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# Design of Compact Ultra Wide-Band Antenna for X-Band Applications

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***Abstract*-This paper had a idea of new compact , ultra-wideband antenna array techniques by using some arrays in square patch and ground of 20mm. At present we are familiar that X-band relates with microwave radio region of the electromagnetic spectrum. The positions of the X-band are assigned by the International Telecommunication Union (ITU) exclusively for deep space communication. X-band is used in radar application including continuous wave , single polarization and phased arrays. Generally we know that X-band lies between the 8GHz to 12GHz. This band is most popular for radar and radio communication.**
**This proposed antenna is made to operate from 8.593GHz – 9.723GHz with the centre frequency at 9.0561GHz with the achieved gain of 3.4db The following design is being simulated on CST simulation tool 2014. The antenna structure is flat, and its design is simple and straightforward geometrically small, hence embedded easily in wireless communication systems.**

***Keywords; X-Band; CST Software; simulation.***

## I INTRODUCTION

Microstrip patch antennas are becoming increasingly very useful because they can be printed directly on a circuit board. They are light weighted so they are mostly used in microwave communication. A Microstrip patch antenna is having planner configuration and inexpensive to fabricate. For such many years Ultra Wide-Band Antennas have had many applications in communication system with broadband and spread-spectrum features in many applications. As we know that a rapid growth is done in wireless communication system, so a huge demand are required to satisfy high gain and larger bandwidth covering all the frequency ranges for these system. Micro strip patch antenna was basically invented by G.A Deschamps in 1953, but didn't become partially until the 1970 when it was developed researches such as Roberts E. Munson. The patch antennas are referred with lots of advantages such as low cost to fabricate and conformal structure are possible. They are easy to form large array, spaced at half wavelength or less. They are very light weighted. There are some disadvantages are also included such as limited bandwidth and low power handling.
Basically ultra wide-band technology was released in February 2002 by as the Federal communication Commission's (FCC), to cover the frequency band 3.1 GHz to 10.6 GHz. These technologies of ultra wide-band technologies are having very attractive specifications like low complexity, ease of fabrication, low cost, low power consumption and very low interference. In this research paper a rectangular Microstrip patch antenna is designed of the frequency band between the ranges 8.593GHz – 9.723 GHz. This designed is done with rectangular patch and cuts on ground and patch and investigated using CST studio suite.

## II DESIGN AND SIMULATION

The proposed structure and parameters of the ultra-wide-band antenna are shown in figure 1, where all the parameters are absolutely optimized for the better presentation. The following structure is constructed on FR4-Lossy substrate with the thickness h=1.59, er=3 to 6, width W=20 mm, length L=16 mm.

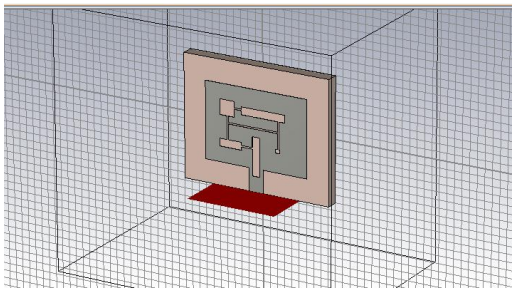

Figure 1. Proposed Antenna Structure

TABLE I. ANTENNA ARRAYS AND SIZE OF UWB ANTENNA

| Name of array | Length | Width | Height |
|---|---|---|---|
| 1 | 14 | 10 | 0.035 |
| 2 | 2 | 1.5 | 0.035 |

TABLE: II. WIDTH AND LENGTH OF THE ANTENNA

| S.no | Component | Width (mm) | Length (mm) |
|---|---|---|---|
| 1. | Ground | 20 | 20 |
| 2. | Substrate | 20 | 20 |
| 3. | Feed | 2 | 3 |

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Antenna arrays are used in the above structure which are used to recover the gain and larger bandwidth. Antenna array is a orderly preparation of radio antennas working together. In this design antenna two pairs of antenna arrays are used to achieve high gain and enhanced bandwidth.

The ground is degraded by making cut of the dimension as follows.

