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New Compact Dual Band BPF with WIMAX Notch and Comparison of Losses with Microstrip

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ABSTRACT

The format of a Dual band Band Pass Filter (BPF) with WIMAX notch for Microstrip (3.0 - 3.9GHz). The most important diagram proposed in this venture are based totally on the Dual band BPF with WIMAX notch, which consists of a easy rectangular body built on a 1.6mm thick commercially on hand Rogers TMM 10 cloth substrate. The twin band BPF insertion loss is improved to -1.5dB, to -0.5dB and return loss is diminished to -13.25dB to -25dB at 3.0GHz to 3.9 GHz, in accordance to simulated and experimental results. With the assist of Ansoft HFSS model 14.0 software, this twin band BPF was once designed and its overall performance was once evaluated. The evolution and improvement of the Dual band BPF for microstrip functions is the primary focal point of this project. The simulated effects exhibit that the insertion loss and return loss of a twin BPF have dramatically increased. The designed filter-antenna operates at a centre frequency of 2.4 GHz and has a incredibly wide-band impedance bandwidth of about 1.22 GHz and a fractional bandwidth (FBW) of about 50%.

The outcomes of three unique kinds of substrate material, which are Rogers RT5880, Rogers RO3003, and FR-4, are investigated and introduced the usage of the equal configuration. The filter-antenna sketch is simulated and optimised the use of pc simulation science (CST) software program and is fabricated and measured the use of a Rogers RT5880 substrate with a peak (h) of 0.81 mm, a dielectric regular of 2.2, and a loss tangent of 0.0009. The shape is printed on a compact dimension of 0.32 λ0 × 0.30 λ0, the place λ0 is the free-space wavelength at the centre frequency. A accurate settlement is bought between the simulation and size performance. The designed filter-antenna with the accomplished overall performance can discover exclusive purposes for 2.4 GHz ISM band and 4G wi-fi communications. Recently, many microstrip filter-antenna designs the use of specific kinds of substrate substances have been proposed. In a co-design of a filter-antenna the usage of a multi-layeredsubstrate is delivered for future wi-fi applications. The layout consists of three-pole open-loop ring transmission traces and a T-shaped microstrip antenna.

The multilayer science is utilized to obtain a compact measurement structure. A Rogers RT5880 substrate with a relative dielectric consistent of 2.1 and a thickness of 0.5 is used in this structure. The filter-antenna layout operates on 2.6 GHz with a fractional bandwidth of round 2.8% and has executed a measured obtain of 2.1 db. The essential benefit of this shape is the compact size, however it lacks simplicity in the building due to the use of a multilayer substrate configuration. The filter-antenna introduced in [25] accompanied the identical process and executed comparable overall performance with a round polarisation characteristic. However, the proposed configuration utilized any other layout approach primarily based on the substrate built-in waveguide technology. It is regarded that the use of a substrate fabric in the sketch of RF/microwave circuits is frequent and has some crucial challenges. One of the format fundamentals is to select the suitable substrate cloth kind as properly as the thickness to suit with a appropriate application. Finding the dielectric substrate for printed circuit board (PCB) substances is a trade-off manner between high-performance designs and the fee of these substances at the RF and MW frequencies. This represents a enormous undertaking for the designer.

We Compare the simulation outcomes of designed filter with Microstrip filter. Design of twin band BPF with wimax notch gives the fulfillment of traits of low insertion loss & return loss. It additionally have a excessive selectivity and wider vary of Bandwidth. It gives a low team lengthen for 2.5/3.4 GHZ(WIMAX) and 4.14-5.32GHZ (UWB) bands. The response of the filter was once simulated with the aid of the use of Ansoft HFSS Simulator

Key Words: *Dual Band BPF, Ultra Wide Band Filter, WIMAX, Microstrip, Ansoft HFSS, Low Pass Filter, High Pass Filter.*

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I. INTRODUCTION:

