UNIVERSITI TEKNOLOGI MARA

DUAL-BAND BANDPASS FILTER WITH RECTANGULAR SHAPED DEFECTED GROUND STRUCTURE

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF STUDY

Nowdays, microwave components such as antennas, filters and couplers are widely used in microstrip technology especially for satellite, microwave communication and wireless communication. In the last few years, many researchers have been working on significant improvements to achieve small-scaled microwave circuits in this modern communication system. In order to make the filter compact, one of the methods is to incorporate the Defected Ground Structure (DGS) technology in the filter design. By using this technique as shown in [1], the size of the filter became more compact compared to other ultra-wideband bandpass filters (UWB BPFs).

Based on the previous studies in [12], a rectangular shaped DGS was designed to enhance the response of an existing design of a dual-band bandpass filter topology. However, the measured results of the filter with the DGS unit cell achieved were relatively poor compared to their simulated results. The author had attributed this to the relatively high loss tangent of the substrate. In this research, an investigation into this problem will be

carried out and a rectangular shaped DGS also was implemented on an existing dual-band bandpass filter topology [15] to improve its performances. Various dimensions and positions of the DGS unit cell will be studied and the performance of the filter were analysed. It is envisaged that the DGS unit cell will be analysed systematically between the parallel-coupled lines to attain the best performance in terms of improved return loss and outer rejection bands. A comparison between the filter with DGS and without DGS will also be observed.

1.2 PROBLEM STATEMENT

From the previous research study [12], the measured results of the filter with the DGS unit cell obtained were relatively poor compared to their simulated results. The author had attributed this to the relatively high loss tangent of the substrate. Therefore, an investigation into this problem will be carried out and rectangular shaped DGS will also be implemented.

1.3 OBJECTIVE

There are several research objectives that need to be achieved:

i. To design and simulate a dual-band bandpass filter with rectangular shaped defective ground structure using CST Studio Suite.
ii. To investigate the effects of varying the dimensions and positions of the rectangular shaped DGS on the bandpass filter performance and determine an optimal design.
iii. To analyse the performances of the optimised filters, with and without DGS.

1.4 SCOPE AND LIMITATION OF THE STUDY

i. CST microwave studio is used to design and simulate the existing bandpass filter topology.
ii. A rectangular shaped DGS is designed and added to the filter. The DGS is tested with different dimensions and positions to observe the effects on the performance of the filter.
iii. Comparison and analysis between filter with and without DGS were executed to fulfil the objectives of the study.

1.5 SIGNIFICANCE OF THE STUDY

This study is important to analyse the improvements that may occur when the DGS unit cell is applied. It can also be used as a reference by other researchers in similar fields to obtain some ideas on the implementation of DGS unit cells.

1.6 THESIS OUTLINE

This thesis is divided into five different chapters. Every chapter describes the details of the work done for the completion of this project. A list of appendices has been included in the end of this thesis.

Chapter 1

In the first chapter, it explains the overall overview of the whole thesis. The introduction states the project background, problem statement, objectives and the scope of project.

Chapter 2

Chapter two describes the theoretical background related to this project. The chapter consists of the details on DGSs and bandpass filters.

Chapter 3

Chapter three discusses on the process of filter and DGS design, and also the simulation.

Chapter 4

Chapter four focuses on the analyses of the simulated results of the filters with and without DGS.

Chapter 5

The last chapter presents the conclusion along with possible future recommendation for this study.