MAT JOURNALS

Journal of Analog and Digital Devices
Volume 2 Issue 2

Design of E-Shaped Patch Antenna with Multi Resonances

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Abstract

In this paper, we tend to designed, simulated, engineered and check 'E- shaped patch antenna with multi resonances' that provides 9 db graph gain. Our simulation and experimental investigation aimed to grasp the behavior of the 2 slits. The first frequency is 3.6GHz with 4.46dBi gain the second frequency is 6.8GHz with 4.98dBi gain, the third frequency is 6.93GHz with 5.558 dBi and the fourth frequency 7GHz with gain 5.3681 dBi.

Keywords: *Antenna, Microstrip patch antenna, E shape patch.*

INTRODUCTION

Slot antennas are known very good radiators and have been widely used in wireless communication devices planar constructions and array syntheses, MMICs. The substrate is a FR4 substrate. The microstrip line is laid symmetrically on the substrate strip. E shape patch antenna made up and experimentally ascertained for operation in AWS, GSM and WLAN [1]. Microstrip antenna arrays are widely used in many applications, such as satellite and wireless communications, radar, missiles, ISM BAND etc. [2]. Microstrip antennas also suffer from narrow impedance bandwidth, which can be improved significantly by employing coupled resonator structures such as stacked microstrip antennas or U- and E-slots-Loaded patches [1], [2]. Different patch structures such as E shaped are used for improved bandwidth of the antenna. [3]. Both E-shape and U-slot-Loaded single-layer rectangular microstrip patch antennas have shown the potential to provide 2:1 VSWR impedance bandwidths of 30%-35% on electrically thick substrate materials [1]-[4]. Wideband directed dipole antennas cannot easily maintain a stable radiation pattern over the operating frequency range [5]. There are several techniques in order to get maximum gain in spite of narrow bandwidth and difficulty of operating frequency range. Modifying the shape or by inserting a single or double shorting wall to the antenna are efficient at receiving good gain.

DESIGN PARAMETERS

Layout of the E shape microstrip patch antenna is seen in fig.1.The feeding line is close to the top of the antenna. As it can be seen in the figure, the length of the H1 is 19mm, H2 is 17.5mm, H3 is 6mm and H4 is 1.5mm. The width of the antenna, W1 is 49mm, W2 is 16.5mm W3 is 5mm, and separation width, W4 is 5.5mm. Air thickness is 10mm and air €r is 1.0. Substrate thickness is 1.8mm, €r is 4.6. Box is 495- 255. The total size of the antenna is 49x25mm. Table 1 demonstrates a parametric study in order to increase the gain. The distance between the top point of the antenna and the top point of the feeding line is varying. It provides good impedance matching and higher bandwidth.

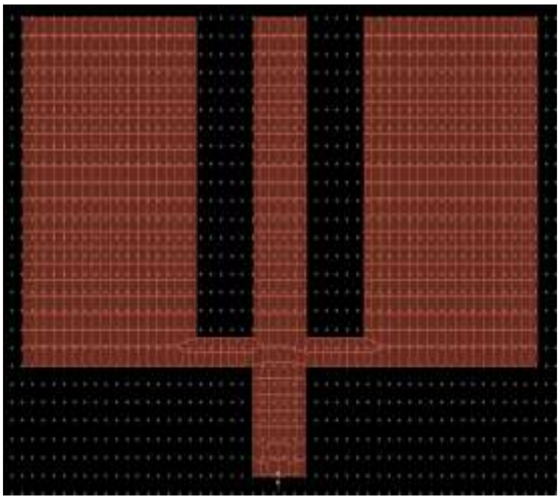

Fig 1 *Layout of E-Shape patch antenna*

SIMULATION AND MEASUREMENT RESULTS

According to millimeter changes in antenna size, we have observed parametric changes in the antenna's S11 in used frequencies. The results of these observations, we can observe a decrease and increases according to margin of error in the production stage in the frequency of 5. For instance, when the value of the h1 is decreased 1mm, antenna is not work in the values of 4.64 and 12.9 GHz but we observe that the gain of antenna is increased in the 10.1 GHz. in 15.0 GHz it cannot seen evident changes.

