A Cramer Rao Analysis on Receiver Placement in a FM band Commensal Radar System based on Doppler only measurements

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Abstract—This paper investigates the theoretical placement of receivers in an Commensal Radar (CR), Doppler only tracking system with a single transmitter multiple receiver configuration. Theory, based on the Fisher Information matrix (FIM), is developed to derive the theoretical achievable bound for a given receiver configuration and used as a basis to select the optimal receiver placement. Theoretical concepts such as Shannon entropy and Cram`er-Rao analysis are explained and used in the selection process of receiver positions. Further, we show that time history information of a target can cumulatively be used together with FIM that will improve the Cramer-Rao bound. Lastly, we use the theory developed to evaluate receiver placement combinations by means of a simulation and provide insight on the method of selecting receivers that would minimise the error performance of a Doppler only tracking system. The demonstrations used here are typical of a CR using FM Broadcast emissions.