

Probe Feed Microstrip Patch Antenna Computer Aided Design Methodology

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Abstract- Antenna is a means for radiating or receiving or transmitting energy an antenna is used in an advanced wireless system is usually required to optimize the radiation energy in same direction and suppress it in others.

A microstrip patch antenna, also referred to as patch antenna is a narrowband, widebeam antenna fabricated by etching the antenna element patch in metal trace bonded to an insulating dielectric substance with a continuous metal layer bonded to opposite side of substrate which forms a ground plane.

Probe fixed microstrip antenna is simulated in Finite Difference Time Domain software IE3D. Proposed novel probe feed microstrip patch antenna is presented. It has a return loss of -30dB at a frequency of 5.102 GHz. Antenna offers a bandwidth of 150.63MHz. In this research article proposed antenna bandwidth is improved by 2.95%. Antenna offers a VSWR less than 1.1 at a frequency of 5.102 GHz. By observing two-dimensional and three-dimensional radiation pattern, it is seen

that antenna offers unidirectional radiation pattern. Unidirectional radiation pattern plays an important role in next generation mobile communication and computing. Due to Unidirectional radiation pattern, the cost of power is saved. Antenna offers maximum antenna gain of 4.17 dBi. Antenna offers radiation efficiency of 72.6%. Also, proposed antenna offers antenna efficiency of 72.6%.

Index Terms- Probe feed, Antenna and radiation efficiency, return loss, radiation pattern, substrate

I. INTRODUCTION

In its most basic form, a microstrip patch antenna consists of a radiating patch on one side of a dielectric substrate which has a ground plane on the other side as shown in Figure 1.

