



**ANALYSIS OF 2 BY 2 RECTANGULAR MICROSTRIP
PATCH ARRAY ANTENNA AT 2.4 GHz FREQUENCY
FOR WIRELESS LOCAL AREA NETWORK
APPLICATION**

**MUHAMMAD AL-QAYYUM BIN MOHD ARIFIN
2009651486**

**BACHELOR OF ENGINEERING (Hons.) ELECTRONICS
(COMMUNICATION)
FACULTY OF ELECTRICAL ENGINEERING
UNIVERSITI TEKNOLOGI MARA**

JULY 2012

ACKNOWLEDGEMENT

With the name of ALLAH Most Gracious Most Merciful

Alhamdulillah, a lot of thanks to ALLAH S.W.T for His wills and blessings, I successfully completed my Final Year Project (FYP) for my first degree of Bachelor of Engineering (Hons) Electronics (Communication).

First and foremost, I would like to express my highest gratitude to my FYP Supervisor, PM Norhayati Binti Ahmad for the right guidance and encouragement given from the early phase of my FYP project to the end of the last stage of my project thesis. My great appreciation goes to my family who has supported me throughout the years. Their love and motivation provides me the spirit to complete this thesis successfully.

I wish to express my special thanks from the bottom of my heart to my parents, my brothers and sisters and also my relatives for their great deal of encouragement morally and materially during preparation of this project.

Last but not least, to my fellow friends and individual involved directly or indirectly throughout the completion of this assignment, I would like to express my deepest gratitude for all their help and support they have provided me with throughout this crucial moment in my life.

ABSTRACT

Antenna is the primary part of communication system. Rapid developments in wireless local area(WLAN) network also parallel with advancements in compactness and efficiency of antennas. This paper discusses on the analysis of 2×2 Rectangular Microstrip Patch Array Antenna. The study concentrates on frequency of 2.4 GHz for WLAN application. The objectives of this project are to design and analyze both simulation and measurement results for the proposed antenna to make comparison. The design is fabricated on FR4 substrate of dielectric constant, ϵ_r equal to 4.9 and thickness of 1.6mm respectively. A combination of several equations and technique are used to get the initial geometrical parameters. The antenna can operate at 2.4 GHz within the desired specification by adjusting the dimensions. A combination of several equations and technique are used to get the initial geometrical parameters. The antenna has return loss of -14.672 at 2.4 GHz for simulation and -21.657 at 2.58 GHz for measurement. The antenna has an directional characteristic. The design and simulation are done using Computer Simulation Technology CST Microwave Studio software and the measurement using Vector Network Analyzer (VNA). The design procedure, simulated and measured has been discussed in this paper.

TABLE OF CONTENTS

LIST OF TITLE	PAGE
DECLARATION SHEET	i
ACKNOWLEDGEMENT	iii
ABSTRACT	iv
TABLE OF CONTENTS	v
LIST OF FIGURE	ix
LIST OF TABLE	xi
LIST OF SYMBOL	xii
CHAPTER 1	1
INTRODUCTION	1
1.1 Introduction	1
1.2 Wireless Local Area Network (WLAN) System	2
1.3 Array Elements	
1.4 Objective	2
1.5 Scope of work	3
1.6 Problem Statement	3
1.7 Thesis Outline	4
1.8 Summary	4
CHAPTER 2	5
MICROSTRIP ANTENNA	5
2.1 Basic Antenna Theory	5
2.1.1 Basic Concept of Microstrip Patch Antenna	6
2.1.2 Advantages vs. Disadvantages of Microstrip Antennas	7

2.1.3 Applications of Microstrip Antennas	8
2.1.4 Substrate Materials	9
2.1.5 Methods of Analysis	11
2.1.6 Excitation Techniques	11
2.1.6.1 Coaxial Feed	12
2.1.6.2 Aperture Coupled Feed	13
2.1.6.3 Proximity Coupled Feed	13
2.1.7 Substrate selection	14
2.1.7.1 Substrate Comparison	15
2.1.8 Element Width and Length	15
2.1.8.1 Fringing effects	16
2.1.8.2 Effective Dielectric Constant (ϵ_{eff})	16
2.1.8.3 Series Fed Arrays	17
2.2 Rectangular Patch Array Antenna Design	18
2.2.1 Wavelength	18
2.2.2 Characteristic Impedance	19
2.2.3 Element Width	21
2.2.4 Element Length	22
2.2.5 Quarter – wave transform	23
2.3 Antenna properties	23
2.3.1 Input Impedance	24
2.3.2 VSWR	25
2.3.3 Bandwidth	26
2.3.4 Radiation pattern	26
2.3.5 Directivity	29
2.3.6 Gain	30
2.3.7 Polarization	31
2.3.8 Radiation efficiency	31
2.4 Design procedure	32
2.5 Summary	34