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Study of X-band Circular Antenna

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***Abstract* :- In this paper, we are studying X-band circular Antenna with Dual Polarization in Circular Waveguide. To study the circular antenna, first we need to study modeling (i.e. Macromodeling) of circular antenna performed by many organizations using a simulation tool called High Frequency Structure Simulator(HFSS) for efficient modeling of antenna. During this study of antenna structure we see the remarkable application to reduce time consumption and the number of resources we use in designing of the wireless or antenna system. For the above macromodeling, we use circular waveguide mounted over the antenna ridge, operating at a certain acceptable frequency band. As a result, the antenna is tightly integrated using deep ridge circular waveguide with cascade arrangement of microstrip dipole antenna. Hence, large scaling angle is achieved using the shared aperture of our antenna. The X-band microstrip patch antenna has been presented with enhanced bandwidth. The proposed antenna is designed on 40mmX40mm printed circuit board and is excited by microstrip line. This antenna is composed of circular slot to generate two resonances and to increase in the desired band. Return loss -17.14dB and -14.29dB which is below -10dB in X-band(8GHz-12GHz). It has achieved stable radiation efficiency of 78.85% and average peak gain 4.31dB in the frequency band. So, the impedence of proposed antenna is 1.59GHz.**

Index Terms :- Circular Antenna, Dual Polarization, Circular Waveguide, HFSS, Macromodeling.

I. INTRODUCTION

X-band(or also known as SHF, i.e. Super High Frequency ranging from 3 to 30 GHz) is widely used in the antenna communication and in the radio frequency region of the Electromagnetic Spectrum used in several sectors. In Microstrip Array Antenna, X-band frequency range is used to efficiently scan the large number of areas in one-dimension as well as two-dimension in apparently less time. Nowadays, major problem occurs in designing of circuit circumscribing of high rate data bit in the physical data link layer is by circuit cascading but have high total power consumption. As a applications of Microstrip Antennas, many wireless communication devices, such as RADAR, Satellites and Spaceborne Systems, which are cost efficiency, simple geometrical structure for ease of installation and fabrication.

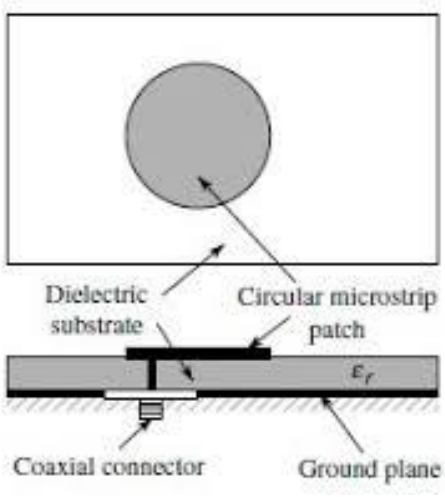

Fig. 1

The circular antennas gains large popularity in digital communication sector due to its cost efficiency and small size. The components requiring in circular polarized microstrip array antenna has no problem of orientation in transmitting and receiving. Microstrip array antenna with circular polarization resolves the problem of small scale fading (occurring in the digital communication which degrades the performance of the communication system), by leading to a system with better spectral efficiency. Instead of using linear polarized antenna, circular polarized antenna is used as the polarization distortion immunity is high. The efficiency is more in Conventional narrow band Circularly Polarized antenna than wide band circularly polarized antenna the. Broad Bandwidth in digital communication is also desired to increase the capacity for digital system, as the Circular Polarized Microstrip Antenna is more immune to the orientation and have to ability to decrease its multiple path fading effect. Over the last few years, different types of Circular Polarized Antenna have been contrived for different antenna band operations. As the radiation pattern of the circular polarized antenna is bidirectional and have low gain, which is a pitfall. So, to overcome this snag, microstrip antenna has been ratified to attain unidirectional radiation pattern and high gain. Although, many microstrip antennas suffer from bandwidth issues, i.e. Axial Ratio Bandwidth and Narrow Impedance Bandwidth.

II. STUDY

Waveguide slot array is divided in two groups:

1- staticwave arrays
2- travelling wave arrays.

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In order to design this antenna, static wave array is used since slots are in
resonance state in static wave array For designing the radiation element, offset of each slot is obtained. Then, for calculating the length of each slot, one slot antenna is simulated with various offsets and by changing the length of the slot for each value of offset, resonance state is obtained.

