A High Gain Directional Cresent Shaped Antenna for Enhanchment for C Band Applications

Manvir singh bhambra
Department of ECE
DAVIET, Jalandhar, India

Neeru malhotra
Department of ECE
DAVIET, Jalandhar, India

Abstract—This paper concentrates on a crescent shaped antenna with high gain and directivity. Bow-tie type radiation pattern was observed by the antenna at the resonating frequency. The antenna not only exhibits high gain it also shows a good impedance bandwidth.

Keywords—patch antenna; cresecnt shape; C band; ultra wide band

I. INTRODUCTION

Nowadays technology has grown to a great extent every gadget is going for wireless communication. Everything is going online, connected to internet. There is a new proposed future technology naming internet of thing in which all the things around us will incorporate with each other and thus will make our surrounding a better place for us to live a luxurious life. For such high requirement of interconnectivity with a very compact size we need an antenna which can transmit and receive at no of different frequencies simultaneously and should also posses high gain so that mobility can be provided to gadgets. Here we are proposing a Microstrip patch antenna which has a gain of 6.4dB. This antenna not only has a good gain but also it has a impedance bandwidth of 2.7GHz at return loss of 10dB which means same antenna can be used to transmit and receive at different frequencies at the same time. Here we have developed an antenna which is of crescent shape and Antenna gives a return loss of less than -10db from 4.95GHz to 7.35GHz. Here, we show that by taking natural and non geometric shaped for designing antenna can give us good results and very specific type of radian properties. Any natural shape can be chosen and then modified to develop desired parameters and patterns.

II. ANTENNA DESIGN AND CONFIGURATION

Here we had designed a corner truncated rectangular antenna having FR4 substrate with dielectric constant of 4.4 and a substrate height of 1.6mm. Figure 1 show bottom view of patch antenna. Antenna is properly labeled and orange color shows the metal or printed conductor. All dimensions are in millimeter. In the beginning an antenna with substrate of 82.20x60mm was designed. In ground plane first window of slot cut starts exactly below where the feed line ends on the top layer. Rest of the slot is also cutout from ground plane of the border line of patch.

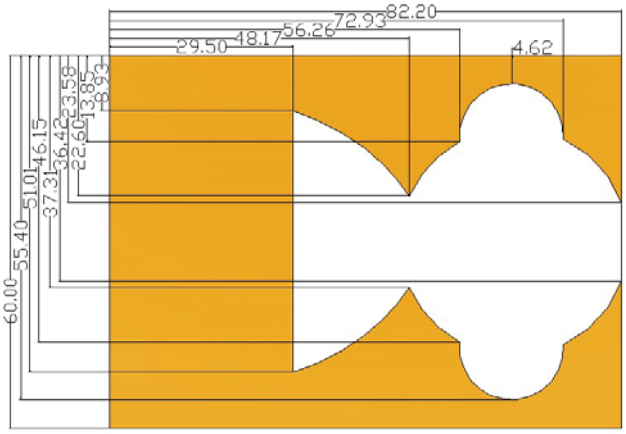

Figure 1.Bottom view show ground plane & its dimensions

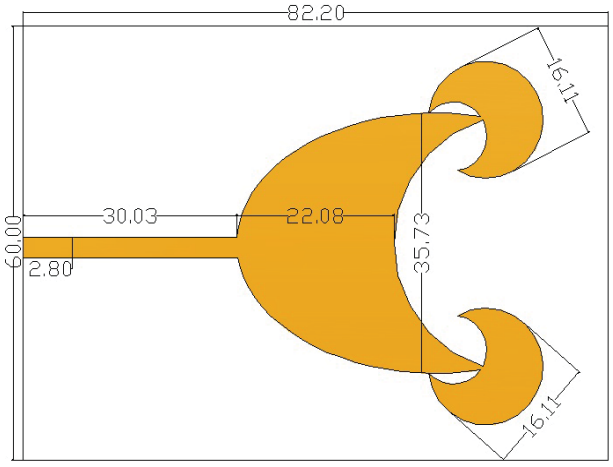

Figure 2 Top view showing Patch & design parameters

Figure 2 present the top view and the geometry details of radiating patch and feed. All dimensions in mm. A crescent patch is designed with two smaller crescent patches add to its two horns. Crescent shape was made using a parabola and cut out of another parabola later additional two another crescent shaped structures were added to the horns of crescent shaped patch to increase its resonant bandwidth. The ratio and size of two smaller crescents was derived by experimenting them for best gain.

III. SIMULATED AND MESURED RESULTS

The antenna structure which is proposed here is designed and simulated in HFSS (high frequency structure simulator version 13.0.0).First of all a simple crescent antenna was developed and measured. First antenna showed a very narrow impedance bandwidth also the gain was less. To rectify these problems two smaller crescent shaped patches were added of smoothening of edges of main patch. Due to smoothening of edges impedance bandwidth of antenna increased to 2GHz and gain of antenna increased up to 6.4dB. Figure 3 show the return loss curve of the antenna. It can be seen that the impedance bandwidth of antenna is 2.4GHz starting from 4.95GHz to 7.3GHz. Figure 4, figure 5 and figure 6 shows Gain of antenna in 3D polar plots in X, Y and Z plane respectively. It can be clearly seen that antenna exhibits gain of 5.8dB in direction normal to the surface of antenna. This antenna has a radiation pattern of a bow tie shape. Antenna can radiate equally in both directions that is top side and bottom side of patch. This antenna can be used in applications in which high directivity is of prime concern. The slot cut in ground plane helps in increasing radiation in lower end of antenna. It also helps in enhancing the bandwidth and better matching of feed line to patch.

