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Band Pass Filter Using U-shaped strips with T-shaped Feed Lines

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Abstract— A band pass filter with tilted ladder shaped patch and U-shaped geometries is proposed in this paper. Feed are connected at the end of open ended stubs. Presented filter is suitable for the application of wireless application in L-band range. A flat passband response can be achieved when it is employed to implement a bandpass filter. The resonator also exhibits attenuation poles close to the edges of the passband, thereby offering sharp rejection in the bandpass filter response. Moreover, since the signal applied at the input port is effectively forced to travel mainly through the transmission line path over the passband frequency, the loss incurred by the coupled lines is minimized. Extensive theoretical analysis of the rectangular ring and design example of the bandpass filter prototypes based on the ring structure is given. The proposed geometry is simulated through ie3d software, and results are purely based on the simulation results.

Keywords— U-shaped patch, tilted patch line, pass-band

I. INTRODUCTION

Among the fundamental components of Microwave, bandpass filters are used in many RF/microwave applications and contributes in the overall performance of a communication system. Microwave filters are utilized in broadband wireless applications like satellite and mobile communication systems and WLAN systems. Filters on various materials are available but preferably standard printed patch filter are being used by engineers over higher frequencies, as they can be fabricated easily with low cost. The size is main constrained in front of microstrip filter designers. Numerous researchers have proposed various configurations for reducing filter size and improving filter performance. Some of the filter configurations are using hairpin resonator, ring resonator, step impedance resonator, defected ground structure, and short circuited stub [1]. From the early investigation of ultra-wideband (UWB) technology in 1960s various wireless services grown very fast, and the demand of multi-band microwave communication systems capable of adapting multiple wireless communication platforms have greatly increased. Apart from the various microstrip components the BPFs possessing tunable multi-band characteristics. In the designing of microwave bandpass filters commonly ring resonator are utilized with the benefit of small circuit size and sharp rejection response [2], [3]. The ring resonator was originally proposed by Woff and Knoppik [3]. Subsequently, with the use of asymmetrical coupling or asymmetrical perturbation, the dual-mode ring bandpass filter was initially reported in [4]. Soon afterward, the ring resonator was established as one of the main structures for planar microwave bandpass filter implementations.

II. P FILTER DESIGN & RESULT ANALYSIS

This paper describes a new design technique for the design of band pass filters with large bandwidths. In this filters quarter wavelength resonators are direct coupled using quarter wavelength transmission lines. Fig. shows a microstrip layout for a band pass filter, used for determining the coupling coefficients.

To use this type of filter in a design, the coupling coefficients must be determined as the tapping point is varied. This can be done using computer simulation using IE3D.

In this research study three progressive patch filter geometries are present. In first geometry an inclined strip is used to connect two T shaped connecting geometries. The length of T shaped feed stub is being calculated by following relation

$$L = \frac{C}{f_c * 10}$$

Where

C = speed of light in mm

f_c = center frequency of desired band

which comes 20 mm and width of end of stub is been taken 1.5 times of L.

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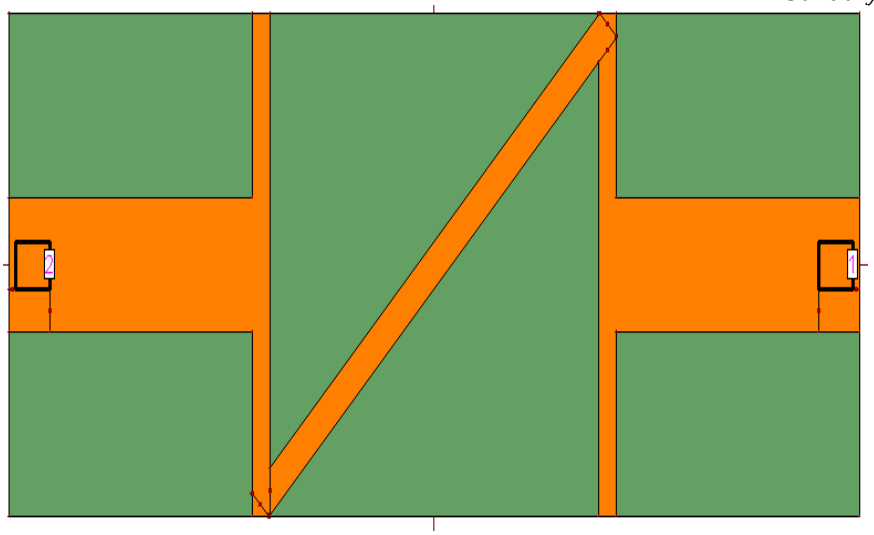

