DESIGN OF MICROSTRIP PATCH ANTENNA WITH LTCC SUBSTRATE FOR K-BAND APPLICATION

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ABSTRACT

This thesis presented the design model and simulation of 2×1 microstrip patch antenna with multilayer LTCC substrate. The antenna was design and simulation for K-band application for the range from 18GHz to 27GHz. Design of this antenna consists a circular microstrip patch antenna array with multilayer LTCC substrate in order to minimize the size of antenna and increase the gain and bandwidth for antenna performance. The specification for the proposed array antenna is it has a frequency of 22GHz, Ferro A6S LTCC substrate, an epsilon 5.9, a substrate thickness of 0.096mm and copper thickness of 0.01mm. LTCC Ferro A6S was chosen as substrate compares to other because it has high relative permittivity and multilayer structure which result in a compact size antenna. This design was simulated using Computer Simulation Tool Microwave Environment Software. The performance of the antenna was evaluated in terms of bandwidth, gain, directivity, return loss, and Voltage Standing Ratio (VSWR).

In microstrip circular patch antenna with LTCC the best result that had been obtained is at layer 3, with the return loss is -26.45 dB, bandwidth is 439 MHz, the antenna gain is 5.57dB and the VSWR is 1.10. Persentage increase between layer 1 and layer 8, for the antenna bandwidth increase 63.95% while gain of antenna increase 33.86% at center frequency 22GHz.

Design microstrip circular patch antenna array with the distance between two elements are λ/4, λ/2 and λ showed the increase gain performance was depend on the distance between two elements. The persentage gain increase between the distance between two element λ/4 and λ at the layer 3 is 15% while λ/4 and λ/2 at layer 3 is 4.41%. In design microstrip circular patch antenna with silver conductor showed the best performance of antenna gain result tha has been obtained is at layer 3, with the return loss is -26.22dB, bandwidth is 459MHz, antenna gain is 5.59dB and the VSWR is 1.10. The best result perfromance at the design microstrip circular patch antenna with parasitic patch at layer 5, with the return loss is -16.27dB, bandwidth is 896MHz, the antenna gain is 5.73dB and the VSWR is 1.36. persentage gain increase between with parasitic and without parasitic at layer 1 is 26.3% while at layer 8 is 11.84% at center frequency 22GHz.

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CHAPTER 1

INTRODUCTION

This chapter discuss a brief about introduction of antenna and LTCC (Low Temperature Co-fired Ceramic) including the problem statements, objective and scope of work.

1.1 INTRODUCTION OF ANTENNA

An antenna is a divice for transmitting or receiving radio waves signal which is essential in radar communication systems [1]. The antenna are recently used by goverment and commercial applicaions of the wireless application. Microstrip antenna was referred to meet the requirement of antenna which the antenna should be low profile, light weight, low volume and broad bandwidth [2]. A Microstrip antenna had been commonly used because of its are simplicity structure, conformable to planar and non planar surface, inexpensive to manufacture using modern printed-circuit technology and they are very versatile in terms of frequency, polarization, pattern and impedance.[3]

1.2 INTRODUCTION OF LTCC (Low Temperature Co-fired Ceramic)

Low temperature co-fired ceramic (LTCC) can be defined as a multilayer structure. In this context 'co-fired ceramic' means that the ceramic support structure and any conductive, resistive, and dielectric materials, and 'Low temperature' means the temperature is less than 1000 °C. LTCC was widely used in wireless communication for next wireless communication because in wireless application are requiring low loss at high frequency and good characteristic comparative to cost[4]. Beside that LTCC are also used in military, spance environments and automotive industry.