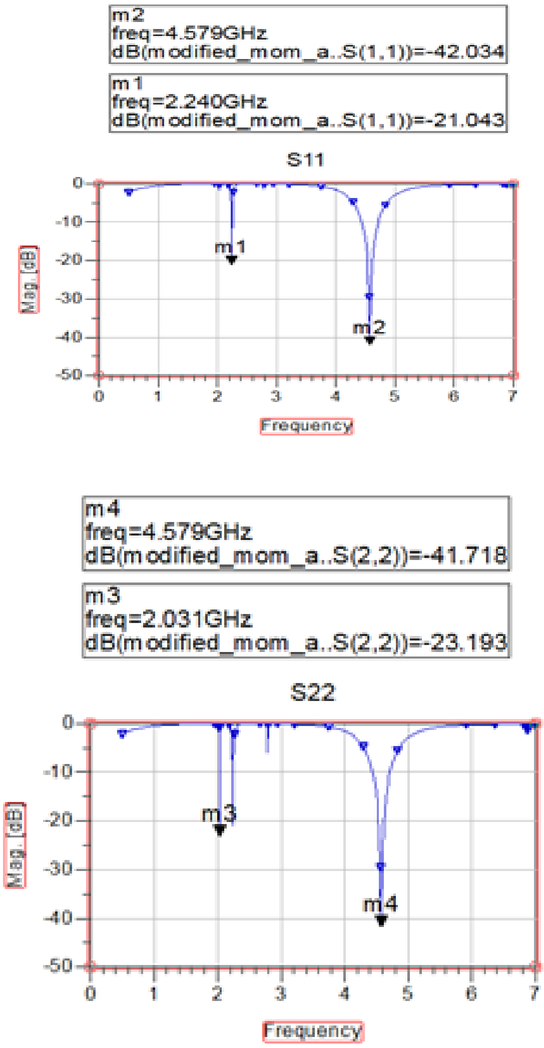

Figure 7: S11 and S22 reflections

From above graphs we get frequency of transmission and reception with minimum reflection, such that S11 has minimum reflection frequency at 2.240 GHz and 4.579 GHz, S22 has minimum reflection at 2.031 GHz and 4.579 GHz.

Output Characteristics

1. At frequency 2.24 GHz

a) Directivity

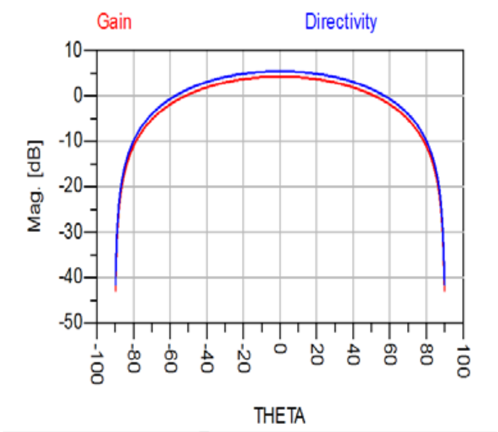

Figure 8: Directivity at 2.24ghz

The above graph shows the directivity of the antenna, from above it can be concluded that the radiation is uniformly distributed throughout the radiation area.

b) Effective Area

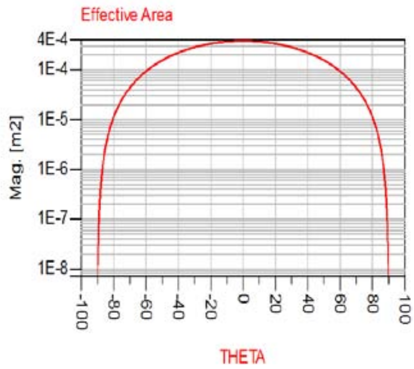

Figure 9: Effective area at 2.24ghz

The above graph shows that the effective area of radiation is distributed between -90 to +90 degree theta.

