DUAL BAND PRINTED MONOPOLE ANTENNA DESIGN FOR MEDICAL IMPLANTABLE COMMUNICATION SYSTEM (MICS) BAND

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ABSTRACT

The aim of this project is to design the dual band monopole antenna to be operated in the Medical Implant Communication Service (MICS) band which is from 402MHz to 405MHz and Forced Resonance Ultra-Short Pulse Laser (FRUSPL) 50MHz ~ 1GHz. But seems there are no any recommendation for the range, frequency chosen for Forced Resonance Ultra-Short Pulse Laser (FRUSPL) band is from 150~153MHz.The whole idea of this project is to learn design method for antenna that can be resonated more than one frequency. In this thesis a single antenna operating at two different frequencies is designed. Therefore, optimization needs to carry out on few parameters to achieve best impedance matching. In other word, best impedance matching can be relate with return loss or well known as $|S_{11}|$ below -10dB. This interpreted that majority of the signal transmitted reach at receiving area. In additional, the challenge in dealing with low frequency is the size of the antenna. The antenna size is inversely proportional to the operating frequency. The technique of size reduction for lower frequency antenna had learnt. In this project meandered style with branching for size reduction been introduced. Basically in this project, more focus given to monopole antenna besides other antennas. The basic characteristic of the monopole antenna is always referring to the ground as starting point. The height of antenna is $\frac{\lambda}{4}$ from the ground. In reality, before design hardware it's important to deal with software simulation. This is very important to avoid time waste and success in first time hardware designing. In this project, Computer Simulation System (CST) had been introduced.

ABSTRAK

Tujuan projek ini adalah untuk mencipta "Monopole Antenna" yang berfungsi pada dwi-frekuensi. Dimana frekuensi operasi pertama adalah pada 402MHz to 405MHz yang dikenali sebagai *Medical Implant Communication Service (MICS)*. Frekuensi operasi kedua adalah antara 50MHz ~ 1GHz yang dikenali sebagai *Forced Resonance Ultra-Short Pulse Laser (FRUSPL)*. Disebabkan tiada sebarang cadanagan untuk frekuensi FRUSPL, julat frekuensi antara 150~153MHz telah dipilih. Secara menyeluruh, konsep yang ingin diterapkan dalam rekacipta antenna ini adalah memahami cara-cara mencipta antenna yang boleh berfungsi pada lebih daripada satu frekuensi. Oleh yang demikian, haruslah kita memahami parameter-parameter yang mempengaruhi keputusan yang akan diperolehi. Selain, itu konsep galangan setara haruslah diteliti dan difahami supaya gelombang merambat dengan senuhnya tanpa sebarang pantulan dan pembaziran tenaga. Dalam erti kata lain, galangal setera juga lebih dikenali sebagai $|S_{11}|$. Nilai $|S_{11}|$ yang kurang daripda -10dB menunjukan antenna yang direka adalah mencapai kapasiti yang maksima untuk merambat gelombang ke arah penerima. Tambahan pula, mencipta antenna pada frekuensi yang rendah adalah membina antenna yang sangat panjang. Ini adalah kerana saiz antenna adalah berkadar songsang dengan panjang gelombang λ. Oleh yang demikian, teknik melipatkan antenna demi mengecilkan antenna adalah suatu tugasan yang mencabar.Pada amnya Monopole antenna mempunyai ketinggian $\frac{\lambda}{4}$ daripada paras bumi. Sebelum membuat prototaip, reka bentuk simulasi perlu dilakukan terlebih dahulu. Perisian simulasi yang digunakan dalam projek ini adalah Computer Simulation Technology (CST).

TABLE OF CONTENT

CHAPTER 1

INTRODUCTION

1.1 Introduction

Antenna is a device for radiating or receiving electromagnetic wave in free space. The antenna is the interface between transmission lines and free space. There are two types of the antenna available which categories as an active and passive antenna respectively. Passive antenna is the reciprocal devices and it can be used for transmitting or receiving. Where else, active antenna is not the reciprocal devices. Antennas are now common place objects in everyday life and their inception. There has been continuing interest in reducing their physical size.

1.2 Objective

This project is mainly on giving exposure to design antennas with low frequency and small in size. To design an antenna systematic approach is very important in order to obtain antenna with best performance. Besides, the objective of this project is to understand important parameters need to be considered during designing an antenna. In addition the needs for smaller antennas has become increasingly important in recent year because the effect of large scale integration of electronic components generally isolates the antenna as the most bulky, heavy and obtrusive part of the equipment

In this project, size reduction techniques will be applied to reduce the antenna size without effect its performance.

1.3 Scope of the project

There are various types of antennas available in current situation. But in this project, only monopole antenna will be considered. Antenna that design should be performing in desired frequency or frequencies. If the single antenna can be tuning to more than one frequency will considered as multi band antenna. Therefore, this antenna called as dual band antenna because it will resonate at two different frequencies. The aim of this project is to design the dual band antenna to be operated in the MICS band which is from 402MHz to 405MHz and FRUSPL 50MHz ~ 1GHz to kills viruses. But seems there are no any recommendation for the range, frequency would chosen for FRUSPL band is from 150~153 MHz

1.4 Problem statement

The antenna design has been widely applied in communication system since year 1800. But the radiation pattern also can be applied for medical purpose. This is because the energy propagates thru our body cell can generate energy pattern to break the composition of the human body cell to change its characteristic. The same idea can be applied for reverse engineering. This is curing the affected cells to get back to its original position. But the limitation is frequency selection to perform this task because don't know on the best resonance frequency can be use for on body application without giving any undesired side effects. In additional, the on body antenna should be very small. The reason is high frequency not suitable for body application due to prevent any hazardous. Therefore, antennas with smaller size with low frequency highly recommended. So, have to perform

optimization to tune the antenna to become as smaller it can. Rectangular antenna and square patch antenna not suitable for body antenna because it will produce big antenna for lower frequency which is not practical.

