Comparison of Target Detection Schemes in Doppler Radar with PSK Signals

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***Abstract* — The aim of this article is to test the effectiveness of the known CFAR processors in order to detect moving targets in the frequency domain of real records. The purpose is to be chosen optimal CFAR detector for moving target detection. The data are obtained by portable, surveillance, Frequency Modulated Continuous Wave (FMCW) radar with Low probability of Intercept (LPI). In the paper are studied and compared CA, OS, SO, GO CFAR processors.**

Keywords – Dopller radar, Target detection, CFAR processors

I. INTRODUCTION

Automatic detection and classification of ground moving targets in conditions of natural interference, using different types of sensors, such as radar and cameras, are actual scientific and application problems. This approach can be applied to various fields such as car industry [1-3], control of sensitive objectives and facilities (nuclear power plants, airports, warehouses, pipelines and borders).

The goal of this work is to analyse the possibility to use the known structures of CFAR processors in the frequency domain for automatic detection of moving targets by Doppler radar with continuous transmission of PSP (Phase Shift Keying) signals. Real records of moving people or bus on the background of woodland are used in the study. When choosing the structure of CFAR processors and the signal processing in the frequency domain, our hypothesis was to maximally take into account both the type and the parameters of the received data and also the sequence of data occurrence in the radar computer memory. Taking into account the principle of continuous radars, and also the type of the recorded data received in the surveillance mode of observation, we choose to study CA (Cell Averaging), OS (Order Statistic), GO (Greatest Of), SO (Smallest Of) CFAR processors.

The obtained results show that detection of targets with well-known structures of Radar Signal Processing using CFAR processors in the frequency domain provides the required efficiency in practice.

II. SIGNAL PROCESSING FOR DOPPLER RADAR

Radar under test is the radar with continuous transmission of a PSK signal generated as a long pseudorandom pulse sequence (figure 1).

Fig. 1 Radar system

The PSK signal is transmitted into space, reflects from the target and after that is received by the receiver. The received signal is time-delayed. The signal delay equals the double way propagation time of a signal. In the receiver, the signal is performed in the mixer, where the code sequence is extracted and then correlated with the transmitted signal (fig. 2).

After that the signal is digitized in the 12-bit analog to digital converter (ADC) and stored in the processor memory. The digital signal processing includes spectral analysis using the FFT, detection of targets with fixed thresholds set by the operator and, finally, tracking of a target. Target classification