A COMPACT DUAL BAND MICRO-STRIP PATCH ANTENNA FOR WIRELESS APPLICATION

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ABSTRACT: *This Project focuses on the design of multiband triangular shaped antenna intended for existing wireless services including GPS, GSM, PCS, DCS, UMTS bands. The Proposed antenna is simulated using High-Frequency Structure Simulator (HFSS). The present technique available in the open literature include the modification of the main radiator via bending, folding, meandering, wrapping. Each approach offers different advantages, depending on the required application. The introduction of the ground slot in an finite antenna ground plane can be further extended to include reconfigurable features. Thus, such antenna that are compact and have multiband capability for many wireless applications. Now, in this slotted multi band planar system is proposed to intend on working for frequency bands such as in GPS, WLAN (over two frequency band spectrum) and Wi-MAX.*

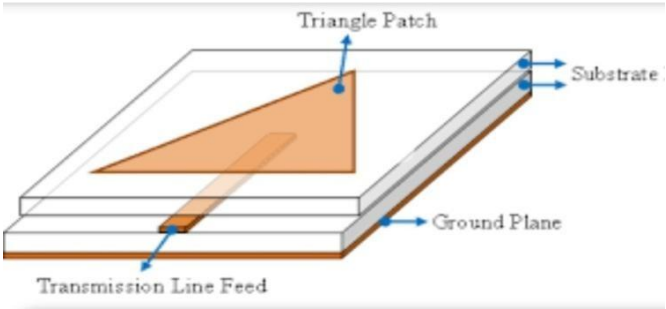
Keywords: HFSS, Micro-strip patch antenna, GPS, GSM, PCS, DCS, UMTS Bands, Wireless Application.

1. INTRODUCTION:

A Micro strip antenna (also known as Printed antenna) usually means an antenna fabricated using micro strip technique on Printed Circuit Board(PCB). It is a Kind of Internal Antenna. Common Micro- strip antenna shapes are Square, Rectangle, Circular, Elliptical, etc,. And also any continuous shape is possible.

The Micro-strip patch antenna structure are the most common option used to realize Millimeter wave monolithic integrated circuit for Microwave Radar and Communication purpose. Within this the operating range of frequency, the antenna should have the stable response in terms of gain radiation pattern, Polarization, etc,. The requirement of the material is low cost, easy to manufacture, light in weight. The antenna's are ideal for use in cell phone, Pagers, and other small electronic devices and also it is used in radar system, satellite communication system.

This type of antenna plays a vital role in any wireless communication. The design is to have a frequency range of 2.4GHz is selected and frequency points are selected to obtain accurate results.



The Resonant length of the antenna is slightly shorter because of the extended electric "Fringing fields" which increase the electrical length of the antenna slightly. The Advantages of Micro-strip Antenna are Light Weight, Inexpensive, Robust, Easy to fabricate (co-axial cable, Micro-strip lines , etc,.).Feed lines and Matching networks are fabricated simultaneously with the antenna structure and make them suitable for numerous application.

2. PROPOSED ANTENNA:

2.1. FEEDLINE TECHNIQUE:

Micro-strip patch antenna can be fed by a variety of methods. These methods can be classified into two categories are Contacting and Non-contacting. The four most popular Feed techniques used are the Micro-strip line, Coaxial probe (for both contacting schemes), aperture coupling and proximity coupling (both non-contacting scheme).

In this type of feeding technique, a conducting strip is connected directly to the edge of the micro-strip patch shown in the fig.2.1.1.

The conducting strip is smaller in width as compared to the patch and this kind of feed arrangement has the advantage that the feed can be etched on the same substrate to provide a planar structure. The purpose of the inset cut in the patch is to match the impedance of the feed line to the patch without the need of any matching element. This is achieved by properly controlling the inset position. Hence this is an easy feeding scheme, since it provides ease of fabrication and simplicity in modeling as well as impedance matching. However as the thickness of the dielectric substrate being used, surface waves and spurious feed radiation also increases, which hampers the bandwidth of the antenna. The feed radiation also leads to undesired cross polarized radiation.

