Design and Simulation of HFSS and Flower Shaped Antenna for Terahertz Applications

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***Abstract* — One of the unexplored research areas is a terahertz has been due to difficulties of detection and generation in electromagnetic fields at these wavelengths. In a terahertz applications are not used in optical and microwave techniques. But it has some characteristics of terahertz wavelength field wavelength too short for optical wavelength and too long for microwave wavelength. However, their band-engineered hetero structures have very short lifetimes of semiconductor to semi-insulting for a manufacturing into an ultrafast optical technique of their development. While a lot of the important applications are quantum electronics in research of new area have been boosted a terahertz field as well as nano technology and micromachining techniques. It has a new idea and new technology of created a THZ application of rectangular resonator was a shape of flower. Flower shape have a dimensions is 20×30×1.6 mm^3 and substrate is used as a FR4 material. Here the study Return loss, radiation pattern and gain of the antenna are presented and analyzed to study the performance of the antenna for THz applications. The frequency band is obtained at 0.92 THz with the impedance bandwidth of 710 GHz. The peak gain of this antenna is obtained as 12.786 dB at 1.01 THz.**

***Keywords*— THz antenna, Flower shaped antenna, Rectangular resonator**

I. INTRODUCTION

Upcoming researcher of THZ technology has been interest in some applications available in the areas of imaging, radio, astronomy, spectroscopy, security control and communication. Impedance matching and power radiations both are unique role in the particular application of the important component. In a worldwide was some different kind of antennas are there such as a dipole antenna, spiral antenna, grapheme antenna, leaky wave antenna, on-chip antenna, Yagi-Uda antenna and butterfly shaped antenna are reported in the literature. Here electromagnetic waves and its fabrication, signal generation and detections are interact a particularly antenna has some limitations are there.

Here design and simulation of this simple, compact, miniaturized antenna for the proposed work of antenna of THZ application. The antenna has an impedance bandwidth of it's to improve the design of the rectangular ring resonator. In this paper presented an FR4 substrate using and flower shaped antenna then, simulation of HFSS.

The difference between antenna arms and low potential of the detector is very low on the power of THZ radiation in practical cases. A small rectified current is obtained by these conditions. While a strong electric field consider a scenario of an alternative approach of it and their antenna characteristics of incoming field to the intensity can be determined then, rectification given in place of applied to a semiconductor device.

Astronomy is a one of the application of driven in Terahertz (THz) technology at earlier days. However Astronomy has some applications of sensor and THZ instruments of scientific satellites launched and deployed successfully of the past 20 years. One of the applications of wireless sensors and communications, medical imaging, security screening are much broader applications of THZ technologies to research and recent development.

Today applications of wireless communication have a capacity of data rates to a demand and it has some limits. In recent years growth of data rates has to achieve and develop in interference to the reduction and modulations of spectral efficient create new technologies. Future wireless network requirements of energy consumption reduce day by day and their data capacity offered to new technologies.

THZ have a potential of the low complexity system is an important advantage of wireless systems. To achieve a performance of multi-gigabit through a channel bandwidth of multiple GHz with couple's modulation schemes has a simple form.

II. ANTENNA STRUCTURE AND DESIGN

However paper design of the flower shape antenna using as a substrate of FR4 material. In this paper taken a thickness of 1.6mm and permittivity ε_r = 4.4 and loss tangent is a 0.02 with respectively. Here Microstrip line feeing used it. While THZ region has a wide range of impedance bandwidth to achieve and rectangular resonator also has a shape of flower to design of it. Here corresponding design of flower shape antenna parameters is shown in the Fig. 1. Therefore a compact and miniaturize of and it has a design is simple. Their flower shape antenna is a simulation of HFSS 14 (High Frequency Simulation Software) of ANSOFT.

