1. Opening

The meeting opened at 9:03 am

2. Attendance

Mr. Paul von Stamwitz	AMCC
Mr. Gregory McSorley	Amphenol Interconnect
Mr. Kevin Marks	Dell, Inc.
Mr. William Martin	Emulex
Mr. Dana Bergey	FCI
Mr. Douglas Wagner	FCI
Mr. David Freeman	Finisar Corp.
Mr. Elwood Parsons	Foxconn
Mr. Mike Fitzpatrick	Fujitsu
Mr. Rob Elliott	Hewlett Packard Co.
Mr. Barry Olawsky	Hewlett Packard Co.
Mr. Jeff Wolford	Hewlett Packard Co.
Mr. Dan Colegrove	Hitachi Global Storage Tech.
Mr. James Rockrohr	IBM
Mr. Harvey Newman	Infineon Technologies
Dr. Mark Seidel	Intel Corp.
Mr. Joel Silverman	Kawasaki Microelectronics Am
Mr. Dennis Moore	KnowledgeTek, Inc.
Mr. Brian Day	LSI Corp.
Mr. George Penokie	LSI Corp.
Mr. David Geddes	Marvell Semiconductor, Inc.
Mr. Kevin Witt	Maxim Integrated Products
Mr. Guillaume Fortin	PMC-Sierra
Mr. Tim Symons	PMC-Sierra
Mr. Alvin Cox	Seagate Technology
Dr. Sanjay Sethi	Toshiba
Mr. Dan Gorenc	TycoElectronics
Mr. Scott Shuey	TycoElectronics

28 People Present

3. Review of documents and proposals
4. Letter ballot resolution
4.1 OOB transmitter requirements
Add note d flag to the first line in Table 66 and change note d to read as follows:

With a measurement bandwidth of 4.5 GHz, each signal level during the OOB burst shall exceed the specified minimum differential amplitude before transitioning to the opposite bit value or before termination of the OOB burst as measured with each test load at transmitter device compliance points IT and CT.

4.2 SAS-2 S-Parameters of Cable Assemblies and Backplanes (08-187r1) [Olawsky]

L,N, and H should have in dB as done with S. Use one graph in reference section. (Figure 97).

4.3 Propagation delay

The STP flow control budget (sas2r14 section 7.17.2 note 77) assumes 5 ns/m prop delay on a cable. For 10 m, this means:
- one-way prop delay 50 ns
- round-trip prop delay 100 ns
- 26 2/3 ns per dword at 1.5 Gbps
- 100 / 26 2/3 = 3.75 dwords on the wire at 1.5 Gbps
- 100 / 26 2/3 * 2 = 7.5 dwords at 3 Gbps
- 100 / 26 2/3 * 4 = 15 dwords at 6 Gbps

We use that to justify a buffer size of 4 dwords at 1.5 Gbps, 8 dwords at 3 Gbps, and 16 dwords at 6 Gbps.

However, http://www.spectra-strip.amphenol.com/ecpartsearch3.cfm?partID=366
says an Amphenol Spectra-Strip cable has 5.1 ns / m nominal propagation delay, longer than our assumption.

What is a good worst-case propagation delay number to use?

If it were 5.3 ns, then we'd be right at the budget:
5.3 / 26 2/3 = 3.975 dwords at 6 Gbps
5/.3 / 26 2/3 * 4 = 15.9 dwords at 6 Gbps

Worst than 5.3 means our budget is not big enough.

We should probably add a rule in chapter 5 that a SAS cable (or any interconnect) must have a total propagation delay of less than 50 ns (or 53 ns... whatever matches note 77).

