PCI Express Tool

For the SIA-3000 with GigaView Software

This guide describes how to measure signal integrity on PCI Express devices using the *WAVECREST* SIA-3000 and *GigaView* software.

PCI Express Specification

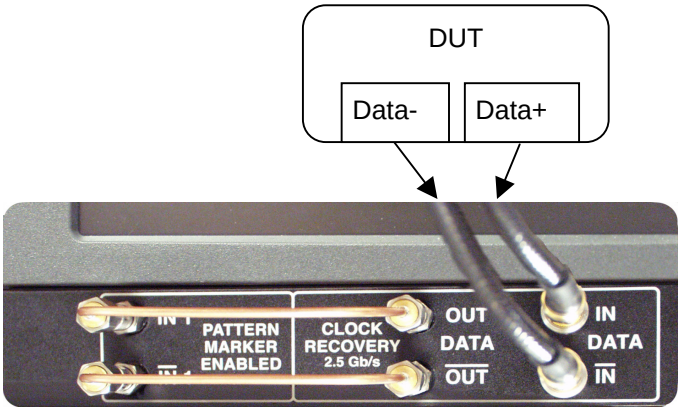
Total Jitter (TJ) and its relationship to Bit Error Rate (BER) is defined in section 4.3.2.2 of PCI Express Base Specification, Rev 1.0a[1], which states, "Jitter is categorized into random sources (Rj) and deterministic sources (Dj). The total jitter (Tj) is the convolution of the probability density functions for all the independent jitter sources, Rj and Dj. The nature of Rj can be approximated as Gaussian and is used to establish the bit error rate (BER) of the link. The UI allocation is given as the allowable Tj at the target BER. The UI allocation must meet a maximum BER of 10^{-12} for the Tj. The allocation to Rj and Dj is not specified." For more information about the various components of jitter, see footnote 2.

The amplitude measurements described in the specification include rise and fall times, zero and one levels, de-emphasis ratio and several others. The Dual Engine architecture of the *WAVECREST* SIA-3000 provides a complete testing solution for 10^{-12} BER measurements with hardware optimized for timing, as well as providing all voltage and amplitude measurements using voltage optimized hardware. This represents a level of versatility that only the *WAVECREST* SIA-3000 can provide.

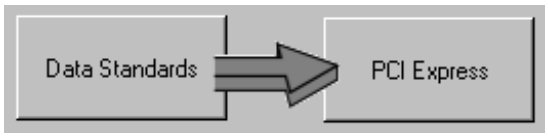
Tool Setup

This tool requires the SIA-3000 to have the Clock Recovery option installed. The PCI Express specification identifies a test pattern to be used for all signal integrity tests. This pattern is 40-bits long and is composed of the following bits: K28.5, D21.5, K28.5, D10.2 which is 0011111010 1010101010 1100000101 0101010101 in binary or 3eaaac1555 in Hex. This pattern is automatically loaded into the PCI Express Compliance tool. If you are using another pattern, it can be manually entered into the tool by selecting the 'Pattern Options' button and then selecting the 'Load Pattern' button (Figure 4). You can load any of the standard compliance patterns saved on the SIA-3000 or you can load a pattern you've created using the "Known Pattern With Marker" tool.

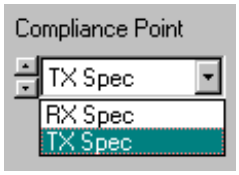
Connect the SIA-3000 as shown below. The Data pattern is input to the Clock Recovery input. The Clock Recovery Data output is looped back to IN1 with the PM50 option.



From the Main Menu, press “Data Standards” and PCI Express to open the tool.



Select your compliance point, Transmitter (TX Spec) or Receiver (RX Spec).



The software settings default to the setup as described above, and should not need to be changed.
If there is not a PM50 installed, or you wish to change the pattern you can choose “Acquire Options” or “Pattern Options” to change the settings.

