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**To: T10 Technical committee**  
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**Subject: Proposal for Ultra320 AAF receiver input signal specification for SPI-4**

### **Introduction**

The following is a proposal defining the input signal requirements for Ultra320 SCSI receivers using AAF compensation, and thus sets the minimum requirements for that compensation. This proposal also allows evaluation of the input signal quality in an application without requiring detailed knowledge of the particular AAF compensation circuitry in the receiver.

The AAF function compensates for frequency-dependent transmission path attenuation by boosting the high frequency components of the received signal. Eye masks are included to establish the minimum AC amplitudes for free-running clock and settled maximum frequency ("101010") patterns (see Mask 1), the minimum amplitude of bit transitions (Mask 2), and the minimum eye diagram opening for all transitions (Mask 3). These masks are used to establish AC signal amplitudes. Any DC offset component of the input signal must be removed before applying the overall eye diagram mask in Mask 3.

The low frequency receiver characteristics are defined by separately specifying a low frequency signal amplitude range and maximum DC offset component of the receiver input waveform. These low frequency requirements are derived directly from the specifications listed elsewhere in SPI-4 for Driver amplitude range and symmetry, terminator tolerances and cable resistance, with an added allowance of 12 ohms max for back-plane resistance. The resulting numbers are included in this receiver input signal specification for clarity.

All references in the following are to the draft standard SCSI Parallel Interface – 4 (SPI-4) revision 3. That document is available at <ftp://ftp.t10.org/t10/drafts/spi4/spi4r03.pdf>.

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Input Signal requirements for a receiver incorporating AAF:

For receivers incorporating AAF compensation, the input signal waveforms shall meet all of the following five amplitude and timing requirements.

1. Low frequency signal amplitude:

The differential low frequency signal amplitude at the receiver during normal data shall fall within the following limits:

$$600\text{mV} < |V_a| + |V_n| < 1.7 \text{ V peak-to-peak,}$$

The low frequency signal amplitudes shall be measured after 100 ns continuous assertion (or negation), and may be measured in the training pattern defined in clause 10.8.4.2.

2. Differential Offset:

The differential offset component of the receiver input waveform, defined as the mid-point of the low frequency asserted and negated levels, shall be less than 50 mV.

$$-50 \text{ mV} < [ (|V_a| - |V_n|) \div 2 ] < 50 \text{ mV}$$

3. Free-running clock and settled 1010 pattern amplitude (1010 patterns preceded by a minimum of 10 bit-cells of 1010 pattern):

The free-running clock and settled 1010 data pattern amplitude, VCLKPP, is defined as the sum of the minimum negated and asserted amplitudes, each measured within a 2 ns interval centered on the appropriate bit-cell centers as shown in Mask 1. The measured data waveform shall be band-limited to 200 MHz.

$$VCLKPP > 240\text{mV}$$

4. All-transition amplitude requirement:

The amplitude change at all transitions as shown in Mask 2 shall exceed 100 mV, measured as shown in Mask 2. The measured data waveform shall be band-limited to 200 MHz.

5. Receiver Input Eye Mask

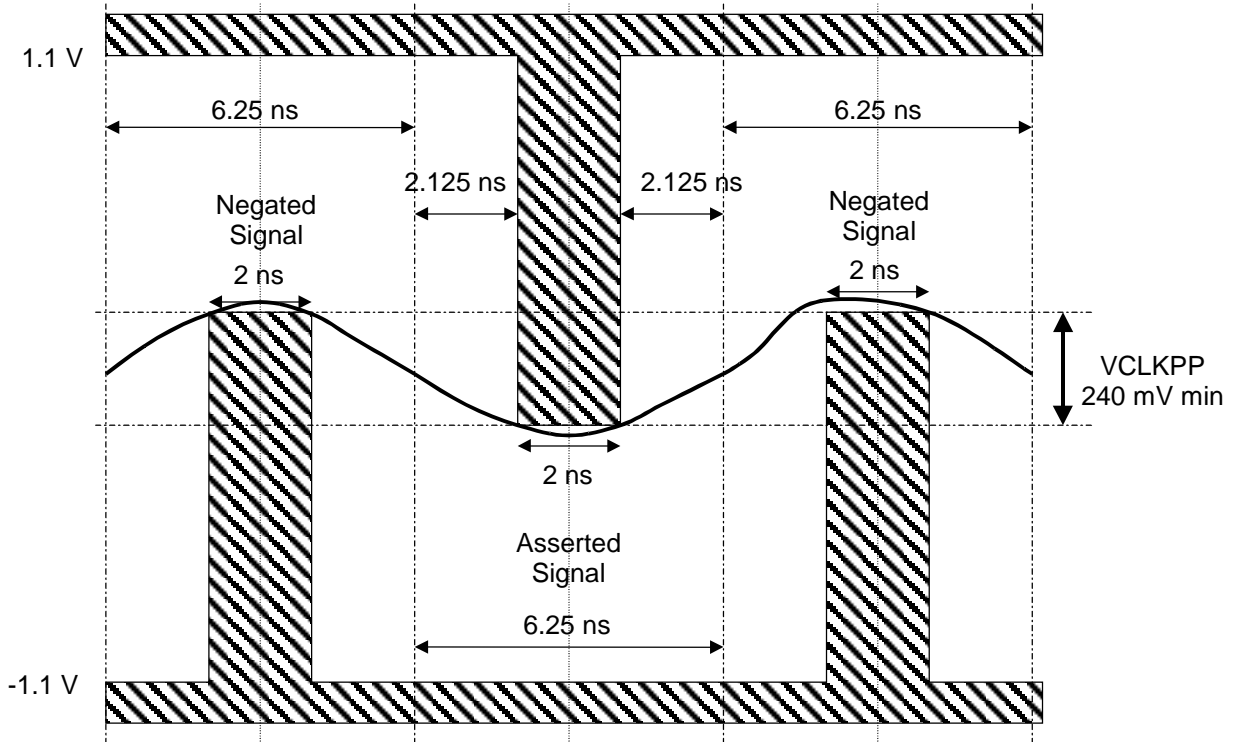
The eye diagram formed by superimposing the waveforms of all bit cells of the input data pattern shall be open for 1.5 ns centered on bit-cell center as shown in Mask 3, where bit-cell center is determined by the location of a settled 101010 clock pattern in the input waveform.

