

Chapter 9

Rhombus-Shaped Cross-Slot and Notched Loaded Microstrip Patch Antenna

Gaurav Varma

Bundelkhand Institute of Engineering and Technology Jhansi, India

Rishabh Kumar Baudh

 <https://orcid.org/0000-0003-1026-2373>

Bundelkhand Institute of Engineering and Technology Jhansi, India

ABSTRACT

The aim is to design a Rhombus microstrip patch antenna. The antenna operates at $FL=1.447$ GHz to $FH=2.382$ GHz frequency for wireless local area network (WLAN). This antenna operates at $f=1.914$ GHz resonant frequency. In microstrip patch antenna, many types of shapes like circular, triangular, rectangular, square, ring shape, etc. are used, but in this design a rectangular shape is used. In proposed antenna, the accuracy and efficiency are increased. Integral equation three-dimensional (3D) software (IE3D) is used for the optimize of the rhombus cross-slotted antenna design. The IE3D uses a full wave method of moment simulator. This antenna fabricated on FR4 glass epoxy double-sided copper dielectric material with relative permittivity of $\epsilon = 4.4$, thickness $h = 1.60$ mm, and loss tangent is 0.013.

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INTRODUCTION

Microstrip rhombus patch antennas contain many properties, includes, light weight, low profile, low cost, less volume and easy to install on rigid surface due to these properties it is easy to fabricate. In microstrip patch antenna, substrate is used as an insulator. The substrate is having fixed dielectric constant. The patch and ground made by copper (Balanis, 1997 & James and Hall, 1989 & Mailloux, McIlvanna, and Kemweis, 1981). In microstrip patch antenna by using substrate having low dielectric constant, thick substrate, using slots (U and L shape), using multilayer and using parasitic patch above the radiating patch to improve bandwidth (Pues and Van de Capelle, 1984 & Chadha and Kumar, 2012 & Ansoft Corp). The microstrip antenna has been considered to be the most inventive field in the engineering of antenna having the properties like low material cost and the simulation and fabrication process is easy. So an idea to use dielectric material as a radiator was perceived. These antennas have use in space applications, government and commercial applications (Singh, Dhupkariya, Bangari, 2017 & Singh et. al, 2013 & Yadav and Singh, 2019). They include radiating patch of metallic material on substrate with ground structure on its back.

In the presented prototype design, It has been used a rectangular microstrip rhombus shape patch antenna which contain a parasitic patch, of length $[L_p]$ and width $[W_p]$ of the patch. All these were calculated by predefine equations. In this design the length and the width of the patch is same and then cut the slots so the one slot of patch at which connect the feed by probe feeding and another patch work as parasitic patch. Application bands are defined by using the software known by IE3D with a S11 of -17.81dB. In this antennadesigntheIE3Dsoftwaresimulatedthefrequencyband from 1.447GHz to 2.382GHz, the WLAN application required this band. The simulation result, we can see that the microstrip patch antenna with parasitic patch find better results. This design achieves percentage bandwidth about 48%.

ANTENNA DESIGN AND MATERIAL

A dielectric constant of this proposed antenna is 4.4, height of the dielectric substrate $h=1.6\text{mm}$ and loss tangent $\tan \delta=.012$ are selected for the designing of this antenna. The designing frequency (f_r) is 2.4 GHz.

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