A Novel Approach on a Compact Micro Strip Antenna for Wireless Communication

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Abstract: *In this present paper a compact microstrip patch antenna for wireless communication has been studied. The microstrip antenna is formed in stacked configurations. Here, the configurations are compared for their return loss, gain and bandwidth. The Ansoft HFSS software has been used for the computation of its characteristics. The main aim of the work is to study the effectof size of driven and parasitic patch on compact microstrip patch antenna*

Key Words: Microstrip, wireless, bandwidth, stack, gain

1. INTRODUCTION

The Microstrip antenna is known for its high frequency, microwave and millimetre wave use with its low gain and narrow bandwidth. The microstrip antennas are now modified with the help of different configurations as well as choosing different shapes of the patch. Selecting the right one is required to optimize the operation of the microstrip antenna. Now, as we are dealing with the microstrip antenna we have to be focussed on its improvement of return loss, gain and bandwidth. A microstrip antenna should have the special configuration which is needed to act accordingly. For improving the performance of the antenna it should be modified to have the optimum return loss, gain and bandwidth. Now, this modification can be done by selecting the dielectric substrate of very high permittivity or by selecting a very high amplification type active circuitry or by selecting some sort of stack configuration of the antenna. Among the above three configurations we find that the patch antenna is getting increased radiation efficiency by selecting the high permittivity dielectric substrate and the antenna will become an active integrated antenna. In the stacked configuration we are using two patches one is the driven and the other is the parasitic. If we compare between the substrate size and the stacked patch size then we will found that the stacked patch size has effect on the characteristics of the microstrip patch antenna.

As for the microstrip patch antenna it really difficult to make a suitable compromise between antenna size reduction with gain and bandwidth enhancement, it is one of the main drawback of microstrip antenna. The microstrip antenna also exhibits a high Q resonance behaviour because of its dielectric substrate with the electrically thin ground plane at back also it is the main cause of narrow impedance bandwidth. If we want to improve the bandwidth the substrate thickness has to be increased or the dielectric constant is to be reduced.

For the stacked configuration the bandwidth increases in many cases by about 10% – 20 %. So, the stacked patch configuration is preferred in this work.

STACKED PATCH CONCEPT

In the stacked patch configuration two patches are used where one is the driven patch and the other is the parasitic. On the top of the ground plane lower substrate is taken with a thickness of h1 and on its top the driven patch is mounted. On the top of the driven patch the upper substrate is taken and on it the parasitic patch is mounted. The stacked configuration is given in fig. 1.

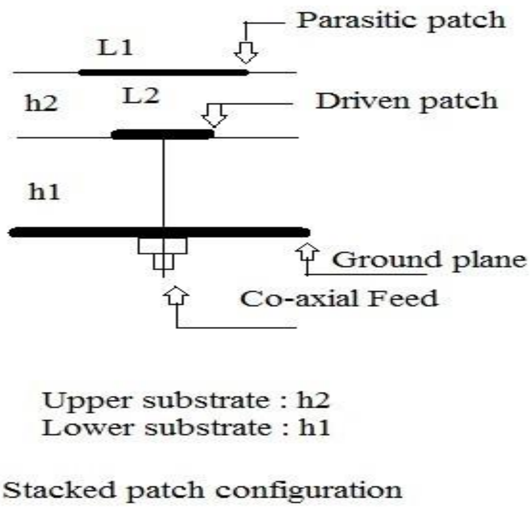

Fig. 1. Stacked patch configuration

Here the thickness of the substrate layer plays an important role for the bandwidth enhancement. As the lower substrate thickens the bandwidth increases. It is better to focus on making the lower patch to be capacitive rather than on minimum return loss. After the mounting of upper substrate and parasitic patch the overall impedance will be inductive.

A compromise between the selection of the thickness of lower and upper substrate has to be taken for lower return loss.

RESULTS AND DISCUSSION

The simulation study for the modelled antenna is carried out by Ansoft HFSS software. Here the co-axial probe feeding is employed for all the simulation study. In the fig. 2 the S11 vs Frequency plot has been shown. In fig. 3 the realized gain has been plotted for the modelled antenna. Basically the entire driven and parasitic patch is compact in between two substrates which has the benefit of gain and bandwidth improvement.

