Journal of Radio and Television Broadcasting
Volume3 Issue 1

# Parametric Analysis of Rectangular MSA for Wi-Max Application

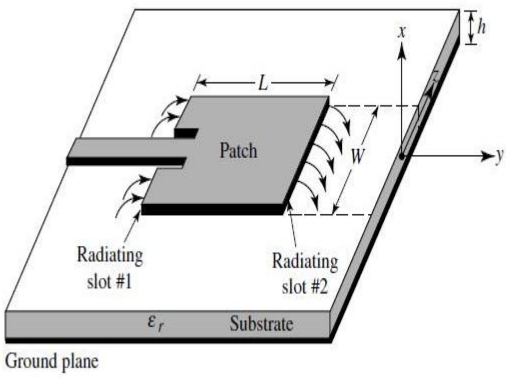
***Jitendra Baldia[1], Ashish Jeswani[2], Harshal Bajanghate[3], Anand Maheshwari[4]***
Final year B.E.[1,2,3], Assistant Professor[4]
Department of Electronics Engineering
Shri Ramdeobaba College of Engineering & Management,
Nagpur-440013 *Maharashtra, India*
Email id- maheshwaria@rknec.edu

***Abstract***
*In this paper a microstrip patch antenna is designed for Wi-MAX application. The patch antenna is designed using Ansoft HFSS v.13.0 software. The finalized patch antenna is intended to be applicable in WiMAX bands (2/3.5 GHz). The antenna exhibits a return loss of -32.6 dB at a frequency 2.37 GHz. The antenna exhibits a bandwidth of 2.33 GHz to 2.42 GHz respectively.*

***Keywords***: *Microstrip Patch Antenna, Wi-Max, return loss, Ansoft HFSS v.13.0*

## INTRODUCTION

Development of microstrip antennas technology paced up in late 1970s. MSA's have numerous advantages over other aerial radiating systems which incorporates small size, small size, low weight, ease of interfacing with active devices. MSA's are increasingly becoming useful as they are easy to fabricate, cheap and can be easily printed onto a circuit.
MSA consists of a radiating patch on the upper part of the dielectric substrate and a ground plane on the other half. Copper or gold can be used to make the patch.




Standard formula used for calculating the length and width for the design of the rectangular microstrip patch antenna are given below:

$$\varepsilon_{reff} = \frac{\varepsilon_r + 1}{2} + \frac{\varepsilon_r - 1}{2}\left[1 + 12\frac{h}{W}\right]^{-1/2}$$

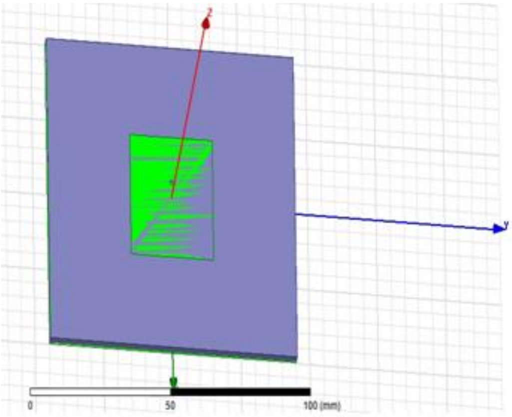
$$\frac{\Delta L}{h} = 0.412\frac{(\varepsilon_{reff} + 0.3)(\frac{W}{h} + 0.264)}{(\varepsilon_{reff} - 0.258)(\frac{W}{h} + 0.8)}$$

$$W = \frac{1}{2f_r\sqrt{\mu_0\varepsilon_0}}\sqrt{\frac{2}{\varepsilon_r + 1}} = \frac{v_0}{2f_r}\sqrt{\frac{2}{\varepsilon_r + 1}}$$

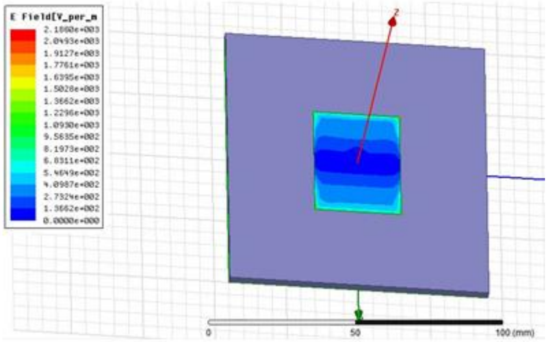
$$L = \frac{1}{2f_r\sqrt{\varepsilon_{reff}}\sqrt{\mu_0\varepsilon_0}} - 2\Delta L$$

$\varepsilon_{reff}$ =Effective dielectric constant
$\varepsilon_r$ =Dielectric constant of substrate
$f_r$ =fringing frequency
h=Height of dielectric substrate
W=Width of the patch
ΔL=extension of the length

Rectangular patch antenna (Basic geometry)



