DEVELOP A 5.8GHZ ANTENNA USING MICROSTRIP TECHNOLOGIES

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Special dedicated to my beloved parents, family and fellow friends, who had strongly encouraged and supported me in my entire journey of learning…

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ABSTRACT

The project is focusing on developing a 5.8GHz Antenna using Microstrip Technologies. While developing this project, there is a certain scope of works where it is such a guideline in order to assure the project is completely finished without facing any much difficulties. The overall project will include the literature review, simulation, fabricating and testing. A few prototypes are created in order to observe whether which method will produce a better performance including the bandwidth, return loss and VSWR. This project highlights the development of an antenna using Microwave Office. The prototype of an antenna must be developing at least five in order to choose the three best samples. At the end of this project, the result will be as requirement that is 5.8GHz of antenna.

ABSTRAK

Perlaksannan projek ini tertumpu kepada membangunkan 5.8GHz Antena dengan menggunakan perisisan Microwave Office. Semasa menjalankan projek ini, terdapat beberapa skop kerja yang harus dipatuhi bagi memastikan projek dapat disiapkan dengan sempurna dan perjalanan projek adalah lancar tanpa sebarang kesulitan yang tidak diingini. Keseluruhan projek tertumpu kepada membuat kajian mengenai teori antena, simulasi, fabrikasi dan pengujian. Beberapa prototaip telah direka bagi menganalisa kaedah terbaik yang dapat menghasilkan prestasi unggul dari segi lebar jalur, kehilangan balikan dan Nisbah Voltan Terhadap Gelombang (VSWR). Simulasi bagi litar dilakukan dengan menggunakan software Microwave Office. Sampel untuk antena ini harus dilakukan sekurang-kurangnya lima sample dan hanya tiga yang terbaik akan dipilih. Pada akhir projek ini, keluaran yang harus diperolehi mestilah mengikut spesifikasi yang dikehendaki iaitu 5.8GHz.

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LIST OF TERMS

f_r	Center Frequency
ε_r	Relative Permittivity
ε_{eff}	Effective Relative Permittivity
Π	Phi Constant (3.142)
λ_o	Free Space Wavelength
ρ	Charge Density
c	Velocity of electromagnetic waves in space ($3x10^8$)
Ω	Ohms
V	Voltage
Z_o	Characteristic Impedance
L	Microstrip Actual Length
L_{eff}	Microstrip Effective Length
ΔL	Microstrip Extended Length
W	Microstrip Actual Width
h	Substrate Thickness
t	Thickness of the Conductor (copper)
VSWR	Voltage Standing Wave Ratio
S_{11}	S-Parameter That Represent an Input Reflection
Γ	Reflection Coeffecient
Z_{in}	Input Impedance
Z_o	Output Impedance
λ_g	Free-space Wavelength

LIST OF APPENDICES

CHAPTER I

INTRODUCTION

This project is covering on designing a rectangular patch antenna with the frequency of 5.8GHz using microstrip technologies.

1.1 OBJECTIVES

The objectives of this project are:

i) To develop a 5.8GHz microstrip antenna.

ii) To simulate the microstrip antenna circuit using Microwave Office software.

iii) To fabricate the antenna design through etching process.

iv) To test the antenna prototype using the Network Analyzer.

1.2 PROBLEM STATEMENTS

The 5.8GHz microstrip antenna is developed in order to fulfill the problem occur and upgraded the antenna for the advanced technologies. The problem statements are:

i) Nowadays antenna is very expensive and this project is trying to develop a low cost antenna using Microstrip Technologies.

ii) Besides, nowadays antenna is very large. Based on this, the smaller antenna is trying to be produces.

iii) This antenna design is for further uses where nowadays the used of antenna do not reach the frequency of 5.8GHz yet.

iv) As for upgrade the frequency or the used of antenna for future works which is for 4G application.