Solution:
Add the following in the TxRx requirements section and add pointer in the cable. backplane section to it:

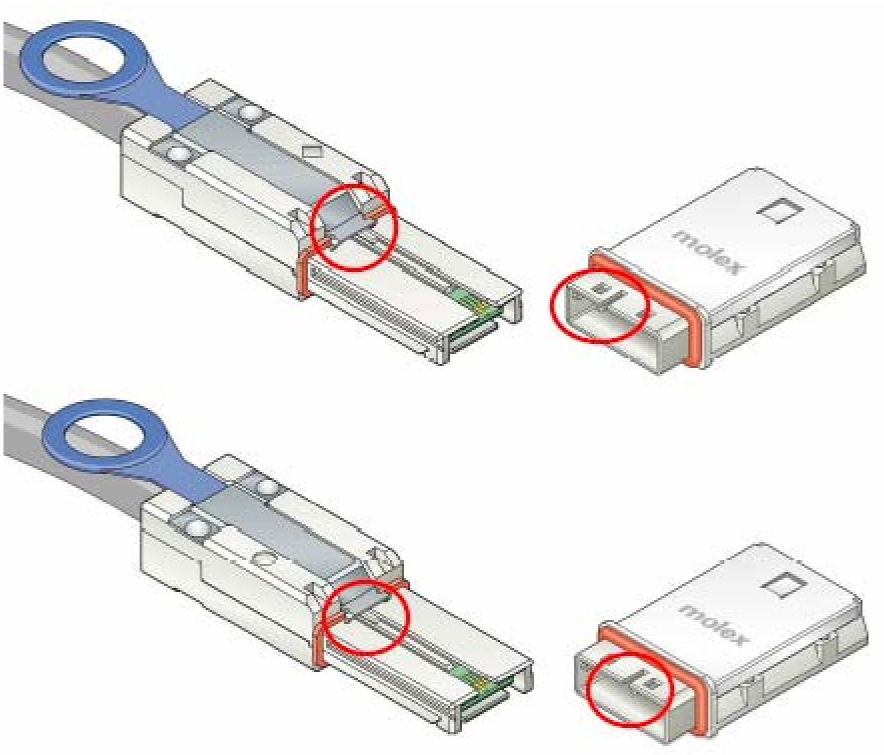
To support STP flow control minimum buffer size implementations, the total propagation delay of the TxRx connection shall be less than 53 nS.

4.4 Electrical questions on SAS 2.0 to SAS 1.1 support? (08-188r0) [Felton]

See topic 4.5 that addresses this issue.

4.5 10-meter cable keying

Molex proposed keys on top in conjunction with key slots. This was agreed to as a reasonable approach that allows SAS 1.1 cables in SAS 2.0 configurations but keeps SAS 2.0 cables out of SAS 1.1 configurations. Regarding marking, it was suggested to use two marks for SAS 2.0 cables (higher loss than the SAS 1.1 TCTF). Jay Neer will provide specification updates. STA decided to use only one key instead of the two different key locations in Molex's original presentation. In other discussion, it was explained that regardless of length, if a cable has less than or equal to the loss of the SAS 1.1 TCTF, then the additional keying for SAS 2.0 should not be used.



4.6 Status of simulation tools

There is currently no available working simulation software for receiver testing. Without simulation software, we have no path to complete SAS 2.0.

It was decided that issues be resolved with the mathematical models first, and then use the captured waveform input. Kevin Witt will generate models including the ideal reference transmitter with and without RJ added. These will also be run through the reference channel in Metlab to produce two additional cases.

The FCAL derivative is not a difficult technical issue to make applicable to SAS. IP issues need to be resolved. We need a parallel path pursued for simulation software. The specification does allow “or equivalent” versions to be used, so efforts to provide an addition software option will not be a wasted effort and may provide the primary solution.

How do we deal with SSC? Including with RJ is not good because of the x14 multiplier. Probably needs to be an added-in budget.

4.7 SAS-2 letter ballot comment updates for transmitter and receiver tables (08-202r0) [Cox]

Alvin to post r1 that was done at the May meeting.

4.8 Considerations for Testing Jitter Tolerance Using the #Inverse JTF# Mask (08-248r0) [Fortin]

Use in conjunction with receiver testing. Add plots for support of SSC with SAS 2.0 1.5 and 3.0 G support.

