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Design and study of a Opened Flower Petal structured Micro strip Antenna for THF

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Abstract

The middle band of Microwave radiation and Infrared radiation is the Terahertz Radiation as per the electromagnetic spectrum. One of the important aspects of the Terahertz radiation is it can travel in the line of sight and also it is non- ionizing. It has a similarity with the microwave that the terahertz radiation can go into non conducting materials. The depth of penetration is less than the microwaves. Terahertz radiation can replace the X-rays, due to this reason the Terahertz is very important now a days in medical applications. Many researchers are working on it. Our present work is on the design and analysis of a Terahertz Micro strip antenna using HFSS software.

Keywords: Microstrip, THF, Radio Communication,

1. INTRODUCTION

The Terahertz radiation is also known as the Tremendously High Frequency (THF). The band corresponding to radiation in the Terahertz band is varying from 1mm to 0.1mm as the terahertz radiation begins at nearly 1 mm and it goes up to smaller wavelengths. The demonstration by Guglielmo Marconi on radio's ability for supplying continuous contact with ships on sailing across the so-called English Channel is one of the remarkable incidences in the history of communication. After that a lot of experiments were carried out by many researchers for the technological developments and advancements. In 1946 United States launched the first public telephone service for up to 50Km through a single but high-power transmitter on a set up of a very large tower in half duplex mode at 120KHz of RF bandwidth.

One of the major elements of communication is antenna [1,2]. Antenna is a special structure for the transmission and reception of electromagnetic energy [3]. It acts as a device for the transitional structure [4] in the middle of the guiding device and the free space. As per the IEEE definition the definition of an antenna can be written as "That part of a transmitting or receiving system that is designed to radiate or receive electromagnetic waves". To know the radiation [5] of an antenna we should know how the radiation takes place. The time varying current [6] is the reason of the radiation from a conducting wire [7]. In the absence of the time varying current the radiation will also does not take place. Along with this concept again if the charges are moving with a uniform velocity, then also it will return zero radiation for straight line propagation. Whereas along a bend or curved path the charges moving with uniform velocity will give radiation. As per the explanation given by Balanis [8] if any charge is oscillating with time, then it will show the radiation.

2. THEORY

In this proposed structure of micro strip patch antenna [9], it has been observed that the design consideration was to obtain one novel antenna for the application in the Terahertz frequency band. The terahertz frequency band is not yet utilized for the application in real life. As per the literature review it has been observed that only up to 0.3THz to 0.9THz some antenna design and analysis work has been found. A general structure of a micro strip patch antenna [10] is given in the Figure 1, where l is the length of the patch, t is the thickness of the patch, w is the width of the patch and h is the

height of the substrate.

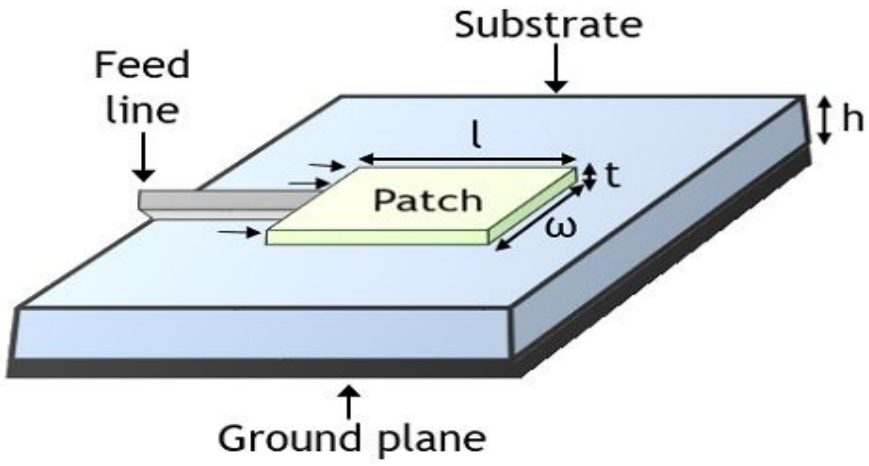

Fig.1: A general overview of Micro strip patch antenna

In our proposed structute we have considered a structure which will represent a flower with opened petals inside the patch. Here the substrate is Gallium Arsenide.

3. RESULTS

The software used for our work is the HFSS software. The simulated antenna is given in the Figure 2 where it is clearly visible that the antenna is representing a opened flower petal structure.