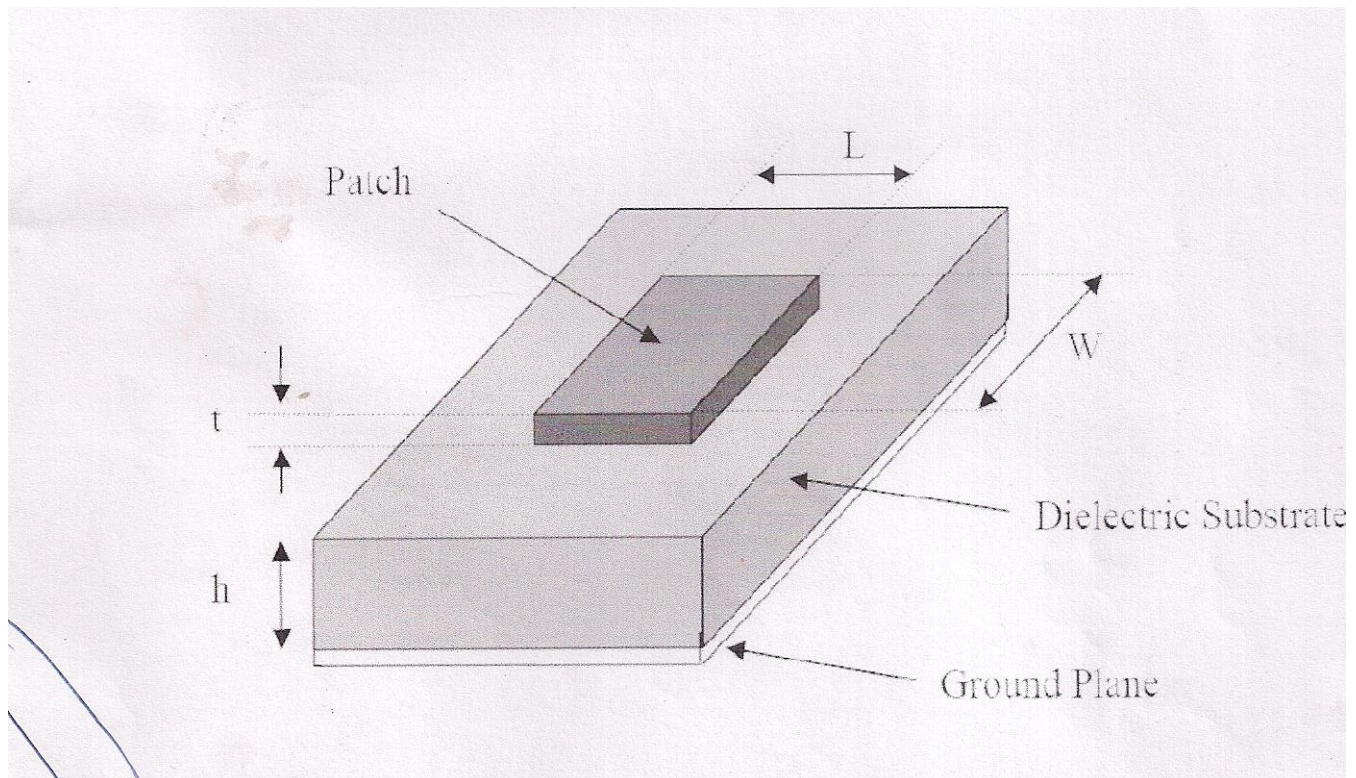


Fig 1: Structure of a microstrip patch antenna

This patch is generally made of conducting materials such as copper or gold, and can take any possible shape. The radiating patch and the feed lines are usually photo-etched on the dielectric substrate.

In order to simplify analysis and performance prediction, the patch is generally square, rectangular, circular, triangular, elliptical or some other common shape.

Microstrip patch antenna radiates primarily because of the fringing fields between the patch edge and the ground plane. For

good antenna performance, a thick dielectric substrate having a low dielectric constant is desirable since this provides better efficiency, larger bandwidth and better radiation. However, such a configuration leads to a larger antenna size.

This model represents the microstrip antenna by two slots of width W , and height h ; separated by a transmission line of length L . The microstrip is essentially a non-homogeneous line of two dielectrics, typically the substrate and air.

II. PROBE FEED

Feed is of different types, but most popular feeds are:

1. Transformer feed
2. Microstrip line feed
3. Coaxial cable feed or probe feed
4. Aperture coupled feed
5. Proximity coupled feed

Out of the above mentioned feed for microstrip patch antenna, feed applied to it is probe feed.

III. MICROSTRIP PATCH ANTENNA DESIGN

Designed frequency for designing microstrip patch antenna design is selected to be 5/102 GHz. By using standard formulae in terms of width of patch (W), length of patch (L), dielectric constant of substrate (ϵ_z), thickness of substrate (t), length and width of patch is to be calculated. Width of designed antenna got to be ($W = 17.6$ mm) and length of designed antenna got to be ($L = 12.3$ mm). By hit and trial method probe feed location is to be selected. Upper portion of substrate shows microstrip patch antenna and lower portion of substrate shows actual ground plane.

By taking designed dimensions, antenna is simulated in IE3D software. Proposed antenna top view is shown in Fig 4

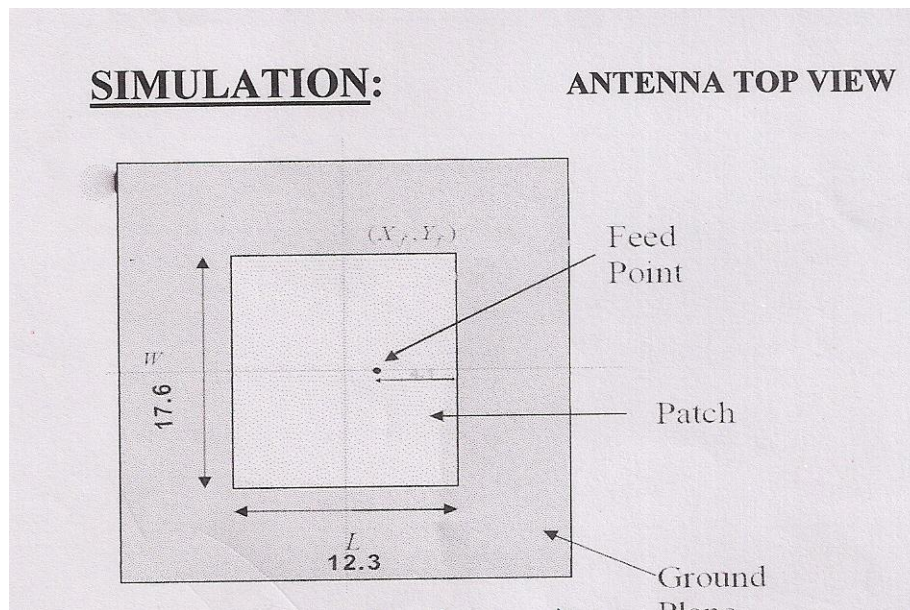


Fig 4: Proposed antenna top view

IV. RESULTS AND ANALYSIS

Figure 5 shows three-dimensional radiation pattern and Fig 6 shows two-dimensional radiation pattern.