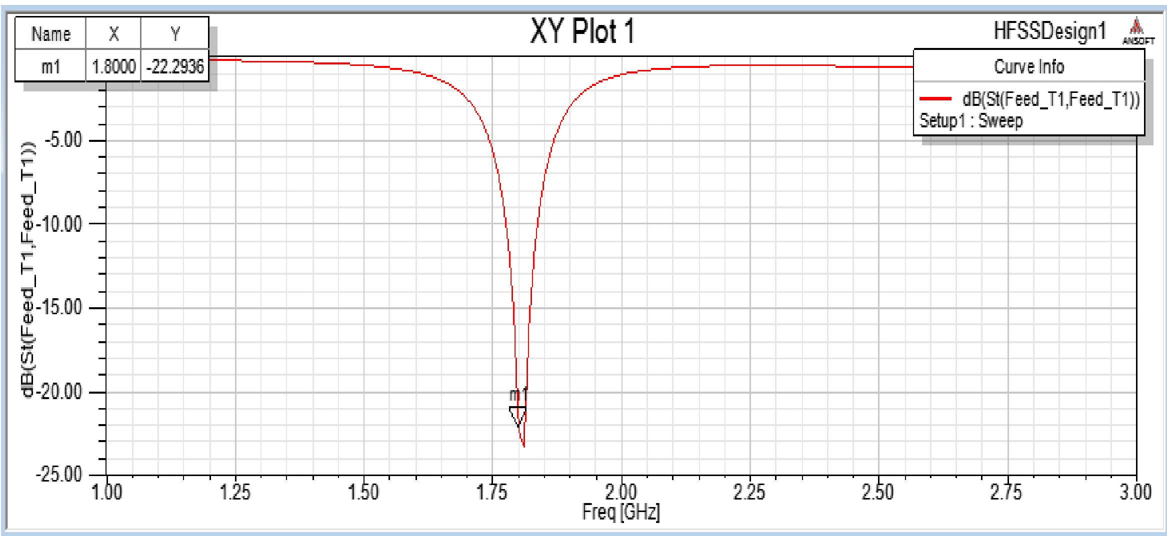

Fig.2. S_{11} vs Frequency plot

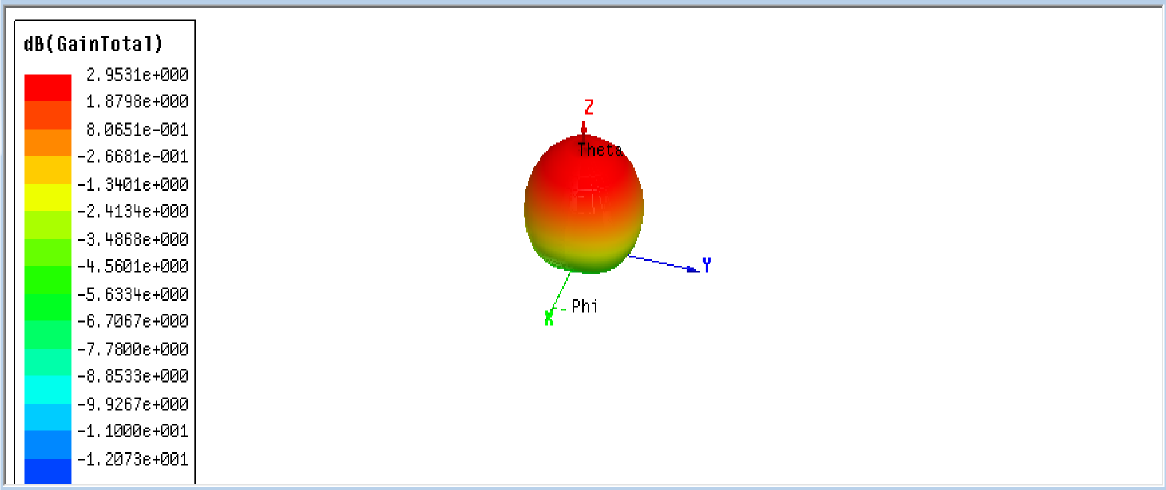

Fig.3. Realized gain of the patch antenna

CONCLUSION

In this approach we have studied about the simulation design of the patch antenna and how to increase the gain by controlling the size of the two patches. So, the gain of the Micro strip patch antenna can be increased by selecting suitable size of the driven and the parasitic patch antenna. Optimization in size of the two patches has to done to reduce the size of the micro strip antenna as it is meant for the wireless communication.

REFERENCES

[1] B. Robert, T. Razban, and A. Papiernik, "Compact amplifier integration in square patch antenna," Electronics letters, Vol. 28, pp. 1808-1810, Sept. 1992.

[2] R. Q. Lee and K. F. Lee "Experimental study of the two-layer electromagnetically coupled Rectangular patch antenna" IEEE Trans. Antennas and Propagation, Vol. 38, pp. 1298- 1302, Aug. 1990.

[3] R. B. Waterhouse, "Design of probe-fed stacked patches," IEEE Trans. Antennas Propa- gat. Vol. 47, pp. 1780-1784, Dec. 1999.

[4] V. R. Gupta, Nisha Gupta "Gain and Bandwidth Enhancement in Compact Microstrip An- tenna", XXVIIIth General Assembly of International Union of Radio Science (URSI GA) held in New Delhi, India, October 23-29, 2005.

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