

Proposal of Ultra-Wide Band Pass Filter by using DGS

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Abstract - In this paper, the reduced size of micro-strip line ultra-wideband band-pass filter is anticipated, this is based on periodic defected ground structure arrangement and micro-strip which is stub loaded. Cascading a high pass filter which has short circuited stubs and a Low pass filter which has non uniform DGS array these together are used to form an ultra-wideband band-pass filter. With ultra wide band-width of 8GHz the BPF worked from 3 to 20GHz .A sharp roll-off frequency and stop rejection of -30dB is detected. Lastly, the filter is made-up and measured. The EM-simulated and calculated results are proposed and outstanding arrangement among them is found.

Keywords- ultra-wideband, micro strip filter, stub, sharp rejection.

INTRODUCTION

An ultra-wideband radio technology is a passive element which is made by ultra-wide band pass filter and much consideration is given to this filter, equally in theoretical as well as engineering practical grounds. Because of the costing is less, huge data transmission speed and very little power intake is more; mark it striking in native area nets, position locality, chasing, and radar system. In wireless communication systems for broadband there is a current progress thus, the proposal of these types of filters is producing a prodigious attention. Inventions in filter grasps and the main transmission line medium for fresh expansions uses the micro-strip filters [1-4].

A fresh procedure intended for the proposal of ultra-wide band pass filters by means of harmonic destruction in pass band is DGS. The projected non uniform DGS assemblies are periodic arrangements that can forbid transmission of electromagnetic wave which

are in assured band of that frequency. Acquires shrill reduction and wide pass band is done by the use of DGS.

The ultra-wide band filter is based on radio technology, these technologies are recommended over others as a very low level of energy for short distance is needed and the communication related to great bandwidth above the huge proportion of the radio spectrum band is required. It is generally used in radar imaging which are generally non cooperative. The basic difference between the conventional radio transmission and ultra wide bandwidth radio transmission is that the information generated by the ultra-wide band width transmission is in the form of radio energy at specific time interval by which it can occupy large band width. These filters are very good and high performance. These are very simple filters and have high frequency performance. This filter is a passive element which plays a very significant part in communication engineering.

The Ultra wide band pass filter contains two parts these are: stubs-loaded multiple-mode resonator (MMR) at the middle of the section and two duplicate interdigital coupled-lines at the right and left segments, by attributing three pairs of stepped-impedance stubs in the mid-section between left and right segment the MMR is formed. Two alike CPWs with extensive slot of the width or high impedance at two sides below the immovable strip width

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and one central CPW with thin slot thickness or low impedance these arrangement composed an open finished MMR resonator on CPW [14].

A new compressed ultra wide band pass filter on micro strip link is created by a single multiple-mode resonator (MMR) that is determined at dual edges by two identical parallel-coupled lines [11].

The information can be modulated in these types of filters by encoding the polarity of the pulse. This phenomenon is not possible in other types of filters. The main aspect of these types of filters is the ability to determine time of transmission at various frequencies. Due to which the problem of multiple path propagation is reduced in the system [18]. Two ultra-wide band contacts might stake the similar range of spectrum by means of orthogonal time-hopping programs for pulse-position that is time-modulated structures or orthogonal beats and orthogonal programs for fast-pulse-based systems.

Multiband devices, have been in recent times receives an enormously rising demand in realizing numerous liberal wireless structures with sudden measures at numerous frequency bands like multiband antenna, multiband filter and multiband low-noise amplifier [20].

Dual-band wireless arrangements of dual-band filter remained originally stated in [21] by gushing two separate filters with dual quantified single pass bands.

These types of filters are mainly used in satellite communication as their outputs are more precise then other types of filters present there. The misrepresentation of a signal because it may take numerous dissimilar tracks to the receiver with various polarization swing and several phase change is a delinquent in narrowband skill for the technology. It also disturbs ultra-wide band transmissions, then due to the multiplicity of geometries smearing to various frequencies the capability towards reimburse is amended. Multipath is the reason for disappearing, and wave intrusion is dangerous.

Multiband structures permit adaptive variety of the bands to offer noble intervention toughness and co-existence properties [17].

To improve multipath-generated replicas of the original pulse is made to improve a receiver's presentation some ultra-wide band systems usage "rake" receiver method. Multiband systems also gives authorization for the adaptive choice of the bands to deliver decent

interference co-existence and robustness possessions, and this article is very conspicuous. The low pass filter arrangement is realized by the resources present from the periodic patterns of DGS and high pass filter contains transmission lines in which shunt stubs are present having equal distances which is alternating with these transmission lines. The sluggish wave outcome related to DGS delivers definite reduction in its size. A very wide forged free pass band with shrill refusals in stop band is used in the projected filter.

