

Date: June 18, 2004

To: T10 Committee (SCSI)

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Subject: SAS 1.1: 1.5 Gbit OOB requirements

## 1 Overview

SAS 1.1 should be modified to encourage the use of 1.5 Gbit for OOB in the future. At the same time the standard should not prevent a change to that when it becomes impractical for 1.5 Gbit to be transmitted and/or received. The following changes to SAS 1.1 would accomplish this goal.

### 5.3.4 Signal characteristics at IT, CT, and XT

This subclause defines the inter-operability requirements of the signal at the transmitter end of a TxRx connection as measured into the zero-length test load specified in figure 52. All specifications are based on differential measurements.

~~The OOB sequence shall be performed at signal voltage levels corresponding to the lowest supported transfer rate.~~ Expander phys supporting being attached to SATA devices shall use SATA 1.0 signal levels (see ATA/ATAPI-7 V3) during the first OOB sequence after a power on or hard reset if the 1,5 Gbps transfer rate is supported. As soon as COMSAS has been exchanged, the expander phy shall increase its transmit levels to the SAS voltage levels specified in table 27. If a COMINIT is not received within a hot-plug timeout at SATA 1.0 signal levels, the expander phy shall increase its transmit levels to the SAS voltage levels and perform the OOB sequence again. If no COMINIT is received within a hot-plug timeout of the second OOB sequence the expander phy shall initiate another OOB sequence using SATA 1.0 signal levels. The expander phy shall continue alternating between sending COMINIT at SATA 1.0 signal levels and SAS signal levels until a COMINIT is received.

If the OOB sequence is completed at the SAS voltage level and a SATA device is detected rather than a SAS target device, the expander phy shall switch to SATA 1.0 voltage levels and repeat the OOB sequence.

NOTE 1 - SAS initiator phys supporting being attached to SATA devices may use the same algorithm as expander phys.

SAS initiator phys and SAS target phys shall transmit OOB signals ~~at the lowest supported transfer rate~~ using SAS signal levels.

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Editor's Note 1: The above deleted text is not needed as the same information is defined in the OOB transmitter section

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## 6.5 Out of band (OOB) signals

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The ALIGNs used in OOB signals ~~are not required to~~ should be at generation 1 (G1) physical link rates (i.e., 1,5 Gbps), ~~as this rate may not be supported in phys compliant with future generations of this standard.~~ The ALIGNs are only required to generate an envelope for the detection circuitry, as required for any signaling that may be A.C. coupled

NOTE 2 - If G2 ALIGNs are used, the number of ALIGNs doubles compared with G1 ALIGNs.

A SAS transmitter should transmit ALIGNs at the G1 physical link rate to create the burst portion of the OOB signal, but may transmit ALIGNs at its lowest supported physical link rate if it ~~does not support~~ is not able to transmit at the G1 physical link rate and shall not transmit them at a physical link rate faster than its lowest supported physical link rate.

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A receiver shall detect an OOB signal after receiving four consecutive idle time/burst time pairs (see figure 58). It is not an error to receive more than four idle time/burst time pairs. A receiver shall not detect the same OOB signal again until it has detected the corresponding negation time (i.e., a COMINIT negation time for a COMINIT) or has detected a different OOB signal (e.g., if a COMINIT was previously detected, then four sets of COMWAKE idle times followed by burst times are detected, a COMWAKE is detected; another COMINIT may follow).

A SAS receiver shall detect OOB signals comprised of ALIGNs transmitted at any rate up to its highest supported physical link rate. This includes physical link rates below its lowest supported physical link rate (e.g., a SAS receiver supporting only 3,0 Gbps ~~needs to~~ detects 1,5 Gbps based ALIGNs thereby providing interoperability to interoperate with a SAS transmitter supporting both 1,5 Gbps and 3,0 Gbps).

NOTE 3 - Future generations of this standard may not support transmitting the G1 physical link rate for OOB signals.