Left Handed Metamaterial Absorber for Energy Harvesting

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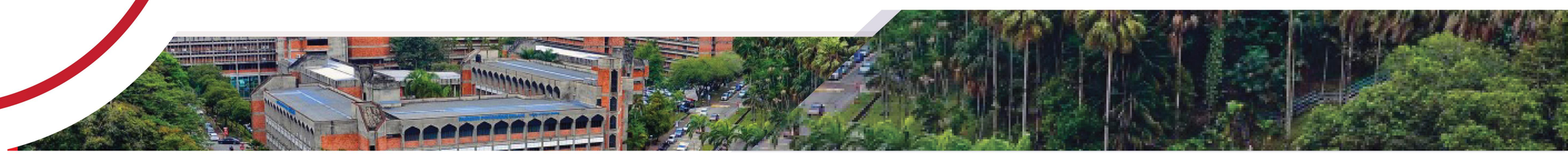


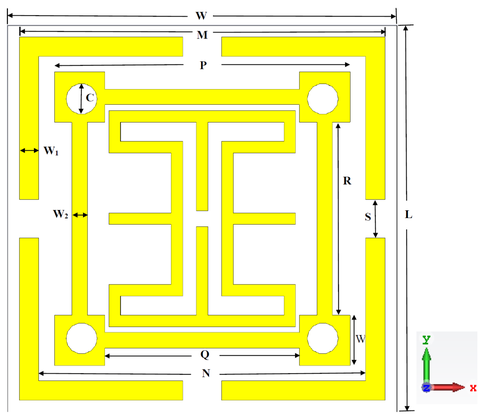
PROTOTYPE / INVENTION

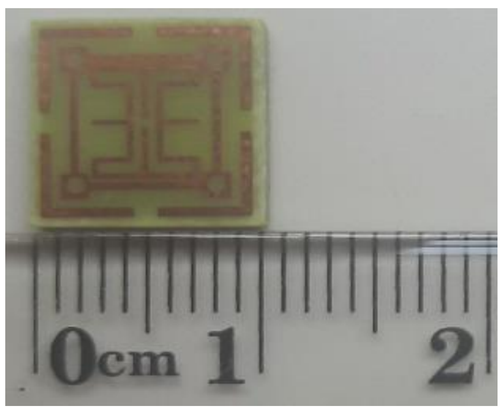
With the increase in the environmental issues caused by traditional resources, renewable and clean forms of energy have attracted worldwide attention nowadays. An absorber is consisted by double E-shaped symmetric split ring resonators which are eligible of high absorption and channeling almost all the absorbed power to the resistive load is presented. The designed absorber exhibited near unity absorption and applicable of C-, X- and Ku-band applications. The dimension of each unit cell of the absorber is 10 mm × 10 mm and array slab is 160 mm × 160 mm. Finite integration technique (FIT)-based CST Microwave Studio has been used for design and analyses purpose. From result analysis, it has been shown that the simulated and measured results are well matched together. The measured result show resonance at 5.392 GHz (C-band), 10.66 GHz (X-band), 12.20 GHz (Ku-band) and the effective medium ratio is 5.56. However, the absorber has the absorption capacity of 97.5% at 5.392 GHz, absorption capacity of 99% at 10.66 GHz, and absorption capacity of 98% at 12.20 GHz.

Design Specifications

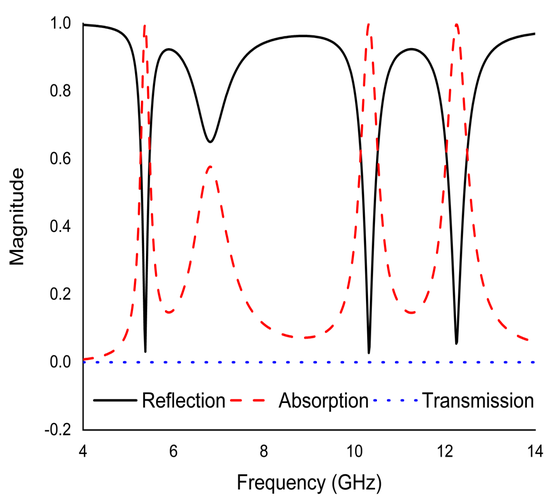
Metamaterial Type	:	Double negative based MA
Operating Region	:	Operates in the C, X and Ku-band of the microwave spectrum
Substrate materials	:	FR-4
Size	:	10 mm × 10 mm × 1.6 mm
Shape	:	Double E-shaped
Layer utilized	:	Metal-Dielectric-Metal

Design & Prototype of the Metamaterial Absorber (MA)

