Designing Of Uwb Bandpass Filter By Cascading Highpass And Lowpass Filter

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Abstract. A Ultra WideBand(UWB) bandpass filter(BPF) is introduced in this paper. According to the paper, we developed good insertion loss and return loss of bandpass filter by cascade the highpass and lowpass filter instead of using simple bandpass filter. This research upgrade the outcome and prototype of the bandpass filter for wireless communication. In this paper butterworth technique is used in the designing of the bandpass filter. In this paper we designed Ultra-wideband bandpass filter and compare result with the simple bandpass filter also improved the various parameters. Simulations have been performed by using Microwave office 2002.

Keywords: Ultra wide band, high pass filter, lowpass filter

1. INTRODUCTION

Ultra-wideband bandpass filter is use remote development prepared for sending information over a wide scope of repeat bunches for small detachments with less power and more speed of information transmission. These filters are used for the action of transmitting and getting less emissions of Radio frequency essentialness. The Ultra wideband channel have unprecedented limit with regards to applications that require precision division or arranging estimation similarly as quick remote system. The Ultra wideband development passes on more transmission rates of bits more than 100 Mbps up to 1 Gbps. The Ultra wideband waves can enter via doors with various checks. The key central purposes of the Ultra wideband structures over smallband systems are more data rate as a result of the tremendous information transmission, small equipment money value, low efficiency and immunity to two or more than two paths[1]. In 2002, The usage of ultra wideband (UWB) is supported by the Federal Communications Commission (FCC) from 3.1 GHz to 10.6 GHz for business correspondence works. The FCC Frequency Mask generally requires the going with excusal for a UWB channel plan:

- 10 dB least excusal at 3.1 GHz
- 10 dB least excusal at 10.6 GHz

The Ultra wideband wireless communication commonly speak with less heartbeats or cycles on the request for minorseconds, send their vitality over a large area of transmission capacity, rather than tweaked sinusoids whose vitality is confined around a solitary recurrence.

The Ultra wideband is shown as the new powerful idea for small dimensions remote interconnection among the figuring gadgets. Number of applications in remote new idea has been centered around
small band implementations. New technical creation necessities on ultra wideband frameworks present disparity from the thin range. Be that as it may, silicon and equipment. Upgrades and calculations for effective knowledge flow and structure the executives are the specific problems that depend on the new technical creation.[2] Ultra wideband innovation regulates mathematical graphs other than constant transporter graphs. As defined over, the quality level of ultra wideband are amazingly short heartbeats, and low obligation cycle at time space. For recurrence area, ultra wide range, low force phantom thickness, and worthy obstruction with other clients are primary quality level. Moving high range of data rate at exceptionally less force with more transmission capacity, it isn't upset by typical RF. Extra factor, it authorize range for use again as 3.1-10.6 GHz coincide with multiples clients. The two or more paths invulnerability is in the structure that way detain is notably more well known than beat range. The UWB framework structures are practically all computerized, basic small part that keep up low cost. UWB gives output information for data transfer capacity, money value, antenna dimensions, and force application for cutting edge necessities.

2. FUTURE OUTLOOK
A Ulta-wideband bandpass filter is evolved and aim is to upgrade the detailing of filter by designing of UWB band pass filter by cascading the low pass filter and high pass filter insted of simple UWB band pass filter.[3] In this paper we used microwave office simulator 2002. first of all we designed the low pass filter and high pass filter than combine both the filter for designing the cascadded bandpass filter. we also designed the simple bandpass filter. comapreall the desired parameter for both the filter that are cascadded BPF and simple BPF[13].

3. FINDINGS OF LITERATURE SURVEY
There have been many techniques is used to designed the various bandpass filter and by changing various paramter different studies have been done. Different software were used for the designing of the bandpass filter. Xiaolin Fan et al. in his paper, a productive full wave electromagnetic (EM) plan and enhancement technique for ultra-wideband bandpass channel is proposed. A ultra-wideband bandpass channel with 100% fragmentary data transfer capacity is structured utilizing Sonnet EM test system to confirm the proposed strategy[9]. Johannes A. G. Malherbe et al. As per the findings of planar wideband bandpass channel with an amazingly wide upper stopband is portrayed. The filter configuration varies from customary methodologies in which it depends on the decision of a wideband bandstop (BS) filter, to which various shunt-shorted nails are associated at explicit hubs; the stubs give transmission zeros at the root[10]. Changkun Liu et al. suggested a wideband bandpass channel with the wide rejectionband and ultra-wide reflectionless range is proposed. Such channel comprises of two equal associated channels[11]. Bhagirath Sahu et al. found a new an Ultra-compact Ultra wideband (UWB) bandpass filter(BPF) in light of adjusted multi-mode resonator (MMR) is proposed. The minimization of the proposed Ultra wideband bandpas filter with great effective resistance is coordinating in bandpass is accomplished[12].

Previously much research has been carried out which shows that varying parameters affects the filter performance but no one has moved towards to improve the different parameters like S21 and S11 by using the cascadded method which may leads to get the best outcome of bandpass filter. In view of this, this research work mainly focused on the improving the filter parameters. Previously simple bandpass filter was designed but efficiency was not up to the mark so in this paper a new technique is used for designing the filter for improving the result.

