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Design of Band passes Filter for Multiband Applications

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Abstract- Band pass filters are mostly used in wireless transmitters and receivers. The function of a filter is to limit the bandwidth of the output signal to the allocated band preventing the transmitter from interfering with other stations. A bandpass filter which optimizes the signal-to-noise ratio and sensitivity of a receiver. In both transmitting and receiving applications, band pass filter, having the optimum bandwidth for the speed of communications is used which maximize the number of signal transmitters that exists in a system, while minimizes the interference among signals. This project deals with the design of micro strip band pass filter and the design is stimulated using microwave office Advanced Design System (ADS) simulation software.
Keywords- Bandpass filter, multiband, microstrip technology, interference, optimum bandwidth

I. INTRODUCTION

IoT is a system where items in the physical world and sensors within it or attached to these items, are connected to the Internet via wireless and wired Internet connections. These sensors use various types of local area connections such as RFID, NFC, Wi-Fi, Bluetooth, and Zigbee. Sensors also have wide area connectivity such as GSM, GPRS, 3G, and LTE. Current trends in global telecommunications require RF transceivers standards, for which bandpass filters (BPFs) featuring wide-band and multiband frequency responses are desired. In addition, multi-mode systems are capable of operating RF signals of different spectral characteristics to serve the end users. In this paper, frequency-reconfigurable microwave filters play an important role in performing highly-flexible RF-signal-pre selection processes.

There are four types of filter that can be used for filtering applications. Each type of filter rejects or accepts signals in a different way, and by using the correct RF filter it is possible to

receive the required signals and reject the signals that are not wanted. The four basic types of RF filter are: Low pass filter, High pass filter, Band pass filter and Band reject filter.

The main objective of this project is to design and develop a multi-band band pass filter for use in wireless communication system at center frequency 1.84 GHz (GSM) and 0.96 GHz (GPS) by using the microstrip line. The ripple factor for GSM and GPS is in the range of -40 db and -60 db.GSM is a mobile communication modem; it stands for global system for mobile communication (GSM). GSM was developed at Bell Laboratories in 1970 and is widely used in mobile communication system. GSM is defined as an open and digital cellular technology used for transmitting voice and data services which operates at the frequency range of 850MHz, 900MHz, 1800MHz and 1900MHz frequency bands. The Global positioning system (GPS) is used for two principal reasons: these are navigation and determining the co-ordinates of points in the GIS.

This paper deals with the application of capacitive- loading –based size-reduction techniques to wide- band and multi-band signal interference planar filters. Using this, a small 0.96/1.84- GHz dual-band band pass filter(BPF) shaped by a branch- line coupler –type transversal filtering section(TFS) is designd and measured. Its main feature is to decrease the area by 55.4% in relation to its fully- planar counterpart. Current trends in global telecommunication system requires RF transceivers which satisfies numerous standards, for which bandpass filters (BPFs) with wide-band and multiband frequency responses are desired. In addition, these multi-mode systems are capable of operating with RF signals of different spectral characteristics to serve the end users.

The frequency-reconfigurable microwave filters plays an important role in performing highly-flexible RF-signal-pre-selection processes. Signal-interference planar filters have proved that they are suitable in performing wide-band filtering actions with high-rejection stop bands, multi-band operation, and tunable filtering functions. They are normally made up of transversal filtering sections (TFSs) which is formed by transmission-line segments with lengths of 90ºmultiple at the design frequency *fd*. Thus, physical size becomes one of the main limiting factors in these filters, mostly in the lower region of the RF spectrum.

