



WAVECREST Corporation

COMPARING THE *WAVECREST* DTS 2075[™] AND
VIRTUAL INSTRUMENTS[™] WITH THE
HEWLETT-PACKARD[®] 3GHZ BERT BOX

Technical Bulletin No. 7

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Introduction:

This bulletin looks at the output of the HP 3GHz BERT box running the PRBS 2^7-1 pattern at Fibre Channel speeds of 1062.5MHz. The same generator is then connected to the DTS 2075™ & Virtual Instruments™ (VI) (Patent pending) DataCom (DC) software package to compare results.

Summary of results:

The output DCD + ISI of the BERT was measured for both rising and falling DCD + ISI with the HP54120A sampling oscilloscope. The measurements were taken over 20 edges each with results of 10ps for the rising edges and 16ps for the falling edges. The RJ of the BERT was also measured using a clock-like toggle pattern with the results being 2.7ps.

The Deterministic Jitter (DJ) and Random Jitter (RJ) were also measured using the DTS 2075 and VI/DataCom (V2.23b) software package.

Two test cases were compared using the VI/DataCom V2.23b software. The first used the AUTOARM mode for clockless and markerless jitter analysis.

The second test case used the PATTERN MARKER generated by the pattern generator.

The measurements made with the HP54120A were assumed to be correct and are used here as the reference for the measurements made with the DTS.

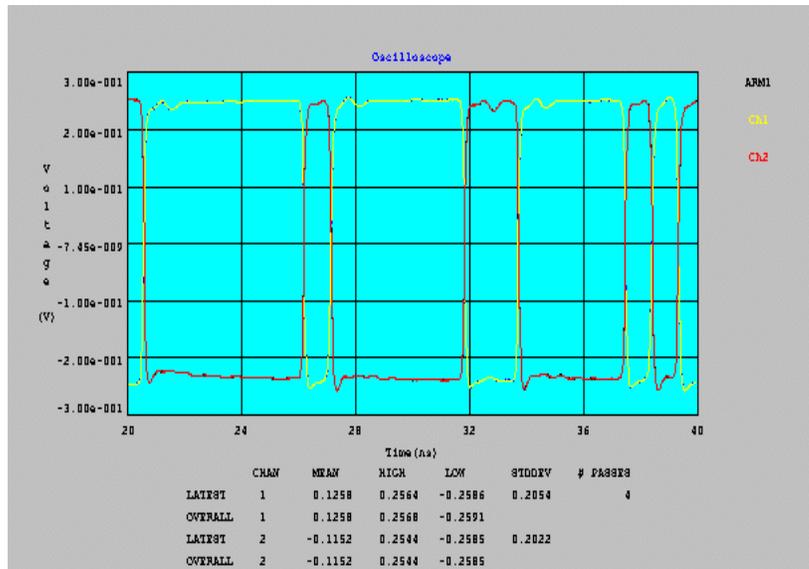


Figure 1

Figure 1 is an oscilloscope plot, taken with VI and the DTS, of the two channels coming out of the BERT. The pattern marker from the BERT was used as the TRIGGER for this picture.

