DESIGN OF 5GHz APERTURE COUPLED MULTILAYER MICROSTRIP PATCH ANTENNA WITH LTCC TECHNOLOGY

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ABSTRACT

A compact aperture coupled multilayer microstrip patch antenna for WLAN application is presented in this project. In this work, transmission line model is used to simulate an aperture coupled microstrip patch antenna that designed to operate in WLAN band at 5GHz frequency. This special feeding technique is implemented in the design to make it possible to obtain better performances and the configuration a broadband microstrip patch antenna can be realized. The goal of this thesis is to explore the dimension effects on aperture coupled antenna performance, to develop design and tuning procedure and to describe performance effects through electromagnetic principles.

The specification for the proposed patch antenna is it has a frequency of 5GHz, Ferro A6S LTCC substrate, an epsilon 5.9, a substrate thickness of 0.096mm and copper thickness of 0.01mm. The simulation was done using CST Microwave Studio 2011 software. Comparative study of simulated parameters like return loss, gain, directivity, bandwidth, Voltage Standing Wave Ratio and the radiation patterns for each antenna configuration were analyzed and presented in this thesis. The results were based on the 14% size reduction of the patch antenna compared to the conventional FR4 substrate.

From the results that have been presented, aperture coupled feeding method gave better performance in term gain which is improved approximately about 12.16% even though have narrow bandwidth compared to inset fed method. In term of bandwidth, the inset feed method results better percentage which is 54.18% better than using aperture coupled method.

TABLE OF CONTENT

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

High speed, broadband and high capacity indoor wireless local area network (WLAN) are becoming more predominant today and it is interesting to become familiar with some of wireless aspect designs that must be overcome [1]. Antenna system for WLAN has a wide bandwidth to accommodate high throughput rates. Beside that it is sufficient power capabilities to ensure adequate transmitted and received power levels maintaining constant robust communication links. However, radiated power intensity must not exceed safety limits and it has a narrow beamwidth to permit angle diversity usage. So obviously to be well known that planar antenna such as microstrip patch have good advantages over conventional antennas such as low profile, conformable to planar and non-planar surfaces, simple and low production cost [2].

There are numerous substrate that be used for the design of microstrip antennas, and their dielectric constant are usually in the range of $2.2 \leq \varepsilon_r \leq 12$ [3]. The dielectric constant of the substrate is closely related to the size and the bandwidth of the microstrip antenna. Low dielectric constant of the substrate produces larger bandwidth while the high of the dielectric constant of the substrate results is smaller size of antenna [2]. LTCC (low temperature co-fired ceramic) has many advantages such as its high temperature resistance, high thermal conductivity, low dielectric loss, the excellent characteristics for high frequency and high-Q, it also offers high-speed and functionality for