DESIGN OF 2X2 RECTANGULAR PATCH ARRAY ANTENNA ON LTCC SUBSTRATE AT 60GHZ

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ABSTRACT

This project is about the design of 2x2 array rectangular patch antenna with inset fed operating at 60GHz based on 4 layers low temperature co-fired ceramic (LTCC) technology. The defected ground structure, electromagnetic band gap, parasitic element structure and different spacing distance were used to evaluate the performance of the proposed antenna in terms of return loss, gain, directivity and bandwidth. The antenna was designed and simulated using CST Microwave Studio. The results showed that the proposed antenna have gain of 9.512dB, directivity of 9.355dBi and return loss of -47.794dB. Meanwhile when the spacing is varied to be more λ the antenna cannot be tuned at the desired frequency. The proposed antenna with DGS structure has gain of 9.570dB, directivity of 9.411dBi and S11 of -38.8831dB. The proposed antenna with EBG structure has gain of 9.375dB, directivity of 9.533dBi and S11 of -49.651dB.

TABLE OF CONTENTS

CHAPTER	TITLE	PAGE
	TITLE	1
	APPROVAL	11
	DECLARATION	111
	ACKNOWLEDGEMENT	1V
	ABSTRACT	V
	TABLE OF CONTENT	V1
	LIST OF TABLE	1X
	LIST OF FIGURE	X
	LIST OF ABBREVIATION	X11
1	INTRODUCTION	
	1.1 BACKGROUND OF STUDY	1
	1.2 PROBLEM STATEMENT	2
	1.3 OBJECTIVE	3
	1.4 SCOPE OF WORK	3
	1.5 SIGNIFICANCE OF WORK	3
	1.6 THESIS ORGANIZATION	3
2	LITERATURE REVIEW	5
3	METHODOLOGY	
	3.1 INTRODUCTION	9

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF STUDY

Antenna is defined as metallic devices that use to radiate and receive radio wave. There are multiple types of antenna that is used for many different applications. One of them is patch antenna. Patch antenna has the advantage of low profile, easy to fabricate compact size and low cost [1] which attracts a lot of attention. Patch antenna is construct by layering a material on top of another. The upper layer is the patch which is radiating element, the second layer is the substrate and the last layer is the ground of the antenna. The substrate layer plays an important role in determining the characteristic of the antenna that will be designed. One group of substrate family that draw much attention lately is Low Temperature Co-Fired Ceramic (LTCC). LTCC offers some advantage such as its able withstand high frequency, excellent conductive material and flexible in design. The substrate dielectric constant is ranged from $2.2 \leq \varepsilon_r \leq 12$ [1]. LTCC substrate is considered to have higher dielectric constant which produce thinner layer. Thin layer substrate is able to minimized undesired radiation and coupling which is desired for microwave circuit and besides that it also produces smaller antenna size [1].

The response of antenna can be monitor in several different forms such as return loss, Voltage Standing Wave Ratio (VSWR), radiation pattern, gain and directivity. With basic design of antenna, the responses is