c) Overall Efficiency

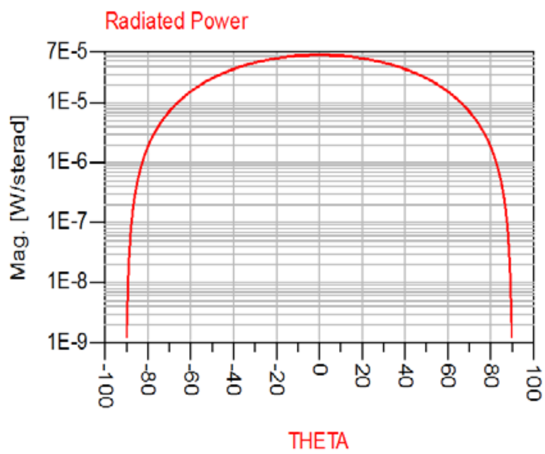

Figure 10: Overall efficiency at 2.24ghz

The graph shows that the radiated power is maximum at the central axis that is 0 degrees.

d)Efficiency

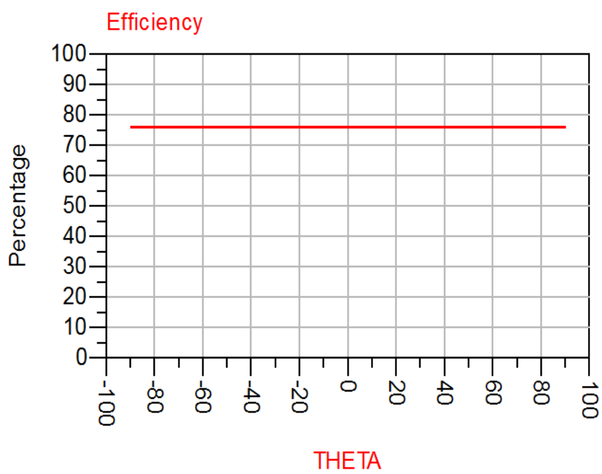

Figure 11: efficiency at 2.24 ghz

The graph shows that the efficiency is 75%

2).At frequency 4.57 ghz

a) Directivity

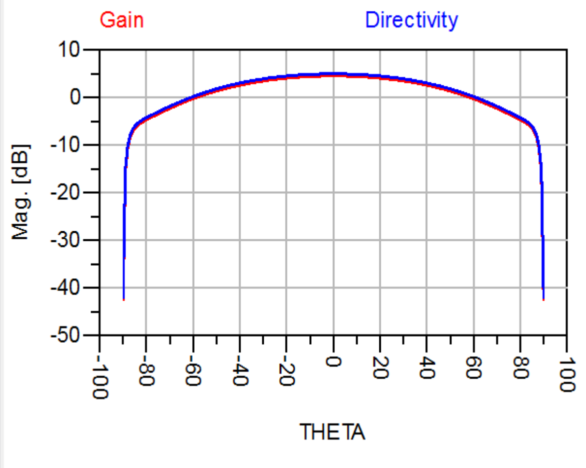

Figure 12: Directivity at 4.57ghz

The above graph shows the directivity at 4.57ghz frequency.

