Design of Very Low Losses and Low VSWR Strip Antenna for Satellite Communication

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Abstract

Patch Antenna is now very famous due to its compact size, good gain and. antenna is Rectangular Microstrip Patch Antenna(RMPA),basic property of the antenna like simulated design, Return loss, directivity, VSWR has been discussed ,but in this paper bandwidth of the antenna is very high, Satellite Communication there is a need of very compact antenna ,This paper presents the designs of Compact C-band antenna for communication at 4GHz,Radiation Pattern and bandwidth, vswr are discussed. The work shows that whenever we increase cut width from 14mm to 16mm its VSWR continuously decreases and reached about up to 1.00 and losses in 16mm cut width antenna reduces up to 100.972% that is very great achievement in Microstrip patch antenna for satellite communication.

Keywords: Rectangular Microstrip Patch Antenna (RMPA), cut width, bandwidth, return loss, directivity

I. INTRODUCTION

Antennas for cellular phones and all types of wireless devices link us to everyone and everything. With mankind's activities expanding into space the need for antennas will grow to an unprecedented degree. Antennas will provide the vital links to and from everything out thereMicrostrip antennas for commercial systems require low-cost materials, simple and inexpensive fabrication techniques. Antennas are the essential communication link for aircrafts and ships.. [1]

This paper presents the designs of Compact C-band antenna for communication at 4GHz.antenna is Rectangular Microstrip Patch Antenna(RMPA),basic property of the antenna like simulated design, Return loss, directivity, Radiation Pattern and bandwidth are discussed. This work shows that whenever we increases cut width from 14mm to 16mm its bandwidth continuously increases and reached about up to 169 MHz and losses in 16mm cut width antenna reduces up to 100.972% that is very great achievement in Microstrip patch antenna for satellite communication.[2]

In the paper, a tetra band U-slot microstrip patch antenna is designed, optimized and simulated. The antenna covers three frequency bands of 1.43-1.5 GHz,2.4-2.55 GHz, 3.8-3.98 GHz and 5.2-5.4 GHz A coaxial probe is connected to the rectangular patch which is located close to rectangular U-slot patch centre for good excitation of the proposed antenna over a wide bandwidth. [3].

Different parameters of antenna like VSWR return loss and radiation pattern are calculated using MATLAB coding and hence their graphs are plotted in accordance with the simulated results using SONNET software. Moreover the antenna achieved and measured demonstrates a good agreement between simulation and typical. [4]

This antenna having the property of high harmonics rejection at unwanted frequencies at 2.0131GHz, and 2.457GHz, 2.565GHz as the designed frequency is 1.3 GHz and return loss is decreased about 43.17%by the DGS structure. It is also used to remove the harmonics and reduce the size of antenna. [5]

The simulation results shows that a return loss of less han -10dB and a VSWR value less than 1.58 through the bandwidth 3 to 12.5 dB is obtained. The simulation software used is high frequency structural simulator (HFSS).The trapezoidal patch placed on the upper surface of the substrate. The radiating strip connected to microstrip line feed tapered at one end..[6]

The design adopts contemporary techniques; coaxial probe feeding, E-shape patch structure and slotted patch. shows an comparative impedance bandwidth and its gain table for various shape arrangement. The entire project is design and simulated in an soft HFSS softwareThe proposed antenna project is about microstrip antenna with meandered ground plane.. [7]

In this paper we present a new patch antenna as a hexagonal patch operating in the Industrial Scientific Medical(ISM) frequency band at 2.45 GHz, the proposed antenna is verifying using to different numerical techniques which are Finite Element Method FEM and Method of Moment MoM, the compression results give us good agreement [8]

The proposed antenna gives a bandwidth of 4.84 to 6.56 GHz for S11<-10dB A novel miniature wideband rectangular patch antenna is designed for wireless local area network (WLANs) applications and operating for 5-6 GHz ISM band, and wideband applications.. [9].

