Spectrum Sensing Method for Spectrum Efficiency Based on the Correlation Feature Detection

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Abstract

Spectrum sensing is the core part of the Wireless RAN system. In this paper, a spectral correlation based peak detection method for spectrum sensing is proposed. The decision is made by searching the unique cycle frequencies from all possible cycle frequencies. Signal type could be decided based on the unique cycle frequencies. Simulation results show that the proposed peak detection method outperforms the conventional energy detection. Additionally, faster decision could be made regardless of the signal type information.

1. Introduction

As the technology developed in the modern society, spectrum resources – which are limited in every country, are used much more than that of it was. Especially, it is expected that spectrum insufficiency below 3GHz. But actually used spectrum efficiency is different depends on the time and location. The FCC (Federal Communications Commission's) frequency allocation chart indicates overlapping allocations over all of the frequency bands, which reinforces the scarcity mindset. The FCC's Spectrum Policy Task Force who reported [1] vast temporal and geographic variations in the usage of allocated spectrum with utilization ranging from 15% to 85%. To overcome these problems and increase spectrum efficiency, the IEEE is planning to establish an international standards called IEEE 802.22 WRAN (Wireless Regional Area Network) to utilize the idle spectral bands of TV user, which is between 54 MHz and 862 MHz. This WRAN system is based on the CR (Cognitive Radio) which is a radio that is able to sense the spectral environment over a wide frequency band and exploit this information to the user. There are wide spectrum bandwidth but the user have to choose specific spectrum to transmit / receive data. If one user transmits data using other's spectrum, it can cause interference to both of them and it may lose data. Therefore, the most important and difficult techniques of CR is to find out empty spectrum bands or unused spectrum. By using spectrum sensing we can get the information of available spectrum. Using that information we can use empty or unused spectrum, so spectrum efficiency is increased.

Conventional detection method which includes energy detection models the signal of interests as a stationary random process. Mean while cyclostationary models for communications signals have been shown in recent years to offer many advantages over stationary models. One such advantage is the correlation between spectral components that many signals exhibits. The theory of spectral correlation in cyclostationary signals developed in [2] and [3] has been shown to provide a unifying conceptual and mathematical framework for signal detection based on cyclic feature exploitation. In this paper, we proposed a peak detection method which is based on the cyclostationary model of signals. In the second part, the detection problem is described for WRAN system, and our signal of interests are introduced. After that, the review of cyclostationary signal processing theory is included and the proposed peak detection method is described in details. In the fourth part, some simulation results and analysis are shown. At last, conclusions are drawn to finish the statement of this paper.