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Sinusoidal Planar Monopole Antenna for WLAN Systems

Yamini Brahmapurikar
ME Student SRIT

Prof Divyanshu Rao
Astt Prof SRIT

Prof Ravi Mohan
Prof SRIT

Abstract – With the increase in the demand of the modern wireless systems such as Bluetooth, tablets, laptops etc., the demand of the antenna which is compact in size, being multiband or broadband characteristics, is increasing. For such wireless systems, printed monopole antenna is a good choice. When the frequency is in the GHz range, the size of the antenna is in the order of millimeter, furthermore to reduce the size of the planar monopole antenna meandering technique is used.

Index Terms – Bluetooth, Tablets, Laptop, Antenna.

1. INTRODUCTION

There is numerous literature available for creating dual band behaviour by creating two separate resonance arms, making slots etc. In our designs we have proposed single monopole structure for having dual band characteristics; by properly adjusting the dimensions of meander strips of the monopole antenna we can control the fundamental and higher order resonance mode .Using this concept, we have designed the planar monopole antenna for wireless systems and also fabricated the prototype

Antenna Design

Fig.1 shows the geometry of the CPW fed planar monopole antenna. The antenna is printed on FR-4 substrate having dimensions 42x24x1.5mm3 with permeability (μ) 1 and loss tangent 0.023. A 50 ohm CPW transmission line width(w1) of 1.5mm , gap 0.25mm and thickness(th) 0.018mm is used for excitation of an antenna. Fig.1(a) shows antenna 1(ant_1) ,which resonates at 2.0 GHz and higher order resonance at 8.4 GHz respectively. Fig.1(b) shows antenna 2(ant_2),which resonates at 1.79 GHz and higher order resonance at 5.5 GHz as shown in Fig.2. As we aware of the fact that the frequency gets scaled down when we increase the current resonance path of the strip, hence the fundamental and higher order resonance frequency is scaled down to the respective PCS and WLAN applications.

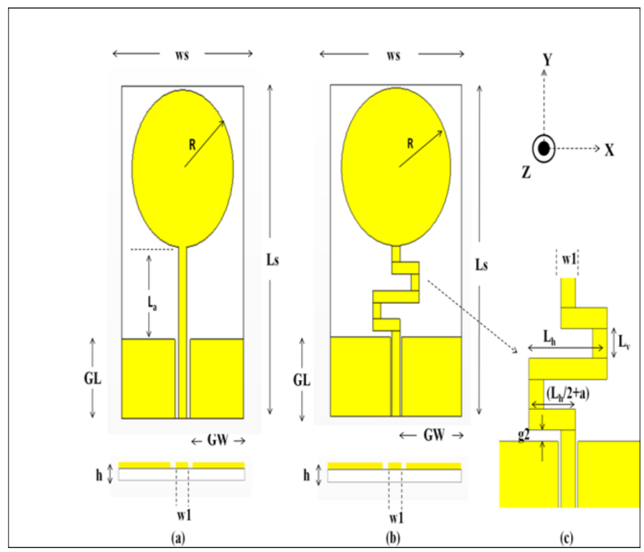

Figure 1 Geometry of the proposed antenna (a) circular patch with strip(Ant_1) (b) Circular patch with meander strip(Ant2).

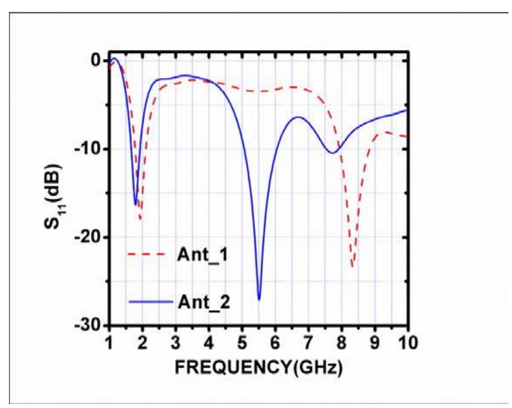

Figure 2 Return loss comparisons between Ant_1 and Ant_2

Effects of various antenna parameter and radiation characteristics

The simulated return loss against frequency with different length of the horizontal segment (Lh) and vertical segment (Lv) of meander line is shown in fig.3 By varying the length of horizontal segment (Lh) and vertical segment (Lv) frequency is scaled down since the current resonance path is increased. In other words there is fine tuning of resonance frequency by altering the length of horizontal and vertical segment. Fig.3(c) shows variation due to radius against frequency as the radius of the circular patch increases, there is a better dip in the return loss (S11) this implies more power is transfer to antenna.

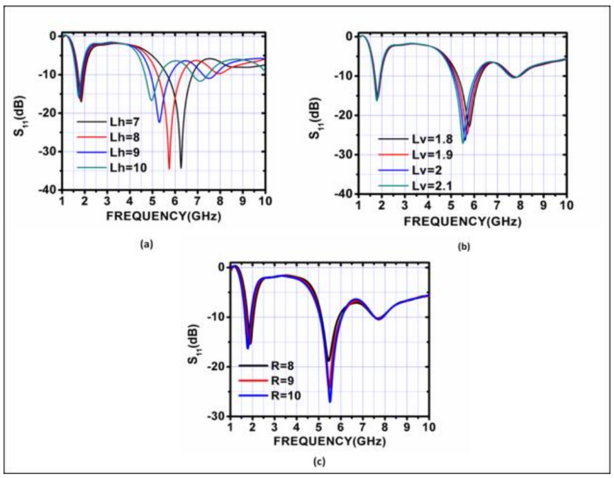

Figure 3 (a) Horizontal segment(Lh) variation (b) Vertical segment(Lv) variation (c) Radius variation.

