

To: T10 Technical Committee
 From: Rob Elliott, HP (elliott@hp.com)
 Date: 4 March 2005
 Subject: 05-098r0 SAS-1.1 External cable intra-pair skew

Revision history

Revision 0 (4 March 2005) First revision

Related documents

05-007r0 SAS-1.1 external cable electrical specification (Alvin Cox, Seagate)(incorporated in sas1r06)
 sas1r08 - Serial Attached SCSI 1.1 revision 8

Overview

Based on 05-007r0, SAS-1.1 revision 6 and later define the maximum external cable intra-pair skew as 20 ps (10 ps for internal cables).

This seems to border on unachievable using typical external cables today. Specifications for InfiniBand cables available on the Internet currently claim support for 1.05 to 4 ps/foot (1.0 equates to 3.33 ps/meter; 2.0 to 6.67 ps/meter, 4.0 to 13.33 ps/meter).

SAS discusses support for a few different cable lengths:

Table 1 — Cable lengths discussed in SAS-1.1

Cable length	Reference
6 m	5.3.3 “For external cables, these electrical requirements are consistent with using good quality passive cable assemblies constructed with shielded twinaxial cable with 24 gauge solid wire up to 6 meters in length.”
10 m	7.17.3 STP SATA_HOLD/SATA_HOLD_A receive buffer requirements

The 10 m number is just the protocol layer bound; the SAS physical WG has decided that 6 m is the achievable length.

In comparison with other technologies using the same cables, InfiniBand, which supports 15 m cables at 2.5 Gbps, recommends (but does not require) 120 ps skew. IEEE 802.3ak (CX-4) does not seem to include any skew requirement.

Assuming the best published cable, 6.00 m x 1.05 ps/ft = 20.67 ps. Leaving some margin for imprecision in the cable length and some cable assembly skew, a value of 25 ps is proposed.

Larger values impact the jitter budget and will be particularly problematic for 6 Gbps.

Suggested changes

5.2.6 Impedance and media specifications

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Table 29 defines impedance and media requirements for external cables.

Table 2 — Impedance and media requirements for external cables

Requirement	Units	1,5 Gbps and 3,0 Gbps
Maximum intra-pair skew	ps	20 25