CHAPTER 1
INTRODUCTION

1.1 Background

Antennas are devices that send and receive wireless signals. They are very important for wireless communication, which allows people to access many services without wires. Wireless communication is very useful for countries like Indonesia, where building wires is expensive and difficult. One kind of antennas is the microstrip antenna, which is a thin metal patch on a flat board. Microstrip antennas are cheap, easy to make, and can be attached to other devices. But they also have some problems, such as low power, low quality, and small range. So, many researchers have tried to make microstrip antennas better by using different methods, such as cutting holes, adding parts, changing shapes, and using new materials.

One way to use microstrip antennas is for WLAN, which is a network that connects devices in a small area using wireless technology. WLAN can provide fast data transfer, mobility, and convenience for users. WLAN works in different frequencies, such as 2.4 GHz, 5 GHz, and 6 GHz, depending on the rules and standards. The most common standards for WLAN are IEEE 802.11, which have different versions, such as 802.11a, 802.11b, 802.11g, 802.11n, 802.11ac, 802.11ax, and 802.11ay. Each version has different features, such as speed, mode, channel, and distance.

One challenge of making microstrip antennas for WLAN is to make them work in more than one frequency. This is called dual band or multi band operation. Dual band or multi band antennas can do more things, work with more devices, and avoid more problems for WLAN devices. For example, dual band antennas can work in both 2.4 GHz and 5 GHz, which can make the data faster and the signal clearer. Multi band antennas can work in more frequencies, such as 6 GHz, which can give more space and power for WLAN.

In Indonesia, WLAN is very popular and widely used, especially for home, office, and public places. According to the Indonesian government, the number of WLAN users in Indonesia was 171.17 million in 2020, which was 17.8 percent more than in 2019. The number of WLAN hotspots in Indonesia was 6.68 million in 2020, which was 23.4 percent more than in 2019. The demand for WLAN services in Indonesia is expected to grow more in the future, as more people use devices that

need wireless connection.

Therefore, making dual band or multi band microstrip antennas for WLAN applications in Indonesia is a good and important topic for research and development. The goal of this research is to make a dual band rectangular microstrip antenna of 5 6 GHz for wifi network in Indonesia. The antenna will use a rectangular patch with two pairs of holes on the opposite sides, connected by a thin line. The holes will make two frequencies at 5 GHz and 6 GHz, which will give a good range, power, and quality for WLAN applications. The antenna will use a FR4 board with a thickness of 1.6 mm and a dialectric constanta of 4.4, which are normal and cheap materials for antenna making. The antenna performance will be tested and measured using software and equipment. The antenna will be good for dual band WLAN applications in Indonesia with small size, simple structure, and low cost.

1.2 Problem Formulation

The growing demand in the Wi-Fi sector, with requirements for high data transfer rates, low latency, and ample bandwidth, poses a significant challenge. To meet these needs, wireless standards have evolved from the 802.11-1997 Standard to Wi-Fi 6 (802.11ax). Opting for the 5 GHz and 6 GHz frequency bands is ideal for Wi-Fi devices. These bands allow greater data transmission, lower latency, and wider bandwidth. While this choice sacrifices some connection range, the addition of dual-band capability ensures that if one band encounters issues, the other serves as a reliable backup, reducing the risk of lost connections.

1.3 Objectives

This study aims to develop a cost-effective dual-band rectangular microstrip antenna operating at 5 GHz and 6 GHz, tailored specifically for enhancing wireless network connections in Indonesia. The antenna design will focus on strategically positioned holes within a rectangular patch to enable resonance at both frequencies, aiming to improve signal quality and range for local network setups. Rigorous performance assessments will include frequency response testing, signal quality evaluations, and efficiency checks. By utilizing practical materials and testing methodologies, this research endeavors to create an antenna solution that addresses Indonesia's growing demand for reliable and budget-friendly wireless connectivity, particularly in local network environments. Ultimately, the goal is to deliver an optimized antenna design that significantly improves the accessibility and reliability

of wireless networks across Indonesia.

1.4 Scope of Works

The Scope of this proposal is.

- To gain VSWR below 2
- To get a gain value of 2 dBi
- To get a bandwidth value of 160 MHz

1.5 Research Method

The research methodology involves initial antenna design using electromagnetic simulation software to create a dual-band rectangular microstrip antenna for 5 GHz and 6 GHz frequencies. Prototyping with cost-effective materials like FR4 boards follows, leading to laboratory testing to measure frequency response, signal quality, radiation patterns, and power efficiency. Real-world testing in Indonesian local network settings validates the antenna's performance. Data analysis guides iterative design refinements, aiming to optimize antenna parameters. Validation through extensive testing and comparison with predefined criteria concludes the process, culminating in comprehensive documentation and reporting of findings, showcasing the antenna's effectiveness in enhancing wireless network connectivity within Indonesia.

1.6 Schedule and Milestone

The schedule and the milestones of this undergraduate thesis.

Table 1.1 Schedule and milestone of completing this undergraduate thesis.

No	Step Description	Duration	Time	Milestone
1	Literature study	1 Weeks	11 May 2024 to 18 May 2024	At least 15 good literatures are found
2	Do the antenna calculation	1 Weeks	19 May 2024 to 26 May 2024	to get the antennas images before doing the simulations
3	Simulation of the Antenna in 3D Modelling Software	3 Weeks	27 May 2024 to 17 June 2024	Simulating the antenna in the 3D Modelling Software to get a desired results
4	Making the Thesis	2 Weeks	18 June 2024 to 1 July 2024	create a thesis from what we get from the simulation and from the calculations