These bands cover GSM mobile phone system (0.9 and 1.8 GHz) and ISM band which is used for Bluetooth and wireless local area network bands applications This paper attempts to design a triple band h-slot antenna by using feed line technique.. [10]

A modified rectangular tuning stub is used to enhance and control the operating bandwidth at the high frequency band. To reduce unwanted interference between IEEE 802.16e standard (3.3{3.9 GHz) and UWB communication systems, the antenna employs a U-shaped slot in the microstrip feeding line which provides a band-rejection performance at 3.6 GHz in the UWB frequency band. The proposed antenna is designed and simulated A rectangular wide-slot etched or the ground plane is used to control the low frequency band and impedance matching of the proposed antenna.[11]

II. ANTENNA DESIGNS

Designing requires selection of suitable dielectric constant and substrate height of an antenna as these are basics to design an antenna

Here designing of antenna is done using CST-Microwave Studio simulation software and the parameters are displayed by the figures. Designing of the patch has to be taken into consideration, the space available on the fuselage where the antenna has to be installed. The antenna physical sizes are an important factor in the design process [13] owing to the miniaturization of the modern mobile terminals. Any technique to miniaturize the size of the RMPA has received much attention.; these are chosen according to the design frequency our designed frequency is 4GHz, here the chosen material is RT duroid 5800.

1) Substrate Height =3.5 mm
2) Dielectric Constant=2.2
3) Loss Tangent=.0009

Designing of RMPA and its iteration done and their respective results are shown by Graph or figure. The Length and Width of Microstrip Patch Antenna has been calculated by the formula given in References books [10], and all other parameter like cut width, cut depth, continue straight path length and width are calculated by iteration on simulation software and dimensions are stored for best simulation results. Antenna Designed by simulation Software, its return loss graph, Directivity Graph, Radiation pattern is shown for antenna design RMPA and its different by CST-MWS simulation Software [12].

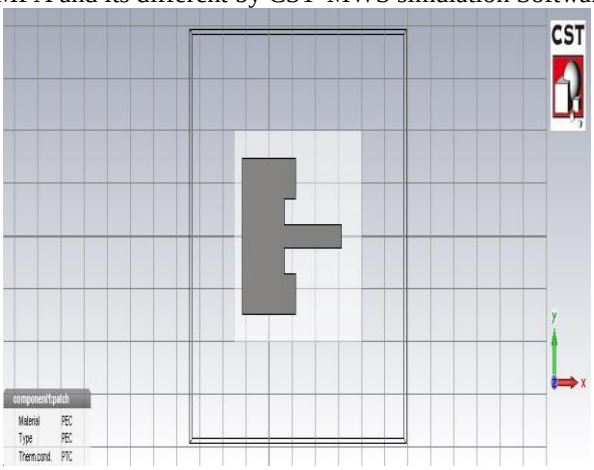

Fig. 1: Simple RMPA with cut width=14mm, for C-band Communication

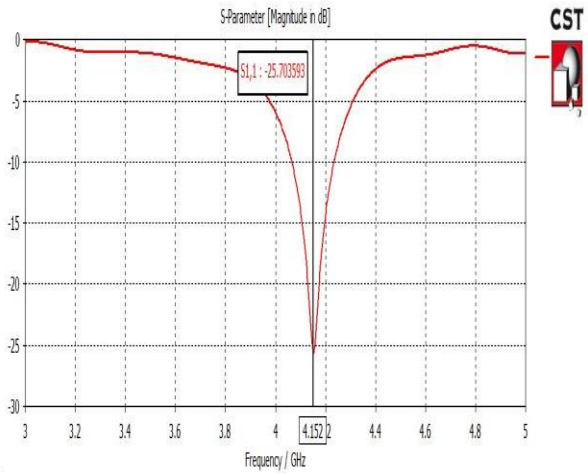

Fig. 2: Simulated Return Loss vs. Frequency of Simple RMPA with cut width 14mm is -25.70dB at 4.152GHz