Dual band Band Pass Filter (BPF) are used for satellite tv for pc S-band. This lookup is vital to enhance the insertion loss in twin band BPF with WIMAX notch. The purposes of this lookup are broadcast radio, wi-fi conversation and television. The Ansoft excessive frequency shape simulator (HFSS) should be a full wave electromagnetic (EM) software program bundle for calculating the electromagnetic conduct of a 3-d structure. They are used significantly in communications purposes to both choose frequencies of activity or reject frequencies which intervene with the communications system. The small top quit band, on the different hand, is the key draw back of this shape of arrangement. The former approach is resonant in nature and consequently perfect for narrowband processing thanks to SRR technology. The 2d solution, on the different hand, has large transmission bands as a characteristic of its blended left and right-handed features.

The CPW is a multimodal waveguide succesful of propagating two indispensable modes (even and odd) at the equal time, which engage at any asymmetry or transformation. The principal intention of a wi-fi verbal exchange system is to provide the first-rate offerings feasible with the aid of the usage of the least quantity of electrical energy and bandwidth available. The graph suggests the two most essential community architectures for elliptic curve low-pass prototype filters. Microstrip processing has been used to include the majority of elliptic-function low-pass filters (LPFs).Microwave Band Pass Filters (BPFs) with excessive selectivity are necessary factors of microwave wi-fi verbal exchange systems. The designed filter-antenna operates at a centre frequency of 2.4 GHz and has a distinctly wide-band impedance bandwidth of about 1.22 GHz and a fractional bandwidth (FBW) of about 50%. The outcomes of three specific kinds of substrate material, which are Rogers RT5880, Rogers RO3003, and FR-4, are investigated and introduced the usage of the identical configuration. The filter-antenna sketch is simulated and optimised the usage of pc simulation science (CST) software program and is fabricated and measured the usage of a Rogers RT5880 substrate with a top (h) of 0.81 mm, a dielectric regular of 2.2, and a loss tangent of 0.0009. The shape is printed on a compact dimension of 0.32 λ0 × 0.30 λ0, the place λ0 is the free-space wavelength at the centre frequency. A top settlement is bought between the simulation and dimension performance. The designed filter-antenna with the executed overall performance can locate exclusive functions for 2.4 GHz ISM band and 4G wi-fi communications.

II. LITERATURE SURVEY:

Seyyed Mohammad MehdiMoshir, MaryamKhodadadi,, NajmehNozhat explained Compact and wideband band pass filters with analysis of the CRLH-TL characteristics based on stepped impedance resonator", In this paper, we have investigated two unique Wide Band (WB) Band Pass Filters (BPFs) based on composite right/left-handed (CRLH) structure that have high performance in C-band. The proposed filters have been implemented with steppedimpedance resonator (SIR) section and inter digital capacitors on it with a parallel coupled-shorted stub (CSS). High selectivity, high out-of-band rejection, low loss and two transmission zeroes at the lower and upper pass band/stop band edges have been observed. The out-of-band rejection levels in two filters are better than 17 dB and 20 dB at the lower and upper band edges, respectively. In addition, the return loss and insertion loss of the proposed CSS filter are greater than 17 dB and less than 0.7 dB, respectively. Also, the return loss and insertion loss of the proposed spiral CSS (SCSS) filter are greater than 20 dB and less than of 0.5dB, respectively. The presented structures have been investigated analytically and experimentally in order to verify balance between the results of the full-wave simulation and the equivalent circuit model with the experimental ones. The dimensions of the suggested filters are 21.6×3.06 mm2 and 14.6×4.2 mm2. The specifications and compact size of the filters make them suitable for wideband wireless communication systems.

