Electromagnetic Band Gap Structure Antenna

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Abstract *— This synopsis presents a design of circularly polarized microstrip antenna with inset feed and employs Electromagnetic Band Gap (EBG) structure to improve antenna efficiency and bandwidth, and it also suppresses surface waves. A cross slot is introduced with equal arm lengths. The antenna is designed to work on RT duroid 5880 having thickness of 0.1588cm and r of 10.2.The proposed EBG structure constructed with many vacuum holes. Return loss, VSWR, E and H plane pattern of the antenna are observed with Zeland IE3D.*

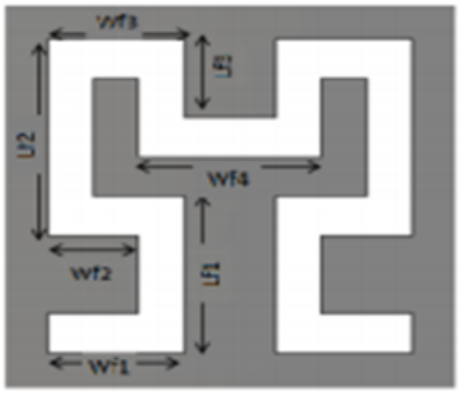
Keywords *— Types of EBG structures, two antenna structure without EBG, two antenna structure with EBG.*

I. Introduction

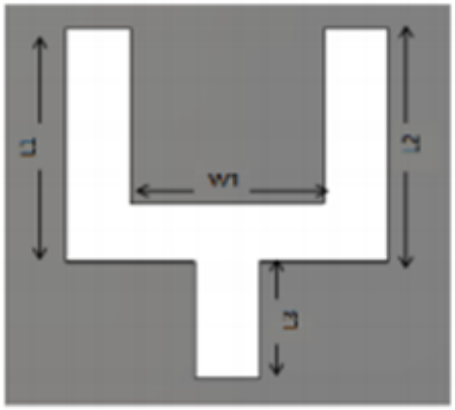
Microstrip antenna was first introduced in the 1950s by Deschamps. However, this concept had to wait for about 20 years to be realized after the development of the printed circuit board (PCB) technology in the 1970s by Bob Munson. Since then microstrip antenna is the most common type of antennas with wide range of applications. Electromagnetic Band gap Structures have been investigated for improving performances of numerous RF and microwave devices utilizing the surface wave suppression and the artificial magnetic conductor (AMC) properties of these special type metamaterial.

II. Types Of EBG Structures

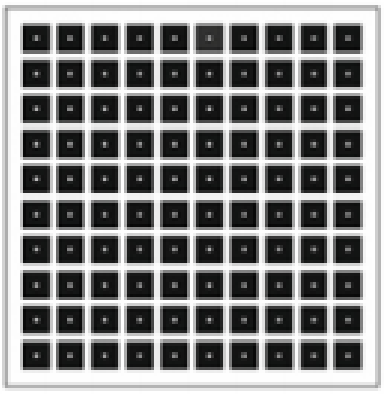
A. Fractal Type



B. Fork Type



C. Mushroom Type



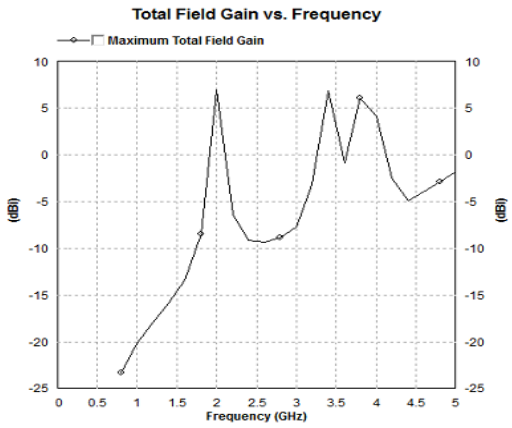
There are many more types of EBG structures. For our project we utilized fork type EBG structure.