Besides, the antenna performance also changes from point to point. In other word SAR on the body will be vary for different parts of body. The liquid that flow into our body also differ instead of density. Therefore, a single antenna cannot perform with same level of conductivity for whole body.

1.5 Project Outline

The understanding of basic function of the antenna is very important. Even though, there so many techniques and types of the antennas available but techniques should be accordance to application. (Refer to Figure 1.0)

In this design, printed monopole antenna has been selected. After that operating frequency has been selected. Upon frequency selection, mathematical computation and understating of formulation needed to design a microstrip simulation. In this design, CST simulator has been used to perform the simulation and to get the best return loss $|S_{11}|$. After that, the performance of the antenna will be determined base on gain obtain by the radiation pattern to evaluate the performance. In final, fabricate the antenna and test with spectrum analyzer to analysis real data obtained.

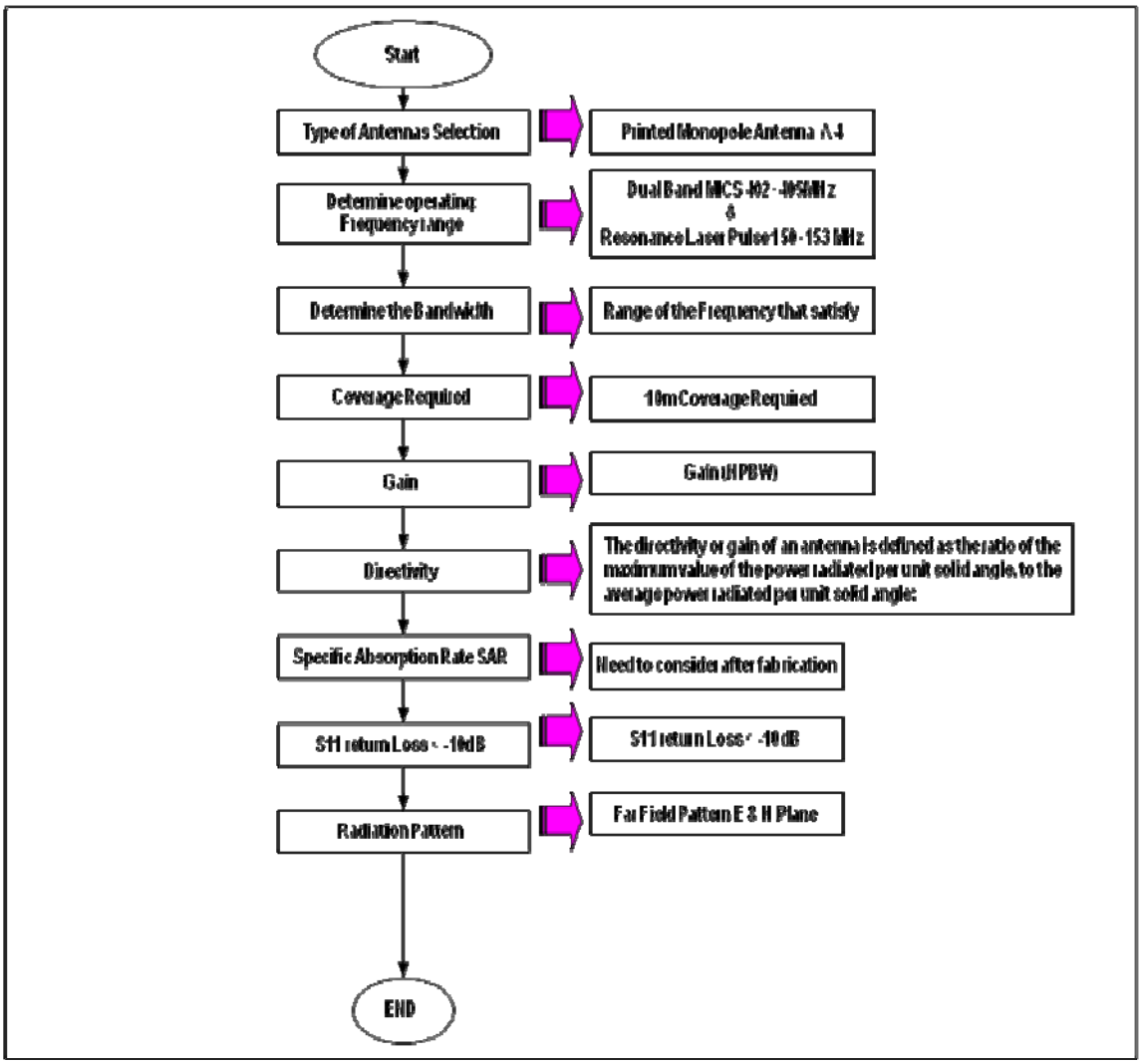

Figure 1.0: Project Outline

1.6 Summary

Antenna designing is one of the interest areas in RF theory. There is some proper approaches are required to achieve best design for antennas. Especially, the knowledge in operating and handling related software for simulation purpose and to obtain the result before transferred into fabrication. This is to avoid waste in term of time and money.

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