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COMPARISON OF MICROSTRIP BAND PASS AND BAND REJECT FILTER DGS TECHNIQUE BASED IN GSM BAND (1850MHz)

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Abstract: In microwave communication filters are more essential high frequency component. To improve the insertion loss the DGS technique is used. DGS i.e, (defected ground structure) is a technique where cuts are drawn on ground to improve the results and reduce the size of filters. Band passes and band reject filters are the filters which pass and reject the range of frequency. A band pass and band reject filter is designed with GSM upper band center frequency i.e, 1850Mhz.with DGS technique to improve the losses.DGS technique is a proposed version of hexagonal ring and hexagonal head. Performance of filters has been compared in terms of insertion loss. The simulation is carried out with CST software 2010.

Keywords*-Band pass filter, band reject filter, CST (Computer simulation technology) DGS (hexagonal ring and hexagonal head)*

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I INTRODUCTION

In mobile communication systems there is a requirement of mobility of components and equipment's [1] and for achieving the properties like insertion loss and return loss. By adjusting the distance and without changing the area occupied by the slot, the cut off frequency of the structure can be controlled [3].New technology such as PBG i.e. photonic band gap and GPA i.e., ground plane aperture have been introduced to improve the quality of the system but these structures cannot be used for microwave component designing because difficulties in modeling and radiation from the periodic ethed effects [2]Band pass filters are the most important component to overcome the losses in communication system for rejecting the the undesired frequency[4].

The filters using DGS technique has an attractive feature, which are-

1) As compared to the conventional low pass filters, the stop band is very wide and deeper.
2) It has a very simple structure and cost is very low
3) The losses will be reduced
4) Easy to fabricate [5]

II DESIGN

2.1 Design of Hairpin band pass filter-In the band pass filter by without DGS the dimension of the filters are having 4cm×3cm.The insertion loss of this filter is -25.1850 dB, which will be improved in DGS technique

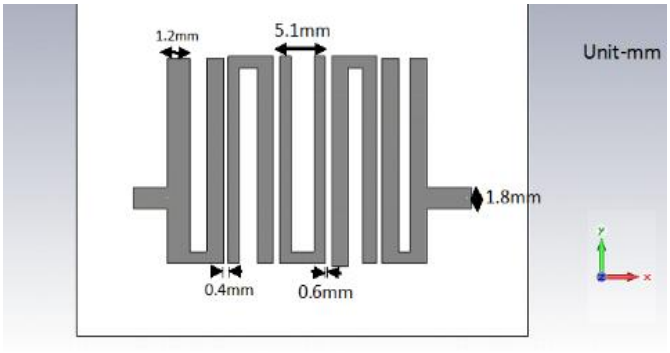

Figure 1 Hairpin band pass filter

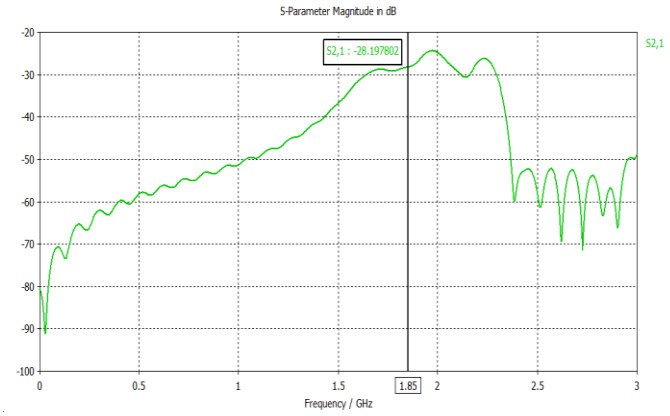

Figure 2 Insertion loss of band pass filter

In this figure the simulated insertion loss of band pass filter without DGS is shown i.e., --28.197 dB.

