

**INVESTIGATION OF THE PERFORMANCE OF CIRCULAR
POLARIZATION ANTENNA AT 1.8 GHZ OPERATING
FREQUENCY**

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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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POLARIZATION ANTENNA AT 1.8 GHZ OPERATING
FREQUENCY**

AHMAD SYAHIRAN BIN SHARIFUDEEN

**This report is submitted in partial fulfilment of the requirements
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**Faculty of Electronic and Computer Engineering
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INVESTIGATION OF THE PERFORMANCE OF CIRCULAR POLARIZATION ANTENNA AT 1.3 GHz OPERATING FREQUENCY

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I declare that this report entitled "INVESTIGATION OF THE PERFORMANCE OF CIRCULAR POLARIZATION ANTENNA AT 1.8 GHZ OPERATING FREQUENCY" is the result of my own work except for quotes as cited in the references.

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APPROVAL

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Signature : 

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DEDICATION

I want to dedicate this to my mother, Zuraini binti Zulkifli, my father, Sharifudeen bin Mohammed, my family, friends and classmate, for their support, prays and helps all the way during this project been implemented. I am really appreciate and grateful of what they have done.

ABSTRACT

In this paper, we are focusing on designing an antenna which a receiver antenna that will receive RF signal. The antenna will use for energy harvesting. The meaning of energy harvesting is the process where energy from another source is capture and stored. So, in this project, the antenna will capture the RF signal and convert to electrical energy. Receiving antenna design is very important because the antenna features can affect the amount of energy harvested. The proposed antenna is circular polarized antenna is aimed to receive RF signal in horizontal, vertical planes as well as every plane in between. This project will focus on the design, analyse, testing and measurement of the circular polarized antenna capture the electromagnetic energy from RF signal that had been radiated by the communication system at GSM 1800.

ABSTRAK

Dalam projek ini, kami menumpukan kepada mereka bentuk antena yang antena penerima yang akan menerima isyarat RF. Antena akan digunakan untuk penuaian tenaga. Maksud penuaian tenaga adalah proses di mana tenaga dari sumber lain ditangkap dan disimpan. Jadi, dalam projek ini, antena akan menangkap isyarat RF dan menukar kepada tenaga elektrik. Reka bentuk antena yang diterima sangat penting kerana ciri antena boleh menjejaskan jumlah tenaga yang dituai. Antena yang dicadangkan adalah antena polarisasi bulat yang bertujuan untuk menerima isyarat RF dalam pesawat menegak, melintang serta setiap diantara satah itu. Projek ini akan memberi tumpuan kepada reka bentuk, analisis, pengujian dan pengukuran antena polarisasi bulat yang menangkap tenaga elektromagnetik dari isyarat RF yang telah dipancarkan oleh sistem komunikasi di GSM 1800.

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TABLE OF CONTENTS

Declaration	
Approval	
Dedication	
Abstract	i
Abstrak	ii
Acknowledgements	iii
Table of Contents	iv
List of Figures	viii
List of Tables	x
List of Symbols and Abbreviations	xi
List of awards	xii
CHAPTER 1 INTRODUCTION	1
1.1 Background Study	1
1.2 Problem Statement	2
1.3 Objective	3
1.4 Scope of the project	3

1.5	Summary	4
CHAPTER 2 LITERATURE REVIEW		5
2.1	Introduction	5
2.2	Radio Frequency (RF) Energy Harvesting System	6
2.3	Review on Microstrip Patch Antenna	6
2.4	Basic Antenna Parameters	8
2.4.1	Beam Width	8
2.4.2	Return Loss	9
2.4.3	VSWR (Voltage Standing Wave Ratio)	9
2.4.4	Bandwith	9
2.4.5	Gain	10
2.4.6	Radiation Pattern	10
2.4.7	Axial Ratio	12
2.4.8	Circular Polarization	13
2.4.9	Directivity	14
2.5	Past Studies Performance And Limitations	15
2.6	Summary	18
CHAPTER 3 METHODOLOGY		19
3.1	Introduction	19
3.2	Flow of Project	20

