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# Design of a Microstrip Ultrawide band Bandpass Filter Using Short Stub loaded

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***Abstract—*** we are proposing a compact micro-strip ultra wideband (3.1 -10.8 GHz) filter in this paper. Here center frequency is resonated by coupled line section and transmission zero is created by short stub of quarter wave length loaded at loading point. It is compact in size and has very sharp selectivity at the corner frequencies. The location of Transmission zero can be located at any desired frequency by varying the length of additional short stub. The insertion loss of the proposed filter is lower than approx .2dB and return loss is smaller than 20dB. We simulate the proposed filter by using the tool ADS and all the results were attached and compared and contrasted with available reported results.

***Keywords—UltrawideBand filters; Microstrip,short stub;***

## 1.Introduction

As we know Ultra wide band including C-band is widely used in radar communication as well as in military operation . There are so many other devices which are also used in Ultra wide band application such as cordless and Wi-Fi, some weather scanning radar equipments. A no. of band pass filter has been released since last few years. The frequency bandwidth has assigned for Ultra wide band application is from 3.1 to 10.6 GHz [1]. So many different methods and structures are being either used or proposed to confine the allotted frequency range (3.1 to 10.6 GHz) for Ultra wide-band application. A lot of new structures and designs have been used recently for the development of new Ultra wide-band Band pass filter [1].

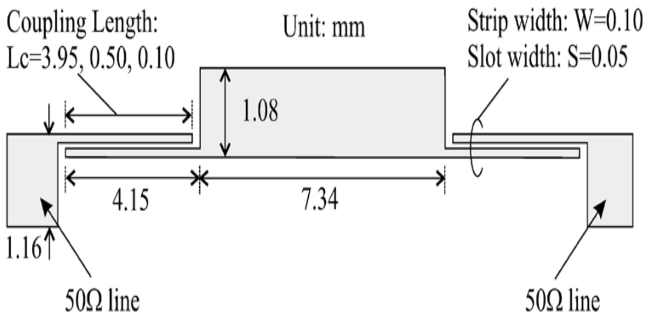
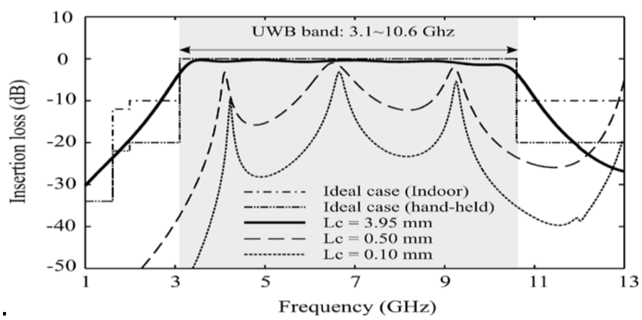



Fig.1. Schematic of the compact micro strip-line UWB band pass filter.

Substrate: " = 10.8; thickness = 1.27 mm.

In the reference paper [1], a MMR is used to create 3 resonant frequencies to form an ultra wide-band.
Structure's dimensions are given in the above figure and simulated results of the above structure are shown in the figure bellow.The problem what we found while creating ultra wide band with the help of MMR is that the bulky stub sizes of the MMR creating problem to make compact size filter. Coupling length Lc can be vary to adjust the transmission zeros and create better selectivity of the band. In this case, the first- and third-order resonant frequencies basically determine the lower and upper cutoff frequencies of a wide pass band.By introducing the two additional transmission poles in the parallel-coupled lines as shown in the above figure, an Ultra wide-band can be made up with good insertion loss and good return loss

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Sheng Sun et al. has proposed in his paper [5], improvement in the above micostrip UWB filter can be done by the coupled line feed with the MMR structure to provide additional transmission zeros.

Hussein Shaman et al. has suggested that coupled line asymmetric open stub is added to provide notch on the pass band to create notch in the UWB filter band.

By varying the length of the uncoupled open stub, place of the notch can be adjusted and bandwidth of that notch frequency can also be adjusted Proposed ultra wide band filter

In Fig 1, the configuration of proposed filter is given which was showing in the tool ADS. Fig.2 shows the proposed UWB filter with the dimension .Because of simple and two via (ground) in the proposed structure, it is slightly difficult to fabricate but because of that via selectivity of the band is very sharp. Filter consists of coupled line sections with coupling length of quarter wavelength of lower frequency. Higher resonating frequency is generated due to the image of fundamental

Frequency. This frequency may be taken as replica of lower frequency. Due to via used in the structure there are three different bands are created and selectivity of these bands are very high. Selectivity near the cutoff frequencies are very sharp which make the proposed filter very good for the created UWB .

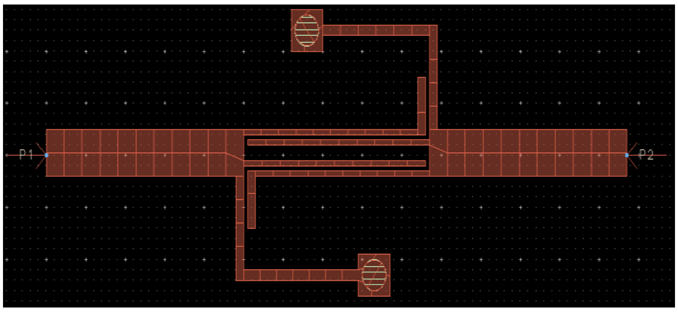
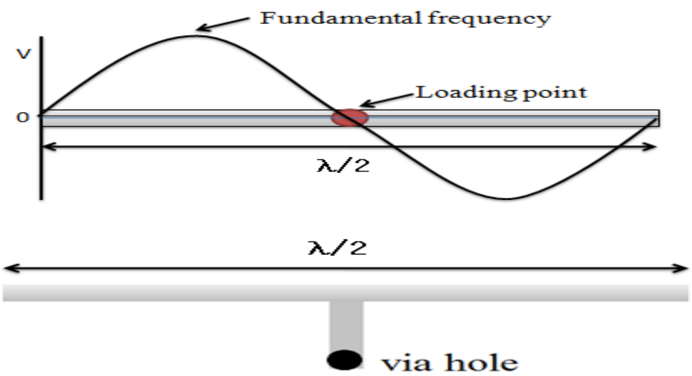



Fig 1. Schematic of the ultra wide band based filter.