1.3 SCOPE OF WORKS

The scope of project regarding title is by developing the antenna using the Microstrip Technologies. The scope itself has divided into two parts, which is:

i) Projek Sarjana Muda I (PSM I)
   - Calculation
   - Simulation

ii) Projek Sarjana Muda II (PSM II)
   - Fabricate
   - Testing

As for the PSM I, the literature review should be able to do before initiate the project. Literature review needs to be done in order to understand the concept and theory, as well as the applications, characteristics, operations, specifications, and design procedures of an antenna. It is also including the research of the antenna calculation. The calculations need to be performed and recognize by selecting the best equation and formula in order to make sure the output will best meet the specification required. The software used for the simulation is Microwave Office. The parameter should be study to get familiar when applying to the project.

As for PSM II, the scope of work is focusing on fabricating and testing the antenna prototype. When fabricating the antenna, the calculations that have been made are applied. The circuit needs to be going through soldering and etching process. Later, the testing needs to be performed using the Network Analyzer. The

testing is important in order to assure the output of frequency response is in meet the requirement, which is 5.8GHz.

1.4 THESIS OUTLINES

For the thesis outlines, it will be cover on the whole thesis. This report is divided into a certain part. Each part will cover on a topic required.

As for Chapter 1, it will be cover on introduction of the project. A little bit of explanation will be done due to the project. It also includes the objectives, problem statements, scope of works, and the thesis outlines of the project.

Chapter 2 is a chapter, which covers on the literature review of the project. Each of the literature review is divided into a certain sub topic or explanation. The literature review begins with the introduction, followed by antenna, microstrip antenna, transmission lines, software development, microstrip technologies and antenna applications.

Introduction is an explanation on the overview of the literature review. As for the antenna topic, it is about the general description of an antenna. It is also covered on the basic principal of the antenna. Microstrip antenna is an explanation regarding the microstrip antenna where it is slightly different from the general explanation of the general antenna. However, the project is more focusing on the microstrip antenna.

The next explanation is on microstrip antenna, and followed by the transmission lines of the antenna itself. This topic is more specific where it is only explain on the microstrip antenna. It is also shows on designing an antenna. The design is focus on the patch antenna and transmission lines. Besides, it also covers on the characteristics of antenna, the specifications and more.

As for the Chapter 3, it will be covered on the antenna properties. The properties are on the basic antenna parameters. It is important to recognize the parameter of the antenna before designing the antenna itself. In addition, this chapter will be explained more on the feed technique of the antenna.

Chapter 4 will be cover on project methodology where it is focusing on the method that used to completing the project accordingly. The methodology will be presenting in the flowchart. In addition, it is representing in details in the form of sentences.

The expected result and analysis will be covered on Chapter 5. This chapter will be elaborate on the expected result for the whole project as well as the frequency response that will be obtained at the end of the simulation process. Besides, is also gives a detail on analysis of the results due to the fabrication and followed by the testing. The discussion will be included in this chapter as well. The discussion is on the calculation and simulation, fabrication and testing.

The last chapter is the Chapter 6, where it is an overall conclusion for the project. It also includes the future works of the project. The conclusion is related to the objective. It is important in order to assure that our objective is achieved.

CHAPTER II

LITERATURE REVIEW

Literature review is one of the processes for developing a 5.8GHz Microstrip Antenna. As for this project, the literature review is explaining on the antenna and the basic antenna operation, microstrip antenna, transmission line, basic antenna parameters, the feed technique, software development, microstrip technologies and the antenna application.

Antenna is a device, which is used for sending and receiving the electric wave for the communication. It is usually called an aerial in Britain. The antenna is a device that builds in the air of effectively radiating electric wave for the purpose of wireless communication. It is also effectively maintaining the electromotive force by the electric wave.

The transmission line in the wireless communication is not a wiring transmission line, but free space. The antenna transmits and receives the signal in such free space as the terminal. The electric signal is transmitted as the flow of charges through a conductor. It wills causes the charges cannot pass through a nonconductor such as free space. However, the electromagnetic wave cannot pass through a conductor and proceeds by forming the magnetic fields on a nonconductor.