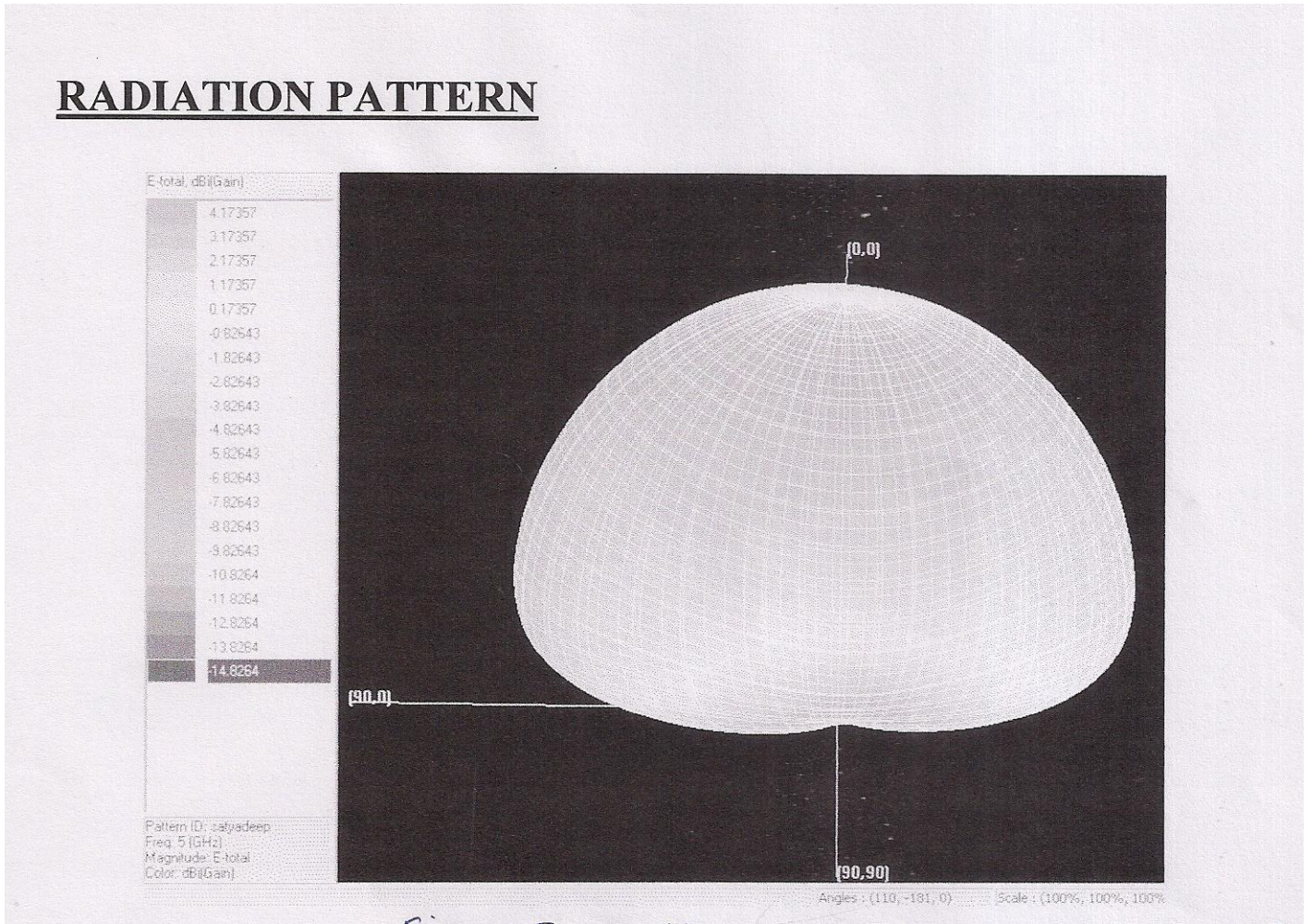


Fig 5: Three-dimensional radiation pattern

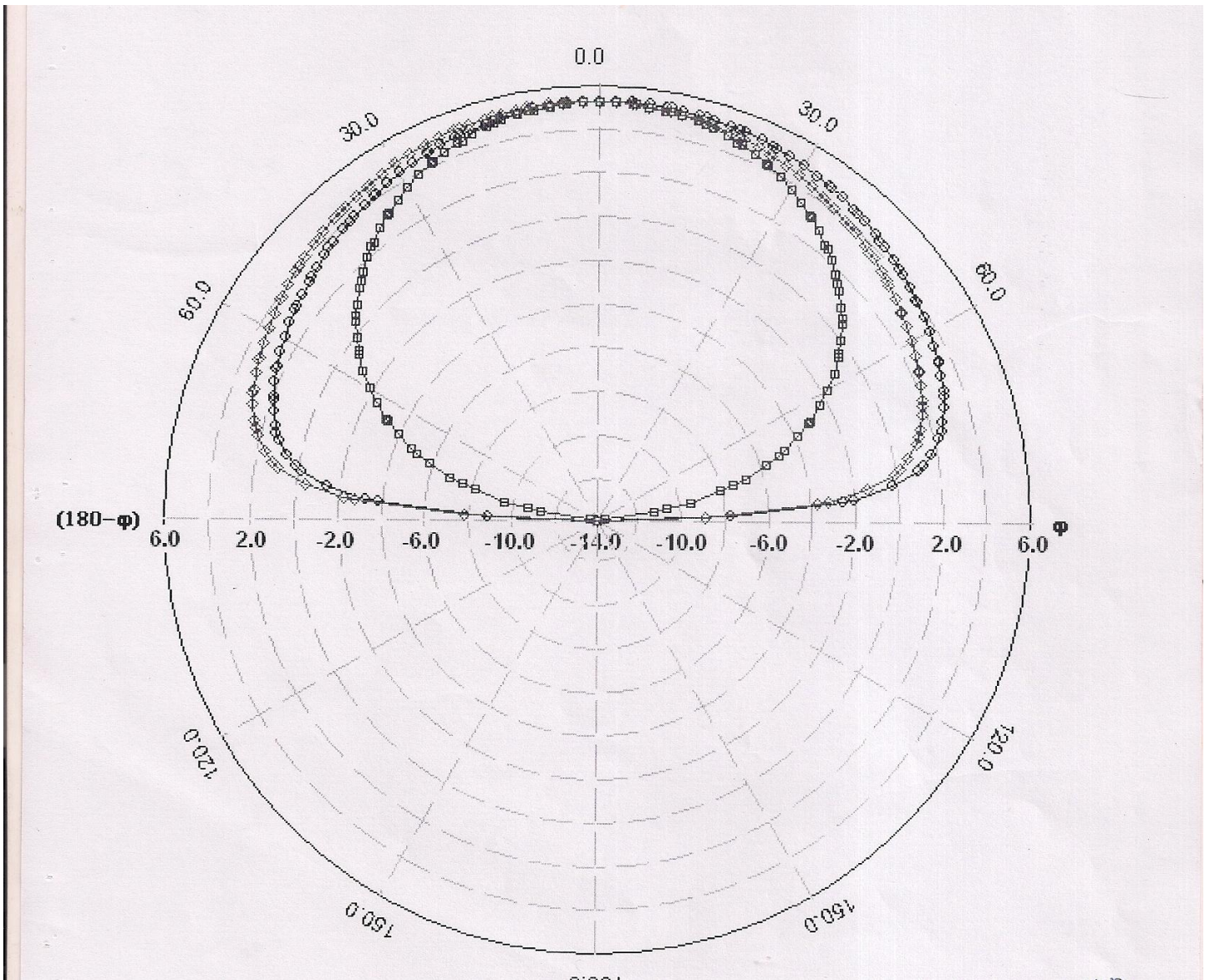


Fig 6: Two-dimensional radiation pattern

By observing 3-dimension and 2 dimension radiation pattern .it is seen that pattern is unidirectional, unimportant pattern plays an important role in next generation mobile communication and computing cost of power is saved due to unidirectional radiation pattern.

