

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

F.D.V. Maasdorp

Council for Scientific and Industrial Research, DPSS, Pretoria, South Africa

R. Nadjiasngar, M.R. Inggs

University of Cape Town, Cape Town, South Africa

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.