COIN ANTENNA DESIGN

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This Report is Submitted in Partial Fulfillment of Requirements for the Bachelor Degree of Electronic Engineering (Telecommunication)

Faculty of Electronic and Computer Engineering
Universiti Teknikal Malaysia Melaka

April 2010

UNIVERSTI TEKNIKAL MALAYSIA MELAKA
FAKULTI KEJURUTERAAN ELEKTRONIK DAN KEJURUTERAAN KOMPUTER

BORANG PENGESAHAN STATUS LAPORAN
PROJEK SARJANA MUDA II

Tajuk Projek : COIN ANTENNA DESIGN

Sesi Pengajian : 2009/2010

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To my beloved father, mother, and to all my siblings and friends.

ACKNOWLEDGEMENT

First of all, I am most grateful to Almighty ALLAH s.w.t. for blessing me with good health and ideas for completing this "Projek Sarjana Muda" successfully. I would like to show my highest gratitude to my supervisor, Encik Mohamad Zoinol Abidin Bin Abd Aziz for his invaluable support, patient, assistance and especially his encouragement to this project. I truly have learnt a lot and all this would not be without his guidance.

I also would like to thank all my fellow friends for their contribution in giving me a moral support throughout my project development period. Last but not least, to all my beloved family members who were always, stand by my side to encourage, advice, comfort, cherish, and support me during this entire project. May Allah always with you. Last but not lease, to the Faculty of Electronic and Computer Engineering (FKEKK), because giving me chance to study and complete my project as part of the Bachelor program in Universiti Teknikal Malaysia Melaka (UTEM).

ABSTRACT

A wireless network system consists of several components that support communications using radio or light waves that propagating through an air medium. The coin antenna is used in wireless system that operates at the suitable frequency. There are many types of antenna which are microstrip, wire, array, dielectric resonator, reflector and so on. For this project, the coin antenna is related to the dielectric resonator antenna. This project is started by searching and finding all sorts of antenna theories and information, the existing coins of Malaysian Ringgit coins and find out the dielectric constant for each coin. After collect all the information that related to the antenna and coins, the calculation of designing the coin antenna can be started. The designing of the coin antenna will be continued by simulate the design that has been calculated. Then, the design will be continue by fabricate the design on FR4 board. The next step is measuring the parameters related to the coin antenna design by using Vector Analyzer which are return loss, resonant frequency, bandwidth and many more. The coin antenna met the specifications needed which operate at frequency of 2.4 GHz and the return loss that is below than -10 dB so that 90% power can be transmitted.

ABSTRAK

Sistem rangkaian tanpa wayar merupakan suatu system yang mengandungi beberapa komponen yang dapat menampung komunikasi melalui radio atau gelombang cahaya di mana tersebar melalui medium udara. Terdapat lima langkah untuk merekabentuk antena yg menggunakan duit syiling. Projek ini dimulakan dengan mencari kesemua teori dan informasi yang berkaitan dengan antenna, duit syiling Ringgit Malaysia dan pemalar dielektrik untuk setiap duit syiling. Setelah mengumpul kesemua informasi berkaitan antena dan duit syiling, pengiraan untuk merekabentuk antena menggunakan duit syiling boleh dimulakan. Proses merekabentuk antenna menggunakan duit syiling disambung pula dengan membuat simulasi terhadap rekabentuk yang telah dikira sebelumnya. Seterusnya, proses merekebentuk diteruskan pula dengan proses fabrikasi antena duit syiling tersebut dengan menggunakan papan FR4. Langkah seterunya ialah membuat pengukuran terhadap parameter-parameter yang berkaitan dengan antena duit syiling tersebut dengan menggunakan Penganalisis Vektor. Projek ini dapat memenuhi spesifikasi yang diperlukan di mana ia beroperasi pada frekuensi 2.4 GHz dan kehilangan bertulis kurang daripada -10 dB supaya 90% kuasa dapat dihantar.

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D	-	Diameter
t	-	Thickness
DRA	-	Dielectric Resonator Antenna
FR4	-	Flame Retardant Type 4
PCB	-	Printed Circuit Board
Tx	-	Transmitter
Rx	-	Receiver
CST	-	Computer System Technology
UV	-	Ultra Violet

CHAPTER I

INTRODUCTION

This chapter contains about the introduction of the project where it involved of the objectives, problem statements and research scope.

1.1 Introduction of Project

The first series of cent coins were introduced in 1967 in denominations of 1 cent, 5 cent, 10 cent, 50 cent then followed by 1 ringgit coin. The second series of cent coins entered circulation in late-1989, sporting completely redesigned observes and reverses, but remaining the designs of edges, diameters and composition of the previous series. Nowadays, the 1 ringgit coins have been terminated by Bank Negara Malaysia [3].

