

Study of Compactness and Percentage Bandwidth of a Patch Type Frequency Selective Surface

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ABSTRACT:The analysed design of a broadband and compact frequency selective surface has been proposed here The effects of introduction of different types of slots are studied and their simulated results are presented This paper proposes an FSS with maximum 10 dB percentage bandwidth of 80.2% and compactness of 71.36% the simulations are done by MOM based Ansoft Designer Software.

KEYWORDS: Frequency Selective Surface, Broadband, Compact, Resonating Frequency, Method of Moments

I. INTRODUCTION

Frequency selective surfaces(FSS) are used widely as electrical filters in Microwave Engineering[1]. In recent years frequency selective surface is also used as a filter in the wireless communication system[2]. The subject of FSS is widely researched on for its uses in the areas of microwaves and optics. It was used as cassegrainian sub reflectors in parabolic dish antenna in early days [3]. Now FSSs are used in airborne radomes absorbers and electromagnetic band gap materials etc [4]. A typical fss is a 2d infinite metallic array printed on a dielectric slab separated by a finite periodicity from each other[5]. It is a periodic structure composed of a one or two dimensional lattice which exhibits bandpass or band stop responses[6]. The first one commonly known as patch type FSS acts as a band reject filter exhibits total reflection at resonating frequency and another type is aperture type FSS which exhibits total transmission at resonating frequency performs similar to a band pass filter[7]. The two disadvantages of FSS are low bandwidth and small band separation. So our primary aim is to improve the disadvantages and increase the bandwidth and the band separation. However nowadays in communication reduced sized hand held communication device and hence reduced sized FSS is preferred. So we also attempt for size reduction and therefore make the FSS more compact. The proposed design is simulated using MOM based Ansoft(Designer) software.

II. DESIGN OF FSS

The reference patch of a 2D copper patch of 20 mm x 20 mm, mounted on dielectric material (Glass PTFE, relative permittivity is 2.4 and thickness is 1.6 mm) is shown in Fig 1. The periodicity is taken as 22 mm x 22 mm .

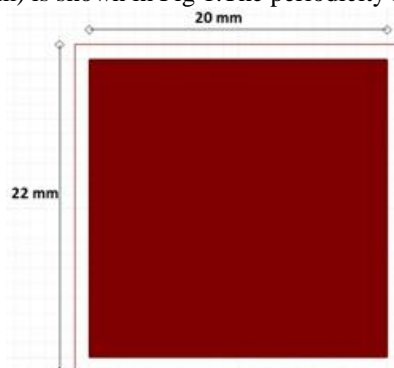


Fig.1:Reference patch

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Now FSS is modified by cutting some slots within metal patch. The modified design is showed in Fig 2. Periodicity is kept the same as the reference patch.

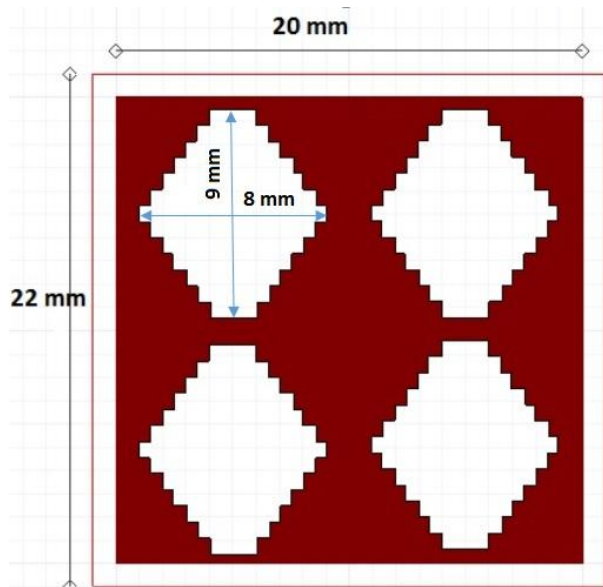


Fig.2: First modified design

The design in fig. 2 is modified again to further enhance the compactness and bandwidth. The modified design is given in fig. 3.

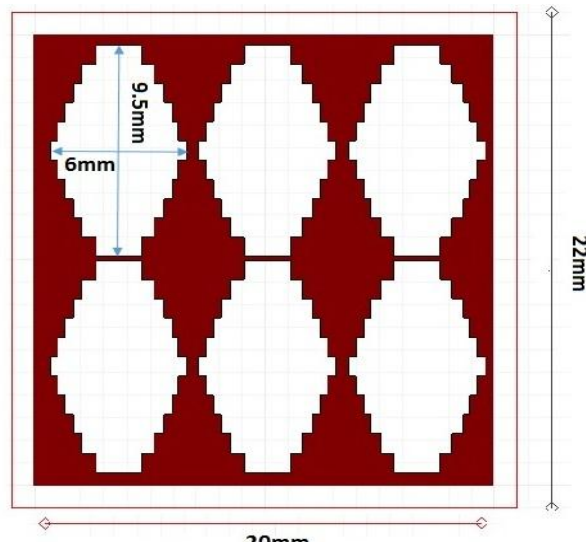


Fig.3: Second modified design

III.RESULT

The corresponding Normalized Transmitted Electric Field (dB) vs Frequency (GHz) graph for the reference patch is shown in Fig. 4.

