MICROSTRIP PATCH ANTENNA DESIGN FOR PLASTIC EXPLOSION

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Abstract : Terahertz Frequency system has gained high attention because of high potential for huge number of analysis. The proposed paper illustrated the design and analysis of microstrip patch antenna for detection of plastic explosive SEMTEX. The substrate used in this design is Fr4 material with thickness of 1.62µm which is having dielectric constant of 4.4. The radiating patch and ground plane are made up of copper material having high conductivity and low resistivity. The ground plane should be reduced to get the resonant frequency. For the designing and analysis of the proposed antenna Computer Simulation Technology(CST) Microwave studio 2016 has been deployed input impedance of 50Ω which resonant at 5.95THz frequency with returnloss of -30.08dB with the gain of 5.76dB and directivity of5.565dBi.

IndexTerms **- SEMTEX, Plastic explosive, Gain, Directivity, Input impedance.**

I. INTRODUCTION

The electromagnetic spectrum present between classical microwave and the infrared region is known as terahertz frequency band (0.1THz- 10THz), it is gaining popularity in applications like sensing, imaging, medicines etc. In order to detect the presence of unobstructed materials, we can use terahertz frequency spectrum using terahertz radiation. These can penetrate through substances like paper, plastic, transparent and has low photon energy which can be used for detection purposes. These light waves can be easily manipulated with the help of lenses and mirrors.

In the last few years ago, there is a lot of research have been taken placed on terahertz frequency. They are trying to develop technique to enable fast, more sensitive and simpler determination to trace or identify explosive substances. They are detected on the basis of their spectral signature which are the result of intramolecular and intermolecular vibrational modes of the materials. We can alsouse of THz-TDS (Terahertz time domain system)and terahertz microstrip patch antenna for the various applications like standoff detection of explosives [10], medical imaging etc. In order to generate and detect terahertz efficiently which emerged as the main spectroscopic modality with more compactness and stability

Terahertz time domain spectroscopy is used. Terahertz microstrip patch antennas was designed for detection and determination of illicit drugs, explosives etc. In this paper a Terahertz microstrip patch antenna has been designed for the detection of plastic explosive SEMTEX which is strongest explosives in world. If we take 250 mg of SEMTEX .it has capability to destroy a commercial airplane. This paper can also able to detect the explosive at resonant frequency of 5.95 THz.

The proposed paper comprises of four section as described below:

Section II consists of antenna geometry and antenna dimensions of the top view, bottom view and side view of the proposed antenna design. Further section III consists of simulated results based upon various antenna parameters and Section IV concludes the proposed technique and observations formulated through it which shows that the proposed paper is suitable for detection of plastic explosive SEMTEX.

II. ANTENNA GEOMETRY

I. Designing and simulation of the proposed antenna design has been done using Computer Simulation Technology (CST) Microwave Studio 2016. In the proposed antenna design Flame Retardant (Fr4) material has been used as substrate having thickness of 1.62 µm with dielectric constant of 4.4. Both patch and ground plane are made up of conducting material copper of thickness 0.02 µm.

II. Reduced ground plane has been used so as to acquire the desired resonant frequency and to improve other antenna parameters like S-parameter, gain, directivity etc. The proposed antenna has an input impedance of 50 Ω so as to match the impedance of coaxial cable in order to have minimum reflections and maximum power transfer. Fig. 1 shows the front view of the proposed antenna along with its dimensions whereas the fig. 2 shows the back view of the proposed antenna.