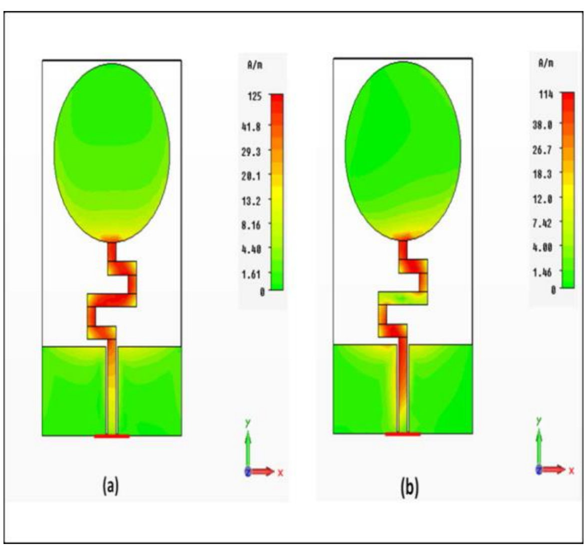

Figure 4 Surface Current distribution at (a) 1.79GHz (b) 5.5GHz

The surface current distribution on the conducting surface is simulated in CST and plotted in fig.4. As mention earlier at 1.79 GHz fundamental resonance occurs and at 5.5 GHz second higher order resonance mode; at fundamental mode the surface current distribution is uniform throughout the entire meander strip and at higher order resonance frequency there is a division of current filament.

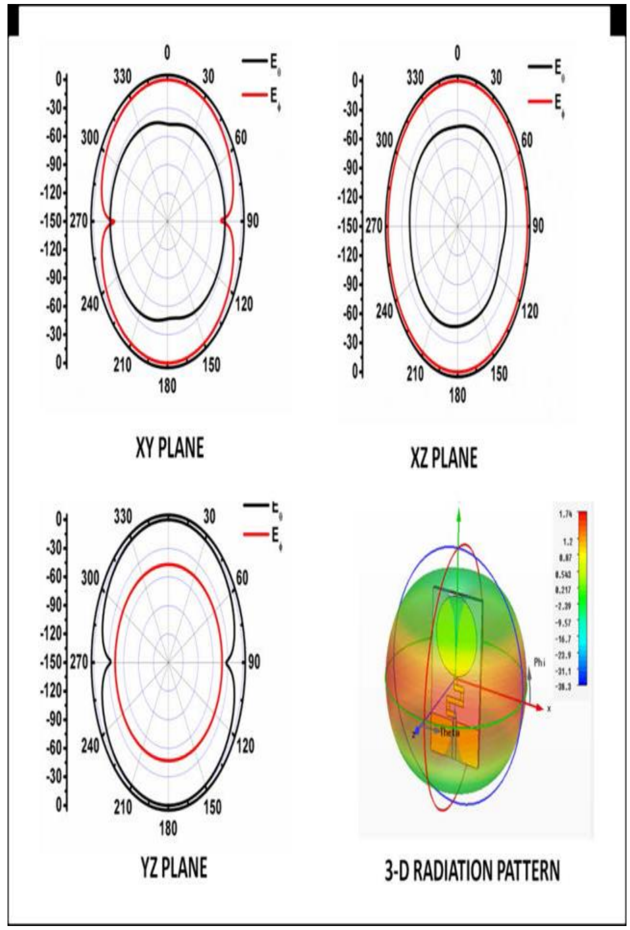

Figure 5 Radiation pattern at 1.79GHz in different planes

Hence the radiation pattern at higher resonance frequency is not a complete toroid shape as shown in 3-D radiation pattern in Fig.5. Figure 5 shows the radiation patterns in the E planes and H plane respectively. The pattern is omnidirectional in the H plane (xz plane) and conical in the E plane (xy,yz plane) at the both the operating frequencies. The radiation behavior is similar to monopole antenna. Fig.6 shows peak directional gain against frequency, the directional gain is 1.74dBi at 1.79 GHz frequency and 3.21dBi at 5.5GHz respectively. At WLAN band gain is 0.98dBi level higher than the half wave dipole

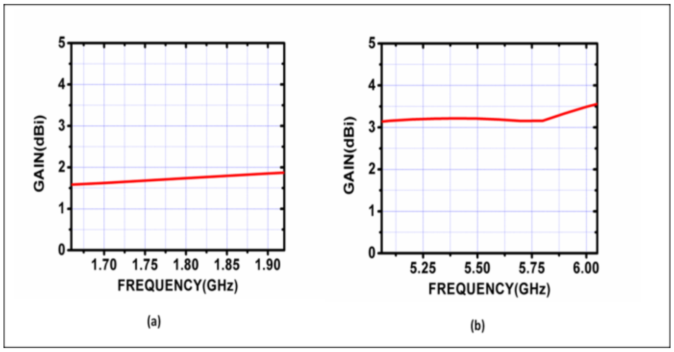

Figure 6 Gain v/s frequency at (a) PCS Band (b) WLAN band 5.5GHz

2. CONCLUSION

In this paper we present two dual band planar monopole antenna (i) sinusoidal planar monopole antenna for WLAN Systems (ii) Dual band planar monopole antenna for PCS and WLAN systems. The unique feature of both the antenna is that single monopole structure have shown dual band behavior, by adjusting the fundamental and higher order resonance frequencies. Tuning of resonance frequency is done by alerting the parameter of the meander section. The compact size and simple geometry makes it suitable for indoor wireless personal communications.

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