T10/04-195r0 SAS-1.1 Internal Wide Connector/Cable Electrical Requirements

To: T10 Technical Committee
From: Barry Olawsky, HP (barry.olawsky@hp.com)
Date: 1 July 2004
Subject: T10/04-195r0 SAS-1.1 Internal Wide Connector/Cable Electrical Requirements

Revision History
Revision 0 (20 September 2003) first revision

Related Documents
sas1r05 - Serial Attached SCSI 1.1 revision 5
03-240r1 - SAS-1.1 Internal wide connector and cable (Rob Elliott, Hewlett Packard)
sff-8484r0.5 - Multi lane internal serial attachment connector (Brian Miller, Amphenol)
04-182r0 SAS-1.1 Internal wide connector/cable proposal feasibility study (Barry Olawsky, Hewlett Packard)

Overview
Propose electrical design/test requirements for internal wide connector/cable solution. Data in support of crosstalk specifications is included after suggested changes.

Suggested Changes
Change paragraph number 5.3.9 title from “Impedance Specifications” to “Impedance and Media Specifications”.

Add the following table to section after impedance requirements table.

Table — Internal 4-lane Cable/Connector Solution Electrical Requirements

Requirement	Units	1,5 Gbps	3,0 Gbps
Time domain reflectometer rise time 20 % to 80 % [a, b]	ps	70	70
Media (PCB or cable)			
Differential impedance [b, c, d]	ohm	100 ± 10	100 ± 10
Differential impedance imbalance [b, c, d, e]	ohm	5	5
Common mode impedance [b, c, d]	ohm	32,5 ± 7,5	32,5 ± 7,5
Mated connectors			
Differential impedance [b, c, d]	ohm	100 ± 15	100 ± 15
Mated Cable Assembly			
Maximum Insertion Loss [b, f]	db	6	6
Maximum Near-End Crosstalk (adjacent pairs) [b, f, g]	db	33	33
Maximum Near-End Crosstalk (between pairs differential signal pairs 1, 2, 3 and 4) [b, f, g]	db	45	45
Maximum Near-End Crosstalk (between differential signal pairs 5, 6, 7 and 8) [b, f, g]	db	45	45
Maximum Near-End Crosstalk (all other differential signal pair combinations) [b, f, g]	db	50	50
Maximum Intra-Pair Skew [b]	ps	10	10

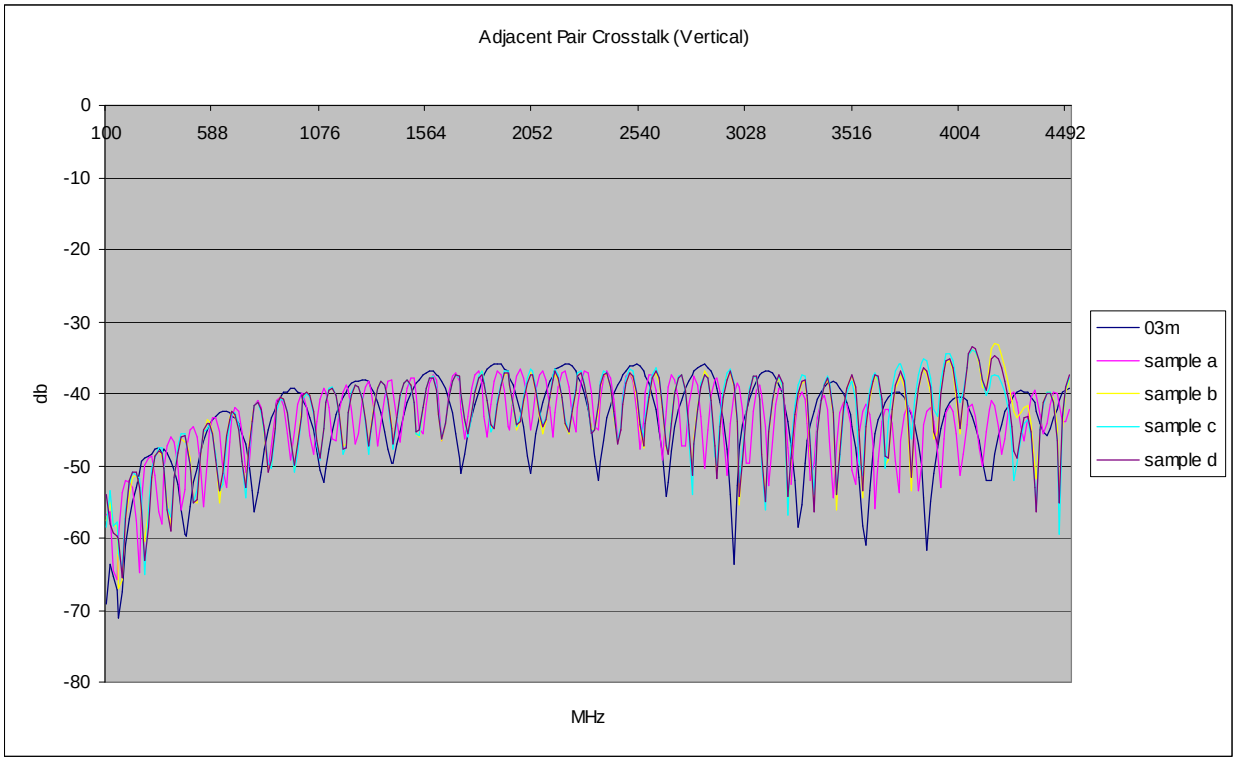
[a] All times indicated for time domain reflectometer measurements are recorded times. Recorded times are twice the transit time of the time domain reflectometer signal.
[b] All measurements are made through mated connector pairs.
[c] The media impedance measurement identifies the impedance mismatches present in the media when terminated in its characteristic impedance. This measurement excludes mated connectors at both ends of the media, when present, but includes any intermediate connectors or splices. The mated connectors measurement applies only to the mated connector pair at each end, as applicable.
[d] Where the media has an electrical length of > 4 ns the procedure detailed in SFF-8410, or an

