MINIATURIZED MICROSTRIP PATCH ANTENNA FOR HIGH FREQUENCY APPLICATIONS

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Abstract: *This paper is based on the design of a miniaturized microstrip patch antenna for high frequency applications. We propose a miniature rectangular patch antenna to increase the bandwidth to attain ultrawide-band. Federal communication commission (FCC) has approved the frequency limit for narrow band and wide band antenna.One of the advantage of the narrow band technology is the design of feasible compact conformal antenna. Therefore, rectangular patch antenna has to be design to attain the better narrow bandwidth then miniaturization have to be done to improve it to ultrawide bandwidth. Return loss, and vswr and s-parameter also to be improved to attain better result. UWB is achieved by using certain technologies which is used for expansion of band width.The rectangular patch antenna with a 50 ohms microstrip feed is fabricated on the substrate.*

keywords*: MSA, return loss, vswr, bandwidth, UWB*

I. INTRODUCTION

Microstrip antenna is a narrow band wide-beam antenna. It is also called printed antenna. It has two dimensional physical geometries. Microstrip antennas offers many benefits to high frequency systems because of their low profile, light weight, small volume. Low profile antenna often has high input impedance. In its simplest form a microstrip patch antenna consists of a patch of a metal, usually rectangular or circular or any other shapes on the top of grounded substrate. In order to simplify analysis and performance prediction, the patch is generally square, rectangle, circular, or some other common shapes as shown in figure.

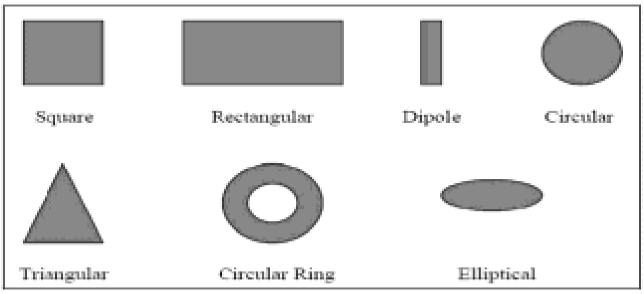

Figure 1: Different shapes of patches for antenna

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The simplest patch antenna uses a patch which is one half wavelength long, so that the metal surface act as a resonator similar to the half wave dipole antennas. a patch antenna is usually fabricated by mounting a shaped metal sheet on an insulating dielectric substrate. such as a printed circuit board

II. DESIGN OF MICROSTRIP PATCH ANTENNA

A microstrip patch antenna is designed initially. The antenna with a relative dielectric constant εr, antenna operating frequency fr and dielectric substrate of width 'w'.

Step 1: A parameter Width of the radiating RPA is compute from this equation

$$W = \frac{C}{2f_r}\sqrt{\frac{2}{\varepsilon_r+1}}$$

c: velocity of light, $3*10^8$m/s,

ε_r: dielectric constant of the substrate. f_r: resonant frequency of antenna

Step 2: Effective Dielectric constant of the PRA is determined as:

$$\varepsilon_{eff} = \frac{\varepsilon_r+1}{2} + \frac{\varepsilon_r-1}{2}\left(\frac{1}{\sqrt{1+\frac{2h}{W}}}\right)$$

Step 3: The effective length is specified at the resonance frequency

$$L_{eff} = \frac{C}{2\,fr\sqrt{\varepsilon_{eff}}}$$

Step 4: Extension length of the PRA compute with this

$$\Delta L = h * 0.412 * \frac{(\varepsilon_{eff}+0.3)\left(\frac{W}{h}+0.264\right)}{(\varepsilon_{eff}-0.258)\left(\frac{W}{h}+0.8\right)}$$

III. FEEDING TECHNIQUES

The rectangular patch antenna can be powered with many techniques. The most commonly used feeding techniques are categorized into two types contacting and non-contacting. In contacting method, the RF power is fed to the radiating patch with the use of a connecting detail such as a microstrip line. In non-contact coupling can be done between the patch and the radiation feed line. The four common **feed techniques** used are the microstrip line, coaxial probe (both contacting schemes), aperture coupling and proximity coupling (both non- contacting schemes). Feed techniques involved in conveying the RF electrical current into the radiating part of the antenna, where the current is converted to radiation.

