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FREQUENCY RECONFIGURABLE ANTENNAS: A REVIEW PAPER

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Abstract

In recent times, there is a high demand for wireless networks that can easily provide multiple access over a large spectrum and use the electromagnetic spectrum. The traditional antenna, however, does not fulfil the requirements of modern wireless communication systems. Therefore, a single radiating element called a reconfigurable antenna is built with the ability to adjust its features in real time. Reconfigurable antennas are categorised according to their antenna switching behaviour as a frequency, radiation pattern and polarisation reconfigurable antenna. The main purpose of this paper is to review numerous global publications on frequency reconfiguration patch antennas, which have greatly reduced the structural complexity and thus the size of the antenna.

Keywords: *Reconfigurable Antenna, MIMO, Micro Strip Patch, 5G Antennas, SISO, Radiator.*

I. INTRODUCTION

The world of antennas includes an understanding of the purpose, features, parameters and shape of antennas. An antenna can be described as an electromechanical instrument capable of transmitting or receiving electromagnetic waves [1]. In other words, an antenna that partners or matches free space with the transmitter or receiver can be said to be a series of elevated conductors. A transmitting antenna attached to a transmitter pushes electromagnetic waves into free space and then flies at the speed of light in space [2]. An antenna that has the ability to change its characteristics according to the state of the environment is referred to as a reconfigurable antenna.

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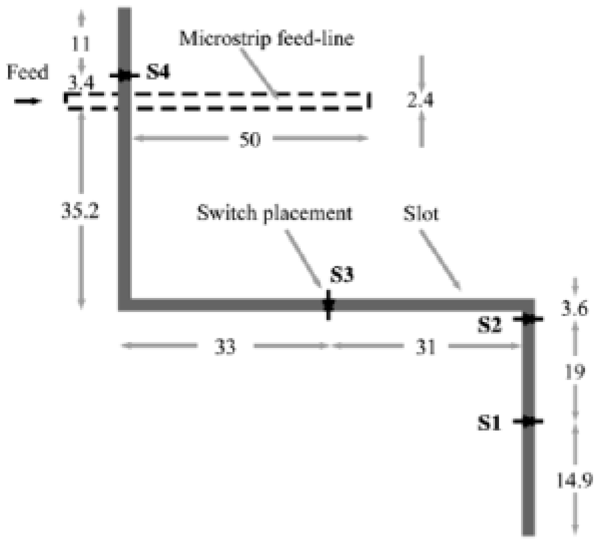

Fig. 1 Shows the Geometry of planar reconfigurable antenna.

Microstrip Line Feed is the simplest feeding technique employed. The patch is attached to a 50 Ohm impedance Microstrip panel, and the port is connected to the other end of the introduced additional Microstrip line [3]. The additional Microstrip line functions as a feeding point for the Microstrip patch's rectangular antennas. Figure 1 shows the Geometry of planar reconfigurable antenna [4]. Figure 2 illustrates the basic structure of antenna (a) circular shape with U slot is in Top View and (b) Pin diode in Bottom View [5].

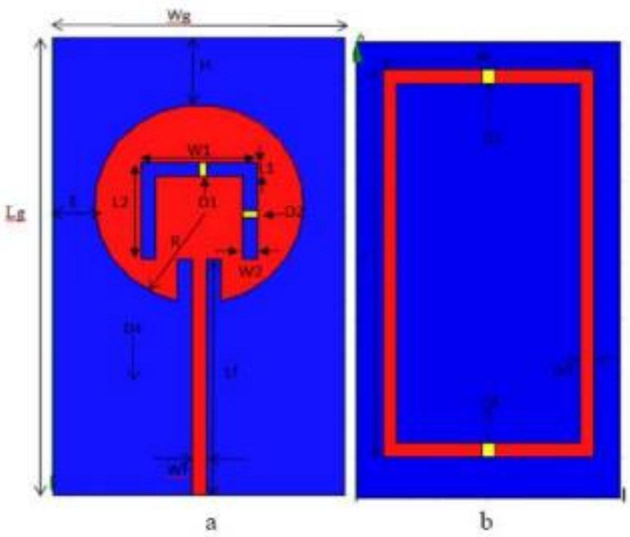

Fig. 2 Illustrates the basic structure of antenna (a) circular shape with U slot is in Top View and (b) Pin diode in Bottom View.

