MINIATURIZATION OF PATCH ANTENNA THROUGH METAMATERIAL APPROACH

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ABSTRACT

This thesis is presents on investigating a method of reducing size through metamaterial approach for Wi-Fi application. A patch antenna has been designed as a prototype to measure the performance. The antenna resonates at 2.45 GHz. Metamaterial characteristics exhibits negative permittivity and permeability after introducing DGS structures by Nicolson-Ross-Weir (NRW) equations. A Simulation has been carried out using Computer Simulation Technology Microwave Studio (CST-MWS). A Vector Network Analyzer (VNA) was used to measure return loss, S11. The antenna was fabricated on Rogers RO3003 substrate with permittivity, εr=3.00 and thickness, h=0.75mm. The simulation and measurement results show that the metamaterial antenna improves the return loss S_{11} and size of the antenna reduces by 38.23% and 82.77% respectively compare to the conventional antenna.

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CHAPTER 1

INTRODUCTION

This chapter consists of a brief introduction about the background of the overall project including problem statement, objectives, scope of works and outline of this thesis.

1.1 Background

Recently microstrip patch antennas are widely used in satellite communications, aerospace, radars and biomedical applications due to its inherent characteristics such as light weight, low profile, low cost, mechanically robust, compatibility with integrated circuits and very versatile in terms of resonant frequency, polarization, radiation pattern and matching impedance. Microstrip antennas however face main weaknesses in terms of narrow bandwidth, low efficiency and relative large size [1,2].

Patch antennas are incorporated with different materials to overcome their drawbacks. There are many kind of materials were used to improve the performances of microstrip patch antenna. Among them, metamaterials are found to be the most suitable [3]. Metamaterials are also known as left-handed metamaterial (LHM) where the permeability and permittivity were simultaneously negative [4]. Negative permittivity means that the materials are physically unique, have unusual realizable response functions and may not be easily found in nature [5].