e	equivalent procedure, shall be used to determine the impedance. The difference in measured impedance to ground on the plus and minus terminals on the interconnect, transmitter or receiver, with a differential test signal applied to those terminals.
f	The range for this frequency domain measurement is 10 to 4500 MHz.
g	The far end of the mated cable assembly must be properly terminated. Insertion loss variations (i.e. cable length) may change the measurement result.

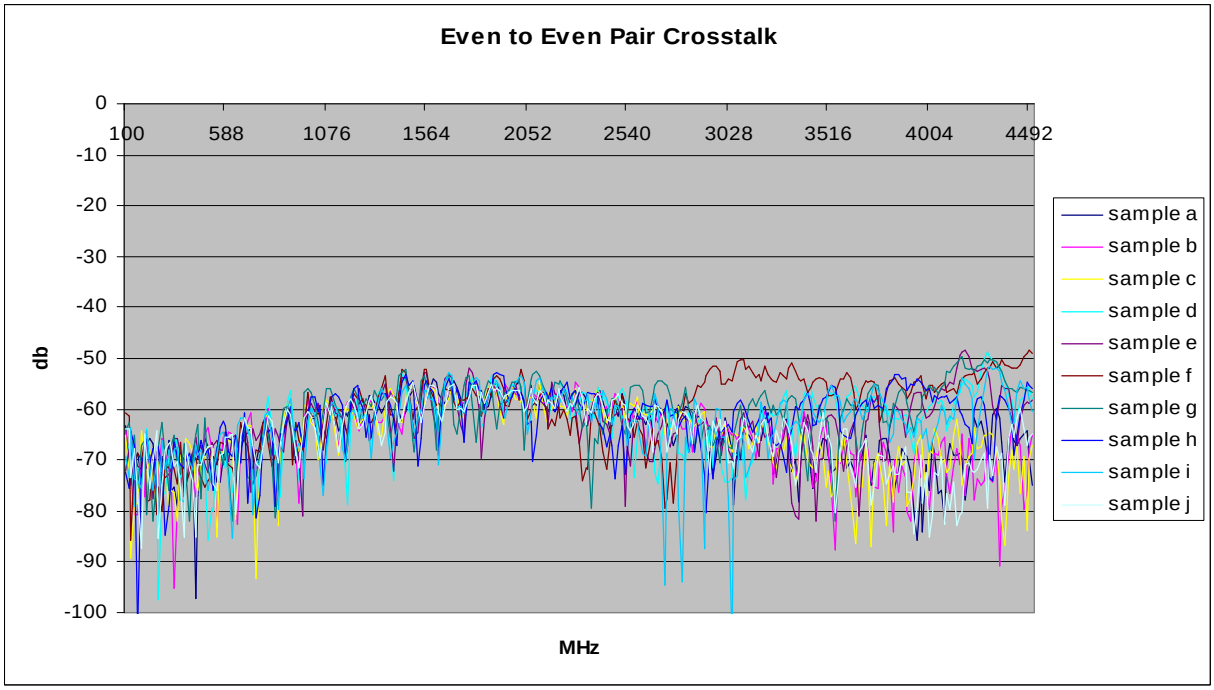
Supporting Information Only:

Various cable samples from different suppliers were randomly selected and the tests performed with various differential signal pairs. Plots with higher crosstalk peaks are combined to understand how existing product compares to the proposed crosstalk levels. The following data is clearly NOT a statistical sample of product available.

Adjacent pairs are RX0/TX0, TX0/RX1, RX1/TX1, RX2/TX2, TX2/RX3, RX3/TX3.



Even pair crosstalk is between RX0/RX1, TX0/TX1, RX2/RX3, TX2/TX3. The results are similar for odd pairs.



End-to-end crosstalk is between any pair of the group RX0, TX0, RX1, TX1 to any pair of the group RX2, TX2, RX3, TX3. In this case, the crosstalk spans the section of the connector reserved for sidebands.