International Journal of Advance Research in Science and Engineering
Volume No.07, Special Issue No. (03), January 2018
www.ijarse.com
IJARSE
ISSN: 2319-8354

DESIGN AND SIMULATION OF MULTIBAND BANDPASS FILTER BASED ON SQUARE SHAPED DEFECTED GROUND STRUCTURE

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ABSTRACT

In order for the advancement of filter designs, a compact multiband bandpass filter with square shaped defects in the ground plane has been designed and analysed in the present paper. The performance of multiband bandpass filter is characterized by return loss, insertion loss etc. Any proposed design is said to be efficient if it has low insertion loss and higher return loss with reduction in its size and complexity & improved stability and fractional bandwidth. The relative permittivity of the substrate is 12.9. The designed filter showed a return loss of -14.69dB at 4.2 GHz, -14.97 dB at 4.8 GHz, and -19.15 dB at 5.6 GHz, -17.13dB at 6.5GHz, -13.7dB at 7.3 GHz., while the insertion loss is ~0dB. In the present work the complete simulation of the design has been carried out using HFSS software.

Keywords: Hairpin Resonator, Insertion loss, Multiband Bandpass Filter, Return Loss.

I. INTRODUCTION

Filters play vital role In R/F Microwave applications. They are used to merge or split up different frequencies. As viewed from the communication point of view filters are very necessary to avoid the interference as they are used to suppress the spurious response and pass only the desired frequencies. For the advancement of the technique, in the present paper we have created square shaped defects in the ground plane, so that a DGS structure is achieved. Recent studies[1,2] indicate that the simulated DGS configuration show improved results as compared to without DGS. Thus enhanced bandwidth and higher return loss can be achieved with DGS. Therefore, in the present paper we have designed a multiband bandpass filter with DGS for WiMAX and other applications to determine the effect of using DGS.

Today, Radiofrequency (RF) engineering is showing a great interest due to its advancement in the voice, data, and video communication[3,4]. Within a specific range to select the signals, bandpass filter is a popular device and the signals which are outside of that particular range are rejected[5,6]. A Survey of Literature[7-10] reveals the performance of bandpass filter and microstrip antennas using defected ground structure. Defected Ground Structure(DGS) is an area of interest in microwave circuit [11] and recently, it is found to be one of the most popular method amongst all other techniques which are used for enhancing the parameters such as harmonic suppression etc. To suppress the higher mode harmonics and for the improvement of band stop characteristics,

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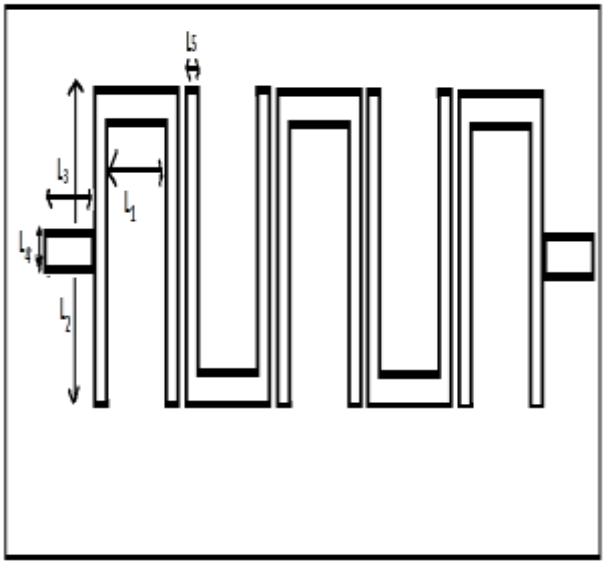
DGS is employed. DGS also has been used for bandpass filter (BPF) response. Several researches [8,9] have also been reported for BPF with DGS.

II. DESIGN METHODOLOGY

In the present work, multiband bandpass filter has been designed using the hairpin resonator. The relative permittivity of the substrate is 12.9. The length of substrate is 7 mm and width of substrate is 10.79 mm. For designing hairpin band pass filter various parameters used are L_1=1mm, L_2=4.1mm, L_3=1.55mm, L_4=0.12mm, L_5=0.2mm. Fig.1 shows designed hairpin bandpass filter. Fig.2 shows the designed square shaped defects in the ground plane. Parameters and their values used in designing the square shaped defect are given in Table 1.



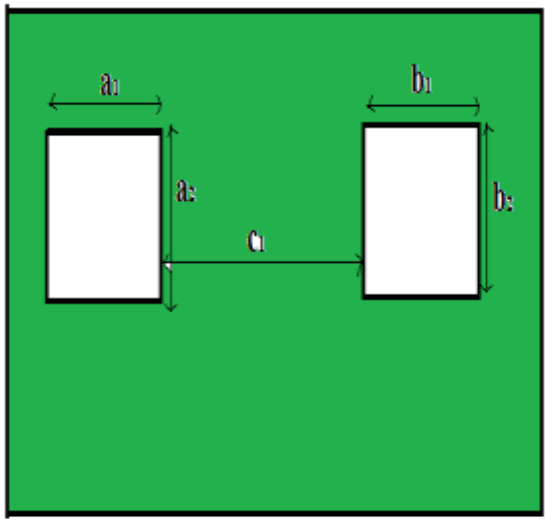


Figure 1.Designed Hairpin bandpass filter **Figure 2.The designed square shaped defect**

Table 1: Parameters used in designing square shaped defect

Parameters	**Value**
a_1	2.6mm
a_2	2.6mm
b_1	2.6 mm
b_2	-2.6 mm
c_1	4.4 mm

III. RESULTS AND DISCUSSION

The designed multiband band pass filter shows improved bandwith and good return loss. The designed filter shows a return loss of -14.69dB at 4.2 GHz, -14.97 dB at 4.8 GHz, and -19.15 dB at 5.6 GHz, -17.13dB at 6.5GHz, -13.7dB at 7.3 GHz., while the insertion loss is ~0dB. 3dB band width is 70 MHz, 150 MHz, 200 MHz, 100 MHz, and 85 MHz. Fractional band-width(%FBW) is 16.7%, 31.25%, 35.71%, 15.38% and 11.64%. Fig.3 and Fig.4, shows S_{11} and S_{21} Plots of the designed filter respectively.

