DESIGN OF NOVEL BANDPASS FILTER USING OPTIMUM SHORT CIRCUITED STUB TECHNIQUE FOR WIRELESS COMMUNICATION

[1]Mr. J. B. Jadhav, [2]Mr. Vivek Nizare
Associate Professor, E&TC Department, RCPIT Shirpur, M.S., India[1] **,** PG Scholar, E&tc Department, RCPIT Shirpur, M.S., India[2]
viveknizare@gmail.com[2]

ABSTRACT

In this paper optimum distributed microstrip structure ultra wideband (UWB) band pass filter (BPF) with sharp roll-off characteristics is presented for wireless communication. Here design of new UWB BPF with Multiple-mode resonator (MMR) and the stub loaded stepped impedance stub loaded resonator (SISLR) is given with detailed analysis using MoM based IE3D simulation software. Its resonance behavior is thoroughly characterized so as to allocate the five resonant frequencies in the UWB pass band within 3.1-10.6 GHz band. The novel stub loaded stepped impedance stub loaded resonator is found to have the advantage of providing more degrees of freedom to adjust the resonant frequencies in the UWB pass band. For the novel UWB filter and the differential mode of the designed balanced filter, three transmission zeros at the pass band are realized by using SISLR, which enhances the pass band selectivity of these filter. The simulated results are in good agreement, showing good UWB filtering performance with sharp rejection skirts outside the pass band. The analytical and accurate design equations for transmission poles and zeros of these are provided based on the scattering-parameters theory for SISLR.

Keywords- UWB, Resonator.

I. INTRODUCTION

The UWB breakthrough is an incredibly reassuring answer for extra target radar, extra data rate coordination, equipped association, and tracking systems. It offers different energizing characteristics, for example, low unconventionality and negligible effort, carrier-free transmission, and astringent multipath energy security and adhesion, much the same as the latent drawbacks. They have a transfer pace of 7.5 GHz, which maintains high speed of data transmission have a low energy thickness in a broadband span driven by a brief excitation of the heartbeat, which not only makes the UWB structure difficult to pick up, but also limits the obstacle with another radio structure; and they have astronomically low transmission power, which is positive for convenient radio switchgear Academic researcher have been vigorous in the assumption of UWB channel.

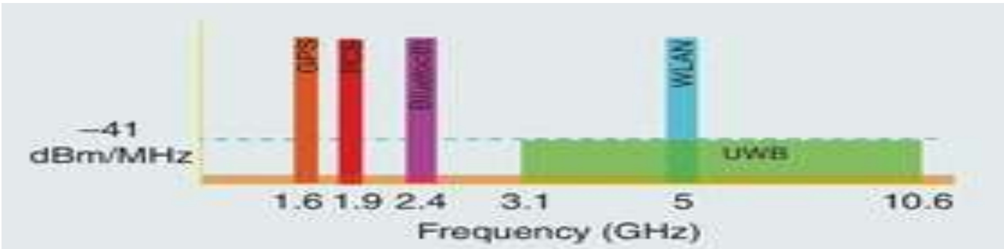


Fig.1 UWB system spectrum distribution

The special requirements for UWB channels are a lower degree of incorporation incidence, a build-up return in the level band & extra out band selectivity. There are few organizational techniques for organizing the ultra-broadband through channel. Resonator methods with different modes, hybrid micro band coplanar waveguide methods, and ideal strategies for short-circuited drop lines, electronic band aperture) structure methods, low-pass channel methods and multilayer lateral coupling techniques with regard to packaging materials, e.g. B. B.