Microstrip Line Feed:

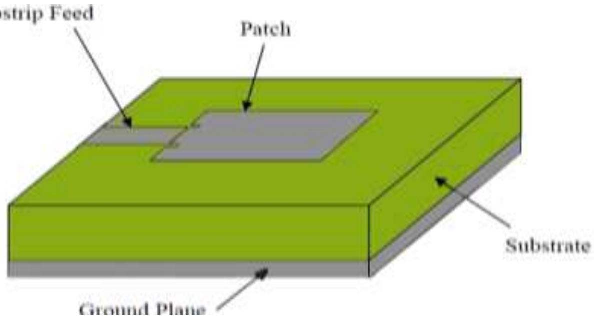


Figure 2: Microstrip feed line

Microstrip Line Feed **-** In this feed technique, a conducting plane is connected to the edge of the microstrip patch. The conducting strip is smaller in width as compared to the patch and this kind of feed arrangement has the advantage that the feed can be etched on the same substrate to provide a planar.

Radiation pattern:

The energy radiated by an antenna is represented by the Radiation pattern of the antenna. Radiation Patterns are diagrammatical representations of the distribution of radiated energy into space, as a function of direction

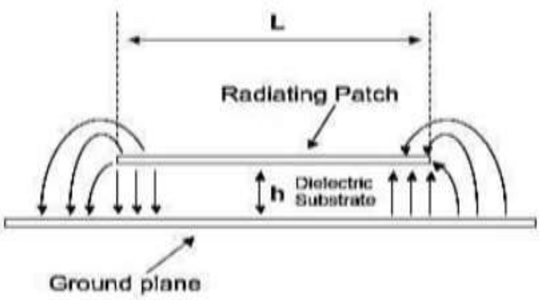


Figure 3: Fringing field

IV. PROPOSED SYSTEM

The proposed system is based on design of *miniature rectangular patch antenna to increase the bandwidth to attain ultrawide*-band. *Federal communication commission (FCC) has approved the frequency limit for narrow band and wide band antenna. One of the advantage of the narrow band technology is the design of feasible compact conformal antenna. Therefore, rectangular patch antenna have to be design to attain the better narrow bandwidth and then mi niaturization have to be done to improve it to ultrawide bandwidth. Return loss, and vswr and s-parameter also to be improved to attain better result.*

V. SIMULATION RESULT FOR NARROWBAND

S Parameter of Antenna

S-parameter is calculated based on the reflection coefficient of the microstrip patch antenna. This parameter describe the relationship between terminals of a impedance matching and discontinuity in the transmission range.

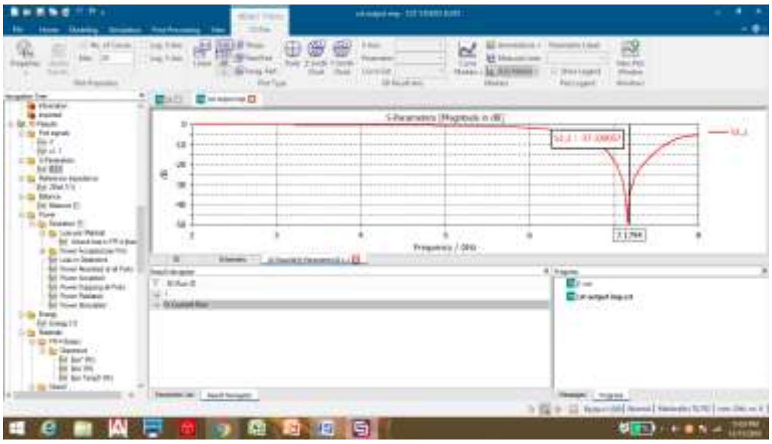


Figure 4: S-Parameter

Return loss

Return loss is a measure of the effectiveness of power delivery from a transmission line to a load such as an antenna. If the power incident on the antenna under test is Pin and the power reflected back to the source is Pref, the degree of mismatch between the incident and reflected power in the travelling waves is given by the ratio Pin/Pref. The higher this power ratio is, the better the load and line are matched. Return loss is the negative of the magnitude of the reflection coefficient in dB. Since power is proportional to the square of the voltage, return loss is given by:

$$RL = 10\log_{10}\frac{P_{in}}{P_{ref}}\ dB$$

which is positive quantity if Pref < Pin.

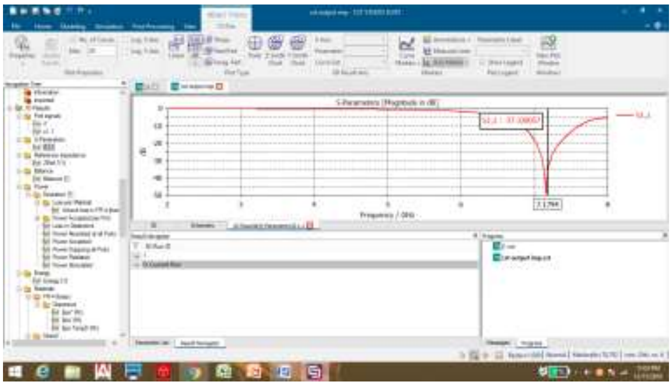


Figure 5 Return Loss

VSWR

The Voltage Standing Wave Ratio is an indication of the amount of mismatch between an antenna and the feed line connecting to it. A VSWR value under two is considered suitable for most antenna applications. The antenna can be described as having a good matched.

