1. The meeting opened at 9:05.
2. Agenda was approved. New business was inserted into the locations where it fit.
3. Attendance

Mr. William Lynn	Adaptec, Inc.
Mr. Ziad Matni	Agere Systems
Mr. Paul von Stamwitz	AMCC
Mr. Brian Miller	Amphenol AssembleTech
Mr. Rick Hernandez	AvagoTechnologies
Mr. Ron Roberts	Broadcom Corp.
Mr. Steven Wong	Comax Technology Inc
Mr. Steve Robalino	Dallas Semiconductor
Mr. Kevin Marks	Dell, Inc.
Mr. Greg McSorley	EMC
Mr. Douglas Wagner	FCI
Mr. Elwood Parsons	Foxconn Electronics
Mr. Mike Fitzpatrick	Fujitsu
Mr. Nathan Hastad	General Dynamics
Mr. Rob Elliott	Hewlett Packard Co.
Dr. William Ham	Hewlett Packard Co.
Mr. Barry Olawsky	Hewlett Packard Co.
Mr. James Rockrohr	IBM
Mr. George O. Penokie	IBM Corp.
Mr. Harvey Newman	Infineon Technologies
Mr. Richard Beckett	Intel Corp.
Dr. Mark Seidel	Intel Corp.
Mr. Mike Micheletti	Lecroy Corp
Mr. Michael Jenkins	LSI Logic Corp.
Mr. Jim Walch	Marvell Semiconductor, Inc.
Mr. Wei Zhou	Marvell Semiconductor, Inc.
Mr. Martin Czekalski	Maxtor Corp.
Mr. Richard Uber	Maxtor Corp.
Mr. Edward Cady	Meritec
Mr. Galen Fromm	Molex Inc.
Mr. Jerry Kachlic	Molex Inc.
Mr. Michael Hopgood	Nvidia Corp.
Mr. Yuriy Greshishchev	PMC-Sierra
Mr. Tim Symons	PMC-Sierra
Dr. Steve Gorshe	PMC-Sierra, Inc.
Mr. Alvin Cox	Seagate Technology
Mr. Vit Novak	Sun Microsystems, Inc.
Mr. Robert Kando	Texas Instruments
Mr. Doug Loree	Toshiba
Ms. Ashlie Fan	TycoElectronics
Mr. Dan Gorenc	TycoElectronics
Mr. Ron Mathews	UNISYS Corporation
Mr. Kevin Witt	Vitesse Semiconductor
Mr. Michael Yeager	Vitesse Semiconductor
Mr. Jeff Williams	Xiotech Corp.

45 People Present

4. Agenda
4.1 Modeling:
4.1.1 SAS-2 10-Meter Multilane Cable Assembly Models (06-027r0) [Fromm]
http://www.t10.org/ftp/t10/document.06/06-027r0.pdf

Models available on T10 site. Contact Galen with any questions. Simulations have shown it is possible to use a 10-meter external cable with proper equalization provided in the transmitter device and/or receiver device.

4.1.2 SAS-2 Channel Models (4-Connector, Board-to-Board) (06-017r0) [Olawsky]
http://www.t10.org/ftp/t10/document.06/06-017r0.pdf

Posted in December to T10 site. High loss models, approximately 25" backplane length. Some of those who have done simulations have supplied feedback to Barry.

4.1.3 Enhanced SFF-8470, SFF-8086 and SATA Cable at 6Gbps (06-052) [Witt]
http://www.t10.org/ftp/t10/document.06/06-052r0.pdf

De emphasis can be used with Meritec cables to achieve an open eye at 10 an 15 meter length at 6Gbps.
S parameters will be posted.
Evaluation card makes a significant difference in test results.
SATA has open eye with a 1-meter cable at 6G
It is expected that 6G SATA Drives will be optimized for the SATA Channel.
It I anticipated that SAS-2 phys will need to provide the Tx and Rx equalization to support SATA 6G drives in SAS-2 non-low-loss channels
Transmitter tuning would add complexity to the SAS specification. This aspect needs to be considered when evaluating the specification requirements.

4.1.4 SAS-2 Channel Model Simulations (05-425R1) [Witt]
(Not posted as of minutes completion.)

Concerns voiced that return loss and system capacitance will have a significant impact on the eye results. The simple case is shown for a starting point. If these models don't allow the eye to open, then adding more complexity to the system model will only make it worse.