4.9 Proposed Changes to Receiver Device Physical Testing Section in SAS 2 Draft (08-146r1) [Jenkins]

Discussed as part of the receiver test solution. (item 4.6)

4.10 Comments on SAS2r14 Physical Layer (08-144r2) [Witt]

Discussed as part of the receiver test solution. (item 4.6)

4.11 Intel comments on common-mode voltage:

T10 Phy WG,

The transmitter common-mode voltage limit is specified in two places, once in Table 61 as a broadband limit, and again in Figure 123 as a per-frequency-band limit. Table 61 limits the overall amount to 30 mVrms which translates to 84.9 mVpp if the AC signal is a pure sinusoid. Figure 123 imposes a limit in the band 100 MHz to 300 MHz (1 MHz measurement band) to 12.7 dBmV which translates to 4.3 mVrms and 12.2 mVpp if it is a pure sinusoid.

Furthermore, if the transmitter had energy at each band that followed the limits in Figure 123 it would far exceed the limit in Table 61. A collection of discrete frequencies at the limit in Figure 123 would violate the overall limit, such as (for example) spikes at 100 MHz, 200 MHz, and so on up to 1400 MHz at the Fig 123 limit would violate the overall limit. As another example, spikes at 100 MHz, 300 MHz, 500 MHz, and so on up to 1900 MHz would violate the limit, as would a set of spikes at 750 MHz, 1500 MHz, 2250 MHz and 3000 MHz. Note that these spikes would violate the "energy" aspect of the limit, where they are combined as a sum-of-squares and then translated effectively into a sinusoid. The actual combination of the spikes would depend on the relative phases; the smallest I could find for the 750/1500/2250/3000 MHz case was approximately 40 mV, so that combination of frequencies could not all simultaneously be at the Fig 123 levels.

Since these sinusoidal levels are quite small, I propose that we remove Figure 123 and its limits entirely and retain only the limit in Table 61. This absolute wide-band time-domain specification will be enough to limit transmitted CM energy and still allow the silicon and system designers enough leeway to specify their power supply noise and filtering limits depending upon the particular frequencies in their systems. This leeway should not jeopardize practical systems.

Resolution: No action taken at this time. Data needs to be supplied regarding this concern. Previous postings regarding the limit value were reviewed.

4.12 Letter ballot editorial comments.

LSI voiced several concerns over rejected editorial comments. These were reviewed and most resolved. In addition to the resolutions made during the discussion, Alvin will take on the task of updating Annex B with regards to the use of "required".

5. SAS-2.1 topics

5.1 SAS-2 Mini SAS 8i connectors and cable assemblies (07-449r0) [Elliott]

Not reviewed.

5.2 Proposal for SAS 2.x Specification to Enable Support for Active Cables (08-052r6) [Oganessyan]

5.3 Active Copper Cables for SAS-2.x, Part 3 (08-280r0) [Oganessyan]

Several comments made regarding many aspects, both editorial and technical. Updates to be made and more discussion to follow.

6. New business

6.1 SAS-2 MiniSAS Channel Characteristics with Return Pin Removal (08-292r0) [Olawsky]

Data taken on crude, experimental physical implementations of removing grounds for active cables highlights concerns over doing this. Suggestions made regarding where to take pins from if the connector is not changed to a different version that preserves the existing ground locations.

7. Review of Recommendations

None.

8. Meeting Schedule

The weekly SAS PHY working group calls will resume on July 31, 2008. All calls begin on Thursdays at 10:00 CDT.

Toll Free Dial in Number: (877)810-9442
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PARTICIPANT CODE: 3243413

Webex information:
https://seagate.webex.com/seagate
Topic: SAS-2 PHY WG
Date: Thursday
Time: 10:00 am, Central Daylight Time
Meeting number: 826 515 680
Meeting password: 6gbpsSAS

9. Adjournment

The meeting adjourned at 6:54pm.