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A Compact Microstrip Antenna for Millimeter Application

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ABSTRACT

In satellite communication, there are various type of microwave patch antennas used. This paper we design a compact, less weight, low cost, high gain antenna for millimeter application. We are using a HFSS software to design a compact microstrip antenna .In this paper we stimulate a results of gain, radiation pattern, impedance, efficiency, VSWR resonant frequency using HFSS software. In this proposed system we are using frequency is 42GHZ.

Keywords: Microstrip, Millimeter, HFSS and Compact.

1. INTRODUCTION

The major development of wireless system and the growing demand for variety of wireless application it is significant to design wide range of frequency for broad band antenna [1]. The simulation may be designed using IED3 software which is used in MOM method In case of small size, light weight, very less cost, high gain antennas is efficiently used in wiMax application. The operating frequency used in wiMax application is short band (2.5-2.69GHZ), the center band (3.2-3.8GHZ), higher band (5.2-5.8). In wireless application using HF (high frequency), LF (low frequency), UHF (ultra high frequency) [2]. It is mainly developed in both scientific and industrial application. The microstrip antenna is easy to design and the passive components are allow to design the low cost, less power consumption antenna. These RFID applications having more benefits on many application like health care, robotics, security, automotive and others. In the wireless communication system antenna is essential parameter to design an antenna. The antenna is a device which transform of RF signal travelling through the conductor in the free space. The frequency, gain, directivity, ¼ wave length is the important parameter to design an antenna. The simulations of antenna we have the parameter to design are input impedance, return loss, bandwidth, radiation pattern, directivity and gain [3].

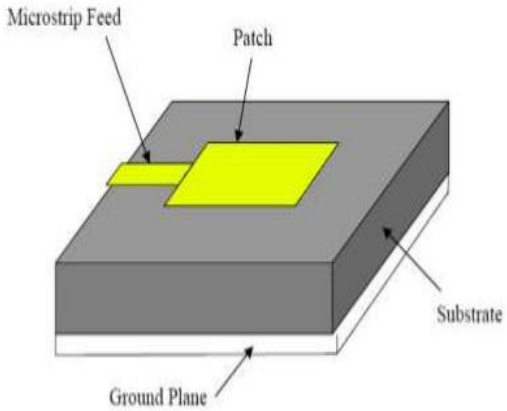

Fig.1. Microstrip line feed antenna

2. PATCH ANTENNA CONIGURATION

Microstrip patch antenna contains conducting patch on the ground plane. The dielectric substrate is used to separate the conducting patch from ground plane. Low dielectric substrate mainly used for high radiation pattern. Microstrip antenna is widely used in many applications like satellite communication, mobile communication. The rectangular and circular shape configurations are most commonly used configuration to design a conducting patch. The characteristics of patch antenna are gain, radiation pattern, length, width and input impedance. In present day most of the designers prefer microstrip antenna because it contain more advantages, they are light weight, low cost, easy fabrication and low volume.

