

Design a Microstrip Band Pass Filter for 6 GHz

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Abstract

The Purpose of this paper described about the design of microwave band pass filter by using microstrip layout. A microwave filter is two port network used to control the frequency response. The developments after microstrip filter are simulated by using IE3D simulator software. Photolithographic process is used for fabrication and after fabrication final testing had done by using the spectrum analyzer.

Keywords: *Band pass filter (BPF) and IE3D software.*

1 Introduction

The rapid growth in commercial microwave communication systems had been developed. Hence microstrip technology play important role in many RF or Microwave applications. Emerging application such as wireless communication continue to challenge RF/Microwave filters with ever requirement higher performance, smaller size, lighter weight and lowest cost[2].

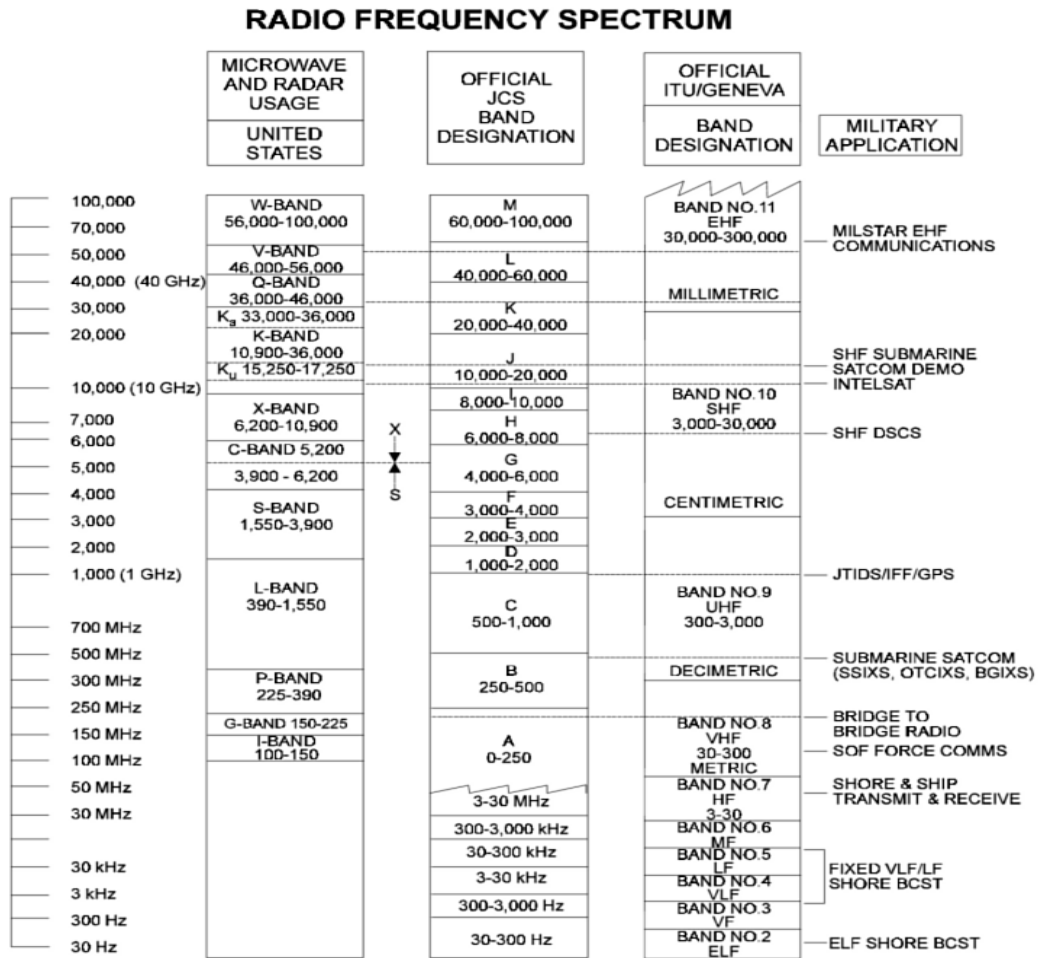


Fig.1 frequency bands for different frequency

Coupled microstrip line: The coupled microstrip line are exhibiting are field term with Quasi-TEM.it has two propagation factor Even mode and odd mode [6].