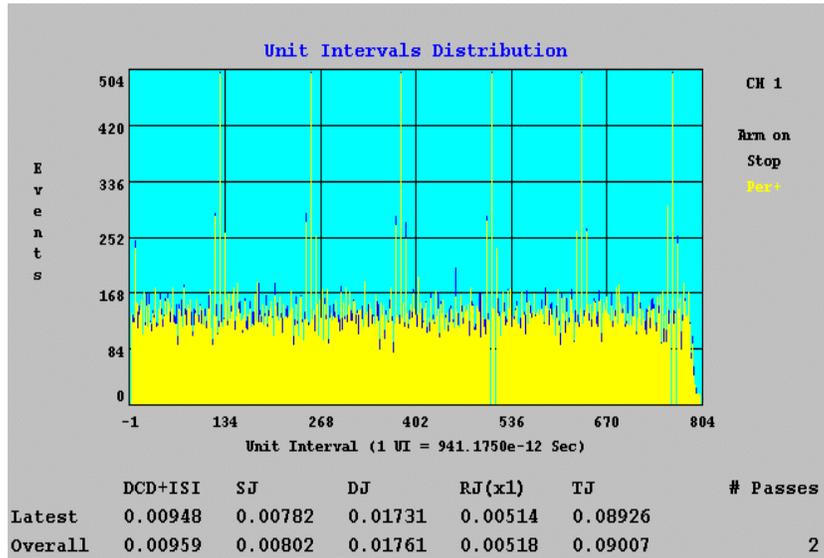


Figure 2a

Figure 2a is showing all of the Unit Intervals (UI) measured by the DTS in AUTOARM mode. The measurements spanned 804 UI. The legend indicates the results of the test. DJ = 17ps (which is the DCD+ISI+SJ) and RJ = 5ps. The RJ bandpass filter in the VI/DataCom software was set from 0.0 to the Nyquist frequency of the pattern. The DCD + ISI was measured at 9.5ps and compares favorably to the DCD+ISI number measured by the HP scope.

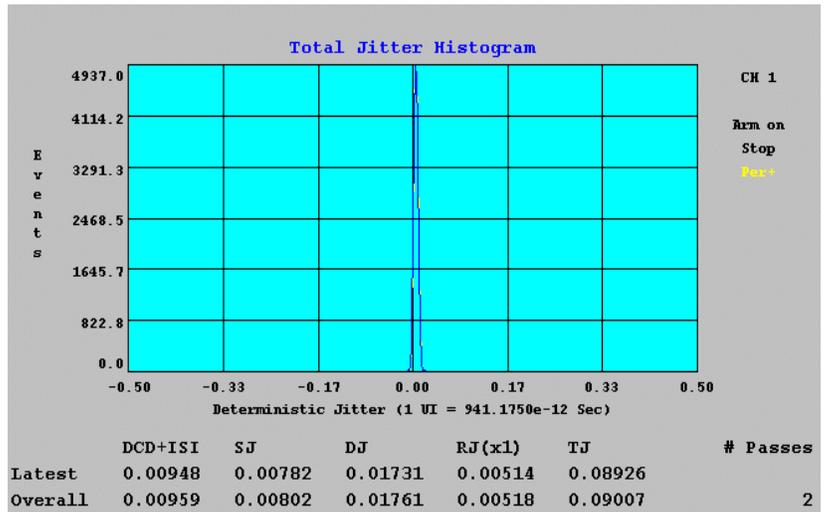


Figure 3a

Figure 3a is showing an overlay of all of the AVERAGE results taken for each UI bin shown in figure 2a. Remember, each UI bin measured (804 in this case) contains both the AVERAGE and VARIANCE for that bin of all of the data taken.

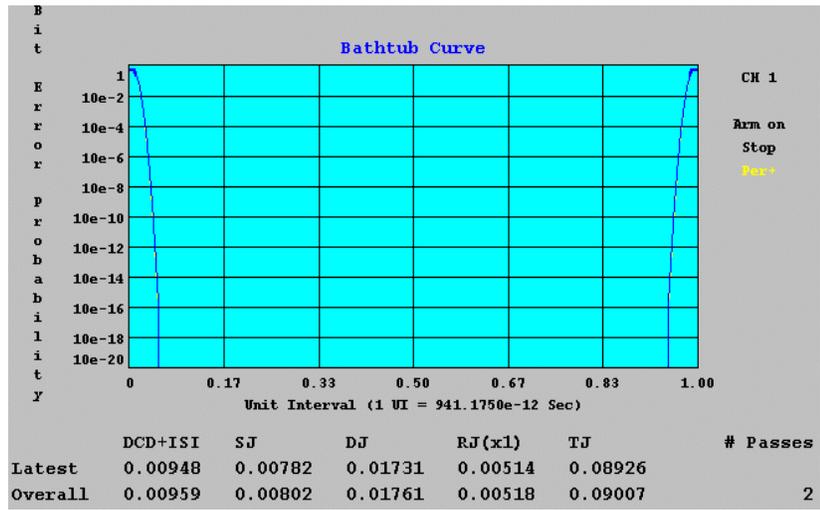


Figure 4a

Figure 4a is of a BATH TUB CURVE for the data taken in Figure 2a. The RJ multiplier was set to 14 sigma so the value of the TJ in the legend is correct for an ERROR PROBABILITY of 10^{-12} .

