Wideband-Switchable Active Metamaterial Absorber

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Electromagnetic (EM) absorbers can minimize the transmitted and reflected EM waves and they can be used for electromagnetic interference (EMI), imaging systems and stealth technology. Recently, metamaterials were introduced for a thin and low-cost EM absorber applications by N. Landy *et al*. Metamaterial-based absorbers (MAs) show almost perfect absorptivity in spite of its thinness. However, these resonant type absorbers suffer from narrow bandwidth. In order to solve this problem, multi-resonance and lossy patterns using resistive inks or chip resistors have been used. Unfortunately, a multi-resonance approach has a lower absorption rate between resonant frequencies. The lossy pattern is hard to expect from numerical simulations due to the non-uniformity of ink distribution.

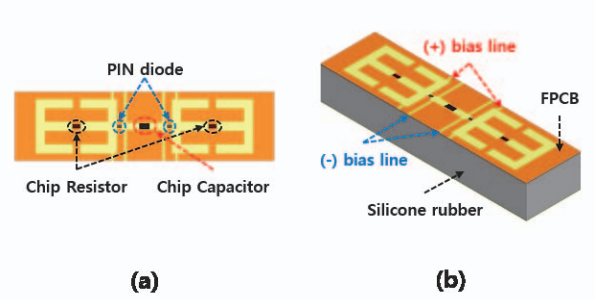

Figure 1. (a) Top view and (b) bird view of the proposed absorber unit cell.

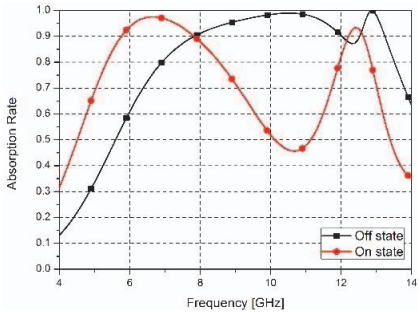

Figure 2. Simulated absorption rates.

In this paper, we propose a novel wideband-switchable MA using PIN diodes based on a silicone rubber and flexible printed circuit board (FPCB). The unit cell is designed with a pair of split ring resonators (SRRs) by using PCB manufacturing process as illustrated in Figure 1. In order to achieve flexibility, we use a silicone rubber and FPCB as substrates. They are bonded using non-conductive epoxy. The bottom layer of the unit cell is fully covered with a copper sheet to prevent transmission EM wave.

The simulated absorption rates are shown in Figure 2. When the PIN diodes are in off-state, the absorption rates shows over 90% from 7.9 to 12 GHz and when the PIN diodes are in on-state, the absorption rates shows over 90% from 5.8 to 7.8 GHz. Therefore, the proposed MM absorber can achieve wideband operation from 5.8 GHz to 12 GHz.

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