

**2 BY 2 CIRCULAR ARRAY PATCH ANTENNA ON  
METAMATERIAL WITH 2 DIFFERENT DEFECT  
GROUND STRUCTURE (DGS) FOR WiMAX  
APPLICATION**

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## ABSTRACT

Metamaterial is the popular technique that is widely used in designing antenna especially in Microstrip Antenna to enhanced performance of miniaturized antenna systems. The purpose, as with any electromagnetic antenna, is to launch energy into free space. However, this class of antenna incorporates metamaterials, which are materials engineered with novel, often microscopic, structures to produce unusual physical properties. This project presents a 2 by 2 Circular Array Patch Antenna on Metamaterial with 2 Different Defect Ground Structure for WiMAX application using metamaterial technique. It's operate at 5.8GHz and the construction of 2 different shape Defect Ground Structure at ground plane contributes the metamaterial features to the antenna. Conventional array antenna and Metamaterial antenna with Defect Ground Structure has been simulated, fabricated and measured. The simulation design has been done using Computer Simulation Technology (CST) microwave studio and both antenna were fabricated on FR4 substrate with permittivity,  $\epsilon_r = 4.7$  and thickness 1.6mm height. The fabricated of the Antenna were measured using R&S®ZNB Vector Network Analyzer (VNA). Comparison between without DGS and 2 different design of Metamaterial antenna has been made and of course Metamaterial antenna proof that it is better than conventional.

The results show that the circular shape and square shape antennas is able to produce the metamaterial features. It enhances the performance of the conventional antenna in terms of return loss is 56%, gain is 4.8% and bandwidth is 13%. This metamaterial antenna is suitable for small range broadband application because it has a smaller bandwidth and high gain. The change in frequency value between simulated and fabricated antenna were stated and concluded as the common factor between both with the count of losses and human error.

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# **CHAPTER 1**

## **INTRODUCTION**

### **1.1 INTRODUCTION**

A summary of this project is presented in this chapter. Objective of this thesis is described briefly. It will discussed the strategy and the project implementation. Finally, at the end of this chapter provide the overview of this thesis.

### **1.2 BACKGROUND OF STUDY**

Nowadays in wireless communication system, antenna is an important role. Without the antenna the signals cannot be able to transmit out or too received. The raise of using microstrip for antenna has been due to the several advantage of microstrip[2].

Arrays of microstrip antennas have received much interest since the last period since of the superiority such as low cost, light weight and easy to fabricate and integrate. Microstrip are also