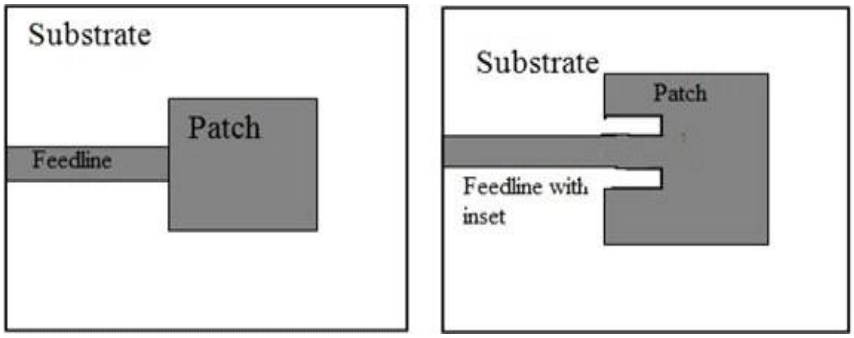


fig.2.1.1.Micro strip feedline Technique.

2.2. ANTENNA DESIGN:

The Proposed antenna is a Triangular shaped Micro-strip patch antenna. To design a multiband antenna for wireless communication bands. To achieve VSWR less than 2, to obtain optimum return loss and radiation pattern.

Frequency of operation(f_0): The resonant frequency of the antenna must be selected appropriately. For multiband operation the frequency range selected is from 0-10 GHz. Hence the antenna designed must be able to operate in this high frequency range. The resonant frequency selected for designs are 5.5 GHz and 16.5GHz.

Dielectric constant of the substrate($\boldsymbol{\varepsilon_r}$): The dielectric constant is 4.4.

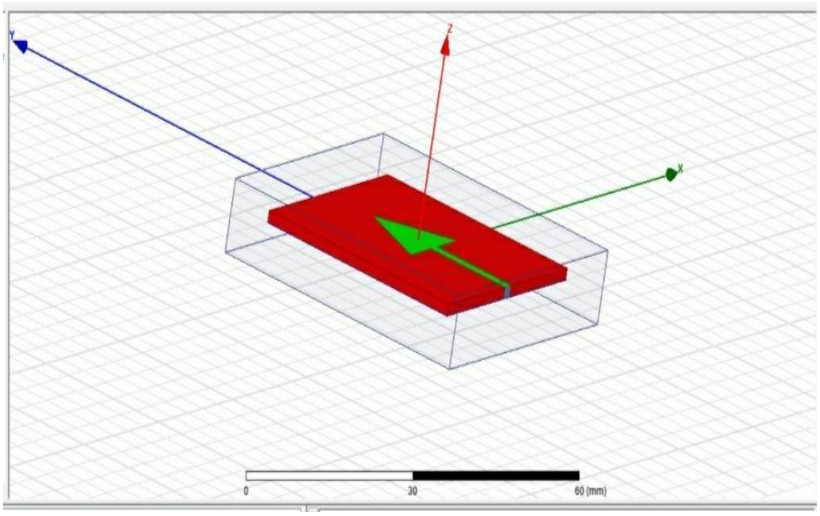


fig.2.2.1.Simulated structure of the antenna.

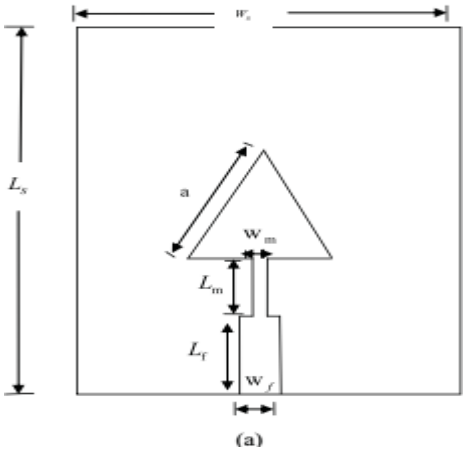


fig.2.2.2. Proposed antenna Geomentry.

PARAMETERS	DIMENSIONS
Substrate Length (Lg)	40mm
Substrate Width (Wg)	40mm
Substrate Thickness (h)	1.6mm
Patch Length(Lp)	10mm
Patch Width (Wp)	10mm
Feed line Length(Lf)	16.5mm
Feed line Width(Wf)	2mm

2.3. SOFTWARE:

2.3.1. HFSS:

HFSS (High Frequency Structure Simulator) is a 3D Electromagnetic (EM) simulation software for designing and simulating high-frequency electronic products such as antennas, antenna array, RF or microwave components, high speed interconnects, filters, connectors, IC packages, and printed circuit boards. HFSS employs Versatile solvers and a intuitive GUI to give an unparalleled performance plus deep insight into all the 3D EM problems. HFSS has a good standard accuracy and reliability for tackling 3D EM challenges by virtue of its automatic adaptive meshing technique and sophisticated solvers, which can be accelerated through High Performance Computing technology(HPC).

