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Design of a Dual band bandpass filter For WLAN Applications

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ABSTRACT

In this article a new approach is developed for designing dual-band band pass filter. In this paper filter design with open circuit stub loaded at loading point where voltage is zero. This new resonating frequency will not disturb the previously resonating frequency. Location of band can easily control by length of half wave length and open stub length. The measured minimum insertion loss less than 2dB.the simulated filter have two frequencies of 5.2 and 7.8 GHz for WLAN application .The speciality of filter centre frequency of band, bandwidth and transmission zero between two pass-band is controllable and adjustable.The filter is simulated with commercially available tool ADS and result were compared and contrasted with available reported results.

Keywords—Dual-Bandpass filters; WLAN ; Microstrip; Resonator,Coupled Line;

I.INTRODUCTION

RECENT development in advance microwave filter has multi service high performance and data rate communication. With the desire of dual band operation has created more potential in GSM, WCDMA and WLANs standards such as IEEE 802.11a (5.2-5.8Ghz) specification in modern wireless communication [1],[2]. Many techniques are used to developed band pass filter for narrow and wide-band bandwidth. Most common method is by using step impedance MMR[2]-[8]. In Step impedance separation between resonating frequencies is decided by ration of impedance of Structure. But complexity of structure and Size is remaining in figure. The second method is to cascade a bandstop filter and a wide-band BPF [9]. The third method to utilize a DGS structure to design the dual-band filters [10]. But designing a DGS is very complex structure and It increases complexity.

In this paper we present a dual band bandpass filter using two sets of half guided wavelength structure with loading point. This structure is uncomplicated and via free so easy to fabricated. This structure is designed by folded half wave guided length. Due to folded structure the size of filter

is reduced . Compared with the previous design in the proposed dual bandpass filter has more flexibility to shift

frequencies range by varying coupled line section. The ratio of second frequency to fundamental frequency of this circuit can be analyze from even and odd mode resonance. At the centre of structure there is centrally loaded of half wavelength and this is loading point there is zero voltage. On this point quarter wavelength are

investigated. The filter is obtained on a low cost Roger material. Finally a second order dual band bandpass filter design and analyses are presented.

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II. FILTER SYNTHESIS

Fig 4. depicted the generic structure of proposed filter with their dimension notation. It consist coupled line in the folded single mode resonator structure. A half waveguide length resonator is open ended at both end and Center part of structure is loading point where a stub is loaded. it is easy to fabricate because of uncomplicated and via free structure . Filter consists of coupled line section with even and odd impedance mode of coupled line of half wavelength of fundamental frequency. In this structure a pair of even and odd mode is shifted closely to formed the first passband of frequency f1 as well as second passband f2. In order to the dual band bandpass filter for WLAN application is designed and simulated to provide experimental verification on predict result.

A. OPEN CIRCUIT STUB LOADED RESONATOR

The geometric schematic of normalize voltage distribution of the fundamental mode and third harmonic mode shows in fig 1

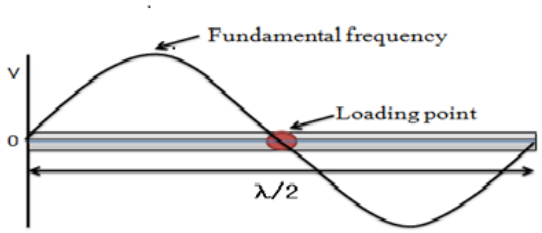
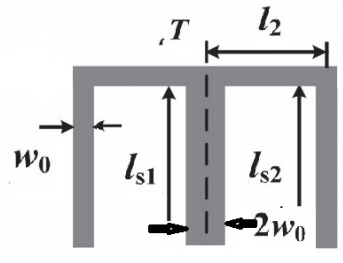
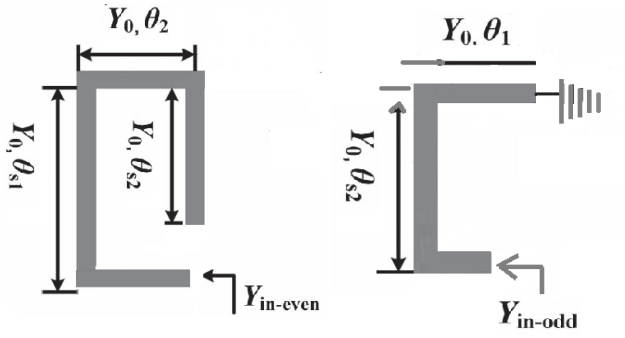


Fig 1- voltage distribution of fundamental mode and third harmonic mode

B. Fig 2(a) show configure of the loaded square ring with two open end stubs which is originally used for single band. Due to symmetrical topology filter design a approach about even and odd mode can be adopted to characterize it . Even and odd mode analysis method can provide dual band behavior. This E-shaped structure consist of half wavelength uniform impedance resonator by one symmetrical plane and two open stubs at two sides of symmetrical plane where (ls1=L1,2w0) and (ls2=2L1,w0) are the length and width of the square ring and open stub. The dimension parameter of square ring loaded resonator a pair of even-odd modes is shifted closely and form the f1and second pair of even-odd mode is used to produce f2.



