SIZE REDUCTION OF CIRCULAR MICROSTRIP PATCH ANTENNA THROUGH METAMATERIAL

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ABSTRACT

This paper recommends a circular microstrip patch antenna with DGS structure to be used in Wi-Fi application. The combination of a circular microstrip patch antenna with Defected Ground Structure (DGS) structures at the ground plane is proposed to reduce the size of antenna. The antenna has been designed to improve the performance. The patch antenna is designed to resonate at 2.45 GHz. Metamaterial characteristics with negative permittivity and permeability of the proposed DGS structures have been verified using Nicolson-Ross-Weir (NRW) method. A complete simulation has been done using the Computer Simulation Technology Microwave Studio (CST-MWS) version 2011. The design was fabricated on Rogers RO3003 with permittivity, ε_r=3.00 and thickness, h=0.75mm. The measurements have been carried out to verify the performance of antenna by a Vector Network Analyzer (VNA). The results show that the size of antenna was reduced by 67% compared to conventional antenna. The best return loss obtained from the design was -45.77976 dB. The measurement results also prove that metamaterial antenna exhibits a better return loss of about -24.62 dB and -23.72 dB respectively. The bandwidths for metamaterial and conventional antenna are 20 MHz.

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

Recently, microstrip patch antennas become the most demanding antenna based on their applications, which has some advantages such as light weight and low fabrication cost, and able to operate in high frequency range [1]. Nowadays, microstrip patch antennas are widely used in satellite communications, aerospace, radars, mobile radio and wireless communications[2, 3]. Microstrip antennas however have main drawback in terms of narrow bandwidth, low efficiency and relatively large size [4, 5].

The important topic in microstrip antenna is to obtain a broad bandwidth and to miniaturize the patch size [6]. The narrow bandwidth can be enhanced by increasing the substrate thickness; however, this will lead to a greater surface wave which will decrease the antenna efficiency and degrade the antenna pattern [7]. To overcome the drawbacks, microstrip patch antennas are incorporated with different materials to improve the potential parameters of the antenna. Among them, metamaterials are found to be most suitable[8].