N	g_1	g_2	g_3	g_4	g_5	g_6
1	0.3052	1.0				
2	0.8431	0.6220	1.3554			
3	1.0315	1.1474	1.0315	1.0		
4	1.1088	1.3062	1.7704	0.8181	1.3554	
5	1.1468	1.3712	1.9750	1.3712	1.1468	1.0

2.2 Design of Band Pass filter with DGS Technique (Hexagonal ring shape)

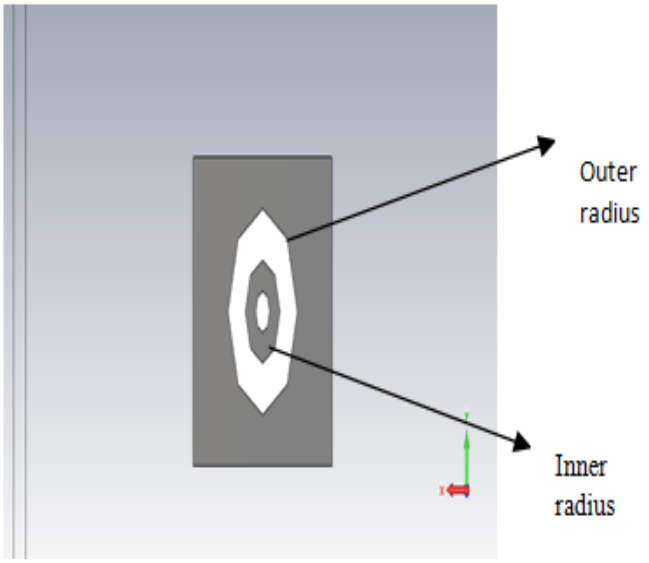

Figure 3 Hexagonal ring

In the hairpin band pass filter the hexagonal ring shape is created to achieve better results the outer radius and inner radius is 1.5 cm×0.2cm.The capacitor and inductor is being used for modeling the resonators.

$Q_{e1}=g_0g_1/FBW$ (1)

$Q_{en}=g_ng_{n+1}/FBW$ (2)

$M_{i,i+1}=FBW/\mathbf{g_ig_{i+1}}$ for i=1 to n-1(3)

Where the Q_{e1} and Q_{en} showing the quality factors of input and output, $M_{i,i+1}$ showing the mutual coupling between the resonators. The FBW (fractional bandwidth) =BW/f_0=55.6dB at center frequency 1850Mhz. The dimension of the hairpin band pass filter have 4cm×3cm center frequency of the band pass filter have 1850Mhz, substrate thickness (h)=1.6,Di-eleltric constant ε_r=4.4 mm, Band pass ripple=0.1 Db, characteristics line impedance Z_0=50 ohm, normalized frequency Ω_c=1,Number of poles=5,circular head pole=2,fractional bandwidth of filter is= F_H-F_L/F_Ci.e, 2.322-1.293/1.850=0.556dB.

Where F_L=lower frequency, F_H=Higher frequency, F_C=cut off frequency.[6]

$M_{12}=M_{45}$=0.3538

$M_{23}=M_{34}$=0.205

$Q_{e1}=Q_{e5}$=2.0625

By varying the spacing between the resonators, the coupling coefficient can be varied, by using the formula,

$K= (f_2^2-f_1^2) / (f_2^2+f_1^2)$

Where f1 and f2 are the peak resonance. The frequencies are obtained and simulated response S_{21}i.e, insertion loss for the resonators.

The table shows the element values-

By applying DGS technique the results will improved

The five pole hairpin filters have parameters $g_1=g_o$=1.0, $g_1 = g_5$ =1.1468, $g_2 = g_4$ = 1.3712 and g_3=1.9750. These values are used to determine the design parameters of band pass filter. By using DGS technique the results are improved, insertion loss is shifted from -28.045dB to -0.93dB

