UNIVERSITI TEKNOLOGI MARA
CAWANGAN PULAU PINANG

HIDDEN PLANAR ANTENNA FOR
REMOTE KEYLESS ENTRY
SYSTEM

AHMAD NADZRIN BIN
MOHAMMAD NIZAM

BACHELOR OF ENGINEERING
(HONS) ELECTRICAL AND
ELECTRONIC ENGINEERING

Jan 2019
HIDDEN PLANAR ANTENNA FOR REMOTE KEYLESS ENTRY SYSTEM

AHMAD NADZRIN BIN MOHAMMAD NIZAM

Faculty of Electrical Engineering

Jan 2019
ACKNOWLEDGEMENT

First of all, I would like to express my gratitude to Almighty Allah for giving me the opportunity to complete my Final Year Project and finally to prepare this report. I would like to express my sincere thanks and gratitude to my Project Supervisor, Dr Ali bin Othman for giving me the guidelines and share his experiences to complete the project research. Starting from the first day of the meeting, he has been my source of moral support and encouragement. This project research might never be completed without the motivation from the Project Supervisor.

Next, I would like to express the appreciation and obligation to Universiti Teknologi MARA (UiTM) Cawangan Pulau Pinang Kampus Permatang Pauh for providing the laboratory and equipment in development of Remote Keyless Entry (RKE) system antenna. Special thanks to En. Nadhar bin Omar, the Assistant Engineer of Printed Circuit Board (PCB) Workshop and En. Mohamad Soufee bin Ismail, the Assistant Engineer of Microwave Laboratory in guiding and helping me to fabricate and measure the antenna.

Finally, I would like to thank to my father, mother, siblings and all my friends who have been there for me and provide their endless support, encouragement and help for me to complete this project research. I believe that this hard work has prepared me for taking up new challenging occasions in the future.
This paper describes a miniaturized low cost printed circuit board planar antenna. The antenna is developed for application of Remote Keyless Entry (RKE) system. The antenna is designed, simulated, fabricated and measured. The antenna frequency is designed at 433 MHz which is commonly used in Europe for RKE system. The dimension of the antenna is 39 mm width and 95 mm length and is implemented on an FR-4 dielectric substrate with a thickness of 1.6 mm. The relative permittivity of the FR-4 is 4.4. Meander line antenna structure with coplanar feed line method technique is used in order to reduce the size of the antenna. CST Microwave Studio software is used to measure the performance of the designed antenna. The software is used as guideline before the real prototype is fabricated. The antenna is investigated based on the return loss, gain and radiation pattern. The antenna is measured in the Microwave Laboratory of Universiti Teknologi MARA Cawangan Pulau Pinang Kampus Permatang Pauh. The simulated result of the antenna shows a positive result with a maximum gain of 0.93 dBi and -10dB bandwidth of 7 MHz. The details and performance results of the antenna is discussed.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>AUTHOR’S DECLARATION</td>
<td>i</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td>ii</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENT</td>
<td>iii</td>
</tr>
<tr>
<td>TABLE OF CONTENTS</td>
<td>iv</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>vii</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>viii</td>
</tr>
<tr>
<td>LIST OF APPENDICES</td>
<td>x</td>
</tr>
<tr>
<td>LIST OF SYMBOLS</td>
<td>xi</td>
</tr>
<tr>
<td>LIST OF ABBREVIATIONS</td>
<td>xii</td>
</tr>
</tbody>
</table>

## CHAPTER 1 INTRODUCTION

1.1 Research Background  1  
1.2 Problem Statement  2  
1.3 Objectives  2  
1.4 Scope of Study  3  
1.5 Thesis Outline  3  

## CHAPTER 2 LITERATURE REVIEW

2.1 Introduction  5  
2.2 Antenna Fundamentals  5  
   2.2.1 Antenna Frequency  6  
   2.2.2 Antenna Bandwidth  6  
   2.2.3 Voltage Standing Wave Ratio (VSWR)  7  
   2.2.4 Antenna Gain  7  
   2.2.5 Antenna Impedance  8  
   2.2.6 Antenna Radiation Pattern  9  
2.3 Previous Work Research  11  
   2.3.1 Remote Keyless Entry Operation Frequency  11  
   2.3.2 Method of Reducing the Antenna Size  11