Radar – Solution Note

Background

RADAR ("Radio Detection And Ranging") is a system that uses electromagnetic waves to identify the range, altitude, direction, or speed of both moving and fixed objects such as aircraft, ships, motor vehicles, weather formations, and terrain. Radar systems use transmitters that emit electromagnetic waves that are reflected by a target ("echoes") and detected by a receiver.

Radar systems operate in a variety of modes, each with its own unique advantages:

- **Pulsed Radar.** Pulsed radar transmitters emit short signal pulses, and measure the time it takes for the signal to return, enabling calculation of the distance to the target. The speed of the target can be determined by calculating the change in the distance to the object over time.
- **Continuous Wave.** A second method is to transmit the signal continuously. The advantage of continuous-wave (CW) radar is its ability to measure velocity with extreme accuracy by means of the Doppler shift in the frequency of the echo. The detected, reflected wave is shifted in frequency by an amount which is a function of the relative velocity between the target and the transmitter-receiver. To determine the range of targets, the frequency of the continuous wave output is modulated, and the range is calculated by comparing the frequency of the echo with that of the transmitter, the difference being proportional to the range of the target that produced the echo.
- **Pulse Compression.** A modified form of continuous wave radar employs long, but *not* continuous, transmission. This is basically the same as transmitting extremely long pulses on an FM carrier. Systems of this type are referred to as *pulse compression* radars. In pulse compression, the phase or frequency of the pulse is changed over time. A popular pulse compression technique is linear frequency ("chirp") modulation, in which the frequency of the pulse is modulated with a linear voltage ramp over time and transmitted. Once the return pulse is received at the radar receiver it must be processed in order to "compress" the pulse. Pulse compression is frequently used in long-range radar applications.

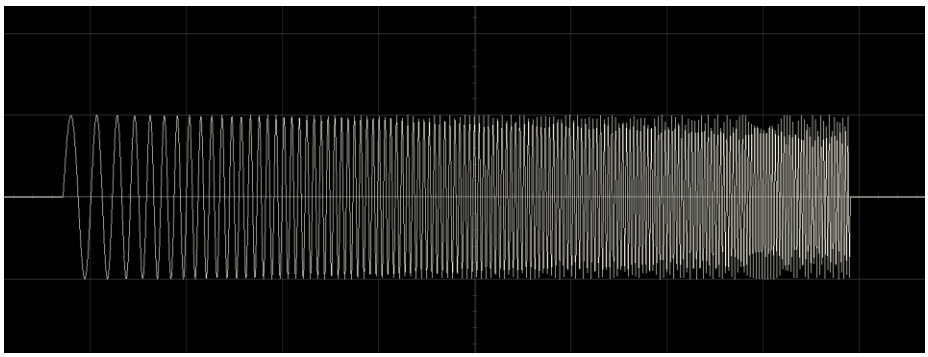

Figure 1: Pulse Compression Using "Chirp" Modulation

Requirement

Radar testing should support the simultaneous simulation of several targets, saving the expense of deploying the radar system together with multiple aircraft.

The signal environment may require simulation of targets, clutter and even various jamming signals. In addition, the following additional requirements apply:

- The test equipment must be able to generate wide-bandwidth signals, in order to simulate the bandwidth of the radar receiver.
- High dynamic range is required, so as not to introduce spurs that can be misinterpreted by the receiver as small targets.
- Low phase noise in signals with added Doppler shifts are required for radar systems that determine velocity.

Solution

Tabor Electronics' *WaveXciter* family of High Speed Arbitrary Waveform Generators (AWGs) serves as an excellent platform for the testing of radar systems. It offers excellent signal quality and dynamic range with a bandwidth of up to 1 GHz. Whether used as a standalone unit or combined with the proper Vector Signal Generator, the WX can be used to simulate the radar transmitter, receiver or targets.

The WaveXciter AWG supports the creation of extremely long scenarios, supporting up to 32 million memory points and 16,000 segments. In addition, WaveXciter supports sequencing and advanced sequencing, nesting, looping, and dynamic jumping, thus offering outstanding support for highly complex applications.

WaveXciter is supplied with *ArbConnection* – Tabor's comprehensive software tool that controls instrument operation, and provides unsurpassed programming and waveform creation capabilities. In addition, as with all of the waveform generators offered by Tabor, the WaveXciter can be controlled via Matlab, LabView, CVI C++ and VB.

For More Information

To learn more about Tabor's solutions or to schedule a demo, please contact your local Tabor representative or email your request to info@tabor.co.il. More information can be found at our website at www.taborelec.com.