Review Paper on Design and Analysis of Microstrip Patch Antenna for Different Applications

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Abstract – As per Micro strip Patch antenna (MPA) provides low profile and low volume, now a day so it is use in the communication devices. It is premeditated that MPA is focused on planning compact sized micro strip antenna. A printed monopole antenna can be used in wireless communication devices in various operating frequency ranges. In this speedy dynamic world in wireless communication dual or multiband antenna has been playing a vital role for wireless service needs applications. In this paper, we will briefly study the various performance parameter of micro strip Antenna such as Return loss, VSWR, radiation pattern are simulated by using MATLAB on different geometries.

Index Terms – MPA, VSWR, MATLAB, Monopole antenna.

1. INTRODUCTION

A micro strip patch antenna (MPA) is commonly used because it is lightweight, low profile and simple structure antennas with reliability, mobility and good efficiency. They are most appropriate for aerospace and mobile applications. It contain conducting patch on a grounded dielectric substrate [7]. The design of a micro strip antenna initiates by deciding used for the antenna so the size of the patch. Due to the fringing fields on the radiating edges of the antenna there is a line extension related to the patch.

The conducting patch can be of any shape but in fact the rectangular, circular and triangular are commonly used shapes because these shapes are less complex and effective [3]. In this design and analysis has been done for rectangular, circular and triangular shaped patches to find out the best one on the basis of various antenna parameters. The performance of a patch antenna depend not only the shape of antenna but dielectric constant of the substrate, dimensions of the dielectric substrate and ground are also affects the performance of the patch antenna. It may be possible that all shapes gives different performance on different frequencies. Therefore, all the antennas are designed for 2.4 GHz.

The most commonly employed micro strip patch antenna is a rectangular patch [1]. The rectangular patch antenna is approximately a one wavelength long section of rectangular micro strip transmission line. The antenna is loaded with a dielectric as its substrate, the length of the antenna decreases as the relative dielectric constant of the substrate increases. When the air is the antenna substrate the length of the rectangular micro strip antenna is approximately one half of a free space wavelength. The design of Double E- shape patch antenna is as shown in figure below.

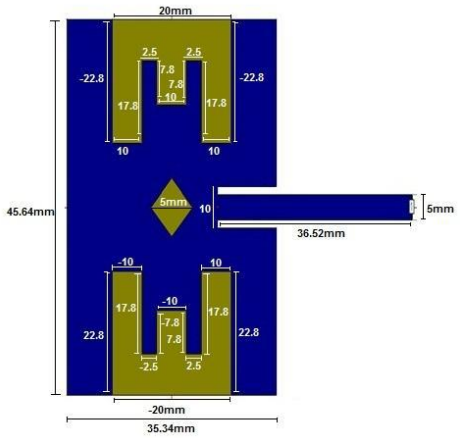

Figure 1 Double E-shape patch antenna

2. STEPWISE PROCEDURE

Step 1: Calculation of the width of Patch (W)-The width of the Micro strip patch antenna is given as

For f o=2.4GHz, ε r=4.4

$$W = \frac{c}{2f_0\sqrt{\frac{\varepsilon_r+1}{2}}} \qquad (1)$$

Step 2: Calculation of effective dielectric constant: Fringing makes the micro strip line look wider electrically compared to its physical dimensions. Since some of the waves travel in the substrate and some in air, an effective dielectric constant is introduced, given as:

$$\varepsilon_{reff} = \frac{\varepsilon_r+1}{2} + \frac{\varepsilon_r-1}{2}\left[1+12\frac{h}{W}\right]^{-\frac{1}{2}} \qquad (2)$$

Step 3: Calculation of Length of Patch (L)-The effective length due to fringing is given as:

$$L_{eff} = \frac{c}{2f_0\sqrt{\varepsilon_{reff}}} \quad (3)$$

Substituting ε_{reff} = 4.4, c = 3.00e+008 m/s and f_0 =2 GH

Step 4: Calculation of ΔL - Due to fringing the dimension of the patch as increased by ΔL on both the sides, given by:

$$\Delta L = 0.412h \frac{(\varepsilon_{reff}+0.3)(\frac{W}{h}+0.264)}{(\varepsilon_{reff}-0.258)(\frac{W}{h}+0.8)} \quad (4)$$

Step 5: Calculation of Substrate dimension-

For this design this substrate dimension would be

$$L_S = L + 2 * 6h \quad (5)$$

3. LITERATURE SURVEY

AlakMajumder[1] stated that, obtainable the design of a rectangular patch antenna covering the 2GHz−2.5 GHz frequency spectrum. It has been shown that this design of the rectangular patch antenna produces a bandwidth of approximately 2% with a stable radiation pattern within the frequency range. The design antenna exhibits a good impedance matching of approximately 50 Ohms at the center frequency. This antenna can be easily fabricated on substrate material due to its small size and thickness. The simple feeding technique used for the design of this antenna make this antenna a good choice in many communication systems.