2.3.2. HIGH PERFORMANCE COMPUTING IN HFSS:

High Performance Computing (HPC) enables a range of different technologies in HFSS that allows efficient simulation of extremely large and complex problems. HPC leverages multiple cores through matrix multiprocessing, distributed frequency points (called spectral decomposition method or SDM), Domain Decomposition method (DDM), Parallel Hybrid FEM/IE solving or the finite antenna array DDM. In addition hierarchical HPC solving is possible where frequency points can be distributed with each frequency points using multi cores or machines for large scale DDM analysis at each frequency points, all in parallel.

3. SIMULATION OUTPUT:

3.1. RETURN LOSS:

The Proposed antenna design is analysed using HFSS software.

The Return Loss obtained for the simulated design are m1 and m2 and its range is -16.72dB at 5.60GHz and -26.20dB at 16.30GHz frequencies respectively. The Reflection coefficient is relatively good. The Return Loss plot is against frequency is shown in the fig. The return loss or reflection coefficient values as -43dB in the frequency range of 4.3GHz.

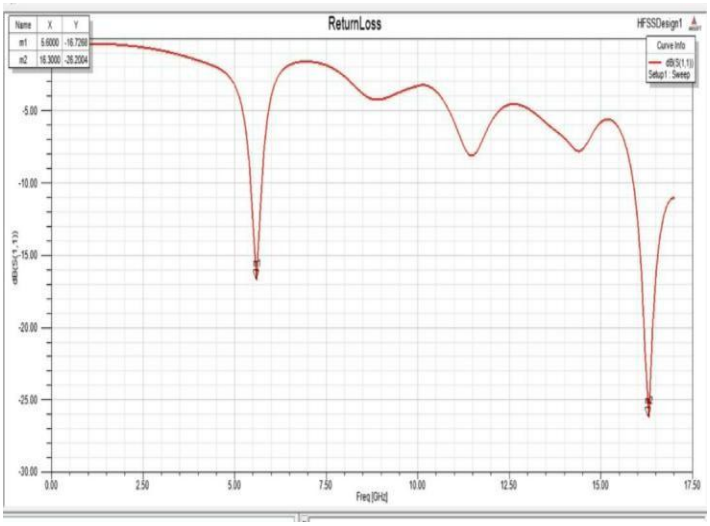


fig.3.1.1.Return loss vs frequency of the antenna.

3.2 GAIN:

For the Proposed antenna, the gain obtained is 3db.The antenna gain is measured by the directivity and efficiency. Where Directivity is the measure of the concentration of an antenna's radiation pattern in a particular direction and the efficiency accounts for the losses of the antenna. The directivity of the radiation pattern, gain radiation pattern and the 3D design if the simulated antenna figures are shown below.

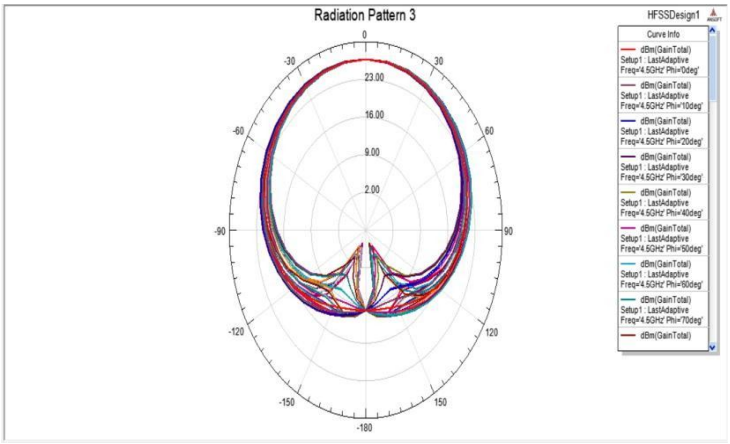


fig.3.2.1. Gain Radiation Pattern.

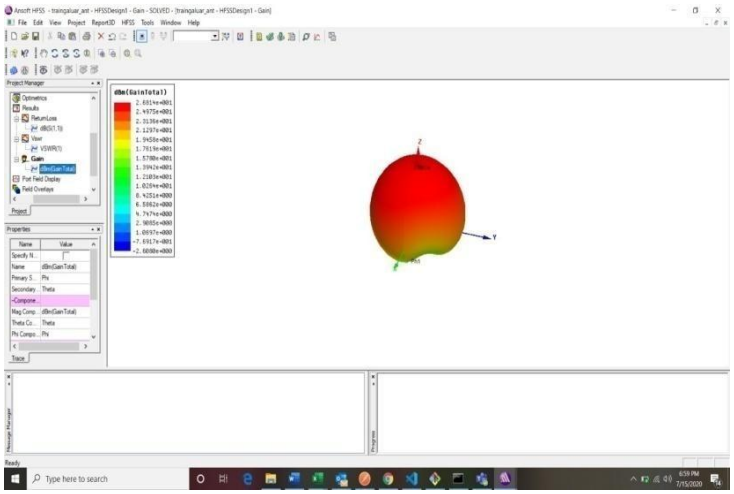


fig.3.2.2.Gain of 3D designed antenna.

