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Microstrip open loop resonator using dual feed techniques for Wireless Applications

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Abstract**:** *In this paper, a simple method and structures are used to design a novel band pass filter using dual feed line and microstrip open loop resonator structure. In this structure, transmission zeros can be created to improve the band selectivity and stopband performance. In analysis, the two open-loop resonators are treated as pass band resonator and stopband resonator. With zero-phase feed structure added, the frequency selectivity is improved with better insertion loss and wide stopband regions. A novel compact microstrip zero-phase feed line BPF with open loop structure is designed and compared with the same feed line structure produces frequency ranges from (5.3-5.4GHz) for LAN Wireless applications. Bandpass filters are designed and simulated using ADS software.*

Keywords**:** *Bandpass filter, Zero-phase feed line, Pass band*

I. Introduction

A miniature planar BPF using a dual feeding structure and embedded resonators was reported. The advantage to use the dual feeding structure is that two transmission zeros can be created near the pass band edges to have a wide stopband [1]. In ref. [2], a bandpass filter is created by combining a low pass filter and a high pass filter so that its circuit area is saved. A compact narrow band pass filter is designed using coupled and crossing lines[3,4]. This kind of filters has compact size and two deep notches in the stopband. In this article, a novel compact microstrip bandpass filter using zero-phase feed line and same side feed line structure is proposed[5,6]. When compared with the other conventional filters using open loop resonators, the bandpass filter has its own advantages[7,8]. It has low insertion loss in the pass band, high frequency selectivity and compact size[9].

II. Modeling Of Openloop Resonator

An open loop resonator is generally derived from one and half wavelength resonator, odd and even mode to enhance bandwidth and introduce transmission zeros in the pass band. The three coupling methods are electric coupling, magnetic coupling and mixed coupling are used to design the filter with desired characteristics. The extent of the fringe fields determines the nature and the strength of the coupling. For a half wavelength resonator, there are two proper feed points at opposite locations slightly off the center of the resonator. Fig. 1a and 1b shows two electric coupling structures constructed by open loop resonators with different input feed points. In Fig. 1a, the input and output feed points are in zero-phase feed line structure when the circuit resonates at its fundamental frequency, whereas in Fig. 1b they are same phase feed line structure. Both arrangements can be used to the advantage of zero-phase feed line structure is to create more attenuation poles. By slightly adjusting the actual feed locations and couplings in Fig. 1a, one attenuation pole can be located in the lower and one in the upper part of the stopband region.

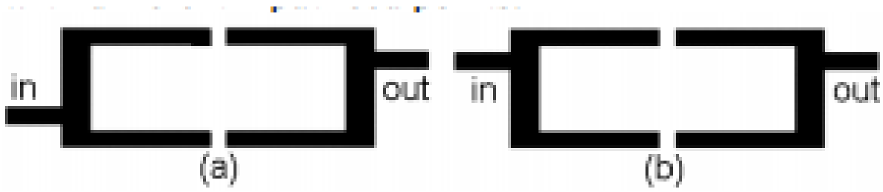

Fig.1a Zero-phase feed line structure
Fig.1b Same-phase feed line structure

The layout of novel compact bandpass filter using microstrip open loop resonator produces narrow band frequency ranges from (5.3-5.4GHz) as shown in Fig.2. The layout of BPF is designed using zero feed line structure to provide more transmission zeros in the pass band. Figure 2 shows the configuration of the novel compact BPF using a dual feeding structure. The simulation result of the pass band is mainly determined by the dual feeding structure and the frequency of the pass band is further tuned by width of the input and output coupling. The first step is to design the pass band by designing the dual feeding structure with the suitable physical length BPF is proposed two split ring resonator as shown in Fig.2. The simulated response have strong coupling and transmission zeros is introduced. The proposed filter structure produces notch band range (5.3-5.4GHz).

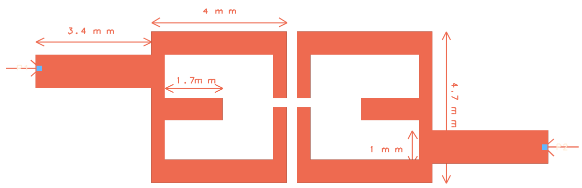

Fig.1 Open loop resonator using zero-phase feed line Filter Structure

Fig.2 Open loop resonator using same-phase feed line Filter Structure

Fig. 2 shows the proposed layout of compact BPF microstrip open loop resonator using same-phase feed line structure. The overall resonator behaves as electric coupling. The electric coupling is dependent of dielectric constant. This is because the substrate is closer to the microstrip line having a higher dielectric constant. The coupling depends on the smaller spacing, W and the fringe field is stronger for a narrow microstrip line. The simulation layout of same-phase and zero-phase feed line structures are compared.

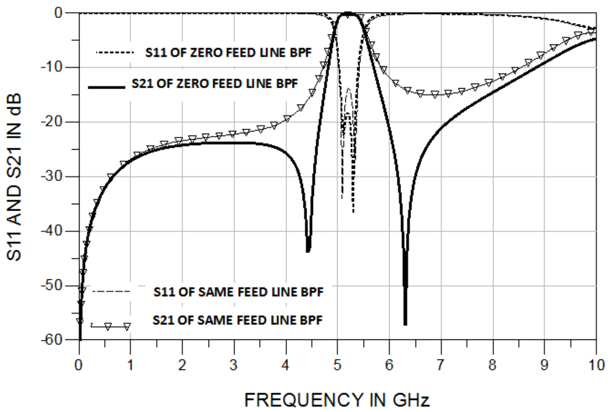

Fig.3 Comparison of simulated result of BPF using two feed line structures

The strength of coupling depends on the gap between the two resonators. The dimensions are mentioned in the design of compact BPF microstrip open loop resonator. The electric delays of the lower and upper paths are different in the ends of the open loop resonator. This symmetrical feed structure is named as sane-phase feed structure. If there is zero degree phase difference between the electric delays of the lower and upper paths, then the structure is zero-phase feed line structure. The compared analysis shows that the return loss and the stopband attenuation are better in the zero-phase feed line structure. The design of compact BPF produces a frequency ranges from(5.3-5.4GHz) for LAN and wireless applications with return loss of above -35dB, less than 0.5dB insertion loss and above 50dB stopband attenuation.

III. Conclusion

Microstrip open loop resonator bandpass filters are proposed and demonstrated for wireless and LAN applications. It shows BPF design using zero-phase feed line structure open loop resonator. The simulated response of this design shows narrow band frequency ranges from (5.3-5.4GHz) of above -35dB return loss for wireless applications. In the second case BPF is designed using same-phase feed line structure open loop resonator is simulated and its response produces frequency range of (5.3-5.4GHz) with Stopband attenuation -50dB and return loss above -25dB. The Simulated and measured results of microstrip open loop resonator bandpass filter are compared.

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