MICROSTRIP BANDPASS FILTER

In modem microwave and millimeter-wave systems traditional planar filter is further satisfactory to be applied, because of its reduced weight, compact size, easier to be integrated and low cost [13]. But it has a disadvantage for its imitation response thus to reduce that difficulty micro strip filter is used.

Design methods for single mode micro strip filters have already been proven for example broad side edge coupled filters. By the means of dual mode cavity or dielectric resonator filters the extraordinary enactment requirements for communication satellite frequency multiplexers surely are satisfied.

An original micro strip band pass filter has a two cascaded PBG structures, which has an extensive stop band. Due to the easiness of design and fabrication, it displays that BPF has a great possible for actual presentations in communication and other systems [15].

Such resonators have very simple structures thus there are many readings which gives information about dual mode ring resonator BPFs [10].

The principle of multiband arrangement is created similar to transmitting unlike signs in unlike bands in a periodic arrangement, likewise a frequency leaping. The entire extent of the ring is selected which is equivalent to one wavelength (h) to the epicenter frequency. The impedance characteristics of ring are given by Z_1 , and Z_2 and a distance of h . An exposed stub agitation taking impedances characterized of 2 and length $h/4$ are located in the regularity plane [10].

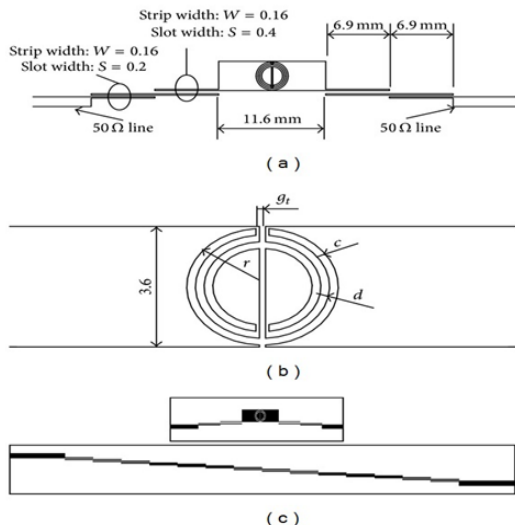


Fig. 1 Representation of a micro strip ring filter

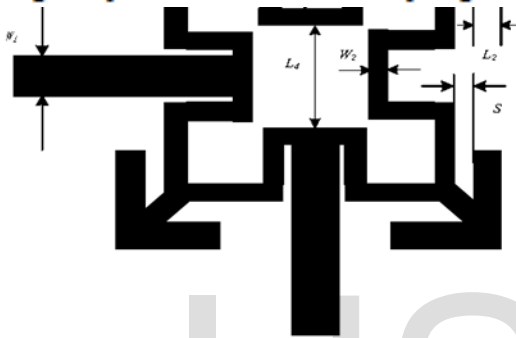


Fig. 2. Dual mode micro strip resonator

Fig. 2 shows, an original dual-mode micro strip ramble loop resonator. A ramble coil containing four matching arms on each side that is every of them might be occupied as a ramble lines during its application in various electronics applications methods as a simple resonator. A minor four-sided cover is involved to an internal curve of the coil for exciting and to formulate a dual-mode resonator coupling a pair of degenerate modes taking the similar propagation constant is used [19].

TYPES OF FILTERS

Filters are the circuits which accomplish signal processing function to eliminate unwanted frequency components from the signals. The types of filters which are proposed in this paper are:

- 1) High pass filter
- 2) Low pass filter
- 3) Cascaded filter

1) High pass filter: The high pass filter is used in electronics device where it permit the signals to pass through it which have the frequency more than to the cut of frequency and attenuation signal with frequencies less than the cut off frequency.

2) Low pass filter: The low pass filter is used in electronics device where it permit the signals to pass through it which have the frequency less than to the cut of frequency and attenuation signal with frequencies less than the cut off frequency.

3) Cascaded filter: The cascaded filter is constructed by combining high pass filter and the low pass filter. Thus, the result which is the output of the cascaded filter is the amalgamation of the high pass filter and the low pass filter outputs.

HIGH PASS FILTER PROPOSAL & SIMULATION

The high pass filter is used in electronics device where it permit the signals to pass through it which have the frequency more than the cut of frequency and attenuation signal with frequencies less than the cut off frequency. The shriller transition band is present between the stop band and the pass band than utmost to the prior referenced ultra-wide band filters with level frequency response so that the loss can be represent at least less than 210 dB below 12 GHz of frequency.

