2.46 GHZ HELICAL ANTENNA DESIGN FOR WIMAX AND WIFI APPLICATION

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MAC 2013

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ABSTRACT

This project is to focus on to design of the basic geometry of helical antenna in small size at frequency 2.46 GHz. Several parameters dimensions and helical profiles were studied in order to obtain a suitable frequency range. The software that was applied for this simulation is the CST Microwave Studio (CST MWS) which is analytical tool that provides an accurate 3D EM simulation results for high frequency designs. From the simulation designs, the return losses were obtained. There were less than -23.9 dB. The results conclude that the helical antenna performed the properties of the 2.46 GHz frequency range. The simulation results obtained were S parameter, farfield, bandwidth and gain of the antenna. The measurement result shown that there was a slightly differences between the simulation results and measurement results. In a nutshell, all the results of revealed that the designed helical antenna performed at 2.46 GHz (Ultra High Frequency (UHF). At this 2.46 GHz can be applied to serve for a number of wireless applications including for WiMAX (Worldwide Interoperability for microwave Access) technologies.

CHAPTER 1

INTRODUCTION

1.1 Introduction

The idea of using an antenna was developed by Guglielmo Marconi [2]. Antennas are essential components used in systems such as radio broadcasting, communications receivers, cell phones, and satellite communications, as well as other devices such as garage door openers, baby monitors, RFID tags on merchandise, and others.

Distribution of the waves depends on the design of the antenna; the transmitting antennas of a radio station might be designed to emit waves in all directions, while an antenna used for radar or space communications would be designed to focus the waves in a single direction. The antenna has a characteristic frequency related to its physical dimensions; a wire of a given length may be inherently tuned to radio waves whose wavelengths are simple fractions or multiples of the length of the wire.

The helical antenna, consisting of wire wound around cylinder and feed by a coaxial cable, was first introduced by Professor Kraus [1]. In most cases, there are mounted over a ground plane. Helical antennas can operate in one of two principal modes: normal (broadside) mode or axial (or end-fire) mode. Helical antenna is a simple way of obtaining high-gain and a broad band of frequency characteristics. A helical antenna radiates when the circumference of the helix is of the order of one wavelength and radiation along the axis of the helix is found to be the strongest. This antenna is mainly directional. The radiation from a helical antenna is circularly polarized, that is to say that the Electromagnetic field rotates about the axis of the helix in the direction of the helix turn. Therefore, the radiation is either circularly polarized clockwise or counter-clockwise.

If one were to explore the field from a helical antenna in the direction of maximum radiation with a simple monopole or dipole antenna, one should find that the strength of the signal will remain the same as long as the dipole is perpendicular to the axis of the Helix. On the side of a helical antenna, the field is elliptically polarized. Therefore, the horizontal and vertical portions of the signal will not be of equal proportions.

In order to design and simulate the helical antenna in 2.46 GHz in this project, CST MICROWAVE STUDIO (CST MWS) is used. CST MWS is a specialist tool for the 3D EM simulation of high frequency components. CST MWS enables the fast and accurate analysis of high frequency (HF) devices included an antenna and multi-layer structures, SI and also EMC effects. The antenna itself is modelled as a planar structure.

While the initial investigation of helical antenna was very revealing, a more in-depth study of this antenna is required in order to understand the effects of the antenna parameters on the radiation characteristics. This indentified improved designs that provide better electrical performance (e.g., higher gain, lower axial ratio, etc,) and/or require smaller antenna size.

1.2 Objectives

This project is undertaken to achieve the following objectives:

1. To design the basic geometry of small size helical antenna at frequency 2.46 GHz.
2. To simulate the helical antenna in 2.46GHz by using CST Microwave Studio (CST MWS).
3. To Construct and measure the helical antenna.

In order to achieve these objectives, The CST microwave studio is used as the simulation tool. The result and performance of these newly developed of small shaped of UHF helical antenna in CST were investigated in details. The exact frequency (2.46GHz) result of simulation construction was studied.