MICRO-STRIPS ELLIPTICAL RING PATCH ANTENNA FOR UWB APPLICATIONS

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This Report is submitted in Partial Fulfilment of Requirements for the Bachelor Degree of Electronic Engineering (Wireless Communication)

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Special dedicate to my beloved and understanding family, my kindhearted supervisor Dr Mohamed Saeed Jawad and to all my dearest and helpful friends

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ABSTRACT

This project is about to design a Micro-strips Elliptical Ring Patch Antenna at operating frequency 3.1GHz until 10.6GHz for Ultra Wideband (UWB) applications. UWB is a unique and new usage of recently legalized frequency spectrum. UWB radios can use frequencies from 3.1 GHz to 10.6 GHz - a band of 7.5 GHz wide. Each radio channel of UWB system can have a bandwidth of more than 500 MHz, depending on its centre frequency. This proposed antenna is consist an elliptical slot inside the half elliptical which is called as ring at the front of the substrate. While at the back of the substrate is the quarter ground plane. This proposed antenna is designed, fabricated and measured. To measure success of the design, the return loss, radiation pattern and gain is determined and compare to the specifications. The simulation results shows that the antenna can operate from frequency 2.9GHz until 10.9GHz while measured antenna is operate at frequency 3.5GHz until 6.8GHz and 8GHz until 9.8GHz yet still can operate at UWB frequency range.

ABSTRAK

Projek ini akan mereka “Mikro-strips Antena Bujur dengan Slot Cincin” beroperasi dijalur-jalur di frekuensi pengendalian 3.1GHz sehingga 10.6GHz untuk frekuensi yang sangat luas (UWB). UWB ialah satu penggunaan unik dan baru, baru-baru ini mengabsahkan spektrum frekuensi. UWB boleh menggunakan frequensi dari 3.1 GHz ke 10.6 GHz - satu kumpulan pancaragam 7.5 GHz luas. Setiap saluran radio sistem UWB boleh mempunyai satu lebar jalur lebih daripada 500MHz, bergantung di frekuensi pusatnya. Antena dicadangkan ini mengandungi satu slot bujur di dalam separuh bujur yang mana dipanggil sebagai cincin di depan substrat. Ketika di belakang substrat ialah satah bumi suku. Antena dicadangkan ini direka bentuk, dibina dan diukur. Untuk mengukur kejayaan reka bentuk, kehilangan balikan, pola sinaran dan keuntungan berazam dan berbandingan penentuan. Persembahan keputusan simulasi yang antena boleh beroperasi dari frekuensi 2.9GHz sehingga 10.9GHz ketika mengukur antena beroperasi di frekuensi 3.5GHz sehingga 6.8GHz and 8GHz sehingga 9.8GHz tetapi masih boleh dijalankan pada julat frekuensi UWB.

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km	Kilometer
mm	Milimeter

Ɛr	Dielectric Constant
GHz	Giga Hertz
λ	Wavelength
RL	Return Loss
UWB	Ultra Wideband
Wi-Fi	Wireless Fidelity
LAN	Local Area Network
IEEE	Institute of Electrical and Electronics Engineers
Pr	Reflected Power
h	Substrate Thickness
Γ	Reflection Coefficient
dB	Decibel
G	Gain
D	Directivity
BW	Bandwidth
η	Efficiency
PSM	Projek Sarjana Muda (Final Year Project)
RL	Return Loss
f_c	Center Frequency

f_h	High Frequency
f_l	Low Frequency
L	Length
W	Width
c	Speed of Light
S_{11}	Return Loss
CST	Computer Simulation Technology

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CHAPTER 1

INTRODUCTION

This chapter introduce on some general information about background study of antenna and Ultra Wideband (UWB) applications and wireless communication systems. Others are problem statement, objectives, scope and methodology of the project to develop an antenna for UWB applications.

1.1 Background of the Project

Antennas are a fundamental component of modern communications systems. Antenna is define as a transducer between a guided wave in a transmission line and an electromagnetic wave in free space. Antenna showing the property known as reciprocal antenna will maintain the same characteristics regardless if it is transmitting or receiving. When the signal is fed to the antenna, will emit radiation are distributed

in a certain way. Graphic displays of the relative distribution of radiation in space called the radiation pattern. [8]

UWB is broadly recognized as a modern generation of short-range wireless communications technology that will provide concurrently high data rate and low power consumption. UWB radios can use frequencies from 3.1 GHz to 10.6 GHz - wide band of 7.5 GHz. Each radio channel UWB system can have more bandwidth of 500 MHz depending on center frequency. The design of the antenna meet new challenges due to the distribution of a wide span of UWB band with special discharge mask. The need for a conventional antenna is used for UWB or impulse systems including a wide impedance bandwidth, transmit-receive transfer reactions are stable, and high radiation efficiency. [1-2]

UWB antenna used in UWB communications applications, the land penetrating radar, through wall radar, medical imaging, and precise location system There are many kinds of UWB antennas such as bow-tie, TEM horn, spiral, Vivaldi, and dielectric fit antennas way to design, dimensions of a single small electric and broadband antennas are covetable in its high-speed data communication system point-to-point, especially. Some planar UWB antenna has been developed to provide the wideband features. Elliptical-shaped planar monopole and dipole antenna is the most famous model of UWB applications in terms of suitable design, low cost, low profile, high radiation efficiency and better impedance stability. [3-5]

For microwave imaging radar-based, short pulse is transmitted from a single ultra wideband (UWB) antenna into the breast and any back scatter detected by the same antenna. This process will be repeated for different locations around the breast. The presence of tumour produces strong dispersion, and any reaction which may be construed to estimate the location of the tumour. Signal travel time at different locations recorded and gathered [6]. Like any other radar-based system, this system

does not require complex image reconstruction algorithms, and thus offer more detailed information than the method of microwave tomography imaging.

The antenna is used as a transmitter and receiver for UWB signals can allow a high level of resolution. This requirement limits the class of antennas that can be used. Large fraction of the bandwidth, low side- lobes and coupling with low (i.e, when the two antennas are used for the operation of the system) is a factor that should also be considered characteristic. Existing antenna used to detect breast cancer need to be lumped load balance for a wider bandwidth. [7, 8] However, in any reality case, it is difficult to perform almost the same medium to surround a patient's breast. This paper presents a micro-strip antenna design compact RF tracking system for cancer cells in the breast tissue of human. Operating two elements including breast models have indicated. [9]

1.2 Problem Statement

In recent years, antenna has been received much attention to the researchers in wireless communications systems. An internal small antenna usually suffer from degradation in performance. Most antenna design is applicable for WLAN, WPAN applications. A good design for UWB applications need high cost.

1.3 Objective

The objectives of this project are:

- To design, simulate and fabricate an efficient elliptical patch antenna for UWB applications.
- To evaluate the performances of the antenna and analyse it uses in UWB frequency bands.