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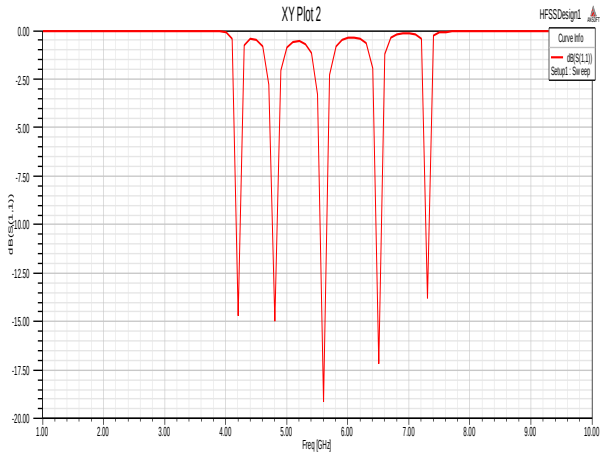

Figure 3. Showing S_{11} Plot

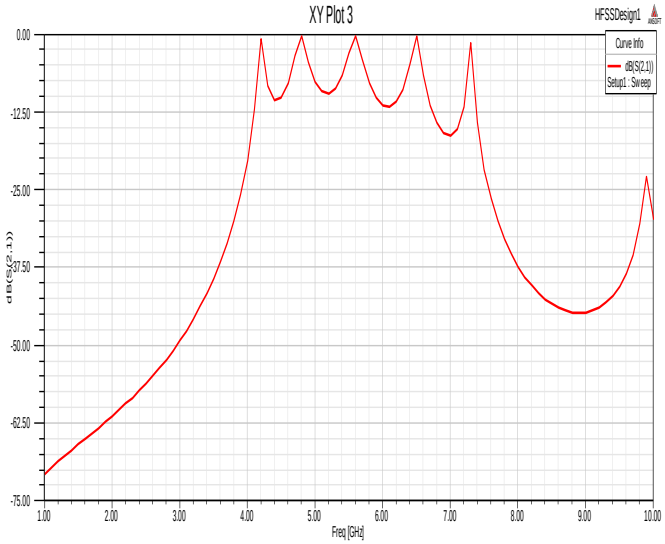

Figure 4. Showing S_{21} Plot

IV. CONCLUSION

In the present paper, a multiband band pass filter with square shaped defects in ground plane has been designed and simulated. Two square shaped defects have been created in the ground plane. The simulation result of proposed filter has low insertion loss, good return loss and improved bandwidth, which satisfy the design requirements.

REFERENCES

[1] M. Sontakke, V. Savairam, S. Masram, P.P Gundewar, "Microstrip Patch Antenna with DGS for Bluetooth Application", I.J.E.R.T., 6(3), 2017, 524-527.

[2] D.Saxena, S. Rathore, "Bandwidth Enhancement of Rectangular Shaped DGS Strip Antenna for 5.8GHz Communication", I.J.I.R.S.T., 2(9), 2016, 12-17.

[3] K. Vidhya and T. Jayanthy, "Design of folded multilayer microstrip triband hairpin bandpass filter", Res. J. App. Sci. Eng. Tech., 6(12), 2013, 2283-2287.

[4] N. A. Touhami, A. Zakriti, M. Lamsalli, M. Boussouis and A. Tribak, "Spurious response suppression in three poles hairpin bandpass filter using detected ground structure (DGS)," 1st Annual International Interdisciplinary Conference (AIIC), Portugal, 2013, 1991-1995.

[5] R. Yadav, K. Dagar, B. Yadav, "Design of ultra high band pass filter by using dielectric resonator", I.J.E.C.S., 2(4), April 2013, 1093-1096.

[6] A.M., Designing Microstrip Bandpass Filter at 3.2 GHz, International Journal on Electrical Engineering and Informatics, 2(2), 2010, 71-78.

[7] D. Guha, S. Biswas, M. Biswas, J.Y. Siddiqui and Y.M.M. Antar, "Concentric ring-shaped defected ground structures for microstrip applications", IEEE Antennas and Wireless Propagation Letters, 5(1), 2006, 402-405.

[8] J. Pie, A.G. Wang, S.Gao, and W.Leng, "Miniaturized triple-band antenna with a defected ground plane for WLAN/WiMAX applications", IEEE Antennas and Wireless Propagation Letters, 10, 2011, 298-301.

[9] Y. Sung, "Bandwidth enhancement of a microstrip line-fed Printed wide-slot antenna with a parasitic center patch," IEEE Transactions on Antennas and Propagation, 60(4), 2012, 1712-1716.

[10] R. Garg, I. Bahl and M. Bozzi, Artech House, Norwood, Mass, USA, 3rd edition, 2013.

[11] Jialinli, Jianxin Chen, Quenxue et.al., "Compact microstrip lowpass filter based on defected ground structure and compensated Microstrip line", Microwave Symposium Digest, IEEE MTT-S International , 12-17 June 2005.