4. STRATEGY FORMULATION
Utilizing wedge components Inductor and Capacitor in the system with the upgrades of the return misfortune and insertion misfortune. Utilizing a less complicated microwave office 2002 test system a glorified band pass channel can be reenacted to help decide sensible qualities for Return loss and Insertion loss.[4]

5. CONCEPTUAL FLOW
Cascade UWB bandpass channel depends on Butterworth model is reproduced in this research. By using the diverse figure of components we watch the outcomes dependent on return and intion
Loss.[5] above all else the study has determined the estimations of inductors and capacitors by utilizing the equations dependent on the bandpass filter. At that point attract the technical prototype in the microwave office test system 2002 than examine the result and contrast both the discussed losses, we designed simple bandpass filter and same filter by cascade the low pass filter and high pass filter than compare the result.[6]

6. DESIGNING PARAMETER

Microwave Office 2002 Circuit Simulator software is used in the designing of UWB bandpass filter.
- Desired center frequency = 0.445GHz, 1.725GHz, 7.722GHz
- Input Impedance = 50 ohm.
- Output Impedance = 50 ohm.

The capacitor and inductor values can be calculated by the below mathematical expression and shown by below formulas,

\[ L_k' = \frac{1}{\omega_0 \Delta C_k}, \]
\[ C_k' = \frac{\Delta C_k}{\omega_0}. \]

By the above expression, values of capacitor and inductor can be calculated easily.

| Element calculated for cascade Bandpass filter | HPF | LPF |
|-----------------------------------------------|-----|-----|
| Capacitor (pF)                               | 10.366 | 0.8583 |
| Inductor (nH)                                | 9.836  | 8.196   |

7. SIMULATION FORMAT

Microwave Office 2002 programming is used to design and simulate the UWB bandpass filter. Microwave Office is design verification tool.[7] AWR (Applied Wave Research) programming for organizing microwave integrated circuits. It analyzes 3 dimensional and more than one layer form. It will all in all be utilized to figure and draw the S11 and S21 parameters, voltage standing wave ratio, return accident comparatively as the radiation structures.
8. RESULTS

Design the circuits of cascade UWB Bandpass filter[fig.1] and also designed the same filter by using the same parameter that is called simple bandpass filter[fig.2 & fig.3]. Return loss and insertion loss comparison have been done in this paper[fig.7]. First of all high pass and low pass filters are designed. Inductance and capacitance values are calculated. Now both the filters are cascaded to form ultra wide band bandpass filter. Comparison between simple BPF and cascaded BPF is done.

8.1. Evaluation of Highpass Filter

Table 2. Calculation of element for highpass filter

| Capacitor(pF) | Inductor(nH) |
|--------------|--------------|
| C1=10.306    | L1=0.836     |
| C2=3.1830    | L2=9.836     |
| C3=10.306    |              |

Zo=50 ohm is used in the designing.

![Figure 2. Circuit diagram of highpass filter](image)

8.2. Evaluation of Lowpass Filter

Table 3. Calculation of element for lowpass filter

| Inductor(nH) | Capacitor(pF) |
|--------------|---------------|
| L1=0.8196    | C1=0.8583     |
| L2=2.6525    | C2=0.8583     |
| L3=0.8196    |               |

![Figure 3. Simulation Graph of return loss(S11) and isolation loss (S21)](image)
8.3. Evaluation of cascade bandpass Filter

| HPF Capacitor(\(\mu F\)) | Inductor(\(\mu H\)) | LFP Capacitor(\(\mu F\)) | Inductor(\(\mu H\)) |
|--------------------------|---------------------|--------------------------|---------------------|
| C1=10.306               | L1=0.856            | C1=0.8583                | L1=0.8186           |
| C2=3.1830               | L2=9.836            | C2=0.8583                | L2=2.8523           |
| C3=10.306               |                     | L3=0.8194                |                     |

Figure 4. Circuit diagram of lowpass filter

Figure 5. Simulation Graph of return loss(S11) and isolation loss (S21)

Figure 6. Circuit diagram of cascade bandpass filter
8.4. Evaluation of simple bandpass Filter

Table 5. Calculation of element for simple bandpass filter

| Element no. | Inductor (nH) | Capacitor (pF) |
|-------------|---------------|----------------|
| 1           | 0.3942        | 9.641          |
| 2           | 9015          | 0.936          |
| 3           | 2911          | 3.934          |
| 4           | 9065          | 0.942          |
| 5           | 899           | 9.466          |

Figure 7. Simulation Graph of Return loss (S11) and Isolation loss (S21)

Figure 8. Circuit diagram of simple bandpass filter

Figure 9. Simulation Graph of return loss (S11) and isolation loss (S21)
Ultra wideband bandpass filter design is a mixer of a lowpass and highpass filter sections[fig.7] that provides less losses in comparison of other design[fig.8]. Ultra wideband bandpass filter design provides sharp cut off. The main benefits of the Ultra wideband system are high data rate due to the large bandwidth, realiable value of equipment, less power, and immunity to two or more than two paths. By the help of table 6 we can easily compare the parameters S11 and S21 in between cascadded BPF and simple BPF.[8]

9. CONCLUSION

A new strategy for planning microstrip BPFs reasonable for the UWB filter interchanges is proposed. The BPF is planned with a composite structure by falling a HPF and a LPF to one another. Despite the fact that the highpass and lowpass structures in a composite BPF are irritated by one another, the whole plan shows an acceptable bandpass trademark over a wide transfer speed. Two exploratory channels are intended to have transfer speeds following the upper recurrence set and full-band of the UWB specifications. The estimated information show a decent passband trademark and a decent concurrence with the reenacted outcomes.

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