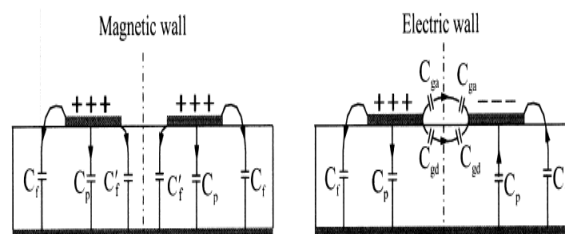


Fig.2 Coupled Microstrip Line

2 Designing Procedure

Determine the number of sections from the specified attenuation characteristic for microstrip parameters.

Table 1:

Mid band Freq. Range	No of Order	Pass band Ripple	Impedance(Z_0)
6GHz	3	0.1dB	50 ohm

Determine the value of prototype element to realize the specifications Ex. Chebyshev filter prototype ($g_0=1$, $\omega_c=6$ and 0.1 dB ripple)[8].

$$g_0 = g_4 = 1.0, g_1 = g_3 = 1.0316, \text{ and } g_2 = 1.1474.$$

Determine the one type resonator network and determine the inverter value for to equivalent realizations of the generic multi-sections low pass filter with normalize elements [1].

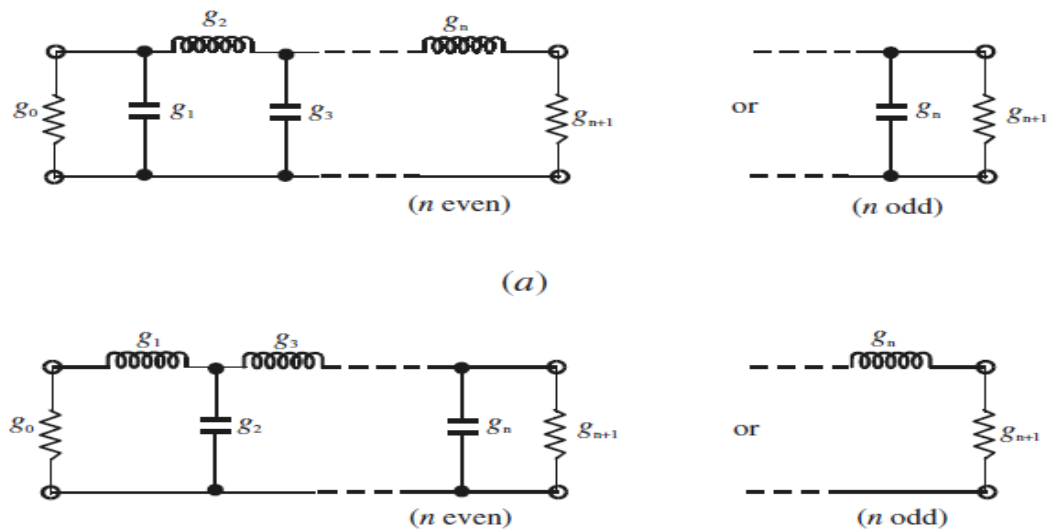


Fig.3 Equivalent circuit for band pass filter

Obtain the even and odd mode coupled line characteristics impedance Z_{0e} and Z_{0o}

$$\{Z_{0n}\}_{j,j-1} = Z_0 \left[1 + \frac{J_{j,j-1}}{Y_0} + \left(\frac{J_{j,j-1}}{Y_0} \right)^2 \right]$$

$$\{Z_{0n}\}_{j,j-1} = Z_0 \left[1 - \frac{J_{j,j-1}}{Y_0} + \left(\frac{J_{j,j-1}}{Y_0} \right)^2 \right]$$

$$\frac{J_{01}}{Y_0} = \sqrt{\frac{\pi}{2} \frac{FBW}{g_0 g_1}}$$

$$\frac{J_{j,j+1}}{Y_0} = \frac{\pi FBW}{2} \frac{1}{\sqrt{g_j g_{j+1}}} \quad j = 1 \text{ to } n-1$$

$$\frac{J_{n,n+1}}{Y_0} = \sqrt{\frac{\pi FBW}{2 g_n g_{n+1}}}$$

Where

Determine microstrip width and separations (W's) of the end-coupled half wavelength resonate filter [3].

