# CIRCULAR PATCH ANTENNA USING METAMATERIAL

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# ACKNOWLEDGEMENT

In the name of Allah S.W.T, The Most Gracious and Most Passionate. All praise to him, Lord of the Universe. I am thankful to Allah S.W.T for his blessing that enables me to complete this project as planned.

First and foremost I would like to take this opportunity to express my deepest gratitude to my supervisor, Mr. Mohamad Huzaimy Jusoh, lecturer in the department of communication engineering for his guidance, constructive and keen interest in supervising this project. Other than that, a lot of thanks also is dedicated to my co-supervisor Mr. Asari Sulaiman for his assistance and idea in developing the project.

The most grateful are dedicated to my parent for great understanding and sacrifices. I also like to express my special thank you to my beloved family for their undying love, motivational support and prayer that gave me strange to complete this project.

The million thankful to all my friends towards laughter and tears that make the best life experiences of all. Last but not least, a lot of thanks are also for each individual who has given an ideas and cooperation either directly or indirectly to make this project success.

# ABSTRACT

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# INTRODUCTION

## 1.0 INTRODUCTION

This chapter consists of the introduction of metamaterial which includes the definition of metamaterial, and some history of metamaterial. This chapter also will cover definition on antenna and also microstrip antenna.

## 1.1 INTRODUCTION OF METAMATERIAL AND ANTENNA

Recently the ancient Greek prefix, meta (means "beyond"), has been used to describe the composite materials with unique features[1]. Metamaterial is an arrangement of artificial structural elements designed to achieve advantageous and unusual properties[2]. Theoretically studies was done in 1967 by V.G. Veselago a physicist from Lebedjev Physical Institute in Moscow[2-7]. He examined the propagation of plane waves in a hypotical substance with simultaneous negative permittivity and permeability[7]. The researcher found that the pointing vector of the plane wave is anti parallel to the direction of the phase velocity, which is contrary to the conventional case of plane wave propagation in natural media[7]. The researcher also come out with the concept of left handed (LH) material and described their distinct properties, such as a reversed Doppler effect, a reversed Snell law and reversed Cerenkov radiation[5]. Although he suggested certain exotic solutions like gyrotropic plasmas, they still were not quite suitable due to many complications and no clear experimental evidence was obtain in this direction[2]. Furthermore it is likely that they are no way to obtain negative permeability at optical or higher frequency[2]. Due to these issues Veselago just got little attention for his work. After 30 years later, Veselago work just got attention from world. In 2001, D.R Smith et al. fabricated a amterial sample by periodically arranging rods and split-ring resonators (SRR) into an arrays, and for the first time verified the real existence of left-handed material by observing a 'negative ' refraction of a microwave beam transmitted through a prism-shaped sample [5]. Started with this finding, a lot of efforts have been put to produce metamaterial and some of the efforts come out with a positive result. The