An Electrically Small Dualband Isotropic Antenna Using Folded Split Ring Resonators

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***Abstract*—This paper presents a dualband isotropic antenna for 880 MHz cellular and 2.4 GHz wireless local area network applications using three dimensional (3-D) folded split ring resonators (FSRR). Based on split ring resonator (SRR) and Interdigital capacitors (IDC), the electrical size of FSRR can be designed as compact size. The folded structure is applied to improve the radiation characteristics and SRRs are implemented on top and bottom plane for high band resonance. CST is used to simulate the designed dualband FSRR antenna.**

I. INTRODUCTION

In recent years, ambient electromagnetic (EM) energy harvesting technologies have become one of the important issues for the low power smart technologies such as Internet of Things (IoT) and smart skins. Since ambient EM energy is scattered randomly due to reflection and refraction, isotropic antennas with full spatial coverage can be attractive candidates for harvesting sustainable energy. As ambient EM energy can be scavenged in many bands, RF energy harvesting antennas are supposed to cover many bands. Also for compact size of energy harvesting systems, the electrical size of the antenna supposed to be small. In this paper, an electrically small isotropic dualband antenna based on folded split ring resonators (FSRR) which operates at 880MHz and 2.4 GHz bands is presented.

II. METHODOLOGY

The designed dualband FSRR antenna is shown in Fig. 1. Based on the split ring resonator (SRR) structures, the electrical size of the antenna can be miniaturized. The interdigital capacitors implemented at the gap of FSRR make the size more compact. Since the designed antenna shows poor radiation characteristics and input matching, the folded structure which uses magnetic coupling is applied to improve its radiation characteristics [1]. Then the second resonance path is implemented for dualband operation.

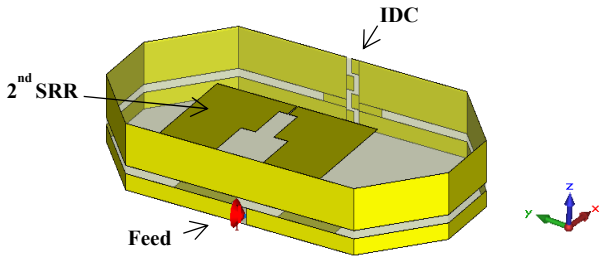

Fig. 1 Side view of the folded split ring resonator antenna with dualband operation

III. RESULTS AND DISCUSSION

The results show 1.9% and 6.5% fractional bandwidth at 880 MHz and 2.4 GHz respectively as shown in Fig.2. The electrical size is ka=0.54 and the gain deviation is 3.23dBi at its lower resonance. The total radiation efficiency is at least 80% at both bands. The designed antenna shows the possibility for the ambient energy harvesting applications.

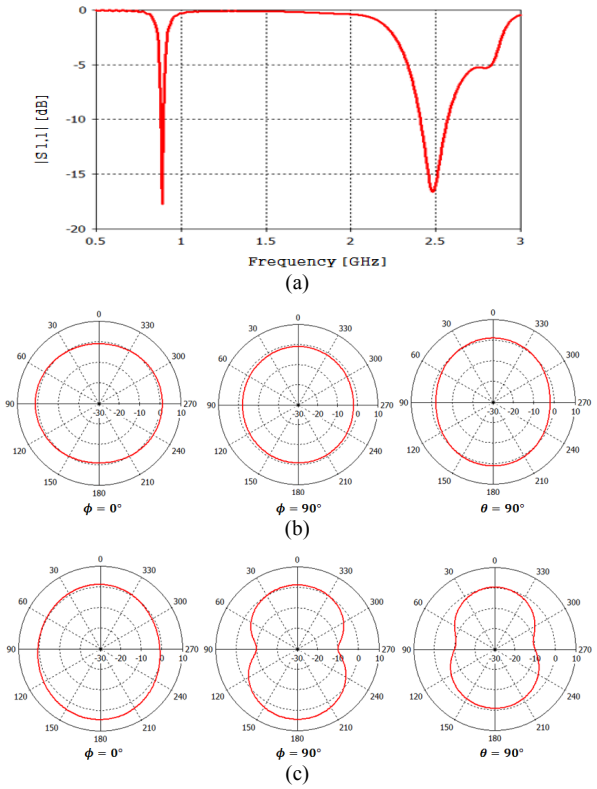

Fig. 2 (a) Simulated reflection coefficient and radiation pattern of folded split ring resonator antenna at (b) 880 MHz, (c) 2.4 GHz

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