Liquid Polymers and Low Temperature Coffered Ceramics [2]. The MMR strategy involves mastering different sound modes in an interlaced resonance plan to organize a UWB channel. Homogeneous real geology as SIR structure (Ventured Impedance Resonator). [2] Compact UWB band pass channels can be designed using cream-colored CPW and micro strip system that view CPW and CPW micro strip short distances as lit-up circuit segments to provide high pass channel capacitance between I / O port of over pass. Channel and through to include by properly arranging the coupled idle beats, a negligible UWB band pass channel can be devised with two transmit zeros, usually found for the pass band edges [2] used to improve the UWB band pass channels to improve the performance of the to suggest the upper obstacle band. In the high / low pass channel strategy, a UWB channel is generated that is generated by eliminating a broadband pass channel and a broadband stop channel [2]. The internal UWB breakpoint described by the FCC covers some recurring groups used to keep radio adaptation structures alive. Similarly, some spatial groups are needed in the UWB band pass channel configuration to decrease the impediment of this frame matching radio.

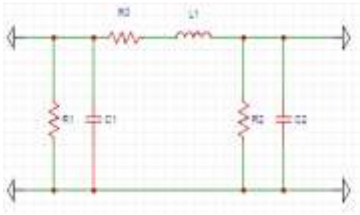
II. ULTRAWIDE BAND BANDPASS FILTER

The chunk-stacked resonator is made of wire-reinforced inter digital capacitor fingers stacked with an open heel and a short nail and can create strengthen resonance to standard multi mode resonator. A wire reinforced inter digital capacitor [5], [6], [7], instead of a usual three-line inter digital capacitor, as in the piece-stacked resonator as shown in [4], is used in this test as a data execution plan. While line width and aperture width use a minimal proportion of the needs of creating a mostly open printed circuit board Valid resonances of multi-finger straight inter digital capacitor can be restricted by wired connection intersections Article begins with stub stacked resonator arrangement and effects. Then the Even circuit is fixed and fabricated using the 1.27mm thickness and RT / Droid 6010.2LM substrate.

III. ANALYSIS OF RESONATOR

A. SIMPLIFIED CIRCUIT MODEL RESONATOR.

The MMR comprises of a low-recurrence line territory with a large portion of the recurrence in the centre and two unclear line territories with high impedance (quarter recurrence) on the various sides. Regarding its development, this proposed MMR could be arranged as an indicated ventured impedance resonator (SIR). The SIR was proposed as a non-uniform transmission line resonator in [15] to strengthen the redundancy division between the roaring method of the first and second solicitation and to reasonably amplify the upper stop band over the fundamental pass band of a band pass channel utilized while the mode for the subsequent solicitation and the other clearing modes bring about conceivable multiband tones in the arranged channel. In our MMR, nevertheless, all the underlying Three Thundering Modes are viewed as together.



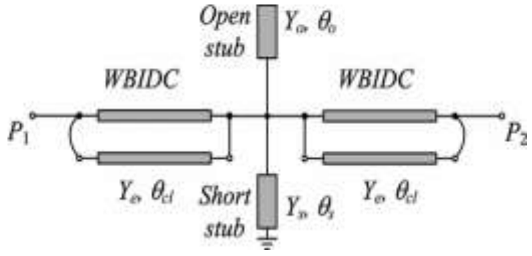


Fig.2 Equivalent-circuit modelFig.3Stub-loaded resonator

The ABCD boundaries for two port organization is given as

$$[A]=[A_{wbidc}]\times[A_{ss}]\times[A_{wbidc}] \tag{1}$$

$$T=\begin{bmatrix}1 & Z\\ 0 & 1\end{bmatrix} \tag{2}$$

Shunt circuit matrix is shown as

$$T=\begin{bmatrix}1 & 0\\ Y & 1\end{bmatrix} \tag{3}$$

$$[A_{wbidc}]=\begin{bmatrix}\cos(\theta_{cl}) & \dfrac{j\sin(\theta_{cl})}{2y_e}\\ j2Y_e\sin(\theta_{cl}) & \cos(\theta_{cl})\end{bmatrix} \tag{4}$$

ABCD parameters are shown as

$$[A_{SS}]=\begin{bmatrix}1 & 0\\ j(Y_o\tan(\theta_o)-Y_S\cot(\theta_S)) & 1\end{bmatrix} \tag{5}$$

