Design of Dual Frequency Dual Linear Polarization Microstrip Patch Antenna

Dr. Shridhar E. Mendhe
Department of Electronics and Communication Engineering
LDRP Institute of Technology and Research, Gujarat, India

Abstract— In today's latest communication technology, antennas play a most important role to create a communication link between transmitter & Receiver. Microstrip antennas are the most useful for mobile communication & Space communication applications because of their small size, light weight and lower power handling capacity. There are various shapes of microstrip antenna which improves the gain and bandwidth. In this paper, an innovative design of dual frequency dual linear polarization rectangular microstrip patch antenna is investigated. Dual linear polarized antennas offer low output correlation and high diversity gain. In this antenna design The Rogers RO3003 material of dielectric constant 3 has been used as the substrate of the antenna. Investigation is carried out related to bandwidth, gain and directivity the proposed antenna exhibits wide percentage bandwidth of approximately 2.49% at 2GHz and 4.99% at 3 GHz.

Key words: Microstrip Patch Antenna, Polarization, Band Width, Gain, Return Loss

I. INTRODUCTION

Microstrip antenna has advantages such as small size, light weight, easy to manufacture, very low fabrication cost, supports for linear and circular polarization. In spite of these advantages microstrip patch antennas have some disadvantages such as narrow bandwidth and low gain [1] [2] [3]. Because of the fast development in satellite communication and wireless communication there is a maximum demand for light weight, small size & low cost antennas which gives the highest performance over large frequency band. In coming years the microstrip antennas are commonly used to develop millimeter size, Monolithic Integrated circuits antenna for Microwave communication, radar & Navigational aids as well as communication purposes. The Compact dual frequency, dual polarization is very suitable for mobile & wireless communication.

There are various methods to increase the bandwidth and gain of antennas, including increase of the substrate thickness, the use of a low dielectric substrate, the use of various impedance matching and feeding techniques, the use of multiple resonators, use of superstrates and use of edge coupled patches [1] [2] [3]. To overcome the above problem, The Compact dual frequency, dual polarization is proposed. This method is chosen to investigate how the Compact dual frequency, dual polarization configuration can improve the gain, bandwidth & all other parameters of a microstrip antenna.

In this paper new design of dual frequency and dual polarization microstrip patch antenna is analyzed and given in-detail explanation of antenna radiation pattern measurement techniques used to determine the performance of dual frequency, dual linear polarized antennas. The performance is antenna is studied by Return loss, bandwidth, Radiation pattern & Gain. feed point and the parameters are adjusted in order to obtain optimum results.

II. ANTENNA DESIGN

The configuration of the proposed dual frequency, dual linear polarized antenna along with its design parameters and co-ordinate system is shown in Figure 1. As is shown in Figure 1, the antenna consists of the patch with two ports and the proposed antenna excited with these ports. Figure 2 shows signal frequency given at 1st port is 2 GHz & at 2nd port 3 GHz frequencies. This patch follows the dual linear polarization. Antenna Substrate is RO3003 of 60mil thickness. Patch is excited in the center of length and width for generation of TM_{10} and TM_{01} as per required Linear polarization.

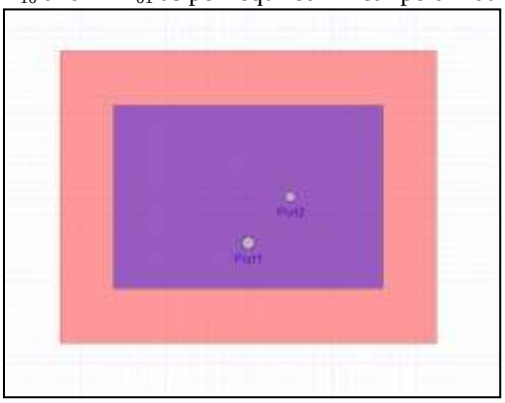

Fig. 1: Geometry of proposed dual frequency, dual linear polarized antenna with two ports.