Substrate: Er=10.6, thickness=1.0 mm.

As shown in the figure there are 2 coupled lines of quarter wavelength to create two resonating frequencies. Using a commercially available tool [2], Fig 2. (a) is analyzed for resonating structure. Here, center part is the resonating structure for UWB- filter. Center frequency of the band is 6.85 GHz. Two stubs of quarter wavelength are grounded to create better selectivity of the created UWB.




S we know half wave length structure is resonating at its fundamental frequency $\frac{\lambda_g}{2}$.additional transmission zeros can be obtained by shorting the quarter wavelength.
As shown in the figure3: there are three bands are created by shorting the quarter wavelength to create two transmission zeros .

Two stubs of quarter wavelength are coupled to create two resonating frequencies in each band.

Two resonating frequencies are available in each band for two mode operation.

Stubs are grounded to create better selectivity of the created UWB. by creating via, sharpness of the created UWB are very good.

(a)

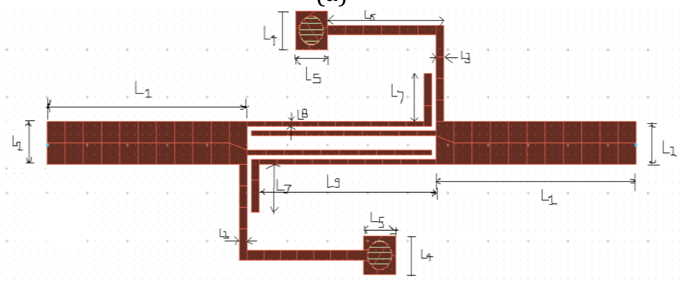


Fig 2. Proposed resonating structures with couple sections (a) Design of UWB filter

Figure 2 shows the dimensions of the proposed filter as mentioned bellow.

**Table.1**

| S.N. | Dimentions of filter | | |
|---|---|---|---|
| | *Symbol* | *Length* | *Unit* |
| 1. | L1 | 5 | mm |
| 2. | L2 | 0.9 | mm |
| 3. | L3 | 0.2 | mm |
| 4. | L4 | 0.8 | mm |
| 5. | L5 | 0.8 | mm |
| 6. | L6 | 2.7 | mm |
| 7. | L7 | 0.5 | mm |
| 8. | L8 | 0.1 | mm |
| 9. | L9 | 4.6 | mm |

All dimensions are in mm, and the center frequency is considered to be 6.85 GHz. Width of the all strip is 0.2mm.Impedance of the strip line is taken 125 Ohm. Input and output feeding 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 roger TMM substrate with a relative dielectric constant of 10.8 and thickness 1.0mm. Commercially available full wave simulator tool [6] ADS is used for verification of all parameter.

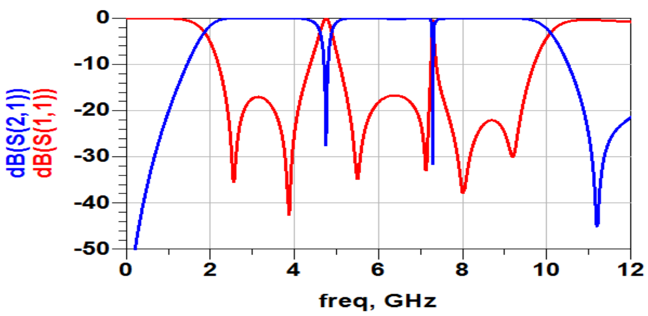



Fig 3. S21 and S11 Parameter of proposed UWB-band filter.

In proposed UWB- filter, Insertion loss is below to -20dB and return loss is about -2.0 dB.

### IV. Performances

Proposed filter is design for UWB- frequency range. Filter consist of two sections of quarter wavelength to create bands for their respected frequencies two stubs at the both side upper and lower end are grounded to to create two transmission zeros and the selectivity of the filter will enhance because of this grounding stubs fundamental used in the proposed filter..

Proposed filter Size is Smaller than most of the UWB filter and selectivity of the UWB filter is very sharp near the cut off frequencies of all the created bands , also the return loss is good from most of UWB filter performance. Present filter is compact in size, having insertion loss less than 2.0 dB and return loss below 20dB (approx.).

### V. conclusion

An UWB filter with three bands are created and two resonating frequencies are available in each band .two notches are created by grounding the two quarter wavelength stubs .the benefits of two notches can be understand by this example that if in the ultra-wide band range (3.1 to 10.6 GHz) if certain frequencies are used for some other application then that frequencies can be eliminated with the help of these created notches. there are four quarter wave stubs in symmetrical position are used to realize the proposed filter and coupling length should be enough to create sufficient wide band .stubs can be adjusted to change the position of the resonating frequencies .Additional stub is adjusted to locate transmission zero at desired frequency. The bandwidth is controlled by adjusting the couple line with feed section. Filter is designed and analyzed to demonstrate the UWB filter and proposed structure. Filter is compact in size, low insertion loss and low return loss.

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