

CIRCULARLY POLARIZED MICROSTRIP ANTENNA

Thesis presented in partial fulfillment for the award of the
Bachelor of Electrical Engineering (Honors)
UNIVERSITI TEKNOLOGI MARA



NORAZWANA BINTI MOHD NAJIB
Faculty of Electrical Engineering
UNIVERSITI TEKNOLOGI MARA
40450 SHAH ALAM
SELANGOR, MALAYSIA

ACKNOWLEDGEMENT

Praise to ALLAH S.W.T for His consent I have successfully completed my project paper. All good inspirations, devotions, good expressions and prayers are to ALLAH whose blessing and guidance has helped me throughout completing this entire project.

I would like to express my warmest gratitude to my respectable project supervisor Prof. Dr. Zaiki. B. Awang for his guidance, comments and ideas through every stage of this project, from initial conception to final design and construction.

My thanks and appreciations go to the laboratory technician, En. Hisham for his help during completion of this project. Another warm appreciation is extended to all my friends for their guidance, encouragement and cooperation for this project.

Last but not least, I would like to thank to all staff in Electrical Engineering Faculty lab University Technology MARA for providing the necessary facilities required and unselfishly helping hand.

ABSTRACT

This project describes the design of a circularly polarized microstrip antenna that operates in WLAN system. A circular polarization design for single feed microstrip antenna is presented and experimentally studied. The antenna proposed is a variation of the 'nearly square' patch and exhibits return loss of less than -10 dB and VSWR of less than 1.5. The frequency of operation for the antenna is 2.45 GHz. The project was carried out with some investigation, analysis, design, simulation using Computer Aided Design (CAD), and fabrication. Typical simulation and experimental results of the circular polarization microstrip antenna obtained by applying this design method are presented and discussed.

TABLE OF CONTENTS

	PAGE
DECLARATION	i
ACKNOWLEDGEMENT	ii
ABSTRACT	iii
TABLE OF CONTENTS	iv
LIST OF FIGURES	vii
LIST OF TABLES	viii
LIST OF ABBREVIATION	ix
1. INTRODUCTION	
1.1. WLAN System	1
1.2. Microstrip Antenna	3
1.3. Antenna Parameters	4
1.3.1. Resonant Frequency	4
1.3.2. Gain	5
1.3.3. Radiation Pattern	6
1.3.4. Impedance	8
1.3.5. Bandwidth	8
1.3.6. Polarization	8
1.3.7. Efficiency	10
1.3.8. Directivity	11
1.4. Objective and Scope of the study	11
1.5. Thesis Organization	12
1.6. Summary	12
2. THEORY OF CIRCULARLY POLARIZED MICROSTRIP ANTENNA	
2.1. Characteristic of Circularly Polarized Microstrip Antenna	13
2.1.1. Advantages	16
2.1.2. Disadvantages	17
2.1.3. Applications	17
2.2. Feeding Techniques	18
2.2.1. Microstrip Line Feed	18

2.2.2. Coaxial Feed	19
2.2.3. Aperture Coupled Feed	20
2.2.4. Coplanar Waveguide Feed	21
2.2.5. Proximity Coupled Feed	22
2.3. Method of Analysis	23
2.3.1. Transmission Line Model (TLM)	24
2.3.2. Cavity Model (CM)	24
2.3.3. Multiport Network Model (MNM)	25
2.3.4. Method of Moment (MoM)	25
2.3.5. Finite Element Method (FEM)	26
2.3.6. Spectral Domain Technique (SDT)	26
2.3.7. Finite Difference Time Domain (FDTD)	27
2.4. Summary	27
3. DESIGN PROCEDURES	
3.1. Methodology	29
3.2. Dielectric Substrate	31
3.3. Design Calculations	32
3.3.1. Calculation of Patch Length	32
3.3.2. Calculation of Patch Width	32
3.3.3. Determination of Feed Length and Width	33
3.4. Design of Circularly Polarized Microstrip Antenna	33
3.5. Summary	34
4. SIMULATION RESULTS	
4.1. Introduction	35
4.2. Simulation Process	35
4.2.1. Effect of Patch Length	36
4.2.2. Effect of Patch Width	39
4.2.3. Radiation Pattern	41
4.3. Summary	42