Design Of Microstrip Patch Antenna Array

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ABSTRACT

The microstip antenna has been studied in the past few decades, still has a huge potential for developments. For satellite communication high directivity is needed. To achieve high directivity number of single elements arranged in an array configuration.

The paper presents design of a rectangular Microstrip patch antenna array. Array is designed around a operating frequency of 2.40 GHz uses two microstrip patch antenna elements of rectangular shape is presented with simulated results.

KEY WORDS

Microstrip patch antenna, array

1. Introduction

In point-to-point communication systems, satellite communication, antenna with high directivity is needed [1]. The basic configuration of a microstrip antenna is a metallic patch printed on a thin dielectric substrate which is grounded. The element was fed with either a coaxial line through the bottom of the substrate, or by a coplanar microstrip line [4]. Microstrip antennas are considered as the most common types of antennas due to advantages of light weight, low cost, planar configuration, easy of conformal, suitable for arrays, easy for fabrication, and easy integration with microwave monolithic integrate circuits (MMICs) [2] [3]. They have been widely employed for the civilian and military applications such as television, broadcast radio, mobile systems, global positioning system (GPS), radio-frequency identification (RFID), satellite communications, surveillance systems, direction founding, radar systems, remote sensing, missile guidance, and so on [5]. Despite the many advantages of typical microstrip antennas, they also have three basic disadvantages: narrow bandwidth, low gain, and relatively large size.

2. Proposed single element patch

A simple rectangular linear polarized microstrip patch antenna is designed to operate at 2.4GHz. As to develop a light weight antenna, FR4_epoxy is used as the substrate material as it is light in weight. So it is used as substrates for the fabrication of antennas where light weight, low loss, reduced cost is required. The length and width of the patch are 39mm and 28.2mm respectively. The feed point is 7.5mm from the centre of the patch as shown in Fig1

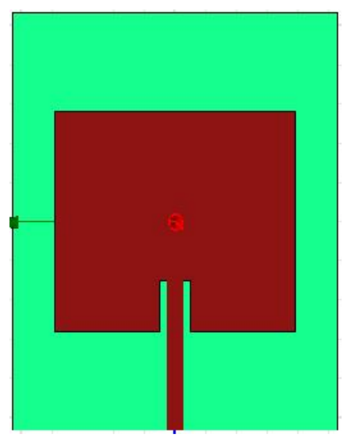

Fig. 1 Rectangular Microstrip Patch Antenna

Simulation of this antenna has been carried out in HFSS.

The simulation results of a single radiating element are given in the following section as shown below.

SIMULATION RESULTS

For single radiating element

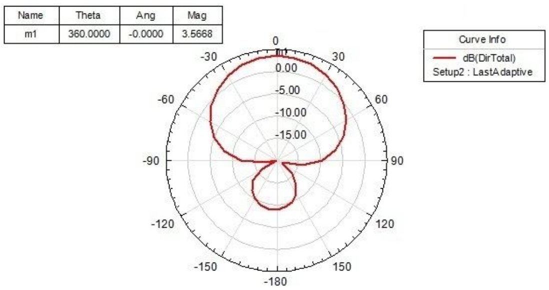

Fig2:Radiation pattern

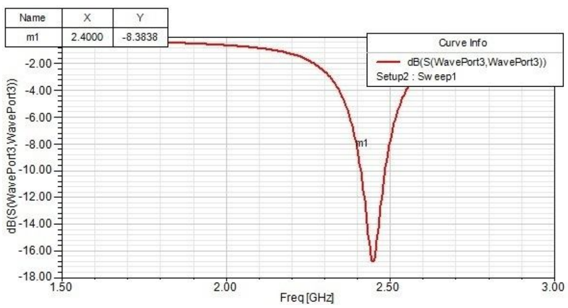

Fig3:Return loss of rectangular Microstrip Antenna

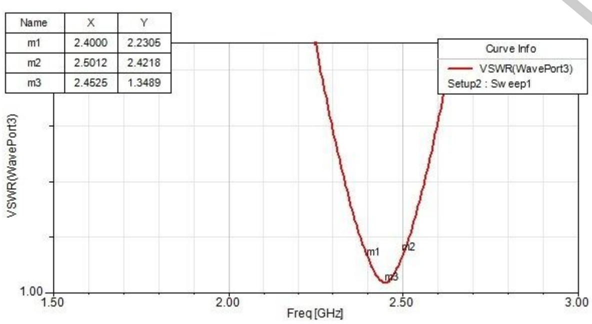

Fig4: VSWR Plot

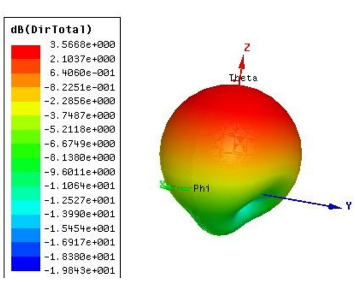

Fig5:Directivity

1 x 2 Microstrip Patch Array

The array is simulated by arranging these two microstrip line feed patch antennas in linear configuration. Each patch element is excited individually using separate port and the integrated response i.e. overall radiation pattern of the 2 element linear array antenna is simulated using HFSS software.

