

To: T10 working group
From: SCSI cable performance study group
Date: June 15, 1999
Subject: Recommendations for content in SPI-3 relating to cable performance

Following are the recommendations of the SCSI cable performance working group for specification limits for all the requirements on the cable media. Specific test procedures for measuring these parameters are specified in an informative annex are presently undergoing the final editing for the proposal.

The following indented material was added by Bill Ham (acting vice chair / secy for this ad hoc group) after the SCSI cable ad hoc meeting but prior to posting this document. This additional material contains some context and background information relating to these new requirements. As such, this additional material has not been reviewed by the ad hoc but is believed to be accurate and important to the understanding of the recommendations of the ad hoc for those not able to participate in the ad hoc directly. It does not constitute a formal part of the ad hoc recommendations.

This is a new set of requirements that include performance requirements that have not been specified previously in SCSI. These new requirements include extensions of the required ranges for some previously specified parameters, detailed specification of the measurement procedure to be used to obtain the values for all parameters (in a separate document), and new tests that are required to ensure performance at higher data rates. Therefore, any cable built to previous specifications may not meet these new, more stringent requirements. The performance requirements specified in this document are intended to be consistent with the performance typically exhibited by high quality SCSI cables built for use with SPI and SPI-2. However, re-qualification of previous cables for use with SPI-3 is required to ensure conformance with these new specifications.

The limitations on the use of flat cable have been replaced by a set of purely performance based requirements (that includes cross talk) for all cables. The limits specified are consistent with the actual performance of high quality flat cable constructions. Note, however, that flat cables have significantly inferior cross talk performance compared to more balanced constructions (twisted pair for example) and that eliminating flat cables is one way to significantly decrease the cable contribution to cross talk noise in a system. Such a need may be seen in future versions of SCSI.

For length dependent parameters both total and per unit length requirements are specified. This ensures performance compliance when concatenating cables in the same SCSI bus segment. Implementers have the practical option to use only the total requirements and to loosen the per unit length requirements in non-concatenated applications; however, this practice will create non conforming cables. Any cable not meeting the per unit length requirements shall be labeled in a manner indicating that it is not suitable for use in cable assemblies that might be used in a concatenated manner.

End of indented material

1. Local transmission line impedance

	Local SE transmission line impedance **		Local DIFF transmission line impedance **	
	Min	Max	Min	Max
Flat, Twisted Flat, Round jacketed unshielded cables	84	96	115	140
Round Shielded cables	78*	96	110	135

All values are measured by time domain reflectometry

* If SCSI loads attached to round shielded cables, are separated by less than 1.0 m, this value is 84 Ohms.

** Ideally one design will meet both SE and DIFF criteria

2. Extended distance transmission line impedance

Swept frequency (extended distance) differential impedance limits: max peak to peak variation of 30 ohms over the frequency range 1 MHz to 1 GHz.

3. Capacitance

Capacitance limits: SE 20 pF/ft max at 100 kHz and 1 MHz

SE variation between 100 kHz and 1 GHz 1% max peak to peak

Differential max 14 pF/ft max at 100 kHz and 1 MHz

4. Propagation time and propagation time skew

Differential propagation time: 5.4 ns/m max within the cable plant and 135 ns max terminator to terminator

Differential propagation time skew (pair to pair): 25 ps/ft max (82 ps/m) within the cable plant and 2.0 ns max terminator to terminator

5. Attenuation

Differential attenuation:

6 dB max from terminator to terminator at 200 MHz producing 0.5 dB max per meter up to 12m (consistent with 30 AWG solid copper at 12 meters) or,

10 dB max from terminator to terminator at 200 MHz producing 0.4 dB max per meter at $\leq 25\text{m}$ and $> 12\text{m}$ (consistent with 28 AWG stranded copper at 25 meters).

6. Cross talk

Cross talk: Aggressor signals on each of the DATA, PARITY, and REQ or ACK pair induces near end cross talk (NEXT) noise on the ACK or REQ pair respectively. Each DATA, PARITY, and REQ or ACK pair shall be separately excited, the induced absolute peak noise (deviation from zero differential) on the ACK or REQ pair measured at a time position not associated with the test fixture and the results added to yield the total cross talk. The allowed limit for the total cross talk is 3.0% of the aggressor signal amplitude at 0.5 ns rise time. Cross talk percent is calculated as follows:

$$\%NEXT = \frac{\text{Arithmetic sum of peak differential victim voltages}}{\text{peak to peak differential aggressor voltage}}$$

Note: 3.0% NEXT yields 48 mV peak max at 1600 mV pp aggressor signal amplitude. The cross talk requirement is based only on percentage as that is all the cable can influence.