Cross Correlation of Radar Cross Section of Colombian Improvised Explosives Devices

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Abstract—This paper presents the analysis of cross correlation to radar cross section and cross radar cross section of several Colombian Improvised Explosives Devices models.

Keywords – Cross Correlation, Improvised explosives devices, Radar Cross Section, UWB Radar

I. INTRODUCTION

A long time in Colombia the illegals groups in Colombia used Improvised Explosives Devices (IEDs), this devices are manufactured using artisanal, non-standardized methods of construction, and additionally the IEDs have low metal content and are variable in shape and size. With these characteristics, some methods have limit effectiveness.

In [1] 22 IEDs was experimentally measured and characterized in frequency domain. In [2] the authors of this paper presented one method for measuring the characteristic response of IEDs in time domain.

In this paper we will analyze the same set of devices in order to get more information leading to the generation of a classification algorithm.

II. EXPERIMENTAL SETUP

The RCS was measured using a computer-controlled M-sequence, polarimetric, MiMo radar platform. One dual-polarized Vivaldi antennas, working at lower GHz range, were mounted on tripods. One of the antennas was used as polarimetric transmitter and used as receiver. The IED under test were mounted on a turntable support in front of the antennas.

The calibration of the system was performed measuring the RCS of a metal corner reflector, a plate and a cylinder. These objects have a known Radar Cross Section (RCS).

5 IEDs were tested in this experiment. The devices were placed on top of a styrofoam turntable in vertical and horizontal positions. The test was performed outdoor.

Each specific model of IED was illuminated with two polarizations, at two orientations. Cross and co polarized backscattering was measured at the receiving antennas. This means that for each IED 4 datasets were measured.

The RCS measurements were processed and a set of common features, leading to identification was extracted.

Fig. 1 shows the behavior of the cross correlation for theta and in Fig. 2 shows the behavior of the cross correlation for frequency of the IED # 1 and IED #2. Now we will getting behavior for all IED used and thus we will get the typical features for these specific models of IEDs.

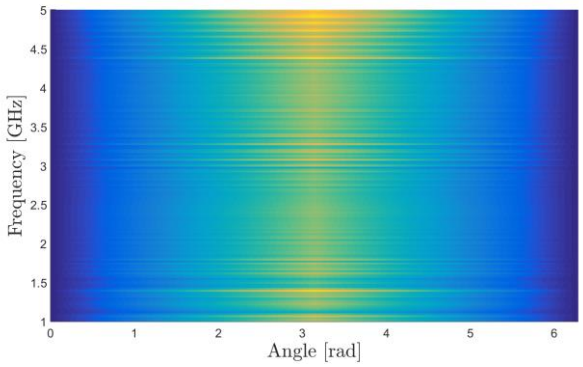

Figure 1. Behavior Cross correlation of RCS for IED # 1 with IED # 2.

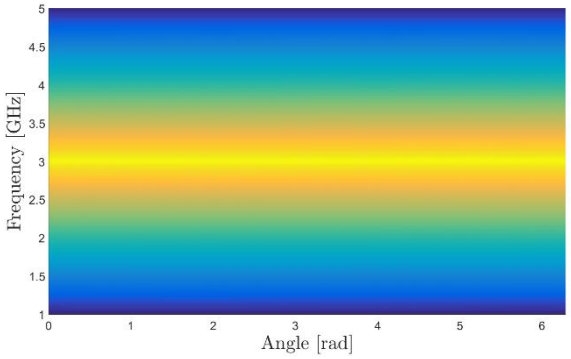

Figure 2. IED 1 and IED 2 used for this test.

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