When the dimension of the h1 is increased, the gain is decreased in 4.64, 10.1, 12.9GHz and antennas are unavailable. In 4.64, 5.3 GHz, the 1mm decline in the h2, the gain decreased slightly. It is seen that in 10.1, S11 is decreased. In 12.9, antenna does not work but in15.0ghz, the value of the s11 is increased. The 1mm increasing of the h2 does not affect 4.64, 5.3 and 10.1 GHz but the antenna is unavailable in the 12.9 and 15.0 GHz. The reduction of h3 does not affect any frequency negatively. The increase h3 affects only S11 in the 10.1 GHz a little bit negatively.

The 1mm increase in h4 has no effect in 4.64GHz and 15.0 GHz but it affects other frequencies negatively. The reduction in the h4 value caused of decrease in all of frequencies. The 1mm reduction and increase in w1 value affected all frequencies negatively. The reduction in w3 decrease the S11 of 4.64 and it affects 5.3 and 12.9 values dramatically. The increase of w3 value affected only 15.0 and 4.64 GHz but it decreased the values of other frequencies.

The 2mm decreasing on the air affected to S11 positively but it affected gain a little bit negatively. The 2mm increase on the air cause of S11 and gain losses in all values. The air to 10 gives us maximum result. As it is shown in fig.2 & fig.3, simulated gain and directivity agree well with measurement.

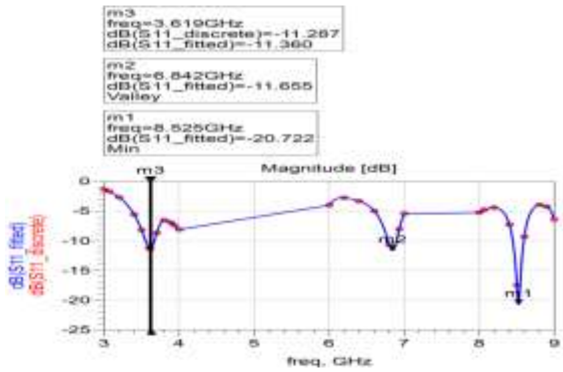

Fig 2 *Return loss of microstrip patch Antenna*

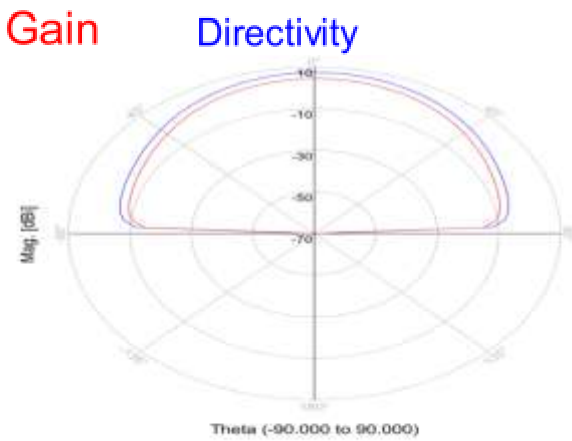

Fig3 *Gain &Directivity*

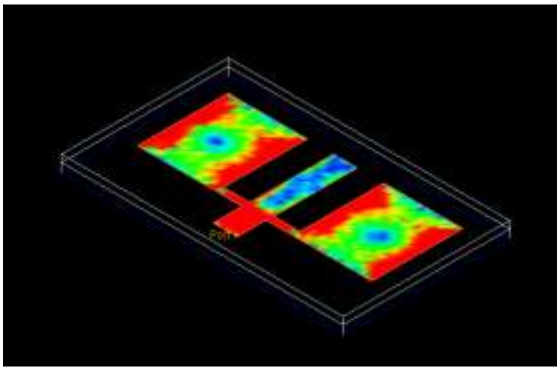

Fig 4 *Current distribution of microstrip patch Antenna*

CONCLUSION

In this work, E--shaped patch antenna with five resonances 3.6Ghz, 4.98Ghz, 6.93Ghz, 7Ghz), edge-fed, E shape microstrip patch antenna was designed, simulated built and tested in order to meet the design specifications. As seen in parametric studies, it can be achieved better results by playing with the size in the desired frequency range. A distinctive feature of the E shape microstrip antenna is working of many frequencies. Measurement results agree well with simulation results for most frequencies of S11, but the only significant measured gain was obtained at 6.93 GHz.

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