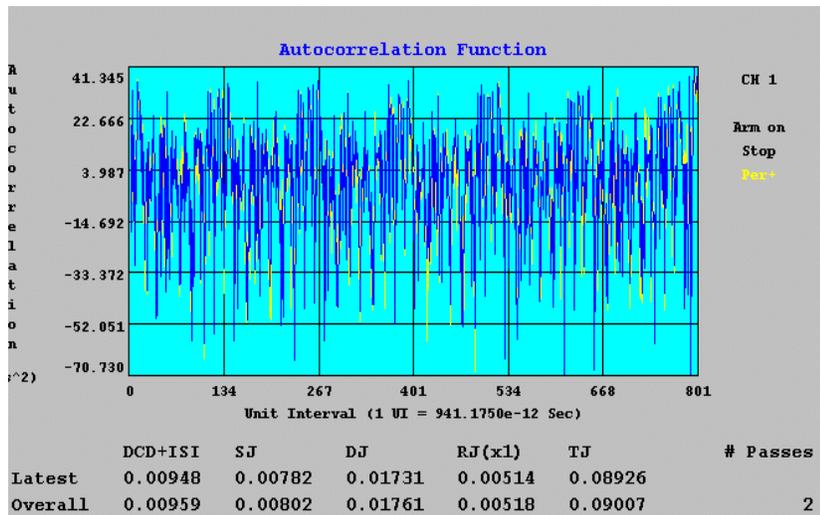


Figure 5a

Figure 5a is showing the AUTOCORRELATION of the VARIANCE of all of the data binned in Figure 2a.

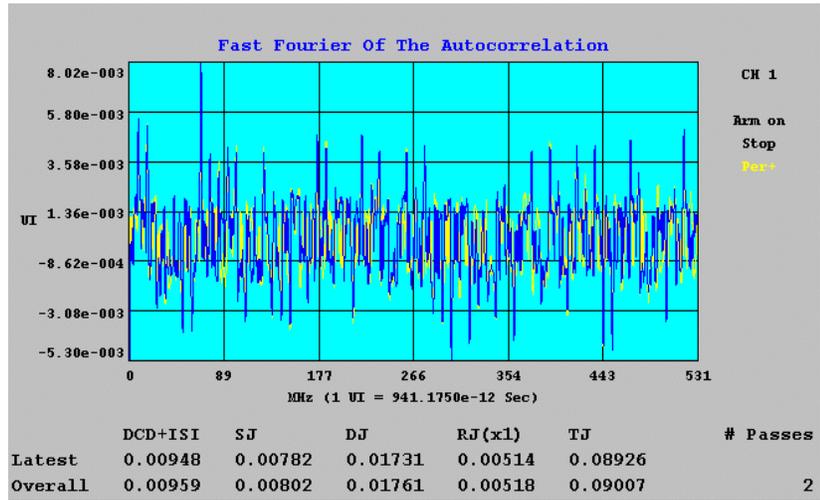


Figure 6a

This plot is an FFT of the VARIANCE shown in figure 5a. The SJ is calculated as the highest peak in the spectrum and the RJ is calculated using the rms of the sum of each bin from the Nyquist to 0.0.

The next series of plots are taken using the same signal source as figures 1 through 6a except with the addition of a PATTERN MARKER.