4.1.5 Comparison of Equalization Schemes for 6G SAS Channels (06-049) [Caroselli, Malipatil]
http://www.t10.org/ftp/t10/document.06/06-049r0.pdf

One or two post curser or pre cursor taps used for the transmitter device. Transmitter emphasis is adjusted in the modeling.
De-emphasis is needed in conjunction with receiver equalization

First two receiver DFE taps make significant impact. Contribution of additional taps diminishes as number of taps increases.

Does it make sense to have a fixed level of de-emphasis for the cable application? Backplane application?

Simple protocol mechanism for setting de-emphasis during training?

Presentation to be updated to include de-emphasis information in the "number of taps required" table. Will also verify what models are used and that there are not issues with the plots.

4.2 Training sequence:

4.2.1 SAS-2 Start-up training sequence (05-397r2) [Newman]
http://www.t10.org/ftp/t10/document.05/05-397r2.pdf

This update included several changes to data patterns and introduces a method of setting transmitter de-emphasis based on receiver requests. Since we don't know what is required for tuning at this time (receiver and transmitter?), this proposal introduces the concept of variable length for the training interval and new primitives for communication between the two PHY's. It was agreed that the training sequence is not ready to go to the protocol group since we don't know exactly wat is needed, but that the updated proposal provides one method of achieving transmitter tuning , a feature that is anticipated to be required at G4 speeds and possibly optional at G3 speeds.

What is the training time if only random data? Is random data alone sufficient (8b/10b compliant)?

Is a JTPAT or stressed signal needed to prove BER capability?

Does the setting made for 6Gbps work for 3 and 1,5 Gbps signals? (Cannot be assumed.)

4.3 Spread spectrum clocking:

SAS-2 SSC Investigation (06-064r0) [Olawsky]
http://www.t10.org/ftp/t10/document.06/06-064r0.pdf

What is the frequency specified in the spectrum analyzer? FCC uses a 1 MHz window.

Should SSC be included at 6Gbs?

Current specification requirements:
Initiator and expander that connect to SATA shall tolerate.
Not a device or non-SATA requirement. (Backwards compatibility consideration.)

Jitter measurement concern.
ATA chose 30kHz – 33kHz to keep above the audible range.
5000 ppm was used for SATA 1.5Gbps, could be 1250 or 1000 ppm for 6 Gbps since it is proportional to frequency.
Reduces EMI so should be considered for 6Gbps. 3Gbps has backwards compatibility issue.
Most implementations have the capability to switch on and off so it should not be an issue to turn off for slower speeds and to have off during training/OOB.

4.4 PHY specification format:

Roadmap to SAS-2 Physical Layer Specification (06-053r0) [Witt]
http://www.t10.org/ftp/t10/document.06/06-053r0.pdf

Introduces alpha point specification.
Alpha point determination and channel segment work needs to be done for specification development but compliance points need to remain at connectors. Alpha point information could be included as informative, but not normative.
Reference SFF-8429 Specification for Signal Specification Architecture for HSS Links

SAS-2 Physical Layer Specification Compliance Method (06-065r0) [Greshishchev]
http://www.t10.org/ftp/t10/document.06/06-065r0.pdf

4.4.1 Towards a SAS-2 Physical Layer Specification (06-011r1) [Witt]
http://www.t10.org/ftp/t10/document.06/06-011r1.pdf

4.4.2 SAS-2 channels analyses and suggestion for physical link requirements (05-428r0)
[Greshishchev]
http://www.t10.org/ftp/t10/document.05/05-428r0.pdf

Add compliant channel specification as in CEI?

How complicated are reference transmitter and reference receiver? (How many taps, etc.)
Interoperability points at connectors.
Use TCTF instead?

Transmitter specification:

mV pk-pk max including pre-emphasis goal?
Minimum transmit voltage
Rise and fall time requirements
Return loss
Jitter
Common mode

Receiver specification:

Input voltage
Return loss
Jitter tolerance
Noise floor or SNR?

5. Recommendations to Plenary
None

6. Meeting Schedule
Bi-weekly conference calls to start January 26, 2006

PARTICIPANT INFORMATION:
All Participants should use the following information to reach the conference calls:
Toll Free Dial in Number: (866) 279-4742
International Access/Caller Paid Dial In Number: (309) 229-0118
PARTICIPANT CODE: 3243413

https://seagate.webex.com/seagate
Topic: SAS PHY working group
Date: Every other week on Thursday from Thursday, January 26, 2006
Time: 10:00 am, Central Standard Time (GMT -06:00, Chicago)
Meeting number: 822 135 571
Meeting password: 10meter

7. The meeting was adjourned at 5:10 pm.Adjournment