

**UNIVERSITI TEKNOLOGI MARA**

**INVESTIGATION ON  
INTEGRATION OF DIAMOND  
SHAPE ANTENNA WITH SMD LED**

**MASWANI KHAIRI BINTI MARZUKI**

Thesis submitted in fulfillment  
of the requirements for degree of  
**Master of Science in Telecommunication  
and Information Engineering**

**Faculty of Electrical Engineering**

July 2015

## ACKNOWLEDGEMENT

*“In the name of Allah, the Most Gracious and Most Merciful”*

Alhamdulillah, with the Allah bless I am able to finish my final year project successfully. The research presented in this dissertation could not have been conducted without the support, encouragement, and cooperation of many people.

First of all, I would like to express my deepest gratitude to my supervisor, Puan Suhaila Binti Subahir, for her guidance to write this thesis report and other thoughtful suggestion at each stage in preparation of this project. I would like to thank her for giving the opportunity to learn and work under guidance, which has been the most memorable experience. Special thanks Antenna Research Group(ARG) member for valuable advice and encouragement throughout in developing this project.

I especially thank my entire family for their continuous pray and support. They are always encourage and be beside me whenever I feel disconsolate.

Last but not least, I am thankful to all my friends who are always give support and criticism for this project

## ABSTRACT

This paper present an investigation on integration square loop antenna with the Surface Mount Device (SMD) Light Emitting Diode (LED). The parameters of the antenna will be determined by using basic square antenna equations. The antenna is designed by using CST Microwave Studio 2013 and fabricated on the FR-4 substrate. The data for experimental is taken by using Vector Network Analyzer (VNA) to get the return loss value and the radiation pattern is captured in a chamber room. The performances of the integrated antenna were investigated in term of the return loss, resonant frequency, gain, radiation pattern and VSWR. Both result from simulation and measurement are compared and analysed. The integrated LED also affected the performance of the antenna by shifting the frequency to the lower frequency and the return loss also change to deeper value. It is verified that LED is acts like a bridge on the antenna and it has the inductance characteristic.

*Keyword: Surface Mount Device (SMD), Light Emitting Diode (LED), Wireless Fidelity(Wi-Fi), Computer Simulation Technology (CST), Vector Network Analyzer (VNA).*

# TABLE OF CONTENTS

	<b>Page</b>
<b>ACKNOWLEDGEMENT</b>	iii
<b>ABSTRACT</b>	iv
<b>TABLE OF CONTENTS</b>	v
<b>LIST OF TABLES</b>	vii
<b>LIST OF FIGURES</b>	viii
<b>LIST OF SYMBOLS AND ABBREVIATIONS</b>	x
<b>CHAPTER 1: INTRODUCTION</b>	
1.1 Background of Study	1
1.2 Problem Statement	3
1.3 Objective	4
1.4 Scope of Works	4
1.5 Thesis Organization	4
<b>CHAPTER 2: LITERATURE RIVIEW</b>	<b>6</b>
2.1 Introduction	6
2.2 Antenna	6
2.2.1 Basic Antenna Parameters	7
2.2.1.1 Resonant Frequency	7
2.2.1.2 Return Loss	7
2.2.1.3 Radiation Pattern	8
2.2.1.4 Voltage Standing Ratio	8
2.2.2 Microstrip Antenna	9
2.2.3 Parasitic Antenna	10
2.3 LED	12
2.3.1 Illumination of LED	12
2.3.2 Thermal Analysis	13
2.3.3 SMD LED	14
2.2.4 Plasma Antenna	15
2.3 Feeding Techniques	17
2.3.1 Coaxial Probe Feeding	17
<b>CHAPTER 3: METHODOLOGY</b>	
3.1 Introduction	18
3.2 Flow Chart	19
3.3 Diamond Shape Antenna Design	20

3.4 Integration of An Antenna With LED	23
<b>CHAPTER 4: RESULT AND DISCUSSION</b>	
4.1 Introduction	27
4.2 Diamond Shape Antenna	27
4.3 The Integrated Diamond Shape Antenna With LED	30
4.3.1 S-Parameter	30
4.3.2 Radiation Pattern	35
<b>CHAPTER 5: CONCLUSION</b>	
5.1 Conclusion	39
5.2 Recommendation	40
<b>REFERENCES</b>	37