

**DESIGN OF WIDEBAND ANTENNA WITH NOTCH
CHARACTERIZATION**

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DESIGN OF WIDEBAND ANTENNA WITH NOTCH CHARACTERIZATION

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DEDICATION

First of all, I would like to express my gratitude to Allah SWT for His Blessing and guidance. Next, I would like to dedicate my thesis to my family. Their endless love, encouragement and support are the most important things happened in my life. Furthermore, I would like to dedicate this work to my beloved project supervisor, Pm. Dr. Mohamad Zoinol Abidin Bin Abdul Aziz. He had given me a lot of guidance, encouragement, assistance and also always support me in completing this project. Finally, I would like to dedicate my thesis to all my lecturers and my fellow friends who always gives me support and guidance in any situation.

ABSTRACT

Wireless communication system is a system that transfer information between one point to another without using any wired or electrical conductor to connect with each other. Notch characterization is a method to neglect unwanted frequency in certain system so that other system can operate much better for antenna purpose. In designing a complicated wireless communication system or any other system, interference of frequency is one of the problem. This project is to design, simulate and fabricate wideband antenna with notch characterization for wireless communication system. One of the techniques is to create slot on the component where it will function as band rejection to avoid interference occur and increase the performance of the antenna. The U-shaped slot will be design in the CPW antenna to obtain the notch characterization for wireless communication system. The simulation for this design is using the CST Studio Suite software and fabricated using FR4 board. To avoid interference, the notch frequency will occur at WiMAX application (3.3-3.8GHz) and WLAN application (5.15-5.35GHz). The proposed antenna can achieve wideband above 2GHz and obtain two frequency notch at WiMAX and WLAN application.

ABSTRAK

Sistem komunikasi tanpa wayar adalah sistem yang memindahkan maklumat antara satu titik dengan yang lain tanpa menggunakan konduktor wayar atau elektrik untuk menyambung satu sama lain. Pencirian takuk adalah kaedah untuk mengabaikan frekuensi yang tidak diinginkan dalam sistem tertentu supaya sistem lain dapat beroperasi dengan lebih baik. Dalam merancang sistem komunikasi tanpa wayar, gangguan frekuensi adalah salah satu masalah. Projek ini adalah untuk merekabentuk, mensimulasikan dan memfabrikasi antena “wideband” dengan pencirian takuk. Salah satu teknik adalah untuk membuat takuk iaitu slot berbentuk U pada antenna CPW di mana ia akan mengabaikan frekuensi yang tidak diinginkan untuk mengelakkan gangguan berlaku dan meningkatkan prestasi antena. Simulasi untuk reka bentuk ini menggunakan perisian CST Studio Suite dan direka menggunakan papan FR4. Keperluan notasi akan berlaku pada aplikasi WiMAX (3.3-3.8GHz) dan aplikasi WLAN (5.15-5.35GHz.) Dalam keadaan sebenar, projek ini akan membantu pengguna untuk mendapatkan prestasi aplikasi yang lebih baik dengan mengasingkan frekuensi minat daripada mengganggu frekuensi lain.

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LIST OF SYMBOLS AND ABBREVIATIONS

FR4	:	Flame retardant 4
SMA	:	Sub Miniature Version A
c	:	Speed of light in free space
λ_g	:	The guided wavelength calculated at desired frequency
ϵ_{eff}	:	The effective dielectric constant
L_{eff}	:	Effective length
ΔL	:	Length extension
PS	:	Length of substrate
HS	:	Width of substrate
PGP	:	Width of ground plane
W	:	Gap between patch and insert feed
S	:	Width of microstrip feed line
TGP	:	Width of ground plane
D	:	Diameter of the circular patch
H1	:	Gap between substrate and circular patch

H2	:	Gap between ground plane and circular patch
TP	:	Thickness of the copper
W1	:	Width of U1-slot
L1	:	Height of U1-slot
L2	:	Length of U1-slot
LS	:	Length of strip
L3	:	Length of U2-slot
L4	:	Height of U2-slot
L5	:	Length of U3-slot
L6	:	Height of U3-slot
TT	:	Height of truncate
TS	:	Thickness of substrate
W2	:	Width of U2-slot

CHAPTER 1

INTRODUCTION

1.1 Project Background

Recent advancements in wireless technology growth in consumer demands have increased the popularity of wireless communication applications. This has been demand multiband and wideband antennas to support different technologies and standards. Personal communications Systems, Universal Mobile Telecommunication Systems, Wireless Local Area Network (WLAN), and Worldwide Interoperability for Microwave Access (WIMAX) are the most important wireless application. Antenna is an important part in wireless communication system which it converts the electronic signals to electromagnetic. It is an electromagnetic radiator, a sensor, a transducer and an impedance matching device with extensive applications in all communication, radar and also in Bio-Medical systems. As a transducer, the antenna

converts radio frequency (RF) electrical current into an electromagnetic (EM) wave of the same frequency.

1.2 Project Objectives

For this project, the objectives are to design, simulate and fabricate the wideband antenna with notch characterization. This project need to design an antenna which can obtain wideband above 2GHz, two frequency notch and achieve return loss for wideband above -10dB so that antenna are in good performance.

1.3 Problem Statement

Recently, wireless communication system has been rapidly developed. Infrared, mobile phone and Bluetooth are several types of wireless communication system. Information can receive faster and more when the data rate is high. Higher data rate frequency can be increase by using larger bandwidth. Larger bandwidth makes more data can be transfer and much faster. This will cause more quality video and best performance. Wide bandwidth is more useful compared to narrow bandwidth because it can reduce time, increase data transmit and give good quality. This is why wideband antenna is needed. Wideband antenna is a technology that can adapt with different frequency band to support different technologies and standards such as wireless local area network (WLAN) standard is designed for short range at one or two hundred meters from transmitter while Worldwide Interoperability for Microwave Access (WiMAX) is designed to obtain wider coverage operating at other frequencies.

Besides, larger bandwidth has its disadvantage which there is many frequency band and it causes interference between the systems such as WLAN and WIMAX.

So the frequency band that is not needed must be neglected. Notch is a band-rejection filter which neglected the interference frequency between narrowband and wideband. So notch is very suitable to differentiate neglected system that is not needed. So, wideband antenna with notch characterization can improve the data rate frequency and avoid interference between any frequencies.

1.4 Scope of Project

The first scope of this project is to design wideband antenna with notch characterization for wireless communication network. Next, CST software was used to design and simulate the wideband antenna with notch characterization. The basic parameters that was highlighted for this project are S_{11} parameter, antenna parameter, resonant frequency and return loss. After that, the fabrication process where material use are substrate which is FR-4 and copper. The dielectric constant, ϵ_r for the substrate is 4.6 and the thickness, h is $1.6mm$. For copper, the thickness is $0.035mm$. Lastly, for the measurement part of the project, there are several parameter must be measure which are antenna parameters, return loss, gain and radiation pattern that needed for this project.

1.5 Project Outline

In Chapter 1, the chapter introduces the project background, the problem statement of the project, the objectives of the project, the scope of the project and project outlines. This chapter purposely gives the readers a clear view on the purpose of the project and brief version of the thesis is all about.

Next, Chapter 2 is about literature review of the project. This chapter actually review and covers the previous works that have been done by other researchers. The