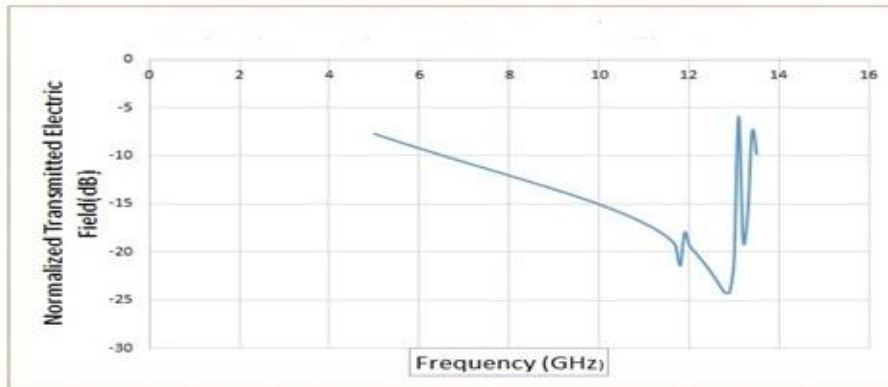


Fig.4: Transmission characteristics of reference patch

For the reference patch, resonating frequency is 12.80 GHz and percentage bandwidth=50.9%. The transmission characteristics for the first modified design is shown below in Fig.5.

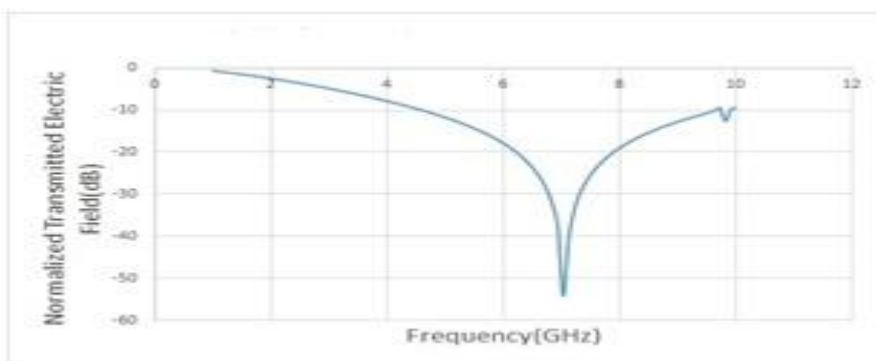


Fig.5: Transmission characteristics of the first modified design

Here resonating frequency is 7.03 GHz, percentage bandwidth=75.81% and compactness=69.83%. The transmission characteristics for the second modified design is shown in fig.6.

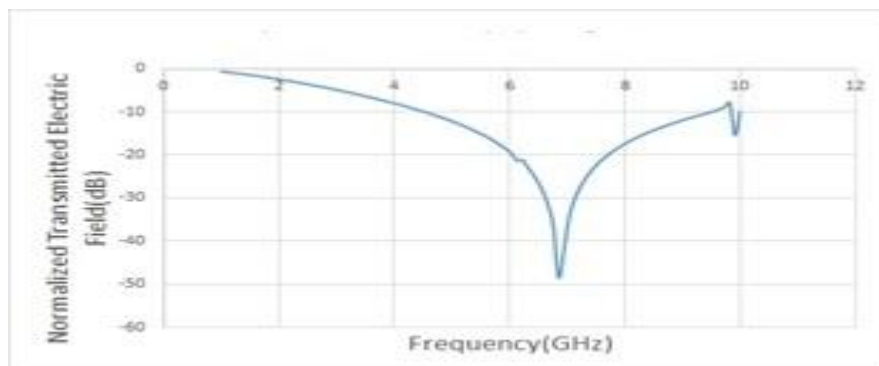


Fig. 6: Transmission characteristics for the second modified design

For this design, the resonating frequency is 6.85 GHz, percentage bandwidth=80.2%, Compactness=71.36%

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IV. CONCLUSION

Even though for very high compactness the bandwidth becomes very small, we have successfully been able to design some FSS by cutting slots in the reference patch where both bandwidth and compactness are quite large. This paper proposes a frequency selective surface with bandwidth as high as 80.2%, the band being from 4.52 GHz to 10.01 GHz, and compactness of 71.36% thereby obtaining a high bandwidth and high compact FSS. Additionally band separation between reflection and transmission band has increased to around 50 dB.

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