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Miniaturized Dual Band Rectangular Patch Antenna on a Metasubstrate

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ABSTRACT—In this paper a new Miniaturized dual-band rectangular patch antenna on a metasubstrate is presented. The metasubstrate consists of a 2-cell metamaterial under the patch which works as a substrate with high magneto-dielectric characteristics. This coplanar waveguide fed antenna works in two frequency bands: (2.38-2.9 GHz) as a monopole antenna and (5.15-5.35 GHz) as a patch antenna, which cover WiFi bands. The patch dimensions (W×L) are 6×9.2mm, resulting in 50% and 73.6% miniaturization for the first and second frequency bands compared to conventional antennas designed for these bands.

KEYWORDS: Coplanar waveguide (CPW), metamaterial, metasubstrate, miniaturized patch antenna.

I. INTRODUCTION

Modern commercial communication devices should support different operating frequency bands such as Bluetooth (2400-2483.5 MHz), and WI-Fi (2400-2480 MHz , 5150-5350 MHz , 5725-5850 MHz), WiMAX (2500-2690 MHz , 3400-3690 MHz , 5250 – 5850 MHz). Therefore it is of the great importance to design an antenna operating in most of these frequency bands. Compactness is also a feature that is essential for these modern wireless systems.

Microstrip patch antennas have a lot of advantages which can be good for these communication systems. Their planar and low profile structure, simple fabrication, low weight and low cost have made a very popular area for antenna design in wireless communication devices. But limited choices of the size to make a resonance in the antenna, and small bandwidth of these antennas are their main constraints.

Conventional approach to miniaturize microstrip patch antennas is increasing the substrate permittivity (ε). Nevertheless, by doing so, most of the electric energy will be trapped in the dielectric material which results in narrow bandwidth and low radiation efficiency.

By using metamaterials in the antenna substrate as a metasubstrate with high permittivity (ε) and permeability (μ) [1], a more compact antenna can be achieved and the problem of high dielectric substrate will be overcome [1] -[5]. In [1], a period of metallic loops terminated to a series capacitor is used as a unit cell for realizing an artificial magneto-dielectric material, which is still hard to implement and costly. A periodic series of Spiral Resonators (SRs)