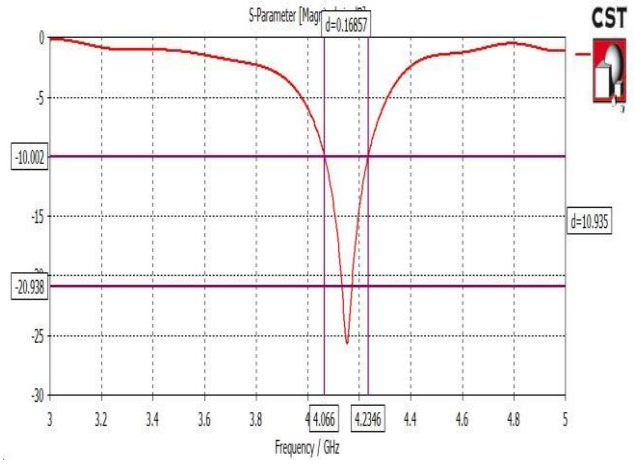

Fig. 3: Bandwidth of Simple RMPA with cut width 14mm is 168.57MHz

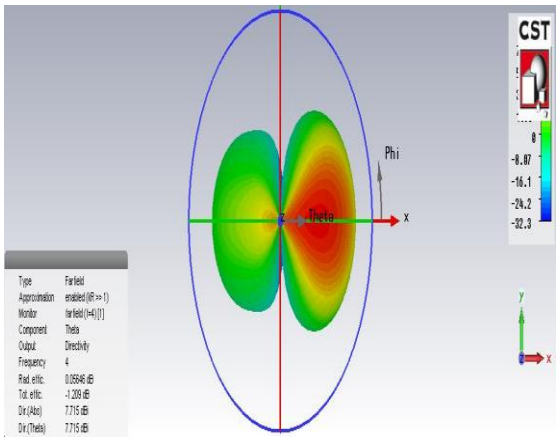

Fig. 4: Total Directivity of Simple RMPA with cut width 14mm is 7.715dBi

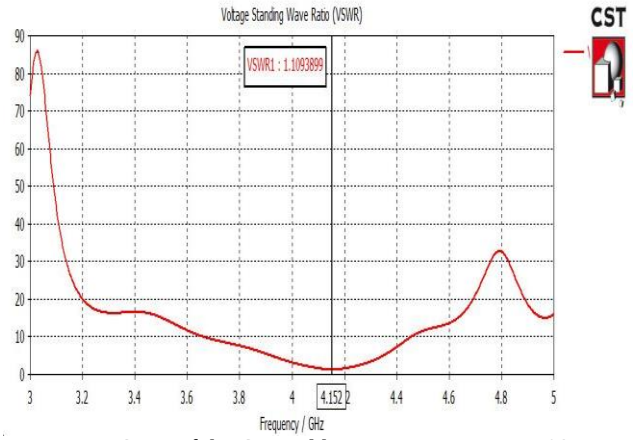

Fig.5: VSWR of the Cut width 14 mm antenna is 1.109

Table-1
Parameter of Simple RMPA at Cut Width 14mm for Satellite Communication

Frequency(4GHz)	*Return Loss(dB)*	*Bandwidth(MHz)*	*Total Directivity(dBi)*	*VSWR*
4.152	*25.70*	*168.57*	*7.715*	*1.10*

As it is very clear from the Fig. 1, Fig. 2, Fig. 3, Fig. 4, 5 and Table I that, antenna is working on 4.152GHz and giving return loss 25.70dB, Directivity 7.715 dbi, bandwidth of 168.57MHz and VSWR is 1.10, which is very good for working of an antenna. Now cut width depth increased to 16 mm has been introduced into the simple microstrip patch antenna as shown in Fig. 6. This width is lowering the losses continuously, which is very important aspect to design this antenna system.