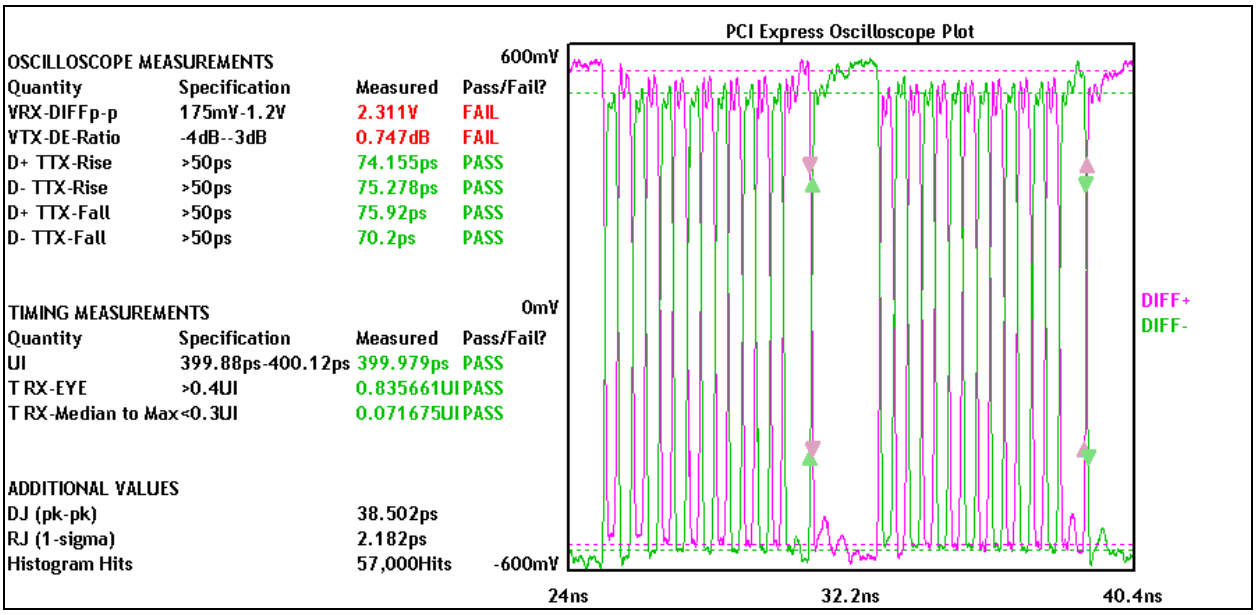
Making the Measurement and Understanding Results

To perform the measurement, first, click the ‘Pulse Find’ button  to automatically set the voltage levels.

Then click the ‘Single/Acquire’ button  . Several views are available once the measurement is complete. All views are displayed with the results summarized to the left of the plot. The specification value, the measured value and Pass of Fail is displayed. Additional values are displayed below. These values are not directly required for the Specification, but are useful for diagnostic purposes in the event that a test fails or only passes by a small margin. The Summary view shows the rev of the specification that the tool will measure. Many specifications continue to evolve and may change. Check to see that this is the current specification release.

