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Design of Rectangular Patch Antenna Operating at a Frequency of 28 Ghz.

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ABSTRACT: Communication systems had made many changes driven towards the fifth generation due to the demands of compact, high-speed, and larger bandwidth systems. In this paper, a 28 GHz Rectangular patch antenna is designed and simulated. The patch has a compact structure including the ground +plane, which is very suitable to be used in handled devices like mobile phones. An inset feed transmission line technique is used for matching the radiating patch and the 50 Ω microstrip feed line. The VSWR, return loss, gain and radiation pattern are obtained. The geometry of the antenna was calculated and the simulated results have been displayed and analyzed using HFSS.

KEYWORDS : Fifth generation , Rectangular patch Antenna ,inset feed, VSWR, radiation pattern, HFSS.

I. INTRODUCTION

An antenna is a device made up of conductive metal (metal that conducts electricity) that sends or receives electromagnetic radio waves of light within a specific frequency that are invisible to the human eye, and are utilized for long distance communication. Antennas have many different uses, from Wi-Fi to radio , but they all work in fundamentally the same way: a transmitter sends a signal, which is intercepted by a receiver. Now-adays, antennas have undergone many changes, in accordance with their size and shape. There are many types of antennas depending upon their wide variety of applications. Antenna has the capability of sending or receiving the electromagnetic waves for the sake of communication, where you cannot expect to lay down a wiring system.

A rectangular micro strip patch antenna is a form of antenna which consists of a rectangular patch. This patch is of any planar or non-planar geometry on one side of dielectric substrate and a ground plane on the other side. Micro strip patch antenna have low profile configuration, narrow bandwidth and is capable of dual and triple frequency operations. Patch used is made of conducting material such as gold tin and nickel. The rectangular patch can be easily analysed using transmission line model and cavity model. Transmission line model yields less accurate results and lacks versatility. In cavity model the interior region of dielectric substrate is modelled as cavity bounded by electric walls on top and bottom.

II. LITERATURE SURVEY

Qudsia Amjad, Areeba Kamran ,and Fareah Tariq: The rectangular patch antenna was designed at a frequency of 3Ghz which are suitable bands for sub-6 GHz 5G applications. The antenna model consists of a rectangular patch with three rectangular slots of different dimensions. In order to show the effects of different parameters on the antenna performance, a parametric analysis is also performed which provides insightful guidelines about the antenna design and performance. Because of good results, the proposed antenna can act as a good candidate for sub-6 GHz 5G applications. the overall size of the antenna was found to be 50×30 mm² . In order to show the effects of different parameters on the antenna performance, a parametric analysis is also performed which provides insightful guidelines about the antenna design and performance.

Tony J.Rouphael: A Rectangular microstrip patch antenna is designed and comprised of a radiating metallic patch which was operating at a frequency of 2.4GHz, situated on one side of a nonconducting substrate panel with a metallic ground plane placed in the other side of the panel. A patch antenna can take many geometric shapes. For a rectangular patch the radiation is generated from the two edges with the two equivalent slots. The other two opposing edges that are apart do not radiate so long as the feed line is at the center of the radiating edges. So it can be concluded that a radiating patch can be modelled by two slots separated by a transmission line. However, the design does not model the mutual coupling present between two radiating slots nor does it account for the radiation due to the nonradiating edges of the patch. Due to its limitations it is very limited in its application.

Tejal B Tandel: The design of a coaxial fed single layer microstrip patch antenna for 5.2GHz WLAN application is presented. The radiation characteristics of these proposed structures are studied and analyzed using HFSS Software, which is commercially available electromagnetic simulator based on the method of finite difference time domain technique to achieve the desired specification.

Ms. Neha Patel, Prof. Jaikaran Singh : Due to the existence of growth in development of low cost, less weight, highly reliable, minimal profile antennas for wireless devices, it poses a new challenge for the design of antenna in wireless communications. This paper presents design and simulation of a rectangular microstrip patch antenna at 6.5 GHz for wireless communications. This antenna has 140 MHz bandwidth, Return loss at Centre frequency has less than -16.70dB. The beauty of this antenna is the use of single patch which makes it easy to fabricate consequently cost of antenna becomes cheaper. The rectangular microstrip patch antenna is analyzed using High Frequency Structure simulator (HFSS).

Houda Werfelli, Khaoula tayari, Mondher chaoui: In this Paper, the author designed a rectangular microstrip rectangular antenna in advance Design System momentum [ADS]. The resonant frequency of an antenna is found to be at 4.1GHz. The Reflection coefficient is less than -10dB for a frequency range of 3.1GHz -5.1GHz. The proposed rectangular patch antenna has been devised using glass Epoxy substrate [FR4] with a dielectric constant 4.4. This rectangular patch is excited using transmission lines of particular length and width. Various parameters like gains parameters, directivity and efficiency of the designed rectangular antenna are obtained from ADS momentum.

