PLANAR YAGI ANTENNA DESIGN

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This report is submitted in partial fulfillment of the requirements for the award of Bachelor of Electronic Engineering (Telecommunication Electronics)With Honours

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To my beloved father and mother

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ABSTRACT

This thesis is present the design of planar Yagi antenna for WLAN application at frequency 2.4 GHz .Now days designing conventional antenna is high cost due to the large size. There several step to design this antenna .The design and simulation of this antenna was completed using Microwave Office software. There are two designs of antenna was investigated. The first planar Yagi antenna with one director and the second planar Yagi antenna with three directors. For both prototype antenna were simulated. The optimized design was fabricated using chemical etching and UV ray. The both antennas and then tested. Compared to the simulation result the operating frequency for both planar Yagi antenna design is 2.4 GHz. The measurement result show that the operating frequency slightly shift to 2.5GHz and the bandwidth of both designs were 14.05% and 6.88% ,Compared to the simulation, the bandwidth of both designs are achieve about 11.88%. The measurement result slightly different from simulation.

ABSTRAK

Thesis ini menunjukkan rekabentuk antenna planar Yagi untuk aplikasi WLAN pada frekuensi 2.4 Ghz .Kini merekabentuk antenna biasa memerlukan kos yang tinggi disebabkan oleh saiznya yang besar.Beberapa langkah digunakan untuk merekabentuk antenna ini.Proses rekabentuk dan simulasi diselesaikan dengan menggunakan perisian Microwave Office. Dua rekabentuk antenna yang disiasat,iaitu antenna planar Yagi pertama mempunyai satu pengarah dan antenna planar Yagi kedua mempunyai tiga pengarah.Kedua-dua antenna prototaip ini disimulasi dan reka bentuk terbaik antenna di fabrikasi mengunakan sinar UV dan teknik goresan kimia.Kedua-dua antenna ini diuji dan dibandingkan dengan keputusan simulasi dimana frequensi operasi kedua-dua antenna ini pada 2.4GHz.Tetapi keputusan ukuran menunjukkan frekuensi operasi antenna beranjak kepada 2.5GHz.dan lebar jalur untuk kedua-dua antenna itu ialah 14.05% dan 6.88%.Jika dibandingkan dengan simulasi lebar jalur mencapai sebanyak 11.88%.Keputusan ukuran sedikit berbeza dari keputusan simulasi.

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LIST OF ABBREVIATIONS

BW	-	Bandwidth
CAD	-	Computed Aided Drawing
dB	-	Decibel
dBi	-	Decibel over isotropic
dBm	-	Power ratio in decibel of measured power
E-plane	-	Electric field plane
f	-	Frequency
FNBW	-	Full Null Beam Width
FR4	-	Flame Retardant 4
GHz	-	Gigahertz
h	-	Substrate height
HPBW	-	Half Power Beam Width
H-plane	-	Electromagnetic field plane
L	-	Length
LAN	-	Local Area Network
mm	-	Millimeter
MoM	-	Moment of Method
MSA	-	Microstrip antenna
S	-	Spacing
SMA	-	Sub Miniature version A
SWR	-	Standing Wave Ratio
		Copper thickness
tan δ	-	Loss tangent
UV	-	Ultra Violet

VSWR	-	Voltage Standing Wave Ratio
W	-	Width
WLAN	-	Wireless Local Area Network
ε_r	-	Dielectric Constant
Θ	-	Angle in degree
λ	-	Wavelength

LIST OF APPENDIX

CHAPTER I

INTRODUCTION

1.1 Introduction

This project is about developing Planar Yagi antenna using microstrip that cost effective and lightweight at frequency 2.4GHz for WLAN application .The main problem of the microstrip antenna is narrowband characteristic up to 3% and low gain. Planar Yagi antenna design can offer wider bandwidth and more gain for antenna application.

1.2 Problem Statement

Nowadays, the antenna size is to large and high cost to design, by using microstrip this problem can be solved. The microstrip offers numerous advantages, such as low weight, small volume, low cost and easy fabrication using printed circuit technology. But using microstrip suffers some disadvantages compare to conventional antenna. The disadvantages of microstrip antenna is it narrowband characteristic which be the major limiting factor for widespread application .This disadvantage can be solve by implement planar Yagi antenna design in this project to increase bandwidth and gain of this antenna design

1.3 Objective

The objective of this project is to design, simulate and fabricate Planar Yagi antenna at frequency 2.4 GHz for WLAN application.