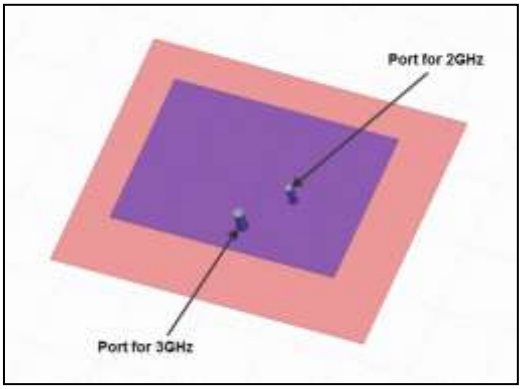

Fig. 2: Geometry of proposed dual frequency, dual linear polarized antenna with frequencies 2GHz & 3 GHz at two ports.

III. SIMULATION RESULTS

All of the simulations are performed by a HFSS software. The return loss of the proposed dual frequency, dual linear polarized antenna at 2 GHz frequency is shown in Figure 3. The obtained result shows that the bandwidth at -10dB of this antenna is in the frequency range from 1.98 GHz to 2.03 GHz, which covers the bandwidth of 0.05 GHz.. The return loss of the proposed dual frequency, dual linear polarized antenna at 3 GHz frequency is shown in Figure 4. The obtained result shows that the bandwidth at -10dB of this antenna is in the frequency range from 2.93 GHz to 3.08 GHz, which covers the bandwidth of 0.15 GHz.. The gain of the proposed dual frequency, dual linear polarized antenna is shown in figure 5 and figure 6, at frequency 2 GHz the gain is 2.4552 dBi and at frequency 3 GHz the gain is 4.2216 dBi. The Figure 7 and Figure 8 shows shows the smith chart of proposed antenna, which shows the input impedance of 1.0659 + *j*0.1 Ω at resonant frequency 2 GHz and input impedance of 1.0216+j0.0381 at 3 GHz.. The smith chart in Figure 7 & 8 shows that the antenna is dual linearly polarized.

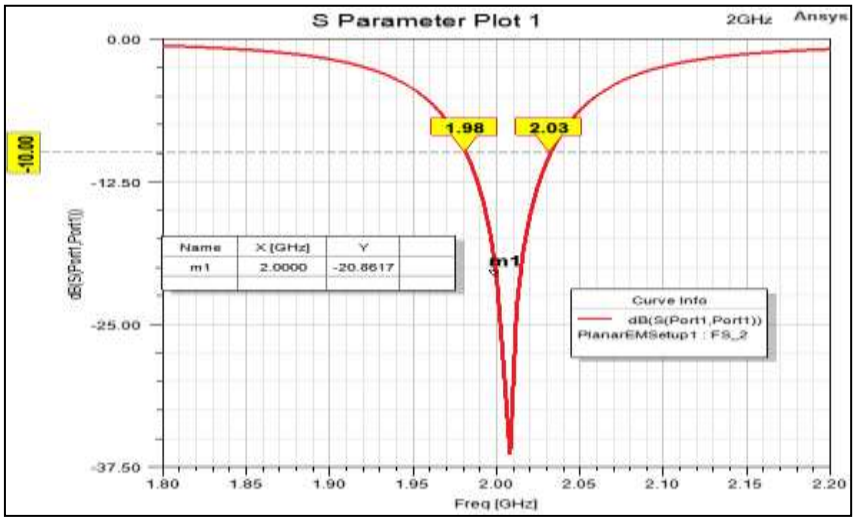

Fig. 3: Return loss plot of the proposed dual frequency, dual linear polarized antenna at 2 GHz frequency.