A. **IE3D: -**

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IE3D is an Electro Magnetic simulation and optimization software uses for circuit and antenna design. IE3D has a menu driven graphic interface with automatic meshing, and uses a field solver based on a full-wave, method-of-moments to solve current distribution on 3D and multi-layer structures of general shape [6].

B. **CST microwave studio: -**

CST microwave studio (CST MWS) is software for the 3D EM simulation of high frequency components. CST MWS enables the fast and accurate analysis of high frequency (HF) devices such as antennas, filters, couplers, planar and multi-layer structures and SI and EMC effects [7].

C. **HFSS software: -**

HFSS is the industry-standard simulation tool for 3D full-wave electromagnetic field simulation. HFSS provides E- and H-fields, currents, S-parameters and near and far radiated field results. This tool is its automated solution process where users are required to specify geometry, material properties and the desired output and it automatically generate an appropriate, suitable, efficient and accurate mesh for solving the problem [8].

The width W of the DRA antenna can be determined by utilizing the following equation.

$$w = \frac{c}{2\, f_r \sqrt{\frac{(\varepsilon_r + 1)}{2}}}$$

Where
f_r denotes the resonant frequency, and
r represents substrate dielectric constant

The effective dielectric constant (ε_{reff}) of DRA antenna is derived by using the following equations.

$$\varepsilon_{reff} = \frac{(\varepsilon_r + 1)}{2} + \frac{(\varepsilon_r - 1)}{2} \sqrt{\left(1 + 12\,\frac{h}{W}\right)}$$

Where h denotes the height of the antenna and W denotes the width.

The length of the antenna may be measured by applying the following equation.

$$L = \frac{c}{2\, f_r \sqrt{\varepsilon_{reff}}}$$

The antenna length extension is calculated by applying the equation below.

$$\Delta L = 0.412\, h\, \frac{\left(\varepsilon_{reff} + 0.3\right)\left(\frac{W}{h} + 0.246\right)}{\left(\varepsilon_{reff} - 0.258\right)\left(\frac{W}{h} + 0.8\right)}$$

Here W represents the width and h denotes the height.

The real length (L_{eff}) of the antenna can be calculated by using the following formula.

$$L_{eff} = L + 2\Delta L$$

II. LITERATURE REVIEW

Peroulis et al. conducted a research on design of reconfigurable slot antennas. The concept of a lightweight, powerful and electronically adaptable antenna is discussed in this paper. The fundamental antenna configuration is a single-fed resonant slot filled with a set of PIN diode switches. The tuning of the antenna is accomplished by adjusting its effective electrical length, which is regulated by the bias voltages along the slot antenna of the solid state shunt switches. Because the design is based on a resonant configuration, via this tuning, an efficient bandwidth of 1.7:1 is obtained without requiring a reconfigurable matching network. This bandwidth selects four resonant frequencies from 540-890 MHz and achieves very strong matching for all resonant frequencies. Theoretical and experimental behaviour of the parameters of the antenna is introduced and it is shown that the frequency tuning remains largely unchanged by the radiation pattern, efficiency and polarisation state of the antenna [9].

III. DISCUSSION AND CONCLUSION

In this article, the contrast and study of their performance enhancement methods is carried out with a thorough review of various 5G antennas. Also, 5G specifications for connectivity are elaborated. While conducting a 5G antenna analysis, the 5G antenna architecture can be categorised into two key categories, i.e. Centered on input ports, SISO and MIMO. On the basis of their frequency response, these are further categorised as wideband and multiband. First, it is possible to classify the SISO antennas into single and multi-unit element antennas. For integration with 5G devices that support IoT, the SISO antennas are suitable. The MIMO antennas for both wideband and multiband can be classified into a multi-element antenna with and without a metal rim. The MIMO antennas are the best smartphone candidates, although it is possible to use the large MIMO antennas at base stations. The use of carrier aggregation reinforces the transmission rate in the MIMO metal rim antenna design. In addition, design features such as orthogonal polarisation increase separation, thus improving overall performance. Additionally, depending on their forms, antennas may be categorised.

IV. REFERENCES

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