The inter-digital capacitors and short-circuited stubs, which are for numerous millimeters are very small and compact in size. It is thinkable to propose a higher quality of high pass filter with two extra rudiments. The comprehensive design procedures of a high pass filter are presented in [5, 6]. High pass filter is executed by shunt stub which are surged together having identical discontinuous distance which have constant lines via transmission occurs. It is also the decent regulator of the characteristics of band-pass filters; which deliver persistent set of delay above the pass-band. A periodic response is shown by high pass filter because of its dispersed environment and it demonstrate a characteristic of band-pass filter from DC up to $2f_0$ and a mark at $2f_0$. The f_0 [5,6] is resolute with the help of stub span which would not interrupt the pass band of high pass filter. Replicated S-parameters of the high pass filter is shown in Fig.3 (a). S-

parameters were replicated by means of CST simulant which is known as microwave simulator.

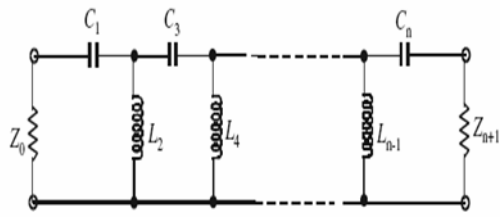


Fig.3 (a) Circuit diagram of High Pass Filter

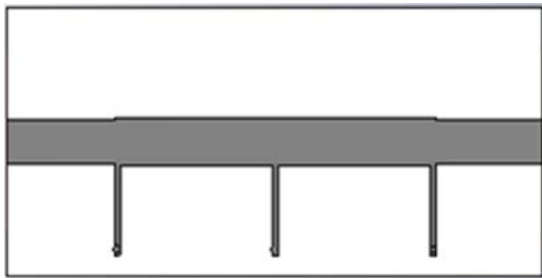


Fig. 3 (b) High pass sample circuit and layout of the used high pass filter

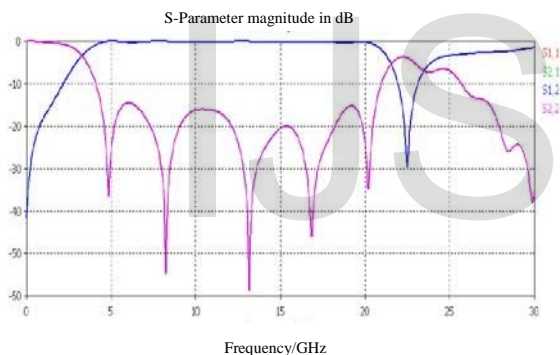


Fig. 3 (c) High pass filter simulated S-parameter

LOW PASS FILTER PROPOSAL & SIMULATION

The low pass filter is being used in electronics device where it permit the signals to pass through it which have the frequency less than to the cut of frequency and attenuation signal with frequencies less than the cut off frequency.

For etching geometries defected ground structures and Electromagnetic band gap were relevant consistently or non- consistently in planar arrangement that is periodically or non-periodically design to suppressed harmonics to improve the characteristics of stop band filter and also improve the delay line. The defected ground structure, which were evolve from

electromagnetic band gap are comprehended by a process called etching in which firm design is done in the back side of metallic ground plane because of that the current circulation in the ground takes place which change according to its electrical characteristics [8,9]. The inductance which is active and the parameter like capacitance of the line changed [7]. The electromagnetic band gap organization is required in circuit to subdue the waves on the surface so that increase in noble pass-band or stop band can occur. The element defected ground structure can offer decrease in size, improvement in bandwidth and they has an ability to suppress harmonics and spurious. By cascading a precise number of DGS defects because of that we can grasp the micro-strip low pass filter. At the stop-band a transmission zero is enhanced by each section of defected ground structure of the low pass filter and therefore there are more sections provided due to the presence of extra transmission zeroes due to which stop-band extended. Using CST Microwave, the magnitudes can be adjusted as well as accustomed to get the finest result in its performance of the low pass filter. Fig.4 (a) represents planned low pass filter and its replicated S parameters. The projected low pass filter has a extensive refusal of -20 dB up to 25 GHz in stop band.

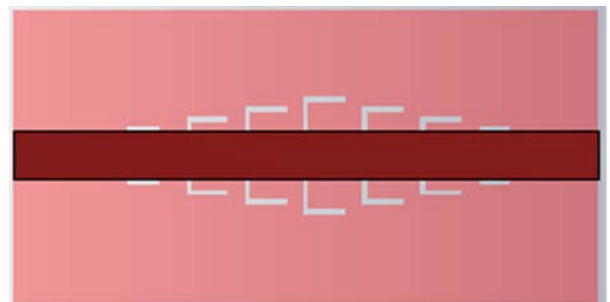


Fig. 4 (a) Layout of Low Pass Filter

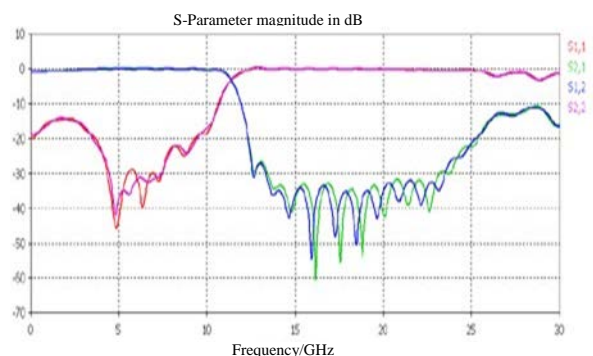


Fig. 4 (b) Low Pass Filter with an array of DGS which is non-uniform in nature and its S-parameter simulation

