

Effect of Carrier Frequency Estimation Error On Clutter Filtering For Magnetron Based Coherent Systems

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Magnetron based systems are frequently utilized in weather radar systems despite the uncertainties in the carrier frequency and phase of the transmitted pulse. In this study, we examine the clutter filtering, stated differently the MTI performance, of magnetron based systems under coherent operation. The coherency of magnetron based systems is suggested to be established by the sampling of the transmitter pulse through a secondary channel via an RF coupler and utilizing the sampled data in the receiver matched filter of the main channel after the estimation of the carrier frequency of the magnetron output. The goal of this study is to examine the effect of pulse-to-pulse varying center frequency estimation errors in the magnetron output on the clutter filtering and Doppler processing. The preliminary results indicate that errors on the order of 10 kHz limit the MTI improvement factor to 40 dB for a system with a pulsewidth of 1/2 microseconds, i.e. 75 meters of range resolution. Results of the present work can be used to evaluate the value of rectifying the conventional non-coherent magnetron based systems to a coherent setting via the described framework.