Design of Rectangular Microstrip patch Antenna Using Shorting Method

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Abstract:

A Rectangular microstrip patch antenna using shorting wall technique have been studied and analyzed in this paper. The antenna is intended to be used in communication applications; in order to decrease the overall size of the antenna shorting wall technique is used. The study of the proposed antenna configuration is analyzed by using IE3D simulation software, which is based on the Method of Moments (MOM). Rectangular Microstrip Antenna is designed with simple coaxial probe feed. The material used is RT Duriod 5870/Rogers which have the dielectric constant of 2.33 with thickness of 3.2 mm.

keywords: microstrip patch, shorting wall, Method of Moment, coaxial probe fed.

I. INTRODUCTION

Now a days mobile communication and other defense and satellite communication systems need a small-sized MSA. An increase in growth of the wireless radio communication systems is currently observed in the microwave band. In the short range communications, microstrip antennas are main components, which must be small, low profile, and with minimal fabrication costs. The microstrip patch antennas are used in communication applications due to their compact structure. The flexibility afforded by microstrip antenna technology has led to a wide variety of design and techniques. The main limitations are low efficiency and narrow impedance bandwidth. The bandwidth of the microstrip antenna can be increased and by decreasing the size of the antenna using various techniques such as by loading a patch, by using a thicker substrate, by reducing the Dielectric constant,etc. However, using a thicker substrate causes generation of spurious radiation and there are some practical problems in decreasing the dielectric constant.

At lower frequencies the size of the microstrip patch antennas becomes very large. To design a smaller antenna at these frequencies, conventional MSA configurations, such as rectangular and circular configurations, need to be modified. There are various techniques to reduce the size of the microstrip antennas. A common technique to reduce the overall size of a micro-strip patch antenna is to terminate one of the radiating edges with a shorting wall.

II. SHORTING WALL MICROSTRIP ANTENNA DESIGN

A rectangular microstrip antenna operating in the fundamental TM_{10} mode has a resonant length of $\lambda/2$; the voltage distribution along its length is shown in Figure 1(a). The zero potential field is along the line OO, which is in the middle of the resonant length. By shorting the patch along the zero potential line OO to the ground plane and by using the half of the patch, a compact short loaded microstrip antenna is realized with $\lambda/4$ length is shown in Figure 1(b). The shorting can be realized either by using a shorting plate or by placing number of shorting posts. By using this shorting wall RMSA configuration we simulate different combinations.

