Annular Ring Frequency Selective Surface based Dual Bandpass Filter for Microwave Communication Application

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ABSTRACT
This paper deals with single layer periodic angular ring elements to design narrow band frequency selective surfaces (FSSs) filters for both C & X band operations. The design is investigated theoretically by CST microwave studio simulation tool.

Keywords
Frequency Selective Surface; Band pass filter

1. INTRODUCTION
Traditional frequency-selective surface (FSS) structures, with resonant unit cells, have been investigated over the years for a variety of applications. The applications of these FSS include band pass spatial filters, absorbers, and artificial electromagnetic band gap materials. A typical frequency-selective surface is a 2-D planar structure consisting of one or more metallic patterns, each backed by a dielectric substrate [1-4].

These structures are usually arranged in a periodic fashion. Therefore, their frequency response is entirely determined by the geometry of the structure in one period, called a unit cell. These surfaces exhibit total reflection or transmission, for the patches and apertures respectively, in the neighborhood of the element resonances. The most important step in the design process of a desired FSS is the proper choice of constituting elements for the array [3].

In this paper, authors have tried to design and obtain a dual band response in two identical bands which were very rarely used in the designing of FSS. All earlier designs were proposed for single band operation. Some research was done on double square loop FSS for dual band application whose performance were not satisfactory. To obtain the better results a new design was proposed in this paper known as annular ring FSS.

This paper presents annular ring FSS designs which have square patch with concentric annular ring slots. We have designed a double band FSS for dual band pass filter (which can pass C and X bands) with good percentage bandwidth and high band separation.[1,2,4-7] These bands are used in satellite communication and microwave band pass filter.

2. FSS STRUCTURE AND DESIGNS

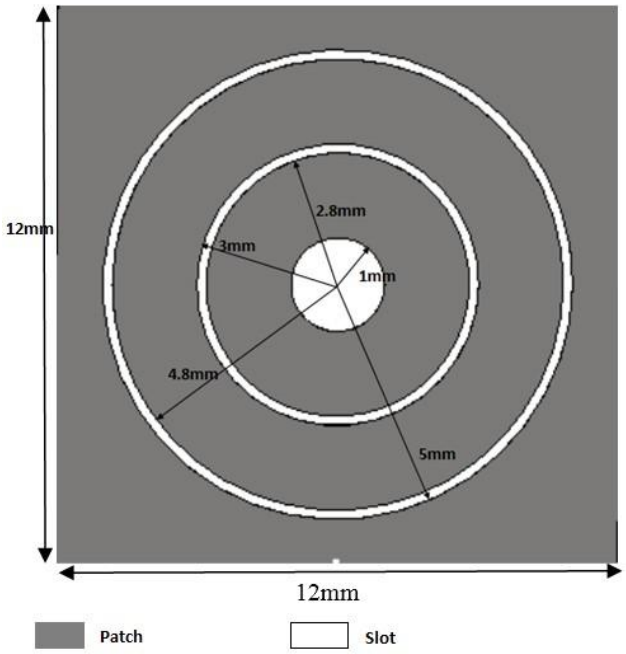

Fig 1 Single Cell Structure

In this design two concentric rings and two circular slot are used as a cell of the FSS.[1,2] The Cell is embedded in a square patch of size 12mm X 12mm. A single cell is shown in Fig.1. A special feature can be noted here that the center position of the unit cell is hollow. That means at center of the rings there is not any kind of metallic layer of a cell. [1,2]

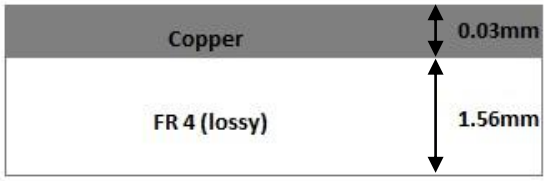

Fig 2 Side view of FSS structure

3. SIMULATION RESULTS

The simulated results for the proposed designed is obtained using CST microwave studio simulation tool. The S parameter curve for unit cell structure is as shown in Fig.3