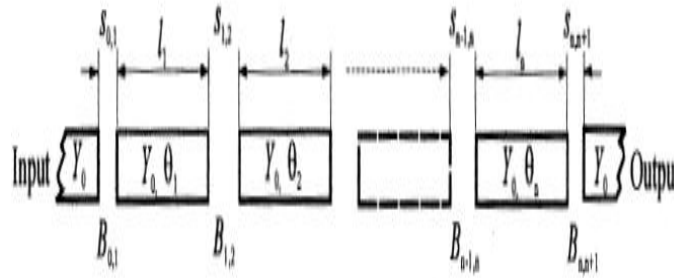


Fig4 General Configuration of end-coupled microstrip band pass filter

Calculate the coupled section length which slightly less than quarter wavelength at center frequency to account for the end fringing [10].

3 Calculated Parameter for Design

1. Frequency bandwidth 0.028 or 2.8%
2. Number of poles, N=3
3. Mid band frequency $f_0 = 6\text{GHz}$.
4. Pass band ripple 0.01dB.

5. Element values are $g_0 = g_4 = 1.0$, $g_1 = g_3 = 1.0316$, and $g_2 = 1.1474$
6. Dielectric constant $\epsilon_r = 10.8$
7. Thickness of substrate $h = 1.27\text{mm}$.
8. The line width for microstrip $W = 1.1\text{mm}$.
9. Characteristic impedance $Z_0 = 50\text{ ohm}$.

Then elements dimensions will be on FR4 microstrip PCB board as shown in fig.5

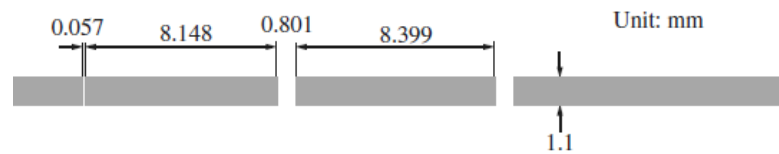


Fig.5. Dimension geometry of band pass filter.

4 Geometry on simulator

Band pass Geometry Design on IE3D as Shown in Fig6.

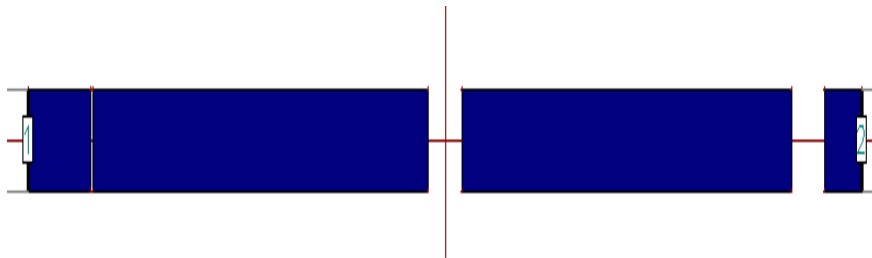


Fig.6 Geometry of Microstrip Band Pass Filter

5 Simulation Result

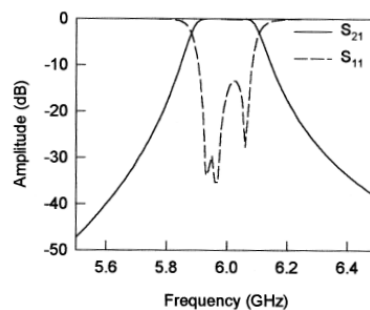


Fig.7 Result in IE3D

6 Conclusions

After the whole analysis it is clearly seen that the proposed microstrip band pass filter has obtained accurate result for 6GHz cutoff frequency.

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