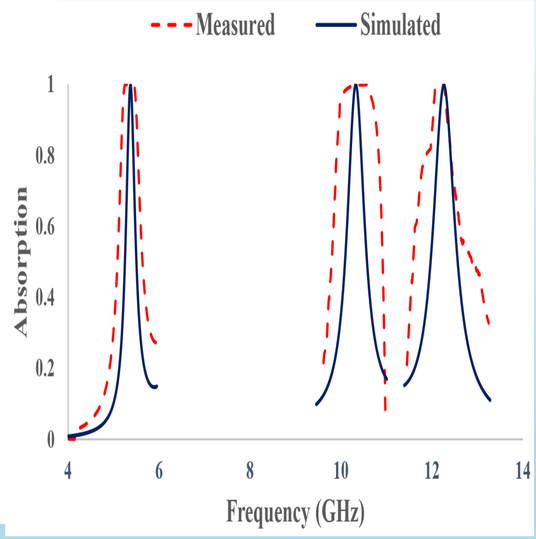




Absorption Characteristics of the Metamaterial Absorber

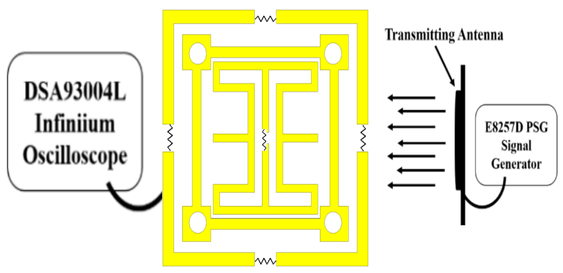


Simulated results of Absorption, Reflection and transmission characteristics



Simulation and measurement result

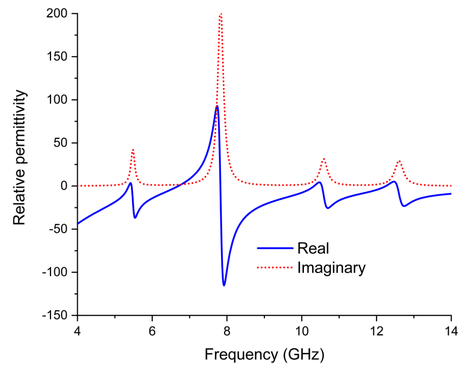
Design & Prototype of MA for Energy Harvesting

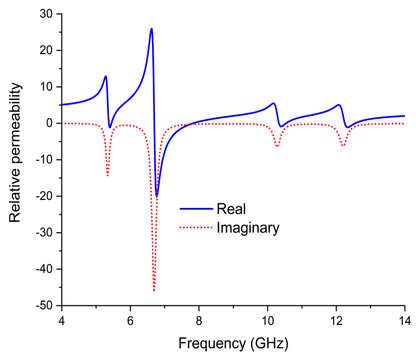


Design for Energy Harvesting

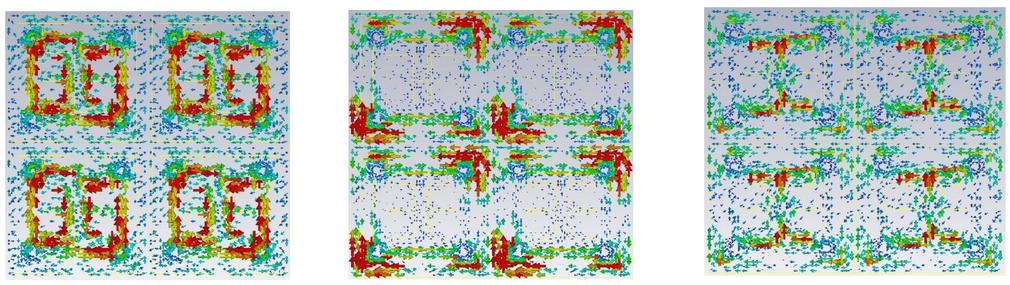
16 × 16 Array for Energy Harvesting

Characteristics of the Metamaterial Absorber





Effective parameters of the metamaterial absorber design



Surface current distribution at the frequency of 5.376 GHz, 10.32 GHz and 12.25 GHz

Features

- ✧ **Wide bandwidth left handed property based metamaterial absorber.**
- ✧ **High absorption and low cost.**
- ✧ **Exhibits polarization insensitivity and wide angle of incidence.**
- ✧ **Compact in size and the effective medium ratio is 5.58.**
- ✧ **Suitable for C-, X-, and Ku-band operations.**
- ✧ **The maximum output voltage and power across the 2.3kΩ gap resistor was recorded 1.2V and 0.626 mW.**

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