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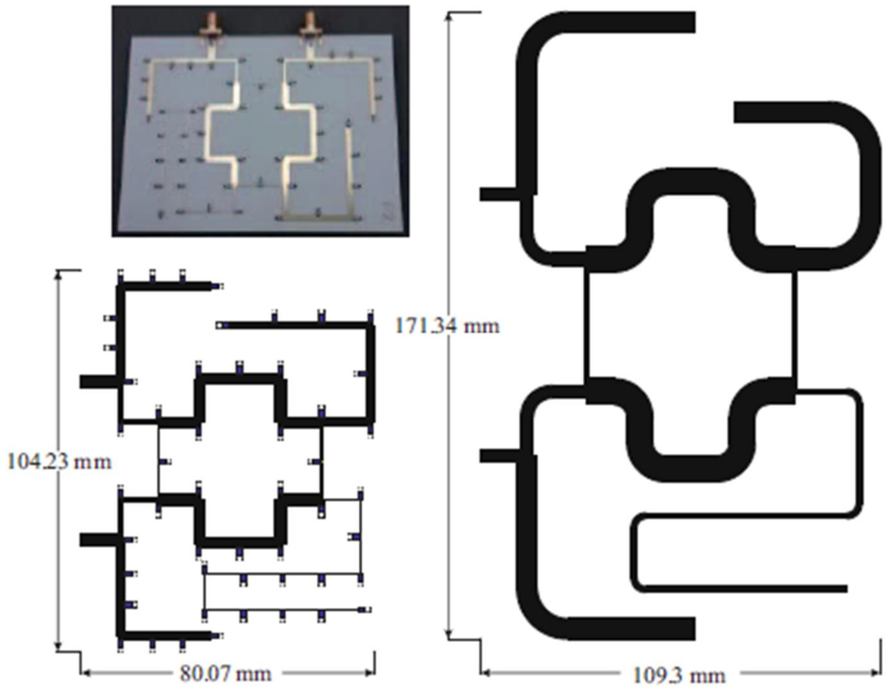

Fig.1. Miniaturized Dual Band BPF And Layout Comparison

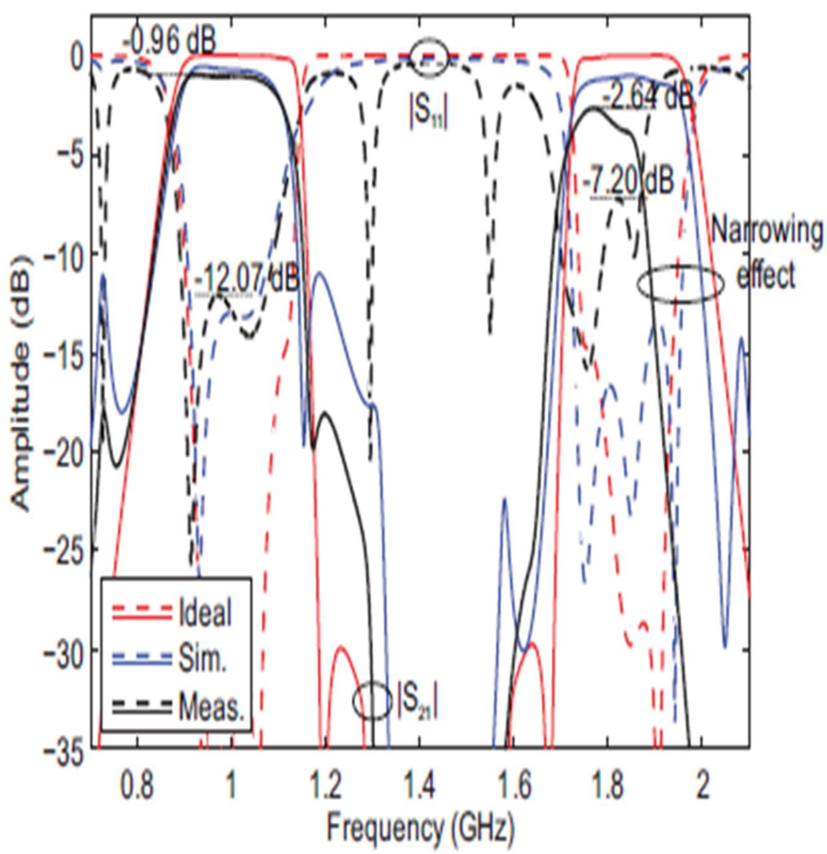

Fig.2. Ideal,EM-stimulated And Measured Power Transmission And Reflection Response

