

Development and Implementation of Wideband Elliptical Ring Microstrip Antennas for 5G and X-Band Use

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Abstract

This study introduces an innovative design of a microstrip antenna with an elliptical ring patch, specifically designed for usage in the 5G and X-band frequencies. The antenna consists of four pairs of elliptical rings of different diameters, with each pair consisting of two elliptical rings that are perpendicular to each other. The design was modeled with the help of the Ansoft High Frequency Structure Simulator (HFSS). Analysed metrics included density of electric surface current, return loss, VSWR, bandwidth, and patterns of radiation. The antenna being suggested demonstrates dual-band capabilities, with the ability to resonate at two distinct frequencies. The modelling findings show that there are resonance peaks at 4.3 GHz and 10.39 GHz, with bandwidths of 2.726 GHz and 1.60 GHz, respectively. The measurement findings indicate resonance frequencies of 4.49 GHz and 9.71 GHz, with corresponding bandwidths of 2.998 GHz and 2.542 GHz, respectively. This antenna design is appropriate for a variety of 5G and X-band frequency bands and applications.

Keywords: Microstrip, Band Width, Dual-Band, 5g, X-Band.

1 Introduction

Wireless communication is essential in modern society, encompassing a variety of applications such as remotely automated and robot-controlled machines, the Internet of Things (IoT) and it's a wide range of applications, reliable and efficient remote communication, intelligent grid systems for energy distribution and transmission, smart home HDTV, and digital financial systems. These technologies significantly enhance human life (Bahmanzadeh & Mohajeri, 2021; Agarwal et al., 2021; Yi et al., 2023). The fifth generation (5G) network aims to exponentially increase communication capacity by utilizing the millimeter wave band, supporting data speeds up to 100 times higher than those of fourth-generation networks (Nasimuddin, 2007; Saleh et al., 2023; Prabha & Gayathri, 2014).