DEVELOPMENT OF MICROSTRIP PATCH ARRAY ANTENNA FOR WIRELESS LOCAL AREA NETWORK (WLAN)

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DEVELOPMENT OF MICROSTRIP PATCH ARRAY ANTENNA FOR WIRELESS LOCAL AREA NETWORK (WLAN)

by

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Report submitted in partial fulfillment
of the requirements for the degree
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To my beloved mother:

Thank you for your understanding and giving me the chance to be what I can be.

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APPROVAL AND DECLARATION SHEET

This project report titled Developments of Microstrip Patch Array Antenna for Wireless Local Area Network (WLAN) was prepared and submitted by Azizan Mat Hashim (Matrix Number: 031080626) and has been found satisfactory in terms of scope, quality and presentation as partial fulfillment of the requirement for the Bachelor of Engineering (Communication Engineering) in Universiti Malaysia Perlis (UniMAP).

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ABSTRACT

In this project, a 4x1 Rectangular Microstrip Patch Array Antenna at frequency 2.45 GHz for Wireless Local Area Network (WLAN) will be designed, fabricated and tested. The antenna will be design base on optimization and characteristics analysis. Some methods for optimize the Microstrip Patch Antenna are studied and implemented to produce the desired antenna. The objective of this project is to develop the antenna that has higher gain, higher directivity, wide bandwidth and higher efficiency. Theoretically, the objective of this project can be achieve through the use of high quality substrate such as RT Duroid 5870 which is have low relative permittivity or dielectric constant and higher substrate that will improve the bandwidth. This is due to the Rectangular Microstrip Patch Array Antenna which the bandwidth is determined by the dielectric constant and the height of substrate. Low loss-tangent will increase the efficiency of the antenna. The patch array also has a better directivity than the single patch. Microwave Office (MWO) will be introduce as an effective tool for modeling electromagnetic structure. The antenna was fabricated based on simulation and measured using Wave and Antenna Training System (WATS2002). The expected result from this project is the antenna will has a high gain, better directivity, larger bandwidth and high efficiency.

PEMBANGUNAN ANTENNA SUSUNAN TAMPAL MIKROJALUR UNTUK RANGKAIAN TEMPATAN TANPA WAYAR (WLAN)

ABSTRAK

Di dalam projek ini, 4x1 Antena Susunan Tampal Mikrojalur Segiempat Tepat yang beroperasi pada frekuensi kendalian 2.45 GHz yang digunakan untuk rangkaian tempatan tanpa wayar akan direkabentuk, difabrikasi dan diuji. Antenna ini akan direkabentuk untuk mengoptimakan prestasi dan ciri-cirinya akan dianalisis. Beberapa kaedah untuk meengoptimumkan prestasi antena dikaji dan dipraktikkan. Objektif projek ini adalah untuk menghasilkan antenna yang mempunyai gandaan, kearahan, lebarjalur dan kecekapan yang tinggi. Secara teori, objektif projek ini dapat dicapai melalui penggunaan substrat berkualiti tinggi seperti RT Duroid 5870 yang mempunyai pemalar dielektrik dan ketinggian subtrat yang tinggi untuk menhasilkan lebarjalur yang lebih luas. Ini adalah kerana bagi Antena Tampal Mikrojalur Segiempat Tepat, lebarjalur adalah bergantung kepada pemalar dielektrik dan ketinggian substrat. Kehilangan tangen yang rendah dapat meningkatkan kecekapan antenna. Perisian Microwave Office (MWO) diperkenalkan dan digunakan untuk tujuan simulasi yang mana ianya merupakan perisian yang efektif untuk permodelan struktur elektromagnet khususnya mikrojalur. Antena ini telah difabrikasi berdasarkan kepada simulasi dan diuji menggunakan peralatan Sistem Latihan Antenna dan Gelombang (WATS 2002). Daripada projek ini, hasil yang dharapkan adalah membangunkan antenna yang mempunyai gandaan yang tinggi, kearahan yang lebih baik, lebarjalur yang lebih luas dan kecekapan yang tinggi.

TABLES OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF SYMBOLS, ABBREVIATIONS OR NOMENCLATURE

c	Velocity of electromagnetic waves in free space
BW	Bandwidth
$HPBW$	Half Power Bandwidth
f	Frequency
L	Length of the Microstrip Patch Antenna
w	Width of the Microstrip Patch Antenna
h	Substrate thickness
Q	Quality factor
t	Thickness of conductor
tan δ	Loss tangent of dielectric material
V	voltage
G	Gain
E	Electric field
ρ	Charge Density
Z_{in}	Input impedance
Z_{out}	Output Impedance
Z_1	Quarterwave (λ/4) Transformer Impedance
Z_0	Characteristic Impedance (Real) of the Input Transmission Line
ε_r	Relative Permittivity
ε_{eff}	Effective Relative Permittivity
f_0	Resonant Frequency, Operating Frequency
ΔL	Fringe factor
R_{in}	Resistance at the edge of the patch

π	A constant (=3.1416)
Ω	Ohms
VSWR	Voltage Standing Wave Ratio
f/b	Front to back ratio
σ	Conductivity
θ	Angle
S_{11}	S-Parameter that represented an input reflection
$^\circ$	Degree
SNR	Signal to Noise Power Ratio