Dualband Equilateral Triangular Microstrip Patch Antenna for C Band Applications

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Abstract— Microstrip patch antennas are extensively used in the field of communication .There are different types of antenna available such as Rectangular, Triangular, Circular, Elliptical and many more. Besides this types of antenna, different types of antennas are available in market. An antenna designing which could function for more than one frequency band with compact size is the requirement of the modern world for communication. This purpose serves by Microstrip patch antenna. Triangular antennas become a first choice of the Researcher. A dualband equilateral triangular microstrip patch antenna with tapered feed for C band applications is presented. The c-band frequency range falls between 4to 8 Gigahertz and are extensively used in satellite applications. The operational frequency is 6.5 GHz that lies in C band. The impedance bandwidth of the designed antenna is 300 MHz (6.34-6.64) for reflection coefficient less than -10dB.The Simulation is done by CST Microwave Studio Suite (CST MW 2016) Simulator.

Key words: Microstrip Patch Antenna, Return Loss, Slot, Tapered Feed, VSWR

I. INTRODUCTION

An antenna is devices that transmit the signal from one end to other end [1]. Antenna is an important \part of communication system [2]. In modern communication systems, dual band , multiband or wideband antenna with low profile, low weight, low cost have a great demand in commercial as well as military applications[3]. Microstrop patch antenna has an advantage of low cost, low weight, and low profile. Microstrip patch antenna comprises ground patch and substrate where substrate sandwiched between patch and ground plane [4].

According to the requirement of the applications different kinds of antenna have been designed. They are Rectangular, Triangular, Circular, Elliptical and many more. Besides this types of antenna, different types of antennas are also available in market. Triangular Microstrip Patch Antenna has very wide scope in future [5]. The impedance matching at higher frequencies can be improved. When The feed line has been tapered [6] near the antenna feeding point. The proposed equilateral microstrip patch antenna radiate an Omni-directional radiation pattern [7].In this paper equilateral triangular patch antenna, slot cut in patch with tapered feed is designed for 6.5 GHz frequency. The Radiation Pattern, Return Loss, Band Width, VSWR are observed for the Triangular Patch antenna using CST Microwave Studio software. To achieve the DUAL band operation, the patch used can be provided with rectangular slots to the upper edge of patch and to reduce the return loss slots cut in lower edge of the patch.

II. DESIGN AND ANALYSIS OF THE PROPOSED ANTENNA

A. Design of Proposed Antenna

An Equilateral Triangular microstrip patch antenna is designed using CST Microwave Stimulator which works on finite integral method a relative of FDTD. The designing model comprises Equilateral triangular patch antenna slots placed at the lower edge of the antenna and two rectangular slots at the middle of the patch.

The volume of design antenna is 16.5x20x1.6 $mm^{3.}$ The antenna has been designed on 1.6 mm thick FR-4 (lossy) substrate with a relative permittivity of 4.3 with a dielectric loss tangent of 0.02 (tan $\delta = 0.02$ as shown in fig 1 (a, b).

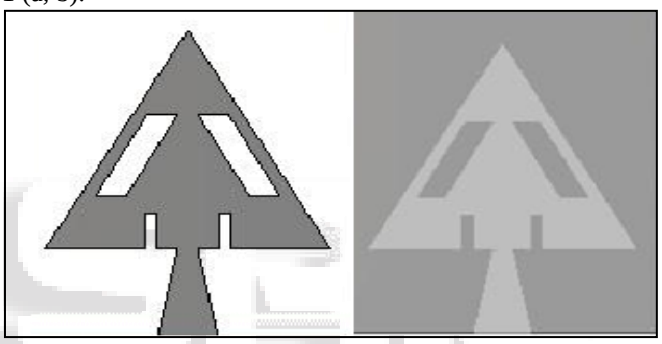

Fig. 1(a): Fig. 1(b):
Fig. 1(a): shows the Front View of patch
Fig. 1(b): shows the Front View of proposed antenna

B. Development of Antenna

The performance of the antenna typically depends on the microstrip feed line at lower frequencies. The Lower band edge frequency of the antenna is determined by the microstrip feed line length and consequently defines its lateral size. In the proposed antenna, the equilateral triangle patch is designed using the standard formula given in [8] and tapered feeding is used for the impedance matching.

The microstrip patch antenna is an equilateral triangle with edges 14 mm, feed length 11.87 mm and height of ground 20. By the two slot of 2x0.61mm^2 is cut in the lower edge of the patch to improve S11 and impedance parameters and two slots of placed at the middle of the patch as shown in Fig. 2 which are optimized in CST microwave simulator.

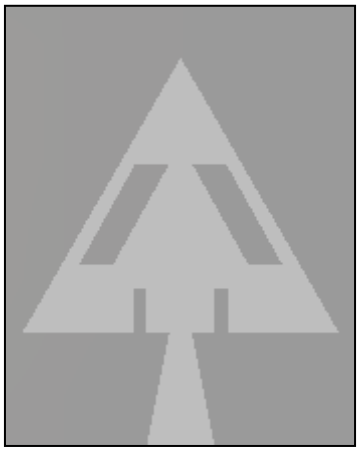

Fig. 2: Proposed Antenna

III. RESULTS AND DISCUSSION

A. Antenna S11

The return loss of dualband microstrip antenna is discribed.S11 versus frequency graph has been shown in fig 3. It is seen that the Return loss is -20dB at the resonant frequency 6.5GHz and -24.5dB at the resonant frequency 10.3GHz where return loss -10dB is acceptable for practical applications.

