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COMPACT ULTRA WIDEBAND BANDPASS FILTER WITH IMPROVED UPPER STOPBAND

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Abstract-A compact Ultra wide band Bandpass filter With improved Upper Stopband is proposed in this research and uwb channel with minimized size and developed after execution has been examined. The Multimode Resonator is formed by connecting three sets of square impedance-stepped stubs in shunt to a high impedance microstrip line,the resonant modes of the Multi Mode Resonator can be allocated within the 3.1 to 10.8 Ghz.In order to Enhance the Coupling Degree,two inter digital coupled lines are used in the input and output lines.finally, the filter is successfully designed and simulated.

1. INTRODUCTION

The ultra-wideband (UWB) systems have become an area of increasing interest.SINCE (FCC)'s decision to permit the unlicensed operation band in 2002.**Ultra-wideband** (**UWB**, **ultra wideband**, **ultra-wide band** and **ultraband**) is a radio technology that can use a very low energy level for short-range, high-bandwidth communications over a large portion of the radio spectrum.Ultra-wideband (UWB) is a radio-based communication technology for short-range use and fast and stable transmission of data.UWB bandpass filters with wide upper stopband, high selectivity and low costs are highly needed in microwave circuits and systems.Multi-mode resonators using half/fullwavelength stepped impedance resonators are good choices to realized UWB passband by strong coupling excitations .A UWB bandpass filter (BPF) is one of the essential components for these systems. But, the design of UWB BPF with good in-band as well as out-of-band performances according to FCC specifications was a challenge for the designer.parallel, the methods of cascading a single lowpass filter and a single highpass filter on microstrip line and cascading microstrip-to-coplanar waveguide (CPW) broadside coupling sections together are explored.an EBG-embedded multiple-mode resonator UWB filter with improved upper-stopband performance is presented.The Design Procedure of the Rectangular MMR is Different as Compared to Circular MMR.By Optimizing The Structure of an UWB Filter with good in band and upper stopband.The Simulation Result Shows That it has various advantages 1) small insertion loss in the passband (1.0 dB in simulation in the 3.2–10.2 GHz range); 2) the wide and deep upper-stopband with an insertion loss (30 dB in simulation) in the 11.1–27.8 GHz range; and 3) compact size with 13.6 mm in length.The Filter is Designed with Cst Microwave Studio Software and it is implemented on a substrate with dielectric Constant 10.9 And thickness of 1.635 mm.

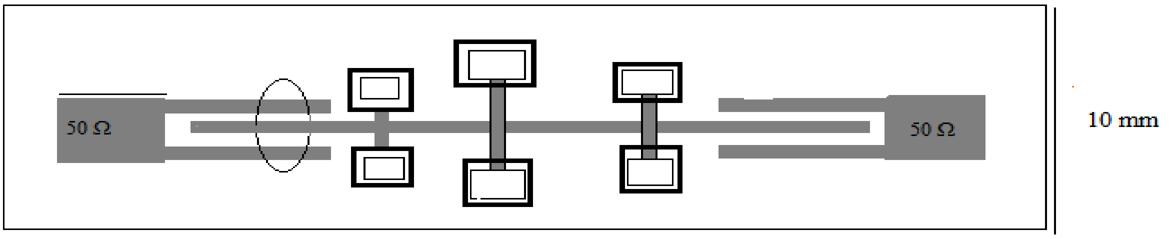
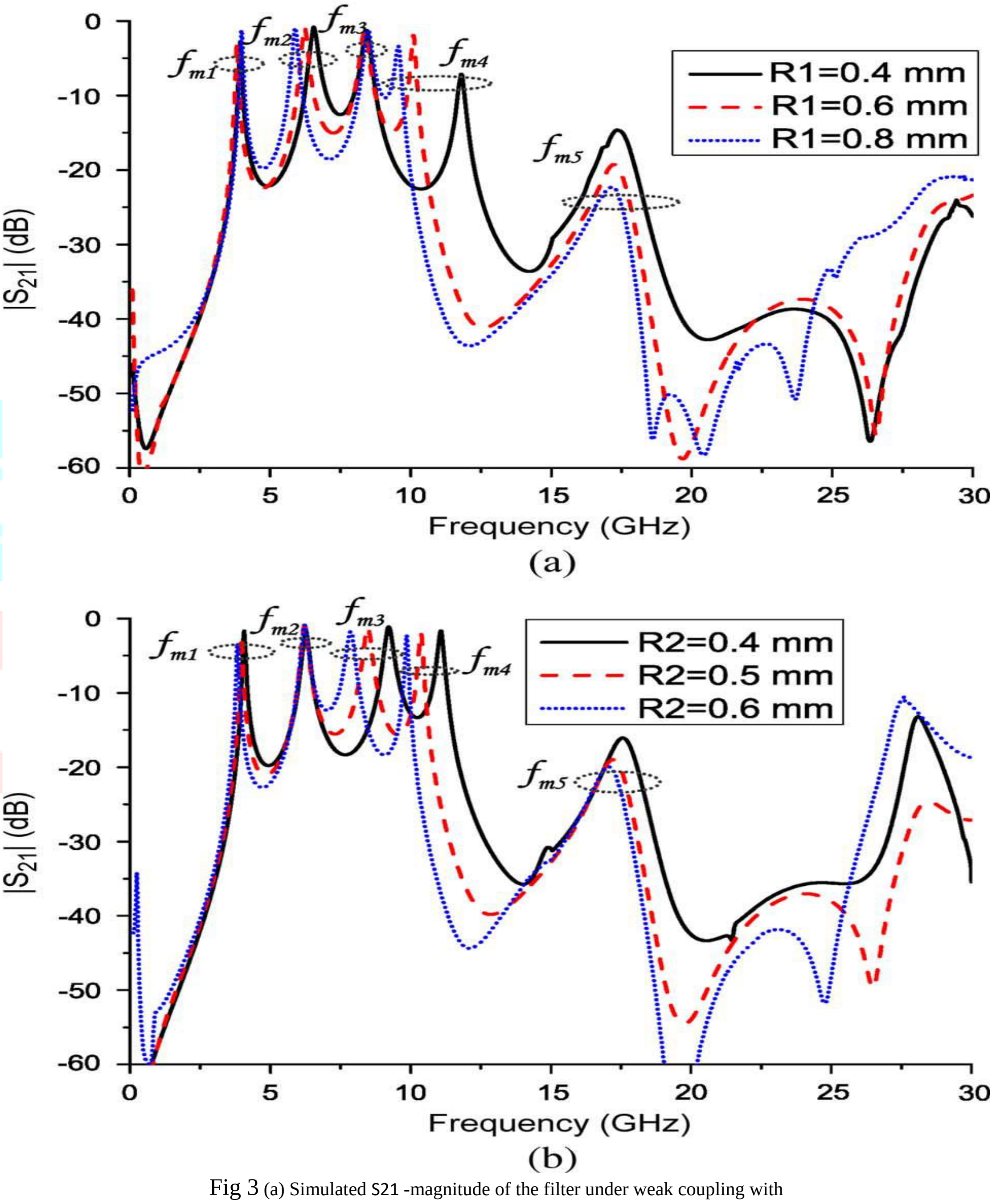


