Chapter 1
A “La” Shape Antenna for High Frequencies Applications

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ABSTRACT

In this chapter, a ‘ला’ shape antenna for high frequencies is designed which has been simulated under CST software using copper material (i.e., FR-4). The dielectric constant of this material is 4.4. The return loss of ‘ला’ shaped antenna is -28 dB at 6.774 giga-hertz and -19 dB at 7.7 GHz resonant frequencies. It covers the bandwidth from 6.555 GHz to 7.122 GHz and 7.38 GHz to 8.07 GHz. In this chapter, simulated results like polarization, smith chart, return loss graph, 2-D pattern, 3-D pattern, and polar plot are presented.

INTRODUCTION

In the city or covered wireless environment, after a complicated multiple reflection or scattering effect, the polarization of the propagating radio wave may change significantly. Although various recent wireless systems are vertically polarized, it has been predicted that it is advantageous to use horizontally polarized antennas at transmitter and receiver ends (Saxena and Singh, 2018a; Saxena, Singh, Bhardwaj, Chae, Sharma, and Bhoi, 2018; Saxena and Singh, 2018b; Singh and Saxena, 2018c).

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The selection of microstrip antenna technology can fulfill these requirements. The main problem is that they usually radiate in a direction along the ground plane, and the gain in the horizontal direction is only a few decibels (Singh and Saxena, 2018d; Verma, Singh, and Saxena, 2016; Toore, Vallozzi, Rogier and Verhaevert, 2010; Lemey, Delercq and Rogier, 2014; Chahat, Zhadobov and Sauleau, 2014).

The broadband antennas are required to be compact, low-profile, directive with high transmission efficiency and designed to be discreet. These antennas are usually large metallic cumbersome objects. For dual band systems directivity and security are important features. It is important for the system to be highly directive in order to reduce coverage in unwanted areas (Lui, Murphy and Toumazou, 2013; Agilent, 2005; Roundy, 2003; Shukla, Verma, Gohir, 2015; Hall and Hao, 2006; Manel, Patil and Dhanawade, 2014).

Use of fractal geometry enhances the impedance bandwidth of an antenna structure based on its self-similarity property, due to which several resonances corresponding to different iterative structures are excited, overlapping with each other to result in wide bandwidth. The space-filling property increases the electrical length of the antenna structure without increasing its physical size. Some fractal antenna structures for SWB applications have been described in literature (Muralill, Maha, Dilip and Chaitanyal, 2014; Zhang, Chai, Xioa, and Ye, 2013; Kennedy, Fink, Chu, Champange, Lin and Khayat, 2009; Chahat, Zhadobov, and Sauleau, 2014; Lui, Murphy, and Toumazou, 2013; Torre, Vallozzi, Rogier and Verheavert, 2010; Lemey, Declercq and Rogier, 2014).

DESIGN CONFIGURATION OF PRESENTED ANTENNA

The presented antenna is imprinted on FR-4 epoxy substrate having thickness of 1.6 mm in which the dielectric permittivity of this material is 4.3 and loss tangent of 0.02. It can feed by a 50 Ω rectangular microstrip line and defected partial ground plane. The dimensions were calculated using standard design equations,

$$50 = \frac{120\pi}{\sqrt{\varepsilon reff}\left[\frac{W_f}{h} + 1.393 + 0.667\ln\left(\frac{W_f}{h} + 1.444\right)\right]}$$