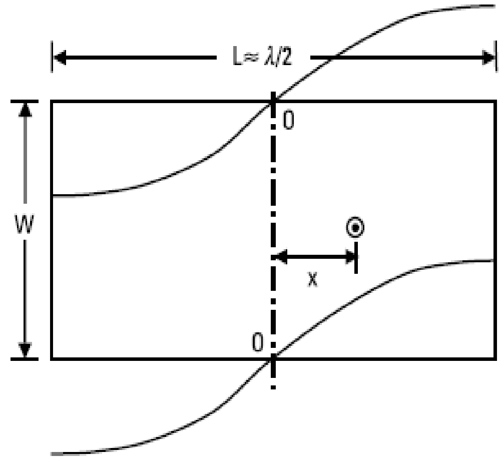

Fig.1 (b). Field distribution of RMSA along length

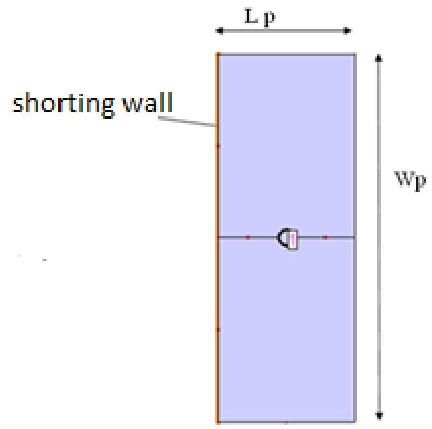

Fig.2. Top view of the RMSA with shorting wall

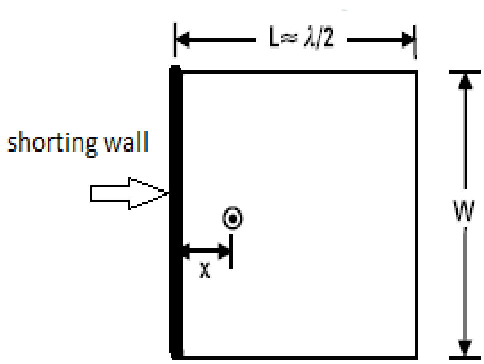

Fig.1 (b). RMSA with shorting wall

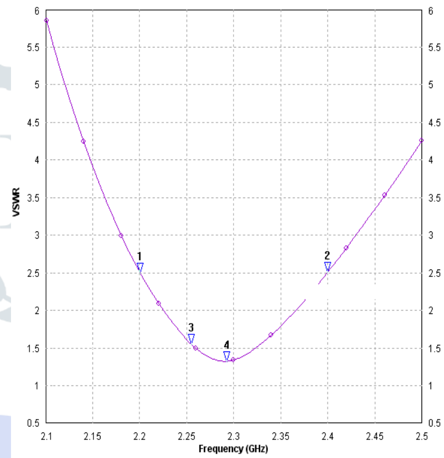

Fig. 3(a). Simulated VSWR Plot for RMSA

III. SIMULATED RESULTS

The RMSA using shorting wall technique is simulated in the IE3D software and its top view is shown in the Figure 2. Here we are used probe feed technique for RMSA. In order to analyze the RMSA using shorting wall technique, it is compared with normal RMSA design. The dielectric material selected for the design is RT Duriod 5870/Rogers which have the dielectric constant of 2.33 with thickness of 3.2 mm. The simulated results of normal RMSA and shorted wall RMSA is analyzed by comparing the results shown in Figures 3(a), 3(b), 4(a), 4(b), 5(a), 5(b) shows the simulated VSWR, Radiation characteristics and Gain respectively.