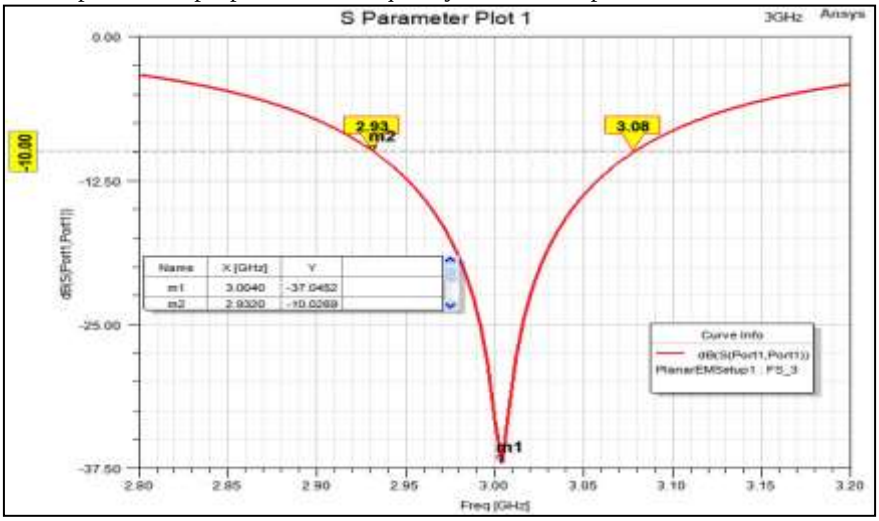

Fig. 4: Return loss plot of the proposed dual frequency, dual linear polarized antenna at 3 GHz frequency.

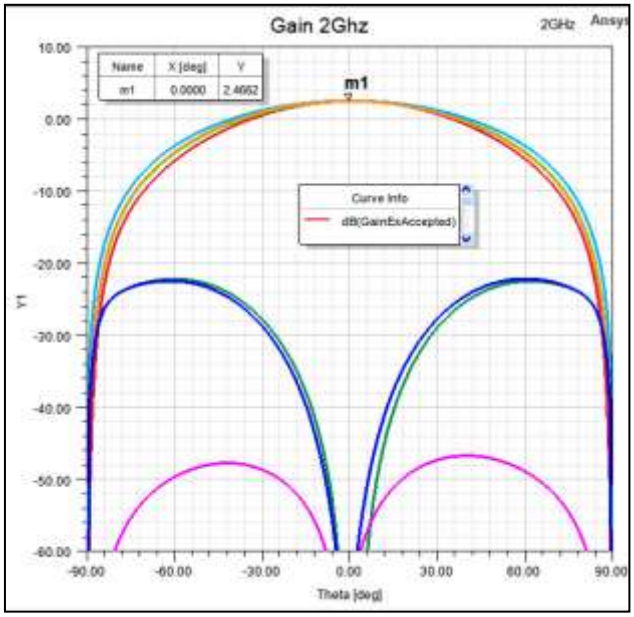

Fig. 5: Gain plot of the proposed dual frequency, dual linear polarized antenna at 2 GHz frequency.

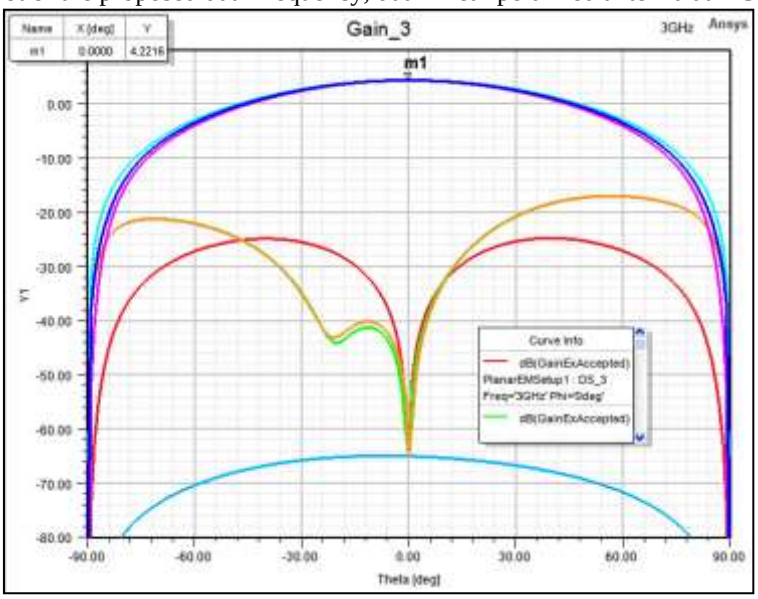

Fig. 6: Gain plot of the proposed dual frequency, dual linear polarized antenna at 3 GHz frequency.

