SCSI signal modeling study group (SSM) 00-302r1
October 11, 2000
Santa Cruz, CA

Subject: Approved minutes for the SSM working group on August 15-16, 2000 in Colorado Springs, CO

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. Larry Barnes of LSI Logic hosted the meeting.

Last approved minutes: 00-254r1.

1. AGENDA SSM MEETING (Colorado Springs, CO)

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
Bob Canniff	Hitachi	rcanniff@hcm.hitachi.com
Umesh Chandra	Seagate	umesh_chandra@notes.seagate.com
Dave Chapman	Amphenol	dave.chapman@aipc.fabrik.com
Zane Daggett	Hitachi	zdaggett@hcm.hitachi.com
Jie Fan	Madison Cable	jfan@madisoncable.com
Bob Gannon	JPM	rgannnon@jpmco.com
Bill Ham	Compaq	bill_ham@ix.netcom.com
Lee Hearn	Adaptec	lee_hearn@corp.adaptec.com
Clint Heiser	Hitachi	cheiser@hcm.hitachi.com
Larry Lamers	Adaptec	ljlamers@ieee.org
Matt Schumacher	Compaq	matt.schumacher@compaq.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

Dean Wallace cannot continue as SSM chair. If it is acceptable to the group, Paul Aloisi will take over as chair and we need to elect a new vice chair.

Larry Barnes agreed to accept the vice chair position effective at the next meeting.

The present administrative structure for SSM is:

Paul Aloisi, TI, chair
Vice chair vacant
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 Cable media model creation methodology, Jie Fan, Madison cable

Jie presented details of a cooperative effort between Madison and Seagate to compare the two model creation methods: (1) parameter extraction from the physical geometry and (2) RLGC matrix based on measured cable performance.

The results of this effort, which will involve testing at both companies, will be presented to the SSM group. The report is expected at the November 2000 meeting.

10.2 Modeling of twisted flat cable assemblies - Umesh Chandra, Seagate

Umesh showed some results at the last meeting from attempts to simulate a twisted flat construction used in a complete SCSI segment. This presentation at this meeting was intended to further explore this subject but was not actually presented due to Umesh having to leave early.

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

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.

10.4 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.

10.5 Fourier Spectrum for SCSI, Larry Barnes, LSI Logic

Larry has a presentation that quantifies the spectral intensity of the Fourier Components.

The power spectrum thru the 7^{th} harmonic contains most of the energy.

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 (reaffirmed)

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.

Action item: Larry Barnes to supply component definition and a graphical representation for the backplane (should not contradict the transceiver board if possible)

11.8 Cable assemblies, owner TBD

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

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.

13. System configurations

Not discussed but reaffirmed as needed for the document

14. Data patterns, Dean Wallace

[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.

15. Data rate, Dean Wallace

[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	???	???

16. Definitions:

A comprehensive set of definitions has been created in the draft document. Definitions from IEEE standard dictionary are used if available.

17. Tools:

Not discussed at this meeting

18. New business

18.1 Press release for the SSM project.

A “press release” was designed for NCITS publication that clearly announces the intent and existence of a web site that is capable of providing links to SCSI component models.

19. Next meetings

Scheduled meetings:

October 11-12, 2000, 1:30PM to 6PM 10/11, 9AM to 6:00PM 10/12, Santa Cruz, CA (Seagate)

Requested meetings:

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

February 21-22, 1:30PM to 6 PM 02/21 9AM to 6:00PM 02/22, Worcester, MA (Madison Cable)

20. Action Items:

20.1 Action items from previous meetings

Status as of the August 15-16, 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 - on hold pending SPI-4 resolution -- carried over

Action item: Bruce Manildi to provide access information for the Seagate transceiver models to the web site.
Status: IBIS models are not intended to be made available at this time due to concern about the accuracy of the model in its present state – a simplified interactive HSPICE model will be supplied via some mechanism to be determined - this approach does not conform to the 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: doneilable on the T10 web site.

Jie Fan, Madison Cable to provide a cable media model to the web site.
Status: model is done and will be made available in HSPICE form – awaiting Madison web page reconstruction - carried over

Larry Barnes to supply component definition and a graphical representation for the backplane (should not contradict the transceiver board if possible)

Status: done

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

Larry Barnes to provide information and techniques to allow generation of an IBIS model. This information will take the form of a section in the SSM document and is expected to be used by SSM folks in creating their transceiver models. This will be part of a rev of the SSM document and is expected to be placed on the T10 web site before the end of May 2000.
Status: done

Dean Wallace to direct an action item to address the methodology for incorporating ISI precompensation into an IBIS model.
Status: carried over

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: Paul Aloisi, Greg Vaupotic, Bob Gannon, others made no progress

Martin will put the connector IBIS model on the T10 web site.
Status: carried over

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

Paul Aloisi to contact J. Lohmeyer to determine why the pointer to Don Getty (TI stuff) as provided by Paul Aloisi months ago is not on the T10 modeling web site.
Status: done and the pointer is now on the site.

Larry Barnes to put rev0 of SMM on the T10 web site
Status: done and rev 02 is the latest on the site

Paul Aloisi to put the subject of the IBIS connector model on the agenda for the August meeting
Status: done

Paul Aloisi to provide the assumptions used to create the system budget for the SPI-3 and SPI-4.
Status: done 99-196r0 and 00-239r0

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

Umesh to check with Gene Milligan to determine if the units for describing the precomp specifications are consistent with the units used in SPI-3
Status: overcome by events

Larry Barnes to create a Fourier spectrum from the following pulse: clock-like, with 1ns rise and fall times, and a 80 MHz rep rate.
Status: done

20.2 New action items from present meeting

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

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

21. Adjourn

The meeting adjourned at 6:00 PM