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Design and Analysis of Micro strip Circular Ring Band Stop Filter

Govardhani. Immadi, M. Venkata Narayana, A. Navya, Y.D. S Sairam, K. Shrimanth

***Abstract**: A Microstrip circular ring band stop filter has been designed by using An-soft HFSS. This filter has five controllable stopbands at different frequencies 5.2GHz, 7.5GHz, 8.9GHz, 11.4GHz, 12.5GHz respectively. The return loss of the band stop filter are -37.1499, -25.0593, -32.1480, -22.9698 and -33.3195 dB while the insertion loss of the band stop filter are -0.5600, -0.4747, -0.6096, -.05885 and -0.6745 dB at the separate stop bands. This Filter is designed by using RT/Duroid 6002 with a thickness of 0.508mm. Band stop channels are structured from numerous points of view, yet we are utilizing micro strip because of the least assembling expense and weight.*

Index terms: - Band stop filter (BSF), Multi band filter, Return Loss.

I. INTRODUCTION

Band stop filter is one of the important element in communication systems. The main role of a band stop filter is to allow the frequencies with in the limited range. In low pass filter the frequency which is lesser than the selected frequency will only pass through the signal. In high pass filter the frequency which is higher than the selected frequency then the signals with the frequency above the range will pass through the filter. The advantage of band stop filter is it will allow the frequencies to pass it in a range. The signals can pass through in between the ranges. Band stop filter can be designed in many ways but here we are using micro strip patch because it will give more efficiency when compared to the rectangular wave guides. The advantage of using these microstrip band stop filters are light weight, easy to manufacture, occupy less space and low cost.

Microstrip-line BSFs have the benefits of minimal effort, low weight, and simplicity of usage. Band stop filters are widely used for suppression of spurious outputs from high power transmitters. Band stop filter is one of the key structures obstructs in correspondence frameworks. Many communication devices like oscillator and blender are regularly trailed by band stop channels to expel the higher request music and other undesirable false flags.

Many microwave segments, for example, duplexers and switches are additionally bargained of band stop channels. Miniaturized scale strip line band stop channels have the benefit of minimal effort, low weight and simplicity of execution. Microstrip band stop filters is made from shunt open-circuited resonators that are quarter wavelength long and straight with interfacing lines that are likewise quarter wavelength long. These band stop channels typically have the tight stop band. Microwave band stop filters are broadly utilized for suspension of deceptive yields from high power transmitters. They become progressively imperative in the structure of correspondence and communicate frameworks to keep the obstruction with different clients. Return loss is defined as the loss of power in the signal which is reflected by an irregularity in a transmission line. This brokenness can be a confuse with the ending load or with a gadget embedded in the line. It is generally communicated as a proportion in decibels (dB). The main reasons occurred due to return loss are the discontinuities and impedance mismatches.

II. DESIGN TOPOLOGY

The structure designed in this paper consists of circular resonator and micro strip feeding which is fabricated using RT/Duroid 6002 substrate with thickness of 0.508mm. The figure 1 shows the layout of the designed filter. The circle designed in the filter is with a radius of 2mm.The total length of the micro strip feeding line is 49.15mm. The transmission line may be uniform or non-uniform.

The equations for designing microstrip circular ring band stop filter are

$$\frac{w}{h} = \frac{8e^{A}}{e^{2A}-2} \text{ for } u=\frac{w}{h} < 2$$

$$A = \frac{z_0}{\mathcal{E}_r}\left\{\frac{\mathcal{E}_{r+1}}{2}\right\}0.5 + \frac{\mathcal{E}_{r-1}}{\mathcal{E}_{r+1}}\left\{0.23 + \frac{0.11}{\mathcal{E}_r}\right\}$$

$$\frac{w}{h} = \frac{2}{\pi}\left\{(B-1) - \ln(2B-1) + + \frac{\mathcal{E}_{r-1}}{2\mathcal{E}_r}\left[\ln(B-1) + 0.39\frac{-0.61}{2\mathcal{E}_r}\right]\right\}$$

$$B = \frac{60\pi^2}{Z_0\sqrt{\mathcal{E}_r}}$$

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* Correspondence Author (s)
Govardhani. Immadi, ECE, KLEF, Guntur, Andhra Pradesh, India.
M. Venkata Narayana ECE, KLEF, Guntur, Andhra Pradesh, India.
A. Navya ECE, KLEF, Guntur, Andhra Pradesh, India.

