Parameter Mathematics

Performing Basic Mathematics On Measured Parameters

Trending is a graphical representation of a series of individually measured parameters. Once a measured parameter is added to the trend graph it is a waveform and waveform mathematics can be applied yielding a new functional capability, parameter mathematics.

Consider the example of this type of calculation shown in figure 1. The acquired waveform, not shown, is a carrier modulated by a random QPSK signal. The upper trace (A) is the square of the last acquired waveform which represents its the instantaneous power. Trace B is the trend graph of the maximum instantaneous power taken over 200 such acquisitions. Similarly, Trace C is the trend graph of the average power of each of the same 200 acquisitions. Trace D is the ratio of these two trend graphs and represents the ratio of peak to average power for each acquisition. The measured parameter data(D) reads out the average, lowest value, highest value, and standard deviation (sigma) of the 200 values which make up the ratio graph.

In figure 2, the calculation is extended to read the ratio in decibels (dB). Trace A contains the ratio values. The $\log_{10}$ of these values is determined in

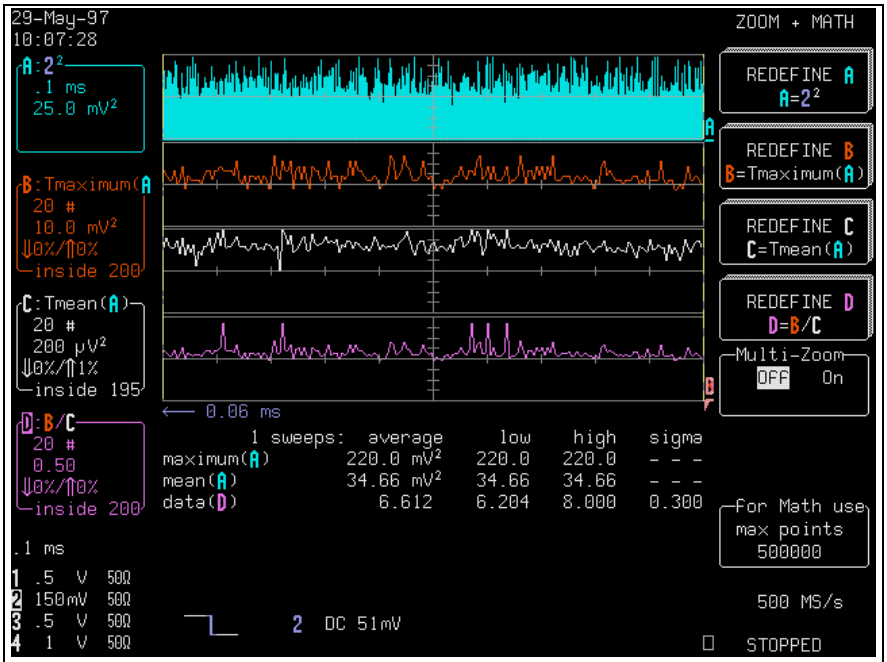

Figure 1 - Calculating the ratio of maximum(A), peak power, to mean (A), average power, over 200 acquisitions

Figure 2 - Calculating the ratio graph in dB=10 log $_{10}$ (P_{peak}/P_{avg})

Trace B. This trace is scaled by a factor of 10 in Trace C resulting in the ratio expressed in decibels .

Another example of parameter math is shown in figure 3 . The acquired trace (2) is a pulse width modulated signal. Beneath the acquired waveform are trend graphs of local time over threshold (cycle by cycle pulse width) and the local period (cycle to cycle period) are displayed. The bottom trace (C) is the ratio of these parameters taken on a cycle by cycle basis over the entire acquired signal. This ratio is the duty cycle of the acquired waveform expressed as a fraction.