2(a)- schematic view of quadruple mode resonator



(b) even mode equivalent circuit (c) odd mode equivalent circuit

III. DESIGN OF PROPOSED FILTER

According to above mentioned discussion in Fig1 shows voltage distribution in open ended stub where voltage is zero at loading point. Fig 2(a) represents square ring consist half wavelength impedance resonator loaded by one open stub at the two sides. Fig 2(b, c) shows the even and odd mode which can justify the operating mechanism of dual band bandpass filter. To construct this filter is using parallel coupling lines , and this structure are considered to realize a dual band. The final layout of the proposed dual-band BPf shown in fig (4) using two sets of the quarter wavelength resonantor Frequency fo1/f0 and fe1/f0 are set for first passband , normalize second resonant frequency fo2/f0 and fe2/f0 are set for second passband. In this way by using even odd mode can be calculated frequency . The coupling as shown in Fig. 4, is introduced and analysis to tap and feed the SIRs to meet the specified dual-band external coupling degrees with reference to [4],as such to obtain physical dimension inductively coupled , as sketched in fig 4 . Because of position of loading point is chosen, the loaded voltage is zero could be an open-circuited stub circuited stub.As shown in Fig. 2(a) with loaded open- circuited stub, its electrical lengths and quality of Admittances mention in structure.

The parameter for design filter are given below in Table.1,

TABLE.1

S.N.	MEASURMENT OF STRUCTURE		
	Symbol	***Length/width/Gap***	***Unit***
1.	L1	5.1	mm
2.	L2	1.5	mm
3.	L3	1.5	mm
4.	L4	5.1	mm
5.	L5	5.3	mm
6.	L6	1.5	mm
7.	L7	1.5	mm

S.N.	MEASURMENT OF STRUCTURE		
	Symbol	***Length/width/Gap***	***Unit***
8.	L8	5.3	mm
9.	L9	6.3	mm
10.	Width	0.3,0.5,0.6	mm
11.	Gap b/w coupled line	0.10	mm
12	Gap between Strip	0.15	mm

All dimensions are in mm, and the center frequency is considered to 5.2 GHz. Width(w1,w2,w3) and length of the L1, L2, L3, L4, L5, L6, L7 L8 and L9 is above mention. Input port and output port width is set to 50 ohm and the length to non resonating length so that its own resonating frequency does not disturb other required resonating frequencies. Filter is realized on a low cast Rogers TMM substrate . ADS is used for verification of all parameter.

IV. SIMULATED AND MEASURED RESULT OF FILTER

The FIG.5 shows the simulated and measured result of dual band BPF which are in good agreement. The return loss of filter is better than insertion loss.Due to parallel coupled line two TZs locate at 5.2 and 7.8 GHz are shown in Fig. 5. These single mode Tzs improve the performance of filter. The presented filter exhibit compact size, good passband performance and band to band isolation.

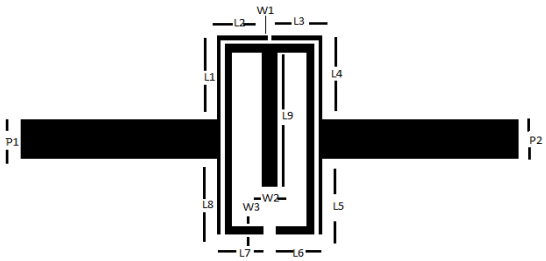
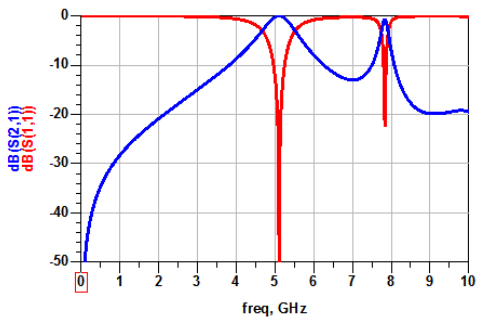


Fig.4 Proposed filter



FIG(5)-S11 and S21 simulated result of proposed filter

V. CONCLUSION

A dual passband structure is constructed and by using that microstrip line and one open stub loaded of quarter wavelength, a single mode based filter is designed and presented in this letter. The coupled-line SIR that can be applied to realize the dual-band BPF paper. Low-resonant frequency ratios of the second passband to the fundamental passband of the dual-band filter have been analyzed, the frequency ratios can be calculated 1.5 . By selecting the coupled-line section, the selectivity of filter improved. The proposed design method using the equal-length shunted-line SIR with open stub loaded (where voltage is zero) is very useful for the dual-band filter structure, when the two passbands are closely spaced. Finally a dual band BPF is designed for WLAN application, the size of filter is compact, good selectivity, high performance, low insertion loss and better return loss.

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