

**UNIVERSITI TEKNOLOGI MARA
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**HIGHLY CONDUCTIVE AND
STRETCHABLE RADIATING
ELEMENT ANTENNA USING
SILVER NANOWIRES AND POLY
DIMETHYLSILOXANE
ELASTOMERS FOR BODY CENTRIC
WIRELESS COMMUNICATIONS
APPLICATIONS**

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ABSTRACT

In this project, involve an antenna with a feedline fed. First antenna was made with an inset-fed and it is of uncommon materials; Silver Nanowires and Polydimethylsiloxane. The conductive radiator used is Silver Nanowires (AgNWs) and for substrate is Polydimethylsiloxane (PDMS) elastomers. The desired antenna was designed to be use on body-centric wireless communications (BWCWs) applications specifically to work in Industrial, Scientific and Medical (ISM) band. The simulation of the antenna was simulated by using the Computer Simulation Technology software (CST). Based on other journals reviewed, the most common element used for the radiating patch for an antenna is usually copper because of its high conductivity and cost. However, when compared to silver, the electrical and mechanical properties of silver is better than copper. When applied pressure, stretching, or bending into certain point the surface of copper is cracked but not to silver. There are several efforts made by previous research where the researchers applied another layer on the top and bottom to reduce the surface cracking such as PDMS-Fe₃O₄ and plastic substrate, and then sandwiched the antenna. In this thesis, there are tests where the simulation has three types of conditions; flat, bending environment; on x-plane and y-plane. These conditions are tested for both antennas to see the effects if the antenna were to apply onto clothes (off-body) or skin (on-body) for wearable applications. As for the results, the resonance frequency for normal or flat environment of the designed antenna shows it is operating at 2.45 GHz with low power reflected. While bending conditions, it has a slight different compare to normal condition, but it is still consider working at ISM band. Other than that, other parameters such as farfield, bandwidth, VWSR, E-field, H-field and directivity are also compared.

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TABLE OF CONTENTS

CHAPTER	TITLE	PAGE
	AUTHORS DECLARATION	i
	ABSTRACT	ii
	ACKNOWLEDGEMENT	iii
	TABLE OF CONTENTS	iv
	LIST OF TABLES	vii
	LIST OF FIGURES	viii
	LIST OF SYMBOLS	x
	LIST OF ABBREVIATIONS	xi
1	INTRODUCTION	
	1.1 Overview	1
	1.2 Introduction	1
	1.2.1 Computer Simulation Technology (CST)	2
	1.2.2 Patch Antenna	2
	1.3 Problem Statement	3
	1.4 Objectives	3
	1.5 Scope of Work and Limitation	3
	1.6 Thesis Outline	4
2	LITERATURE REVIEW	
	2.1 Overview	6
	2.2 Different Types of Material Used	6
	2.3 Optimization/Modifications On Antenna	10
	2.4 Theory on Microstrip Antennas	11
	2.5 Parameters Fundamental of Antenna Analysis	14
	2.5.1 Return Loss	14
	2.5.2 Bandwidth	15

CHAPTER 1

INTRODUCTION

1.1 OVERVIEW

This chapter consists of the introduction, general ideas of the project, problem statement, objectives scope of work and limitation. Moreover, brief history, evolution and previous studies on the material used are also stated of antenna and its applications.

1.2 INTRODUCTION

An antenna is a device that has the capability either to transmit or receive electromagnetic energy. Over the years, antenna designing has expanded from the shape larger than a house in the 1960's [1] to being smaller than our palm as current time. The evolution of miniaturizing the size of antenna has been done [2] parallel to the modern time. Antenna has been used in remote controllers and now it is focusing more onto elastic and wearable applications for body-centric wireless communications (BCWCs) [2], specifically in the industrial, scientific and medical (ISM) band [3]. The propose material to be used in the project is silver nanowires (AgNWs) as the radiating element and polydimethylsiloxane (PDMS) for the substrate.

Semiconductor nanowires has been proven to be easier to fabricate with its excellent doping and morphology control [4]. Silver is a conductor which is used in in many applications [5]. The compositions of these metals, AgNWs is used as a radiating element in the flexible antenna as stated in literature [6-9]. These two materials showed that they have a good bending properties.

There were some types of substrate used these past years such as polyetherimide (PEI), polyethylene terephthalate (PET) and polymer ceramic [10]. These materials shared common properties for a flexible antenna which is low dielectric constant, low