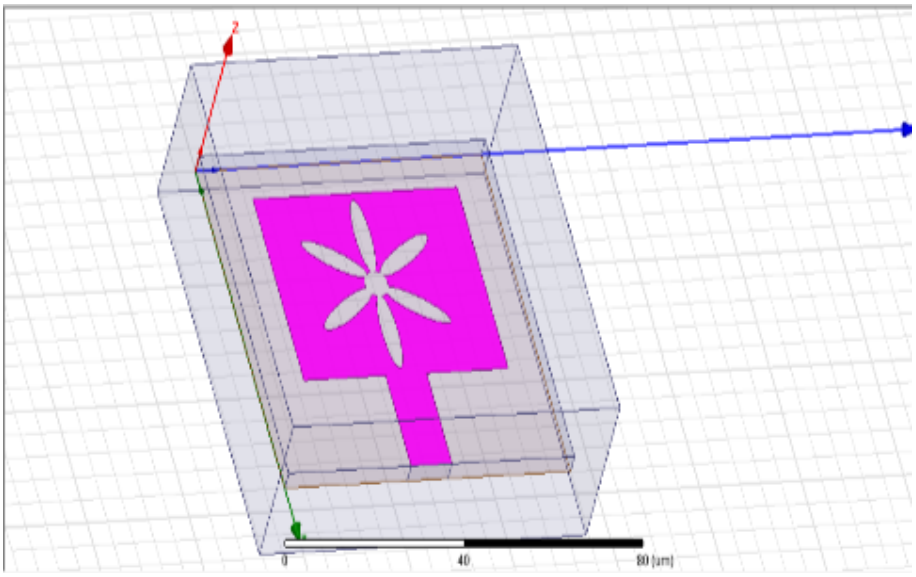

Fig. 2: The proposed micro strip antenna designed in the HFSS software

The S11 vs frequency plot is given in the Figure 3 which is showing satisfactory result at 8.738THz frequency.

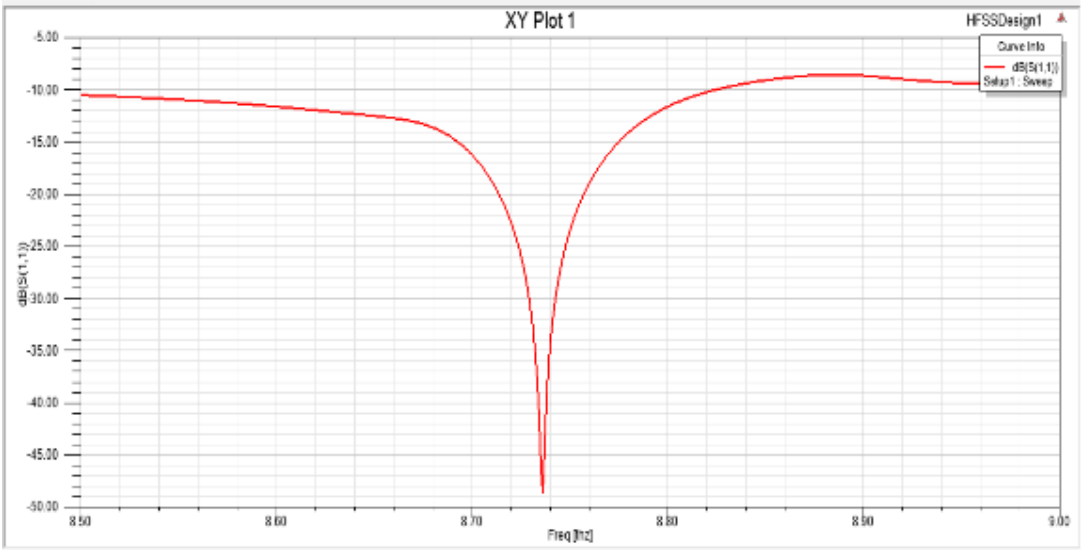

Fig. 3: S11 vs frequency plot of the proposed micro strip antenna

The VSWR vs frequency plot is given in the Figure 4 which is also satisfying with its value for the frequency of 8.738THz.

