Boonton

Application Note

4500B Advanced Trigger Capabilities

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Abstract

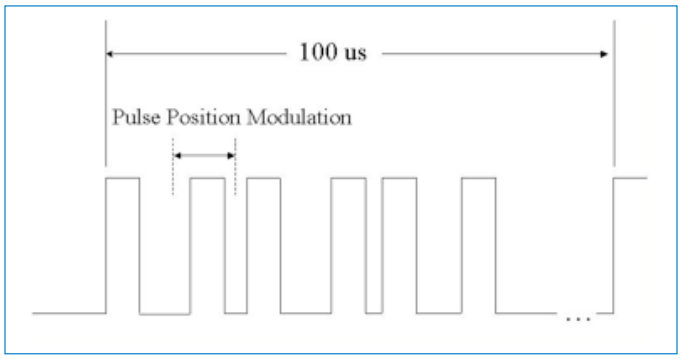
Pulsed signals used for radar, remote sensing and tracking, MRI medical imaging, and certain wireless communication applications such as WiMax & LTE have become increasingly complex to measure. The instruments used to measure these signals must have sufficient capability to account for synchronization changes within a burst of pulses to capture a specific region and measure the signal accurately. A Peak power meter with advanced trigger capabilities is an excellent tool for this purpose. The Boonton 4500B can trigger using a single edge, pos/neg slope, standard hold-off, or a delay by time or event. This application note explains how to use the 4500B triggers to isolate areas of interest in your signal.

4500B Advanced Trigger Capabilities

In the Boonton 4500B, pulse power is a triggered mode of operation with a setup very similar to an oscilloscope including selections for auto or normal trigger mode, source selection, level, slope, holdoff and delay. 4500B has an integrated standard feature which allows automatic delay by events rather than by time only. This capability is useful for selecting a particular pulse in a burst of pulses.

Pulse Position Modulation Example

A practical example to illustrate the need for sophisticated triggering in a Power meter is the analysis of a pulse position modulated (PPM) signal. As the name implies, PPM is a data-encoding scheme where the position of the transmitted pulses is modified. Typically this will result in a long stream of pulses that are unevenly spaced in time. For the purposes of this technical note the signal to be measured is a group of six 1 us wide pulses in a burst that repeats every 100 us.



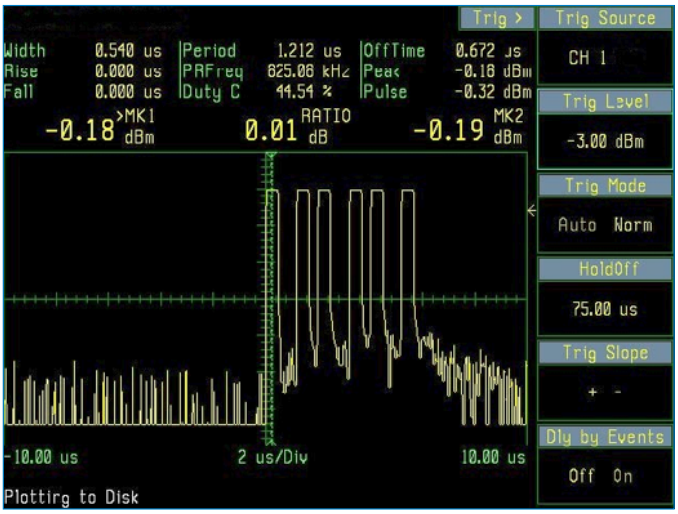
Simple Edge Trigger Limitations

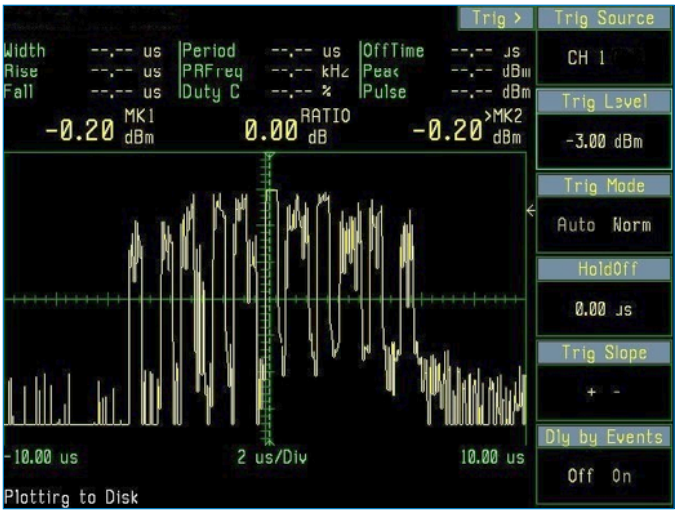
The 4500B screen image below illustrates the limitations of simple edge trigger for applications that produce a burst of pulses. In this example, the peak power analyzer will successfully trigger on the edge of a pulse but that pulse is random. The trigger point is in the center of the screen and the resultant waveform is an average built from a number of triggers events. The peak power analyzer cannot synchronize to any particular edge or in the burst given this trigger setup.