Dong-Sheng La, Hong-Cheng Li, Jing-Wei Guo, and Yu-Ying Li described Design of Broadband Band-Pass Filter with Cross-Coupled Line Structure, Band-pass filters (BPFs) with high frequency selectivity and out-of-band rejection levels are intensively required in the modern wireless communication systems. Resonators are usually proposed to construct wideband BPFs. Wang introduced a cross-shaped resonator with wide pass band. By cascading two cross-shaped resonator structures, a compact ultra-wideband band-pass filter is designed. The performance of the wideband BPF need to be improved. Xu proposed a broadband band-pass filter composed of the coupled lines and a cross-shaped resonator, which improves the frequency selection characteristics of the band-pass filter by introducing a transmission zero point. In a novel band-pass filter with a T-shaped structure is proposed. The position of the transmission zeroes can be adjusted to achieve high selectivity of the band-pass filter. Cheng proposed a broadband band-pass filter based on parallel coupled lines and cross-shaped resonators. The p-i-n diodes are used as the tuning elements, which can implement three reconfigurable bandwidth states. In, the filter is based on the cross-shaped resonator structure with terminal short circuit. The low- frequency band of the first pass band can be adjusted by the capacitance value, while the other three band edges remain unchanged. In, a cross-shaped resonator with an open stub is used to design a band-pass filter and a cross-coupled stub is used to design a microstrip band-stop filter. Most filter structures are complex and difficult to be analysed and discussed. Some filters are difficult to give an equivalent circuit for analysis. In addition, most filters require high manufacturing accuracy.

Mamoon A. Al-Atrakchii, Khalil H. Sayidmarie, & R.A.Abd- Alhameed introduces a Compact Band-stop Microstrip Line Filter Using U-Shaped Slot, A band stop filter is proposed, where the resonant element is a slot that is folded to the shape of the letter U and embedded into the microstrip line so that no extra width is required. Moreover, the folding of the slot reduces its length to ¼ the effective wavelength. This is a considerable size reduction in comparison with the filters using the resonant elements like rings or coupled short-circuited and open-circuited stubs. The designed prototype at the WLAN frequency of 2.45 GHz was investigated using the CST software package and showed low insertion loss at the pass bands and high rejection across the stop band. The folding of the slot offered very low radiation at the stop band. The simulation results are validated by measurements on the fabricated prototypes..

III. EXISTING SYSTEM

The Dual band Pass Filter (BPF) is similar to the UWB dual band filter in this analogy. In the old filter, they used a compact dual band filter, but in the new one, we used a dual band BPF. The original filter has a low insertion loss, while the newly constructed filter has a low return loss. In this case, He is using HFSS (high frequency structure simulator). HFSS is a platform for constructing three dimensional (three-dimensional) electromagnetic (EM) models. Electronic components include antennas, antenna arrays, RF or microwave elements, IC sets, and circuit boards, which are all examples of high-frequency electronic objects. We will use FEKO and CST to obtain a higher insertion loss than the current research (Osman and Raju 2020).

- Microstrip filter designs involves number of Considerations including careful Choice of topologies and substrates.
- The choice of substrate depends on Size, Surface wave effects, Dielectric Loss ,Temperature Stability.
- Loss of the filters has reduced up to 5dB only.
- To avoid mismatching of forwarded information.
- Wideband filters can be employed in various Wireless Systems

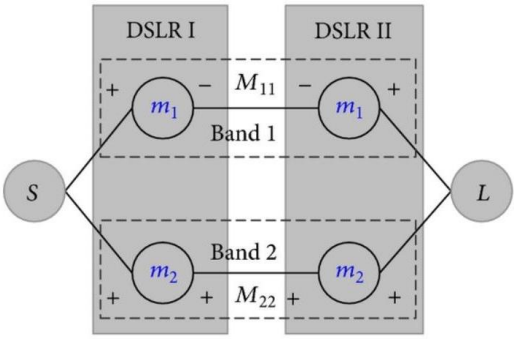

Fig 1: Existing Block Diagram

PROBLEM IDENTIFICATION

- Narrow bandwidth
- Large circuit size
- High Cost
- Installation of Hardware takes more time

PROPOSED SYSTEM

- Supports both linear as well as circular polarization.
- Easily integrated with microwave integrated circuits.
- To provide high speed data rate and telecommunication services.
- Simulation results of Losses of the dual band BPF with Wimax notch has reduced up to 15db.
- Provides a complete analysis of comparison with pictorial information.