Author's proposed a micro strip patch antenna with clockwise rotated E-shape radiating patch with I-cut on middle slot using at 3.5 GHz. [2]. A Micro strip Patch Antenna of design Clockwise rotated E shaped antenna with I-cut slot on the radiating plane of size 19.99×26.08 (L×W) mm2 has been proposed using IE3D Zeland Program Manager. In the simulation and results proposed antenna satisfies the VSWR < 2 requirement from 2.9 to 3.1 GHz and Return loss -36.12 dB having a bandwidth 66.6%.the proposed antenna has given better performance than the ordinary patch antenna.

Akansha Gupta, Rahul Vishnoi [3], they proposed antenna is designed by cutting two V shaped slots in Rectangular patch. Cutting of these slots in antenna increases the current thickness h=2.4 mm. The coaxial probe feeding is used for optimum results. It is observed that a probe feed, V shaped slotted rectangular micro-strip patch antennas is presented. The proposed antenna has a compact size of (8.6072 x 15.33 x 2.4) and it can effectively covers the Satellite Communication, and the application of C band of communication system. It shows RL of -28dB, VSWR of 1.08, Efficiency of 60%, Directivity of 4dBi and many other related parameters.

NiveditaMishrav [4], achieved the micro strip patch design is by using probe feed technique. The double layer approach is used designing at 3.2mm height, the method to designing is using mirror image shape of patch on substrate(FR4) for improving return loss larger impedance bandwidth .any single structure having no mirror image cannot alter the performance of simple patch. The two E shaped structures are used in this work and result is in good agreement for parameter as return loss, VSWR with respect of frequency. These antennas have several applications in the today's environment like in s band.The designing parameters as VSWR, return loss and impedance bandwidth are improved using E shape patch designs.

NilimaArunBodhaye, Prasanna L Zade [5], stated a new approach to multiband antenna structure is shown for increasing the number of operating frequency bands and improvement in return loss. The comparison between patch antenna with H-shape slot and with double I-shape slot is shown. From comparison table, the conclusion the future aspect of this work is to increase the number of operating frequency bands by made change using different shaped structures in place of H-slots and I-slots. This structure can be further modified by increasing the switch-ability of radiating patch by connecting PIN diode or RF-MEMS switch in switchable slot. The modified antenna are very valuable for many modern wireless applications and radar system applications, such as object detection, secure communication, multi frequency communication and multi frequency communication.

S. Kumar, D. Chandra [6], presented a Seljuk star shape slotted micro strip patch antenna on a rectangular shape glass epoxy FR4 substrate having thickness of 1.6mm. Probe feed technique is used in this slotted antenna for multiband behavior. The proposed antennas have slotted geometry. The performances of the said antenna are studied for different number of slots. It is found that the as the number of slots are increased, the operational frequency band also increases. For zero slot three resonant frequency bands occur, for single slot five resonant bands occurs and for five slots six resonant frequency bands occurs. These antennas can be used at various application such as GSM and WLAN-IEEE-802.11. Therefore the proposed antennas have satisfactory performance for use as a multiband communication antenna.

RajanFotedar, Pankaj Singh Garia, Rahul Saini, A. Vidyarthi, R. Gowri [7], proposed work shows design and comparative performance analysis of micro strip patch antennas with different shapes of patch to find out the best shape. Work design and analysis has been done for rectangular, circular and triangular shaped patches to find out the best one on the basis of various antenna parameters. The results shows that the Rectangular patch shows good return loss and radiation efficiency. Directivity is also good in rectangular patch. In the case of triangular patch return loss is very good but radiation efficiency and directivity are average. Circular patch return loss is not good as rectangular and triangular. Radiation efficiency

is better than triangular patch but below than rectangular. Directivity is better than rectangular and triangular patch.

Type of shape	VSWR	Return loss in db
H	1.33	-16.34
I	1.37	-15.94
Star	1.43	-16.98
Mho	< 2	-15.83
V	1.08	-28
E	1.031	-34

Table 1VSWR and return loss for various shape patch antenna.

4. CONCLUSION

With the duties of this paper, we need to further scrutinize various shapes on the basis of various parameters such as return loss, VSWR. This paper shows the survey of VSWR and returns loss for various Shapes patch antenna. It also shows its pros, cons and future work need to be done for improved results.

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