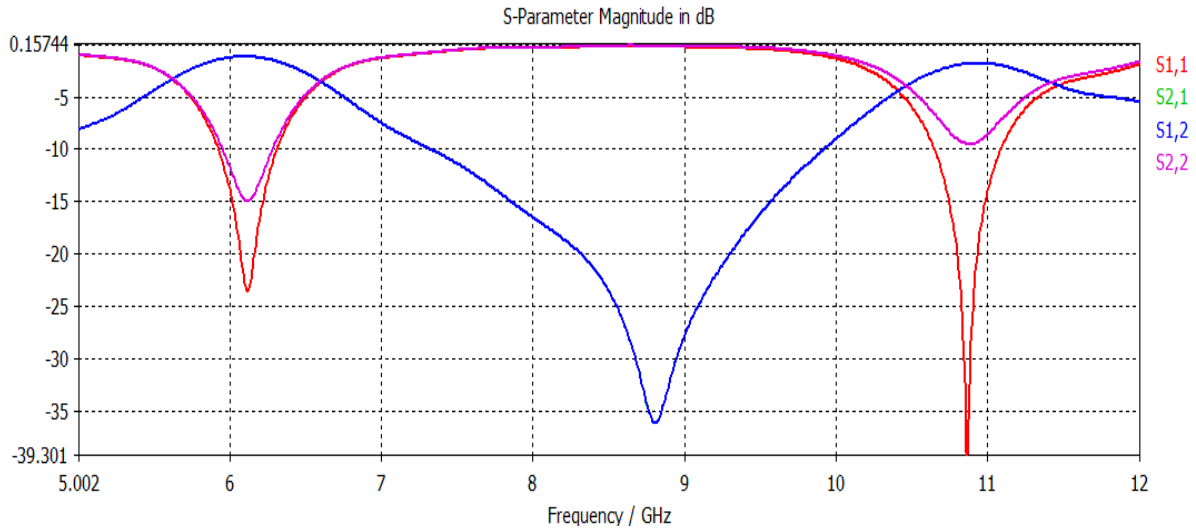

Fig 3 Simulation performance of S-parameters of annular ring for single unit cell

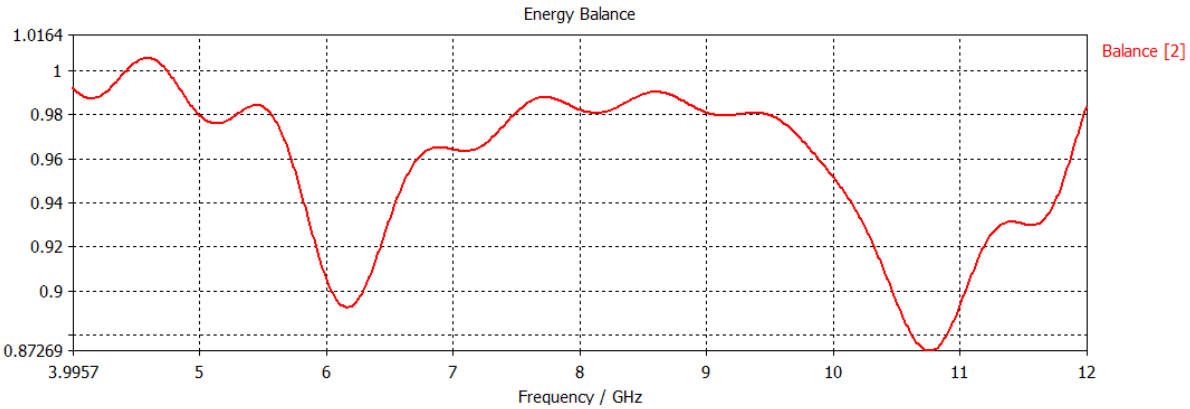

Fig 4 Energy balance curve of simulated FSS unit cell

Table 1 Simulated Result in Tabular form

Resonating Frequency (GHz)	**6.1241**	**10.732**
Bandwidth (GHz)	**0.3986**	**0.5764**
Percentage Bandwidth	**6.50**	**5.37**

4. CONCLUSION

Here dual band pass frequency selective structure has been designed. It is observed for such structures, that the size reduction of annular ring shifts the resonance frequency and the bandwidth. That means when the structure resonates in a lower frequency(C and X band) the bandwidth of the structure is also reduced. The energy balance curve shows energy distribution on the surface of structure at resonance. It is also observed that the structure resonates at different frequency by changing the ring size; bandwidth enhancement and multi frequency operation are achieved by varying the ring size or introducing new ring.

Presently, frequency selective surfaces are in use have single band application and some dual band FSS are have various limitation like dependence on incident angle, narrow bandwidth etc. The complexity involved in the design of the existing frequency-selective surfaces and their required size and sensitivity to the angle of incidence leads to limiting of their functionality, thus showing the demand for analyzing their response and optimizing the necessary parameters so as to improve their characteristics.

5. REFERENCES

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