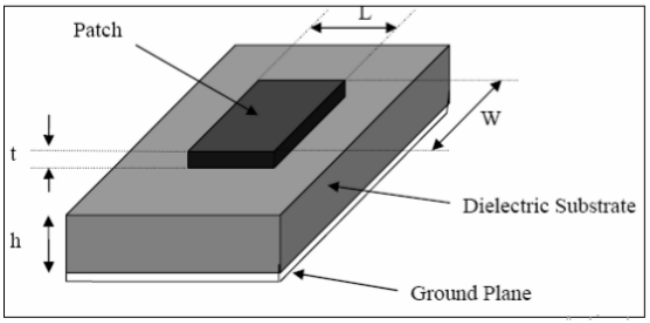

Fig.2. Microstrip patch antenna

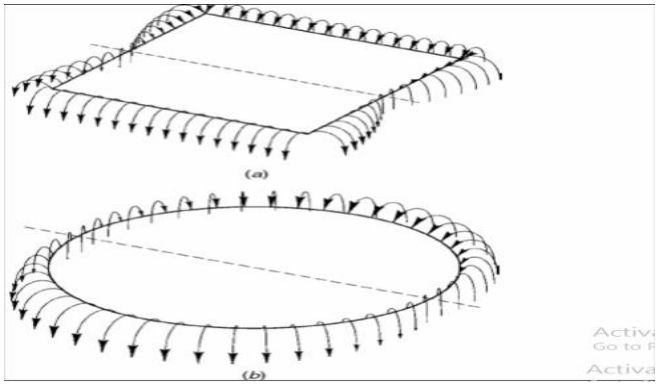

Fig.3. Fringing field of patch antenna

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The antenna has the radiation patch on one side and ground plane on the other side in the dielectric substrate. The radiating patch is made up of conducting material like copper and gold it may be particular shape and any possible shape. The patch and feeding line are etched to the dielectric substrate the antenna arrays are etched with the dielectric substrate with the feeding network. Microstrip antenna is recently used antenna because it having more advantages. The gold has high conductivity, permittivity and easy to design. The feeding is important for antenna because feeding point is transfer the maximum amount of power to the receiver. The patch feed structure is capable of capturing the more amount of energy. This software is easy to design and less consumption of time.

Table 1. Comparison table for different feed

Characteristics	Micro strip line feed	Coaxial feed	Aperture feed	Proximity feed
Spurious feed radiation	More	More	Less	Minimum
Reliability	Better	Poor	Good	Good
Ease of fabrication	Easy	Soldering needed	Alignment required	Alignment required
Impedance matching	Easy	Easy	Easy	Easy
Bandwidth	2-5%	2-5%	2-5%	13%

3. INTRODUCTION TO SOFTWARE

HFSS (High frequency structured stimulator) is easy to design a microstrip antenna. To design a patch antenna make the dielectric substrate, ground plane and copper trace. ANSYS HFSS is an industry standard tool for simulating 3-D full-wave electromagnetic fields. Students registered in ECE451 can get free access to ANSYS HF package from the University of Illinois Software Webstore.it is one of several commercial tools used for antenna design, and design of complex RF electronic circuits elements including filters, transmission lines, and packaging. It was originally developed by professor Zoltan Cendes and his students at Carnegie Mellon University. HFSS and CST are 3D EM simulator based upon different computational, techniques. HFSS is based on Finite Element Method (FIT) and is also popular among antenna designers due to ease in simulations. However results of both the simulators are not same because of different computational techniques involved. HFSS results are close to experimental results with more insight into the structure available. At UNCC, the HFSS application resides on a Linux based server by the name of "hertz" which is part of the Reconfigurable Computing System (RCS). The best way to access this server is through the Mosaic system.

Logging into Mosaic Linux Server When you are logged in to one of the Mosaic windows computers, you first need to log in to Exceed Linux. This is done by selecting the start menu => All Programs => MOSAIC XP => Unix Connectivity => Exceed Linux, as shown in Figure 1.1. This should bring you to a screen that looks something like. In the box, lxs-sm1 and lxs-sm2 are identical Linux servers that are maintained by Mosaic. Highlight whichever one you prefer and click OK. You should then be presented with a login screen for Red Hat Enterprise Linux use your normal Mosaic login ID and password to login to the linux server.

Logging into the Reconfigurable Computing System Network At this stage, you should be looking at a linux desktop (probably with a red background). To log in to the RCS network, start from a command prompt. To do this, right click anywhere on the desktop and click "Open Terminal" in the pop–down menu that appears.

4. RESULT AND DISCUSSION

Parameter to be analyzed shown below:

1. Efficiency
2. Return loss
3. Input impedance
4. Gain
5. Radiation pattern

Parameter	Microstrip antenna	Dipole Antenna	Horn antenna
Return loss	-26.7db	-30.6db	34.8db
Efficiency	94%	67%	82%
Frequency	42GHZ	25GHZ	18GHZ
Gain	6.14db	4.5db	3.2db

