SIZE REDUCTION AND BANDWIDTH ENHANCEMENT IN METAMATERIAL ANTENNA

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UMI NAMIRAH BINTI ZAKARIA
FACULTY OF ELECTRICAL ENGINEERING
UNIVERSITI TEKNOLOGI MARA
40450 SHAH ALAM,
SELANGOR, MALAYSIA

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ABSTRACT

This thesis presents a design of metamaterial patch antenna incoperates with Electromagnetic Band Gap (EBG) structure for WiMax application. The patch antenna was fabricated on RO3003 substrate together with three circular EBG structure on ground plane. The RO3003 substrate has relative permittivity, $\varepsilon_r = 3.0$, and height, $h = 0.75$ mm. The patch antenna was designed to resonate at 3.5GHz. This metamaterial antenna is focusing on reducing the size and increasing the bandwidth. All simulations and measurements were done using Computer Simulation Technology Microwave Studio (CST-MWS) and Vector Network Analyzer (VNA) respectively.

The metamaterial characteristics were tested for the negative permittivity and permeability using Nicolson-Rose-Weir (NRW). The simulation results show that the metamaterial antenna has improved the return loss, S_{11} by 37.29% compared to the conventional antenna. The size of the metamaterial patch was reduced by 18.03% compared to the conventional antenna. The bandwidth was increased by 138.13% from the conventional antenna.

In the measurement, the resonant frequency of the antenna is slightly shifted from the actual frequency. The both antennas shifted to the 3.545 MHz frequency which represented the return loss (S_{11}) for the patch antenna with EBG and without EBG are -26.694dB and -17.874dB respectively.

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

Wireless communication has experienced an enormous growth since it allows users to access network services. WiMAX is the most rapid evolution and wide popularity in standard developed by IEEE (Institute of Electrical and Electronics Engineers).

Nowadays, one of the fastest growing segments in the telecommunication industries is microstrip antenna. Microstrip antennas are low profiles, conformable to planar and non-planar surfaces, simple and inexpensive to manufacturer using modern printed-circuit technology. Microstrip antenna consists of dielectric substrate, radiated patch and ground plane. The disadvantages of microstrip antennas are it has narrow bandwidth and low gain. The bottom layer of dielectric substrate is fully covered by conductors which is act as ground plane. The bandwidth and increase can be increase by the thickness of substrate layer but it will generate surface wave with low propagation that cause lost of power. It is consists of a very thin metallic strip (patch) placed a small fraction of a wavelength above a ground plane.