DESIGN AND DEVELOPMENT OF MONOPOLE RECTANGULAR CURVED EDGE PATCH ANTENNA FOR UWB APPLICATIONS

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ABSTRACT

In this paper,we have designed a rectangular monopole patch antenna with circular slot in the middle and curved edges.It works under the frequency range of 3.1-10.6GHZ,completely covering the UWB.It has a etched ground plane to work in multi-band.Its has been observed that the rectangular monopole antenna are easy to design and fabricate.They are small in size and flexible.They are wearable antenna type fabricated on Copper material **.**

Keyword: -. UWB, Rectangular monopole patch antenna

1.INTRODUCTION

The Federal Communication Commission (FCC) regulates all use of radio-emitting device within the united states .It has the authority to prohibit operation of any device that interferes with the operation of any device that FCC has approved.FCC allotted the spectrum(3.1-10.6 GHZ) for UWB application. The advantages of such as high data transmission capacity, resistance to noise and low power consumption .As UWB spectrum can penetrate obstacles .This property can be used to detect and rescue survivors in disaster situation. Ultra Wide band (UWB) is a wireless technology for transmitting digital data at very high rates using low power.UWB is the ideally suited for short-range and high-speed data transmissions for wireless personal area network(WPAN)application.UWB is free spectrum (7.5GHZ).UWB is desirable for short range(10m). Microstrip patch antennas are increasing in popularity for use in wireless applications due to their low-profile structure. Therefore they are extremely compatible for embedded antennas in handheld wireless devices such as cellular phones etc., The telemetry and communication antennas on missiles need to be thin and conformal and are often Microstrip patch antennas. Another area where they have been used successfully is in satellite communication. The advantages are low fabrication cost, hence can be manufactured in large quantities, capable of dual and triple frequency operations .Disadvantages are low impedances bandwidth, extra radiation occur from its feeds and junctions, excitation of surface waves .The size of microstrip antenna comes in both the advantages and disadvantages but there are some applications where size of microstrip antenna is too large to be used. As the antenna is loaded with a dielectric as its substrate, the length of the antenna decreases as relative dielectric constant of the substrate increase. The resonant length of the antenna is slighty shorter because of extended electric "Fringing field" which increase electrical length of the antenna slighty. An early model of the microstrip antenna is a section of microstrip transmission line with equivalent loads on either end to represent the radiation loss .The dielectric loading of microstrip antenna affects both its radiation pattern and the impedance bandwidth .As the dielectric constant of the substrate increases, the antenna bandwidth decreases the impedance bandwidth. This relationship did not immediately follow when using the transmission line model of the antenna, but is apparent using the cavity model which was introduced in the late 1970s by Lo et al [14].The radiation from a rectangular microstrip antenna may be understood as a pair of equivalent slot.Circular slot on patch has been introduced for getting better return loss.The patch antenna with circular slot improves the performance of the antenna.

In this paper, monopole rectangular curved edge patch antenna is proposed for resuce purpose, which work at UWB frequency of 3.1-10.6GHZ .The proposed antenna is fabricated of a textile substrate and a copper patch on the substrate. The proposed antenna is designed by using CST Microwave Studio 2016 and experimentally validated by measurement.

2.DESIGN AND SIMULATION

The structure of proposed antenna is consisted of monopole rectangular curved edge patch antenna with a circular slot in the middle and curved edges put on copper fabric as a substrate.The strip (patch) and ground plane are separated by a dielectric sheet(refer to as the substrate).The radiating elements and the feed line are usually photoetched on the dielectric substrate.Microstrip line feed is a feeding method where a conducting strip is connected to the patch directly from the edge. The transmission line equations

To find Width

$$W = \frac{c}{2 f_0 \sqrt{\frac{\varepsilon_r + 1}{2}}}$$

where f_0 is the resonant frequency of the microstrip antenna , εr is the relative dielectric constant of the substrate In this design, FR4 substrate of the relative permittivity of 4.4 and height h=1.6 mm is used. The value of $\varepsilon_{\varepsilon}$ is slightly less than ε_r , because the fringing fields around the periphery of patch are not confined in dielectric substrate but are also spread in the air.

