

## Triple Frequency Fractal Patch Structure Antenna for C Band Applications

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**Abstract:** In this study, a triple frequency fractal triangular shape microstrip patch antenna is presented for C band applications. The proposed antenna comprises of two triangular shape patches with two triangular slots and excited by a 50  $\Omega$  microstrip transmission line. The antenna excites three separate resonant modes where lower resonant mode of the antenna has an impedance bandwidth (VSWR<2) of 50 MHz (5.64-5.69 GHz), middle resonant modes impedance bandwidth 140 MHz (6.47-6.61 GHz) and the upper resonant mode impedance bandwidth of 140 MHz (7.59-7.73 GHz). It has achieved stable radiation pattern in the operating frequency band. The proposed fractal triangular patch antenna is presented and discussed in details.

**Keywords:** C band, fractal, multi frequency, patch antenna, triangular

### INTRODUCTION

Antennas are very significant in the area of wireless communications and the Microstrip Patch Antenna (MPA) is one of the most popular and widely used in this field. Indeed, the MPAs have attracted so much research interest, due to their light weight, compatibility, low-profile, ease of fabrication, multi-frequency capability and low cost. Other merits include ease of integration with other kinds of Microwave Integrated Circuits (MICs) on the same substrate and capability of being deployed for both linear and circular polarizations. However, MPAs have such disadvantages as low power handling capability, low gain and narrow BW. Many techniques have been developed to overcome these limitations (Wong, 2004). Now a day's wireless communication system requires antennas that have large bandwidth, multi-frequency and fewer dimensions than existed before. Various types of multiband antenna can be made depending on the idea of fractal geometry because of proving itself the Sierpinski as an attractive and excellent multiband antenna. An antenna has multiband and ultra-band characteristics on account of being self-similarity of fractal geometry (Garg *et al.*, 2001; Puente-Baliarda *et al.*, 1998) whereas miniaturization of antenna is constructed with the space filling properties (Khan *et al.*, 2008; Lule and Babij, 2004). Fractal hexagon shape has been evaluated and found appropriate for multiband usage (Gianvittorio and Rahmat-Samii, 2002; Tang and Wahid, 2004). Circular microstrip fractal antenna has also been constructed ultra wide bandwidth reduced size using self-similarity and space filling characteristics. The antenna shows the low

backscattering and radiation pattern approaches to Omni-directional (Kumar and Malathi, 2010; Samsuzzaman *et al.*, 2012a). The microstrip triangular patch searches various applications with many useful MIC components such as circulators, resonators and filters. The triangular patches have been read practically and theoretically. They are got to deliver radiation properties similar to those of rectangular patches with a small size. In this study, an effort is performed to design a triangular fractal antenna of effective radiation, intact size and multiband properties. It can be seen that greater demand is created by means of quick growth of wireless communications and electronics for wireless devices that can obey different rules at different standards. It also the paved the way for wide usage of mobile phones in modern society resulting in mounting concerns surrounding its harmful radiation (Faruque *et al.*, 2011, 2012a, b; Islam *et al.*, 2010a). The process for decreasing the size of microstrip patch antenna are reported (Azim *et al.*, 2012; Habib and Islam, 2012; Islam *et al.*, 2010b; Tiang *et al.*, 2011) vastly and include capacitive loading (Rowell and Murch, 1997; Samsuzzaman *et al.*, 2013), LC resonator (Lui and Murch, 2001), configuration (Islam *et al.*, 2009), reactive loading (Ullah *et al.*, 2012). However, this process deals with antenna bandwidth or antenna efficiency to achieve the decrease in antenna size. Different processes for constructing multiband microstrip patch antennas have been disclosed such as including parasitic elements (Cho *et al.*, 2005; Mobashsher *et al.*, 2011) to make an additional resonant frequency or including more radiating elements shared with similar feed and ground (Rowell *et al.*, 2006; Samsuzzaman *et al.*, 2012b). This process compulsory