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DATE: May 27, 1992
TO: Membership of X3T9.2
FROM: Richard S. Mizia, C&M Corp.
SUBJECT: Raw Cable Impedance and Bend Radius Test Results

X3T9.2/92-128

Because of questions that have arisen in the SPI Working Group, Bill Ham of DEC requested specific data on the distribution of Impedance values across the population of conductors in a typical 34 twisted pair SCSI III-type cable. Page two (2) shows the distribution of these values. The formal Test Report is too lengthy to include here, but we will gladly send a copy to anyone who requests one by calling me at (203) 774-4812, or by FAX at (203) 774-7330.

At the same time, Bill asked about a "minimum bend radius" for a cable like this. The Industry rule of thumb has been: 3 - 5 times the OD of the cable. He requested some hard data to support this rule. Since none existed, we decided to run some actual tests. Pages three (3) through five (5) show the results of these tests. It should be noted the 180° bend is equivalent to a radius of 1/2 to 1/4".

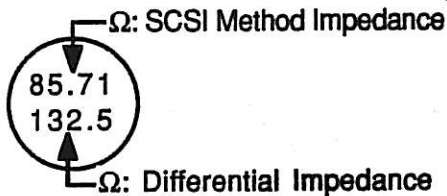
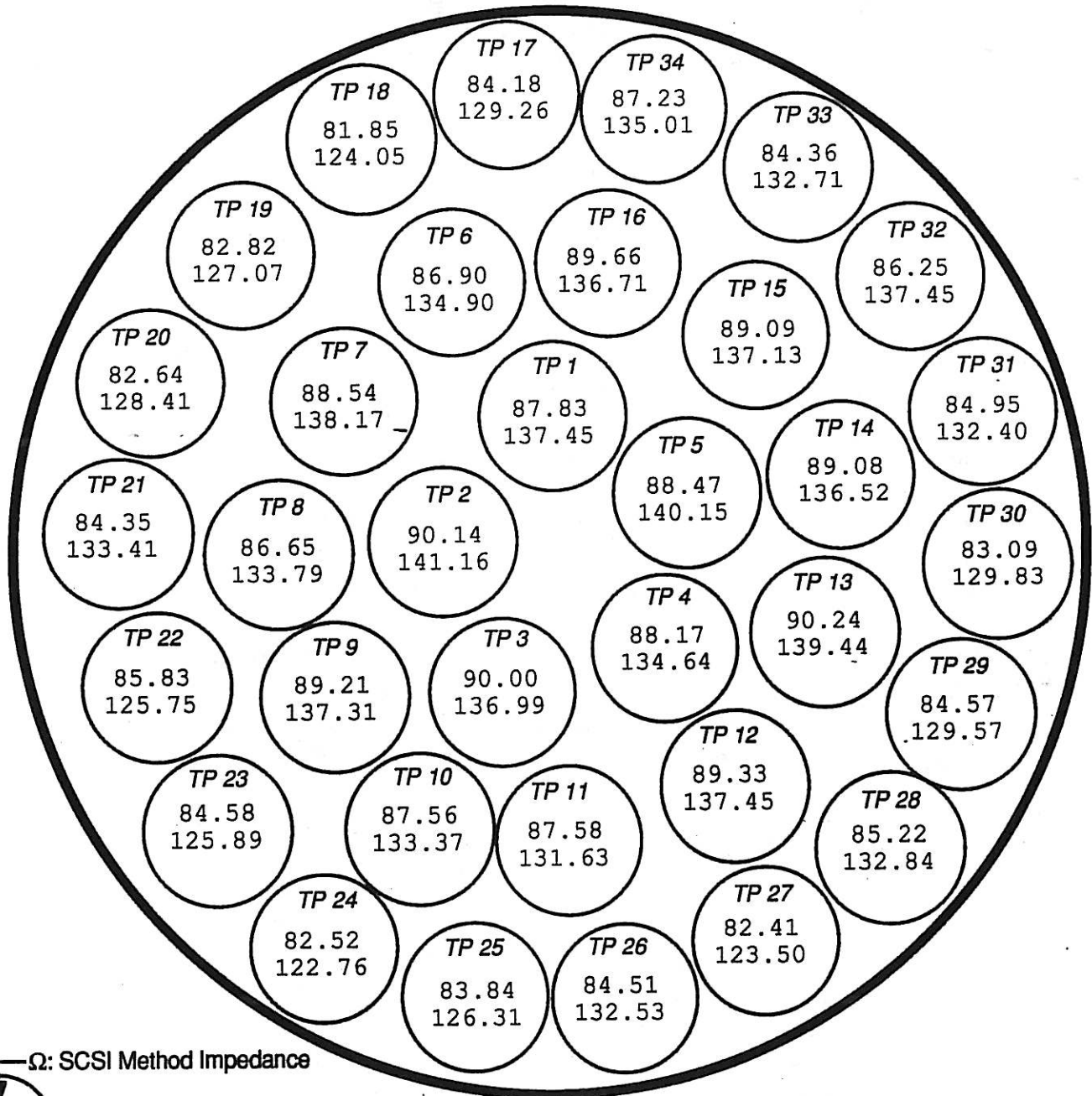
We also conducted a "flex life" test, and subjected the cable to a moment of 180° against a hard surface. This simulated the type of cable abuse experienced after exiting a connector, either mechanical or post-molded. We tested the Impedance vales after 2,000, 4,000 and 8,000 flexes without noting any primary failures. We found three (3) open primaries after a total of 9,200 cycles. A formal Test Report is being readied at this time, and will be submitted to the Committee in the very near future.

