A NEW APPROACH OF BROADBAND ANTENNA USING METAMATERIAL

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PENGHARGAAN

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Semua ahli penyelidik, rakan-rakan pensyarah yang telah memberikan kerjasama dan komitmen. Penyelidikan ini dapat dijayakan adalah hasil dari sokongan dan idea semua pihak.

ABSTRACT

This research has proposed a new generation of antenna that applies metamaterial as a based substrate to enhance the performance of the device and reduce the size of the circuit area. The current bulky size of conventional antenna on single layer can be easily replaced by the invented metamaterial from this research.

An omega structure was chosen from two combination materials; Flame Retardant 4 and Perfect Electric Conductor were used to produce the material that has negative permittivity. An investigation into the S-parameters has been carried out to prove the negative permittivity produced by the metamaterial.

This research is focusing on the simulation of the metamaterial antenna in order to enhance the bandwidth of the device and come out with a compact antenna. Another investigation is to use the metamaterial as a cover or reflector to the conventional transceiver device. The results from the investigation show that the metamaterial able to improve the bandwidth and directivity of the conventional antenna.

Results from the investigation show that the return loss of the metamaterial antenna and the conventional antenna that applied the new material as cover provide better responses in term of bandwidth, amplitude of the loss and directivity compared to the conventional antenna. The obvious feature is the size reduction of the device which can be reduced more than 50% of the conventional design. The antennas lead to the enhancement of the technology, hence provide an a sophisticated technology to the consumers by the advantages such as smaller in size, cheaper in cost and better in performance.

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CHAPTER 1

1.0 INTRODUCTION

1.1 BACKGROUND STUDY

Metamaterials are structured composite materials with unique electromagnetic properties due to the interaction of electromagnetic waves with the finer scale periodicity of conventional materials [1]. Metamaterial synthesized by embedding various constituents or inclusions with novel geometrical shapes and forms in some host media [2]. The person who is responsible in discovering the concept of metamaterials is Veselago in 1967 [2, 3]. Veselago assumed the unknown materials has negative permeability and permittivity in the same frequency range and it show abnormal electromagnetic properties when he studied the uniform plane-wave propagation [2-5]. Veselago also found that the Poynting vector of the plane wave is anti-parallel to the direction of the phase velocity [5-7]. As a result, Veselago referred the material as left-handed material (LHM) which has reverse basic feature of light, such as negative refractive index (NRI) and he also suggested the metamaterial support backward wave propagation which contribute to backward wave material (BWM) [5, 8].

Negative permittivity means the material produce may not be easily available in nature, physically unique and has unusual realizable response function [2, 5]. The metamaterial also can be mention as double-negative materials (DNG), negative-index