The proposed block diagram consist of four sections. They are: Source, Dual Band BPF with Ansoft, Output of the dual band filter and Comparing of results with microstrip filter. At the initial stage of the proposed system, we have to feed the basic requirement to the software designing platform to design a Dual Band pass filter. Later the output characteristics has been obtained by clicking on the report analysis in the Ansoft. The results which are obtained from Ansoft Should be placed in SPSS to compare the output Characteristic graph with existing microstrip filter.

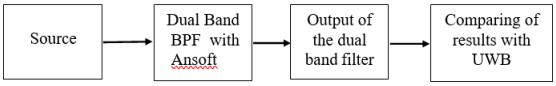

Fig 3: Block Diagram of Proposed design

HARDWARE AND SOFTWARE REQUIREMENTS:

- ZELAND IE3D
- Ansoft HFSS
- Microwave Studio CST
- Antenna Magus
- Filter lab
- Filter wizard

IV. METHODOLOGY

The WiMAX notch filter is fashioned by means of the mixture of the each the LPF and HPF with one of a kind cut-off frequencies. Filter designs past 500MHz are hard to realise with discrete elements due to the fact the wavelength will become related with the bodily filter thing dimensions, ensuing in a number losses. Band omit filters (BPFs) have an imperative function in distinct wi-fi verbal exchange structures specially in microwave structures that are restricted with a small occupied vicinity for microwave factors and circuits. This kind of filters need to fulfill the following specifications, such as dimension compactness, harmonics suppression, excessive selectivity, and insertion loss discount in the executed band to be like minded with the current verbal exchange systems. The resonator with open-loop configuration can be completed by means of the use of a half-wavelength microstrip line of the running frequency with coupling structure. The coupling can be electrical, magnetic, or blended coupling to gain the favored filtering performance. With the repaid traits of the wi-fi conversation systems, designing filters with multi bands is preferable. More research have been carried out to obtain the dual-band response of the band ignore filter. Since there are a lot of purposes that must be operated concurrently besides any interference such as WLAN, which runs at 2.45, 5.2, and 5.8 GHz and WiMAX, which additionally runs at 3.5 and 5.2 GHz.

The electric powered area distribution effects of the BSF at the principal and 2d modes 5.5/14.5 GHz (band end region) and at 2.5 GHz (pass-band region). The physical shape of the third-order BPF is decided the usage of EM simulation relying on the values of coupling matrix and exterior fine factor. The filter is composed of two coupled resonators as preceding second-order filter linked with the input/output ports and the 1/3 resonator is an open-loop resonator with large dimension and coupled with the two resonators. The lumped capacitor enhances the strength saved in the resonator which in turn will increase the high-quality component of the resonator at the fee of the bandwidth. Two electrically coupled OLRs loaded with a stub the usage of 0◦feeding technique, two spiral resonators and lumped capacitors have been utilized to acquire the preferred 3.5/5.5 GHz and 3.5/6 GHz frequency band to serve in wi-fi applications, in particular WiMAX/WLAN applications.