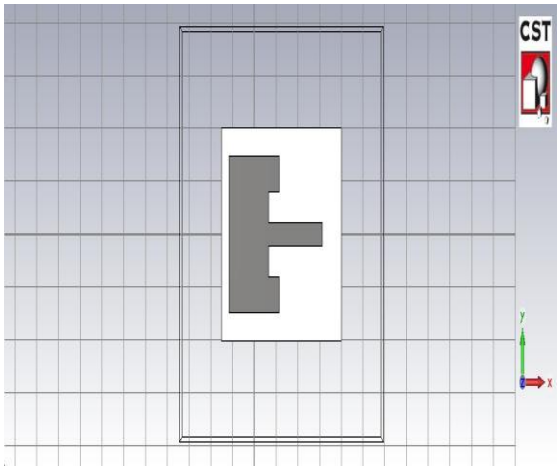

Fig. 6: increased cut width to 16mm RMPA for satellite Communication

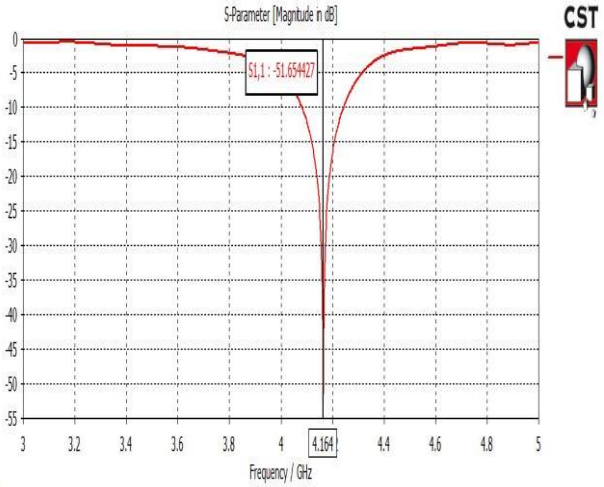

Fig. 7: Simulated Return-loss of cut width 16mm Slot RMPA is 51.65dB at 4.164GHz

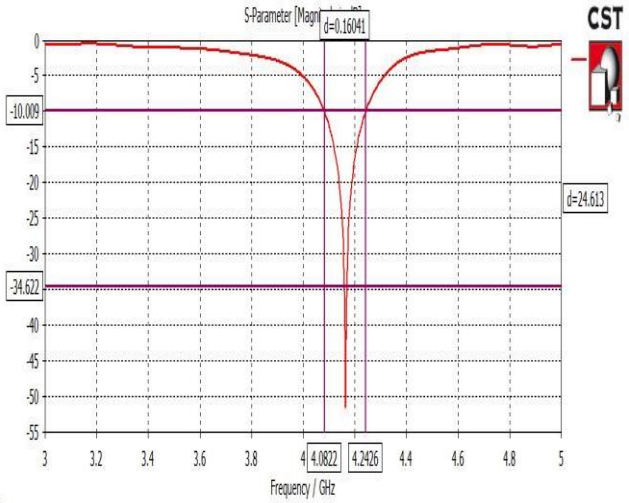

Fig. 8: Bandwidth of cut width=16mm RMPA is 160.41 MHz

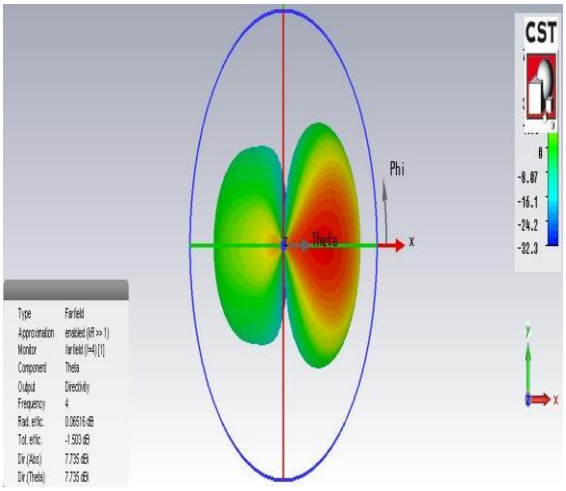

Fig. 9: Total directivity of cut width =16mm, RMPA is 7.735dbi

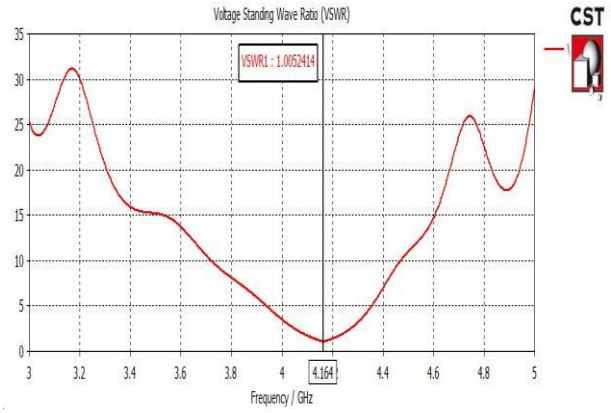

Fig. 10: VSWR of the antenna with cut width 16mm is 1.00

Table - 2
Parameter of RMPA at cut width of 16mm for satellite Communication

Frequency(4GHz)	*Return-Loss(dB)*	*Bandwidth(MHz)*	*Total Directivity(dBi)*	*VSWR*
4.164	*51.65*	*160.41*	*7.735*	*1.00*

III. CONCLUSION

The paper concludes from above figures and tables that the when cut width increases to 16mm from 14mm Antenna characteristics has been improved like return loss are decreased, bandwidth are almost same and VSWR are greatly decreased due to this cut width enhancement, due to this improvement in parameters maximum output is achieved. In this paper improvement in return loss in great amount this will give the maximum output and bandwidth is also increases in great extent, the great achievement on patch antenna designing system.