$$\varepsilon_{r1\,eff} = \frac{\varepsilon_{r+1}}{2} + \frac{\varepsilon_{r-1}}{2}\left[(1+\frac{12}{4})^{-0.5} + 0.04(1-u)^2\right] \qquad Z_0 = \frac{n}{2\pi\sqrt{\varepsilon_{r1\,eff}}}\ln[\frac{8}{4} + 0.254]$$

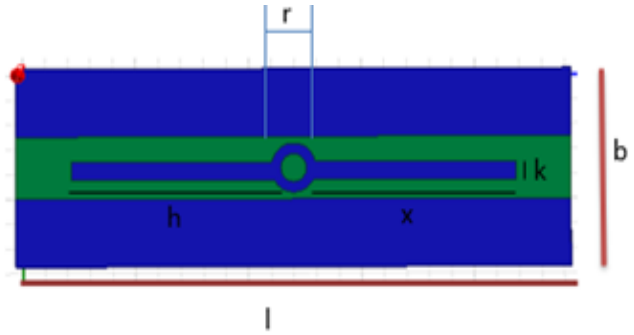

Fig 1: Layout of the microstrip circular ring band stop filter
The dimensions are l=49.15 mm, b=16 mm, r=2mm, h=17.96 mm, x=17.96mm, k=1.5mm

III. SIMULATED RESULTS

A microstrip circular ring band stop filter is designed by using RT Duroid 6002 with a thickness of 0.508 mm by using HFSS. Return loss and insertion loss characteristics are estimated by An-soft HFSS Software within the frequency range of 5GHz to 13GHz. The following fig 2,3,4,5 demonstrates about the experimental results of the circular ring band stop filter. The band stop filter exhibits better band stop performance at 5.2GHz, 7.5GHz, 8.9GHz, 11.4GHz, 12.5GHz frequencies respectively.

Table: Experimental Results of the Circular Ring Band Stop Filter

Parameter	Simulated Outcomes
Center Frequency (GHz)	5.2,7.5,8.9,11.4,12.5
Insertion Loss(dB)	-0.5600, -0.4747, -0.6096, -.05885, -0.6745
Return Loss(dB)	37.1499, -25.0593, -32.1480, -22.9698, 33.3195

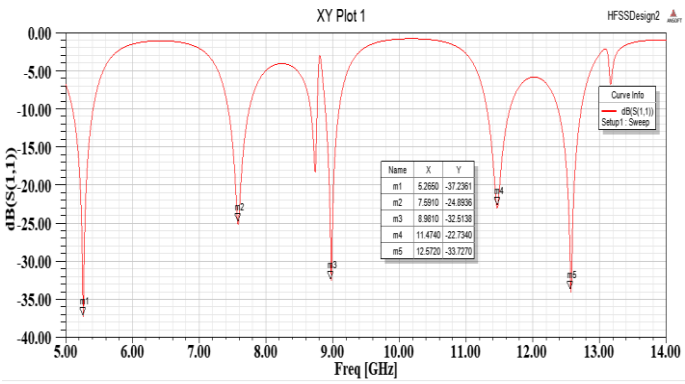

Fig 2: Return Loss curve of microstrip circular ring band stop filter.

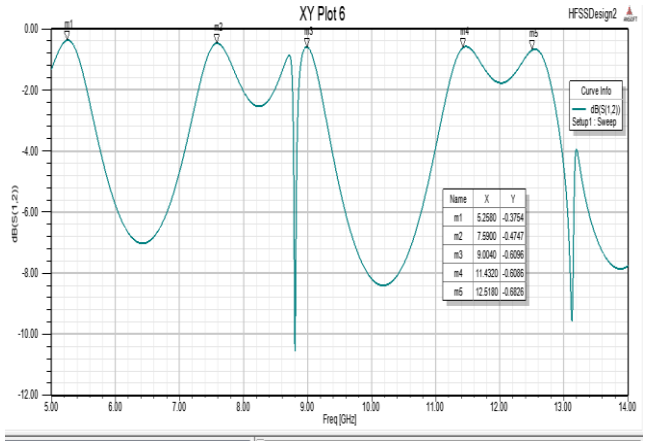

Fig 3: Insertion Loss of microstrip circular ring band stop filter.

