January 13, 1992

TO: X3T9.2 Committee

FROM: David Steele
NCR, Microelectronics Products Division
1635 Aeroplaza Drive
Colorado Springs, CO 80916
Telephone: (719) 596-5795 ext. 363

SUBJ: Fast Single-Ended and Other Recommended Changes to SCSI-3 Parallel Interface

5.1 Physical Description
Add to end of second paragraph or add to Annex A - When mixing SCSI devices of different widths, care must be taken not to exceed the skew allowances provided by the Cable Skew Delay and Deskew Delay SCSI bus timing values (see 7.0). To accomplish this may require restricting SCSI device input capacitance, stub length, cable length and the number of SCSI devices to less than the specified maximum allowable value and close adherence to the cable recommendations made in section 5.2.

Modify last sentence of fourth paragraph to read - Use of single-ended drivers and receivers with the fast synchronous data transfer option is recommended only for a restricted set of conditions. Recommendations for single-ended systems which use the fast synchronous data transfer option are made in sections 5.2.3, 6.1.1 and 6.1.2.

5.2 Cable Requirements
Modify first paragraph to read - The characteristic impedance of the cable should be 95 +/- 15 ohms. There are successful single-ended implementations using cables with characteristic impedances outside of this range. However, system integrity in single-ended implementations is improved when the characteristic impedance of the cable is between 80 and 110 ohms. Cable parameters other than cable impedance are critical to system integrity. See Annex (TBD) (use document X3T9.2/90-114 as basis for annex) for information concerning the measurement of cable parameters.
5.2.3 Cable Requirements for Fast Synchronous Data Transfer
Modify characteristic impedance to read -
Characteristic Impedance: 80 to 110 ohms

Add to end of section 5.2.3 - In single-ended systems which use the fast synchronous data transfer option, it is particularly important to follow the cable recommendations made in section 5.2. In addition, it is recommended that cable lengths be restricted to less than 3 meters. There are successful single-ended implementations using cables longer than 3 meters. However, to maintain system integrity may require restricting SCSI device input capacitance, stub length and the number of SCSI devices to less than the specified maximum allowable value and close adherence to the cable recommendations made in section 5.2.

6.1.1 Single-Ended Output Characteristics
Add to end of section 6.1.1 - It is recommended that single-ended systems which use the fast synchronous data transfer option have the following output characteristics when measured at the SCSI device’s connector:

all signals;
Rise and Fall Time = 5 ns minimum

See Annex (TBD) for information concerning the measurement of rise and fall times. (The intention here is to provide a simple test circuit for measuring the 10-90% rise and fall times. The circuit suggested last month in San Diego is a 20 pF capacitor on the driver output with a 47 ohm resister to 2.5 volts.)

ACK, REQ and DATA BUS signals;
It is recommended that the ACK, REQ and DATA BUS signals use three state drivers to actively negate these signals. The three state output drivers for these signals should have the following electrical characteristics when driving in the negated state:

$I_{OH}$(High-level output current) = 24.0 mA maximum at $V_{OH} = 3.0$ volts dc

NOTE:
To maintain compatibility with the most common implementations of Alternative 2 Termination, $I_{OH}$ may need to be further restricted. The suggested specification for a P Cable with the ACK, REQ and DATA BUS signals employing three state drivers is:

$I_{OH}$(High-level output current) = 7.12 mA maximum at $V_{OH} = 3.24$ volts dc.
6.1.2 Single-Ended Input Characteristics
In order to support more than 8 SCSI devices on a cable, the
I_{IL} and I_{IH} specification should be changed as follows:

I_{IL} (Low-level input current) = -20 to 0 uA at V_{I}=0.5 volts dc
I_{IH} (High-level input current) = 0 to 20 uA at V_{I}=2.7 volts dc

Add to end of section 6.1.2 - It is recommended that
single-ended systems which use the fast synchronous data
transfer option have the following input characteristics:

all signals;
Minimum input hysteresis = 0.3 volts dc

ACK and REQ signals;
It is recommended that SCSI receivers on the ACK and REQ
signals be capable of tolerating the narrow voltage
transients that can occur during the negation transition of
these signals. These transients are frequently the result of
voltage reflections from stub capacitances and the mixing of
cables of different characteristic impedances. As a minimum,
it is recommended that the ACK and REQ input receivers not
change logic state as the result of a voltage swing on the
input signal of amplitude less than or equal to 1.0 volt and
is of less than or equal to 10 ns in duration.

6.4 SCSI Bus
Add after second paragraph - When more than 8 SCSI devices
are used on a cable, signal quality may be degraded. This is
particularly a concern in single-ended implementations.
There are successful single-ended implementations using more
than 8 SCSI devices on a cable. However, to maintain system
integrity may require restricting SCSI device input
capacitance, stub length and cable length to less than the
specified maximum allowable value and close adherence to the
cable recommendations made in section 5.2

6.5.1 Signal Values
Add to end of paragraph - See section 6.1.1 for additional
recommendations concerning the use of active negation
drivers.