Modulation Analysis - PM

Using Jitter And Timing Functions To Analyze PM signals

The Jitter and Timing Analysis (JTA) option functions are ideal for extracting the modulating waveform from a phase modulated (PM) signal as well as the peak phase deviation. This type of analysis can be useful in the analysis of communications systems employing continuous phase modulation as well as those using phase shift keying for transmitting digital data.

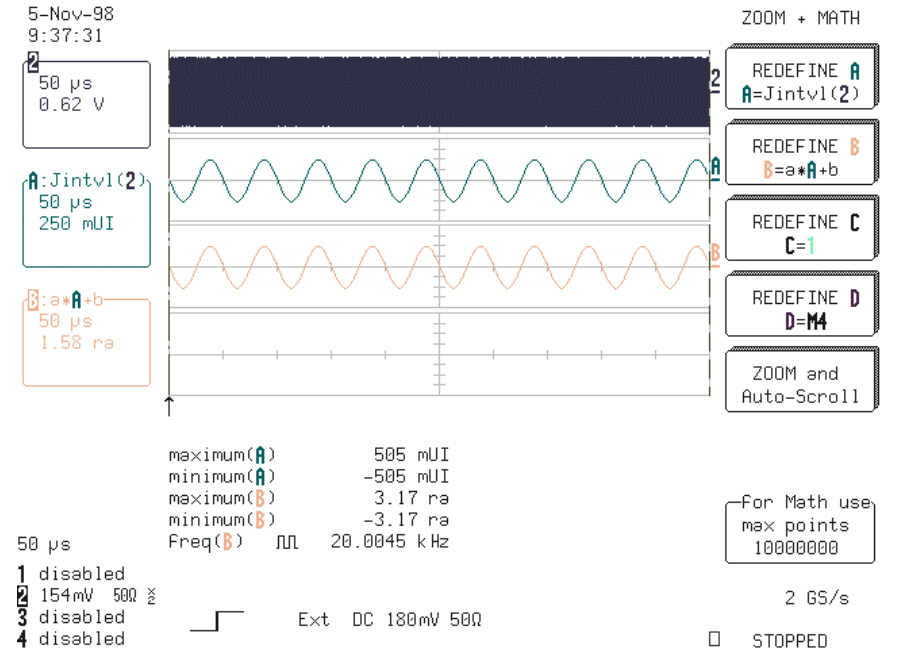

Figure 1 Analysis of a PM signal using both Time Interval Error (JIntvl) .

The analysis of a 10 Mhz PM signal with a 20 kHz sinewave modulation and π radian (180°) deviation is shown in figure 1. The acquired phase modulated waveform is shown in the upper trace (CH2). The JTA function JitterTrack Interval (Jintvl) is used to obtain a function of time interval error vs. time as shown in trace A. Time interval error is the time difference between a waveform crossing a preset voltage threshold and the ideal location of that crossing as specified in a user entered reference frequency. In this example the threshold was set at 0 Volts and the reference frequency is set to 10.00000 MHz. The sinusoidal modulation is clearly evident in the Jintvl function.

The vertical units of the Jintvl function are user selectable as absolute time or unit intervals (UI). A unit interval is the time error divided by the ideal reference period. The unit interval therefore represents a full cycle or 2π (6.28…) radians. The Rescaling math function is used to convert the units of the interval measurement from UI into radians as seen in trace B. Measurement parameters read the maximum and minimum values of both Jintvl function and the rescaled modulation waveform. The maximum and minimum phase deviation is 3.17 radians. The frequency of the modulation waveform (20 kHz)

This example shows the analysis of continuous phase modulation. In many data communications system digital data is encoded using phase shift keying (PSK) where 1's and 0's are represented by discreet phase shifts. Figure 2 contains an analysis of a PSK signal.

In this example we have extracted the non-return to zero (NRZ) data from the phase modulated carrier using the same techniques outlined in the previous example. The top and base parameters read the nominal phase of the 1 and 0 states.

Note that the histogram of the data parameter (voltage value of every data point in the waveform) is used to measure the relative proportion of time the NRZ data is at each voltage value.

It should be obvious that the JTA functions, augmented by the full featured math processes available in LeCroy digital oscilloscopes, allow users to extract and analyze phase variations as functions of time. These functions serve as the basis for phase modulation analysis within the scope.

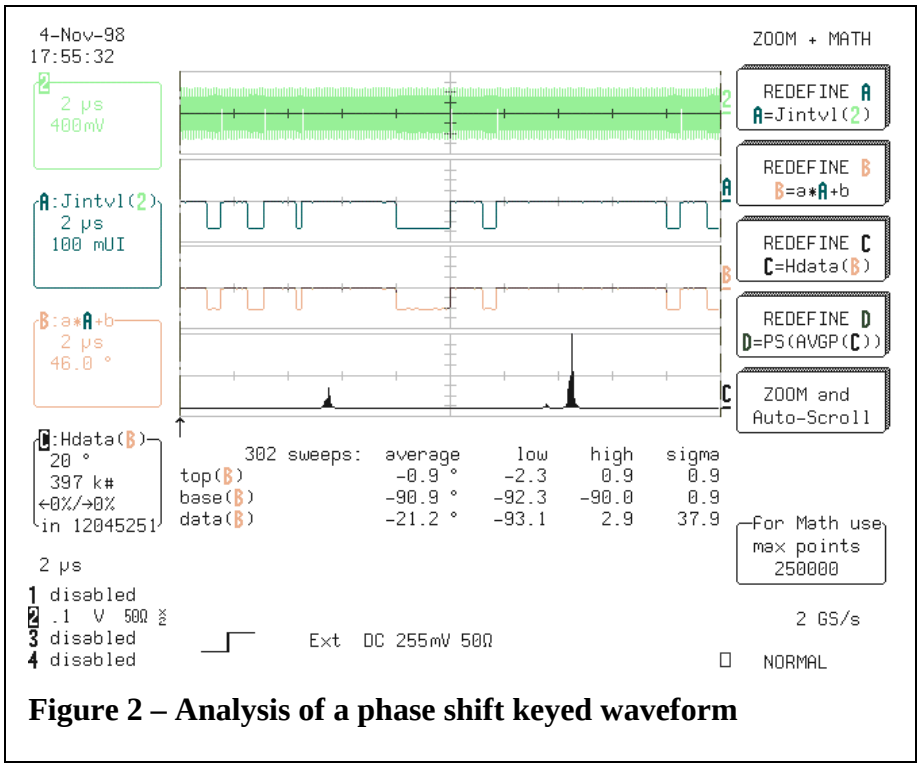

Figure 2 – Analysis of a phase shift keyed waveform