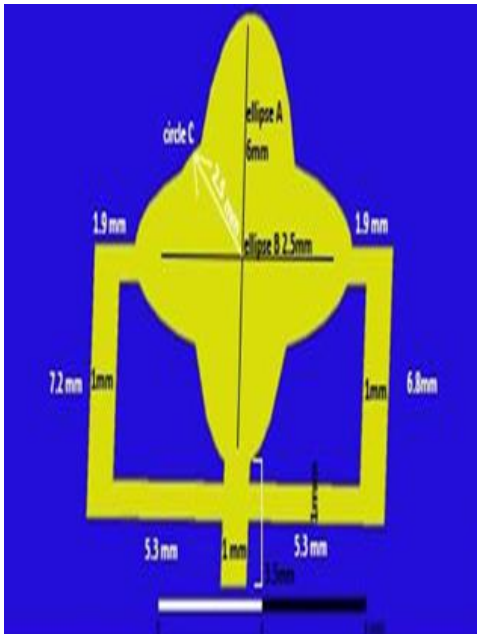

Figure.1 Design of flower shape Antenna

However, their design of antenna has high gain with compact size are the advantages of the THz radio system. The design and fabrication of THz antenna exit of technical challenges into a practical. Recently, a reported of nano phased array (NPA) to a breakthrough it. In substrate of CMOS integrated circuit has a high doping of semiconductor device constituted to ground plane and configuration of monopole antenna. The space station has crew modules for WLAN services with high data rate of Gbps of a THz wireless system. Spacecraft have manned and unmanned of enabling technology for wireless communication. It has an eliminating cabling of maintenance costs, decreasing mass, science return, increasing safety and mobility of crew and instruments. In this section analyzed by a theoretical concept of potential space applications for Terahertz wireless system links. Additive white Gaussian noise (AWGN) channel assumed for the wireless link. The practical THz has some distances of limited to 50 meters indoor communication and due to the THz signals has an attenuation of atmospherics. Microwave signals are compared to THz frequency has insignificant at creeping wave or diffracted fields and structure blockage could not overcome by THz signals. While transmitter and receiver have operations light of sight would require THz systems.

III. RESULT AND DISCUSION

Figure 2 shows the result of proposed antenna for Return loss vs. Frequency plot. The band at 0.92THz is quite broad with an impedance bandwidth of 710 GHz. The return loss of -33.56 dB is obtained at 0.92 THz.

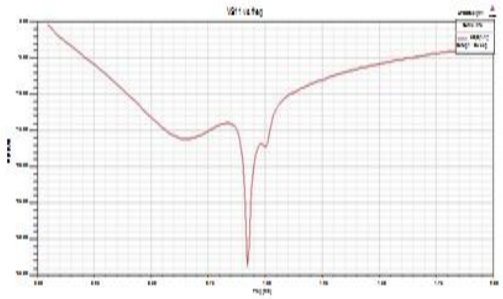

Figure. 2 Results of S parameters S11 Vs Frequency plot

Figure 3 shows the results of VSWR Vs Frequency plot for proposed antenna. While their results of frequency range are 0.573 and the VSWR is obtained as 0.573. In this paper has less than 2 are seen at 57.6 GHz is a bandwidth range, but S11 vs frequency has a compression bandwidth of lesser by seen.

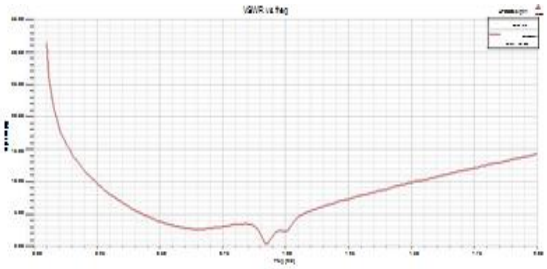

Figure. 3Results of VSWR Vs. Frequency plot of antenna

Figure 4 (a) shows the proposed design of 0.92 radiation pattern at the E-plane. It has multi directional patterns are $\phi = 0$ and $\phi = 90$. Figure 4(b) illustrates their results of H-plane radiation pattern at 0.92 THz. In H-plane has a multi directional at the radiation pattern of $\theta = 0$ and E plane pattern is less than of gain. Here gain has got decreased with omnidirectional of their radiation pattern at $\theta = 90$.

