# Energy efficiency in cognitive radio network: Study of cooperative sensing using different channel sensing methods

By

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# ABSTRACT

When cognitive radio (CR) operates, it starts by sensing spectrum and looking for idle bandwidth. There are several methods for CR to make a decision on either the channel is occupied or idle, for example, energy detection scheme, cyclostationary detection scheme and matching filtering detection scheme [1]. Among them, the most common method is energy detection scheme because of its algorithm and implementation simplicities [2]. There are two major methods for sensing, the first one is to sense single channel slot with varying bandwidth, whereas the second one is to sense multiple channels and each with same bandwidth. After sensing periods, samples are compared with a preset detection threshold and a decision is made on either the primary user (PU) is transmitting or not. Sometimes the sensing and decision results can be erroneous, for example, false alarm error and misdetection error may occur. In order to better control error probabilities and improve CR network performance (i.e. energy efficiency), we introduce cooperative sensing; in which several CR within a certain range detect and make decisions on channel availability together. The decisions are transmitted to and analyzed by a data fusion center (DFC) to make a final decision on channel availability. After the final decision is been made, DFC sends back the decision to the CRs in order to tell them to stay idle or start to transmit data to secondary receiver (SR) within a preset transmission time. After the transmission, a new cycle starts again with sensing.

This thesis report is organized as followed: in Chapter II, we study how to achieve maximal energy efficiency when CR senses single channel with changing bandwidth and with constrain on misdetection threshold in order to protect PU; furthermore, a case study is

given and we calculate the energy efficiency. In Chapter III, we study how to achieve maximal energy efficiency when CR senses multiple channels and each channel with same bandwidth, also, we preset a misdetection threshold and calculate the energy efficiency. A comparison will be shown between two sensing methods at the end of the chapter. Finally, Chapter IV concludes this thesis .