# DESIGN OF ULTRAWIDEBAND MICROSTRIP ARRAY ANTENNA FOR 5G COMMUNICATION

**WAN NUR LIANA BINTI WAN MOHD DIN**

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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# DESIGN OF ULTRAWIDEBAND MICROSTRIP ARRAY ANTENNA FOR 5G COMMUNICATION

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**This report is submitted in partial fulfilment of the requirements for the degree of Bachelor of Electronic Engineering with Honours**

**Faculty of Electronic and Computer Engineering**
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Sesi Pengajian : 2021/2022

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# APPROVAL

I hereby declare that I have read this thesis and in my opinion this thesis is sufficient in terms of scope and quality for the award of Bachelor of Electronic Engineering with Honours.

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# DEDICATION

This project is devoted to myself, as an engineer student, and this is the first of my projects ever, as I am currently studying and attempting to accomplish this project. It is also dedicated to my mother and father, who showed me that even the most difficult endeavour can be finished if approached patiently and one step at a time. Finally, I would want to express my heartfelt gratitude to my project supervisor, Dr. Maizatul Alice Binti Meor Said, and to all my friends for being such pillars of support throughout this project's journey.

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# ABSTRACT

Wireless technology is currently a rapidly evolving technology that has a significant impact on social life. This non-wired technology necessitates an examination of the need for antenna development, as the antenna is the primary device for this technology. In the current research trend, antenna research is rapidly progressing, resulting in many antennas designs in modern wireless technology because it allows a single antenna to be used in multiple systems. Five Generation (5G) wireless technology is currently the next generation of wireless technology, with many advantages such as higher data rates, greater reliability, network scalability and flexibility, incredibly fast, super real time, improved efficiency, and excellent service in congested areas. This research focuses on an array antenna operating at 3.5 GHz. In this study, several designs for an optimal antenna will be chosen and manufactured. The design, which is light in weight, low in cost, and has a wider coverage area, will be tested to ensure that it meets the requirements so that it can be used by our local rescuers in the future. CST Studio Suite has been used as the simulator and the results was measured through Network analyzer.

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# ABSTRAK

*Teknologi tanpa wayar pada masa ini merupakan teknologi yang berkembang pesat yang mempunyai kesan yang besar terhadap kehidupan sosial. Teknologi bukan berwayar ini memerlukan pemeriksaan tentang keperluan untuk pembangunan antena, kerana antena adalah peranti utama untuk teknologi ini. Dalam aliran penyelidikan semasa, penyelidikan antena sedang berkembang pesat, menghasilkan banyak reka bentuk antena dalam teknologi wayarles moden kerana ia membenarkan satu antena digunakan dalam berbilang sistem. Teknologi wayarles Lima Generasi (5G) kini merupakan generasi teknologi wayarles yang akan datang, dengan banyak kelebihan seperti kadar data yang lebih tinggi, kebolehpercayaan yang lebih tinggi, kebolehskalaan dan fleksibiliti rangkaian, sangat pantas, masa nyata super, kecekapan yang dipertingkatkan dan perkhidmatan cemerlang di kawasan yang sesak. Penyelidikan ini memfokuskan pada antena tatasusunan yang beroperasi pada 3.5 GHz. Dalam kajian ini, beberapa reka bentuk untuk antena yang optimum akan dipilih dan dihasilkan. Reka bentuk yang ringan, kos rendah, dan mempunyai kawasan liputan yang lebih luas, akan diuji untuk memastikan ia memenuhi keperluan supaya ia boleh digunakan oleh penyelamat tempatan kami pada masa hadapan. CST Studio Suite telah digunakan sebagai simulator dan hasilnya diukur melalui Penganalisis Rangkaian.*

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# LIST OF SYMBOLS AND ABBREVIATIONS

| | | |
|---|---|---|
| 5G | : | 5 Generation |
| CST | : | Computer Simulation Technology |
| VNA | : | Vector Network Analyzer |
| FR-4 | : | Flame Retardant 4 |

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# CHAPTER 1

# INTRODUCTION

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## 1.1 Introduction

The advancement from first generation (1G), second generation (2G), third generation (3G), fourth generation (4G) (LTE-A), and fifth generation (5G) wireless technologies has increased their popularity in recent years (5G). Demand for high-speed data drives this revolution and progress. Antennas are used as a front-end in the creation of communication networks.

Currently, the world is moving towards 5G communication technology. This 5G technology capable of delivering a It provides 10 to 100 times faster internet than 4G technology, as well as improved connection. The older antenna version may not be able to meet the requirements for 5G mobile communications. The efficiency of

mobile internet connections via 5G makes energy consumption lower on devices. Determining the gain, bandwidth, return loss, and radiation pattern of an ultrawideband microstrip array antenna for 5G communication is the purpose of this study. The antenna is designed using CST studio software, which is then manufactured using etching and UV printing techniques. This project is concentrating on 5G communication at 3.5 GHz.

**Figure 1: 5G**

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## 1.2 Problem Statement

Due to reduced latency, high speed data transfer, and tremendous traffic, 5G antennas are in high demand. Celcom, TM Net, and Umobile in Malaysia conduct 5G experiments. In addition, communications antennas must be thin and compact to fit in electronic gadgets.

The Internet of Things (IoT) will improve our quality of life. Things will be outfitted with sensors, allowing them to communicate, share data, and act. Taking this a step further, the 4G cellular network will soon be unable to handle an overburdened network due to a projected surge in the number of devices connected to the internet. Therefore, 5G technology is required to implement a faster, more reliable, and more efficient mobile network. ' In addition, it is necessary to enhance the overall quality of the experience.

It is important to note that 5G is the future, and study into it is incredibly vital. Despite this, no worldwide standard for 5G technology has been established yet. When Since 5G antennas only operate if they are compatible with the Soon, real 5G technology and architecture will be used, but there are still a lot of problems that need to be solved.

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Currently, demand for various types of advanced and high-performance antennas is increasing, and most antennas on the market are unable to meet those high requirements for 5G applications. As a result, by upgrading 4G cell frameworks to 5G cell frameworks that use high-frequency transmissions, remarkable transmission capabilities, and considerable data rates are more easily achieved. Second, a UWB antenna was chosen to meet the project's requirements because it can operate between 3.0GHz and 10GHz, which is compatible with 5G characteristics. Furthermore, ultra-wide band (UWB) systems have recently gained popularity due to their advantages,

which include the ability to transfer large amounts of data at a low cost and in a compact form factor. Furthermore, UWB is used to replace the multi narrow band antenna, which can be effective. Hence, the purpose of this project is to design an antenna which can fulfil the 5G requirement. Furthermore, the ultrawideband antenna used because its more coverage and not just focused on one frequency only. The array antenna be used to increase the overall gain.

## 1.3 Objective

There are two main objectives of this project work enlisted as follows:

I. To design the Ultrawideband Microstrip Array antenna at 3.5Ghz for 5G applications

II. To analyze the performance of the array antenna including gain, return loss, bandwidth and radiation pattern through fabrication and measurement results.

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## 1.4 Scope Of Project

The work is divided into five stages:

**Stage 1: Review of Literature**

This stage entails revising and analyzing previous works on substrate materials and their impact on antenna characteristics and performance.

**Stage 2: Specifications and synthesis of materials**

Based on the antenna principle, as well as ultrawideband antenna and its applications in a variety of industries.