INVESTIGATION ON SPLIT-RING RESONATORS BASED ON DIFFERENT SUBSTRATES AND DIMENSIONS OPERATING AT TERAHERTZ FREQUENCY

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In the name of ALLAH
Most Gracious and Most Merciful

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ABSTRACT

Radiation in the THz band, 0.3 to 30 THz, presents difficulties to workers in the engineering and physics field; because the band is positioned between microwave and optical frequencies. Recent developments in terahertz sources include compacted electron beam systems, optical mixing techniques, and multiplication of microwave frequencies. Despite significant advances in THz science, however, few source technologies are mobile or suited for field deployment. Strategies in source development have approached generation from either end of the THz spectrum, from up-conversion of high-frequency microwave to down-conversion of optical frequencies.

In order to operate at THz frequencies, a composite material may be engineered to manifest optical effects for a particular range of frequencies. The term metamaterial encompasses materials with subwavelength structures whose aggregate interacts in a macroscopic manner with radiation of a specific wavelength. The split ring resonator (SRRs) geometry investigated in this project falls under this heading. Metamaterials that serve as THz active elements are well established and promise to yield new technologies that are smaller, cheaper, and more efficient than previous methods.

This project report presents the investigation on the response of split-ring resonators (SRRs) with the operating or resonant frequency approximately at 1THz. Different substrates and dimensions of the rings are investigated to observe the response of the SRRs at the operating frequency. The main parameters concern for this project is the voltage standing wave ratio (VSWR), return loss (S_{11}) and the resonant frequency. The SRRs is simulated using CST Microwave Studio 2006 to obtain the response used for the investigation.

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CHAPTER 1

INTRODUCTION

1.0 INTRODUCTION

This chapter will provide the fundamental and overview of the project. It consists of several topics such as background to the project, problem statement, objective, scope of work.

1.1 BACKGROUND OF THE PROJECT

Radiation in the THz regime, 0.3 to 30 THz, presents a bit of difficulties to workers in the engineering and physics field; because the band is positioned between microwave and optical frequencies [1].

Applications include THz radiography for high-contrast images similar to x-ray, but without harmful ionizing effects. THz imaging has been indicated as a replacement for x-ray in soft tissue imaging and security screening. Spectroscopy is another valuable application due to the strong interaction of THz with organic compounds which create chemical signatures for detection and identification [2, 3]. Because this frequency range offers significant benefits for numerous applications, much effort has been spent on development of smaller cheaper THz technologies [4].

The purpose of this project is to investigate the response of split-ring resonators (SRRs) with the operating or resonant frequency approximately at 1THz. Different substrates and dimensions of the rings are investigated to observe the response of the SRR at the operating frequency. The main parameters concern for this project is the voltage standing wave ratio (VSWR), return loss (S_{11}) and the resonant frequency. The SRRs is simulated using CST Microwave Studio to obtain the response used for the investigation.