

Analysis of High Resolution Land Clutter Using an X-Band Radar Amer Melebari, CITRI, KACST, Saudi Arabia

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Abstract—In modern radar systems with high range resolution, the statistical properties of clutter have a significant effect on the performance of the radar. Analyzing the radar returns from various clutter terrains is essential when aiming to optimize the detection performance of the radar within these terrains. This paper presents the statistical analysis of three types of land clutter terrains: Saudi Arabian urban, South African urban and Saudi Arabian date farms, all measured at low grazing angle. Measurements were performed with an X-band radar system with two instantaneous bandwidths of 40 MHz and 400 MHz. The clutter data was analyzed by fitting the amplitude Probability Distribution Function (PDF) to different distributions using the Method of Moments (MoM) and applying the Kullback-Leibler Divergence test to assess the accuracy of the PDF fittings. The analysis also included computing the Power Spectral Density (PSD) of the measurements. Finally, a comparison was made between the different land clutter terrains. The amplitude PDF of the urban clutter measurements had a longer tail compared to the amplitude PDF clutter measurements of the date farms terrain. The best fit for the urban clutter amplitude PDF measurements was found to be the Log-normal distribution whereas the date farms amplitude PDF measurements were best fitted by the K-distribution. Lastly, the Doppler bandwidth of the date farm clutter measurements was found to be larger than the Doppler bandwidth of the urban clutter measurements, however this could be explained by the difference in wind conditions on the measurement days.