V. RESULTS :

- With the help of obtained results, we can conclude the characteristics of designed filter has reduced
- There are various types of methods are available to design the filter on that by using WLAN Notch gives better results
- These results are used to compare with UWB filter
- This project gives an idea of all, how to reduce the losses of filters by various approaches

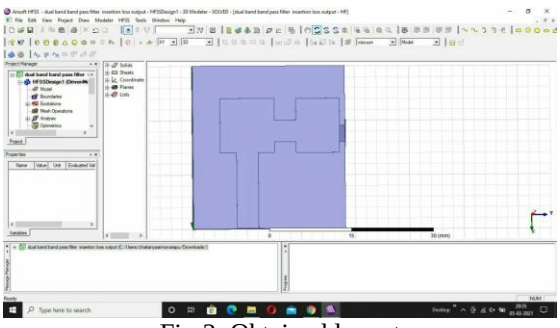

Fig 2: Obtained layout

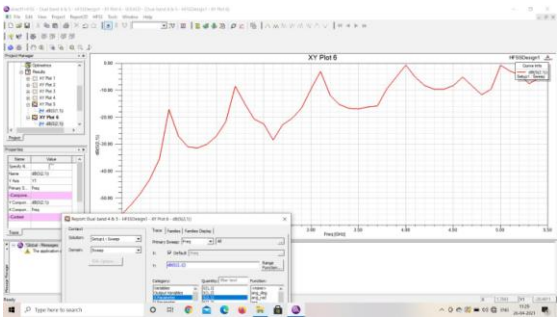

Fig3: Output of Return loss

	Group	N	Mean	Std. Deviation	Std. Error Mean
frequency	fr4 epoxy	10	3.4500	.30277	.09574
	Rogerus rt/duroid 6010	10	3.4500	.30277	.09574
Return loss	fr4 epoxy	10	7.5358	4.98063	.05750
	rogerous rt/duroid 6010	10	8.6292	6.45135	.04010

Fig X:Group Statistics of return loss

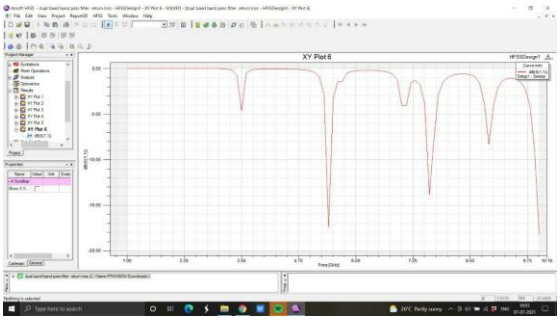

Fig 4: Output of Insertion Loss

	Group	N	Mean	Std. Deviation	Std. Error Mean
frequency	silicon	10	3.4500	.30277	.09574
	rogerus rt/duroid 6010	10	3.4500	.30277	.09574
Insertion loss	silicon	10	4.1783	1.70557	.05393
	rogerus rt/duroid 6010	10	4.3903	2.65539	.08397

Fig X: Group Statistics of Insertion loss

VI. CONCLUSION

This project emphasizes on the current scenario of Filter design and the need of the dual band filters is to manage the vast range of applications in our day to day life. There are various types of methods are available to design the filter on that by using WIMAX Notch gives better results . After obtaining the results of designed WIMAX Notch filter. These results are used to compare with Microstrip filter. This project gives an idea of all how to reduce the losses of filters by various approaches.

- With the help of above results, we can conclude the characteristics of designed filter has reduced.
- We can also verify the results of our designed filter with microstrip filter for justification of analysis.

VII. FUTURE SCOPE

Performances of twin band BPF and Ultra Wide Band (UWB) BPF are analysed. The return Loss outcomes have been simulated for band skip filter. The proposed graph of twin band BPF has a return loss of -

13.25dB and -25dB at the frequency of 3.0GHz and 3.9GHz. After analysing the simulation curves, it has been discovered that the CPW dual band BPF has higher insertion loss than the Microstrip twin band filter. The contrast of insertion loss for CPW twin band BPF with Microstrip twin band filters. When compared to microstrip band ignore filters, the Dual band BPF has a first-rate enchancment in insertion loss. The Dual band BPF insertion loss is extended to 1.5dB,-0.5dB at the frequency of 3.0GHz and 3.9 GHz, in accordance to simulated and experimental findings in Ansoft HFSS 14.0 model software.

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