

# CHAPTER 1

## INTRODUCTION

### 1.1 Background

The technology is developing and increasing in this period of time. Especially, when it comes to the telecommunication devices. One of the telecommunication devices that people and the scientist try to invent and develop is Wireless Body Area Network (WBAN). WBAN is a special purpose sensor network designed to operate autonomously to connect various medical sensors and appliance, and this WBAN can be located inside or outside human body[1]. WBAN consists of a number of tiny sensor nodes and a gateway node used to connect to the external data base server. With the decreasing size and increasing capability of WBAN, this WBAN inevitable that small and portable devices would be developed for communications around human bodies [2].

One of the component for WBAN sensor is the antenna to perform its transmission and receiving the signal. The antenna that can be applied for WBAN sensor is microstrip antenna. WBAN needs the antenna such small dimension, light weight, ease realization, and low profile specification that can be beneficial in the implementation of antenna for WBAN in medical sectors [3]. The microstrip antenna can be designed with low frequency and radiation to purpose avoid the risk for human body. So it does not damage or change any part of human body structure while keeping its performance sufficient in satisfying the specified requirement [1]. The microstrip antenna has lots of design and shape. Planar Inverted-F Antenna is one of the microstrip antenna design and can be implemented for WBAN. Specific Absorption Rate (SAR)'s method is needed. SAR is a measure of how transmitted radio frequency energy is absorbed. This SAR is a method to know this antenna has a low radiation and save for human body.

Based on existing PIFA research, PIFA antennas can be designed to be a multi-band antenna where these antennas can work on certain frequencies and needs, such as WiMax and Wi-fi application [1][4][5]. This undergraduate thesis focused on PIFA to be an antenna that can produce two resonance frequency, based on the requirement of WBAN that following the standard of ISM [2]. PIFA antenna for WBAN is definitely effective. The specification of this antenna can solve and fulfil the needs, because this microstrip antenna can do its antenna function to transmit or

receive the signal performance [6]. The performance is save for human body with its low frequency and low radiation. PIFA Antenna can be a new innovation to be implemented on the WBAN [7].

This undergraduate thesis focused on design, simulate, fabricate, and measure the PIFA as microstrip antenna with a Dual-Band. The design of this microstrip antenna is a Planar Inverted-F Antenna (PIFA). PIFA is used for wireless circuitry implemented in microstrip. PIFA can decrease the occupancy required area and work in low frequency. The expected of this antenna can be worked in two frequencies, which this antenna is a Dual-Band Antenna. The frequencies are 900 MHz and 2.4 GHz for WBAN's configuration. The return loss is less than -10 dB.

## **1.2 Formulation of Problems**

The formulation of problem in this undergraduate thesis is WBAN is configured to human body. Which the antenna needs to be has small dimension, light weight, and low radiation so the antenna can be save for human body. The antenna is also has to be work for WBAN's configuration, where the WBAN resonance frequencies in 900 MHz and 2.4 GHz. The antenna has to be proved that is save for human body with SAR's method.

## **1.3 Purpose of The Research**

The purpose of this undergraduate thesis is to design and realize the compatible antenna on WBAN's configuration. The antenna is applied on data base external. The function of data base external is to transmit and receive the data from sensor that located outside or inside of human body. This undergraduate thesis is also to fulfil the requirement for final thesis for graduate from Telkom University.

## **1.4 Scope of Problems**

The scope of this thesis is as follows:

1. The undergraduate thesis is focused on design and the realization of the antenna, not the whole system of WBAN.
2. The undergraduate thesis is designing and realization of the PIFA antenna with two resonance frequencies, 900 MHz and 2.4 GHz as an antenna for WBAN.

3. Antenna design does not include the cover and shield for antenna.
4. The antenna parameters measured and analyzed such as Return Loss and Voltage Standing Wave Ratio (VSWR).
5. The focus of this undergraduate thesis are the value of return loss and VSWR, where the expected of value for return loss is less than -10 dB.
6. The antenna is not focused on installation WBAN, where the distance of this antenna is not reviewed.
7. Designing antenna simulation is using software.
8. This undergraduate thesis is not using any SAR's simulation and measurement.

## 1.5 Research Methodology

The stages of research methodology proposed in this thesis are carried out as follows.

1. Identification of Problems  
Identify problems by conducting literature studies related to microstrip antenna, PIFA, WBAN, and how to create the PIFA with slots to purpose the antenna can be worked in two frequencies.
2. System Planning  
The next step is to define the system planning. analysing the problem and find the solution to solve the problem.
3. Simulation  
The solution of the problem have to be tested and reviewed. Also, if in the simulation has a problem that must to be solved by finding out the problem and solution.
4. After the final design from simulation, the fabrication is needed to realize the PIFA antenna.
5. The comparison between simulation and fabrication measurement.
6. Conclusion  
Analyse the result of comparison, and make the conclusion and suggestion for this undergraduate thesis.

## 1.6 Structure of Thesis

The structure of thesis writing consist of several stages as follows:

- Chapter 2 BASIC CONCEPT  
This literature review is including WBAN, PIFA, Impedance Matching, Method to produce multi-band frequency.
- Chapter 3 SYSTEM MODEL AND THE PROPOSED METHOD  
Create the system design, simulation, optimization, and the final configuration for the fabrication.
- Chapter 4 RESULTS AND ANALYSIS  
This chapter contains the fabrication of PIFA antenna, the result of measurement, and the comparison between simulation and fabrication's result.
- Chapter 5 CONCLUSION AND SUGGESTION  
Create the conclusion and suggestion based on the data from the results that have been obtained on the Chapter 4.