

Hilton Ocean Front Resort - Hilton Head Island, SC

1. Opening Remarks
2. Approval of Agenda
3. Attendance

Mr. Ziad Matni	Agere Systems
Mr. Paul von Stamwitz	AMCC
Mr. Brian Miller	Amphenol AssembleTech
Mr. Michael Wingard	Amphenol Interconnect
Mr. Greg McSorley	EMC
Mr. Ramez Rizk	Emulex
Mr. Douglas Wagner	FCI
Mr. Elwood Parsons	Foxconn Electronics
Mr. Mike Fitzpatrick	Fujitsu
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
Dr. Mark Seidel	Intel Corp.
Mr. Praveen Viraraghavan	LSI Logic Corp
Mr. Michael Jenkins	LSI Logic Corp.
Mr. Jason Stuhlsatz	LSI Logic, Engenio Storage
Mr. David Geddes	Marvell Semiconductor, Inc.
Mr. Martin Czekalski	Maxtor Corp.
Mr. Mark Evans	Maxtor Corp.
Mr. Richard Uber	Maxtor Corp.
Mr. Edward Cady	Meritec
Mr. Galen Fromm	Molex Inc.
Mr. Jay Neer	Molex Inc.
Mr. Yuriy Greshishchev	PMC-Sierra
Mr. Tim Symons	PMC-Sierra
Mr. Alvin Cox	Seagate Technology
Mr. Vit Novak	Sun Microsystems, Inc.
Mr. Doug Loree	Toshiba
Mr. Dan Gorenc	TycoElectronics
Mr. Kevin Witt	Vitesse Semiconductor
Mr. Jeff Williams	Xiotech Corp.

34 People Present

4. Old Business
- 4.1 Modeling:

4.1.1 SAS-2 External link crosstalk budget suggestion and analyses (06-104) [Greshishchev and Molex]

<http://www.t10.org/ftp/t10/document.06/06-104r1.pdf>

-36 dB may apply only to a 10-meter cable requirement.

Some discussion about cable design information versus normative specification and concerns about marrying a cable length to a crosstalk requirement.

Since the existing specification needs to be maintained and data shows that 3Gbps can use the 10-meter cable if transmitter device de-emphasis is used, a separate specification for the 10-meter version will be drafted by Galen and Yuriy. I would suggest that this be identified as a high-loss external cable. We used a similar method concerning SATA interface levels in the SAS domain. This way it is not tied to either external connector type (mini or 8470-style), but the crosstalk requirement may need both sets of pin numbers if the aggressor locations are identified. STA has indicated that the usage for the 10-meter cable is relatively low and that if a user wants to run it 3Gbps, the specification should allow that. Some sort of labeling may be specified on the 10-meter cables warning that equalization is typically needed for proper performance.

Backplane models have shown more loss than the mini 4x 10-meter cable in 6Gbps simulations.

#### 4.1.2 Comparison of Equalization Schemes for 6Gbps SAS Channels (06-049) [Caroselli, Malipatil]

<http://www.t10.org/ftp/t10/document.06/06-049r1.pdf>

The LSI presentation looks at peak vertical amplitude only, rather than width of the eye also. Yuriy will run simulations to show how number of taps increases width of eye opening. Full version posted. (Huge file: 11419945)

#### 4.1.3 What a 6G-capable Serdes Adds to 3G Link Performance (06-132) [Jenkins]

<http://www.t10.org/ftp/t10/document.06/06-132r0.pdf>

Simulations showed the advantages of letting the SAS receiver device equalization circuitry be active when handling a SATA signal. A single tap DFE may be sufficient for all characterizations that have been supplied. Setting equalization for the SAS transmitter device to the SATA device poses an issue that was not addressed.

#### 4.1.4 Transmitter device de-emphasis requirement versus TCTF

Should the transmitter device de-emphasis, transmitter device waveform or TCTF model be specified for the 10-meter cable?

TCTF seems the most likely way to specify. If the receiver can control both ends of the equalization, it the best solution but would only be included as optional in SAS 2.

#### 4.2 Spread spectrum clocking:

##### 4.2.1 SAS-2 SSC Investigation (06-064) [Olawsky]

<http://www.t10.org/ftp/t10/document.06/06-064r1.pdf>

More data needs to be taken to establish the baseline improvement. 2000ppm versus 3000 ppm SSC were compared. The baseline (no SSC) data has not been collected yet.

##### 4.2.2 SAS-2 Spread Spectrum Clocking consideration list (06-129) [Cox]

<http://www.t10.org/ftp/t10/document.06/06-129r0.pdf>

Discussed why SSC is advantageous and how it might be implemented. It should be available in future generations as a tool because there are backwards compatibility issues with current products. How much can be addressed with adding common mode specs to the 6Gbps PHY requirements? Having a more complete specification is a step in the right direction, however SATA does have the common mode specs in addition to SSC.

The majority of serial specifications include SSC as optional. SAS, FCAL, and Infiniband do not at this time. Alvin will revise this proposal to define what "all or nothing" means rather than just including the term with no explanation of how it is being used. SSC is currently only down-spreading in SATA. Should we consider having it split above and below the nominal frequency for 6Gbps? This might help the PLO design, especially for cases when SSC is not turned on.

SSC increases transmit jitter in most implementations. This is a concern as frequencies increase. Multiple PHY's in a single device (expanders in particular) appear to have the worst EMI issues. Common clock SSC implementations may have issues and having separate SSC control for each PHY adds complexity.

Much more discussion is needed.

#### 4.3 Training sequence:

##### 4.3.1 SAS-2 Start-up training sequence (05-397) [Newman]

<http://www.t10.org/ftp/t10/document.05/05-397r2.pdf>

Included for reference. Sort discussion on this posting and clarified that speed negotiation is in band and called "speed negotiation", not OOB. Reminded that this proposal is a way to conduct training and is an excellent place to start from. Also reiterated that transmitter tuning is likely to be needed at the next generation beyond 6Gbps, so we need to look at it now to understand the next timing window in speed negotiation and make it as a possible optional behavior at 6Gbps.

##### 4.3.2 Proposal for Optional Adaptation of TX FFE Tap Weights (06-133) [Jenkins]

<http://www.t10.org/ftp/t10/document.06/06-133r0.pdf>

Describes some elements in the system to adjust TX by closed loop communication.

#### 4.4 PHY specification format:

##### 4.4.1 Towards a SAS-2 Physical Layer Specification (06-011) [Witt]

<http://www.t10.org/ftp/t10/document.06/06-011r1.pdf>

Carry over to future meeting. Not discussed.

##### 4.4.2 SAS-2 channels analyses and suggestion for physical link requirements (05-428)

[Greshishchev]

<http://www.t10.org/ftp/t10/document.05/05-428r0.pdf>

Carry over to future meeting. Not discussed.

#### 5. New Business

Ed Cady questioned I we need cable lengths up to 20 meters. Informed that if he wants to pursue this, he needs to submit a proposal to the group.

#### 6. Review of Recommendations to Plenary

None.

#### 7. Meeting Schedule

Bi-weekly conference calls to start March 23, 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

Time: 10:00 am, Central Standard Time (GMT -06:00, Chicago)

Meeting number: 822 135 571

Meeting password: 10meter

Next face-to-face:  
May 9, 2006, 9:00 am  
The Fairmont Hotel  
170 South Market Street  
San Jose, CA 95113

NOTE LOCATION CHANGE!

8. The meeting adjourned at 5:03 pm