Chapter 3
A Quick Overview of Different Spectrum Sensing Techniques

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ABSTRACT

The next generation of emerging wireless technology is dealing with spectrum shortage. For appropriate and practical implementation of latest wireless technologies, the sufficient amount of frequency is needed. Cognitive radio (CR) is introduced as a proficient nominee to manage spectral undersupply problem, as it rapidly increases the use of underutilize spectrum via spectrum sensing. This chapter introduces brief start about spectrum holes in addition to spectrum sensing framework. Further, the chapter explains the issues in spectrum sensing and how the cooperative sensing technique is fit to overcome these issues like shadow fading and receiver uncertainty. Consequently, the various non-cooperative sensing techniques are also discussed including their test statics. The advantages and disadvantages of different sensing techniques is exhibited at the end.

INTRODUCTION

There is always being an immense scope for all the engineers and scientists to create advance, utilize and the technology in best possible way for the betterment of society. In this series, the conventional spectrum allocation regulatory framework have major constrain i.e. under utilization of spectral band, because most of the frequency bands are exclusively provided only to the licensed user and restrict them from any kind of intersystem interference. On the other hand from all over the world nearly 6 billion people have access to mobile phones via using only selected portion of radio frequency due to its fundamental physical limit. These issues motivated the scientists to derive new wireless technology i.e. cognitive radio

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which allows interference in the territory of licensed user by the unlicensed users'. Therefore, Cognitive radios must have to sense the spectrum first in order to obtain information about the spectrum usage and geographical condition of the existing licensed user. In cognitive radio network spectrum sensing is one of the most decisive tasks, the un-licensed users required to make constant check on the activities performed by the primary user on spectrum band. Secondary user continuously try to grab spectrum hole when primary becomes silent, but again emergence of primary user derives secondary user to quit the frequency band as soon as possible in order to avoid interference. The process of finding spectrum hole is known as spectrum sensing. Spectrum sensing plays one of the major roles in cognitive radio networks. In this chapter, we have discussed spectrum sensing techniques and various sensing types.

BACKGROUND

To select effective sensing method for QoS in cognitive radio (Giweli, Shahrestani, & Cheung, 2016) had discussed, examine various non cooperative sensing methods precisely, and compare them with each other. Further, focused to identify the factors, which are essential to enhance the performance of CR system. In their study, they had also highlighted the requirement of real-time selection mechanism of the proper sensing method.

- **Limitations:** Although the author factually describe the selection of sensing method for improving the Qos in Cognitive radio network (CRN) but simultaneously it has been observed that, in their study cooperative sensing techniques and their issues were not addressed. Secondly, Test statics of different non-cooperative sensing methods and current existing challenges in sensing techniques have not been discussed.

A comparative study of spectrum sensing Techniques in Cognitive Radio Networks (Khan & Nakagawa, 2013), have discussed different sensing techniques to verify the presence of primary user (PU) and had concluded that, more than 99% accurate decision related to the presence and absence of PU should be there in order to achieve effective spectrum sensing. Their study also revealed the appropriate sensing technique adoption for densely populated and for less populated licensed spectrum band.

- **Limitations:** During the study authors didn't explain the spectrum sensing framework and issues of cooperative spectrum sensing techniques. Eigen value Based Detection which is capable to maintain minimal probability of false alarm is not discussed, neither Covariance Based Detection nor Waveform Based techniques were considered. The present issues related to sensing techniques like Rate -Reliability adjustment, Multipath fading and Hidden Terminal Problem were also missing.

Spectrum Sensing in Cognitive Radio Networks: Requirements, Challenges and Design Trade-offs (Ghasemi & Sousa, 2008) the authors addressed a range of issues related to the design of spectrum sensing functionality for dynamic spectrum access. Most of the time author aimed towards the implementation, sensing challenges like (channel uncertainty, noise uncertainty aggregate-interference uncertainty) and regulatory challenges like (sensing periodicity, detection sensitivity), of spectrum sensing in cognitive