Fig 1: Proposed UWB

2. Filter Characterization

In Multi Mode Resonator(MMR) was originally used to design UWB filter.The UWB Filter Consisted of stubs loaded Multimode Resonator at the Center Section and two identical coupled lines located at input and output side.Three open ended stubs were introduced at the centre of a stepped impedance resonator to allocated the resonant modes more closely with each other.a modified embeded Multimode resonator for bandpass filter with improved upper stopband performance has been explored.It is Formed by attaching three pairs of rectangular impedance stepped stubs in shunt to a simple high impedance microstriplin as shown in fig-1.The interdigital coupled-line can be equaled as two single transmission lines at the two sides It is well valid in theory that the center location of the resonator corresponds to a short circuit or perfect electrical wall for odd modes, and its characteristics are hardly affected by the attachment of the shunt stub, whereas it indicates an open circuit or perfect magnetic wall for all the even resonant Thus, the second mode can be adjusted to the middle of the passband, while the fourth mode can be reduced and allocated within the UWB.



(a)

(b)

Fig 3 (a) Simulated S21 -magnitude of the filter under weak coupling with fixed R2=0.5mm L=0.6mm and varied R1. (b) Simulated S21 -magnitude of the filter under weak coupling with fixed R1 = 0.6mm,L=0.6mm and varied R2.

Conventional UWB filters suffer from narrow upper stop band and interference from other wireless services. Since UWB communication devices occupy a large frequency spectrum, interference mitigation or avoidance with coexisting users is one of the key issues of UWB technology.

As a result, an UWB BPF with improved upper-stopband is realized (insertion loss larger than 30 dB in the range of 12.1 to 27.8 GHz in simulation). On the other hand, as Fig. 3(b) depicts, the five resonant modes all move towards the lower frequency except the second mode (fm2) which is almost unchanged while changing the size of rectangle from 0.4 mm to 0.6 mm. Thus, the two side rectangular impedance-stepped stubs with varied size of two rectangular stubs allocated at left and right corner can provide an additional degree of freedom to adjust the locations of the first four resonant frequencies in an alternative way.