If you compare Figures 2a and 2m you will see that in 2m there is an equal number of measurements in each bin. This is indicative of a clock like pattern. What the PATTERN MARKER does is make the random pattern look like a clock like pattern to the DTS. This has the effect of reducing the amount of spectral noise seen in the AUTOCORRELATION plot and consequently makes the FFT results less noisy as well. The DCD + ISI number will be more accurate because the START point for each of the measurements taken by the DTS is always at the same point in the pattern.

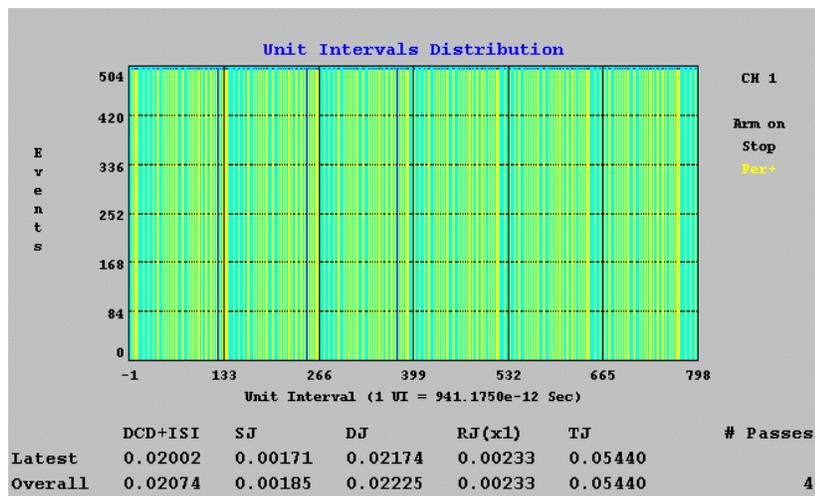


Figure 2m

Notice the RJ number, 2.3ps, measured in figure 2m. This correlates very closely with RJ measured with the 54120A, 2.7ps.

Also, notice the DJ from figures 2a and 2m. For 2a the value is 17.3ps while in 2m it is 21.3ps. The value measured by the 54120A was 10ps. The average error of 10ps between the DTS and the 54120A is attributed to DJ in the DTS instrument.

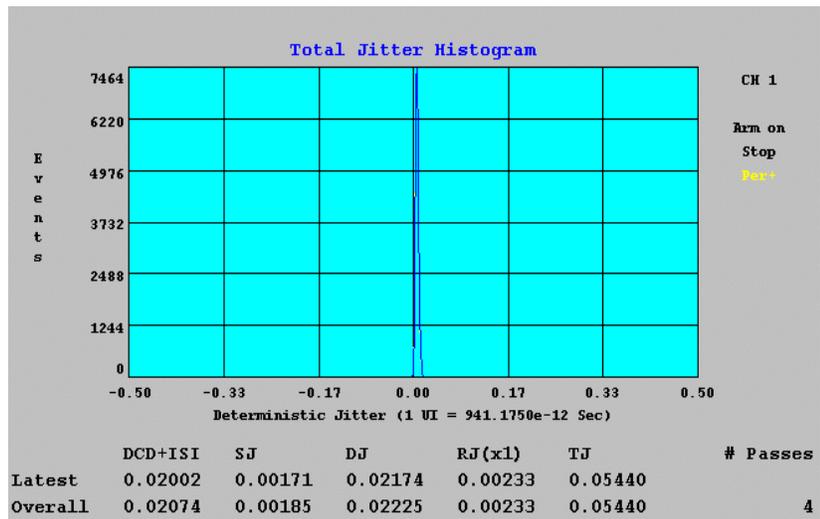


Figure 3m

Figure 3m is showing an overlay of all of the AVERAGE results taken for each UI bin shown in figure 2m. Remember, each UI bin measured (804 in this case) contains both the AVERAGE and VARIANCE for that bin of all of the data taken.