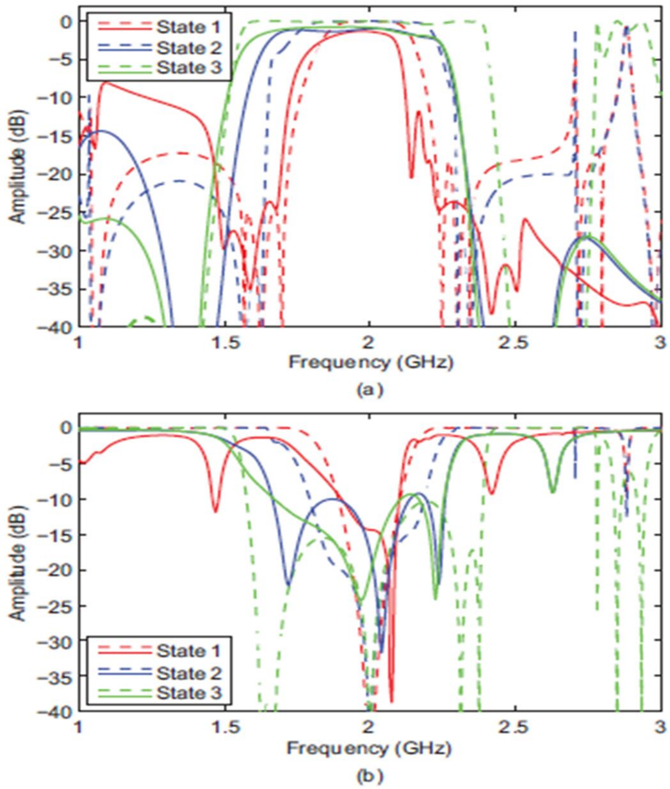

Fig.3. Ideal And EM-stimulated Power Transmission And Reflection Response

II. BAND PASS FILTER DESIGN

A bandpass filter is an electronic circuit which allows signals between two frequencies and eliminates signals at other frequencies. Some bandpass filters requires an additional power and uses active components known as active bandpass filters. Other bandpass filters which doesnot uses additional power and consist only of passive components are called passive bandpass filters. The cutoff frequencies, f1 and f2 are the frequencies at which the output signal power falls to half of its level at f1 , the center frequency of the filter. The value f1-f2, is expressed in hertz (Hz), kilohertz (kHz),megahertz (MHz), or gigahertz (GHz), is called the filter bandwidth. The range of frequencies between f1 and f2, is called the filter pass band.

A microstrip structure is used in open ring resonator microwave filter. These resonators are used to design a bandpass filter. Open ring resonator structures are characterized by higher performance and good frequency response for bandpass filters. Both resonator and band-pass filter is designed with a simulation program and two frequency response is present. Band pass filters is an essential part of any signal processing systems, the integral part of superhetrodyne receivers which is currently employed in many RF/Microwave communication systems. At Microwave Frequencies the discrete components of the filter are replaced by transmission lines and for low power applications, microstrip is used which provides cheaper and smaller solution to Band Pass Filter. This Paper describes the design of the microwave Bandpass filter using microstrip technology. There are many techniques used to create microstrip filters. The general Microstrip filter structure is given in fig

