

**SIERPINSKI CARPET FRACTAL ANTENNA (SCFA)  
FOR RFID APPLICATIONS**

**This thesis is presented in partial fulfillment for the award of the  
Bachelor of Engineering (Hons.) Electrical  
UNIVERSITI TEKNOLOGI MARA (UiTM)**



**NORDIN AHMAD BIN KHALID  
FACULTY OF ELECTRICAL ENGINEERING  
UNIVERSITI TEKNOLOGI MARA  
40450 SHAH ALAM,  
SELANGOR, MALAYSIA**

**MAY 2011**

## **ACKNOWLEDGEMENT**

With the name of Allah, praise in only Allah S.W.T for His bounty and blessing upon us. In preparing this thesis, I was in contact with many people, friends and academicians. They have contributed towards my understanding and thoughts.

In particular, I would like to express my gratitude to my supervisor, Madam Kamariah Ismail for encouragement and guidance. Without her continued support and interest, this thesis would not have been the same as presented here.

I also would like to extend my sincere appreciation to all my friends who have provided assistance at various occasions. To my colleagues who have helped me throughout this project, their views and tips are useful indeed.

Finally, I would like to thank my loving family. Their loves, supports and prayers have given me strength to finish what I have started.

## ABSTRACT

This work presented the design, simulation and analysis of Sierpinski carpet fractal antenna (SCFA) for Radio Frequency Identification (RFID) application. This prototype antenna was fabricated on RT Duroid 4350 of dielectric constant,  $\epsilon_r = 3.48$  with thickness of 1.524 mm while the center frequency was 5.8 GHz and using microstrip line feed.

The commercial electromagnetic simulator, CST Microwave Studio was used to carry out the design and simulation. The prototype SCFA was realized and the measurement and analysis was carried out using Vector Network Analyzer (VNA) and Antenna Training System (ATS).

This work consists of two measurement results which are without and with stub matching. Without using stub matching, the operating frequency has been shifted around 2.4138 % from its original state.

While after using stub matching, simulated and measurement values of the parameters of the antenna were compared. It was observed that the measured and simulated values of the parameters of the antenna were closed with each other and the omnidirectional radiation pattern was realized. The result shows that the fractal antenna is very small in size while keeping high radiation efficiency.

## TABLE OF CONTENTS

<b>CHAPTER</b>	<b>TITLE</b>	<b>PAGE</b>
	<b>TITLE</b>	<b>i</b>
	<b>APPROVAL</b>	<b>ii</b>
	<b>DECLARATION</b>	<b>iii</b>
	<b>ACKNOWLEDGEMENT</b>	<b>iv</b>
	<b>ABSTRACT</b>	<b>v</b>
	<b>TABLE OF CONTENTS</b>	<b>vi</b>
	<b>LIST OF FIGURES</b>	<b>x</b>
	<b>LIST OF TABLES</b>	<b>xii</b>
	<b>LIST OF SYMBOLS AND ABBREVIATIONS</b>	<b>xiii</b>
<b>1</b>	<b>INTRODUCTION</b>	<b>1</b>
	1.1 INTRODUCTION	1
	1.2 RADIO FREQUENCY IDENTIFICATION (RFID) SYSTEM	2
	1.3 OBJECTIVE	3
	1.4 SCOPE OF WORK	3
	1.5 OUTLINE OF THESIS	4
<b>2</b>	<b>THEORY</b>	<b>5</b>
	2.1 INTRODUCTION TO ANTENNA	5
	2.1.1 Microstrip Patch Antenna (MPA)	5
	2.1.2 Advantages of MPA	7

# CHAPTER 1

## INTRODUCTION

### 1.1 INTRODUCTION

Antenna is a device that transmit or receiver electromagnetic waves and acts as a transducer to convert electromagnetic radiation into electrical current or vice versa. It is used in wireless system such as radio and television broadcasting, wireless LAN, cell phones, radar, and spacecraft communication.

Microstrip antenna also known as a printed antenna. There are many type of microstrip antenna; the most common is the microstrip patch antenna (MPA) or patch antenna. MPA consist of a radiating patch, ground and dielectric material. Generally, the radiating patch and ground is made from conducting material such as copper or gold and can take any possible shape.

In communication system, there is a need for a high performance device and not only the size of the circuitry have evolved to transceiver on a single chip, there is also a need to evolve antenna designs to minimize the size. Several methods have been suggested to reduce the size of antenna with a high dielectric constant substrate, short-circuiting the patch to ground, modifying the geometry of the patch and other techniques that combine these three methods [1].