1.4 Scope of Project

There is several scope of the project that has been determined. The first scope was to design Planar Yagi antenna at 2.4 GHz for WLAN application .The second scope was to simulate Planar Yagi antenna by using Microwave Office software to get the wanted properties or specification of the antenna. After design and simulation has been done .The antenna was fabricate on FR4 using UV ray and chemical etching technique. Lastly the antenna then measured and compared with the simulation

1.5 Methodology of Project

The methodology of project started with literature review. During this stage all information and data about Planar Yagi Antenna is collected from books ,IEEE journal and web .Then the design process started when all data and parameter that has been selected during literature review .After that ,the antenna structure was designed and simulated in Microwave Office software environment .After simulation achieved the required parameter and properties ,The fabrication process was started .The antenna is fabricated on FR4 board using UV ray and chemical etching technique. The fabricated antenna measured and the simulation result compared with the measured result .Last, all data and literature review that collected since the project started is compiled together to make full report.

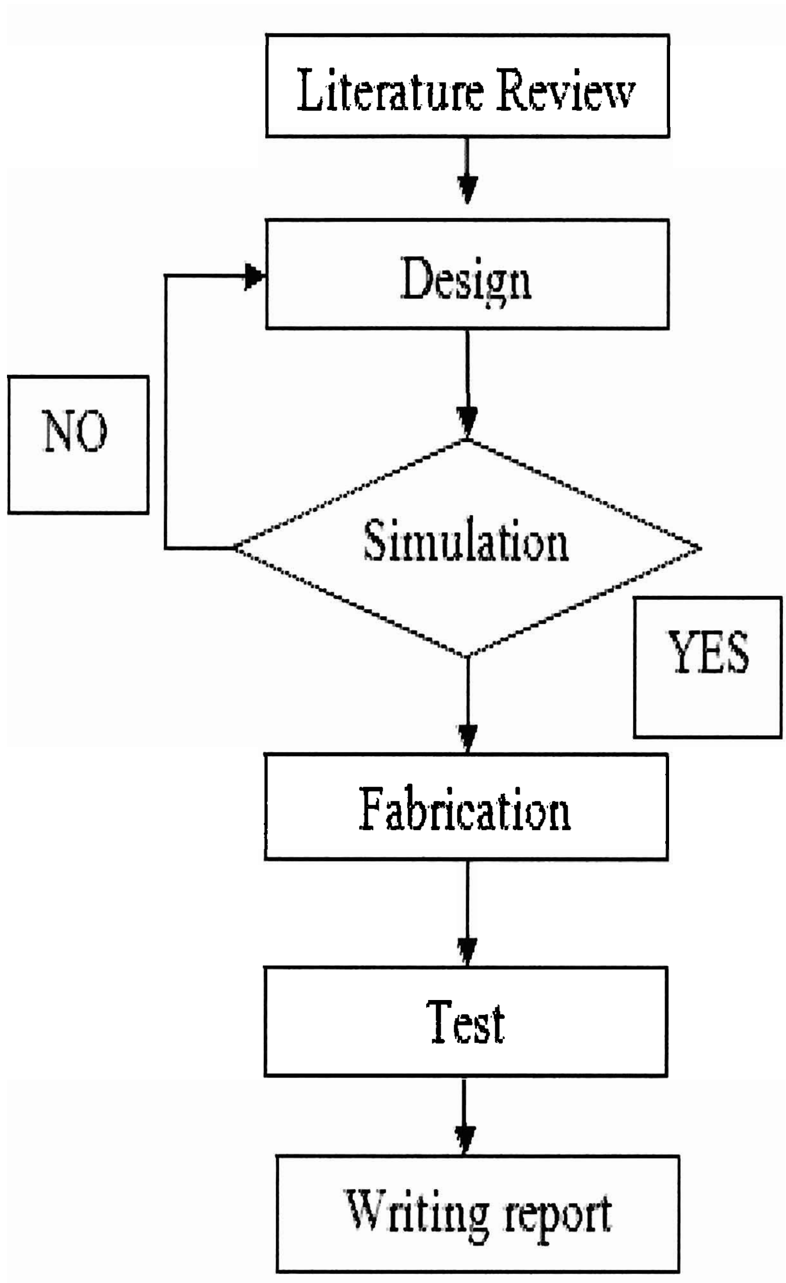

Figure 1.1: Methodology flow

CHAPTER II

LITERATURE REVIEW

2.1 Microstrip Antenna

2.1.1 Introduction

Deschamps first proposed the concept of the MSA in 1953 [1]. However, practical antennas were developed by Munson [2] and Howell [3] in the 1970s.The numerous advantages of MSA, such as its low weight, small volume, and ease of fabrication using printed-circuit technology, led to the design of several configurations for various applications [4]. With increasing requirements for personal and mobile communications, the demand for smaller and low-profile antennas has brought them MSA to the forefront. As shown in figure below figure 2.1 is the simplest configuration of a MSA .This antenna consists of a radiating patch on one side of the dielectric substrate and the ground plane on other side. The patch conductor, usually copper or gold is use. The MSA can be in any shape, but the regular shape is use to simplify and performance prediction.