International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 3 Issue 11, November-2014

Bandwidth Enhanced Hexagonal Patch Antenna using CPW Fed

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***Abstract*— A Compact patch antenna for Ultra Wideband (UWB) applications is proposed here. The antenna is fed by Coplanar Waveguide technique & geometry having Hexagonal shape. The designs have the dielectric constant 4.4, substrate thickness of 1.6 mm and loss tangent of 0.02. This antenna produces omni-directional radiation pattern & efficient return loss (S11< -10 dB) from the frequency range 2.9Ghz to 12Ghz. The proposed geometry is examined by using a method of moments based Electromagnetic solver IE3D which are applicable for wireless UWB application like Wi-Fi (Wireless fidelity), ,WLAN (wireless local area network), Wi-MAX(world interoperability for microwave access) .The parameters like return loss, gain, Directivity are investigated.**

Keywords*—Patch Antenna, UWB, CPW, Wi-Fi (Wireless Fidelity)

I. INTRODUCTION

In the year 2002, Federal Communications Commission (FCC) has released the unlicensed UWB spectrum 3.1 GHz to 10.6 GHz for the commercial purposes The FCC has also allocated a bandwidth of 7.5GHz, i.e. from 3.1GHz to 10.6GHz for UWB applications so far the largest spectrum allocation for unlicensed use the FCC has ever been granted [1-2].To realize a high rate of wireless transmission, the widespread use of ultra-wideband (UWB) systems has attracted much public attention on the development of UWB antennas with good impedance matching and radiation pattern over a wider 3.1 - 10.6 GHz frequency range. [3]. The increase of wireless technology has motivated designers to make a new antenna which csan cover wide range frequencies and applicable to most of devices. Due to low profile, simple structure & ease with integration, the Patch antenna attracts all the researchers. [4]-[9].However, there still exist several narrow bands for other communication systems over the designated frequency band, such as: world interoperability for microwave access (Wi-MAX), the wireless local area network (WLAN) & wireless fidelity(Wi-Fi). The Wi-Max frequency bands are 2.3/2.5/3.3/3.5/3.7/5.8Ghz, while Wi-fi and WLAN are having bands of 2.4/5.2/5.5/5.8Ghz [10]. So avoid interference, we must design a UWB antenna. CPW fed antennas have the advantages of wide bandwidth and easy integration with monolithic microwave integrated circuits, the designs of the CPW-fed wide antennas have recently received much attention. The proposed antenna is fed with CPW because it has Less radiation and dielectric loss [11]. Large no of micro strip patches to be used in wireless applications. In this design we use Hexagonal Patch to increase bandwidth. The main objective of this antenna is to design antenna that are suitable for the future. UWB communication system s that will be applicable to techniques like Wi-Fi, Wi-MAX, WLAN.

II. ANTENNA DESIGN

Details of the antenna design are discussed and simulation results of the proposed antenna are presented. Initially we started the design with rectangular shape then hexagonal patch is created to increase the B.W. The proposed Hexagonal patch antenna having length x width dimensions are 25.1 mm × 20 mm shown in Fig.1.

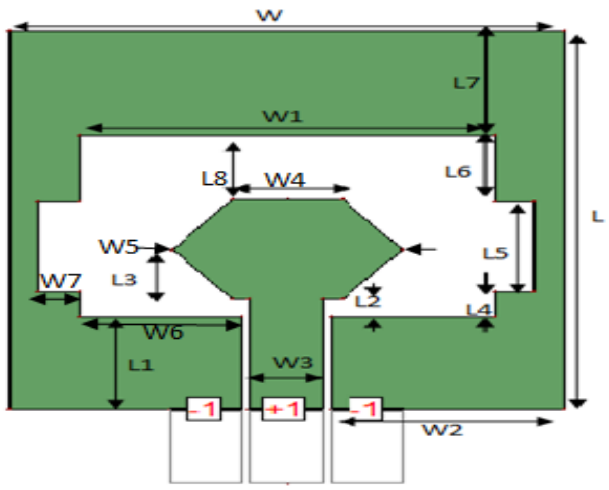

Fig 1. Proposed Hexagonal Shaped antenna

The proposed antenna is made with dielectric substrate (FR4) having the permittivity of 4.4 with the thickness of 1.6mm. Higher thickness of substrate is selected because, a thicker substrate will increase the radiation power, reduce conductor loss and improve Band width .The Radiation element is hexagonal shaped, which is fed by CPW. The proposed antenna produces wider bandwidth with good radiation properties.