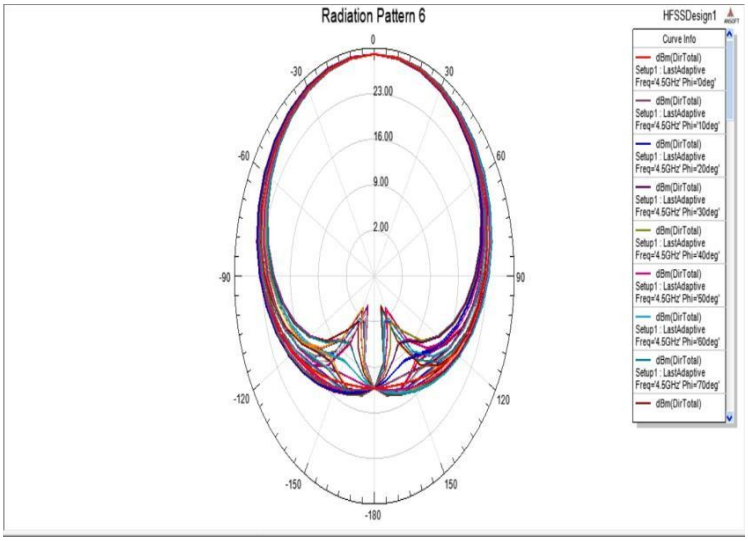


fig.3.2.3.. Directivity Radiation pattern of the antenna.

3.3. VSWR:

VSWR is the one way to find it and it is the ratio of maximum voltage and minimum voltage. When the system is perfectly matched then the VSWR is not be more than 2 or less than 1. From the fig. it is observed that the proposed design has a VSWR is 1.34 and 1.10 for m1 and m2 respectively. Hence it can be said that almost the feed and the patch are perfectly matched.

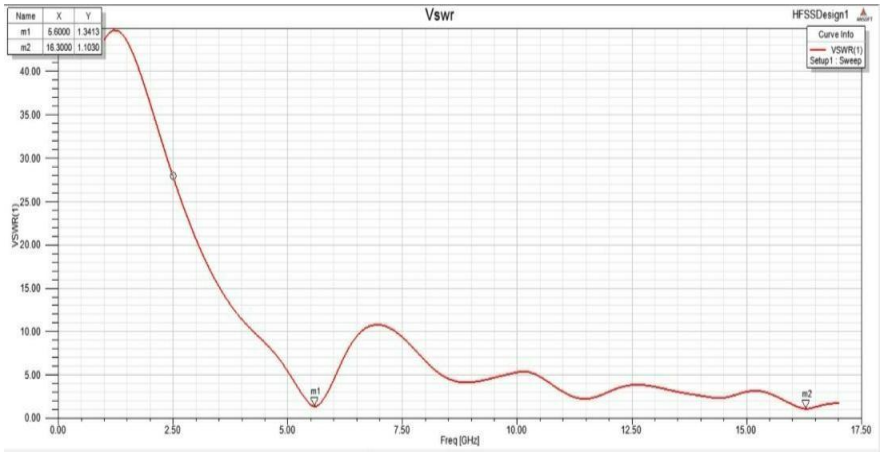


fig.3.3.1. Voltage Standing Wave Ratio(VSWR) vs frequency.

4. CONCLUSION:

The Proposed antenna is Triangular shaped its axis is designed in Z-axis and the micro-strip is 2mm length in X-axis and 16.5mm in Y-axis. Patch antenna for multiband frequency application with MIMO technique is simulated. The proposed antenna exhibits bands and it supports 5.5GHz and 16.5GHz as well as good radiation properties. This antenna is suitable for Super High Frequency Application and other Wireless application. The proposed antenna is light weight, easy to fabricate, small size . It require small space only, so it can be used in wireless application. In future, to analyse and design this microstrip patch antenna with any shape in the partial ground plane by using microstrip feeding method. Result of studies have also been used to propose a methodology to design other frequency bands.

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