

On the performance of the 2D planar metamaterial structure

ABSTRACT

The performance of a 2D metamaterial (MTM) structure using finite element method (FEM) and transmission line model (TLM) is investigated in this paper. The size of the proposed unit cell is $4\text{ mm} \times 4\text{ mm}$ to resonant around 12 GHz. The unit cell is constructed from a patterned patch and solid ground plane that are connected with via through an FR-4 substrate. The unit cell is characterized from 11 GHz to 14 GHz in terms of S-parameters, effective refractive index, and dispersion properties. It is found that the proposed unit cell behaves like unbalanced case of a passive constant k band elimination filter. Moreover, it is found that the unit cell exhibits no negative refractive index (NRI) over a wide range of frequencies; however, it shows a less than 1 refractive index over then same frequency range. A theoretical investigation based on TLM is developed to extract the values of the basic lumped, RLC, elements network.

Keyword: NRI unit cell; MTM; TLM; FEM