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Monopole Antenna with Modify Ground Plane

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Abstract

This paper presents on modified the ground plane of monopole antenna with varying the shape and length. Basically the length of ground plane of monopole antenna is equal and greater than λ/4. Here analyzed a different ground plane of monopole antenna that is provided an efficient bandwidth with sufficient return loss.

Keywords: *Monopole antenna, return loss, spectrum analyzer.*

1 Introduction

Monopole is an Omni-directional antenna which has the same gain in every direction. Many methods are used to improve the performance of monopole antenna. Here the basic idea of varying the return loss of antenna by modifying the length and shape of ground plane that is provided a batter bandwidth with sufficient return loss. This research are investigated such type of monopole antenna. Bandwidth improvement is about 37.15%, 56.08% and 70.12% respectively in different ground plane.

2 Antenna Design

The monopole antenna constructed from the copper wire of 1.5 mm diameter, resonated at 1.3 GHz frequency in L band (1-2 GHz). The length of monopole is calculated by "λ/4" [1] with different ground plane of various size is being used (as per designing parameter of monopole) [2]. First design a rectangular ground

shape monopole antenna having a 5×5 cm ground plane of PCB with 50 mm length of antenna as shown in Fig. 1.

Fig. 1 Monopole antenna with PCB based ground plane

Other types of antenna with modifies ground plane such as the circular and rectangular metal sheet. Design a monopole antenna has circular ground plane of λ/4 diameter as shown in Fig. 2 and with rectangular ground plane of 15×15 cm as shown in Fig. 3. In every design of antenna the height of radiator is always "λ/4" [3].

Fig. 2 Monopole antenna with circular ground plane

Fig. 3 Monopole antenna with rectangular ground plane

3 Analysis

The return loss of the monopole antennas was measured with FS315 spectrum analyzer connected by SWR (50 Ω) bridge as shown in Fig. 4. Spectrum analyzer operated at minimum hold position for all measured values.

Fig. 4 Experimental set up

The resonant frequency of monopole antenna is 1.3 GHz at PCB ground plane with 14.75 dB return loss as shown in Fig. 5.

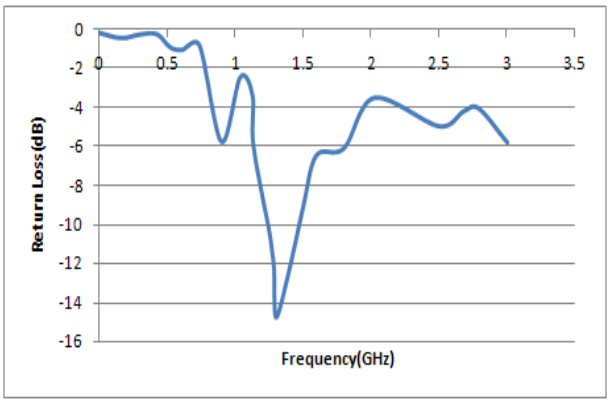

Fig. 5 Return loss Vs Frequency response at PCB ground plane

The return loss of monopole antenna with circular metal sheet ground plane is 18.23 dB at same frequency (1.3 GHz), as shown in Fig. 6.

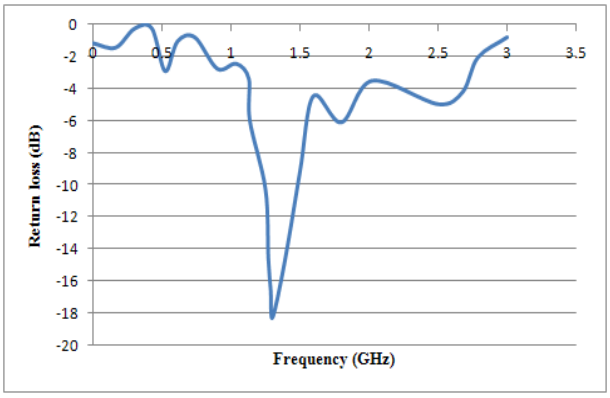

Fig. 6 Return loss Vs Frequency response at circular metal sheet ground plane

The resonant frequency of monopole antenna is 1.3 GHz at rectangular metal sheet ground plane with 43.90 dB return loss as shown in Fig. 7.

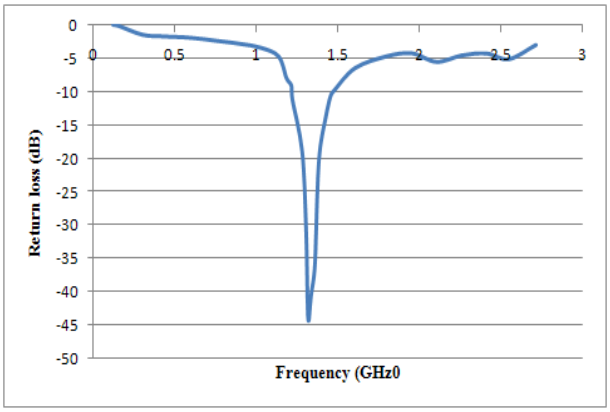

Fig. 7 Return loss Vs Frequency response at rectangular metal sheet ground plane

4 Results and Discussions

The whole procedure of monopole antenna was moving around the modification of ground plane of monopole antenna. It was normally operated at 1.3 GHz with all ground planes. When altering the ground plane of antenna (specific length) to improve the return loss and bandwidth of design antenna, it was analysis that the ground plane not only impact antenna return loss but also increases the bandwidth. There is improvement in bandwidth about 37.15%, 56.08% and 70.12% respectively in PCB ground plane, circular ground plane and rectangular ground plane compared to their basic design frequencies band which is about 1.3 GHz as shown in Table 1.

Table 1: Comparison among different ground plane

Sr. No.	Type of ground plane	Frequency (GHz)	Bandwidth (MHz)	Return loss (dB)
1	PCB plane	1.314	102	14.75
2	Circular plane	1.314	162	18.23
3	Square plane	1.314	234	43.90

5 Conclusion

This paper presents the experimental analysis of monopole antenna that was effective microwave radiator. The simple monopole antenna was tuned at 1.3 GHz resonant frequency with sufficient return loss more than -10 dB levels and bandwidth through with different ground plane. The monopole antenna is an Omni-directional antenna which has the same gain in every direction that properties employ in many applications, medical, microwave sensors, Wi-Fi and wireless communication. The obtain result are compared with available published data and good agreements are found.

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