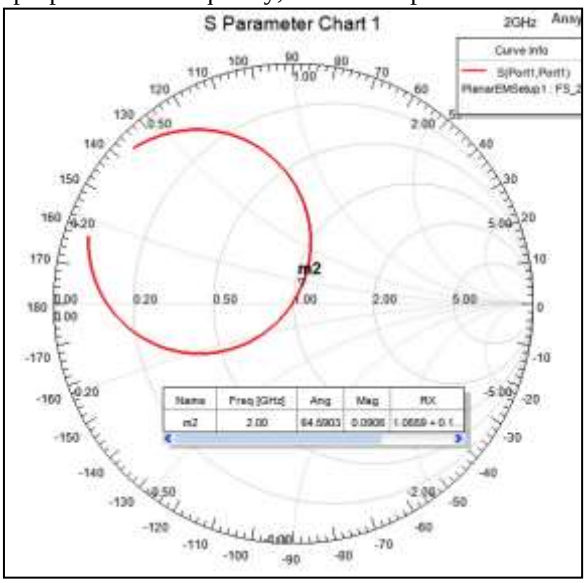

Fig. 7: Smith chart of the proposed dual frequency, dual linear polarized antenna at 2 GHz frequency.

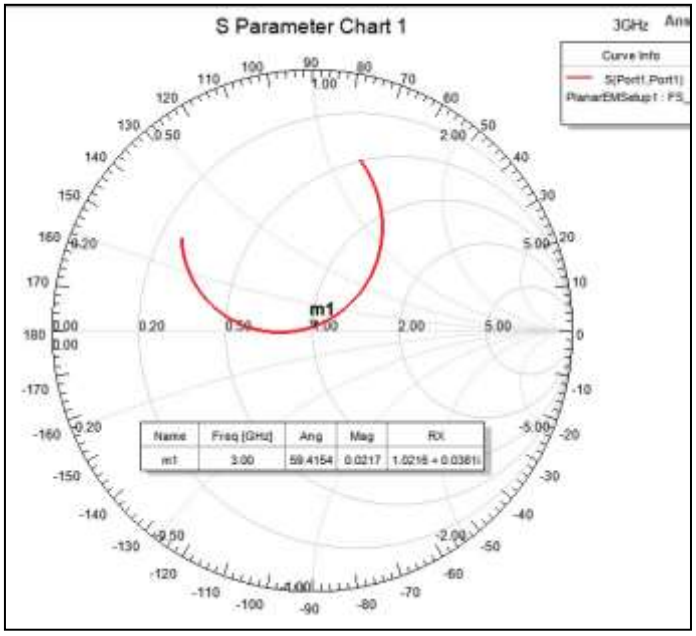

Fig. 8: Smith chart of the proposed dual frequency, dual linear polarized antenna at 3 GHz frequency.

IV. CONCLUSION

In this paper, dual frequency, dual linear polarized antenna is presented. The antenna achieves extremely wide frequency bandwidth and good radiation characteristics in terms of gain. by simulation, the antenna demonstrated a bandwidth of 0.05 GHZ at frequency 2 GHz and 3.08 GHz at 3 GHz frequency. for a VSWR < 2 and the at frequency 2 GHz the gain is 2.4552 dBi and at frequency 3 GHz the gain is 4.2216 dBi. According to the results obtained, using the design method presented in this paper can extremely increase the impedance bandwidth and gain of a microstrip antenna at frequency 3 GHz.

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