Title: **Proposal for a training pattern for SPI-4**

To: **T10 Technical committee**
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As we examine the timing budget for 160 megatransfers per second we see that the nominal transition-to-transition time for ACK and REQ is 6.25 ns. Therefore, we need to look at all elements of the timing budget to see if there are areas where improvement can be made. An obvious area for investigation is skew adjustment since the specification for signal skew for Ultra 160 exceeds the total budget for Ultra 320 (i.e., 3.35 ns times two equals 6.7 ns).

The best place to adjust for signal skew is at the recipient device. This allows the recipient to adjust for all elements of skew – from transmitter skew through cable plant skew – that contribute to the total system signal skew observed at the recipient device's receivers.

In order for a recipient device to perform adjustment on skew it must first determine the system skew. This can be performed by having the transmitting device send a known "training pattern" to the receiving device. The recipient device establishes the adjustment required for each signal while it is receiving the training pattern. In addition, transmitting a known pattern establishes a closed-loop system without requiring any other communication between the transmitting device and the recipient device.

The pattern that is specified in SPI-3 for measuring cable skew is a 010101... pattern. We propose that this pattern be used as the training pattern for skew compensation. For additional justification:

- This pattern is the simplest to generate at the transmitter, requiring the minimum amount of circuitry;
- This pattern has a fixed ISI component and gives a valid skew situation for real data;
- With the high frequency of edges, the recipient can acquire the skew error over several training pattern cycles in a short time with simple circuitry; and,
- With the high frequency of edges, the recipient can average several skew error measurements in a short time to reduce the effects of noise.

Once we have agreed upon the pattern, we can begin to develop the protocol required to implement it.