RESEARCH PAPER | Engineering | Volume - 5 | Issue - 1 | Jan Special Issue - 2015 | ISSN - 2249-555X



Design band pass filter using parallel coupled line technique for wireless Application

KEYWORDS: Band pass Filters, Coupled Line, Cst 2012, Wlan

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ABSTRACT Band pass filters play a significant role in wireless communication systems. Transmitted and received signals have to be filtered at a certain center frequency with a specific bandwidth, in this paper, a coupled-line bandpass Filter at the center frequency 6 GHz with the wide bandwidth of 2 GHz. this type of filter can be used in WLAN and other applications for the frequency range of 5-7 GHz.

I. INTRODUCTION

The broadband wireless access (BWA) is an important issue in current developments of the modern wireless communication system. To meet this trend, the bandpass filters with relatively wide bandwidth are frequently required in the RF front ends. In microwave communication systems, the bandpass filter is an essential component, which is usually used in both receivers and transmitters [1].In this work we would like to give a way to design a bandpass filter for the WLAN application at the frequency 6 GHz with parallel-coupled Micro strip.

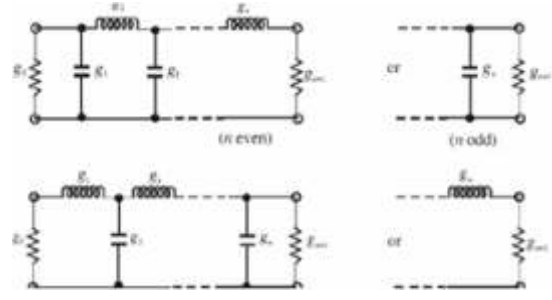
The design goals and parameters have been shown in the Table 1.

Order of the Filter	3
Frequency	6 GHz
, FR4	4.3
Height of the Substrate	1.56 mm
Thickness of the conducting	0.035 mm
Loss tangent	0.025
Fractional Bandwidth	33% at 6 GHz
Bandwidth	>1GHz

II. DESIGN CONFIGURATIONS

1) Parallel Coupled lines Bandpass Filter:

Fig.1 gives the circuit implementation of the filter by means of concentrated components like inductors (L) and capacitors (C), for the even and odd filter degree (n).



(n even) (n odd)

Fig.1: Realization of filter using LC components.

The component values can be calculated with the following rules:

$g_o = 1$

$g_1 = 2/y \sin(\pi/2n)$

$g_i = 1/g_{i-1}\{[4\sin(\pi/2n\,(2i-1))\sin(\pi/2n(2i-3))/ y^2 + \sin^2(\pi/n(i-1))]\sin(\pi/2n(2i-1))\}$

For i=2 to n

$g_{n+1} = \{(1$ for odd n)/($\cot^2(B/4)$ for even n)}

Where $B = \mathrm{Ln}[\cot^2(L_{Ar}/17.37)$ and $y = \sin^{-1}(B/2n)$

2.1 Designing bandpass filter:

Figure 2 shows the filter structure observed in this work. This filter type is known as parallel-coupled filter. The strips are arranged parallel close to each other, so that they are coupled with certain coupling factors. We use the following equations for designing the parallel-coupled filter [2].

$J_{0,1}/y_0 = [\pi\,FBW \div 2g_0g_1]^{1/2}$
$J_{j,j+1}/y_0 = [(\pi\,FBW) \div 2(g_jg_{j+1})^{1/2}]$

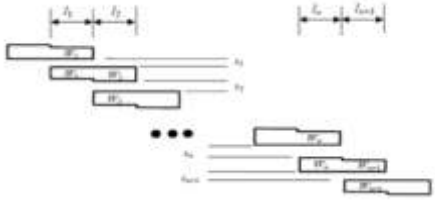
For j=1 and n=1

$J_{n,n+1}/y_0 = [\pi FBW \div 2g_ngn+_1]^{1/2}$

Volume - 5 | Issue - 1 | Jan Special Issue - 2015 | ISSN - 2249-555X

FBW is the relative bandwidth as explained before, $J_{j,j+1}$ is the characteristic admittance of J inverter and y_0 is the characteristic admittance of the connecting transmission line.