From this

$$Y_{SS}=jY_s(\tan(\theta_o-\cot(\theta_S)) \tag{6}$$

Total admittance Y_{in} at port1 is shown as port 2-left open

$$Y_{in}=\frac{jY_e\tan\theta_{cl}+jY_S(\tan(\theta_o)-\cot(\theta_S))}{1-\tan^2\theta_{cl}+\dfrac{jY_S(\tan(\theta_o)-\cot(\theta_S))\tan\theta_{cl}}{2Y_S}} \tag{7}$$

Resonance condition may be obtained by showing $Y_{in} = 0$.

$$\begin{cases}\tan\theta_{cl}=\infty\\ 4Y_e\tan\theta_{cl}+jY_S(\tan(\theta_o)-\cot(\theta_S))=0\end{cases} \tag{8}$$

Different Cases for a resonance condition are as bellows.

Case 1:- the Low hole of passband returns.

$$\theta_S=\tan^{-1}\left(\frac{Y_S}{4Y_e\tan\theta_{cl}}\right),\left(\theta_{cl}=\frac{\pi}{2}\right) \tag{9}$$

Case 2:- Between a returns of a passband.

Case 3:- At a upper edge of passband returns.

$$\theta_O=\tan^{-1}\left(\frac{4Y_e\tan(\pi-\theta_{cl})}{Y_S}\right),\left(\frac{\pi}{2}\prec\theta_{cl}\prec\pi\right) \tag{10}$$

INTERDIGITAL CAPACITOR

Some techniques have been used to describe interdigital capacitors, including assumed research, comparable representation of the J inverter network, full-wave strategies, and estimate-based model.

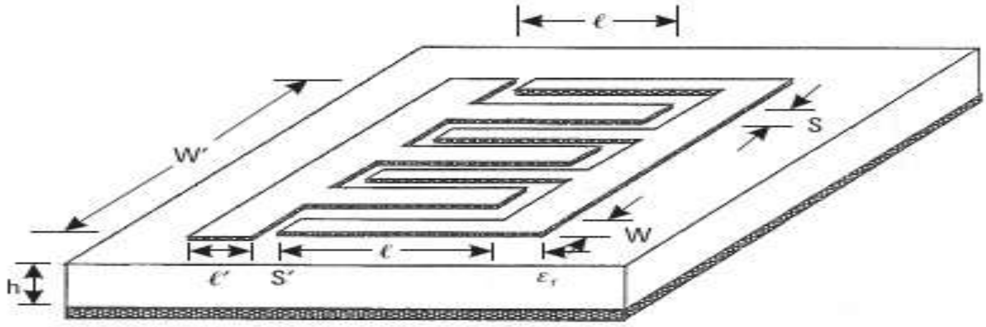


Fig.4 A inter digital capacitor configuration

An approximate expression for the inter digital capacitance is shown as

$$C = \frac{\varepsilon_r + 1}{W'} l[(N-3)A_1 + A_2] \quad (11)$$

where C is the capacitance per unit length along with W ′,.

For infinite substrate thickness (or no ground plane),

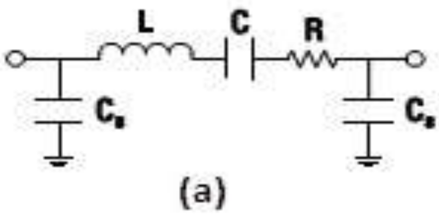
A1 = 4.409×10^{-6} pF/mm and A2 = 9.92×10^{-6} pF/mm.

$$C = (\varepsilon_r + 1) l[(N-3)A_1 + A_2] \quad (12)$$

Where, A_1 and A_2 are the approximate expressions and are obtained by following expressions

$$A_1 = 4.409 \tanh\left[0.55\left(\frac{h}{w}\right)^{0.45}\right] \times 10^{-6}\ pF/\mu m \quad (13)$$

$$A_2 = 9.92 \tanh\left[0.52\left(\frac{h}{w}\right)^{0.5}\right] \times 10^{-6}\ pF/\mu m \quad (14)$$