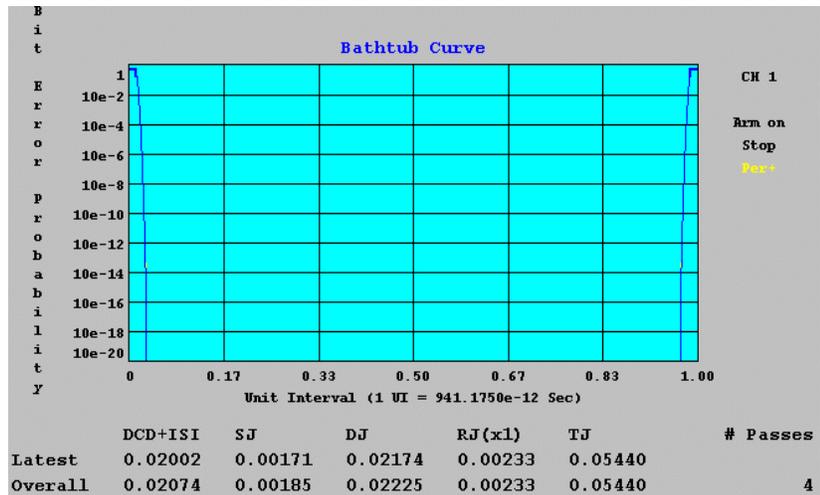


Figure 4m

This plot is of a BATHTUB CURVE for the data taken in figure 2m. The RJ multiplier was set to 14 sigma so the value of the TJ in the legend is correct for an ERROR PROBABILITY of 10^{-12} .

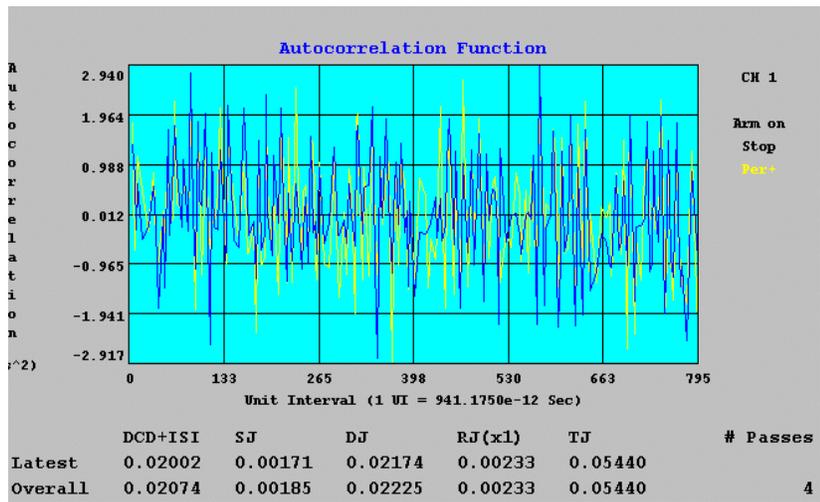


Figure 5m

This plot is showing the AUTOCORRELATION of the VARIANCE of all of the data binned in figure 2m.

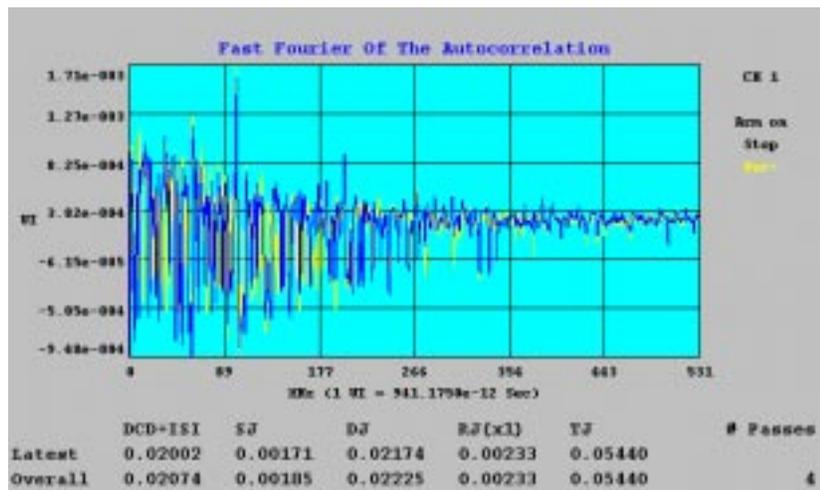


Figure 6m

This plot is an FFT of the VARIANCE shown in figure 5m. The SJ is calculated as the highest peak in the spectrum and the RJ is calculated using the rms of the sum of each bin from the Nyquist to 0.0.