To find the dielectric constant

$$\mathcal{E}_{reff} = \frac{\mathcal{E}r+1}{2} + \frac{\mathcal{E}r-1}{2}\left(1+12\,\frac{h}{W}\right)^{-1/2}$$

ε_{reff} = Effective dielectric constant

ε_r = Dielectric constant of substrate

h = Height of dielectric substrate

W = Width of the patch

To find the effective length

$$L_{eff} = \frac{c}{2 f_{\circ} \sqrt{\mathcal{E}reff}}$$

To find the fringing length (ΔL)

$$\Delta L = 0.412\, h \,\frac{(\mathcal{E}reff+0.3)\left(\frac{W}{h}+0.264\right)}{(\mathcal{E}reff-0.258)\left(\frac{W}{h}-0.8\right)}$$

To find the actual length L and length of the ground

$L = L_{eff} - 2\Delta L$

$Lg = 2\, L * L_{16}$

$W\ g = 2 * W$

To design the microstrip feed line(inst-fed)

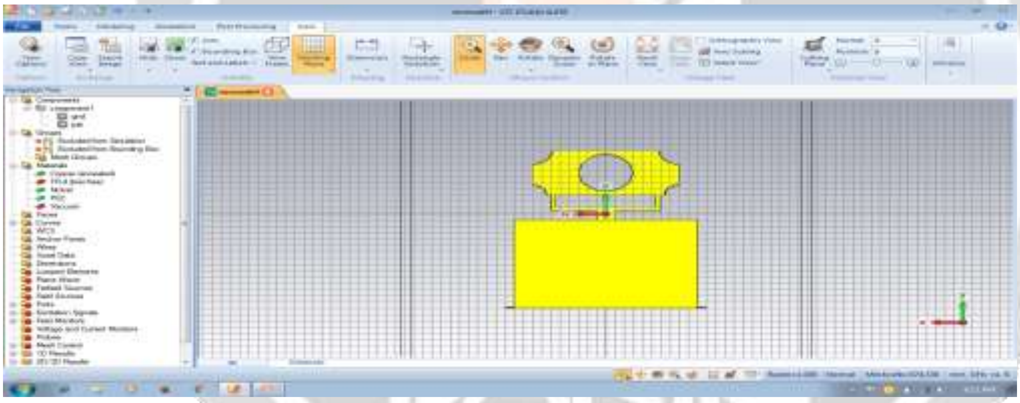
- The input impedance is usually 50 Ω.
- The width of microstrip feed line (Wf).

The length of inset(Fi)

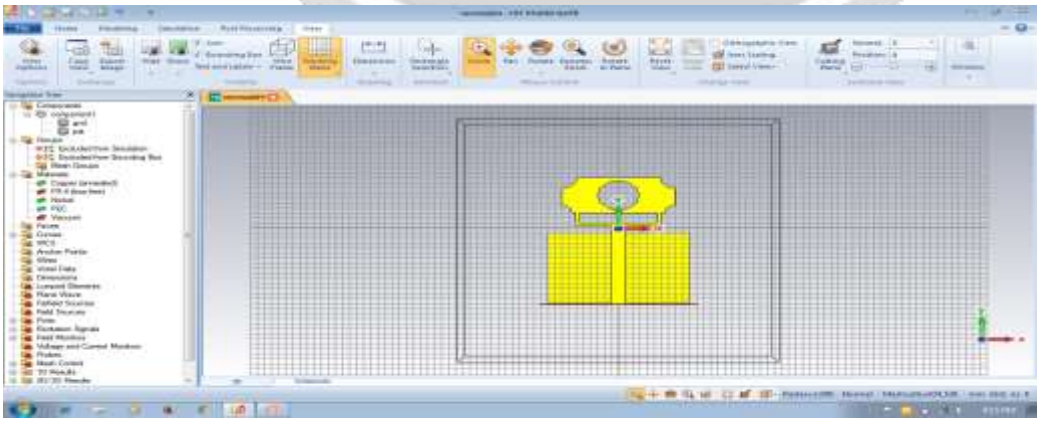
$Fi = 10-4\ 0.001699*\varepsilon r7 + 0.13761 * \varepsilon r6 - 6.1783*\varepsilon r5 + 93.187*\varepsilon r4 - 682.69*\varepsilon r3$

The gap between the patch and the inset-fed (Gpf) usualy 1 mm.

a) Back View



b)Front View



3 .RESULTS AND DISCUSSION

The VSWR, S-parameter,gain,far field and bandwidth of the proposed antenna is shown in figure (1,2,3) respectively.

