THE DESIGN OF INTERDIGITAL BANDPASS FILTER ON METAMATERIAL SUBSTRATE

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ABSRACT

Nowadays, the world telecommunication become more complex and need a high frequency in transferring information. There are also increasing demands for the development of miniaturized and high performance microwave components such as filters to meet the emerging telecommunication applications. Therefore, many designers have recently concerned and developed to reduce the volume, weight as well as mass production cost.

This project focuses a new invention of multilayer bandpass filter that consist of metamaterial as the substrate. The presence of metamaterial as a new composite and artificial dielectric gives good results in terms of the return and insertion losses as well as stopband attenuation. An S-structure with combinations of Flame Retardant 4 (FR-4) and Perfect Electric Conductor (PEC) has successfully performed metamaterial. The metamaterial behaviors are only viable at certain frequency and for certain design. A lot of effort has been done to prove that the design structure follows the metamaterial behavior. Based on simulated result, the return loss of metamaterial bandpass filter is two times better performance than conventional bandpass filter. At center frequency, the insertion loss and stopband attenuation for metamaterial bandpass filter have been improved about 58.6% and 14.2% respectively as compared to the conventional bandpass filter. As for Voltage Standing Wave Ratio (VSWR), metamaterial bandpass filter provides 49.7% better performance than the conventional one.

TABLE OF CONTENTS

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

Nowadays, there has been an increasing demand for the development of miniaturized and high performance microwave and millimeter wave systems to meet the emerging telecommunication applications [1]. The integration of the entire communication system on a single chip has lead to the design of RF circuits on micromachined substrate materials. Microwave communication systems are expanding rapidly to higher frequency such as Ku-band since they can provide many advantages over conventional wireless links.

Microwave filters are widely used in communication applications to reject spurious signals and to separate different channels in a multichannel communication system. So the characteristics of compact size, high selectivity, and low insertion loss for microwave filters are highly required since it is the current trend in microwave technology [2].

This project concentrates on the design of conventional bandpass filter and metamaterial bandpass filter. The performances for both filters are compared. In this case, the parameter such as return loss, insertion loss, stopband attenuation loss, bandwidth and Voltage Standing Wave Ratio (VSWR) are concerned.

1.2 PROBLEM STATEMENT

The recent years had witnessed the emergence and rapid development of wireless technology. The current drawbacks of most commercially available bandpass filter provide with high production cost and lossy. Conventional planar filter structures suffer from radiation from the resonators into the substrate and from high