This eye diagram is concerned with the "AC" components of the input waveform only, and any DC term as calculated in requirement 2 above shall be removed before applying the test mask. The measured data waveform shall be band-limited to 200 MHz.

**Mask 1 – Free-running clock, and settled 1010 patterns:**

A minimum of 10 bit-cells of 1010 pattern must precede the 1010 patterns being tested.

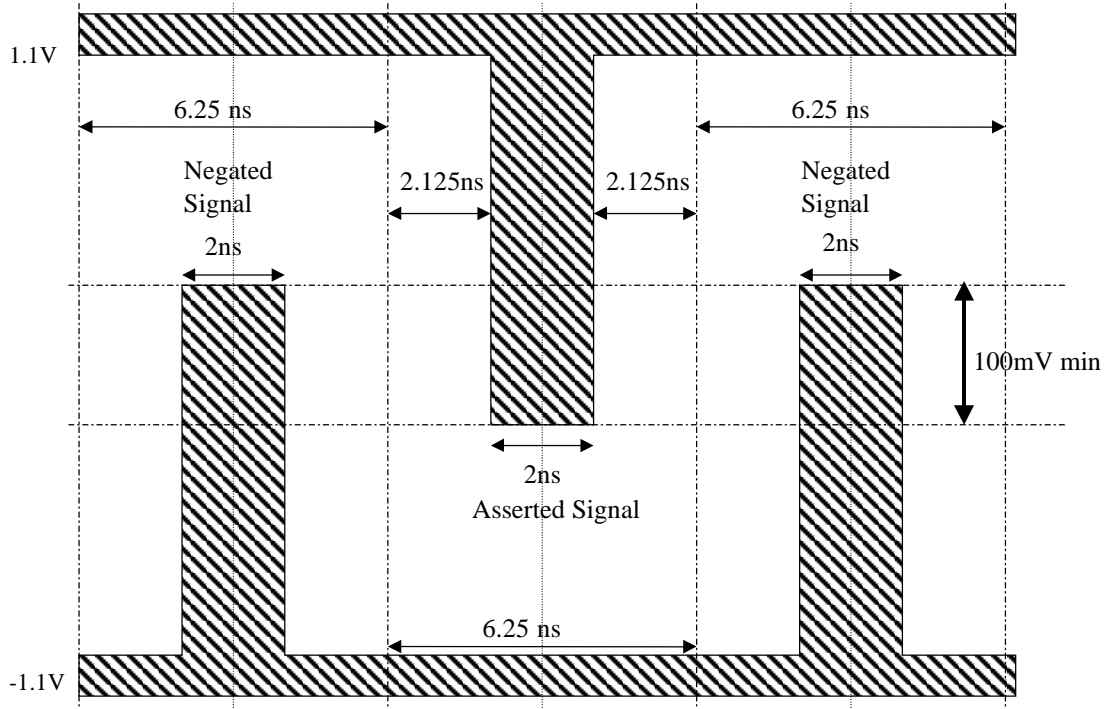
Fast160 AAF Receiver Mask: VCLKPP definition and amplitude



Minimum Amplitude: VCLKPP > 240mV

**Mask 2– Minimum Transition Amplitude:**

Fast160 AAF Receiver Mask: Minimum Transition Amplitude



- Notes: 1. Bit-cell boundaries, determined by settled 101010 pattern
- 2. Peak-Peak Transition Amplitude > 100mV

Mask 3: overall eye diagram mask