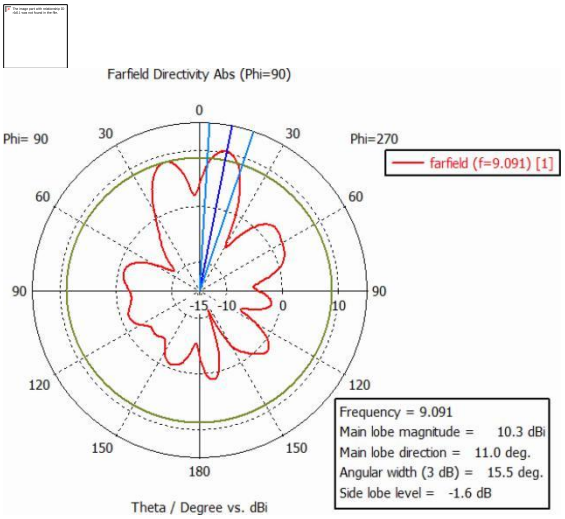

Fig : 2

The gain of antenna is 23.27dB which more than required and effective. As it can be understood from the gain of antenna the side lobe of antenna pattern level should be less than -15dB, which can be desirable.The Half power beam width is 9 degree for better efficiency. The imaginary part of the admittance approaches to zero to give better performance. The band-width of the antenna without magic-T is 100MHz that is very good for detecting the target. In addition, direction of the main lobe of antenna does not change by frequency. In order to attain this antenna in various plane for other frequency values. It is obvious that the direction of the main lobe does not change with frequency variation.

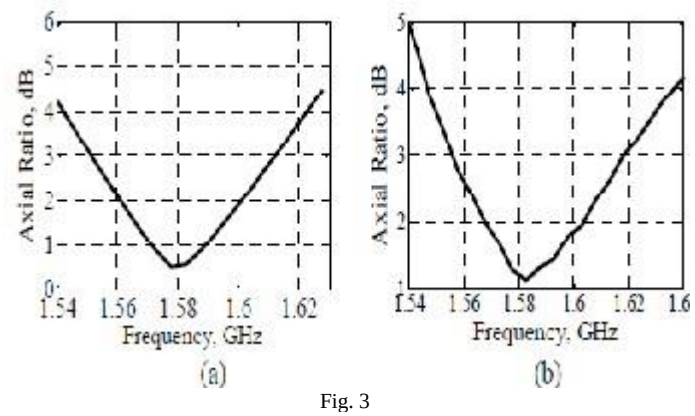

Fig. 3

III. CONCLUSION

The growth of digital communication and data transfer using handsets and personal communications (PCS) devices has developed the lack for major advancements of antenna designs as a fundamental part of any radio system. This type of antenna is used in most of the radio systems . These antennas are widely used on base stations devices.The Microstrip antennas have a variety of configurations and are currently the most active field in antenna research and development. The microstrip antennas is great advantages and increasingly wide range of applications in wireless communication systems as well as the satellite communication systems, and biomedical applications. It cause the radiations that may cause health hazardous effects.The type of antenna has low profile, and easy to integrate with other wireless communication system components. The antenna designer must consider all these issues besides the electrical characteristics of the antenna performance which include antenna tuning (operating frequency), VSWR and return loss(input impedance), bandwidth, gain and directivity, radiation pattern, diversity, and size of the chassis (expressed as a function of wavelengths) and specific absorption rate (SAR) of the antenna. These design considerations have led antenna designers to consider a wide variety of structures to meet the often conflicting needs for different applications.
In future this type of antenna is used in many industries which reduce the manual work also the new designs are investigated for several wireless communication applications. The new design of harvesting is also use these type of technique for better productivity .There are different microstrip antenna characteristics but also valuable information about numerical analysis and fabrications.

IV. RESULT

In this paper modeling of X-band Microstrip array antenna with dual polarization and circular waveguide have been studied. Since, the antenna have the active aperture for the , this antenna can be used for detection purpose. The modeling of antenna is completed and the antenna simulated. The gain of this antenna is 23.27 dB for f = fc = 9.4GHz which is desirable. The side lobe level is less than -10 dB that is satisfactory. The beam width of the antenna is also close to our requirement.

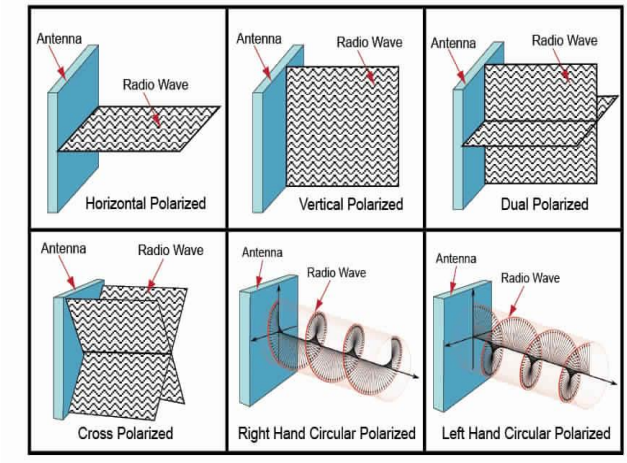

Fig. : 4

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