DESIGN LTCC ANTENNA FOR BLUETOOTH APPLICATION

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UNIVERSITI TEKNOLOGI MARA

ANIS AMIRAH BINTI ZULKIFLI
FACULTY OF ELECTRICAL ENGINEERING
UNIVERSITI TEKNOLOGI MARA
40450 SHAH ALAM

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ABSTRACT

A miniaturized compact antenna is in demand due to the rapid progression of the Radio Frequency (RF) and also wireless of the telecommunication systems. By developing a compact and portable antenna will provides many advantages to the humankind. Designing a multilayer antenna by using the Low Temperature Co-Fired Ceramic (LTCC) provides the superiority of producing a compact, low profile and high performance antenna. A design of a compact novel Low Temperature Co-fired Ceramic (LTCC) antenna for the integrated Bluetooth application is presented in this paper. There are three types of novel antenna designed in this paper which are aperture coupler LTCC antenna, microstrip feed LTCC antenna and microstrip feed FR4 antenna. The specifications for the LTCC antenna designed to operate at a frequency of 2.45 GHz. Ferro A6S material type is used with the dielectric, ε_r 5.9, a substrate thickness, h of 0.096 mm and the copper thickness, t of 0.01 mm. The FR4 antenna is designed to operate at 2.45 GHz with a dielectric, ε_r of 4.7, a substrate thickness, h of 0.8 mm and the copper thickness, t of 0.035 mm. The simulation was done using the CST Studio Suite version 2011 software. The aperture coupler LTCC antenna was first designed to operate at 2.45 GHz. Each aperture coupler antenna performances have been analyzed by layer and also by placement of the ground to obtain the best design for this feeding method. The microstrip feed LTCC antenna and FR4 antenna were designed and optimized to get the best performance for these designs. These three types of antenna with different materials and feeding method are compared in terms of their sizes, return loss, and gains. The simulation results for the proposed aperture coupler LTCC antenna and microstrip feed LTCC antenna having a compact size of 25.6 mm x 22.0 mm and 32.5 mm x 23.5 mm. The microstrip feed FR4 antenna has the size of 38.4 mm x 28.18 mm. The aperture coupler LTCC antenna has a return loss of -17.883 dB and a maximum gain of 3.326 dB meanwhile the microstrip feed LTCC antenna has a return loss of -14.995 dB and a maximum gain of 2.614 dB. The results obtained for the microstrip feed FR4 antenna are -10.179 dB return loss, and a maximum gain of 2.692 dB.

Keywords—Multilayer, LTCC, CST CAD Package, return loss and maximum gain.

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CHAPTER 1

INTRODUCTION

1.1 Background of Study

A few antennas were invented in the early of 1980s. The experiments manifests the electromagnetic waves transmission uses these basic devices as a part of the demonstrated experiments. By World War II, the lives of the average person have been transformed due to the antenna ubiquitous via radio and television reception. The number of antennas in the United States represents one per household, and growth rivaling the auto industry during the same period. In the early of 21st century, the average person carries one or more antennas with them wherever they go due to the rapid development of mobile phones which every cell phone have multiple antennas, each antenna has its own application (eg: Bluetooth, GPS, and etc) [1].

Antenna plays a very important role in the telecommunications industry especially in wireless communication system as it converts the electronic signals (propagating in the RF Transceiver) into Electromagnetic Waves (Propagating in the free space) efficiently with minimum loss. Antennas are also used in a communication involving a missile or over a rugged mountain terrain in which cables are expensive and take a long time in order to install. The selection, position and design of the antenna suite give a big influence on the performance characteristics of the parent system. There are many types of antennas, for examples microstrip patch antennas, slot antennas, dipole antennas, and parabolic reflector antennas [2]. Each antenna has its own