**CASCADED HPF & LPF PROPOSAL,
 SIMULATION & RESULT**

The cascaded filter is a filter which is made up by the amalgamation of the high pass filter and the low pass filter. Thus, the result which is the output of the cascaded filter is the amalgamation of the high pass filter and the low pass filter outputs. Replications shows that after gushing, the low pass filter and the high pass filter, the cut-off frequency which is low of high pass filter moves in association with its complement parts without defected ground structure segment in the plane. The low pass filter and high pass filter can be unswervingly cascaded or embedded each other to make a system of wideband BPF [12]. Above the specified frequency band this plan demonstrates a better band pass filter characteristic. Fig.5 displays the outline of the projected ultra-wide band pass filter composed with its replicated S-parameters. The total magnitudes of this ultra-wide band pass filter are 15mm by 30 mm. Application of the optimization to the cascaded filter directly is not done, and the performance of this filter is used as a benchmark. Of the unswervingly cascaded band pass filter, the upper and lower transition bands agree well with its counterparts. The composite band pass filter needs further optimization since the low pass filter part of the composite band pass filter assembly is disturbed. Later optimization takes place which results in-band return loss which can be further more developed more than 20 dB

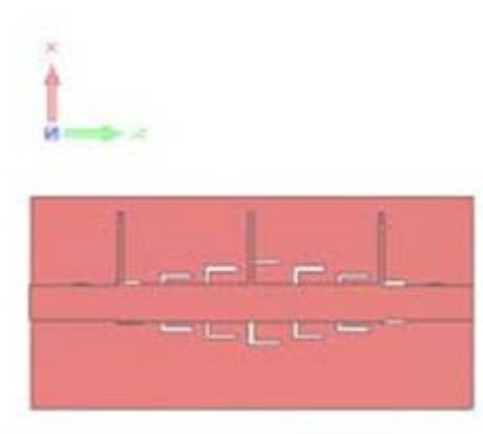


Fig. 5 (a) Ultra wide band pass filter layout

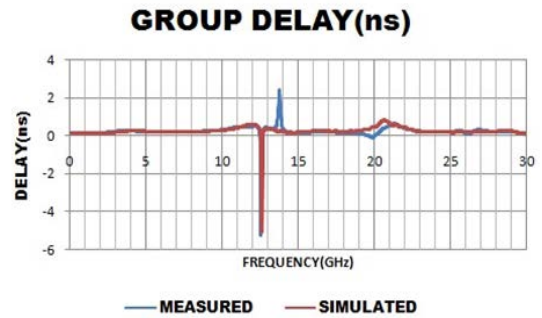


Fig. 5 (b) S21 and S11 plot of cascaded high pass filter and low pass filter

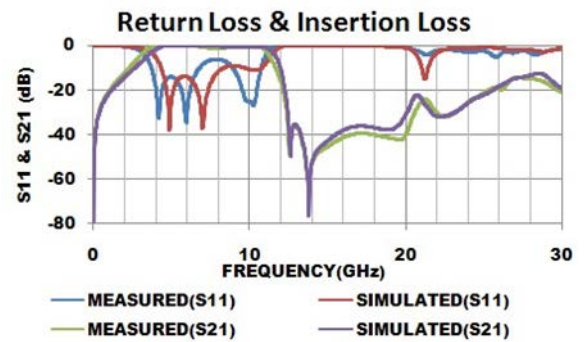


Fig. 5 (c) Group Delay between port 1 and port 2

CONCLUSION

An ultra-wide band pass filter based on cascading of low pass filter and high pass filter is realized which have high performance and compressed size. The originality of projected ultra-wide band band-pass filter is large bandwidth with sharp refusal without humiliating its pass-band presentation. The recreation result for the high pass filter and low pass filter are also obtained in this paper. Low pass filter arrangement is realized by the use of periodic patterns which are found in DGS. The composite band pass filter was imitated with the help of EM simulators. The filter has a sharp stop rejection better than 30 dB up to 20GHz with a bandwidth of 3 dB of 7.9 GHz with sharp roll off is exhibited by the simulations which are represented by the S-parameters of the filters. The proposed ultra wide band filter can be used in radio systems, integrated systems to enhance the interference immunity efficiently due to the reduction in its size.

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