Wideband Circularly Polarized Horn Antenna Design and Effect of the Polarization on Basic Direction Finding (DF)

Mustafa Asili [(1)], Adnan Orduyilmaz [(1)], Mahmut Serin [(1)], and Alper Yildirim [(1)]
(1) TUBITAK- BILGEM, Advanced Technologies Research Institute, Ankara, Turkey

Ultra-wide band (UWB) and high gain antennas used in Electronic Warfare (EW) are growing in importance. Polarization of the antenna is a crucial issue to sense the signal in the environment for EW applications. It helps to detect signals in any polarization coming from the target or threat. Also, polarization of the target's receiving antenna is important to be able to jam with convenient jamming signal polarization. Since circularly polarized (CP) antennas can communicate with any signal in terms of polarization, use of CP horn antenna is getting wider for electronic attack (EA) and electronic support (ES) applications.

Since frequency band used for EW covers 2-18GHz, it is required to consider UWB antennas. UWB CP horn antenna designs made progress with the help of the patent published in 1960 (E. A. Jones et al., US Lett. Patents, No: 2942261, June 1960). In this patent, there is no limitation on the dimension of the radiator. Therefore, antenna's performance depends on the designer. However, achieving operating bandwidth (BW) of 2 octaves or more is still a challenge for this kind of antennas. Designing an antenna for EW aims to cover full frequency band at most in 3 sub-bands (2-6GHz, 6-18GHz or 2-4GHz, 4-8GHz, 8-18GHz) which require at least 2:1 BW. For this purpose, a CP horn antenna (8-18GHz) and a four-armed sinuous antenna (2-18 GHz) are designed to demonstrate a simple Transmitter (Tx)/Receiver (Rx) system for direction finding (DF) of the target. During this study, performance of the Tx/Rx system with CP receiving antennas and a transmitting horn antenna (CP and Linearly Polarized (LP)) is compared to understand the effect of polarization in DF system. The system is created in CST simulation environment, and the power level received from each horn antenna is detected by the designed sinuous antenna. Specified magnitude and phase of the received signal from CP and LP horn antennas are compared and used to calculate the angle of arrival (AOA) of the signal emitted from the threat. Horn and sinuous antenna design, Tx/Rx setup, performance, and simulation results of both antennas including return loss will be presented.