Fig. 1 First Geometry

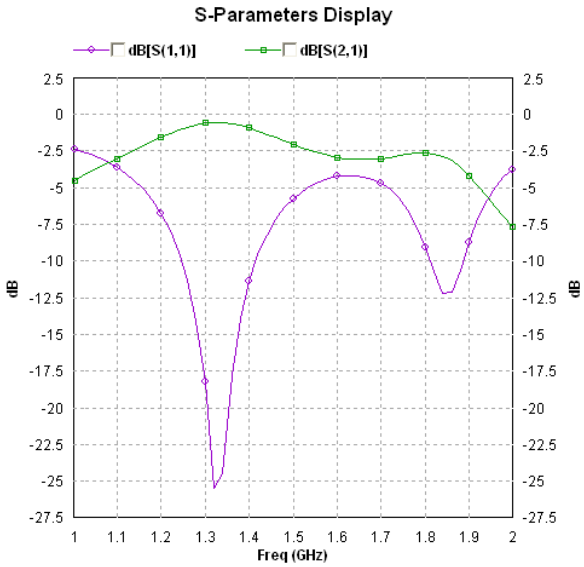

Fig. 2 Response of First Geometry

The simulated results for first geometry, shows that pass band for proposed design is from 1.1 GHz to 1.95 GHz, which is a band of 850 MHz with center frequency of 1.525 GHz. The bandwidth of pass band for proposed filter is 55.7% of center frequency, which makes this filter suitable for the category of ultra-wide band pass filter.

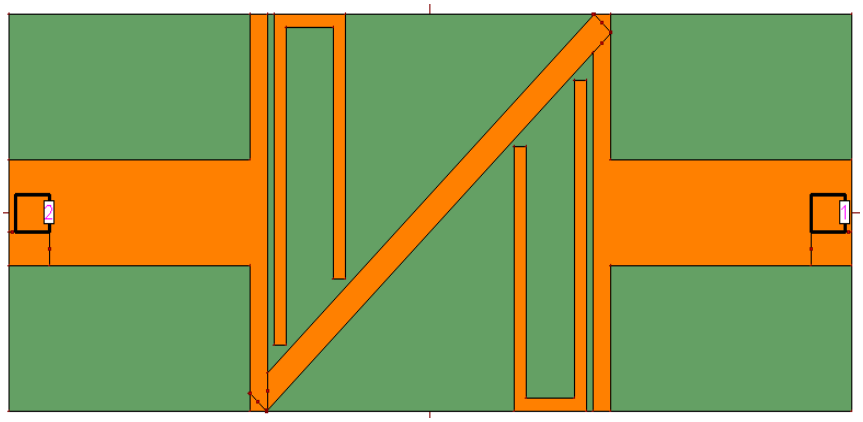

Fig. 3 Second Geometry

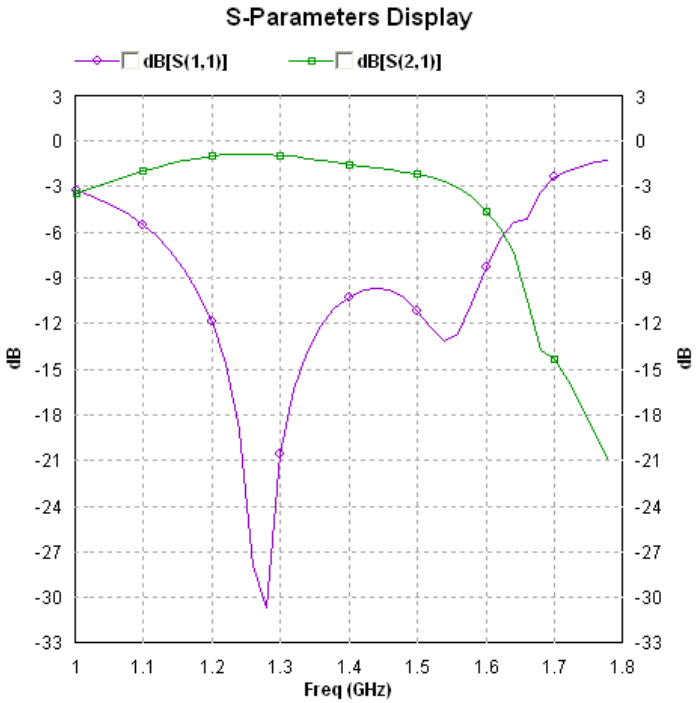

Fig. 4 Response of Second Geometry

By inserting U-shaped geometry in first geometry as shown in second geometry simulated results were got changed and found that pass band is modified to 1GHz to 1.65 GHz which is band of 550 MHz with center frequency at 1.375 GHz. Although the pass bandwidth is decreased in this case but results got improved in the sense of performance