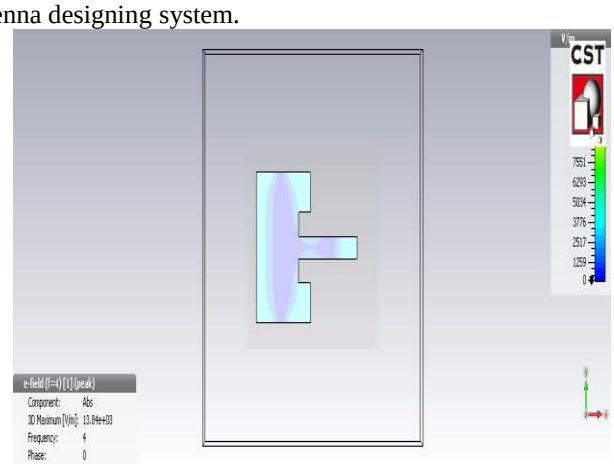

Fig. 10: Current distributions in 14mm cut width RMPA

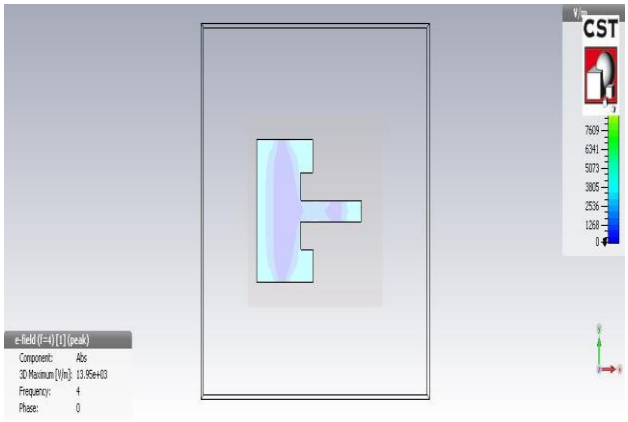

Fig. 11: Current distribution in 16mm cut width RMPA

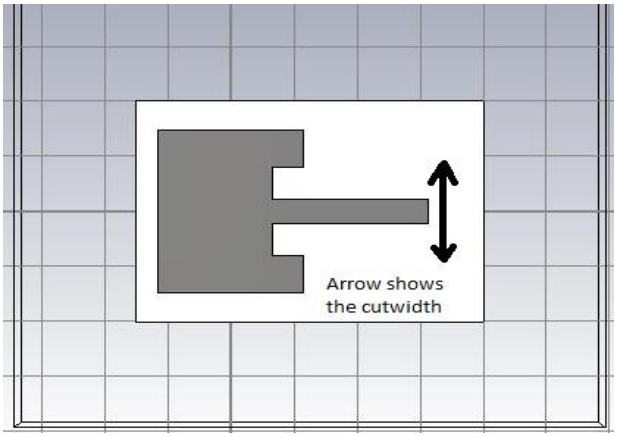

Fig. 12: Cut width in Rectangular Microstrip Patch Antenna

IV. RESULT

Comparative study of both the antenna is done as shown, in Fig. 6 and Fig. 1 the size is reduced. from Fig. 2 and Fig. 7 the Return-loss of antenna is decreased about 100.972%Antenna directivity is increased from7.715dbi to 7.735dbi clear from Fig. 4 and Fig. 9, antenna total efficiency are almost same as shown in figure 4 and 9, bandwidth is slightly reduced due to decrement of losses up to 100.972% and VSWR reduced 1.1 to 1.00 shown

from figure 5 and figure 10 , bandwidth slightly decreases to 160.41Mhz from 168.57Mhz as shown in Fig. 3 and Fig. 8 and, all these results can be justified from Table I and Table II .the bandwidth of these antennas are too much higher for satellite communication this is main important advantage of this antenna ,figure 11 and figure 12 shows the current distributions the illustration of cut width of the RMPA respectively.

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