

11.9 How to develop IBIS model annex, Barnes

12. Simulation integration strategy

Determine the goal of the simulation (examples: validate the basic behavior of a new component in a system, troubleshooting guidance, qualification of the signal integrity in a specific configuration, characterization of the expected EMI performance)

Determine the specific characteristics that are sought (example: ??)

Define the topology

Define the collection of components

Obtain the models for all the components

……subject discussion truncated – will continue next meeting.

12.1 System configurations - Topology

Not discussed but reaffirmed as needed for the document

12.2 Data patterns, Bill Ham (new owner)

The training pattern specified in SPI-4 shall be used as one input pattern. Clock-like patterns are also needed (full data rate, 1/32 of the data rate). Isolated “1’s” and “0’s” – stable period at least a round trip time before the isolated bit.

The following is extracted from SPI-4 as the only existing description of the training pattern. This description needs to be modified in a way that takes the protocol sequencing out but leave a description of the training pattern itself. It is clear that the simulation that uses the training pattern needs to be aware of the specific details of the application (such as, data phase speed and intensity of precompensation to be used).

[beginning of training pattern description]
10.8.4.2.3 DT DATA OUT phase training pattern
The target shall request a training pattern on a DT DATA OUT phase by:
1) negating the SEL signal a minimum of two system deskew delays before changing the MSG, C/D,and I/O signals, and
2) asserting the SEL signal a minimum of two system deskew delays after asserting the MSG signal and negating the C/D and I/O signals.
The target shall begin the training pattern no sooner than two system deskew delays after negating the SEL signal. The target shall transmit the following training pattern:
1) disable precompensation;
2) assert REQ and P_CRCA signals;
3) wait 32 transfer periods (e.g., 200 ns at fast-160);
4) negate REQ and P_CRCA signals;
5) wait 32 transfer periods (e.g., 200 ns at fast-160);
6) set precompensation to negotiated state;

7) negate SEL signal;
8) simultaneously assert and negate REQ and P_CRCA signals at the negotiated rate for 64 transfer periods, (e.g., 400 ns at fast-160); and
9) on detection of the 8th 0000010011111011b pat t ern on the DB(15- 0) signals the target shall begin asserting and negating REQ to indicate to the initiator valid data may be sent. The number of REQ transitions shall not exceed the negotiated offset.

The initiator shall begin the A section of the training pattern on detection of the assertion of the SEL signal with MSG true and C/D and I/O false. The initiator shall transmit the following training pattern:
Start of A section;
1) simultaneously assert ACK, P1, and DB(15-0) signals;
2) wait 32 transfer periods (e.g., 200 ns at fast-160);
3) simultaneously negate ACK, P1, and DB(15-0) signals;
4) wait 32 transfer periods;
5) simultaneously assert and negate ACK, P1, and DB(15-0) signals at the negotiated rate for 128
transfer periods, (e.g., 800 ns at fast-160);
Start of B section;
6) on the 128th transfer period negate P1, and DB(15-0) signals while continuing to assert and negate ACK at the negotiated rate for 8 transfer periods (e.g., 50 ns at fast-160);
7) negate ACK for 8 transfer periods;
8) simultaneously assert and negate P1 and DB(15-0) signals at twice the negotiated rate for while asserting and negating ACK at the negotiated rate for 48 transfer periods (i.e., simultaneously
repeat a 1100b bit pattern 12 times on each signal); and
Start of C section;
9) assert and negate ACK at the negotiated rate for 128 transfer periods while repeating a 0000010011111011b bit pattern eight times on P1 and DB(15-0).
At the completion of the training pattern the initiator continues asserting and negating the ACK signal at the negotiated rate (e.g., 6,25 ns transfer period at fast-160) and the P1 signal at twice the negotiated rate
(e.g., 12 ns transfer period at fast-160). When the initiator is ready to transfer data and there are outstanding REQs it shall reverse the phase of P1 (see 10.8.4.3).

[end of training pattern description]

[The following is retained from the last minutes until transferred into the SSM document]

A preliminary discussion of the issues involving data patterns was held. The following resulted:

Data patterns need to consider the following properties:

- Intersymbol interference effects on single lines
- Cross talk from other SCSI lines

- driver release effects (driven to hi Z)
- Residual jitter (clock like patterns)
- Word patterns as well as individual patterns
- SSO
- Worst case digital patterns
- Sinusoidal patterns
- Resonance sensitivity

A spirited discussion concerning how to deal with receivers that modify the input signal (either adaptively or not) was held. Is this part of the signal path or not?