Trigger Holdoff

Trigger holdoff is an effective way to stabilize the display of complex waveforms and is especially useful in pulse burst applications. The holdoff function allows you to specify a period of time when triggering is inhabited. This time should be slightly less than the burst cycle time. The peak power analyzer will ''lock-on'' to the first edge of the pulse train when this is setup correctly. In this example the burst cycle time is 100 us and the delay was set to 75 us.

Trigger holdoff should be used in normal trigger mode to avoid any forced triggers that could occur in auto trigger mode especially when the burst cycle time is long. Trigger holdoff can also be used in combination with trigger delay to view time sections of a burst of pulses.





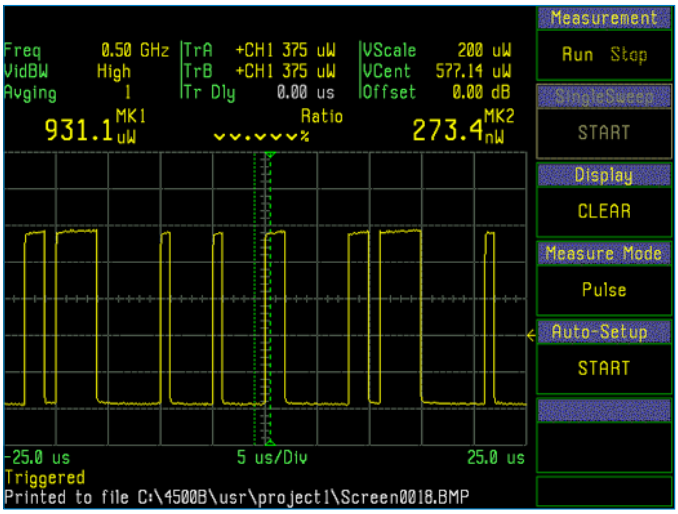
Delay by Events Trigger

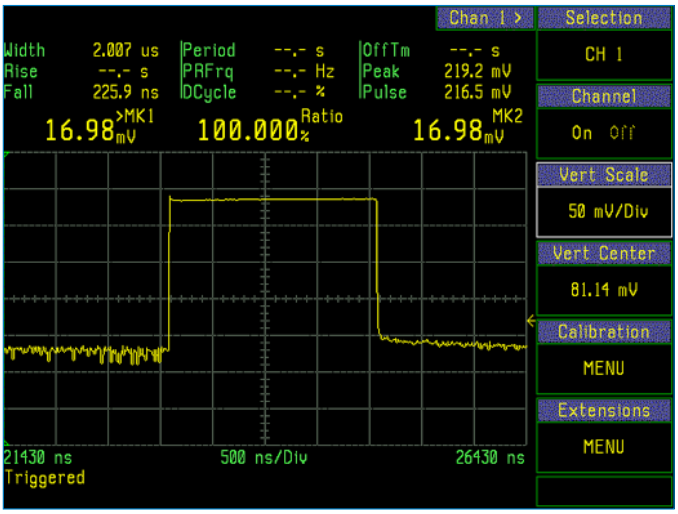
Delay by event trigger is a standard feature for 4500B which extends the system functionality to trigger on specific events within a pulse burst. It combines trigger holdoff in time with an event counter to ensure synchronization not only with the start of a burst of pulses but any pulse up to 999,999 events thereafter. This feature eliminates synchronization problems associated with time jitter and pulse position modulation.

Below is the setup of the delay by events trigger for a pulsed RF signal such as RADAR. The user selects the trigger holdoff time and again this slightly less than the burst cycle time. Next the user can choose the specific event to trigger on. The circuit will count events and hold the trigger until the event count has been reached even if it needs to count into subsequent bursts or the holdoff time has elapsed

Analyzing a Specific Pulse:

The delay by events trigger allows a user to synchronize and observe the nth pulse of a burst even if its time position is highly variable. 4500B Peak power meter users can analyze individual pulses in great detail. For example, in pulse position modulation applications the pulse rise/fall times typically need to be controlled to minimize jitter. These edges need to be fast enough to get low jitter and a good measurement of the time between pulses but not too fast to ensure they do not go out of band. In the image below the fourth pulse in the burst has been ''locked-on'' and the time scale has been changed to make an accurate measurement of the rise/fall time of the fourth pulse in the burst. In order to observe the rise time properly, the pulse needs to zoom in perfectly and the time base setting should be adjusted to low enough.





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