This document contains the recommendations of the SCSI cable performance
study group as of the August 30, 31, 1999 for specification limits for
all the requirements on the cable media. Specific test procedures for
measuring these parameters are specified in a normative annex presently
undergoing the final editing for the proposal.

The following indented material was added by the study group for
enhanced understanding of the recommendations. This additional material
contains some context and background information relating to these new
requirements. 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 The limitations on the use of flat cable have been replaced by a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 eliminating flat cables is one way to
> significantly decrease the cable media 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 media 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. [Need a common way to do this
> indication.]

> End of indented material

The following sections are the performance requirements for uniform SCSI
cable media.

1. Applicability of requirements for SCSI cable media

The requirements in this section apply to uniform cable media.
Performance of media designed to be non-uniform for the purposes of
enabling connector attachment is considered to be part of a cable
assembly or harness performance and is affected by the (sometimes
unused) connector attached as well as by the non-uniformity.

Additional allowances beyond the uniform media requirements may be
required to meet SCSI signal requirements. See annex F.

2. Local transmission line impedance

Cable construction	Local SE transmission line impedance **		Local DIFF transmission line impedance **	
	Min	Max	Min	Max
All	84*	96	110	135

All values are measured by time domain reflectometry
* If SCSI loads attached to the cable media are separated by more than 1.0 m this value is
78 Ohms
** Ideally one design will meet both SE and DIFF criteria

3. 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 on a 30 meter cable.

4. Capacitance

Capacitance limits: SE   66 pF/m max at 100 kHz and 1 MHz

                     DIFF 46 pF/m max at 100 kHz and 1 MHz

                     Dielectric constant variation between 100 kHz and 1
                     GHz 5% max peak to peak

5. 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): 82 ps/m max within
the cable plant AND 2.0 ns max terminator to terminator

5.   Attenuation

The attenuation requirements (all differential) are specified in Table
1.

Table 1 – Attenuation requirements for SCSI cable media

Distance between SCSI bus terminators (meters)	Attenuation per meter max (dB) @ 200 MHz	Attenuation of length equivalent to terminator to terminator spacing max (dB) @ 200 MHz	Lengths are consistent with these minimum size conductors:
0 to 9	0.63	6	32 AWG solid
0 to 12	0.5	6	30 AWG solid
>12 to 25	0.4	10	28 AWG stranded
Both the per meter and the length equivalent to the terminator to terminator spacing requirements shall be simultaneously met			

6. Cross talk

The maximum near end cross talk (NEXT) on REQ or ACK is 3.0% of the 1.0
ns rise time aggressor signal amplitude. Cross talk percent is
calculated as follows:

$$\%NEXT = \frac{\Sigma \text{ peak absolute differential induced voltages on REQ or ACK}}{\text{peak to peak differential aggressor voltage}}$$

The aggressor signals are each of the DATA, PARITY, and REQ or ACK
pairs. If REQ is the victim line DATA, PARITY, and ACK shall constitute
the set of aggressor signals. If ACK is the victim line DATA, PARITY,
and REQ constitute the set of aggressor signals. Each aggressor signal
is separately excited, the induced absolute peak noise (deviation from
zero differential) on the victim pair measured at a time position not
associated with the test fixture and the results added to yield the
total cross talk.

Note: 3.0% NEXT yields 58.9 mV peak max at 1963 mV pp aggressor signal
amplitude (135 ohm max cable impedance at 7.3 mA max driver current).
The cross talk requirement is based only on percentage as that is all
the cable can influence.