Figure 8 shows VSWR offered by antenna

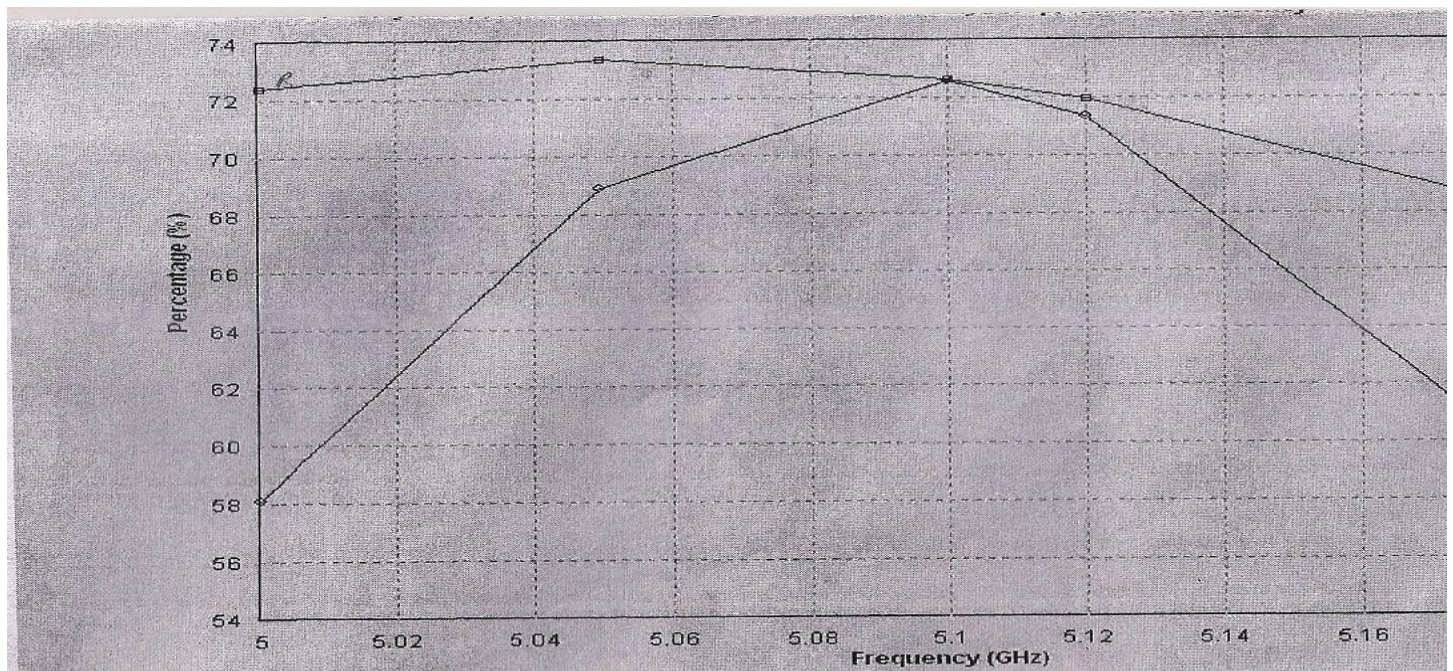
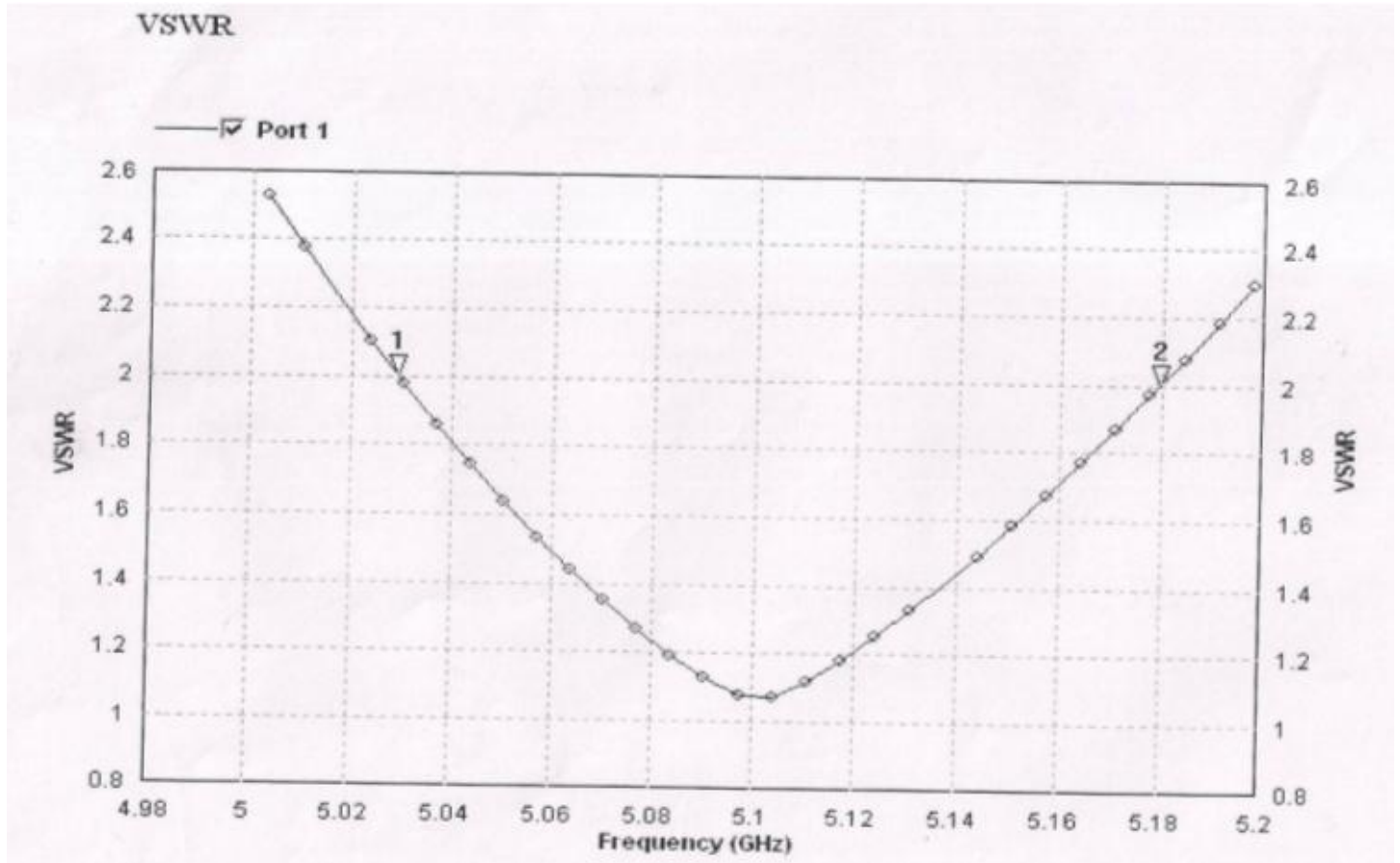