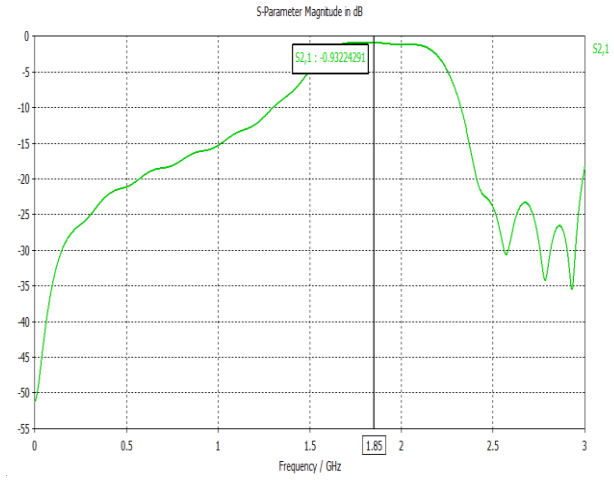

Figure 4 Insertion loss of DGS technique based band pass filter

In this figure the simulated insertion loss of band pass filter with DGS is shown i.e, -0.93 dB.

Design for the filter

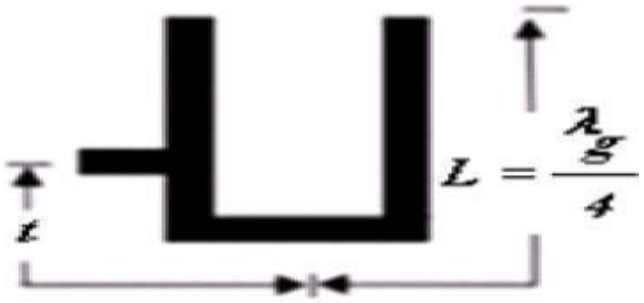

Figure 5 U-shape structure

2.3DESIGN OF BAND REJECT FILTER

The length and width of the filters have 13cm×3.5cm.The insertion loss is -33.71dB.The dielectric constant of substrate (FR4-LOSSY) ε_r=4.4mm, loss tangent=0.0025 are used in design configuration. Band reject filter

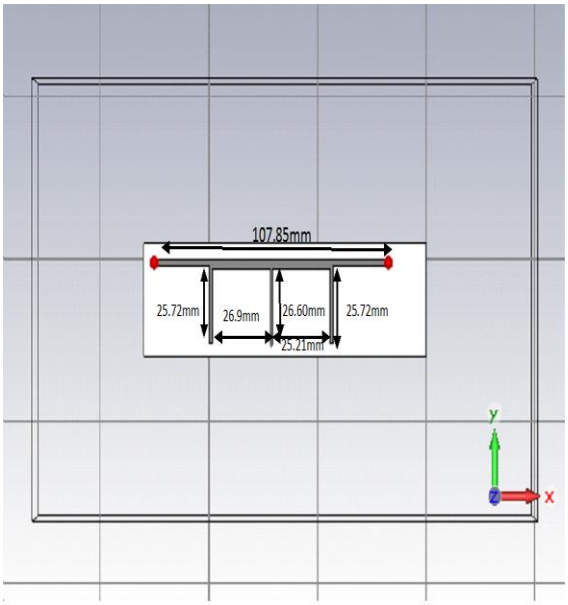

Figure 6 BAND REJECT FILTER

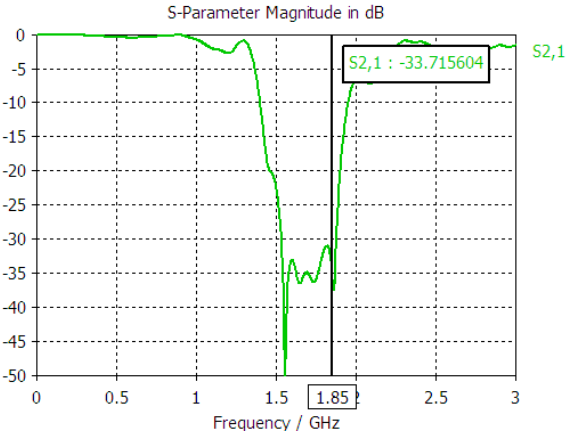

Figure 7 Insertion loss without DGS

In this figure 7 the simulated insertion loss of band reject filter without DGS is shown i.e., 33.71dB

2.4 DESIGN OF BAND REJECTFILTER WITH DGS

The insertion loss of the band is improved by using DGS technique i.e., -45.81dB.In order to design the band stop filter with a sharpe cut-off, DGS slot is used. The slot consists of 9cm×3.5cm Performance of filter depend upon the number of factors such as slotted ground, shape radius and position of DGS. All the filters are designed using 50Ω micro strip line.