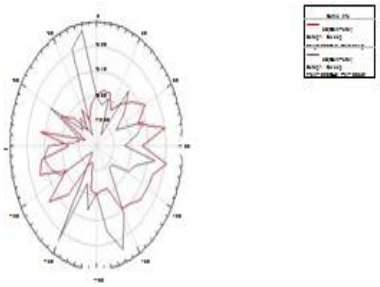

Figure. 4(a) Results of E-plane radiation pattern at 0.92THz

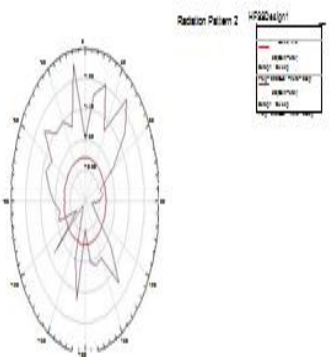

Figure. 4(b) Results of H-plane radiation pattern at 0.92THz

Figure 5 shows their results of gain vs. frequency graph for the proposed design. The peak gain is observed as 12.786 dB at 1.01 THz for $\phi = 90$, $\theta = 350$.

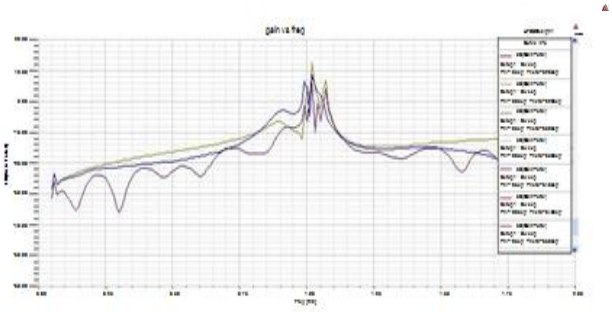

Figure. 5 Results of Gain Vs Frequency Plots

Figure 6 shows the results of radiating patch 0.92 THz on surface current density of distribution. It is distributed throughout the radiating patch. Here the design of flower shape antenna has a very strong of the patch is rest and feed line between the coupling. However, in this design has better performance of the current width and gain. In this proposed system design of flower shape antenna miniaturized of THz application and ground plane and radiating patch has different design parameters further it will improve.

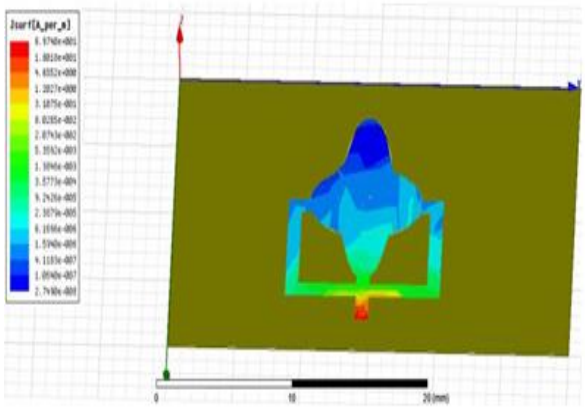

Fig. 6 Surface current density distribution on radiating patch

IV. CONCLUSION

This paper has been presented a topic of flower shape antenna and it has characteristics of compact, miniaturized THz application and their issues of simple design. WLAN have an interior potential of wireless system links in Terahertz applications. In THz band could be overcome a high space loss at high gain. It has a compact size of high gain antenna. THz band has an application of long range by technical challenge. It has a feasibility of long range communication could be required a high power transmitter and high gain antenna. Flower shape antenna gets a result of resonating frequency 0.92 THz and impedance bandwidth of 710 GHz. While their peak gain is 12.786 dB at 1.01 THz obtained it. Design of flower shape antenna using a substrate of FR4 and it has a thickness 1.6 mm, $\varepsilon r = 4.4$ and loss tangent 0.02 and dimensions of the antenna is 20×30×1.6 mm of the flower shape antenna. Design of flower shape antenna has an application of imaging, communication and remote sensing applications used for THz.

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