ON THE DESIGN OF MICROSTRIP BANDPASS FILTERS

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ABSTRACT

The aim of this project is to design, fabricate and characterize maximally flat (Butterworth) bandpass filter to be used in microwave communication transceiver. The Butterworth response is chosen since it has less delay distortion and offers the flattest passband compared with the other filter responses. A commercially available computer aided design (CAD) package HP Eesof LIBRA was used to simulate the filter response. The filters were designed to work from 1.9 GHz to 2.1 GHz. The specified stopband attenuation is more than 15 dB while a 1 dB loss in the passband is required. The filter configuration chosen was based on microstrip planar resonators and uses a parallel-coupled filter form.

The filters were fabricated on microstrip laminate, 'RT/Duroid® 5870' with a substrate thickness of 0.5 mm and relative permittivity 2.33. The circuit was fabricated using in-house facilities available at the faculty. The filter characteristics were determined using a Wiltron 562 Scalar Network Analyzer.

The filters were found to exhibit excellent properties. The response obtained was very close to simulation. Typical return loss values measured were of the order of 12.56 dB, while the passband attenuation was found to be about 1 dB. This agreement with the original specification reflects the accuracy possible with CAD and indicates the capability of rf circuit fabrication facility available at the faculty.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Communication systems using microwave technology began to be developed after the birth of radar and has since developed rapidly. In several applications especially for satellite and mobile communications, there are continuous demands for smaller size, light weight, cheaper and high performance devices. Most of the criteria can be fulfilled using microstrip technology. The expectations required from filters are similar. For cellular applications, high quality filters are required in the handset as well as the base station.

This chapter will describe the objectives of the project, the microwave fundamentals and its applications, the concept of microwave integrated circuits (MIC) and also computer-aided design (CAD) package for microwave engineering.

1.2 Objectives

The objective of this project is to design, fabricate and characterize a maximally flat (Butterworth) bandpass filter. The filters are designed to operate from 1.9 GHz to 2.1 GHz, with a specified stopband attenuation of more than 15 dB and a passband attenuation of 1 dB.

For the simulation a CAD package called HP Eesof Libra is used to analyse and optimize the filter response. The maximally flat type is chosen since it offers the flattest response in the passband. The synthesis of maximally flat filters using insertion loss method is more convenient than image parameter technique.