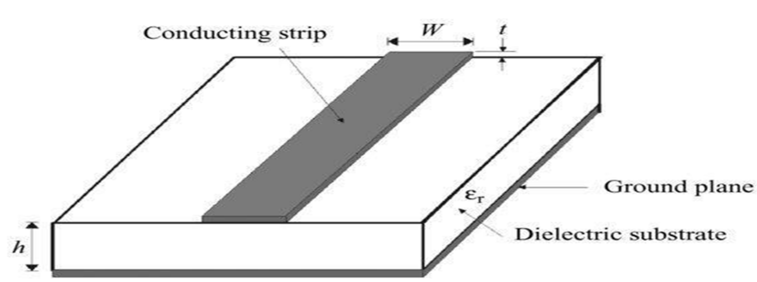

Fig.4. Microstrip filter structure

III. RF FRONT END RECEIVER

The RF Front End Receiver consists of an antenna, low noise amplifier, mixer and processor. The GSM and GPS signal from the free space enters into the antenna. From the antenna it enters into the amplifier called low noise amplifier. This amplifier will filter the unwanted signal and the filtered signal enters into the RF Band pass filter. This filter divides the signal into GSM and GPS. These signals enter into the mixer along with local oscillator for modulation or demodulation,When the message signal is added to the carrier signal is called modulation and when the message signal is subtracted from the carrier signal is called demodulation. Till this the operation is done by the receiver side. Hence it is called as Front End Receiver . The final process is the message signal is carried to the processor. This operation is given by block diagram shown in fig

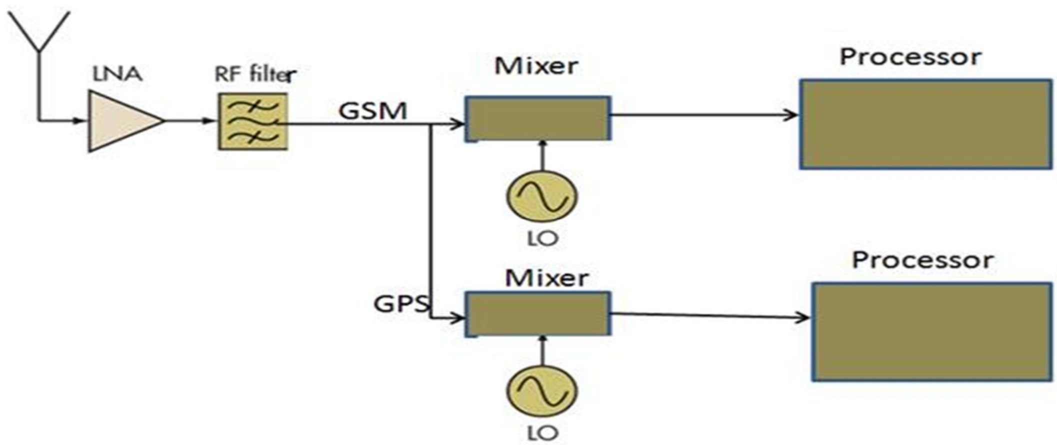

Fig.5. Block Diagram Of Front End Receiver

A. Software Tool

The software tool used in this design is Advanced Design System (2011). The ADS is a electronic design automation software produced by Key sight of EEs of EDA a division of Key sight technologies. Key sight ADS supports each and every step of the design process—schematic capture, layout design rule checking ,frequency domain and time domain circuits simulation, and electromagnetic field simulation—allowing the user to fully characterize and uses an RF design without changing the design tools. Key sight EDA has donated the copies of the ADS software to the electric engineering departments at many universities and a large percentage of new graduates are experienced in its use.