III. Understanding The Basics

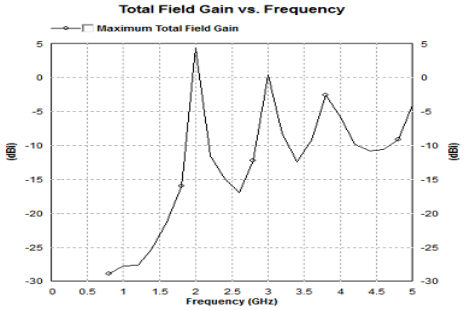
First to understand the concepts of microstrip antenna, we simulated antenna's with two different dielectric constants viz 2.2 and 10.2 on IE3D. The results which we observed are as follows:

A. Gain Results:

1) For dielectric constant 2.2

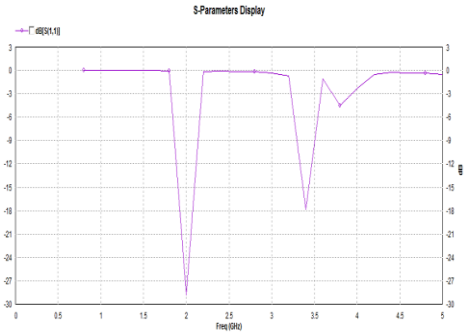


2) For dielectric constant 10.2

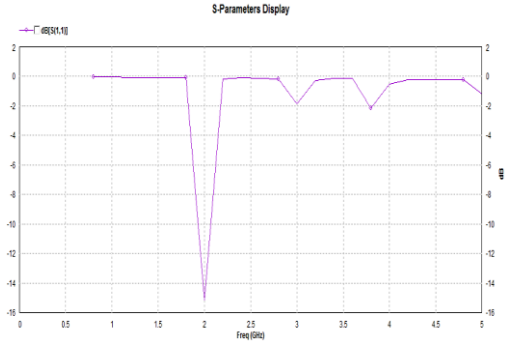


B. S-Paramater Results:

1) For dielectric constant 2.2

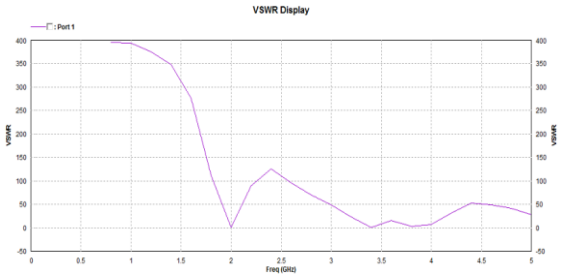


2) For dielectric constant 10.2

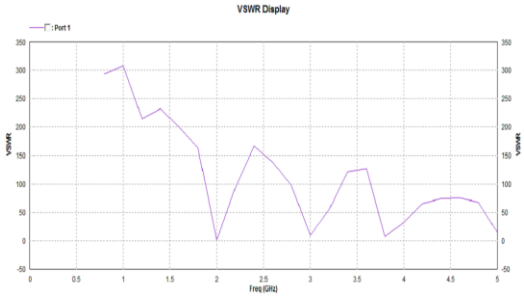


C. VSWR Results:

1) For dielectric constant 2.2

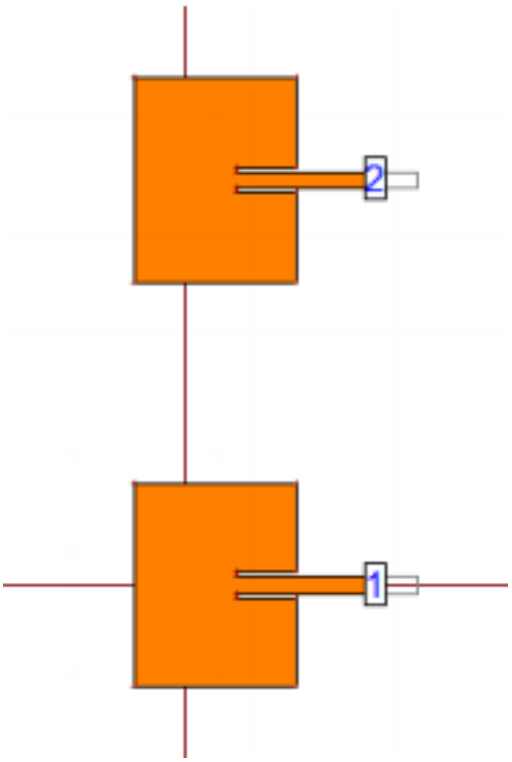


2) For dielectric constant 10.2



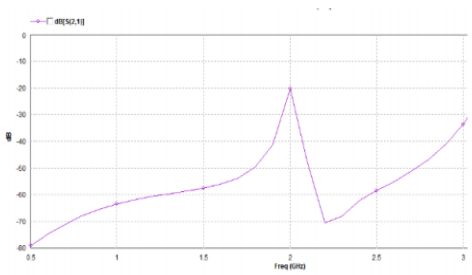
We can conclude from the above simulation results the as the dielectric constant is increased the gain and directivity of the antenna is increased.

IV. Two Antenna Structure Without EBG



In order to demonstrate the effectiveness of EBG structure in improving the gain we first simulated two antenna structure without EBG structure.

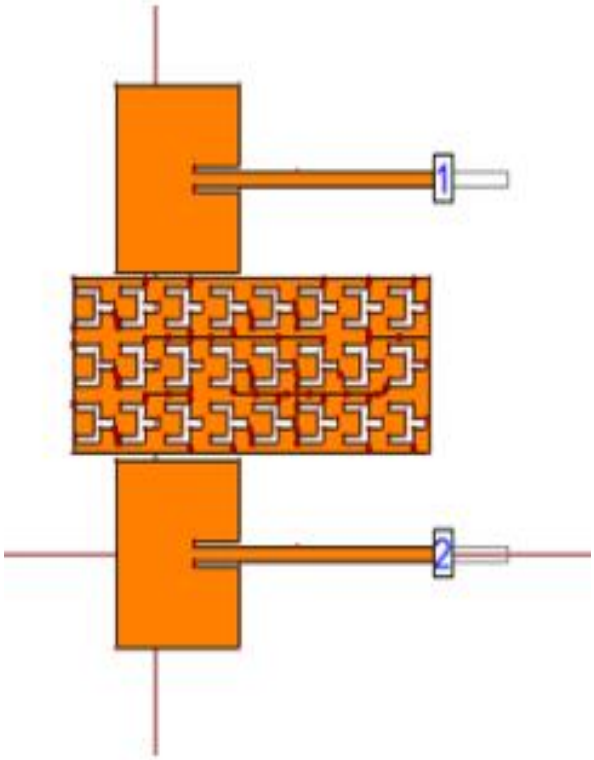
The results of which are shown below.



The above result shows the graph of S21 ie when port 1 is excited output measured at port 2.

The above graph shows the gain to be -20dB.

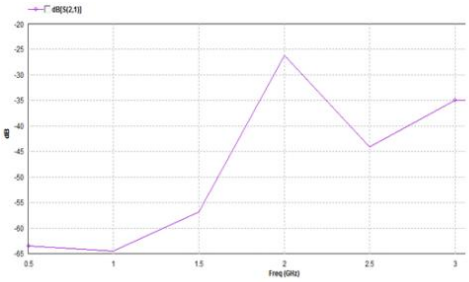
V. Two Antenna Structure With EBG



We simulated the above two antenna structure with EBG structure implemented in between two antenna's.

The EBG structure suppresses the surface waves which in turn will increase the gain and directivity.

The following graph shows S21 of the above two antenna structure.



The above result shows the gain as -27dB. Thus we were able to achieve slight improvement in gain with the help of EBG structure.

VI. Conclusions

It is evident from the results that there was a considerable improvement in the results for gain and directivity and also the surface radiation reduces majorly when an EBG structure is used in the antenna system.

Acknowledgment

It has been a sincere desire of every individual to get an opportunity to express his views, skills, attitude and talent in which he is proficient so as to give him satisfaction and confidence in his ability to do or produce something useful to mankind. A project is one such avenue through an engineer gives vent to his feeling and expressions.

We take this opportunity to express our gratitude towards our internal guide Prof. Mr. Nilesh Nagrale encouragement and guidance in our endeavour without which we would have found it difficult to maintain the tempo and enthusiasm. Working with him has been a wonderful learning experience.

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