3.3	Design of Antenna	21
3.3.1	Computer Simulation Technology (CST)	21
3.3.2	Antenna Design	22
3.3.3	Antenna Theory	22
3.3.4	Square Patch	23
3.3.5	Simulation	26
3.4	Fabrication Process	27
3.4.1	UV Exposure	28
3.4.2	Developing	29
3.4.3	Etching	29
3.5	Measurement Process	29
3.6	Summary	31
	CHAPTER 4 RESULTS AND DISCUSSION	32
4.1	Introduction	32
4.2	Result of antenna	33
4.2.1	Return Loss	33
4.2.2	Radiation Pattern	37
4.2.3	Gain	38
4.2.4	Axial Ratio	39
4.3	Summary	41

CHAPTER 5 CONCLUSION AND FUTURE WORKS	42
5.1 Conclusion	42
5.2 Future work	43
References	44
appendices	49

LIST OF FIGURES

Figure 2.1: RF energy harvesting block diagram	6
Figure 2.2: Common shape for microstrip patch.	7
Figure 2.3: Operation of the Microstrip patch	8
Figure 2.4: The radiated power against elevation angle	11
Figure 2.5: Radiation pattern of omni-directional	12
Figure 2.6: Example of linear polarization and circular polarization	13
Figure 2.7: Clockwise rotation of the polarizarion	13
Figure 2.8: Anti-clockwise rotation of the polarization	14
Figure 3.1: Flow chart for the project	20
Figure 3.2: 3D front end	21
Figure 3.3: Microstrip patch	23
Figure 3.4: Example of the square patch	25
Figure 3.5: Flow chart of fabrication process	27
Figure 3.6: UV Exposure	28
Figure 3.7: Etching	29
Figure 3.8: Microwave Test set	30
Figure 3. 9: Anechoic chamber	30
Figure 4.1: First Design	33

Figure 4.2: The return loss the first design	33
Figure 4.3: Second Design	34
Figure 4.4: The return loss the second design	35
Figure 4.5: Third design	35
Figure 4.6: The return loss the third design	36
Figure 4.7: Measured and simulated of the return loss	36
Figure 4.8: The radiation pattern obtain	37
Figure 4.9: 3D plot of radiation pattern	38
Figure 4.10: Result for the gain	38
Figure 4.11: The final design	39
Figure 4.12: Result of the axial ratio for each design	40
Figure 4.13: The axial ratio obtained	40

LIST OF TABLES

Table 2.1: Review Paper	15
Table 3.1: The required specification of antenna	21
Table 3.2: FR-4 specification	22
Table 3.3: Value obtained from the all equation	26
Table 4.1: Length of the truncate for every design	39

LIST OF SYMBOLS AND ABBREVIATIONS

mm	:	millimeter
dB	:	decibel
Hz	:	hertz
K	:	kilo
d	:	diameter
h	:	height
L	:	length
W	:	width
Γ	:	reflection coefficient
Z_0	:	characteristic impedance
λ_0	:	free-space wavelength
$r \epsilon$:	dielectric constant of the substrate
t	:	patch thickness
c	:	speed of light 3×10^8 m/s

LIST OF AWARDS

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CHAPTER 1

INTRODUCTION

1.1 Background Study

With the rapid development of integrated electronics towards high frequencies, low power consumptions and low power supply, wireless power transfer is on the trends recently. Wireless power transmission is essential at remote and isolated places. The need is increasing rapidly over the years.

The meaning of energy harvesting is the process by which energy from different source is captured and stored. In modern areas, there are larger number of RF energy sources such as broadcast televisions, mobile phone signals and wireless networks. Therefore, some part of the energy will be collected and convert it into usable DC voltage.

The type of antenna will be use is circular polarized antenna. Circular polarization defined as a light which consists of two perpendicular electromagnetic plane waves of equal amplitude and difference in phase by 90 degrees.

The main advantage of circular polarization is because of it as a receiver orientation so that it can receive a signal even from different axis of transmission.