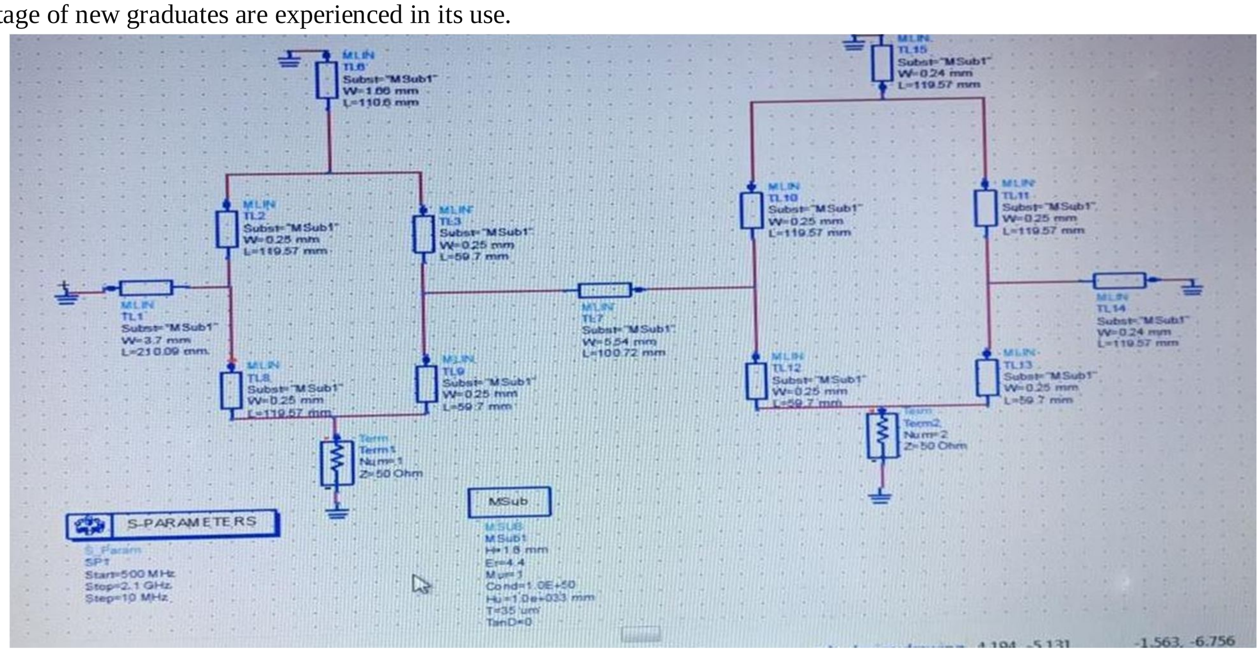

Fig.6. Simulated Design

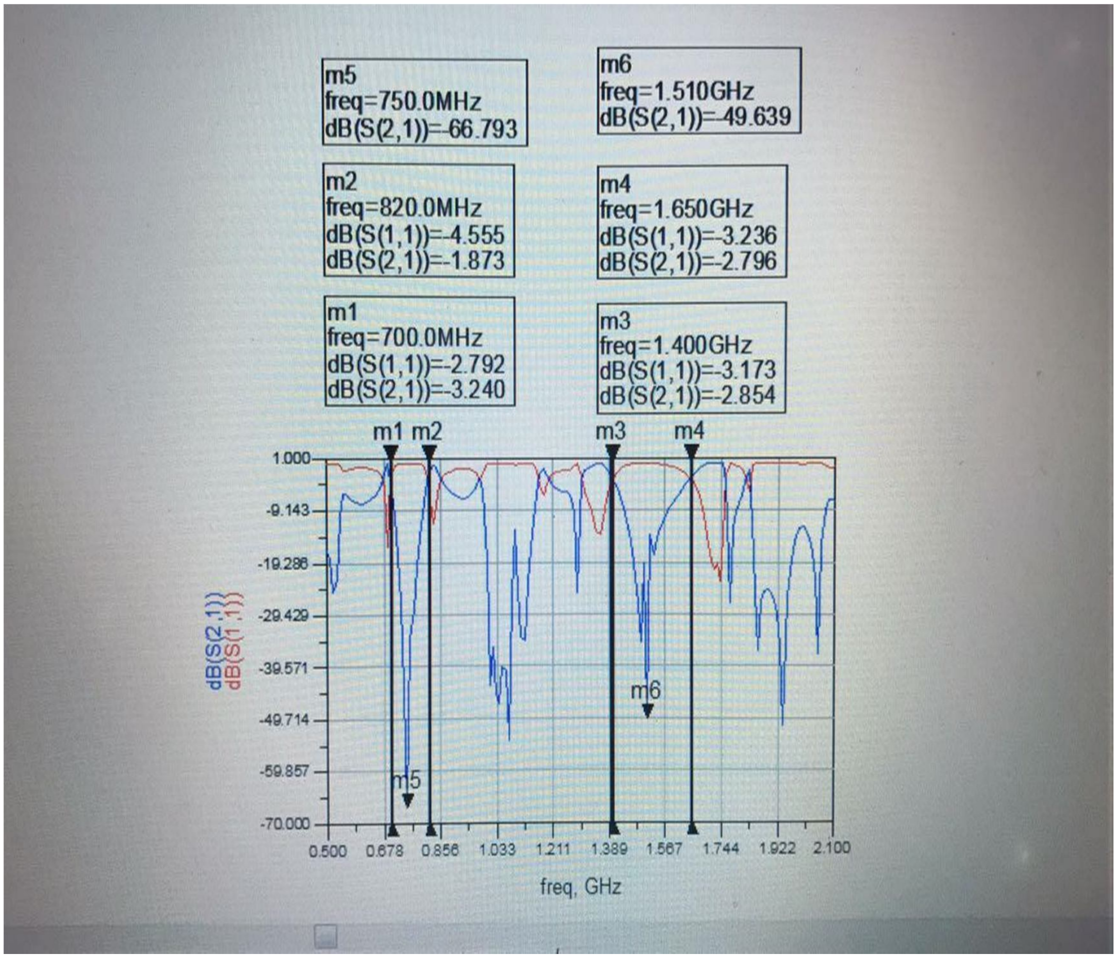

Fig.7. Simulated Output

B. Obtained Results

1) *m1:* lower cutoff frequency ofGPS=0.70GHz
2) *m2:* higher cutoff frequency ofGPS= 0.82GHz
3) *m3:* centre frequency of GPS= 1.40GHz
4) *m4:* lower cutoff frequency ofGSM= 1.65GHz
5) *m5:* higher cutoff frequency ofGSM=0.75 GHz
6) *m6:* centre frequency of GSM= 1.51GHz

C. Ranges of S(1,1) and S(2,1)

1) *M1 Frequency*: S(1,1) = 2.792
S(2,1) = 3.240
2) *M2 Frequency:* S(1,1) = 4.555
S(2,1) = 1.873
3) *M3 Frequency:* S(1,1) = 3.173
S(2,1) = 2.854
4) *M4 Frequency:* S(1,1) = 3.236
S(2,1) = 2.796
5) *M5 Frequency:* S(2,1) = 66.793
6) *M6 Frequency:* S(2,1) = 49.639

IV. CONCLUSION

In this work, the method used to implement the bandpass filter for multi band applications has been presented. The filter which is working on the frequency for GSM and GPS has been demonstrated on the substrate of FR4. The design is fulfilled by using microstrip transmission line in the schematic window of Advanced Design System(ADS). The design provides 0.75GHz for cable TV systems and 1.5GHz for satellites, Telecommunication, Aircraft, Surveillance, Amatuer Radio, Digital Audio Broadcasting and Astronomy. Besides, the equivalent microstrip.

transmission line act as band pass filters without changing the response of the fundamental frequency. The purpose of the design is to achieve the frequencies of 0.96GHz and 1.84GHz for GPS and GSM , but the approximated frequencies achieved 0.75GHz and 1.50GHz for GPS and GSM.

V. FUTURE ENCHANCEMENT

The bands of the proposed multi-band BPF may be used for GPS application, GSM application and Wi-Max applications. These applications may be performed through the proposed BPF. There are several techniques to enhance the selectivity in which one of the best techniques will be used in proposed work. Better coupling methods can be used to decrease the insertion loss. With the increasing demand for multi-band applications in modern wireless systems, such as the global systems for the Global Positioning System (GPS) at 1.57 GHz, Worldwide Interoperability for Microwave Access (Wi-MAX) at 3.5 GHz and wireless local area networks (WLANs) at 2.4/5.2 GHz, research on innovative designs of multi-band filters has become very popular.

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