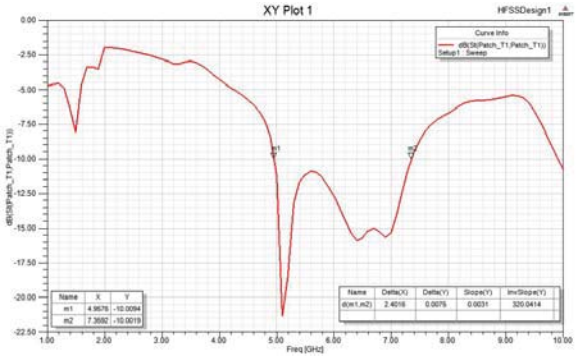

Figure 3 Simulated return loss of crescent antenna

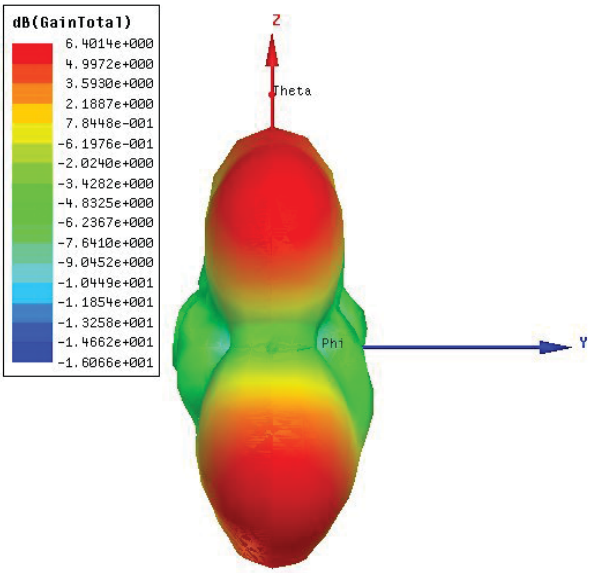

Figure 4 3D polar plot of Gain X axis

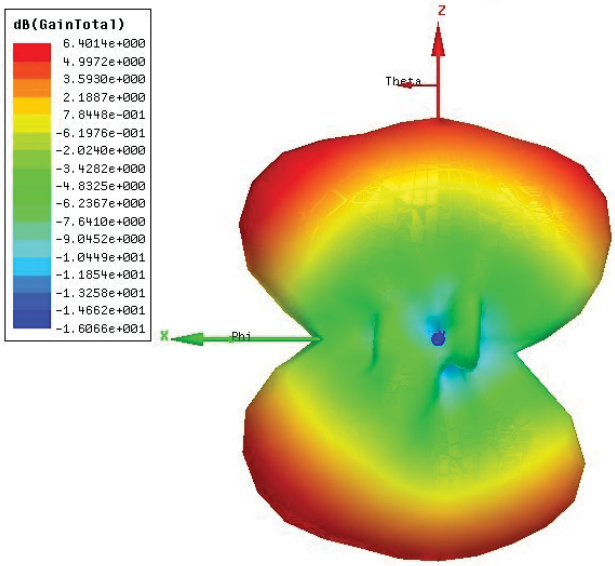

Figure 5 3D polar plot of Gain Y axis

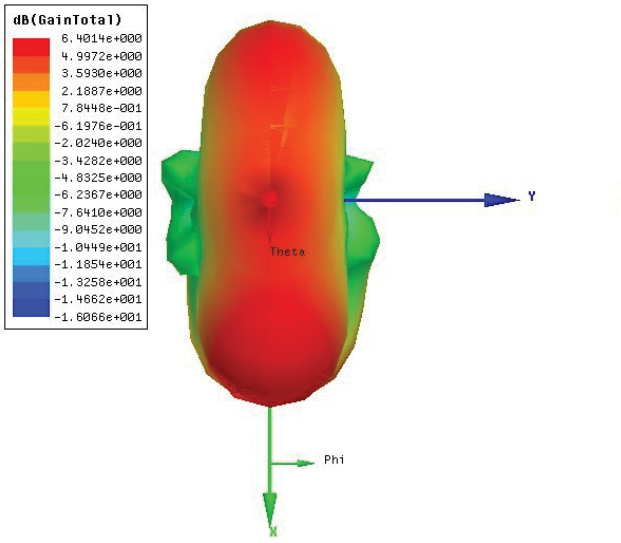

Figure 6 3D polar plot of Gain Z axis

IV. Conclusion

A crescent shaped antenna with two sub elements is realized and studied. It is found that FR4 epoxy glass serves a good substrate material when we require less thickness to area ratio of substrate. Also a gain of 6.4dB and bandwidth of 2.4GHz is achieved. This antenna was found to be highly directive in nature and can be used in application where gain and directivity is of prime concern. It is show that how engineering can also become work of art.

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