b) Power efficiency

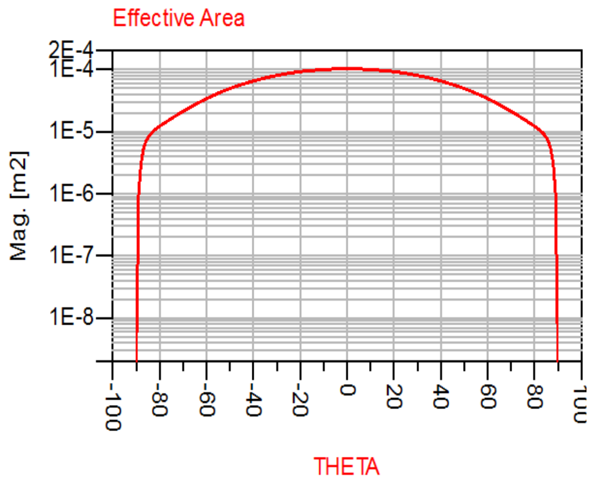

Figure 13: Power efficiency at 4.57ghz

c)Overall efficiency

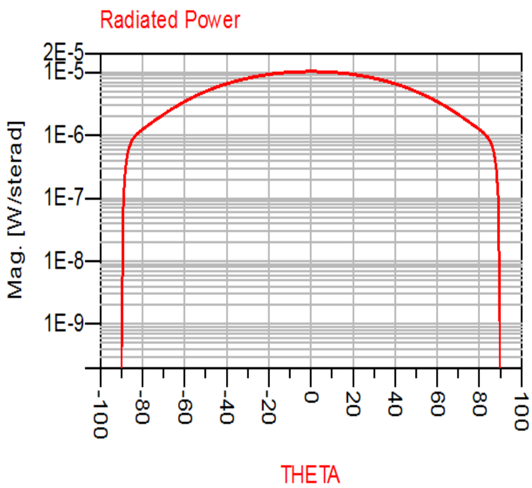

Figure 14: Overall efficiency at 4.57ghz

d) Efficiency

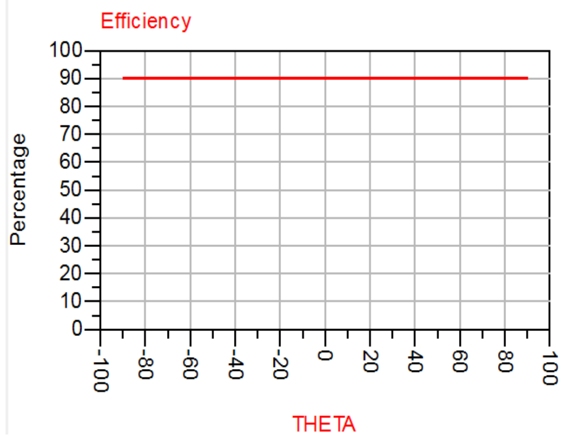

Figure15: Efficiency at 4.57 ghz

The above graph shows the efficiency is 90% .

Practically implemented antenna using copper PCB:

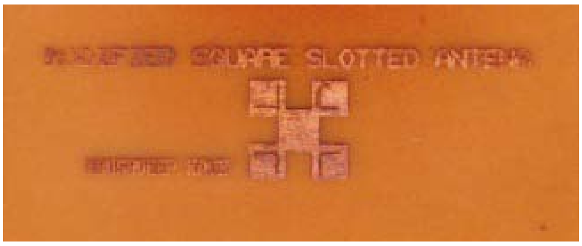

Figure 21: Practical Implementation

5. Conclusion

Through the course of study while analyzing various antenna designs it was found that using single polarization the quality of reception is not appreciable the bit error rate is high, a solution to the problem was found in the use of dual polarization antenna. A dual polarized antenna was designed and implemented physically as well and it was found that the overall efficiency is drastically improved with better directivity and uniform power radiation.

References

[1] Dan Yu; Shu-Xi Gong; Yang-Tao Wan; Wen-Feng Chen "Omnidirectional Dual-Band Dual Circularly Polarized Microstrip Antenna Using ${rm TM}_{01}$ and ${rm TM}_{02}$ Modes", Antennas and Wireless Propagation Letters, IEEE, On page(s): 1104 - 1107 Volume: 13, 2014.

[2] Anagnostou, D.E.; Mavridis, G.A.; Chryssomallis, M.T. "Quality Factor Comparison of Coaxial-Fed and Edge-Fed Electrically Small Microstrip Antennas", Antennas and Wireless Propagation Letters, IEEE, On page(s): 1493 - 1496 Volume: 11, 2012.

[3] Lee, K.-F.; Kin-Fai Tong "Microstrip Patch Antennas—Basic Characteristics and Some Recent Advances", Proceedings of the IEEE, On page(s): 2169 - 2180 Volume: 100, Issue: 7, July 2012.

[4] Peixeiro, C. "High efficiency aperture-coupled stacked-patch antennas with foam substrate", Antennas and

Propagation Society International Symposium (APSURSI), 2013 IEEE, On page(s): 1828 – 1829.

[5] Dan Yu; Shu-Xi Gong; Yang-Tao Wan; Ya-Li Yao; Yun-XueXu; Fu-Wei Wang "Wideband Omnidirectional Circularly Polarized Patch Antenna Based on Vortex Slots and Shorting Vias", Antennas and Propagation, IEEE Transactions on, On page(s): 3970 - 3977 Volume: 62, Issue: 8, Aug. 2014.

[6] Tae-Young Kim, Young-Min Yoon, Gun-Su Kim, and Boo-Gyoun Kim, Senior Member, IEEE, "A Linear Phased Array Antenna Composed of Inductive Loaded Patch Antennas" IEEE ANTENNAS AND WIRELESS PROPAGATION LETTERS, VOL. 10, 2011.