Rectangular patch antenna



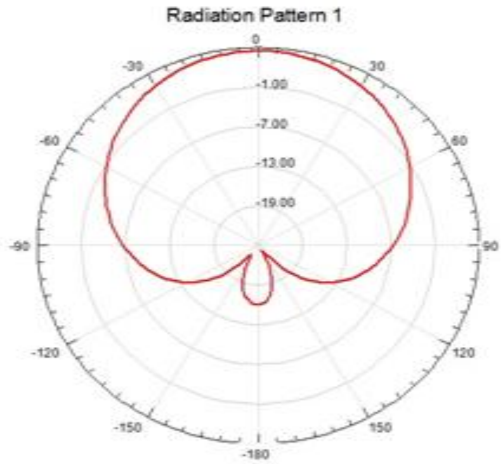
Reference table for patch antenna all parameter calculated by the above formula

| | Dimensions | Unit |
|---|---|---|
| Dielectric Constant (ϵr) | 2.2 | |
| Thickness (h) | 3.2 | mm |
| Operating Frequency | 2.4 | GHz |
| Length (L) | 40 | mm |
| Width (W) | 49 | mm |

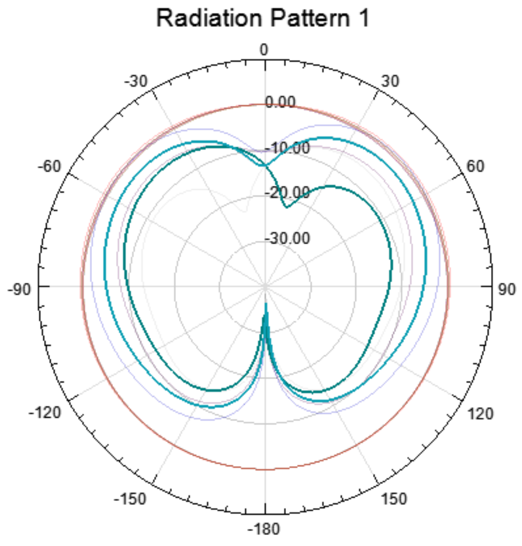
**Radiation pattern**

The graphical representation of the power radiated or received by an antenna which is the function of radial distribution and angular position is known as radiation pattern.

**For Roger (RT-5880) substrate**




**For Fr-4 substrate**

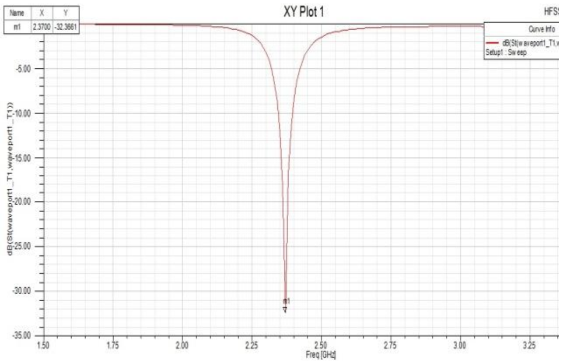



Return Loss/S-parameter

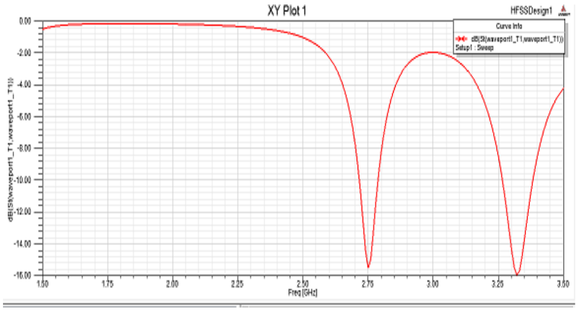
The loss of power due to reflection from the load end or due to non- compliance of the impedance matching at the load side in dB is known as return loss.

Figure below shows the return loss for the simulated patch antenna using two different substrate materials i.e., Roger (RT-5880) and FR-4. The antenna designed using Roger exhibits a return loss of -32 dB at 2.35 GHz whereas the antenna modeled using FR-4 substrate exhibits a return loss of -16 dB.

**For Roger (RT-5880) substrate**




**For Fr-4 substrate**




## CONCLUSION

In this paper we have study that for Roger (RT-5880) substrate (2.2) the bandwidth in between 2.34-2.4 GHz, Return loss is-32dB.For Fr-4 substrate (4.4) the bandwidth in between 2.71-2.79GHz and 3.26 -3.38 GHz, Return loss is -15.6dB and -16dB

## REFERENCES

1. C. A. Balanis, “Antenna theory analysis and design”, Jhon Wiley & Sons, Inc., Second Edition, 1996.
2. An UWB monopole antenna for WLAN and WiMAX applications” by Bappadittyaroy Department of Electronics and communication Engineering, National Institute of Technology, Durgapur, India
3. Design of U-shape microstrip patch antenna for WiMAX applications at 2.5 GHz” by SanjeevDwivediElectronics & Communication Engineering. Samrat Ashok Technological Institute, Vidisha (mp), India
4. Pozar D.M., and Schaubert D.H, Microstrip Antennas, the Analysis and design of Microstrip Antennas and Arrays, IEEE Press, New York, USA, 1995
5. Manual of Ansys high frequency structure simulation (HFSS).