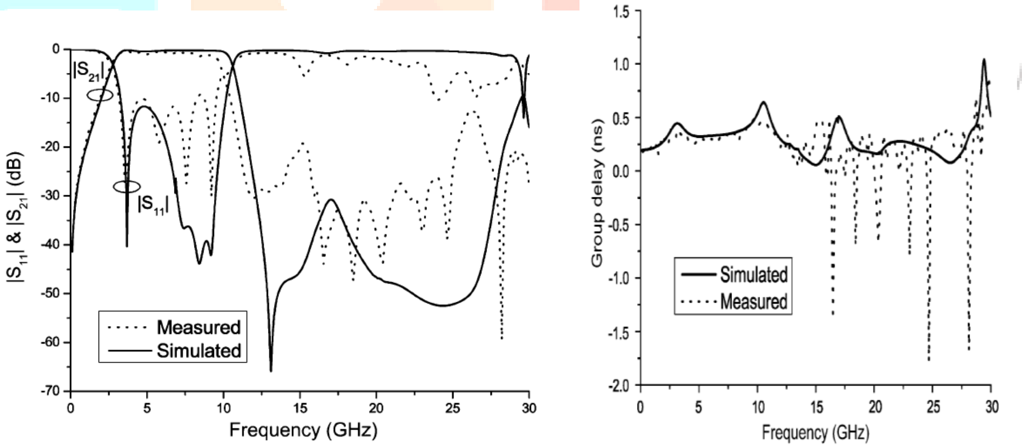
The First four resonant modes(fm1,fm2,fm3,fm4) can be used to make up an UWB passband, if this MMR is properly fed with interdigital coupling lines with increased coupling degree.It has been seen that lowpass behaviour of the proposed mmr highly rejects the two spurious passbands centered at around 17.5 GHz and 23.5 GHz. Respectively as shown in fig.finally we choose L=4.3mm,size of two rectangular stubs 0.6 and 0.5mm.an UWB with improved upper-stopband is realized (insertion loss larger than 30 db in the range of 12.1 to 27.9 GHz.

3. SIMULATED AND MEASURED RESULTS

An Ultrawide Band Bandpass Filter With Improved Upper Stopband Performance is Designed ,Fabricated And Measured.It is Implemented On a Substrate with Relative Permitivity 10.5. and thickness of h=1.635mm. And its Filtering Performance is Measured By Cst Microwave Studio.The Predicted And Measured frequency Response of Insertion And Return Loses Existing electronic devices include current IEEE 802.11a WLAN devices.In the measurement, the 3 dB UWB passband is from 2.8 to 10.2 GHz against the counterpart frequency of 2.8 to 10.6 GHz in simulation. The measured upperstopband is greatly extended up to and beyond 25.5 GHz with an insertion loss larger than 20.0 dB. The predicted spurious passband near the 29.6 GHz slightly moves towards to the lower frequency .and its filtering performance is measured by cst studio suite 2018. The predicted and measured frequency responses of insertion and return losses as well as group delay are plotted in Fig. 5 for comparison. Over the wide frequency range, the simulated and measured results are found to be in good agreement with each other. In the measurement, the 3 dB UWB

passband is from 2.8 to 10.2 GHz against the counterpart frequency of 2.8 to 10.6 GHz in simulation. The measured upperstopband is greatly extended up to and beyond 25.5 GHz with an insertion loss larger than 20.0 dB. The predicted spurious passband near the 29.6 GHz slightly movestowards to the lower frequency. Meanwhile, the measured group delay (0.3 ns) is small and flat in the passband, as depicted in Fig. 5(b). Some minor discrepancies between simulated and measured results may be caused by unexpected tolerances in simulation, material parameters and soldering. using the new MMR which is formed by attaching three rectangular impedance-stepped stubs in shunt to a high impedance

microstrip line. The design procedure of this rectangular MMR is much difficult compared to the circular MMR [8]. Just by simply adjusting the size of 0.5 and 0.6 mm, the first four resonant modes of this MMR can be successfully allocated within FCC regulatedUWBpassband, which makes the 3-dB bandwidth from 2.8 to 10.6 GHz. Meanwhile, a wide upper-stopband with the insertion loss higher than 30 dB in range of 12.1 to 27.8 GHz is achieved. In addition, it has a compact size with 13.6 mm in length.



(a) (b)

Fig. 5. Simulated and measured frequency responses of the proposed UWB BPF (a) s11 —and s21 —magnitudes. (b) Group delay.

IV. CONCLUSION

In this work, a compact UWB BPF with improved upperstopband performance is proposed, designed and demonstrated using the new MMR which is formed by attaching three rectangular impedance-stepped stubs in shunt to a high impedance microstrip line. The design procedure of this rectangular MMR is much difficult compared to the rectangular MMR [8]. Just bysimply adjusting the radius of and , the first four resonant modes of this MMR can be successfully allocated within the FCC regulatedUWBpassband, which makes the 3-dB bandwidth from 2.8 to 10.6 GHz. Meanwhile, a wide upper-stopband with the insertion loss higher than 30 dB in range of 12.1 to 27.8 GHz is achieved. In addition, it has a compact size with 13.6 mm in length.

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