CIRCULAR PATCH ANTENNA WITH DGS STRUCTURE FOR RADIO FREQUENCY IDENTIFICATION (RFID) USAGE

NURUL HIDAYAH BINTI MD NAWAI

FACULTY OF ELECTRICAL ENGINEERING
UNIVERSITI TEKNOLOGI MARA
MALAYSIA

ACKNOWLEDGEMENT

In the name of Allah, The Most Gracious, The Most Merciful and The Most Beneficant. Praise in only Allah S.W.T for His bounty and blessing upon us. It is with deepest sense of gratitude to Allah who has given me the strength and ability to complete this project as it is today.

This project could not be a possible without Prof. Madya Norhayati Ahmad. I have spent couple of hours with her to share vision and thoughts which are most memorable for me and I look forward to see her again in near future. I would also like to express my deepest thanks to all my friends, as my coursemates in UiTM who had supported and shared with me their valuable ideas in this project. Special thanks to all lecturers in Faculty of Electrical Engineering, UiTM and to those who have devoted their precious time either directly or indirectly, for their ideas, support and a lot of contribution towards the success of this project.

Last but not least, a very huge special thanks to my beloved parents and family for their understanding, support and prayer throughout the years. All of you are the source of my strength and inspiration to my successful.

Nurul Hidayah Binti Md Nawai
Universiti Teknologi Mara
40450 Shah Alam

ABSTRACT

Compact size, high performance and low cost are become often become a prerequisite in most modern microwave communication systems. In recent years, microstrip antennas have its own attraction to the scientists for their possible usage in satellite, mobile and wireless communication systems due to the prerequisite demand. These antenna are increasing in popularity for use in communication systems, therefore they are extremely compitable for embedded antennas in handheld wireless devices such as cellular phones, pagers etc. Microstrip antenna quite versatile in terms of resonant frequencies, polarization, radiation pattern and impedance, so that this project was chose to design the conventional circular patch antenna as the radiating element.

However, future technology needs smaller patch antenna to go well with future gadgets. In order to overcome this limitations, a new technology has emerged which may be the key developing circular patch antenna. The circular patch antenna of a radio frequency identificatin (RFID) usage with defected ground structure (DGS) are designed on the predicted frequency which is 2.5GHz.

This thesis presents design, simulate, fabricate and measurements between conventional and DGS circular patch antenna by using Computer Simulation Technology Microwave Studio (CST MWS) and the measurement using Vector Network Analyzer (VNA). Both design were simulated, measured and compared in the results part to achieved the main objective which is to reduce the size of the antenna. The other objectives of this project is to improve the performances of the antenna in terms of antenna bandwidth, return loss, radiation pattern and voltage standing wave ratio (VSWR).

TABLE OF CONTENTS

DECLARATION

ACKNOWLEDGEMENT ii

ABSTRACT iii

TABLE OF CONTENTS iv

LIST OF FIGURES vii

LIST OF TABLES viii

LIST OF SYMBOLS/ABBREVIATIONS ix

CHAPTER 1: INTRODUCTION 1

1.1 OVERVIEW 1

1.2 PROBLEMS STATEMENT 3

1.3 OBJECTIVES 3

1.4 SCOPE OF WORKS 4

1.5 THESIS ORGANIZATION 4

1.6 SUMMARY 5

CHAPTER 2: LITERATURE REVIEW 6

2.1 INTRODUCTION 6

2.2 ANTENNA PROPERTIES 8

2.2.1 POLARIZATION 8

2.2.2 RADIATION PATTERN 9

2.2.3 VOLTAGE STANDING WAVE RATIO (VSWR) 13

2.2.4 RETURN LOSS 14

2.2.5 BANDWIDTH 15

2.3 MICROSTRIP ANTENNA 15

2.3.1 OVERVIEW OF MICROSTRIP ANTENNA 15

2.3.2 SURFACE WAVE EFFECT 17

2.3.3 MICROSTRIP LINE 18

2.3.4 CIRCULAR PATCH ANTENNA 20

2.3.5 FEEDING TECHNIQUE 22

CHAPTER 1

INTRODUCTION

This chapter consists of an introduction of my project which includes the problem statement, objectives and scope of work. The most important part in this project is the methodology of the overall project which also been mention in this chapter. The summarization of the project has been written at the end of this project.

1.1 OVERVIEW

Radio frequency identification (RFID) is a bar code technology that allows for data to be transmitted from an RFID tag to compatible reader [2]. RFID tags are integrated circuits that include a small antenna. There are typically small enough that they are not noticeable and therefore can be placed on many types of objects [3]. RFID is the name given to the wireless, radio wave technology that allows for a small RFID chip to be embedded in any physical object and uniquely identified by an RFID reader [1]. In recent years, a new technology has emerged which may be the key developing antenna.

The antenna is probably the most overlooked part of an radio frequency (RF) design. The range, performance and legality of an RF link are critically dependent upon the antenna. However, it is often left until the end of the design and expected to fit into whatever space is left,no matter how unfavorable to performance that location may be. Many of these design will have to ultimately accept degraded performance or go through multiple redesigns. Generally, an antenna is the component of a radio system that is used to send or receive a radio signal. A radio frequency (RF) signal that has been generated in a radio transmitter travels through a transmission line to an antenna. An antenna connected to a transmitter is the device that release RF energy in the form