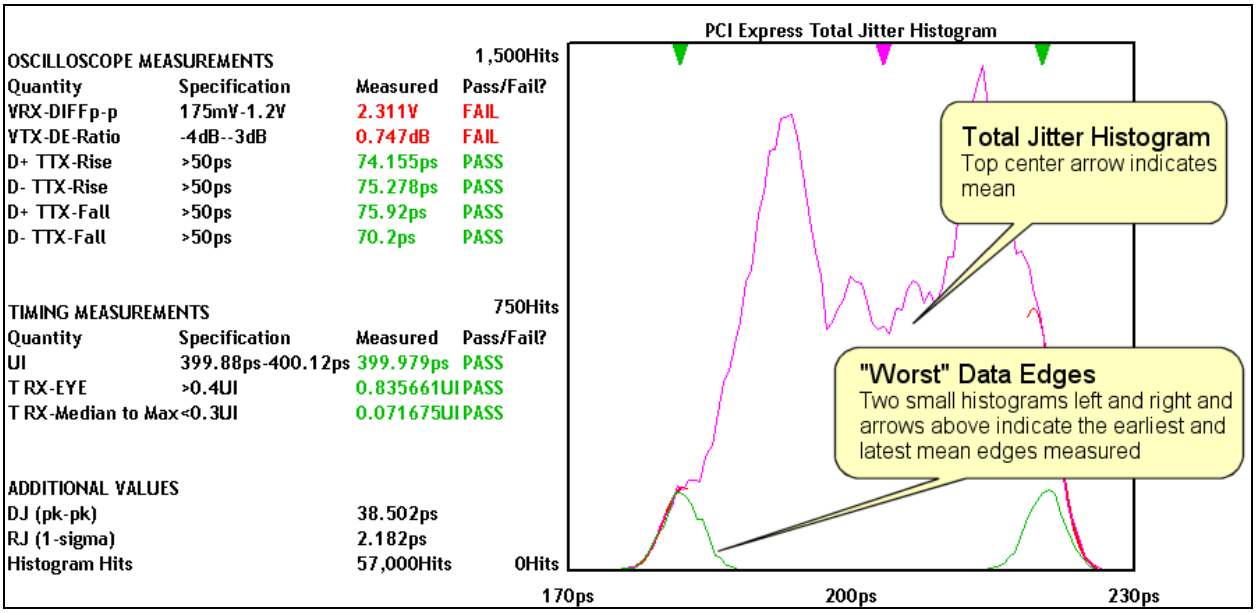
Oscilloscope View

This view shows the voltage vs. time for a portion of the pattern. Measurements are summarized on the left.



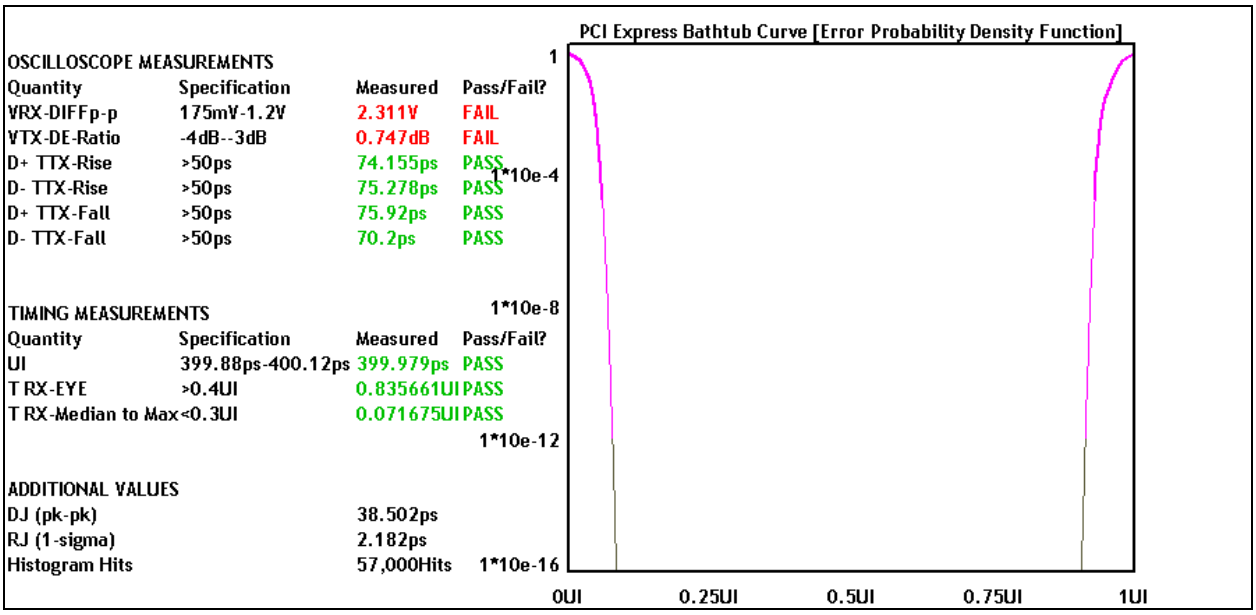
Total Jitter Histogram View

The Total Jitter Histogram view shows the Clock to Data measurements. An arrow at the center top of the plot indicates the *mean* of the Total Jitter Histogram. The two other histograms, to the left and right, are the histograms of edge measurements from the earliest and latest measured mean edge times. The *mean* for each of those are indicated by different colored arrows at the top left and right.



Bathtub Curve View

The Bathtub curve shows the predicted Total jitter at a specific Bit Error Rate. Bit Error Rate is displayed on the vertical axis and one UI is displayed on the horizontal axis. As jitter increases, the two lines will move closer to each other.



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