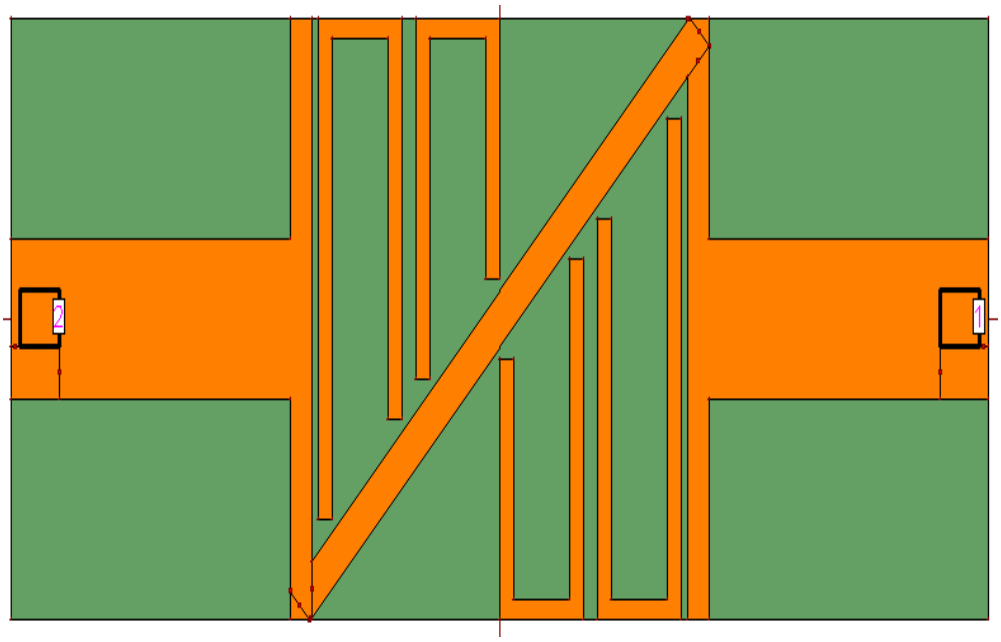

Fig. 5 Final Geometry

In third and final geometry two U-shaped geometries were inserted to improve the results. In this case pass band is changed to 0.95 GHz to 1.6GHz band and performance is more improved.

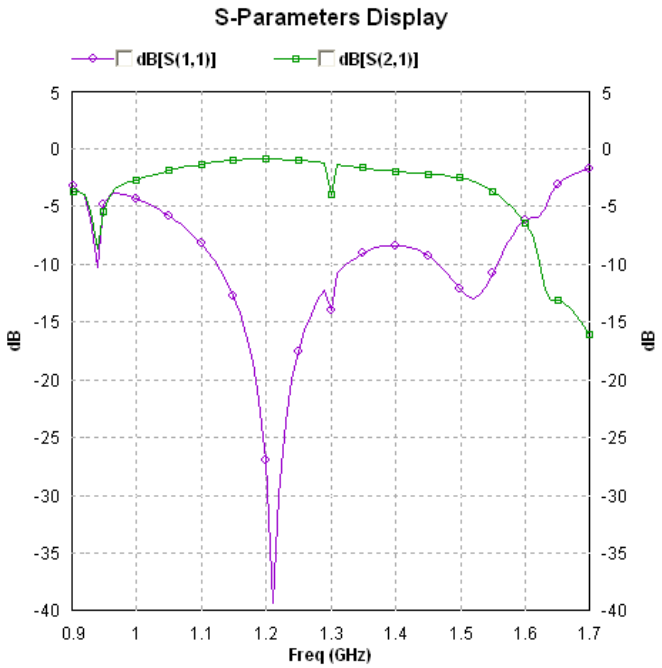

Fig. 6 Response of Final Geometry

III. CONCLUSIONS

A U-shaped patch bandpass filter have been proposed and successfully simulated in a microstrip technology using IE3D software a product of Zeland software company. The introduction of a pair of identical open-ended coupled lines with a shunt open stub, into a transmission line branch of a conventional ring resonator, has led to the band-pass filter application. When the U-shaped filter is employed to implement a bandpass filter, the ultrawide passband resonance frequencies is achieved.

The presented filter is having more than 55% of passband with center frequency at 1.525 GHz. This filter will be suitable for various wireless applications and satellite communication.

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