1.2 Problem Statement

Wireless communication system technology is one of the technologies that people used for daily life to accomplish their task more faster and easier compared to messy wired counter part. However the increase number of user will affect the wireless system especially the performance of an antenna. One of parameter to measure the performance of antenna is by measured the gain of the antenna. The low gain resulted means that there are high loss in antenna system will needed extra power source or input to increase the performance of the antenna. So, the lower gain in the antenna system produce lower efficiency of transmission signal. The use of linear polarization gives a poor performance towards any signals which are not straight due to the distance between antenna. The linear polarization only able to detect the signal in one direction. Linear polarization is more likely become out of phase due to linear type only can send or receive only at certain angle. Circular polarization (CP) has alleviated this problem by always receive a component of the signal due to the resulting wave having an angular variation. CP antennas is able to send and receive signals in all angles, thus the signal strength is not transferred anywhere but to a different plane and are still utilized. Therefore, the circular polarized antenna has been choose because it can provide flexibility in orientation. However, circular polarized antenna has

disadvantage which is more expensive and more complex design. Microstrip is one of type of circular polarized antenna which small in size while high performance of antenna. Microstrip antenna has many advantage such as low cost, low weight and low profile with easy implementation.

1.3 Objective

The objective of this project is:

1. Design and investigate the circular polarization antenna at 1.8GHz operating frequency.
2. Fabricate the designed antenna after simulated in CST.
3. Perform the measure of the fabricated antenna and compare the simulation and measurement.

1.4 Scope of the project

The main objective of this project is to design a circular polarized antenna for the energy harvesting system. The first step in designing process is to find and gather the information regarding to the project such as from journal and paperwork on the internet. This project will focus on design and analysis, testing and measurement of microstrip patch antenna capture electromagnetic energy from RF signals that have been radiated by the communication system at GSM 1800 frequency range. Computer Simulation Technology or CST Studio Suite will be used for design process of antenna. After complete the design process, the next procedure is to fabricate on FR4 substate on the circuit and doing the testing and measurement procedure. Then, the result will be compared within the measurement result and the actual result. Other

antenna parameters such as return loss level, gain, and radiation pattern also will be look in antenna design.

1.5 Summary

This chapter provide an introduction of the project and explanation about the project. Followed by brief about the problem statement of this project. Objective of the also explained in this chapter, as well as the scope of the project.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Antenna is a device that not only can transmit radio signal, but it also can receive the radio signal. It can collect the radio signal from the free space and convert electromagnetic wave into guided wave in the transmission line when it as receiving device but when work as transmitting device, it will transmit radio wave into free space after converting guided wave in transmission line into electromagnetic wave. But in some case it can do both.

2.2 Radio Frequency (RF) Energy Harvesting System

Energy is everywhere surrounding us, energy can come in different form such as wind, solar, thermal, or radio frequency (RF). Energy harvesting means capturing energy from another source and store for later use. So, the idea of RF energy harvesting that can apply in this project is capturing radio frequency energy from another to convert it into DC power, and store for later use.

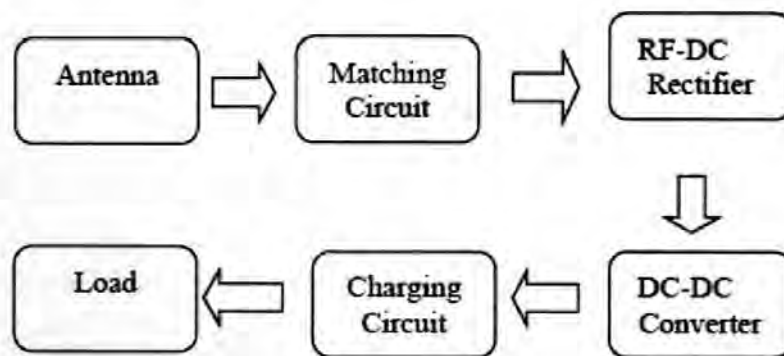


Figure 2.1: RF energy harvesting block diagram

2.3 Review on Microstrip Patch Antenna

The microstrip antenna is one of small type antenna. Because of this project which focuses on the small antenna types, the microstrip type is one of the choices can be consider for the project design. The microstrip antenna also known as printed antenna and the most popular types is microstrip patch antenna or patch antenna. A patch