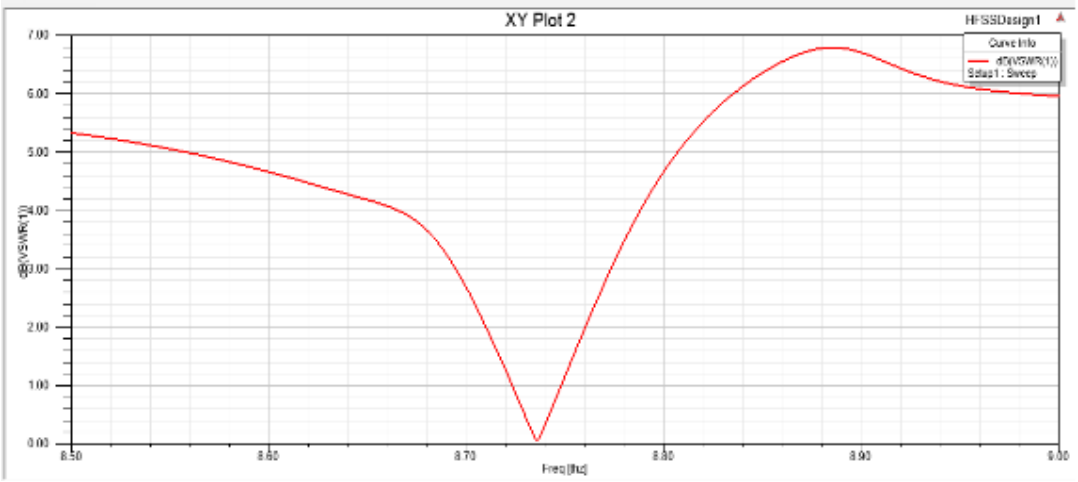

Fig. 4: VSWR vs frequency plot of the proposed micro strip antenna

The radiation pattern for the antenna has been given in the Figure 5 and it is also acceptable for the designed antenna.

