

Design and Analysis of a Hybrid Shaped Microstrip Patch Antenna Using Ie3d Software

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ABSTRACT

Microstrip patch antennas have been widely used in a various useful applications, due to their low weight and low profile, conformability, easy and cheap realization. The compact antenna is expected to improve the cost of production due to the size reduction in the overall circuit area specially in a mass production. In this paper a novel planar antenna with hybrid shapes of the patch and the ground is presented. Simulation has been performed in IE3D software and later the hardware implementation was done using the FR-4 substrate. The simulation result is in close approximation of measured result. Due to its compact size and ease of design the proposed antenna is applicable to use in the mobile communication. Changing the parameters like length & width of patch and dielectric constant affect the gain performance of the antenna.

Keywords: Hybrid shape patch, Compact antenna, S-parameter.

Introduction

Micro strip antennas are started in early 1970's when conformal antennas were required for missiles. These antennas are attractive due to their light weight, conformability and low cost. These antennas can be integrated with printed strip-line

feed networks and active devices. A major contributing factor for recent advances of micro strip antennas is the revolution in electronic circuit miniaturization. As conventional antennas are bulky and costly, micro strip antennas based on photolithographic technology have low cost and small size. This is a relatively new area of antenna engineering. Micro strip patch antennas get more and more important in these days. This is mostly due to their versatility in terms of possible geometries that makes them applicable for many different situations.

The invention of the microstrip antenna concept has been attributed to the various applications in the field of telecommunications.. Due to its light weight, low volume, low cost, low profile, smaller in dimension and ease of fabrication and conformity, it has made great progress in recent years. Compared with conventional antennas, microstrip patch antennas have more advantages and better prospects. 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, pagers etc. The telemetry and communication antennas on missiles need to be thin and compact in size and are often in the form of Microstrip patch antennas.

It is found that in the treatment of malignant tumors the microwave energy is said to be the most effective way where the design of the particular radiator to be used should possess light weight, easy in handling and to be rugged. Only the patch radiator fulfils these requirements.

For this Microstrip radiator for inducing hyperthermia was based on the printed dipoles and annular rings which were designed and later on the design was based on the circular microstrip disk. Microstrip patch antennas are used in telemedicine applications. To overcome the inherently narrow bandwidth of microstrip antennas, various techniques have been developed to cover the entire UWB bandwidth, such as L-/F-shaped probe to feed the patch [1, 2], triangular patch [3], U-/V-slot monopoles [4, 5] and etc..

In this article, we present a compact patch antenna using hybrid shaped patch as well as the ground. Because of the hybrid shape effects, a good match to antenna's input impedance is achieved. The simulation is performed in IE3D simulator. The designed patch microstrip antenna has found its application in the field of mobile communication as it presents the desired performance and improved bandwidth and gain.

2 Hybrid Shape Antenna

A hybrid shaped antenna is proposed, as shown in Figure 1. The patch of the antenna is formed by elliptical cutting of a rectangle to smooth out the discontinuity of the overlapping areas. The ground plane is also formed in a similar way. The cutting of patch as well as ground is performed in IE3D simulator of Zealand Inc. 14.0.

Where the resonant frequency was taken as 2.4 GHz where this frequency was proposed so that it could be used in mobile communications.

The antenna was fabricated on a FR4 material having 1.6 mm thickness and relative dielectric constant of 4.4. The design specifications are given below:

- 1. Frequency (f_0) = 2.4 GHz.
- 2. Velocity of light (c) = 3×10^8 m/s
- 3. Patch width (W) = 37.03 mm.
- 4. Loss Tangent = 0.0016.
- 5. Patch Length (L) = 28.44 mm.
- 6. Length of transmission line = 14.89 mm.

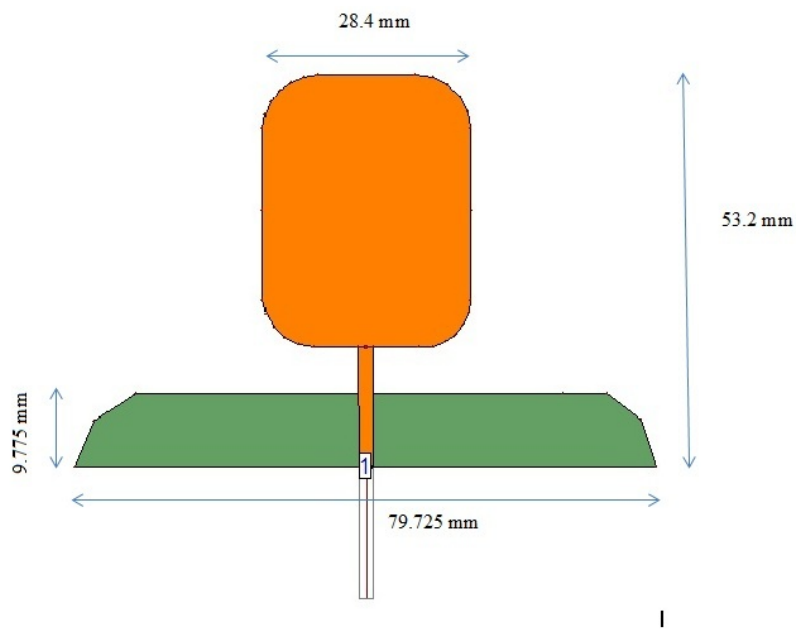


Fig 1-geometry of the hybrid shape patch antenna designed on IE3D software.