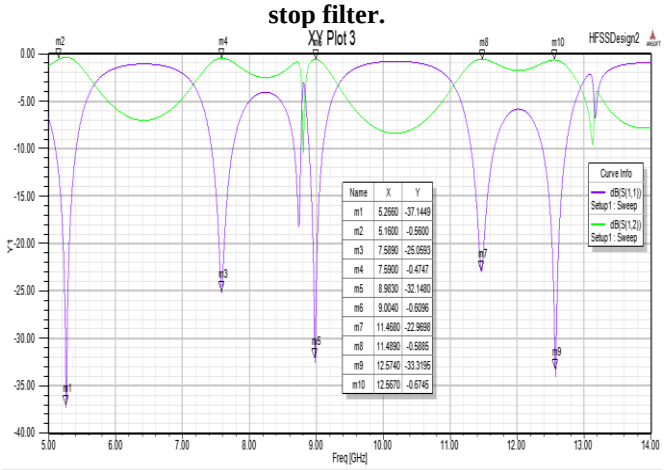

Fig-4 Return loss (S11) and insertion loss (S12) of microstrip circular ring band stop filter.

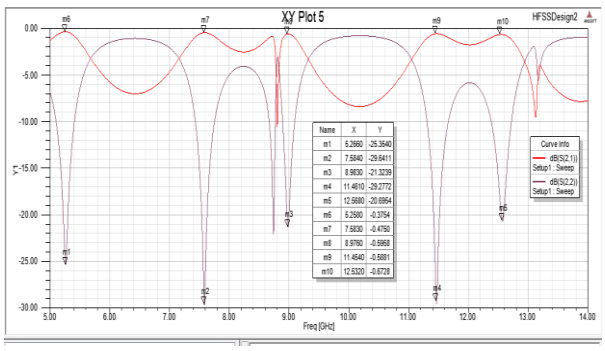

Fig 5-Insertion loss(S21) and Return loss (S22) of microstrip circular band stop filter.

IV. CONCLUSION

Microstrip circular ring band stop filter is designed and this filter has stop bands at 5.2GHz, 7.5GHz, 8.9GHz, 11.4GHz, 12.5GHz respectively with manageable center frequencies while insertion loss of the band stop filter are in the range between 0 and 1.

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The return loss of the filter at center frequencies are 37.1499, -25.0593, -32.1480, -22.9698, 33.3195 dB. The performance of the filter is increased by using circular shaped resonators. Due to the multiple stop bands band stop filter is used for lower cost product with a flexible size and for easy transmission.

REFERENCES

1. M.-Y. Hsieh and S.-M. Wang, "Compact and wideband microstrip band stop filter," *IEEE* Microw. Wireless Compon. Lett., vol. 15, no. 7, pp. 472–474, Jul. 2005.
2. Wolff, I. and N. Knoppik, "Microstrip ring resonator and dispersion measurement on microstrip lines," Electronics Letters, Vol. 7, No. 26, 779–781, December 30, 1971.
3. Jia-Sheng Hong, "Microstrip dual-mode band reject filter", 2005 IEEE MTT-S Int. Microwave Symp. Dig., vol., no., pp.4.
4. Snyder, R.V.; Sanghoon Shin, "Band stop filters using dielectric loaded evanescent mode resonators," Microwave Symposium Digest, 2004 IEEE MTT-S International, vol.2, no., pp. 599- 602 Vol.2.
5. Xu, J.; Miao, C.; Cui, L.; Ji, Y.-X.; Wu, W.; "Compact high isolation quad- band bandpass filter using quad-mode resonator," Electronics Letters, vol.48, Analysis and Design of Multi-Band Band stop Filter 1025 no.1, pp.28-30, January 5 2012.

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