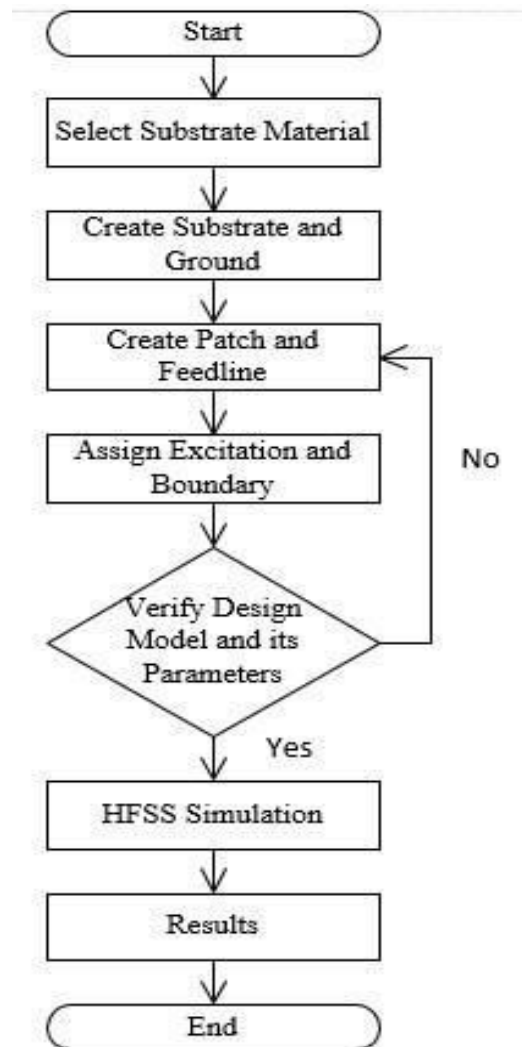
III. PROPOSED SYSTEM

In this Project, we designed a rectangular patch antenna which is operated at a frequency of 28GHz. The designing part of the Rectangular patch antenna was done in the HFSS software. Generally the designing part includes three main levels i.e. 1. ground plane 2. substrate and 3. patch respectively, which are supposed to be placed on top of every layer. The selected materials for the substrate and patch should be perfect E and perfect H respectively. A connecting feed transmission lines are attached from patch to ground plane through port, which helps in radiating the signals. Then we have assigned the excitation and boundaries to the patch antenna to achieve the radiating signals inside the radiation box. During the radiating signals, we calculated some parameters like VSWR, Return loss, Radiation pattern, efficiency, Bandwidth, directivity and gain. The below are the dimensions taken to design the rectangular patch antenna.

Resonating frequency fr	28GHZ
Patch Width W	22mm
Patch Length L	24mm
Substrate height H	6mm
Feedline length	18mm
Feedline width	2.85mm
Relative permittivity ϵ_r	4.4

Table 1.1. Dimensions To Design The Patch Antenna

Flow Chart:



To design any antenna, we need to follow the above sequence of steps as in the above shown flow chart.

Results:

i.Gain:

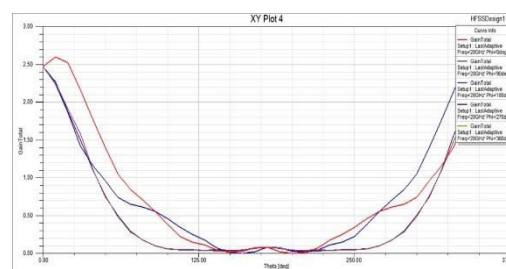


Fig:1.1.Gain

ii.Radiation pattern:

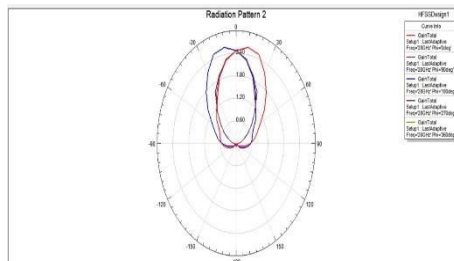


Fig.1.2.Radiation Pattern

iii.Radiation efficiency:

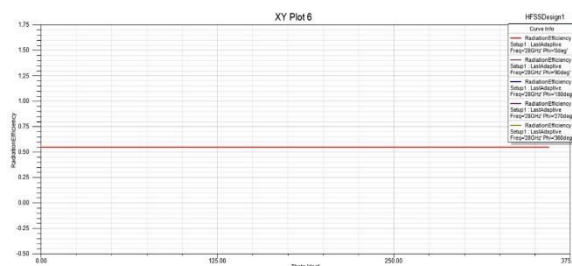


Fig1.3.Radiation Efficiency

iv.VSWR:

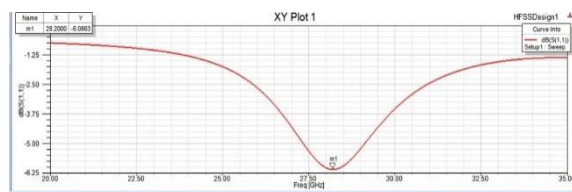


Fig1.4.VSWR

V.3D Polar plot:

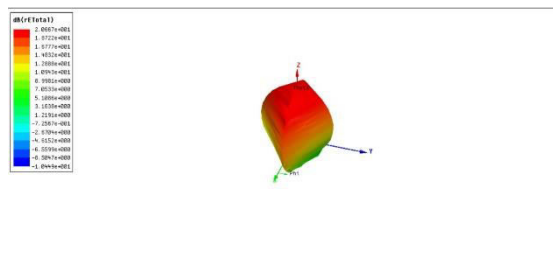


Fig.1.5.3D polar plot

IV. CONCLUSION

We have designed the rectangular patch antenna in the HFSS software and calculated. The Resonant frequency is observed at 28GHz. And it is very efficient to use in mobile communication, satellite communication and military applications.



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