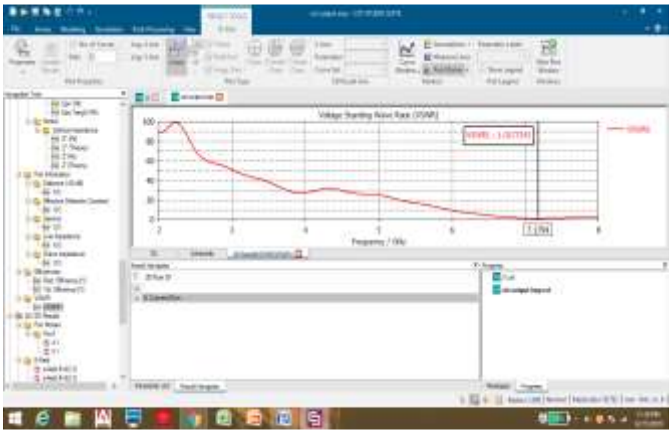
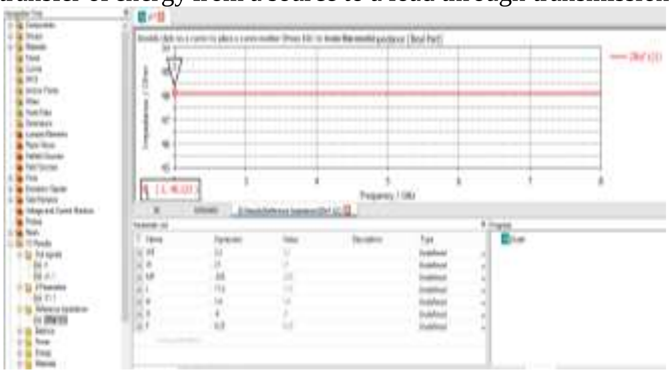


Figure 6 VSWR

4. Impedance Matching

Impedance matching is a transfer of energy from a source to a load through transmission lines without power loss.



VI. ULTRA WIDE BAND

The entire proposed work is focused on design of microstrip patch antenna to attain the ultra wide band and the first module of this proposed work would achieved narrow and of 7.2GHZ. the next module focused on improving the bandwidth. The bandwidth enhancement will be carried out by different ways in that few has been listed below.

1) Intrinsic techniques
2)Microstrip Feed line
3)proximity coupled feed
4) Ground plane reduction and slotted ground plane
4) Parasitic elements on the single layer
5) Stacked patches
6) Aperture-stacked patches
7)Broadband techniques for circular polarization

6.1 Intrinsic techniques

This techniques focused on increasing the thickness of the substrate and reducing the dielectric constant to improve and enhance the bandwidth. By increasing the substrate thickness will increase the aperture size by increasing the radiation pattern to provide perfect impedance matching.

By decreasing the dielectric constant will leads to reduce the s11 parameter which provide the impedance matching as well as improves the bandwidth. With the help of the above techniques we can able to achieve the bandwidth upto GHZ.

6.2 Microstrip Line Feed

In this microstrip line feed technique, a conducting strip line is connected to the edge of the microstrip patch. The width of the conducting strip is smaller when compared to the patch of the antenna. By coating feed with protective layer on the same substrate this type of arrangement provide a planer structure. The insert cut is taken into the patch to get good impedance matching. The inset position can control properly to achieve good impedance matching. This feeding technique is very easy and it provides simplicity of modeling and easy of fabrication

6.3 Ground plane reduction and slotted ground plane:

In this technique bandwidth can be enhanced by reducing the size of the patch in terms of length and width, the reduction of patch will increases the radiation pattern which in turn improves the resonant frequency. The improvisation of bandwidth also can be done by introducing the slots in the ground based on the number of the slot decide the frequency band. The above method tries to improve the bandwidth upto GHZ

VII. CONCLUSION

The proposed method focused on design of an microstrip patch antenna to attain better narrow band approved by FCC. The proposed antenna is obtained with an resonant frequency of 7.4GHz and antenna parameters with impedance 50Ω, VSWR of 1.82 and return of 48db. The work focused on the method to attain the ultra wide band from the narrow band.

VIII. REFERENCE

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