Fig.2(a)

Fig 2 (a) shows the design of hybrid shape patch antenna



Fig2. (b)

Fig.2(b) shows the design of ground with a SMA Connector



Fig. 3(a)



Fig.3(b)

Fig 3 (a) shows the designed antenna being tested using the network analyzer (b) graph shown during testing of designed antenna

3. Simulation Result

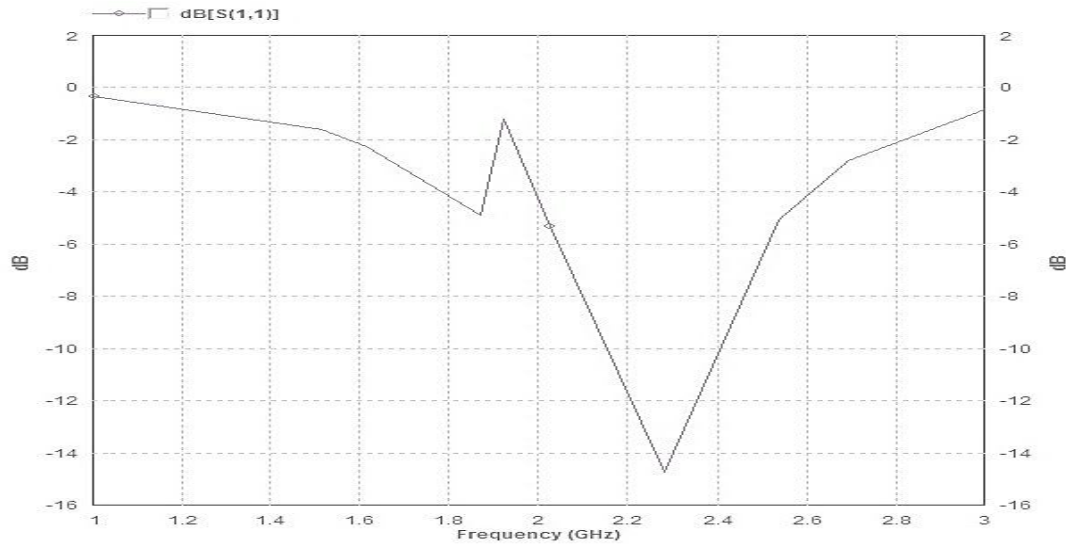


Fig.4

4. Measured Result

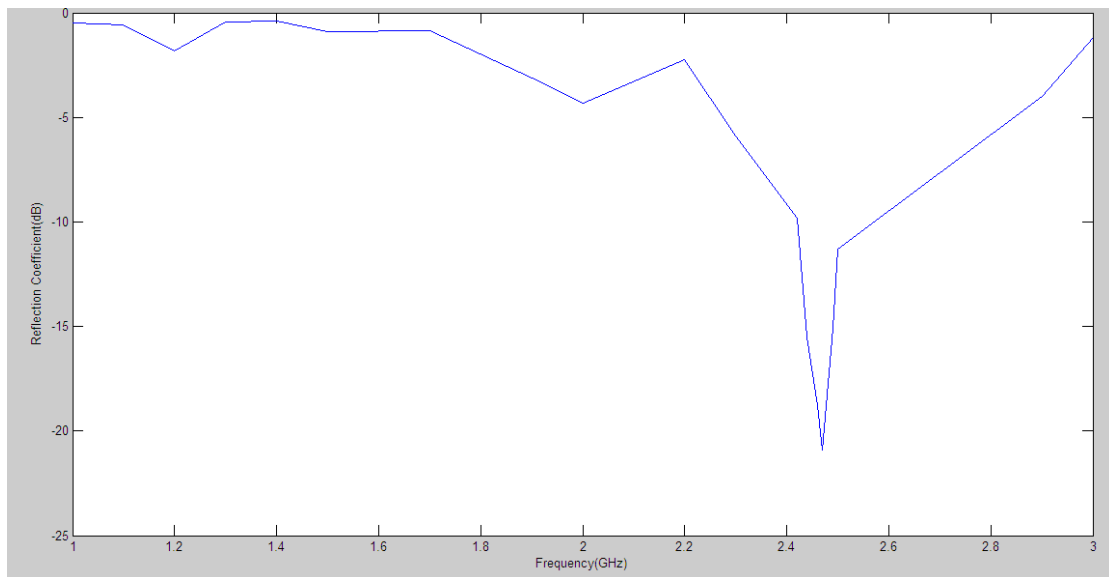


Fig. 5

5. Conclusion

The radiation performance of the proposed antenna is given in this paper. The

simulations result of the designed antenna was carried out on the IE3DSoftware which is in close approximation of measured result. The antenna was designed using the FR-4 substrate which is easily available and is less expensive. The designed antenna is compact in size and suitable for mobile communications. The results indicates that the geometry of the designed antenna fulfills the requirements needed for the mobile communication systems. The proposed antenna is expected to improve the cost of production due to its compact size. Fig. 4 shows the S parameter display of the antenna. The dip is present at 2.3 Ghz which is approximately equals to our resonant frequency and the return loss is below of-10 dB. Apart from it we are also achieving bandwidth of 200 MHz so the antenna can be used in mobile communication.

6. Future Work

Wireless multimedia systems are receiving increasing research and application interests. But improvements are still required to provide higher data-rate links, for instance, the transmission of video signals. As future work we can work on some points given below:-

- A more complete study of different field solvers and simulators (such as Sonnet, AWR, HFSS etc.) can be made. We were only able to focus on IE3D.
- We can increase the height of dielectric substrate to increase the bandwidth of the antenna.
- We will try to reduce the antenna sizes. Also the preferred substrate needs to be wisely selected. The permittivity of the substrate affects the size and performance of the antenna.

7. References

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