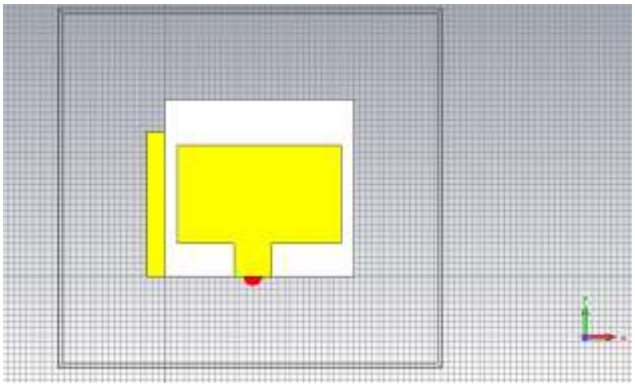

FIGURE 1 front view of proposed antenna

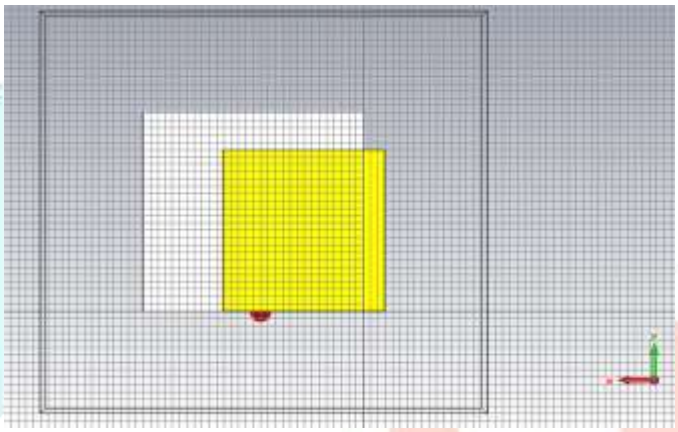

Figure 2 back view of proposed antenna

III. SIMULATED RESULTS AND OBSERVATION

Computer Simulation Technology (CST) Microwave Studio 2016 is used to analysis the antenna parameters. It is also very user friendly and produce more accurate calculations.

The analysis are done on the basis of gain (dB), directivity (dBi), S-parameter (dB), impedance (ohms) and HPBW (degrees).The proposed antenna resonates at5.95 THz with a return loss of –30.08 dB having gain of 5.76 dB and directivity 5.656 dBi. It has an input impedance of 50 Ω . The ground plane has been reduced in order to improve the return loss plot of the proposed antenna and other antenna parameters. Fig. 3 represents the return loss of the proposed antenna at resonant frequency of 5.95 THz, fig. 4 represents the gain of the proposed antenna, fig. 5 represents the directivity of the proposed antenna.

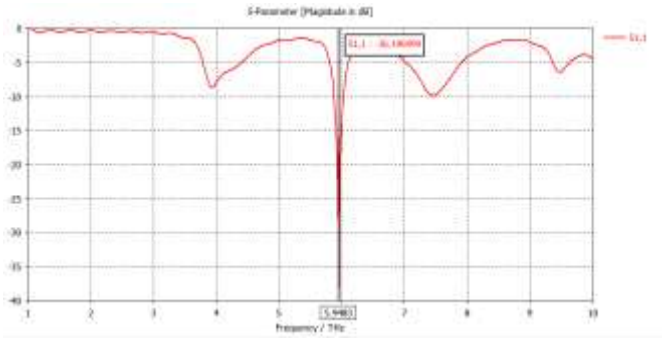

Figure 3 returnloss of proposed antenna

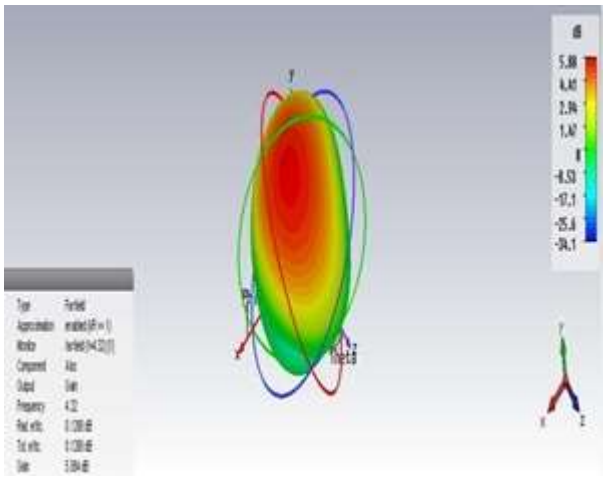

Figure 4 Gain of proposed antenna

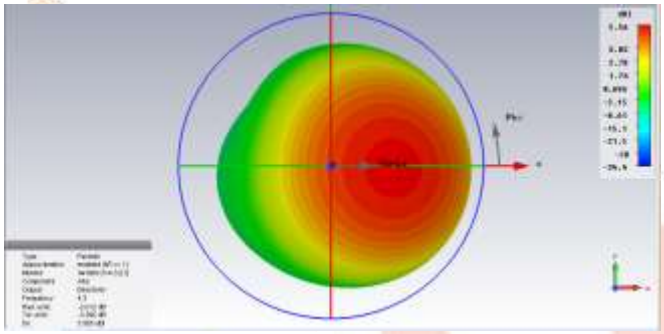

Figure 5 Directivity of antenna

IV. CONCLUSION

The design and analyzing of a microstrip patch antenna is used for detection of plastic explosive SEMTEX. This antenna increases the gain and also improves the returnloss. The proposed antenna resonates at 5.95THz which is used as signature for detecting SEMTEX. Further implementation can be done to improve the returnloss and other antenna parameter by reducing the ground plane thickness.

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