The size of band pass reject fixed are kept fixed which is 13cm×3.5cm.The dielectric constant of substrate (FR4-LOSSY) ε_r= 4.4mm, loss tangent=0.0025,conductor height is=1.53mm are used in design configuration. The simulated results are shown.

2.5 Various DGS pattern

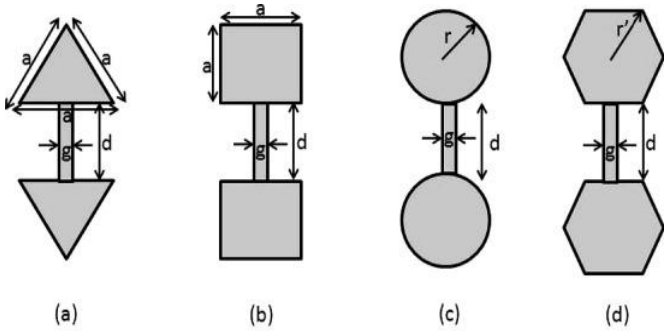

Figure 8 (a) Triangular head (b) Square head (c) circular head (d) Hexagonal head

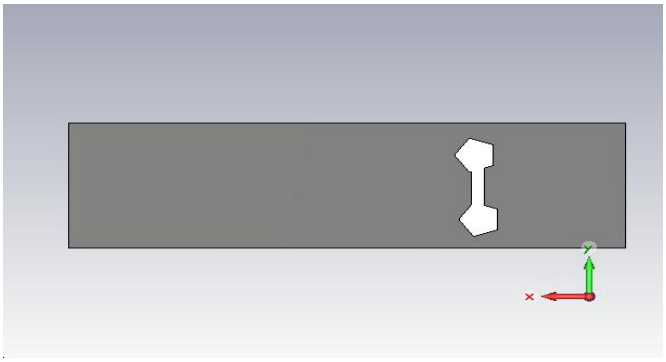

Figure 9 Band reject filter with hexagonal head

Table-2 The dimensions of hexagonal head is calculated by this table.

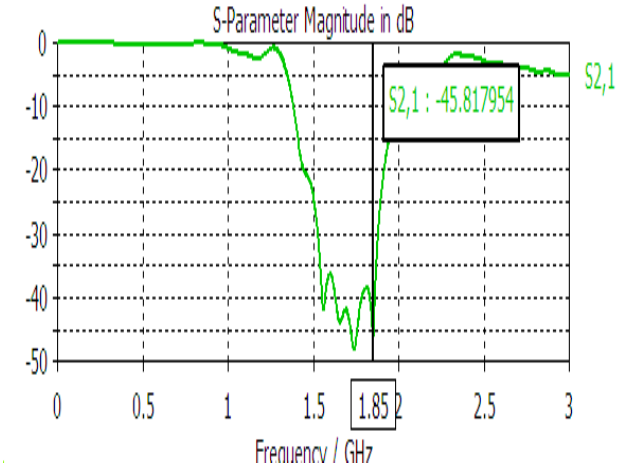

Figure 10 Improved results with DGS technique

In this figure the simulated improved insertion loss of band reject filter with DGS is shown i.e., -45.81dB.

III RESULTS

Table 3: Comparison of filter's results-

FILTERS	WITHOUT DGS (insertion loss)	WITH DGS (insertion loss)
Band pass	-28.197Db	-0.93Db
Band Reject	-33.715dB	-45.81dB

Dimensions in mm	Hexagonal head
G	1
D	1.2
r'	3.1

Fabricated Results

IV CONCLUSION

In this paper all the results achieved, with accurate and sharp frequency and insertion loss is being improved, by applying DGS techniques.

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