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MEASURING THE FREQUENCY ON FREQUENCY AGILE RADAR SYSTEMS

BACKGROUND: Most radar systems transmit repetitive bursts of RF at a single frequency, but some radar systems develop frequency agile signals. The bursts of RF transmitted from these systems vary in frequency from pulse to pulse in a quasi-random fashion.

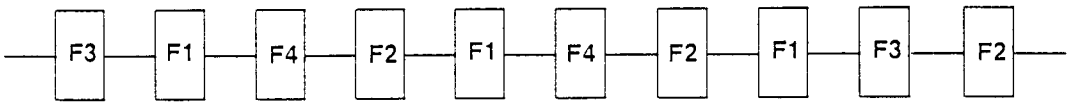

Figure 1. Frequency Agile Radar Signal

PROBLEM: Modern Pulse Microwave Frequency Counters are capable of measuring repetitive bursts of RF at a single frequency. Measuring a radar signal that varies in frequency from one pulse to the next presents unique problems.

SOLUTION: Using the following techniques and the EIP Model 585 or 588 Pulse Microwave Frequency counters, most of the problems in counting frequency agile radar signals can be overcome.

FREQUENCY WINDOWING

The first technique, and the simplest, is to use the frequency windowing feature of the counter. The EIP Models 585/588 are the only microwave pulse counters currently available that offer this capability. They use a narrow bandpass electronically tunable microwave filter (YIG Filter) on the microwave input. In addition to protecting the microwave input from damage at power levels up to 10 watts, the microwave filter also provides the ability to select a minimum and maximum frequency (window) for the counter, eliminating the counting of other frequencies.

To use the frequency windowing technique the following requirements must be met:

1. The minimum frequency separation between signals must be 200 MHz.
2. The maximum time between the leading edges of the RF bursts being measured must be known. The reciprocal of this time must be entered into the counter as the Minimum PRF.
3. The frequency window around the signal to be measured must be set using either the Frequency Limit keys or the Center Frequency key.
4. The pulse width must be 50 nS or greater.

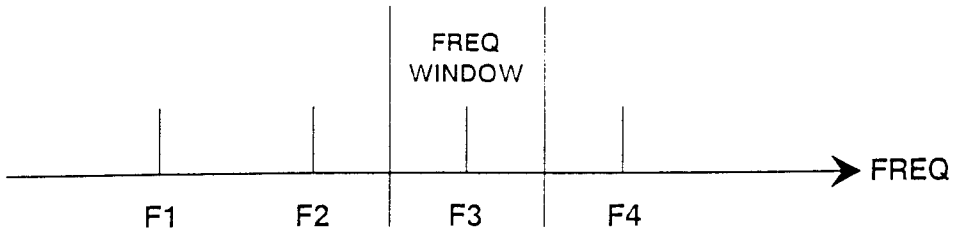

Figure 2. Frequency Windowing an Agile Radar Signal

Once the requirements are met the counter will automatically search for and measure the frequency of the signal within the frequency window. By moving the frequency window, each different frequency in the agile pattern can be measured.

TIME WINDOWING

The second technique uses a time windowing approach for measuring the frequency of an Agile Radar Signal. Time Windowing uses the measurement inhibit feature of the counter. Measurement inhibit prevents the counter from seeing a signal, unless the measurement enable pulse is active. Unlike Frequency Windowing, Time Windowing inposes no minimum frequency separation between signals. The following method is one technique for using Time Windowing, but any approach that causes the measurement enable pulse to be coincident with the signal to be measured will work.

To use this method, the following conditions must be meet:

1. The radar system must be setup to output its signal in a repetitive pattern (See Figure 3).

2. The maximum time between the leading edges of the bursts of RF at the frequency being measured must be known. The reciprocal of this time must be entered into the counter as the Minimum PRF.

