CHAPTER I
INTRODUCTION

1.1 Introduction

For wireless communication systems, the antenna is one in every of the most critical components. A good antenna design can reduce system requirements and improve overall system performance. A typical example is a TV that the general broadcast reception will be improved by utilizing a high-performance antenna [1]. In needs of an antenna with very large bandwidth for new technology that can open a new way to wireless communication. Ultra-Wideband (UWB) could be a possible solution to this problem. UWB, though not a recent technology, is currently receiving special attention and is quite a hot topic in industry and academia. UWB antennas have been in active commercial use for decades. UWB technology is based on the use of very narrow pulses on the order of nanoseconds, which covers a very wide bandwidth in the frequency domain [2]. Since UWB antenna regulation is released by Federal communications Commission (FCC) in February 14, 2002 that UWB allocated bandwidth of 7.5Ghz with range from 3.1Ghz to 10.6Ghz [3].

UWB antennas are gaining prominence and becoming very attractive in modern and future wireless communication systems, mainly due to two factors. First, the increasing demand for wireless transmission rate and UWB properties such as high data rate, low power consumption, low cost, small design and high effeciency could cover that. Second, now the wireless portable device need antenna operated in different frequencies for various wireless transmission functions, and operation bands and functions are increasing more and more, which may result in challenges in antenna design, such as antenna space limitation and multi antennas interference [4]. Other than that one UWB antenna can be used to replace multi narrow-band antennas, which may effectively reduce the antenna number.

Although UWB has advantages, but the gain that can be transmit is smaller over the conventional communications system, there are many ways to increase gain of the UWB antenna from changing the material of the antenna or adding reflector such as Metamaterial, Artificial Magnetic Conductor (AMC), Substrate Integrated Waveguide (SIW), and Frequency Selective Surface (FSS). In this Final Project UWB antenna with gain enhancement using Multilayer FSS is proposed. However, there is a trade between bandwidth and gain enhancement in antenna structure. If

the antenna need to increase the gain, then the consequence that the antenna bandwidth will be sacrificed then the bandwidth enlargement technique must be done. to improve the matching bandwidth of subwavelength absorbers are based either on substrate properties modifications or on the use of more complicated FSS-element geometry [5]. In other experiment the proposed Multilayer FSS as reflectors is proved by using CPW-fed circular-disc monopole as a radiator and obtained 8.5dBi average gain, 0.5dB gain variation and 2.5 - 11Ghz operating bandwidth [6]. The UWB circular monopole antenna using a Frequency-Selective Surface (FSS) layer as a reflector obtain maximum gain of 9.7 dBi with gain variation $<$2 dB [7]. In [8] presents a compact multilayer FSS the average peak gain of antenna is increased from 4 dBi to 7 dBi as a result of FSS superstrate as a reflector. The average peak gain variation in the operating frequency range of antenna from 2.5 GHz - 14 GHz.

1.2 Problem Identification

The need for applications using UWB antennas that require a high and stable gain value to increase high data transfer on a wireless communication system is very much needed. Meanwhile one of the properties of UWB is its wide bandwidth which impacts on the small gain it can transmit. The gain power that can be emitted by the UWB antenna is smaller than the other conventional communication systems. This thesis observes the addition of a multilayer FSS as a reflector on the antenna in order to enhance the antenna gain while still paying attention to the UWB characteristics.

1.3 Objective and Contribution

The objective from this thesis is to observe that gain enhancement with multilayer FSS method could increase the gain of UWB antenna. Which is expected to help the researchers in developing communicational system especially UWB technology.

1.4 Scope of The Thesis

This thesis has scope of the problem as follow

1. The thesis focused on gain enhancement
2. The observation will be done by simulation on CST Microwave Studio and measurement

3. This thesis only observe on 3 antenna parameters such as realized gain, VSWR, and radiation pattern.

4. The frequency range that observed is only from 3.1 Ghz to 10.6 Ghz.

1.5 Research Method

This thesis divide by 2 sections *work packages* (WP):

1. WP1: Literature Study This thesis studied about Ultra-Wideband antenna and Multilayer Frequency Selective Surface from text books, journals, or papers.

2. WP2: Designing Antenna and FSS This process is to define the antenna and FSS design that ideal and compatible for UWB planar monopole antenna.

3. WP3: Fabrication and Simulation System Obtained the value of antenna dimension and FSS to get simulation result and optimization. Then when the result is decent, the system is printed out.

4. WP4: Antenna Measurement Measurement of the antenna is calculating parameters of antenna that has been printed.

5. WP5: Analysis After simulation and measurement results are obtained then, both are compare and analyze to ensure that the results are in accordance with desired specifications.

6. WP6: Writing Report After all the results and analysis are obtained, then the report about the thesis is made.

1.6 Book Structure

For the following are the writing system of this thesis:

- Chapter I INTRODUCTION
  This chapter contains a description, background, problem identification, objective and contribution, scope of this thesis, research method, and book structure of this thesis.

- Chapter II BASIC CONCEPTS
  This chapter consist the explanation and basic theory about UWB, FFS, antenna and its parameters.

- Chapter III PROPOSED MODEL OF ANTENNA
  This chapter consist about the final model system of antenna and design of FSS that used for the thesis.

- Chapter IV RESULT AND ANALYSIS
  This chapter discuss about the analysis result of simulation and measurement of antenna parameters that observed such as gain, VSWR, and radiation pattern.

- Chapter V CONCLUSION AND SUGGESTION
  This chapter contains about the conclusion from the analysis and suggestion.