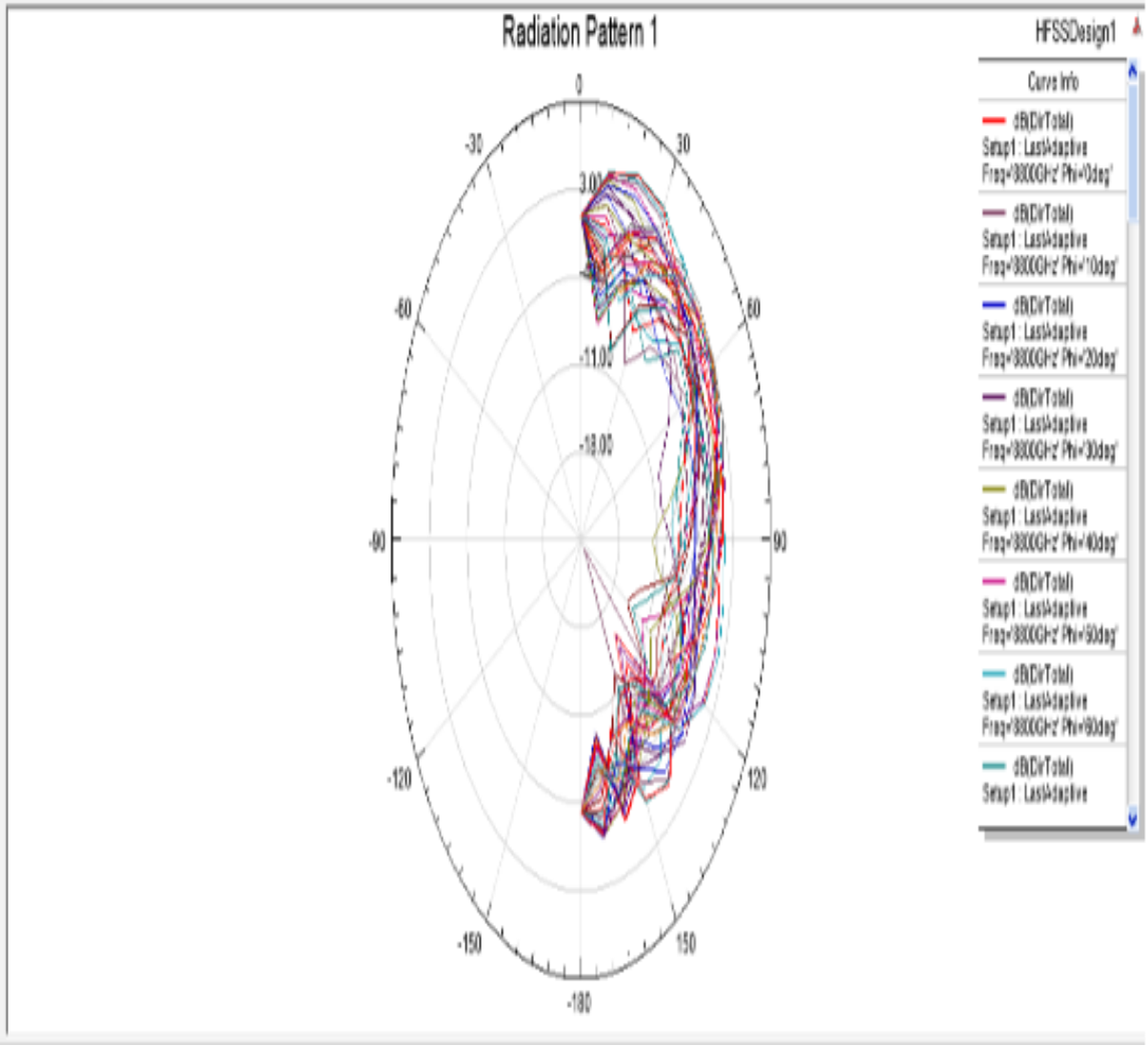

Fig. 5: VSWR vs frequency plot of the proposed micro strip antenna

The polar plot of the antenna is given in the Figure 6 and it is showing a good result for the proposed antenna.

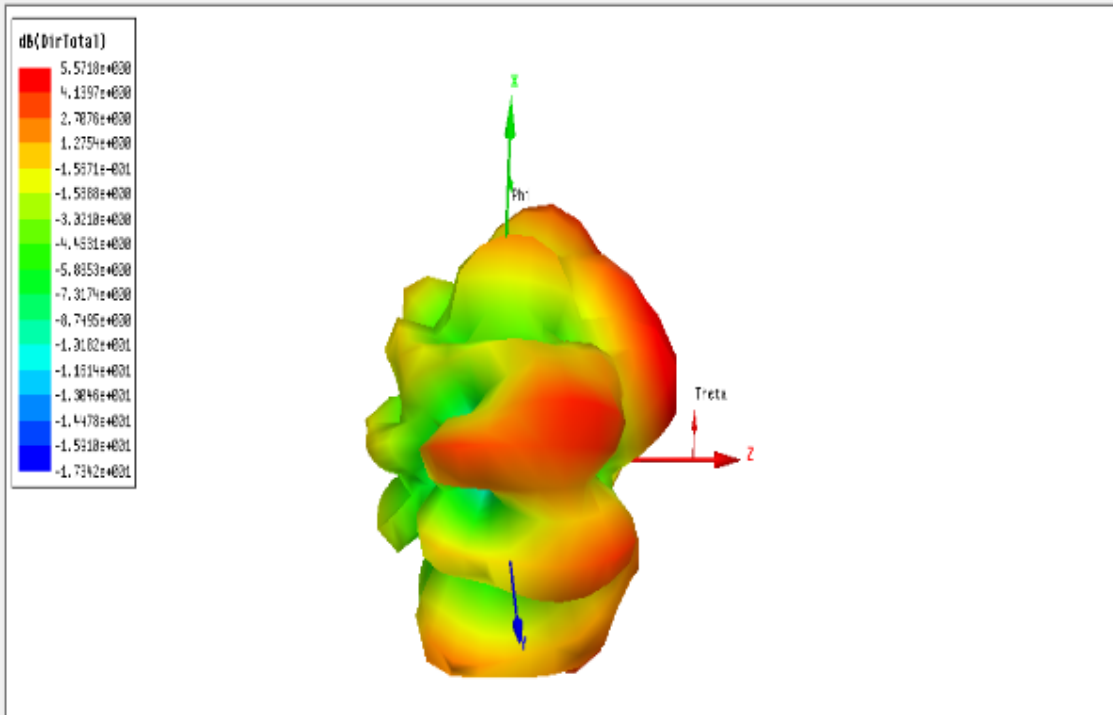

Fig. 6: The polar plot of the proposed micro strip antenna

4. CONCLUSION

A novel micro strip patch antenna has been proposed in this work where it has been found that the antenna is suitable for the operation in the Terahertz frequency with a resonance frequency of 8.738THz. Due to the light weight, compact design, and portable design applicable for the proposed antenna this antenna will be suitable for operation in the terahertz frequency.

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