This completes the comparison of the HP 3GHz generator, HP-54102A scope with the DTS-2075™ and Virtual Instruments™ software for DataCom.

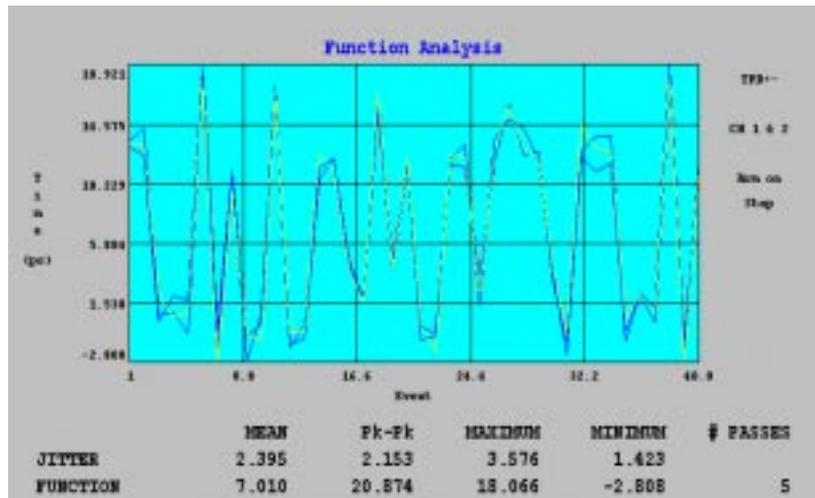


Figure 7

This plot is measuring the delta T (TPD+-) of the rising to falling of the differential output of the HP 3GHz generator over 40 events after the marker. Notice the deterministic jitter varies 21ps pk-pk with a mean jitter of 7ps. This technique is also valid as a approach to determining the DJ for the generator output and is lower than the value measured with the HP-54120A scope.

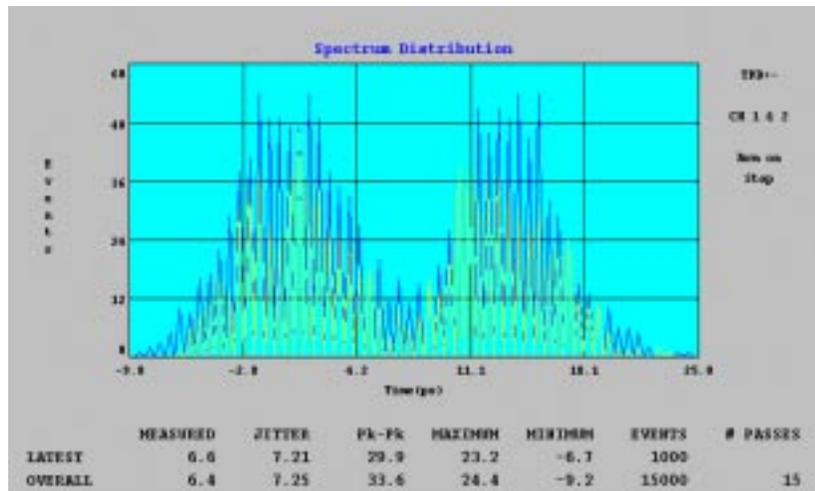


Figure 8

This plot is of the same two differential outputs as shown in Figure 7 except, this plot is showing a histogram of all the data measured between the rising and falling edges of the generator.

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