If there are any questions, please call me.

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CABLE SPECIFICATION

X3T9.2/92-128



DRAWN BY RSM	DATE 5/7/92	C&M PART NUMBER 34/2-60F287C33TC10/PPFAM/S/J33		
CHECKED BY		CATALOG NUMBER	REV:	SHEET 2 OF 5
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C & M CORPORATION

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C & M CORPORATION TEST REPORT

SCSI-III BEND TEST

C & M CATALOG: 35330

MAY 12, 1992

PREPARED BY:

MARC DUPUIS

QUALITY ASSURANCE ENGINEER

SCSI-III: THE EFFECTS OF BEND ON ELECTRICAL CHARACTERISTICS

PURPOSE:

Determine the effects of sharp radius bend tests on cable electrical performance.

TEST:

To best demonstrate the effects of a localized severed bend imposed on the test sample, TDR impedance plots were obtained for the following conditions:

1. Before bend (baseline)
2. Sharp bend, 90° around table top
3. Sharp bend, 180° (cable folded back on itself)
4. 180° bend sample, accelerated aging, 80°C for 24 hours
5. 180° bend sample, accelerated aging, 80°C for additional 168 hours (192 hours total)

Seven representative pairs were chosen for the impedance plots:

One pair from core (White/Tan)
Two pairs from inner layer (Tan/Violet and Tan/Brown)
Four pairs from outer layer (Orange/Violet, Pink/Violet, Pink/Orange, and Brown/Yellow).

Sample prepared using the SCSI termination, one conductor from each pair electrically connected to overall shield and grounded, remaining conductors left floating and tested one at a time to ground in the single end mode. Test sample was ten feet in length, with the bend point at two feet from the beginning of sample.

Impedance plots obtained on a Tektronix 11801A/SD-24 Digital Sampling Oscilloscope/TDR using a NIST calibrated 50 ohm airline (Hewlett Packard 11567A) as a reference impedance. A window was created to obtain the maximum, mean, and minimum impedances over the ten foot sample, neglecting the fixture mismatch and open circuit at either end of the test sample.

RESULTS:

As can be seen in the impedance plots, very little change was exhibited at the bend point for the first four test conditions, and only minimal change for the 192 hour aged sample (test condition 5). A summary of the statistics calculated on the minimum impedance over the ten foot length is as follows.

		TEST CONDITION				
		1	2	3	4	5
AVG Z_o	ohms	80.79	80.52	80.15	79.14	79.68
MAX Z_o	ohms	84.00	83.92	82.81	81.14	81.73
MIN Z_o	ohms	78.16	78.24	77.81	77.06	77.54
RANGE Z_o	ohms	5.84	5.68	5.00	4.08	4.18
STD. DEV.		2.14	1.81	1.76	1.36	1.45

After the final test (test condition 5), the stress point was stripped to observe any physical damage, with the following observations made:

OUTER JACKET:	Kinked, no fractures
BRAIDED SHIELD:	No broken strands
A/M TAPE:	Wrinkled, no breaks
FMPP TAPE:	Some crushing, no rips
PRIMARIES:	Some deformation, no opens or shorts, no insulation breakdown

MD:cp:6191c