A more general concept of data pattern is possible with simulation because the inputs can be selected in the model. For example, skew from line to line and skew within the same line can be introduced. This latter was not considered in any detail but promises to be a significant benefit of modeling.

12.3 Data rate, Dean Wallace (need new owner)

[Retained from the last minutes until transferred into the SSM document]

Data transfer rates in SCSI are determined by more than the highest frequency content of the signals. Specifically, single transition, double transition, width, specific protocol variant and adaptive filtering affect the data rate. Therefore one must be careful in simulation to ensure that the relationship between the analog signals and the application is understood.

The following table will be added to the document that shows some of the relationships:

SCSI variant	REQ/ACK maximum frequency (MHz)	Data line maximum frequency (MHz)	Minimum rise / fall time (ns) (20-80%)	Maximum launch amplitude
SCSI-1 SE	async - NA	NA	NA	5.25V
SCSI-2 SE	5 MHz	2.5 MHz	NA	5.25V
SPI-1 SE	10 MHz	5 MHz	5 ns	5.25v
Ultra SE	20 MHz	10 MHz	5 ns	3.7v
Ultra2 LVD	40 MHz	20 MHz	1 ns	2.2 V DFpp
Ultra 160 LVD	40 MHz	40 MHz	1 ns	2.2 V DFpp
Ultra 320 LVD	80 MHz	80 MHz	1 ns	2.2 V DFpp
Ultra 640 LVD	160 MHz	160 MHz	???	???

13. Tools:

Not discussed at this meeting

14. Document framework, Barnes

15. Should the group standardize on the IBIS connector matrices?

To be answered by the group in December.

16. New business

17. Next meetings

Scheduled meetings:

December 13-14, 2000, 1:30PM to 6PM 12/13, 9AM to 6:00PM 12/14, Manchester, NH (Hitachi)

Requested meetings:

February 21-22, 2000 1:30PM to 6 PM 02/21 9AM to 6:00PM 02/22, Southern CA Foxconn
April 4-5, 2000 1:30PM to 6 PM 04/04 9AM to 6:00PM 02/05 Worcester, MA (Madison)

18. Action Items:

18.1 Action items from previous meetings

Status as of the October 12, 2000 meeting is shown.

Larry Barnes will hatch a BIRD at IBIS to incorporate ISI compensation as defined by SPI-4 when SPI-4 stabilizes.
Status: transformed from old action item - needs group input for resolution -- carried over

Action item: Bruce Manildi to provide access information for the Seagate transceiver models to the web site.

Status: The presently available transceiver IBIS models are not accurate enough to release for general use. Seagate intends to continue to work toward generating an accurate IBIS model. A simplified interactive HSPICE model can be supplied via some mechanism to be determined - this approach does not conform to the present requirements for the T10 web site - carried over

Larry Lamers to provide access information for the Adaptec transceiver models to the web site.
Status: IBIS models now exist but there is reluctance within Adaptec to release the models to the T10 web site because of concern about the IP contained in the model, Adaptec intends to provide appropriate models after due internal consideration within Adaptec -- carried over

Larry Barnes to provide access information for the LSI transceiver models to the web site.
Status: done.

Chuck Grant, Madison Cable to provide a cable media model to the web site.
Status: model is done and will be made available in circuit form – awaiting Chuck Grant review - will be supplied to T10 web site - carried over

Bob Gannon to produce matrix of transition regions and issues with each.
Status: partially done

Dean Wallace to direct an action item to address the methodology for incorporating ISI precompensation into an IBIS model.
Status: overcome by events and transferred to the Larry Barnes BIRD

Clint Heiser, Hitachi, to provide cable media models to the SSM web site (per last meeting minutes).
Status: carried over

Section owners are to create basic material and submit to Larry Barnes before the next meeting.
Status: the following supplied info: Greg Vaupotic, others made no progress

Martin will put the connector IBIS model presentation on the T10 web site.
Status: done

Paul A to send emails to all folks with open action items on Tuesday of each week (until the action item is completed).
Status: ongoing

Larry Barnes to take the material in the SPI-3 and SPI-4 document relating to the signal budget and figure out how to incorporate into the SSM document
Status: carried over

Larry B to send emails to all folks with open document issues on Tuesday of each week (until the issue is closed).
Status: ongoing

Section editors to provide material to Larry for the next revision of the document.
Status: ongoing

18.2 New action items from present meeting

Larry Barnes to bring a “bird” document template to be filled out in the December meeting
Status: new

Umesh to describe his experience with using HSPICE for an entire system simulation including validation.
Status: new

Bill Ham to add the interoperability material to his section
Status: new

19. Adjourn

The meeting adjourned at 6:00 PM