Simulation Results for 1x2 Array

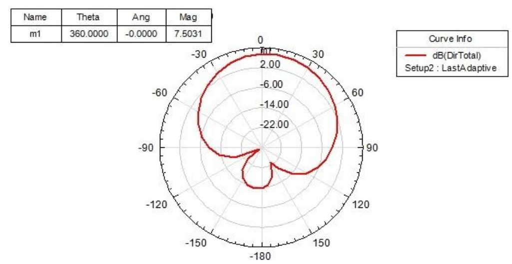

Fig6 : Radiation Pattern

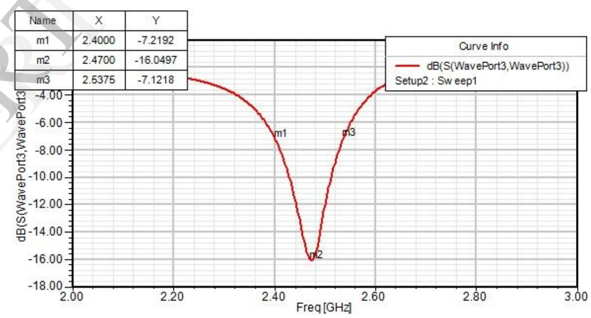

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Fig7 :Return loss

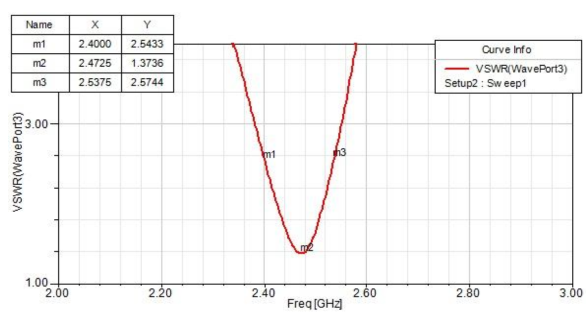

Fig8 : VSWR

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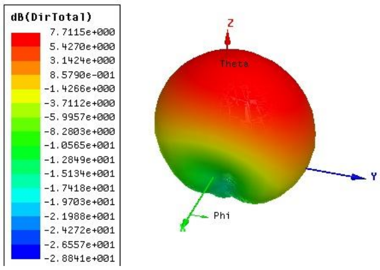

Fig9 : Directivity

Table 1 : Comparison of characteristics obtained for single element and 1 x 2 array.

Parameter	**Single Patch**	**1 x 2 Patch**
Return Loss	-8.3838	-7.2192
VSWR	2.2305	2.5433
Gain	3.5668	7.5031
Directivity	-1.983×10^{1} to 3.5668	-2.884×10^{1} to 7.7115

Fig. 2, 3, 4, 5 shows simulated results of single radiating element. The corresponding response of 1 x 2 microstrip patch array are shown in fig. 6, 7, 8, 9. The comparison of the parameters obtained for single element and 1 x 2 array are shown in table 1.

4. Conclusion

The performance of the single radiating element and 1 x 2 microstrip patch array obtained using HFSS simulation software. Hence from the results performance of 1 x 2 array is better than single radiating element.

5. References

[1] E. A. Soliman, A. Vasylchenko, V. Volski, G. A. E. Vandenbosch, and W. De Raedt, "Series-Fed Microstrip Antenna Arrays Operating at 26 GHz", *IEEE Antennas and Propagation Society International Symposium (APSURSI)*, 2010, Page(s): 1 – 4.

[2] I. J. Bahl and P. Bhartia, Microstrip Antennas, Artech House, 1980.

[3] K. R. Carver and J.W.Mink, "Microstrip antenna technology,"IEEE Transactions on Antennas and Propagation, vol. 1, no. 1,pp. 2–24, 1981.

[4] D. M. Pozar, "Microstrip antennas," Proceedings of the IEEE,vol. 80, no. 1, pp. 79–91, 1992.

[5] R. Garg, I. Bhartia, I. Bahl, and A. Ittipiboon, Micro-Strip Antenna Design Handbook, Artech House, Boston, Mass, USA,2001.