Design and Analysis of Dual Band Pass Filter

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Overview

Introduction

Microwave - definition

Microstrip - advantages and disadvantages

Idea

Microstrip structure

Main characteristics of the DBPF

Design Methodology

Measure unit

Material

Source impedance

Size

Parameters Variations

S parameters, input match, insertion loss and VSWR

Tables

DBPF

Changing specific parameters (geometry and material characteristics)

Compact

Dual

Values for S11 parameter are -20.70dB and -41.72 dB for 4.9GHz and 5.5GHz, respectively. Values for S12 parameter are -0.03dB and -2.91e-4dB for 4.9GHz and 5.5GHz, respectively

DBPF

box dimensions 40x40mm

Main applications of this type of filter are in manufacturing wireless transmitters and receivers

When designing and analysing filters we must know that there is no perfect filter

Filter with narrow band-pass are found demanding in modern technologies

DBPF

Main characteristics of design are given as follows:

Dielectric constant:
Er=4.4 (Quartz-fused)

Frequency range of 4.8-4.9GHz and 5.4-5.5GHz

Cell size 0.2x0.2 mm

Design Methodology

As measure unit millimeters are chosen since those are the most convenient according to European standards and our proposed design

For dielectric material Fr-4 with dielectric constant 4.4 is chosen since it is commonly used, easiest for fabrication and gives good performance

Copper

Source impedance = 50 Ohms.

Output of the signal is shown in Figure 2 in the form of Cartesian plot.