Figure 9 shows antenna and radiation efficiency

Antenna offers a VSWR less than 1.1 at a frequency of 5.102ghz,bandwidth improvement is observed ,it's shown in figure 8when there is improvement is bandwidth tracking errors are reduced a large extent when tracing errors are reduced to a large extent then mobile receiver is good aligned to a transmitter, then problem of tuning the receiver is reduced.

Antenna offers radiation efficiency of 72.6 % at a frequency of 5.102 GHz also proposed offers antenna efficiency of 72.6 % at a frequency of 5.102 GHz, antenna offers maximum antenna gain of 4.17db1.

V. CONCLUSION

It is seems that the design adopted for microstrip patch antennaare quite accurate .bandwidth of antenna improved by 2.95hence problem of tracking errors is are reduced to large extent this antenna can be used at 5.102ghz frequency for mobile satellite communication and computing application where the frequency of operation is 5.102ghz for an antenna to work properly the vswr must be less than two and return loss must be less than 10db only then the antenna will radiate or receive the power with minimum reflection .as designed antenna has a return loss of -30db at a frequency of 5.102,so this antenna is used in mobile satellite communication and computing applications where the weight is the main constraint .due to unidirectional radiation pattern microstrip patch antenna plays important role in next generation mobile communication and computing also due to unidirectional radiation paptern cost of power for mobile for communication is saved.

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