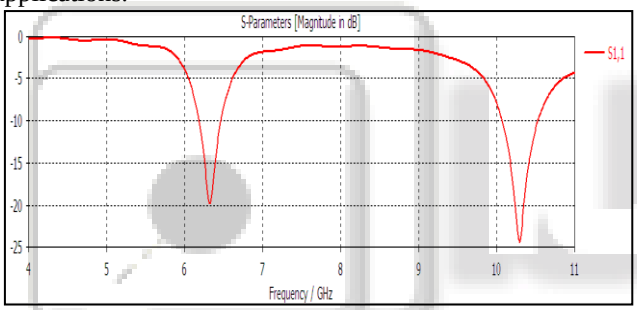

Fig. 3: S_{11} Parameter of proposed antenna

B. Antenna VSWR

Fig 4 shows the graph between VSWR versus frequency. Graph clearly indicates that VSWR is less than 2.5 in the entire frequency band.

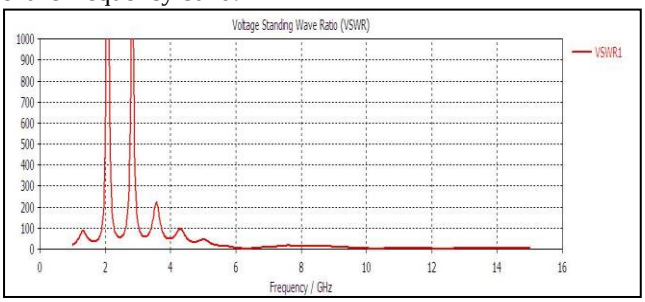

Fig. 4: VSWR of proposed antenna

C. Antenna Input Impedance

The real and imaginary parts of antenna impedance versus frequency curve is shown in fig 5.The graph clearly indicates that the real part of impedance is neraly50 ohm which means that feed line characteristic impedance is matched with the load impedance and the imaginary part of the impedance is closely 0 means reactance is zero.

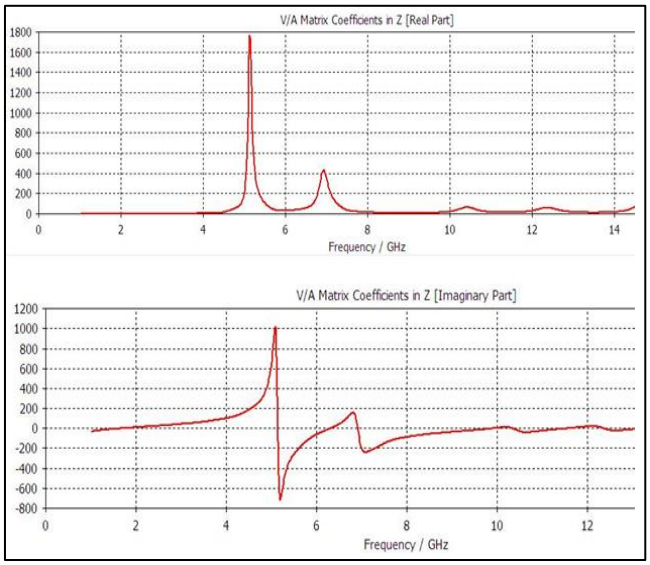

Fig. 5: Reference Impedance of proposed antenna

D. Radiation Pattern

Fig. 7 describes the Radiation Pattern of proposed antenna. Radiation Pattern of the antenna describes how the antenna radiates the energy into the space.

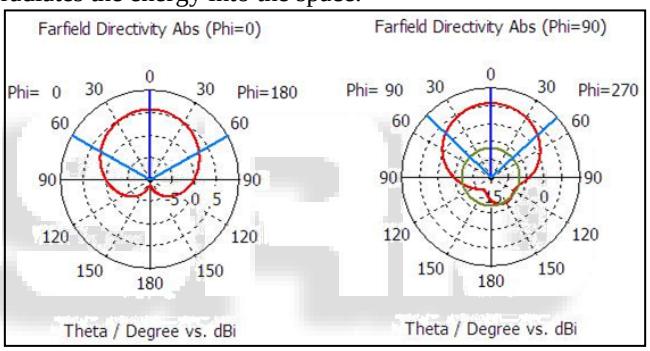

Fig. 7(a): E plane Fig. 7(b): H plane

Fig. 7: Radiation Pattern of proposed antenna E plane and H plane

IV. CONCLUSION

In this paper the research work is mainly focused on the design and simulation of dualband equilateral triangular patch antenna using the tapered feed technique which is simulated using CST Microwave Studio Suite (CST MW 2016) Simulator. The Triangular microstrip patch antenna operates on the frequency 6.5 GHz. The Bandwidth of the proposed antenna is 300MHz while maintaining the lower size; another band occurred at the frequency 10.3GHz with frequency band (10.05-10.55). Bandwidth of the band is 500MHz. Impedance matching is 50 ohms at resonant frequency of the design antenna which shows the good impedance matching. It can be used for various applications such as satellite communication, weather radar system application.

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