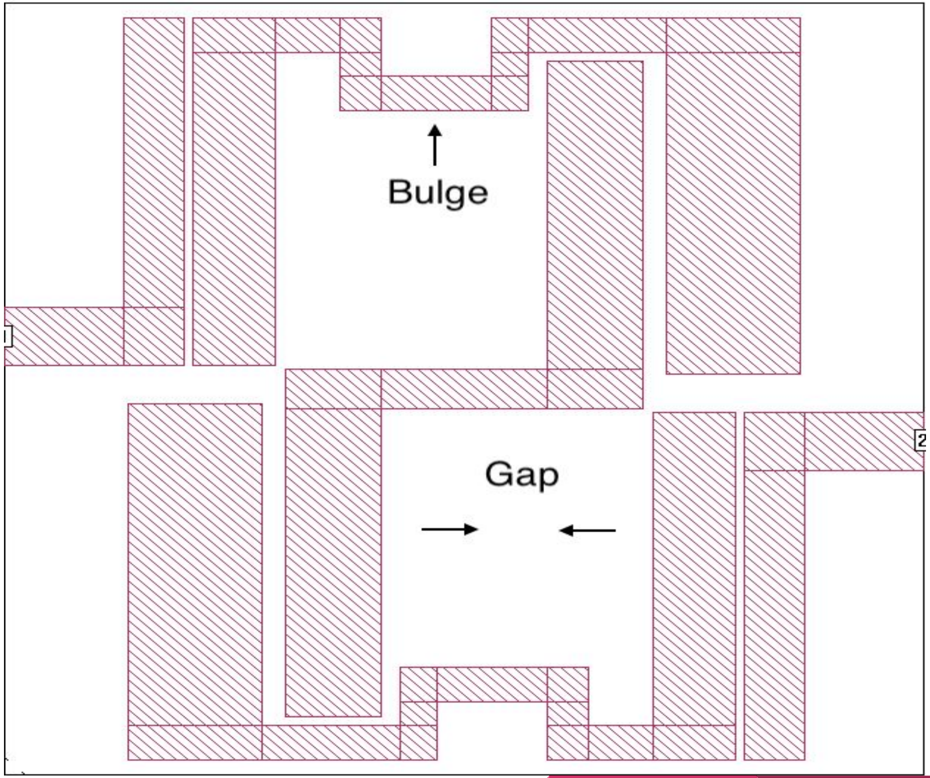

Figure 1. Design of the Dual Band Pass Filter

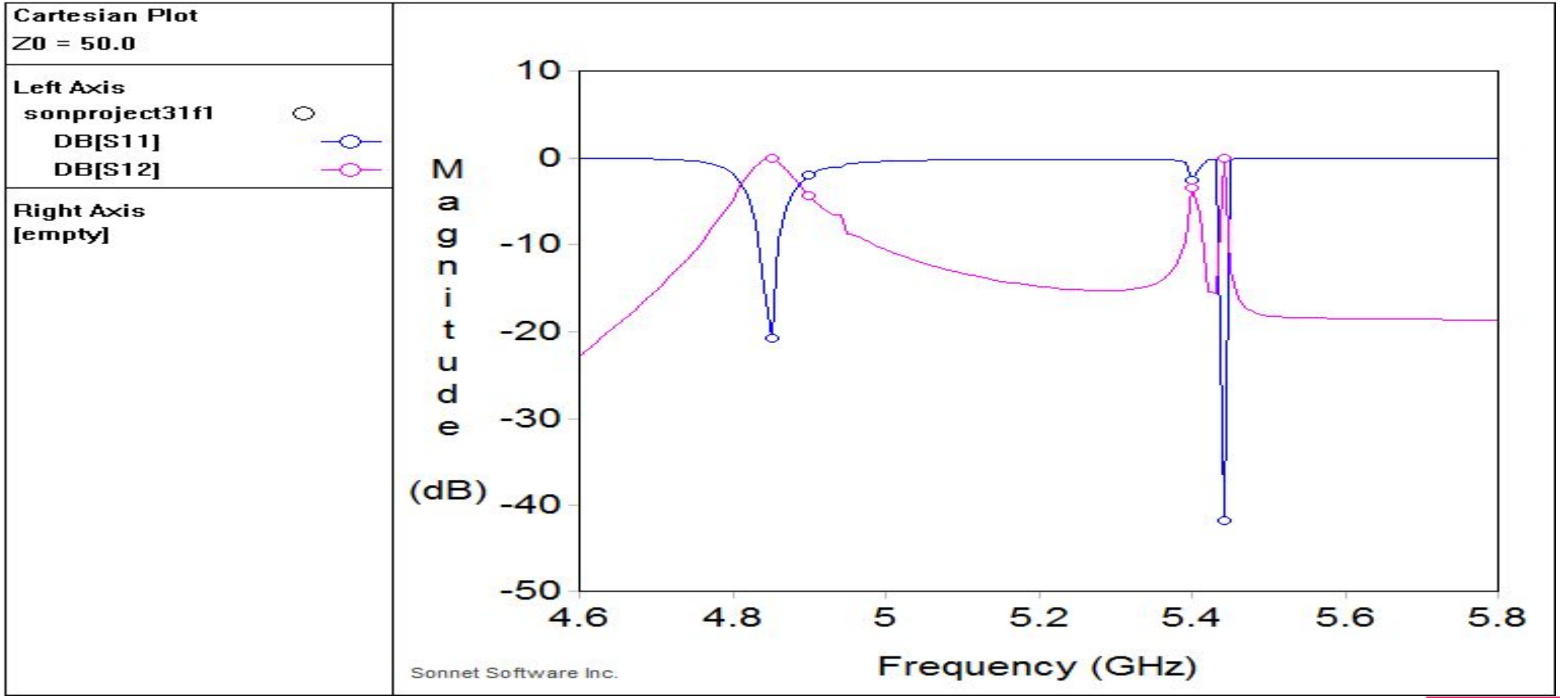

Figure 2. Output signal of the Dual Band Pass Filter simulation

Parameters Variations

Parameters to evaluate the performance of any filter

The S parameters - easy to measure and indicate the results of output signal

S parameters are given in decibels (dB)

From all geometry changes we have done, largest changes are in variety of bulge and gap

TABLE I CHANGING DISTANCE OF THE BULGE

Distance	S11	S12	S11	S12
0.3mm	-20.70	-0.03	-41.72	-2.9e-4
0.32mm	-22.63	-0.02	-21.37	-1.3e-4
0.34mm	-22.44	-0.02	-17.39	-0.07
0.36mm	-20.19	-0.04	-19.63	-0.04
0.38mm	-17.84	-0.07	-14.28	-0.16

TABLE II CHANGING THE GAP WIDTH

Gap	S11	S12	S11	S12
11.8mm	-20.70	-0.03	-41.72	-2.9e-4
12.0mm	-20.07	-0.04	-16.19	-0.10
12.2mm	-30.20	-4.1e-3	-2.93	-3.09
12.4mm	-33.50	-1.9e-3	-2.12	-4.12
12.6mm	-27.09	-8.4e-3	-9.4	-26.72

TABLE III CHANGING DIELECTRIC THICKNESS

Dielectric T.	S11	S12	S11	S12
1.58mm	-35.85	-1.1e-3	-18.40	-0.06
1.59mm	-28.37	-4.2e-3	-12.03	-16.39
1.60mm	-20.70	-0.03	-41.72	-2.9e-4
1.61mm	-18.09	-0.06	-10.03	-16.21
1.62mm	-23.07	-0.01	-16.75	-1.02

CONCLUSION

Dual Band Pass with our proposed design is affordable, simple, small, compact device.

This type of the filter plays huge rule in wireless communication and microwave technologies.

Simulations in Sonnet software are done in 2 minutes which represents the high-speed response.

When designing and analyzing filters we must know that there is no perfect filter.

There are many different influences from components of which filter is composed that affect output signal.

However, we can design components in a way to get signal near ideal.

Acknowledgment

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