3. A trigger coincident with the start of the repetitive train is required for the Delaying Pulse Generator.

4. The pulse width must be 50 nS or greater.

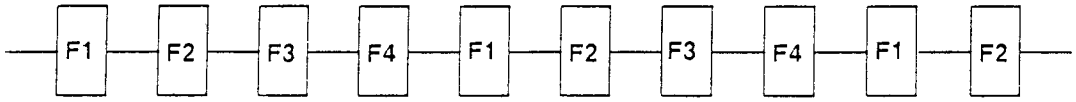

Figure 3. Frequency Agile Radar System Must Be Setup to Output a Repetitive Pattern

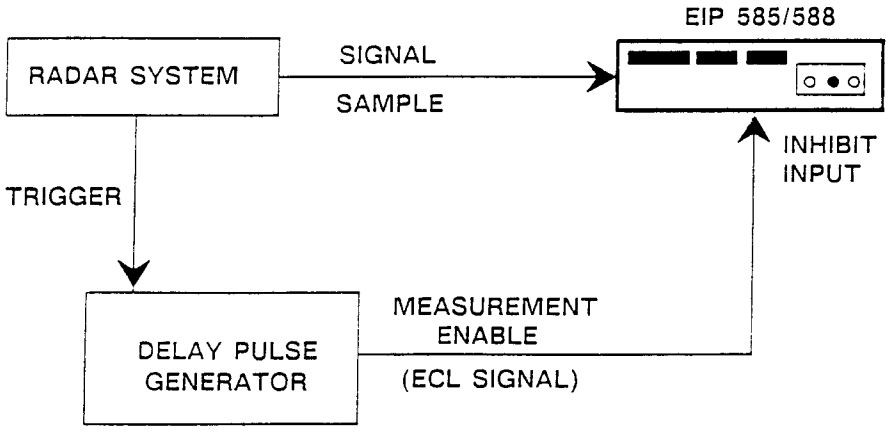

Figure 4. Equipment Setup for Time Windowing Technique

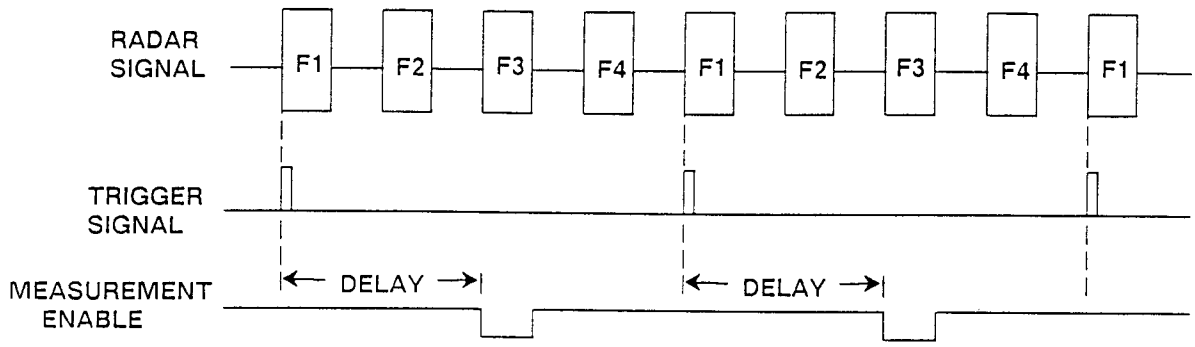

Figure 5. Time Windowing an Agile Radar Signal

Using this technique the counter will automatically measure the frequency of the RF signal coincident with the measurement enable pulse. With the delay set up as shown in Figure 1, the counter will measure the frequency of "F3". By adjusting the measurement enable delay, each signal in the repetitive pattern can be measured.

CONCLUSION: The EIP Model 585/588 Pulse Microwave Frequency Counters offer a superior solution to the problems of measuring Frequency Agile Radar Signals. If you have any questions on this application, suggestions on other unique applications, or other questions on using EIP equipment, please contact your local sales representative or an Applications Engineer at the factory in San Jose, California.