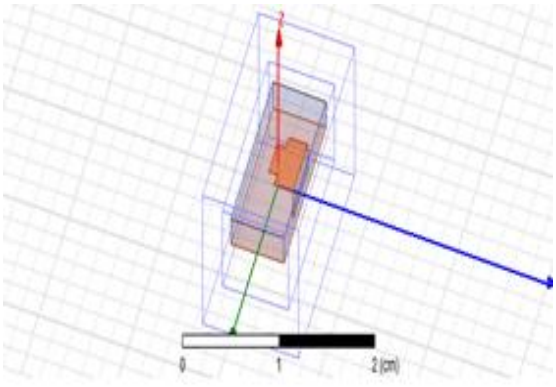

Fig.4. Microstrip antenna design

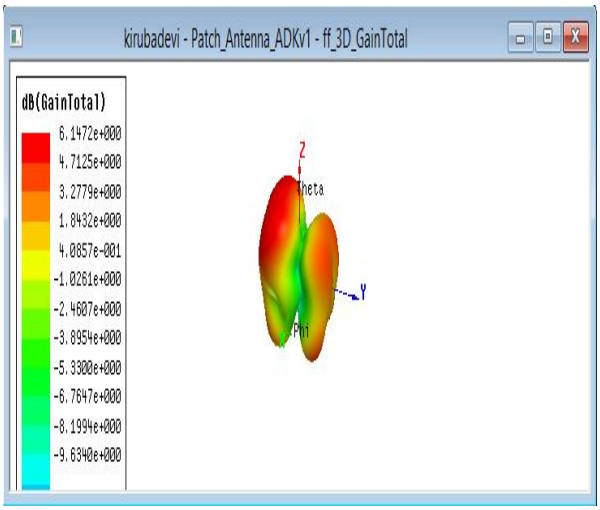

Fig.5. Diagram of gain

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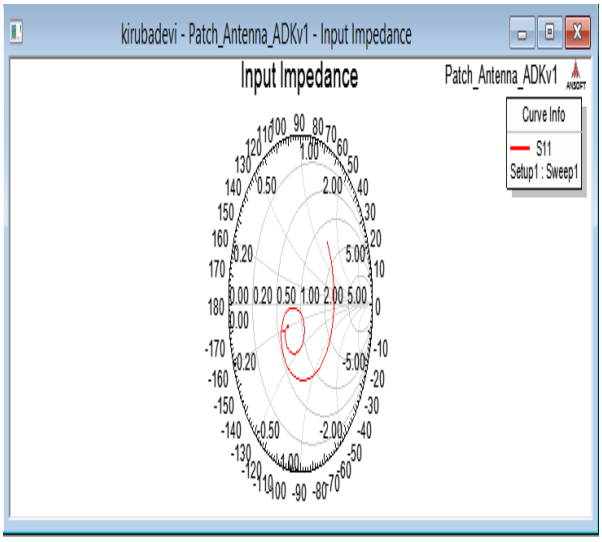

Fig.6. Input impedance

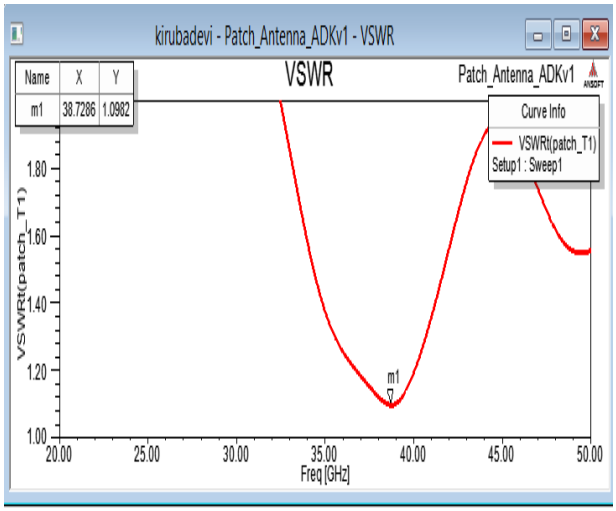

Fig.7. VSWR

5. CONCLUSION

The main parameters to design an antenna (such as Return Loss curves, Radiation Patterns, Directivity and Beam width) that affect design and applications were studied and their implications understood. The constructed microstrip antennas operated at the desired frequency and power levels. Several patch antennas were simulated (using HFSS). The frequency of an antenna is reduced and the coverage distance is increased. The efficiency of antenna is increased above 90%.bidirectional radiation is produced by microstrip patch antenna.

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