TABLE III. CUT DIMENSIONS

| CUT | WIDTH | LENGTH |
|---|---|---|
| 1 | 2 | 2 |
| 2 | 6 | 1 |
| 3 | 0.7 | 0.5 |
| 4 | 3 | 1 |
| 5 | 1 | 5 |
| 6 | 1.5 | 0.2 |
| 7 | 0.2 | 3 |
| 8 | 0.1 | 0.2 |
| 9 | 0.2 | 3.5 |
| 10 | 0.8 | 0.2 |

## III. RESULT AND DISCUSSION

The proposed design is simulated using CST studio 2014 software using time solver operation. The earning gain along the bandwidth bigger gradually as the frequency increasing up. And after the simulation process resonant frequency was recorded as 9.0561GHz at -32.83dBi. It's found that the proposed antenna has nearly like Omni- directional in *xy-plane* and *yz-plane* for chosen frequency samples, which makes the projected antenna appropriate for wide range wireless applications in X-Band spectrum. Antenna reflection coefficients S11 parameter is as follows in the given figure

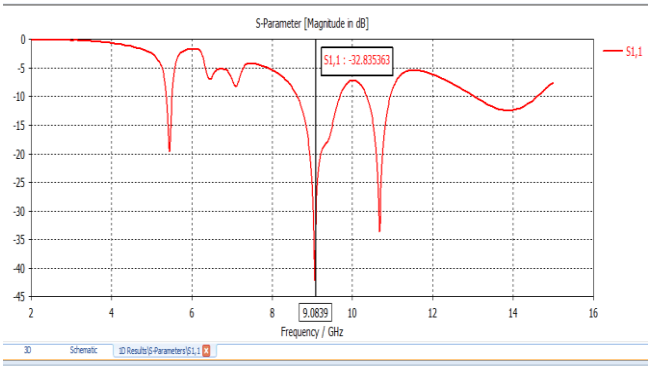


Figure 2. Return Loss Of The Antenna

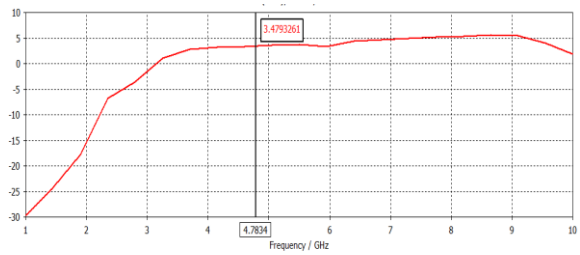


Figure 3. Simulated total Gain (dB)

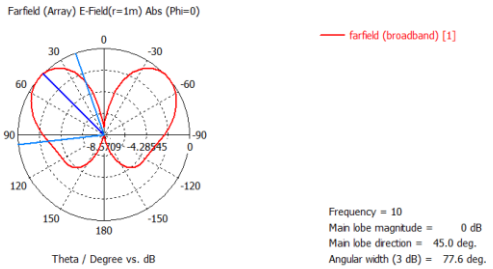


Figure 4. Radiation pattern Axial Ratio

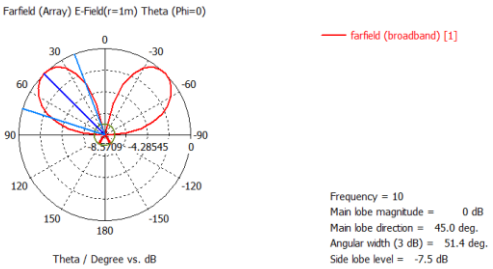


Figure5. Radiation pattern E- field

## IV. CONCLUSION

This paper a compact Microstrip patch antenna has been designed for wideband applications. Modest gain of 3.4dB all through the entire X-band has been achieved with the Microstrip patch antenna. So the present structure on Microstrip patch antenna has wide applications over radio communications system or Radar communication system. The antenna is having very compacted size of design and easy to fabricate and it suitable for satellite communication. The simulated antenna shows percentage bandwidth of 64.93% and frequency range of 8.593GHz to 9.723GHz suitable for X-band applications. As well as stable omnidirectional pattern almost along the entire operating bandwidth. This in turn makes the proposed antenna good competitor for UWB wireless applications.

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