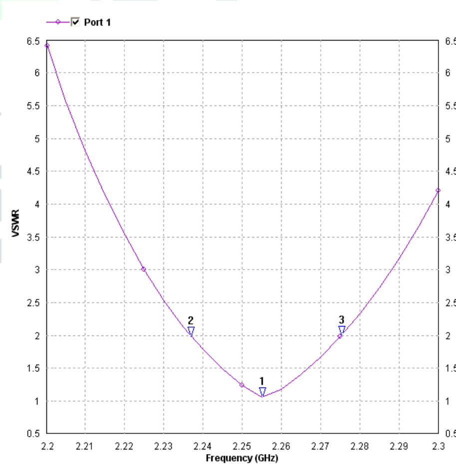

Fig. 3(b). Simulated VSWR Plot for shorted wall RMSA

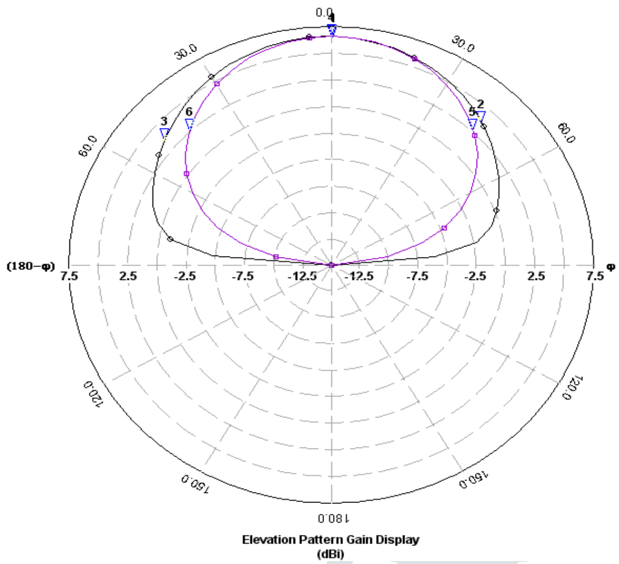

Fig. 4(a). Simulated Radiation pattern Plot for RMSA

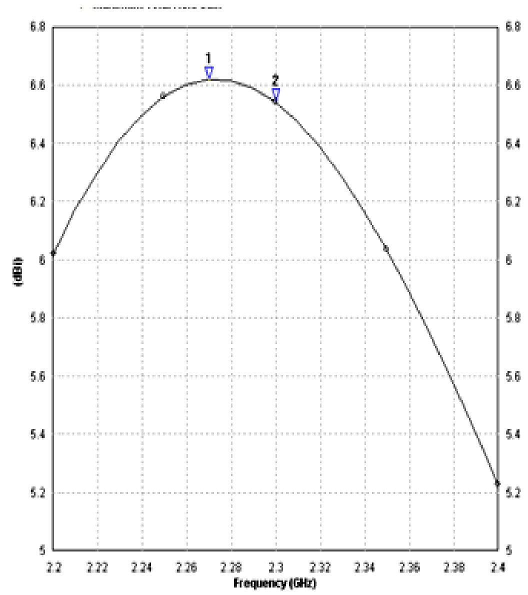

Fig. 5(a). Simulated Gain Vs Frequency plot for RMSA

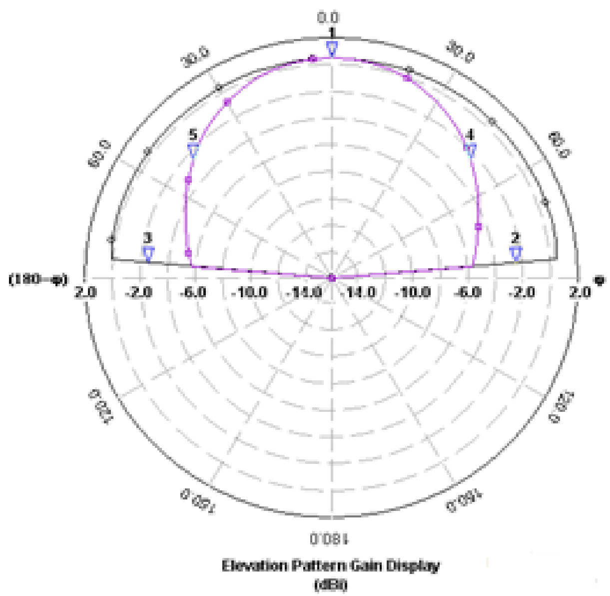

Fig. 4(b). Simulated Radiation pattern Plot for shorted wall RMSA

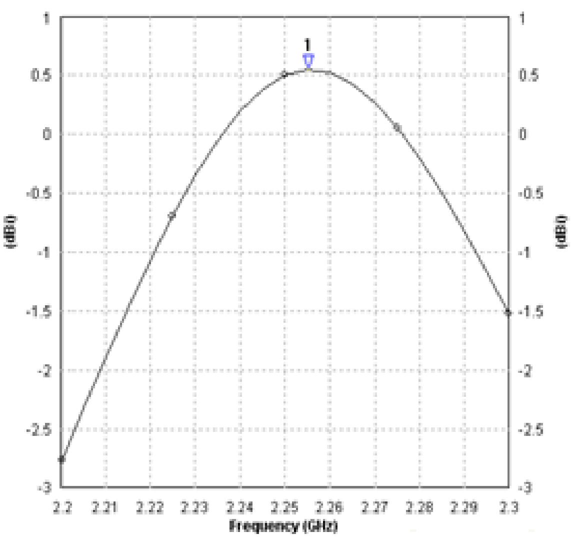

Fig. 5(b). Simulated Gain Vs Frequency plot for shorting wall RMSA

From Fig 3(a), 4(a), 5(a) the simulated VSWR bandwidth is seen to be 106MHz for 2:1 of the centre frequency , gain of the antenna is about 6.77 dBi and minimum half power beam width is 77^{o} in H Plane, 84^{o} in E Plane at operating frequency respectively for normal RMSA and from Fig 3(b), 4(b), 5(b) the VSWR bandwidth is 273MHz for 2:1, gain of the antenna is 0.22 dBi and half power beam width is 95^{o} in H plane and 150^{o} in E plane. From this we observed by intorducing shorting wall to the normal RMSA there is a increse in the VSWR and Half power beamwidths. And also observed that the efficiency of the antenna is droped that means the gain is very low but the overal size is comes down.

IV. CONCLUSION

A rectangular microstrip antenna using shorting wall technique is simulated, and also compared the shorted wall RMSA with normal RMSA using IE3D simulation analysis.

ACKNOWLEDGEMENT

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