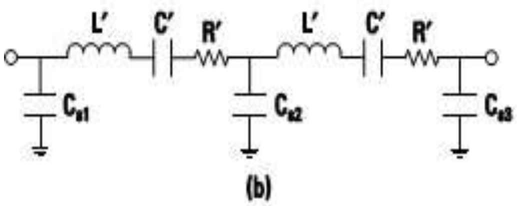


Fig.5 capacitor for low frequency

Fig.6 capacitor for high frequency

IV. DESIGN OF UWB FILTER

The open-end swing is then remembered for the wake of catching the equivalent additional line length of the final limit [10]. Similarly, equivalent additional line length is derived from the brief rush to represent the foundation inductance through [11]. True estimation is certainly supported to compensate for the repetition dispersive cross Carrier assemblies are used to relate the fingers of the inter digitated capacitor. Equivalent circuit of the one-phase UWB channel can be shown below Figure 7. Floss holding capacitor and segment plane. Relationship of the interface lines with stripes appeared in the figure.

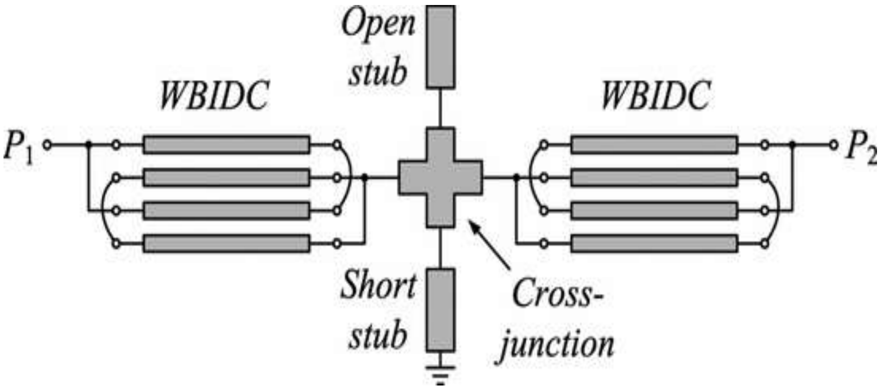
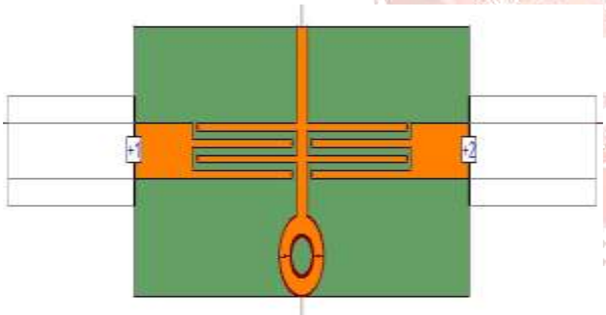


Fig.7 Equivalent Circuit model of the Single stage UWB filter

The brand impedance of the data and performance bands on the top of the substrate is 50 ohms RT / Droid 6010.2LM substrate with a thickness of 1.27 mm and Ɛr = 10.2, tan δ = 0, 0023. The finger length of the wire an improved inter digitated capacitor can be started by changing the second resonation of the stacked resonator at mid-repetition of the UWB band with an early gauge of the stump width. Taking into account the cut-off frequencies of the first and third modes, the gauges of the lengths of the short & open section may be considerfrom conditions [3].



