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Subject: Proposal for SCSI Cable Performance Specification

The intent of this document is to outline the critical electrical characteristics for cables used in SCSI applications.

Table 1: Proposed Electrical Requirements for SCSI Cables		
	Single-Ended	Differential
Impedance, minimum, any signal pair	72 Ohms	116 Ohms
Impedance, maximum, any signal pair	96 Ohms	145 Ohms
Impedance, maximum difference between any two signal pairs on the same cable (excluding TERMPWR pair)	12 Ohms	20 Ohms
Attenuation (Signal pairs only)	.06 db/ft at 5 MHz maximum	.029 db/ft at 5 MHz maximum
D.C. Resistance (TERMPWR only)	.068 Ohms/ft maximum	.068 Ohms/ft maximum
Velocity	1.58 ns/ft maximum	1.58 ns/ft maximum
Skew	.04 ns/ft maximum	.04 ns/ft maximum

Some general comments on Table 1:

- The minimum and maximum impedance values noted are based on our current customer requirements and have been verified via manufacturing test data. The pair to pair impedance difference for the 77 ohm SEM cable is typically measured between 5 and 7 ohms. The difference increases as the average impedance of the cable increases.

- The attenuation specified is for 28 AWG signal pairs. Cables using 30 AWG signal pairs exhibit higher attenuation.
- The D.C. Resistance value indicated is the ASTM requirement for 28 AWG, 7 strands of 36 AWG, tinned copper.
- Specifying a velocity of 1.58 ns/ft excludes the use of PVC as an acceptable dielectric. Materials which have faster velocities, such as foam polyolefin, would be allowed.

The table below shows the designs of typical 25 pair, 77 and 88 ohm SEM SCSI cables. Similar designs are available from a number of cable manufacturers. They represent two of the most common designs currently used in SCSI applications.

Table 2: Typical SCSI Cable Designs		
	Cable 1	Cable 2
Conductor	28 AWG, 7/36 TC	28 AWG, 7/36 TC
Insulation	Solid Polyolefin	Cellular Polyolefin
Insulation Diameter	.034" \pm .001"	.034" \pm .001"
Buffer Layer	Foam Polypropylene	Foam Polypropylene
Shield #1	AL/PET	AL/PET
Shield #2	36 AWG, 90%	36 AWG, 85%
Jacket	PVC	PVC
SEM Impedance	77 \pm 5 Ohms	88 \pm 8 Ohms
Differential Impedance	123 \pm 7 Ohms	134 \pm 11 Ohms
D.C. Resistance	.068 Ohms/ft maximum	.068 Ohms/ft maximum
Velocity	1.46 ns/ft nominal	1.33 ns/ft nominal
Skew	.04 ns/ft maximum	.04 ns/ft maximum
Attenuation	.029 db/ft at 5 Mhz	.023 db/ft at 5 Mhz

It has been suggested that the electrical test procedures for cables be included in the appendix of the specification. The table below shows the critical procedures which should be included in the specification.

Although TDR measurement has become the de facto technique for the measurement of SCSI cable impedance, the option of an alternate method, using a network analyzer should also be included. The network analyzer has the advantage of measuring the average cable impedance over long cable lengths instead of looking at short lengths which may or may not be representative of the entire manufacturing lot. Procedures for impedance using this method are currently being developed by ASTM.

ASTM procedures usually address only differential measurements. To modify the procedures for single end mode use, it is suggested that the following statement be added for clarification.

"For single end mode measurements, measure between the signal wire of a particular pair and the ground wire of all pairs connected to the shield."

Table 3: Test Procedures for Inclusion Into the Appendix	
Impedance, TDR, SEM	No industry standard procedure exists. Berk-Tek will formalize the test procedure for inclusion in the standard.
Impedance, TDR, Differential	No industry standard procedure exists. Berk-Tek will formalize the test procedure for inclusion in the standard.
Impedance, Network analyzer, SEM	Per ASTM D-4566 and note above
Impedance, Network analyzer, Differential	Per ASTM D-4566
Attenuation, SEM	Per ASTM D-4566 and note above
Attenuation, Differential	Per ASTM D-4566
Velocity	No industry standard procedure exists. Berk-Tek will formalize the test procedure for inclusion in the standard.
Skew	No industry standard procedure exists. Berk-Tek will formalize the test procedure for inclusion in the standard.
D.C. Resistance	Per ASTM D-4566