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The Spectrum Analysis Solution (SAS) System for Multi-Purpose Spectrum Sensing: Design and Performance

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Abstract

A multichannel superheterodyne signal analyzer, called the Spectrum Analysis Solution (SAS), has been developed to perform multi-purpose spectrum sensing to support the cognitive radar effort. The SAS operates from ultrahigh frequency (UHF) to the S-band and features a wideband channel with eight narrowband channels. The wideband channel acts as a monitoring channel which can be used to tune the instantaneous band of the narrowband channels to areas of interest in the spectrum. The data collected from the SAS has been utilized to develop spectrum sensing algorithms for the budding field of spectrum sharing (SS) radar. Bandwidth (BW), average total power, percent occupancy (PO), signal to interference plus noise ratio (SINR), and power spectral entropy (PSE) have been examined as metrics for the characterization of the spectrum. These metrics are utilized to determine a contiguous optimal sub-band (OSB) for a SS radar transmission in a given spectrum for different modalities. Three OSB algorithms are presented herein: the spectrum sensing multiobjective (SS-MO), the spectrum sensing with brute force PSE (SS-BFE), and the spectrum sensing multi-objective with brute force PSE (SS-MO-BFE). The SS-MO function uses a weighted sum multi-objective (WSMO) function to balance the SINR/BW trade-off for selecting an OSB that allows for maximized radar performance. This OSB determination technique is used as a baseline of comparison for two new OSB selection techniques, the SS-BFE and the SS-MO-BFE. The SS-BFE is designed to find an OSB with maximized electromagnetic compatibility (EMC) in which a radar can perform its intended operation. The SS-MO-BFE determines an OSB that provides a compromise between the SS radar's operating EMC. This paper provides a description of the SAS system and the results of various algorithms described above.