1
INTRODUCTION

1.1 Background

In the telecommunications world we will be faced with a frequency usage restrictions according to government policy. Where we had to use radio frequency in accordance with the permission granted by the government to the user. Due to the implementation of this frequency is not the free stuff that is freely given or used by anyone. This departs from limited existing allocation of radio frequencies. So the use need to buy a license for using of certain frequency bands with a certain price in certain areas. It could be in one region to another has allocated different frequencies. This limitation can also be a barrier to the implementation of the new wireless technology.

In fact the use of this frequency band is considered optimal. Such as the data submitted by the FCC, that the radio frequency is still below 20% of its course [1]. And so we need a technology that is able to maximize or improve the effectiveness of the use of the frequency band. Therefore made Cognitive radio, as a technology that is expected to overcome these problems. Cognitive radio originally introduced by J. Mitolla [2]. The most important

characteristics in Cognitive radio is its ability to sense the environment, making decisions based on observations and mission objectives, and learn from past experience for future decision-making.

According to Simon Haykin [3], cognitive radio has three main tasks, namely radio-scene analysis or spectrum sensing, the estimated channel status and predictive models, transmit power control and dynamic spectrum management. Among the three tasks of cognitive radio, spectrum sensing is the main task before the next task. Because if we are wrong detection of the spectrum where there is supposed to be the main user of the spectrum detected but not detected on the sensing process are the primary user then can disrupt communications major users.

Cognitive radio technology IEEE 802.22 WRAN (Wireless Regional Area Network) accommodated at the one application in digital television with a range of 54-862 MHz frequency usage. In Indonesia, digital television has begun to be applied using the standard DVB-T2 (Digital Video Broadcasting-Terrestrial 2nd generation) using frequency range 478 MHz – 694 MHz. And this is an opportunity the use of cognitive radio in Indonesia with the initial step detection unoccupied spectrum in the frequency DVB-T2 are empty at a certain time and a certain place. This standar use OFDM (Orthogonal Frequency Division Multiplex) for

communication like many of the current and future technologies for wireless communication, such as WiFi, WiMAX, and LTE, use OFDM signaling. We can explore OFDM parameter for spectrum sensing process.

Simple detection could use energy detector on condition unknown signal conditions but known noise variance. However, detection capability have weaknesses in detecting the low SNR condition. Though the range of digital television that much can cause a decrease in SNR in the farthest reaches. So that the detection capabilities should be able to detect low SNR conditions. Moreover, the condition of the realities faced in the detection process is not known noise parameters. During simulation modeling research many of these parameters with previous knowledge. In fact, when we did not have prior knowledge of the condition of the noise, it will make the design of different detector.

In the detection process is also faced with the problem of how the detector may perform the detection process with the minimal detection errors. Especially do not do miss detection detector that can cause interference to the primary user. In fact, the detector must also have a high sensing accuracy resulting in a small miss detection probability or large detection probability.

1.2 Problem Identification

Spectrum detection process can be done by observing the characteristics of the signal parameter affected user. Detection of the OFDM signals can be done by taking into account the parameters used in the system. OFDM modulation can be used in the detection process, in which OFDM has the property repeated in each symbol, ie, cyclic prefix (CP). And its used for detection using calculation of autocorrelation coefficient. In this study, conducted in conditions when the noise is unknown and a maximum length of data known [4]. This technic have improved when length of cyclic prefix known. This technique is based on autocorrelation can not be used when the noise condition is unknown. Because the detection system will be different in different conditions. So that detection research using GLRT detector on conditions noise and signal are unknown [5]. This is best detector when condition are unknown and uncertainty noise. To get a good GLRT detector, we need data that is very long to get to the threshold conditions there is only noise alone which means that the condition is offline. And we will also be difficulties when switching places having to do the same empirical calculations on condition there is only noise. In the study [7], that spectrum sensing using the bootstrap can determined the distribution of test statistic with small size sample. This allows detection calculation

process performed GLRT detector to determined threshold on condition only noise from received signal.

1.3 Formulation

Based on problem identification, problems studied is how the receiver section capable of detecting the presence of a OFDM signal is present or not on the observations received signal with unknown environmental conditions, which is then formulated into::

1. How do the detection on the OFDM signal whether in active or not
2. How to perform detection during low SNR
3. How to perform detection on noise conditions unknown
4. How to improve performance detection on uncertainty noise

1.4 Scope of Problems

Scope of work abaout this research are:

1. This research only focus detect there is a signal or no.
2. SNR said to be low when the noise power is greater than the information signal or SNR with a value lower than 0 dB.

3. This research focus on spectrum sensing Cyclic Prefix CP-OFDM
4. Digital modulation signal under test is a 16-QAM modulation
5. This research use standard of OFDM signal as transmitter
6. Disruption to signal only a AWGN (Additive White Gaussian Noise).
7. This detector used GLRT (Generalized Likelihood Ratio Test)
8. This detector used resampling bootstrap approach

1.5 Objective

The purpose of this research is to get the design detector which capable of detecting the OFDM signals at low SNR conditions with unknown and uncertainty noise in everywhere and anywhere. And conduct good performance measurement detector designed that the high probability of detection or low probability of miss detection with a given probability of false alarm.

1.6 Hypotheses

The hypothesis of this study is design of bootstrap approach on GLRT detector to detect the OFDM signals can perform at low SNR and unknown noise conditions, and time varying with the expected detection performance.

1.7 Methodologi

Methodology for the finalization of this thesis consists of several stages, there are:

1. Identification of the research problem

   At this stage, do the identification and state of the art of the existing problems in the study of literature. Literature taken from the proceeds of recent studies either paper journals or international conference papers and textbooks related to the research theme.
2. Model Design and problem formulation

   At this stage, do the OFDM signal detection algorithm design and modeling into blocks diagram to facilitate determination of test points.
3. Testing and analysis

   At this stage testing of troubleshooting techniques using computer simulation. Computer simulations using software

matlab. To ensure the validity of research results, the montecarlo method used in testing where testing is iterated as many as the number of miss detection is expected. Then collect the data from the results of experiments which refers to the testing plan are made to see the link between the observations of variable with the performance parameters were observed.

4. Final conclusion

   At this stage the determination conclusion of the study is based on data of experimental results and achievement of the performance to answer the problem of research.

1.8 Writing organization

This thesis consists of 6 chapters, chapter 1 describes the background of the research, identification and formulation of the problem, the scope and purpose of the research, hypothesis and research methods.

Chapter 2 contains a literature review of studies related to OFDM signal detection algorithm in low SNR. Explain how the state of the art of OFDM signal detection from the problems that exist in the detection signal to explain detector design is offered for each condition. Among the matched filter detector design, energy detector, and the detector features with statistical test

approach is to use a second-order autocorrelation coefficient and GLRT techniques.

Chapter 3 contains the basic theory of the spectrum sensing starting cognitive radio and spectrum sensing to specifications OFDM signal. This chapter also describes the signal detection theory to obtain statistical test detector.

Chapter 4 discusses the design or scheme GLRT detector with a bootstrap approach to detect the OFDM signal at low SNR condition. This chapter also describes the design model of OFDM transmitter will be detected. And explain how the workings of the proposed signal detector.

Chapter 5 discusses the results and analysis of computer simulations using matlab software according to plan testing to be performed.

Chapter 6 contains the final conclusions of the research conducted overall.