The existing coins are used in designing the coin antenna in this project. The antenna that has been refer to in designing this coin antenna is cylindrical dielectric resonator antenna. The coin antenna is used in wireless system that operates at the suitable frequency. A wireless network system consists of several components that support communications using radio or light waves that propagating through an air medium [7].

1.2 Objectives

The objective of this project is to design coin antenna using the existing coins in the market with a low cost and a suitable frequency as stated in Industrial Science Medical (ISM). The coin antenna will be feed by using transmission line feeding system.

1.3 Problem Statement

This project is efficient to the environmental factors. This is because coins such as 1 cent and 5 cent are lack in used. To overcome this problem, those coins can be used to design the coin antenna. Besides that, the coin antenna will give a broader bandwidth. This is because usually the antenna comes with a narrow bandwidth.

1.4 Scope

This project is subjected to several scope and limitations that are narrowed down to the study. There are few scopes and guidelines listed to unsure the project is conducted within its intended boundary. This is to ensure the project is heading in the right direction to achieve its intended objectives. The scope of this project is started by designing the coin antenna using the existing coins. Next, simulate the parameter of the coin antenna in terms of the resonant frequency, bandwidth gain, directivity and so on using CST Software. After finished the simulation, the design is been fabricated by using FR4 board. Then, the parameter of the coin antenna is been measured by using Vector Analyzer.

1.5 Methodology

There are few methods that have been taken to complete the project. The flow chart of the methodology is shown as Figure 1.1.

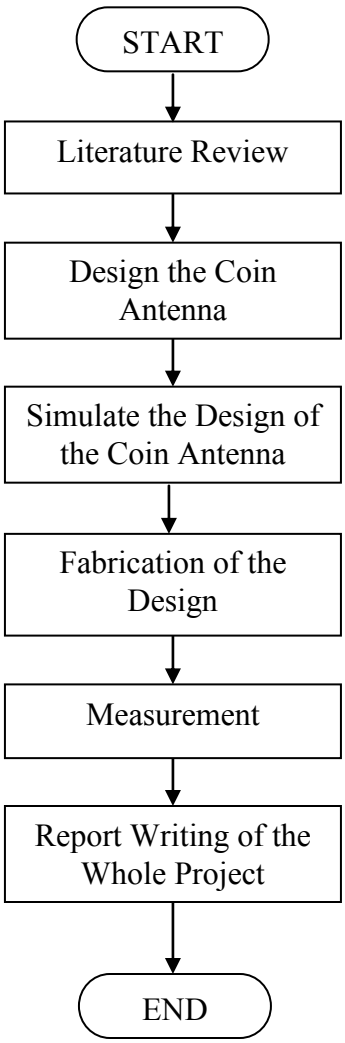

Figure 1.1: Flow Chart of Methodology

CHAPTER II

LITERATURE REVIEW

This chapter will discuss about the theory of the antenna in terms of various types, parameter and so on. Besides that, the information of the existing coins specific in size and composition also will be explained in this chapter.

2.1 Introduction of Antenna

An antenna is a transducer designed to transmit or receive electromagnetic waves. In other words, antennas convert electromagnetic waves into electrical currents and vice versa. Antennas are used in systems such as radio and television broadcasting, point-to-point radio communication, wireless LAN, radar and space exploration. Antennas are most commonly employed in air or outer space, but can also be operated under water or even through soil and rock at certain frequencies for short distances [1].

Physically, an antenna is simply an arrangement of one or more conductors, usually called elements in this context. In transmission, an alternating current is created in the elements by applying a voltage at the antenna terminals, causing the elements to radiate an electromagnetic field. In reception, for the inverse occurs, an electromagnetic field from another source induces an alternating current in the elements and a corresponding voltage at the antenna's terminals. Some receiving antennas (such as parabolic and horn types) incorporate shaped reflective surfaces to collect electromagnetic waves from free space and direct or focus them onto the actual conductive elements [1].

Antennas have practical uses for the transmission and reception of radio frequency signals such as radio and television. In air, those signals travel very quickly and with a very low transmission loss. The signals are absorbed when moving through more conductive materials, such as concrete walls or rock. When encountering an interface, the waves are partially reflected and partially transmitted through. A common antenna is a vertical rod a quarter of a wavelength long. Such antennas are simple in construction, usually inexpensive, and both radiate in and receive from all horizontal directions (omni directional). One limitation of this antenna is that it does not radiate or receive in the direction in which the rod points. This region is called the antenna blind cone or null [1].

2.2 Antenna Parameters

There are several critical parameters affecting an antenna's performance that can be adjusted during the design process. These are resonant frequency, return loss, gain, radiation pattern, polarization, dielectric and bandwidth. Transmit antennas may also have a maximum power rating, and receive antennas differ in their noise rejection properties. All of these parameters can be measured through various means.