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Design of novel perfect metamaterial absorber for Radio Frequency energy harnessing

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Due to the rapidly growing wireless communications and sensing applications, the frequency spectrum has already been saturated. Consequently, the abundance of Radio Frequency (RF) signals in the ambient environment made the concept of wireless energy harnessing to be emerged as an attractive solution to energize low-power wireless devices. In this study, a novel tuneable perfect metamaterial absorber (PMA) unit cell was designed by combining two C-shaped split-ring resonators (SRR) embedded with simple electronics circuitry. The feasibility of harnessing energy from 1.8 GHz signals was investigated through electromagnetic (EM) simulations. The design and numerical analysis of the proposed PMA structure is carried out with the aid of the commercially available EM simulation software, High Frequency Structure Simulator (HFSS). The proposed structure's capability to absorb EM energy as a perfect metamaterial absorber is studied. According to the simulation results, it shows a high absorption coefficient of around 99%. This verifies that the proposed tuneable PMA structure encompasses a high absorption of RF energy. It can be used for the harnessing of RF energy to power up low-power devices and wireless sensor networks.

Keywords: Electromagnetic energy, Metamaterial unit cell, Perfect metamaterial absorber, Radio frequency, Wireless energy harnessing

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