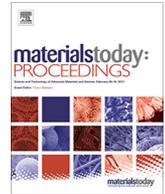




Contents lists available at ScienceDirect

Materials Today: Proceedings

journal homepage: www.elsevier.com/locate/matpr

Pentagonal-shaped slot two port MIMO antenna for sub 6 GHz 5G wireless applications

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ARTICLE INFO

Article history:
Available online xxxxx

Keywords:
Isolation
MIMO antenna
WLAN
5G
Slot Antenna

ABSTRACT

In this paper, two-element multiple-input-multiple-output (MIMO) antenna system is presented for future sub-6 GHz 5G applications with improved impedance matching and isolation. In first design, a single rectangular patch antenna of $16.76 \text{ mm} \times 14 \text{ mm}$ with pentagonal shaped slot and defected ground structure is proposed with a gain of 2.79 dB for WLAN (5.2 GHz) application. Second design consist of two elements MIMO patch antenna of dimension $16.76 \text{ mm} \times 47 \text{ mm} \times 1.6 \text{ mm}$ on front side and defected ground structure on the back side of a FR4 substrate. The resonance frequency of antenna is 5.2 GHz with $S_{11} = S_{22} = -26.47 \text{ db}$ and good isolation between two ports and gain is 6.83db. Simulation has been performed on CST studio suite.

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Selection and peer-review under responsibility of the scientific committee of the 3rd International Conference on "Advancement in Nanoelectronics and Communication Technologies".

1. Introduction

Wireless communication technologies are used in a wide variety of applications, resulting in an ever-increasing amount of data being transmitted wirelessly. WLAN frequency bands are crowded, so to attain a greater channel capacity, multiple-input-multiple-output is a well-known technique [1,2]. In MIMO systems, there may be interference of signals. To avoid mutual coupling and work efficiently, the antenna elements are required to be isolated from each other with proper spacing between the elements [3–5].

In paper [6] a MIMO antenna is proposed which can cover both 3.5 GHz band (3.4–3.6 GHz) and 4.9 GHz band (4.8–5.0 GHz). A computationally optimized compact MIMO antenna for UWB applications is proposed in [7]. In [8] a high gain 4G wireless network covering several well-known frequency bands from 1870 to 2530 MHz along with the mm-wave frequency band at 28 GHz is proposed. In [2] a collinear MIMO antenna and its conformal models for 5G and millimetre wave communications is presented which is compact in size with dimensions $22 \times 13 \times 0.254 \text{ mm}^3$ and operates at 2.4 GHz. Different MIMO structured antennas are proposed and analyzed for different application in [3,9–12]. The proposed antenna in this paper is a two port MIMO structured

antenna which is very compact on size of $47 \times 16.76 \times 1.6 \text{ mm}^3$, used for sub 6 GHz application with an adequate peak gain of 6.3 dB.

2. Design and analysis of single element antenna structure

2.1. Antenna design

Fig. 1 shows the geometry of proposed single element microstrip patch antenna with Pentagonal-Shaped Slot for.

Sub 6 GHz 5G Wireless Applications. The antenna is excited by microstrip line feed method for a 50 Ω characteristic impedance. The proposed antenna is designed on a low-cost FR-4 substrate with a dielectric constant $\epsilon_r = 4.4$ and loss tangent $\tan\delta = 0.002$. The dimensions of the substrate are $14 \text{ mm} \times 16.76 \text{ mm} \times 1.6 \text{ mm}$. A pentagonal slot was cut aligned with feed line to get desired frequency shift and a defected ground structure is used to achieve a good return loss. The dimensions of the proposed antenna are written below (Table 1):

2.2. Simulation results

Simulation results of proposed single element antenna reported here are carried out using CST Microwave Studio. Fig. 2 shows the simulated reflection coefficient [S₁₁] of the proposed antenna in

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