The Hexagonal Patch has the width of W3 & lengths of L1+L2. The Hexagonal patch widths are W3, W4,W5 whereas L1,L2,L3 are the lengths. The proposed antenna having the Optimal length dimensions of length & width which as follows-

Table-1 Optimal Dimensions of length & width of proposed antenna

Length	Size(mm)	Width	Size(mm)
L1	6.17	W1	15
L2	7.32	W2	8.4
L3	3.3	W3	2.6
L4	1.615	W4	4
L5	6	W5	8.3
L6	4.38	W6	6.1
L7	6.93	W7	1.5
L8	4.25		

III. SIMULATION RESULTS

In order to evaluate the performance of the proposed system , the antenna is simulated through the simulation tool IE3D

A. Return Loss

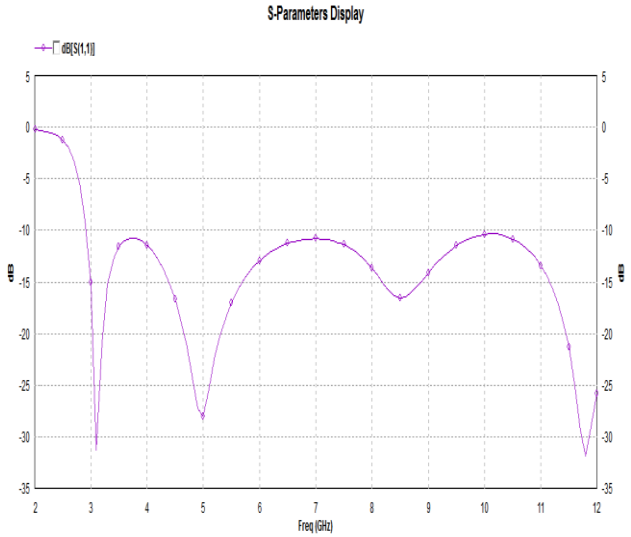

Fig 2. Simulated Return loss of Hexagonal shaped antenna

The Fig 2 Shows Return loss which is less than -10db all over the UWB range. The Bandwidth is defines as the frequency range in which return loss is -10db[12].The proposed antenna having a very high bandwidth band i.e more than 100% of UWB band. At the Frequency near 11.8Ghz, it shows maximum return loss of 31db.

B.Gain

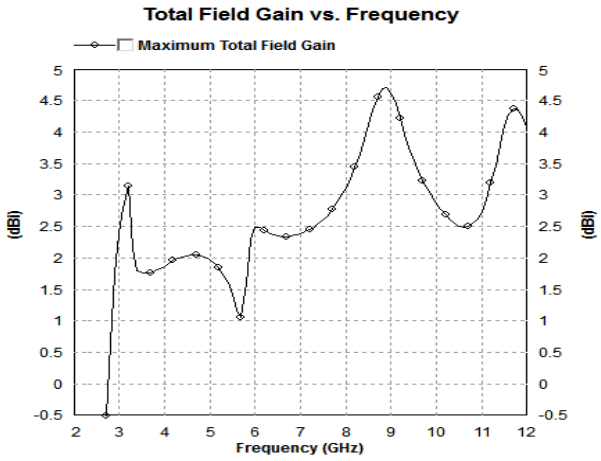

Fig 3. Simulated Total Field gain of Hexagonal shaped antenna

Fig.3. shows the simulated antenna having a non negative value of gain for all UWB frequency range. The Antenna gain G is closely related to the directivity, but it takes into account the radiation efficiency of the antenna as well as its directional properties .It is having the maximum value at 9Ghz.

C. Directivity

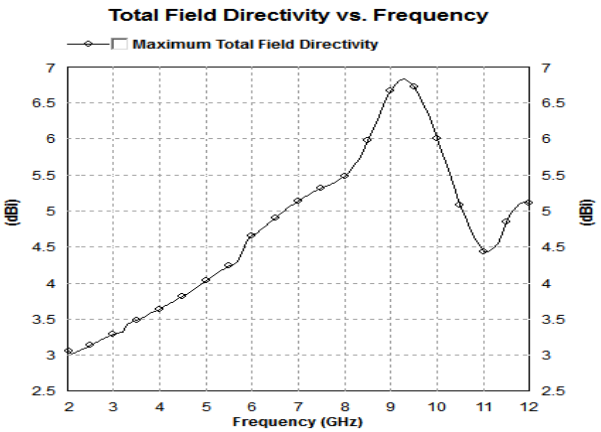

Fig 4. Simulated Total Field Directivity of Hexagonal shaped antenna

Fig.4 shows the total field directivity. To describe the directional properties of antenna radiation pattern, directivity is introduced. It is having maximum directivity of 6.75 around 9.3Ghz. All the shown dimensions are measured & optimized by using IE3D Simulator to achieve maximum bandwidth.[13] By observing the relevant parameters like return loss, gain & directivity, it might be useful for Ultra wideband applications

IV. CONCLUSION

The proposed hexagonal shaped antenna which is fed by Coplanar waveguide is investigated.The simulated results give return loss less than -10db from 2.9Ghz to 12Ghz, which is more than 100% of UWB range, having efficient gain & good directivity. The simulation results shows that the proposed antenna can offer good performance for UWB application.

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