DESIGN A 3.5 ANTENNA FOR DUAL BAND APPLICATIONS

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To my mother and father

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My brothers

For your infinite and unfading love, sacrifice, patience, encouragement and best wishes

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ABSTRACT

In the wireless world today, the antenna design facing many problems and issues those need to be solved immediately to fulfil the user needed. The problems involved in antenna design such as in some applications space is very limited so it need to be in compact size, challenges to make the antenna broadband and now dual band issues. To achieve the objective of this project, the design process is done such as calculation, simulation and fabrication. Firstly the basic shape structures are designed at frequency 2.4 GHz based on radiating structure 5 and 5.2 GHz based on radiating structure 3. Then both structures are combined to achieve the dual band. In this project, the technique that has been used to achieve dual band is by designing the 3.5 shaped by using microstrip, planar and coplanar waveguide structure. Then, the changes on the position of radiating structure 3 have been carried out to investigate the effect for dual band. After that, each antenna parameter such as return loss, bandwidth, gain, directivity and radiation pattern was simulated using CST Studio Suite software. The parametric study is done for each design parameter for all design aspect. Next the planar and coplanar waveguide designs are fabricated using chemical etching technique. Lastly the antennas that have been tested using the Network Analyzer, Field Fox Analayzer and antenna measurement systems to measure the antenna parameter such as return loss, radiation pattern and gain.

ABSTRAK

Dalam dunia tanpa wayar hari ini, reka bentuk antena menghadapi banyak masalah dan isu-isu yang perlu diselesaikan dengan segera untuk memenuhi pengguna yang diperlukan. Masalah yang terlibat dalam reka bentuk antena seperti dalam ruang aplikasi beberapa sangat terhad, jadi ia perlu berada dalam saiz yang kompak, cabaran untuk membuat antena jalur lebar dan kini isu band dua. Untuk mencapai objektif projek ini, proses reka bentuk dilakukan seperti pengiraan, simulasi dan fabrikasi. Pertama struktur bentuk asas direka bentuk kekerapan pada 2.4 GHz berdasarkan terpancar struktur 5 dan 5.2 GHz yang berdasarkan terpancar struktur 3. Kemudian kedua-dua struktur digabungkan untuk mencapai dwi-jalur. Dalam projek ini, teknik yang telah digunakan untuk mencapai jalur dwi adalah dengan merekabentuk berbentuk 3,5 dengan menggunakan struktur mikrostrip, pandu gelombang satah dan sesatah. Kemudian, perubahan ke atas kedudukan struktur terpancar 3 telah dijalankan untuk menyiasat kesan untuk band dua. Selepas itu, setiap parameter antena seperti kehilangan balasan, jalur lebar, keuntungan, ‘directivity’ dan corak sinaran simulasi menggunakan perisian CST Studio Suite. Kajian parametrik dilakukan untuk setiap parameter reka bentuk untuk semua aspek reka bentuk. Seterusnya reka bentuk pandu gelombang satah dan sesatah palsu menggunakan teknik punaran kimia. Akhir sekali antena yang telah diuji menggunakan Analyzer Rangkaian, Field Fox Analyzer dan pengukuran sistem antena untuk mengukur parameter antena seperti kehilangan pulangan, corak sinaran dan keuntungan.

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AMPS	-	Advanced Mobile Phone System
Bw	-	Bandwidth
c	-	Speed of Light
CPW	-	Coplanar Waveguide
CP	-	Circular Polarization
d	-	Thickness of Substrate
d	-	Distance between transmitter and receiver
dB	-	Decibel
dBd	-	Decibel Dipole
D	-	Directivity
DS-CDMA	-	Direct Sequence Code Division Multiple Access
DCS	-	Distributed Control System
EM	-	Electromagnetic
Eq.	-	Equation
f	-	Frequency
f_r	-	Resonant Frequency
Fig	-	Figure

FCC	-	Federal Communications Commissions
FM	-	Frequency Modulation
FNBW	-	First Null Beamwidth
G	-	Giga
G	-	Gain
G_r	-	Gain at Receiver
G_t	-	Gain at Transmitter
GPS	-	Global Positioning System
GPRS	-	General Packet Radio Service
GSM	-	Global System for Mobile
Hz	-	Hertz
HPBW	-	Half-Power Beamwidth
IEEE	-	Institute of Electrical and Electronics Engineers
IFA	-	Inverted-F Antenna
ISM	-	Industrial, Scientific and Medical
L	-	Length of patch or antenna layer
LAN	-	Local Area Network
MAN	-	Metropolitan Area Network
MB-OFDM	-	Multi-Band Orthogonal Frequency Division Multiplexing
Mbps	-	Mega bit per second
MHz	-	Mega
MMS	-	Multimedia Messaging Service

mm	-	millimetre
m/s	-	millisecond
PAN	-	Personal Area Network
PCB	-	Printed Circuit Board
PCS	-	Personal Communication System
PDA	-	Personal Digital Assistant
PIFA	-	Planar Inverted-F Antenna
P_r	-	Power Receive
P_{rad}	-	Power Radiated
P_t	-	Power Transmit
$p^{'}$	-	Polarization of antenna
RF	-	Radio Frequency
RSW	-	Reduced-Surface Wave
$\hat{S}$	-	Closed Surface Containing Antenna
$\hat{S}_{iso}$	-	Power Density
SMA	-	SubMiniature version A
SMS	-	Short Message Service
SWR	-	Standing Wave Ratio
Tx	-	Transmitter
UHF	-	Ultra High Frequency
UWB	-	Ultra-Wideband
VHF	-	Very High Frequency
VSWR	-	Voltage Standing Wave Ratio

W	-	Width of strip
WLAN	-	Wireless Local Area Network
WLL	-	Wireless Local Loop
λ_0	-	Wavelength
λ_g	-	Wavelength
ε_r	-	Dielectric Constant
ε_{ff}	-	Effective Dielectric
Ω	-	ohm

LIST OF APPENDIXES