With the data of characteristic admittance of the inverter, we can calculate the characteristic impedances of even-mode and odd-mode of the parallel-coupled Micro strip transmission line, as follows [2, 3].



For j= 0 to n

$$(Z_{0e})_{j,j+1} = 1/y_0[\ 1 + (J_{j,j+1}/y_0) + (J_{j,j+1}/y_0)^2]$$

For n=1 to n

$$(Z_{0o})_{j,j+1} = 1/y_0[\ 1 - (J_{j,j+1}/y_0) + (J_{j,j+1}/y_0)^2]$$

From these values, width, length and spacing of the parallel coupled line are calculated and are shown in Table-2,

n	gn	Z0 Jn	Z0e	Z0o	W (mm)	L (mm)	S (mm)
1	0.6292	0.63	101.5	38.5	1.4	6	0.2
2	0.9703	0.32	71	39	2.4	6	0.2
3	0.6292	0.32	71	39	2.4	6	0.2
4	1.0	0.63	101.5	38.5	1.4	6	0.2

III. DESIGN CONFIGURATION AND SIMULATED RESULTS

3.1 GEOMETRY ON SIMULATOR

In this proposed design the height of the substrate is 1.5 mm and relative permittivity 4.3 and the conductor thickness 0.035 mm and loss tangent is 0.025, figure 3 shows the 3-dimensional view of proposed bandpass filter. Proposed design is simulated in CST microwave studio 2012 [5].

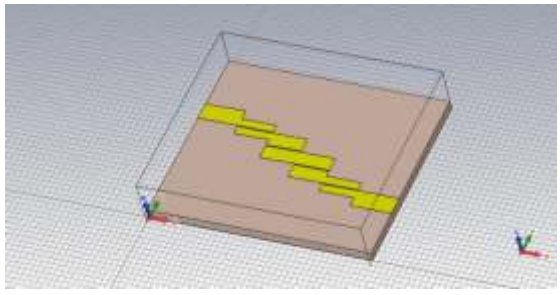


Fig 3: Geometry of Micro strip Band Pass Filter

IV. SIMULATION RESULT

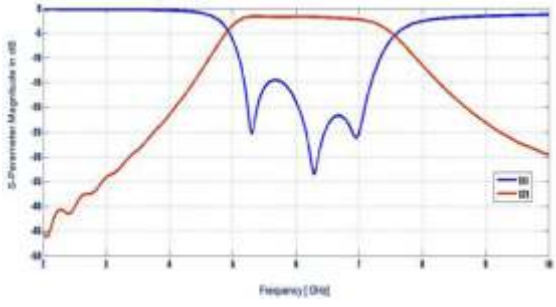


Fig 4: Simulation S-parameters of parallel coupled line bandpass filter at 6 Ghz

V. CONCLUSION

ESIGNING OF BANDPASS FILTER WITH CHEBYSHEV APPROACH IN COMBINATION WITH CONCENTRATED COMPONENTS, I.E. INDUCTORS AND CAPACITORS AND ITS COMPUTATIONAL VERIFICATION IN FORM OF PARALLEL COUPLED MICRO STRIP LINES WITH THE CST GIVE VERY GOOD FILTER CHARACTERISTICS AT THE CENTER FREQUENCY 6 GHZ WITH FREQUENCY BANDWIDTH OF ABOUT 2 GHZ AS REQUIRED AT THE SPECIFICATION STAGE. AT THE CENTER FREQUENCY THE INSERTION LOSS AND REFLECTION FACTOR HAS THE VALUES ABOUT -2 DB AND BETTER THAN -15 DB, RESPECTIVELY.

VI. FUTURE WORK

In this filter design we can improve bandwidth of the band pass filter and that is actually which our title wideband band pass filter. We can also reduce its insertion loss and return loss. So this is the future which you can do in band pass filter using parallel coupled line technique.

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