CHARACTERIZATION OF 5G ANTENNA AT 38 GHz

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PROJEK SARJANA MUDA II

Tajuk Projek : CHARACTERIZATION OF 5G ANTENNA AT 38 GHz

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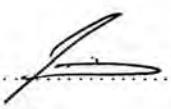
Signature : 

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DEDICATION

Special dedication to my lovely parents, Farakkasi bin Labundu and Isawami binti Lateddu, my siblings, my kind hearted supervisor Dr. Imran bin Mohd Ibrahim, all lectures in Faculty of Electronic and Computer Engineering and to my dearest friend.

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ABSTRACT

Nowadays, the antenna is very important in wireless communication system. This project is designing microstrip antenna array by using millimetre wave technology. Microstrip patch antenna have a low profile, simple and low cost. This type of antenna can be used in many application such as satellite, radar, and wireless communication. The purpose of this project to design high gain antenna used for the 5G application. This project started analyses the single patch antenna then follow by 2x2, 4x4, and 8x8 antenna array. The design of 2x2, 4x4, and 8X8 microstrip array antenna at 38 GHz using transmission line model and coaxial feed. The antenna simulated using CST software. The length of the gap and substrate thickness are adjusted to meet desired frequency. The gain and beamwidth of 8x8 microstrip array is 22.7 dBi and 8 degrees respectively.

ABSTRAK

Sejak kebelakangan ini, antenna memainkan peranan penting dalam komunikasi tanpa wayar. Projek ini direkabentuk dengan mengunakan teknologi gelombang milimeter. Mikrojalur antenna mempunyai ciri-ciri seperti kos rendah, mudah dan *'low profile'*. Antenna jenis ini banyak di gunakan dalam aplikasi satelit, radar dan komunikasi tanpa wayar. Tujuan projek ini adalah untuk menghasilkan antenna gandaan yang tinggi untuk di gunakan pada aplikasi 5G. Projek ini bermula dengan menganalisis satu antena mikrojalur di ikuti dengan 2x2, 4x4 dan 8x8 antena mikrojalur. Rekabentuk 2x2, 4x4 dan 8x8 antena pada frekuensi 38 GHz menggunakan transmisi model dan teknik coaxial. Simulasi antenna ini adalah menggunakan perisian CST. Panjang *'gap'* antenna dan ketebalan substrat boleh mengawal frekuensi yang ditetapkan. gandaan dan alur lebar antenna mikrojalur 8x8 adalah masing-masing 22.7 dBi dan 8°.

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LIST OF ABBREVIATION

1G	-	**One Generation**
2G	-	**Second Generation**
3G	-	**Third Generation**
4G	-	**Fourth Generation**
5G	-	**Fifth Generation**
CST	-	**Computer Simulation Technology**
CPW	-	**Coplanar Waveguide**
EO	-	**Electro-Optic**
ETSI	-	**European Telecommunication Standard Institute**
FNBW	-	**First Null Bandwidth**
HPBW	-	**Half Power Bandwidth**
LTE	-	**Long Term Evaluation**
METIS	-	**Mobile and wireless communications Enablers for the Twenty-twenty Information Society**

QPM-	**-**	**Quasi-Phase Matching**
SIW	**-**	**Substrate Integral Waveguide**

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CHAPTER I

INTRODUCTION

1.1 Project Background

Communication technology has grown to become a part of our lives. This technology has changes our lives dramatically from 1G to 4G communication. Now we are trying to come out with 5G communication to enhance the previous communication technology. 5G communication will be commercialized in 2020 and it has the ability to send Giga Byte data per second and faster than 4G communication. For the future communication technology, people can use a smartphone to work anywhere and anytime. In this project, we are focusing on basic antenna theory to understand how it operates.

A lot of research in order to produce 5G communication. METIS is one of the biggest projects with objective toward 5G building and system [1] funded by European Commission which is a start in November 2012. This study focusing of millimetre waves antenna system. This system operates at high frequency.

To make our imagination become reality, we are trying to design an antenna for 5G communication at 38 GHz. This project using Computer Simulation Technology (CST), it will analysis the important part of the antenna such as return loss, radiation pattern and so on. By designing an antenna 5G communication, we can analyse the performance characteristic of antenna 5G communication at 38 GHz.

1.2 Problem Statement

Communication technology is the most vital technology. Today the world is facing 4G communication in many countries which is provided a lot of advantages to the user, for example, the LTE service. However, the user's demand on the high data rate, high speed, and low latency. This technology required larger bandwidth, high gain, narrow beam and high-efficiency Hence to fulfill the 5G technology, future antenna 5G is needed. The frequency of 38 GHz was been choose to increase the capacity as well as to increase the antenna gain which is larger than 20 dBi. The microstrip antenna is used due to the low cost, simple, and easy to fabricate. Therefore, by designing microstrip antenna array it will help to solve this problem.

1.3 Objective

The objective of the project is to design the Microstrip Antenna Array with high gain (>20 dBi) for 5G application at 38 GHz.

1.4 Scope of Project

To design microstrip antenna array for 5G application at 38 GHz, the studies are based on basic microstrip antenna and millimeter wave technology. The project developing using Computer Simulation Technology (CST). This project includes calculation, design, and simulation to get the specification of 5G antenna. This design refers to European Telecommunication Standard Institute. Finally, design and analyse microstrip antenna array to get high gain (>20 dBi).

1.5 Thesis Organization

This study consists of five chapter. Chapter one talk about the introduction of the antenna at 38 GHz for 5G communication. This concern leads to study on fundamental of the antenna in order to design it. Next, chapter two basically focus on previous study or literature review on designing 5G antenna. Chapter three discuss methodology. This chapter includes simulation of 5G antenna at 38 GHz. After that, chapter four focused on result and discussion from simulation and compare them. Conclusion for this project and future developments were briefly on chapter five.

CHAPTER II

LITERATURE REVIEW

2.1 Introduction

A literature review is a text of a scholarly paper, which includes the current knowledge, including substantive findings, as well as theoretical and methodological contributions to this project. This chapter reviews of articles, books and journals to understand the concept that needs to know in order to complete this project.

2.2 History of Communication

The brick phone was launched in 1973. It is the first generation (1G) phone, the start of personal mobile communication which is in the analog signal. Second generation (2G) communication debuted in 1991. 2G is a digital signal that allowed the user to transmit data like a text message. In 2001, the third generation (3G) start to