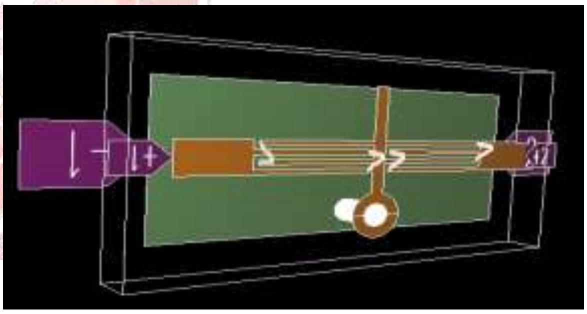


Fig.8The design of Single stage UWB Band pass filterFig.9 3D View of the Design

V. EXPERIMENTAL VERIFICATION

We had used IE3D electromagnetic test system for construction planning. IE3D is the complete wave reproduction and enhancement package for 3D and planar microwave circuits.

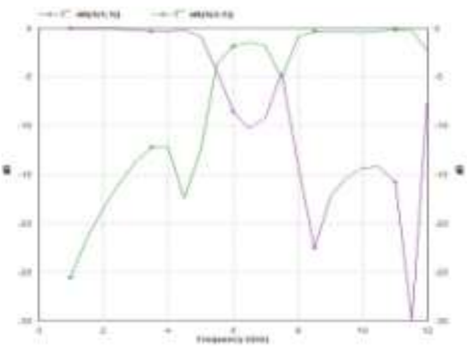


Fig.10 Simulation Results

As can be seen in the figure, the additional incidence S21 is the most unsurpassed in the UWB transfer speed, the S21 is comparable to zero. The fallback S11 is not actually -10 dB within the valuable band. The data indicate that the assignment between the connections in an electrical flank can be achieved using S limit values. Shortly before that, the broadly named limit value for channel S11.S11 shows the influence reflected by the radio wire and is accordingly known as reflection.

VI. CONCLUSION

In this article, we have introduced a lone-stage UWB channel that uses an ideal short out stub procedure dependent on stub-stacked resonators. Extensive data transmission is performed with the wire-reinforced inter digital capacitor. Resonator, circuit organizations should advance the arrangement method by which a UWB channel is prepared for singular phases.

REFERENCES

[1] Revision of part 15 of the Commission`s rules regarding ultra-wideband transmission systems, FCC, Washington, DC, Tech. Rep, ET-Docket 98-153, FCC 02-48, adopted in Feb. 2002.

[2] Zhang-Cheng Hao and Jia-Sheng Hong. “Ultra wideband Filter Technologies", IEEE Microw. Mag., pp. 56-68, Jun. 2010.

[3] L. Han , K. Wu and X. Zhang "Development of packaged ultra-wideband bandpass filters" IEEE Trans. Microwave Theory Tech., vol. 58, pp. 220-228, 2010.

[4] L. Han , K. Wu and X.-P. Chen "Compact ultra-wideband bandpass filter using stub-loaded resonator" IET Electron. Lett., vol. 45, pp. 504-506, 2009.

[5] E. Mrquez-Segura "Analytical model of the wire-bonded interdigital capacitor" IEEE Trans. Microw. Theory Tech., vol. 54, no. 2, pp. 748-754, 2006.

[6] J. E. Page "Exact analysis of the wire-bonded multiconductor transmission line"IEEE Trans. Microw. Theory Tech., vol. 55, no. 8, pp. 1585-1592, 2007.

[7] F. P. Casares-Miranda "Wire bonded interdigital capacitor" IEEE Microw. Wireless Compon. Lett., vol. 15, no. 10, pp. 700-702, 2005.

[8] G. I. Zysman and K. A. Johnson "Coupled transmission line networks in an inhomogeneous dielectric medium" IEEE Trans. Microw. Theory Tech., vol. MTT-17, no. 10, pp. 753-759, 1969.

[9] M. H. Ren , D. Chen and C. H. Cheng "A novel wideband bandpass filter using a cross-shaped multiple-mode resonator" IEEE Microw. Wireless Compon. Lett., vol. 18, no. 1, pp. 13-15, 2008.

[10] M. Kirschning , R. H. Jansen and N. H. L. Koster "Accurate model for open end effect of microstrip lines" IET Electron. Lett., vol. 17, pp. 123-125, 1981.