Performance Investigation on Tunable EM Wave Absorber Composed of Varactor Diode-loaded Open Ring Resonator

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Abstract—This paper presents the performance investigation of tunable electromagnetics (EM) wave absorber which is composed of open ring resonator loaded by varactor diode. The proposed EM wave absorber configuration is mainly constructed by an array of 2-dimensionally grounded open ring resonators on a dielectric substrate. The varactor diode with varied reverse direct current (DC) bias voltages is loaded into the open ring resonator of EM wave absorber configuration for achieving the tunable frequency operation. As the basic pattern, a unit cell of 1.5 mm width open ring resonator is configured on a 1.6 mm thick FR4 epoxy dielectric substrate with the dimension of 25 mm $\times$ 25 mm. The characteristics of varactor diode loaded open ring resonator are analyzed through its equivalent circuit, whereby its consists of an inductor connected in series with a shunt capacitor which is connected in parallel with a series of resistor and junction capacitor. Here, the values of junction capacitor are set from 2.67 pF to 0.63 pF which correspond to the reverse DC bias voltage of varactor diode. By using those junction capacitor values, the EM wave absorber yields the tunable frequency operation from 2.54 GHz to 2.70 GHz with varied reflection coefficient values from $-12.81$ dB to $-18.89$ dB, respectively. The result shows that the loading varactor diode into open ring resonator can tune the frequency operation of EM wave absorber configuration.