

A Model of the MRR Distributed Passive Radar System

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The Manastash Ridge Radar (MRR) is a bistatic passive radar system with receivers located at the University of Washington (UW) and the Manastash Ridge Observatory in Ellensburg, Washington. The transmitter is located about 6 miles from the UW, broadcasting commercial FM around 100 MHz. MRR is unusual in that the reference signal is uncontrolled and 100 percent duty cycle. The signal processing chain is straightforward but analysis of the system is impeded by the system structure and the illuminating waveform. Various subsections of the radar have been analyzed, however a full system analysis would be very useful.

Therefore we are modeling the complete radar system including the transmitted signal, the ground clutter channel, including accurate estimates of additive noise, fading, and phase perturbations, the analog and digital receiver processing, and the subsequent cross ambiguity estimator. This model will permit non intrusive diagnosis of the dependence of the data product upon various imperfections in the system, and to test new detection algorithms, for targets such as meteors and the International Space Station (which could serve as a calibration target). The model will allow us to optimize the post-processing of captured data to see the target, and possibly the sampling rate, which can then be applied to the actual system. We implement this model in Simulink(TM) which gives a concise block diagram level of understanding of the processing as well as integrating a Matlab(TM) implementation of the digital receiver processing code written in C.