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STATISTICAL STUDY AND SIMULATION OF MULTIBAND FILTERS -DUAL AND TRIPLE BAND

By

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INTRODUCTION

Filters are one of the fundamental building blocks of RF and microwave systems, along with amplifiers, oscillators, mixers and switches. Filtering of signals in telecommunication is necessary in order to select the desired signal from the range of signals transmitted and also to minimize the effect of noise and interference on the wanted signals. Many of the applications in telecommunications require filters with very sharply defined frequency characteristics.

A multiband microwave filter that can selectively transmit a band of signals or any discrete or combination of predefined frequency bands. A high performance, compact microwave multiband filters with good in and out-off band performance is desirable in all most all communication system for handling multiple services within a single module such as Global System for Mobility (GSM) at 0.9 /1.8 GHz, Global Positioning System (GPS) at 1.57 GHz, Wireless Local Area Network (WLAN) standard IEEE 802.11at 2.4/5.2/5.8 GHz, WiMax standard IEEE 802.16 etc.

AIM and OBJECTIVE

Aim:

To conduct a statistical study of various methods to implement multiband filters, design and develop a low cost multiband filter structure by using simulation Software.

Objectives:

1. Study the basic concepts of microwave single band filters and multiband filters.
2. Study the different approaches to develop multiband filtering: using integrating multiple filter method and single filter structure with multiple pass band method.
3. Analyse various techniques to develop multiband filters.
4. Design and simulate the filter structure using simulation software IE3D.
5. Evaluate the transmission and reflection parameters.

PROJECT FINDINGS

The microwave multi-bandpass filters with high performance are essential for the design of receivers and transmitters in modern communication system. Planar microstrip filters has been receiving much attention due to the advantages of highly compact, low cost, and very easy to fabricate using photolithographic process. Fabrication of multi section bandpass or coupled line filters is particularly easy in microstrip or stripline form for

bandwidth less than about 20%. Wider bandwidth filters generally require very tightly coupled lines, which are difficulty to fabricate.

Multiband filters can be implementing either by using multiple filters to implement multiple bands or by using single filter with multiple bands. The different technique is used to implement multiband filters using multiple filters are:

1. Channelized banks of bandpass filters with an input/output power divider/combiner
2. Multiplexing Method
3 Using multiple harmonic resonating modes
4. By cascading different filter element.

The main drawback of multiple filter integration is the compatibility of the multiple structure design, i.e, the design of individual component should match with each other in terms of frequency charecteristics and structural charecteristics. Alternative of this problem is reaisation of multiband filers using single filter structure. This approach offers advantages over the above in terms of design complexity, hardware manufacturing and post-manufacture tuning.

The different technique used to implement multiband filters using single filter structure are:

1. Single filter structure based on coupling matrix
2. Frequency transformation method
3. Single filter with signal interfacing technique.

Filter design and realisation can be challenging for several reasons. No one technology or filter topology is suitable for all applications. There is also a fundamental limitation imposed by the relation between unloaded Q and volume.

RESULT

A very simple compact dual band filter with multimode resonator is designed and simulated. By connecting parallel open stubs at both ends of the parallel coupled microstrip line, we can develop a filter with two pass bands within 0-8GHz range. The material used is a low cost FR4 substrate with thickness 1.6mm, dielectric constant 4.4 and loss tangent is 0.002. The filter designed and simulated by Electromagnetic Simulation software Zeland IE3D.

Rigours analysis shows that if we introduce an open loop resonator (OLR) inside the structure the transmission parameter will change accordingly. Studied the structure with and without OLR. Without OLR the structure gives two pass bands within 0 to 7 GHz with a single transmission zero at 3.5353 GHz of -57.93 dB, and a -10 dB stopband bandwidth of 1.386 GHz. Available two passbands are 1.232 to 2.42 GHz and 4.94 to 5.76 GHz. By inserting an open loop with a gap 0.4 mm inside the developed structure there exist two transmission zeroes in the stop band at 3.18 GHz and 3.5327 GHz. The -10 dB stopband bandwidth is 1.55 GHz and passbands are from 1.210 to 2.39 GHz and 4.96 to 5.47 GHz.

We can modify the response characteristics by adjusting the individual dimensions of the structure.

SUMMERY

Modern communication transceivers especially satellite communication and mobile communication require high performance microwave filters with low insertion loss, high frequency selectivity and small group delay variation. High frequency selectivity can be achieved by proper design with transmission zeroes near the passband. Together with all these features , multiple frequency bands selection is a challenging area of research. A multi mode resonator is designed and simulated for dualband, tripleband and quadruple band microwave filter .The selectivity of the passband can be improved by inserting transmission zeroes in between the passbands. An open loop resonator is designed and is inserted in a multimode resonator thereby we can achieve the target.