Conferences > 2014 IEEE Asia Pacific Confer...

Non cooperative Cournot economic game model for heterogeneous coexistence in TVWS

Publisher: IEEE

2

Author(s)

Anabi Hilary Kelechi ; Rosdiadee Nordin

Abstract: In this paper, we formulated heterogeneous coexistence strategy in TVWS (TV White Space) between Primary Users (PUs), Cognitive Secondary Networks (CSNs) and TVWS coexistence standards using Cournot economic game model. Cournot economic game model is based on quantity and it is appropriate because, there are fewer TV transmitters in rural areas and hence, lots of TVWS spectrum channels per footprint. The robustness of the proposed model is that, it takes into account the unique SINR requirements of both PU and CSNs. While simultaneously, maintaining the key functionalities of heterogeneous coexistence framework. Contrary to the norm that, as PU continues to sell their licensed spectrum, revenue is maximized. Rather, it was discovered by way of simulations, such assumption never hold. However, Cournot point is simulated in which PU can maximize both revenue and QoS. In spectrum auction, an arbitrator is required to act as a spectrum broker, we propose the use of existing TVWS standards for this purpose. Thus, enabling coexistence between PUs and TVWS networks. View less

Contents

I. Introduction

The task force constituted by US Federal Communication Commission (FCC) to study spectrum utilization reported that most of the currently licensed VHF and UHF spectrum bands are highly underutilized [1]. Hence, there is a need for a paradigm shift from the conventional fixed spectrum assignment to a market driven spectrum policies capable of sustaining the large demand for broadband services. The unused spectrum holes are referred as White Spaces and when such occurs in TV channels, it is referred as TVWS. The Recent advances in Reconfigurable Radio Technology (RRT) can be exploited as a possible solution to the abovementioned problem. A special class of RRT being proposed as an attractive candidate is Cognitive radio (CR) [2]. CR is defined as a smart radio with the ability to learn, observe,

optimize, and change their transmission parameters according to the ambient radio environment [3]. Consequently, CR is set to revolutionize spectrum resource utilization in wireless communication through Dynamic Spectrum Access (DSA) technology. As a result, communication regulations worldwide have capitalized on DSA by relaxing spectrum rules to enable secondary users to gain temporary access to licensed spectrum in the absence of PUs. Beginning with TV channels in the VHF-UHF bands (54–806 MHz) [4]. Hence the names, TV White Space Band devices (TVBD) connote nodes that operate in PU free TV spectrum. Expectedly, many wireless standards are envisioned to be deployed in the TVWS. The standards targeting TVWS include IEEE 802.22 for Wireless Regional Area Networks (WRANs) [4], IEEE 802.11af "Super Wi-Fi" [5]. With the plethora of networks jostling for spectrum access in the TVWS, heterogeneous coexistence between different operators, standards and technologies are expected to mar the QoS of the end-users if not well coordinated. Thus, aggravating the already complex Radio Resource Management (RRM). Heterogeneity and coexistence are not novel to wireless standards as both have been successfully implemented in the ISM bands. However, it is expected to be an important topic in TVWS because of the variability of TVWS channels which is spatial-temporary. Different initiatives have also been proposed by IEEE 802.19 and IEEE P1900.4 as to improve coexistence in the TVWS [6], [7]. The aforementioned TVWS standards have propose coexistence etiquette for harmonious coexistence in TVWS, which can only be implemented based on the conformance on the availability of TVWS spectrum. Thus, the underlay research issue in TVWS is how best spectrum channels can be made readily available to TVWS networks. Not just TVWS channels but also, high quality spectrum channels in the context of reduced switching cost.