RADIO SPECTRUM OCCUPANCY MODEL

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ABSTRACT

This paper will introduce a spectrum occupancy algorithm that can detect active spectrum users. This algorithm has been employed to quantify spectrum usage at several locations, and is being used to develop frequency agile radio protocols that maximize the amount of spectrum reused and lessen the possibility of interference.

1. INTRODUCTION

The shift from static spectrum licenses to a more flexible framework offers the possibility of increased utility from this limited resource. The legacy method of assigning spectrum to a user for a band of frequencies in one geographic area, with a specified intended use, has resulted in far from optimal spectrum usage. To quantify this inefficiency, several spectrum studies were performed and analyzed. These studies took place in both urban and rural locations and covered the spectrum from 400 MHz to 7.2 GHz. This study improved on past ones by resolving spectrum usage azimuthally, in polarization, and in time. The often-dynamic nature of spectrum usage necessitates the analysis of its usage over time. To provide accurate and substantive information on spectrum usage more than five billion data samples were taken.

2. SPECTRUM USAGE DETECTION ALGORITHUM

The analysis of the spectrum studies to find active users resulted in the development of a spectrum occupancy model. An algorithm developed using this model has the ability to detect spectrum users that are marginally above the receiving system's thermal noise floor. The sophisticated algorithm employed to do this uses the study's multidimensional aspect to achieve significantly better performance than a conventional threshold detector.

Displayed in Figure 1 is a comparison of the advanced spectrum usage detection algorithm and threshold detection. This plot depicts perceived spectrum usage from 2.7 to 2.8 GHz; a band that is occupied by Airport Surveillance and Weather Radars. The algorithm developed exhibits a much lower false alarm rate while retaining a probability of detection similar to the threshold method.

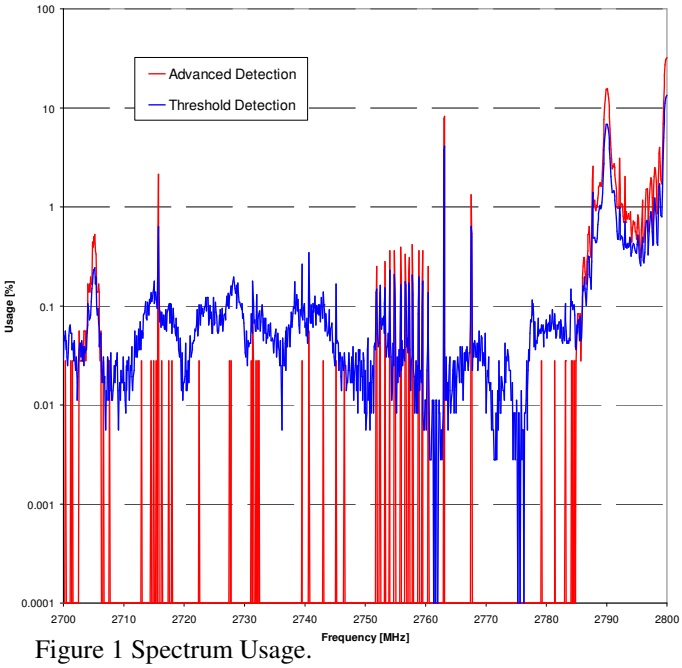

Figure 1 Spectrum Usage.

3. CONCLUSION

One goal of this research work it to use the database of spectrum measurements and the current occupancy model as a baseline to develop frequency agile radio protocols that operate with reduced spectral information. A practical frequency agile radio (in comparison to the spectrum measurement system) would have poorer sensitivity and not have the ability to resolve spectrum usage in azimuth or polarization.