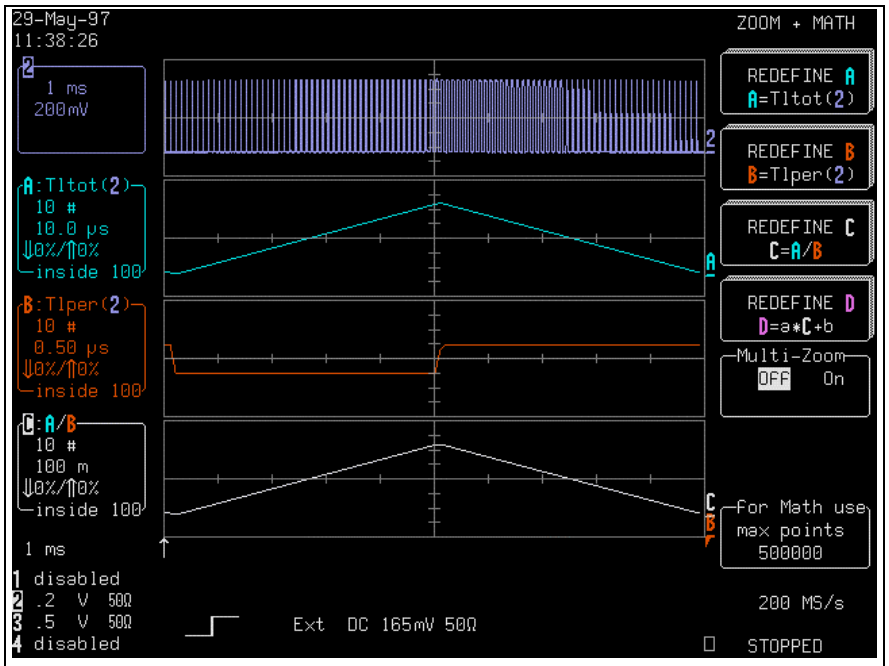

Figure 3 - Calculating the instantaneous variation in duty cycle based on the ratio of width/period on a cycle by cycle basis

Duty cycle is most often expressed as a percentage. We can covert the ratio from a fraction to percent by multiplying all the value by a factor of 100. The re-scaling operation is illustrated in figure 4. The data parameter readout for the re-scaled graph, Trace D, shows the duty cycle varies from 1% to 49.4 % within the acquired waveform.

These are common examples of combining local parameter measurements, the trend function, recently added to the WP03 Statistical Analysis Software option, and waveform math to perform parameter mathematics.

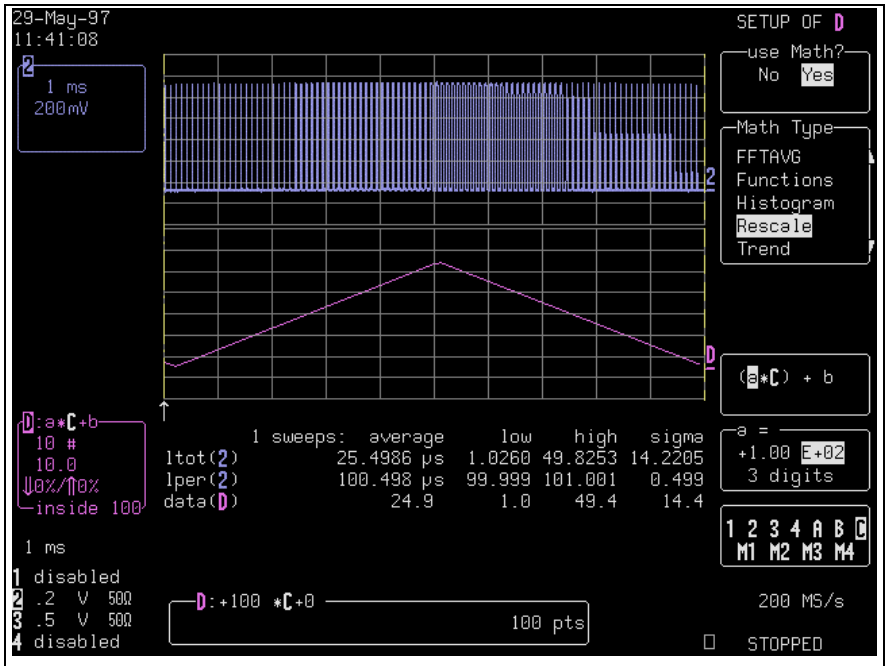

Figure 4 - Using parameter math to re-scale duty cycle to read in percent.