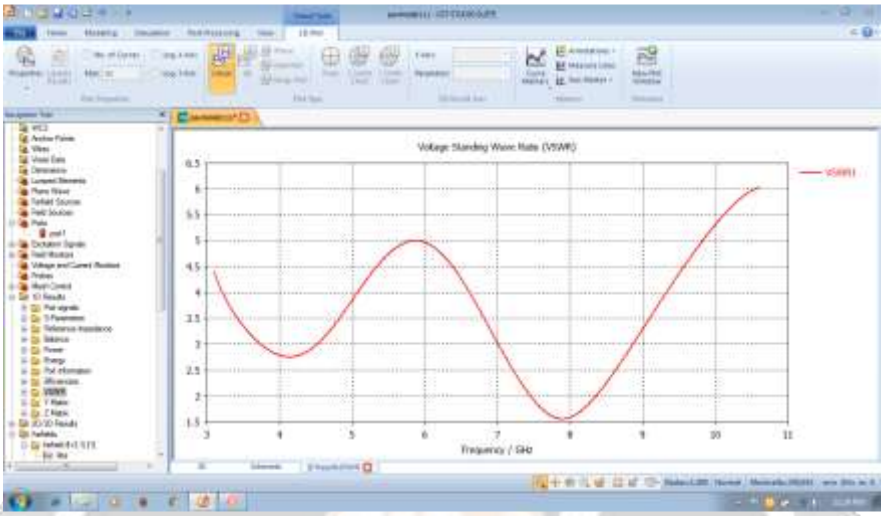


Figure 1.VSWR

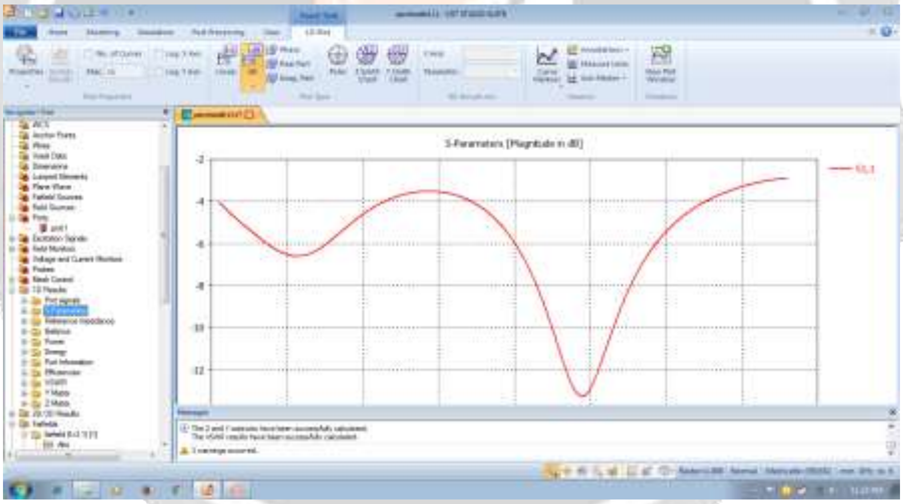


Figure 2.S-Parameter

The discussed design achieves the bandwidth of 6 GHZ (3.1-10.6GHZ) and corresponding VSWR is < 6 for entire bandwidth range.The simulated results show that the proposed antenna could be a candidate for UWB applications.VSWR is a function of the reflection coefficient, which describes the power reflected from the antenna.VSWR is ratio of the peak amplitude of a standing wave to the minimum amplitude of a standing wave.For high frequencies, s-parameter is convenient to describe a given network in terms of wave rather than voltages or currents.S-parameter permits an easier definition of reference planes

Figure 3.Gain

4.CONCLUSION

In this paper, monopole rectangular curved edge patch antenna for UWB applications is proposed. The modeling of antenna using CST software is essential for variation of the shape of antenna.The design antenna is flexible.The new structure is simulated with CST from reflection coefficient S11.We observe that losses are reduced.Good impedance matching characteristics, compact size,Ultra Wideband,nearly omni directional radiation pattern,over the entire operating bandwidth of 3.1-8GHZ makes this antenna a good candidate for UWB applications.In our propsed antenna ,we have achieved gain of 3.9GHZ.

5. REFERENCES

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