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Tri-Strip Monopole Antenna for LTE, WLAN and WIMAX Communication Applications

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ABSTRACT- In this study, a Tri-strip monopole antenna for LTE, WLAN, and WiMAX (Worldwide Interoperability for Microwave Access) applications is presented. This is because wireless apps do not need to connect to all working frequencies at once, improving functionality without requiring a larger antenna. For LTE, WLAN, and WIMAX applications, a tiny triple wideband coplanar waveguide-fed patch antenna with a defective ground structure is used.
Gain and radiation patterns have improved, return loss has been examined, and parametric analysis has been offered for antenna optimization. Average gain through the band is reported to be 3.5 dB, while radiation efficiency for the model is observed to be 94% on average.

KEYWORDS- Applications include LTE, WLAN/WiMAX, Coplanar waveguide (CPW) feed, Defected ground structure (DGS), patch antenna, triple-band antenna, and wideband antenna.

I. INTRODUCTION

An antenna is created for the transmission and reception of radio waves, in accordance with IEEE (Institute of Electrical and Electronics Engineers) standards. A metallic object, such as a rod or wire, that is used as a guiding and free-space device. Coaxial cable or a waveguide are used as the guiding medium or transmission line to convey electrical or electromagnetic energy from the receiving wire source to the antenna receiver.
Faraday's initial experiment, which served as the inspiration for the antenna, showed a complete link between electrical coupling and magnetism in the 1830s. He maneuvered the electromagnet around a cable's coil that was connected to the galvanometer.
Yagi-Uda antennas have traditionally been used for TV reception. The Yagi-Uda antenna is made of a dipole and parasitic components. It is well-liked for its strong gain and directivity performance, and it is a member of both the VHF and UHF bands. To increase the directivity, many directors will be put, and the feeder will be a folded dipole. utilized mostly for RF applications. a Yagi-Uda antenna model.
Aperture antennas include open-ended waveguides, horn antennas, conical antennas, and reflector antennas. They radiate from an open aperture. Applications for airplanes and spacecraft use these types of antennas. Additionally, dielectric material is covered to provide protection from risky circumstances.
The increase of crucial antenna parameters like Gain and bandwidth is the goal of this work's analysis of metamaterial characterisation on antennas. Traditional frequency domain and time domain responses are also observed and examined in the context of dual port scenarios.

II. LITERATURE SURVEY

The improvements in antenna technology for wireless portable devices were proposed by Jaume Anguera et al[1]. This paper provides an outline of the recent changes that wireless portable technology has gone through. Regulations, difficulties with modern smartphones, descriptions of the progress of wireless portable devices, and handset characterization are discussed. The concept is concentrated on stimulating the intrinsic ground plane radiation modes that operate at mobile frequencies for any smartphone platform. With the help of this technology, massive quarter-wavelength antenna elements are no longer necessary, allowing the wireless platform to incorporate many antenna elements, as well as a variety of functionality and services.
Laxmi Goswami et al.[3] concentrate on a comprehensive assessment of various kinds of receiving devices that may be identified based on their shapes, materials utilized, signal data measurement, transmission shift, and other factors throughout this article. Our primary aim is to categorize these receiving devices according to their intended use.
A CPW-Fed MIMO antenna was presented by Amit Kumar et al.[4] for dual-band applications in the 2.4/5.8 GHz ISM band and the 2300 MHz LTE-4G spectrum. This device utilizes a rectangular split-ring resonator to isolate 3.5GHz WiMAX heavy traffic. The ground structure is changed to produce a greater impedance bandwidth. FR-4 substrate is the material that was utilized to create the antenna. The

measurements are 3*72*56*0.8 mm.The minimum measured gain is 2.5 dB across all operational bands.

Seyed Sasan Haghighi, et al. [6] proposed an antenna with substrate integrated waveguide that operates at triple band. The work in this case is based on left-handed structures, which are typically referred to as metamaterials. The low loss conduction in the materials is also defined by the substrate integrated waveguide.

Practical coplanar waveguide-Fed UWB antenna with reversible dual band-notches was proposed by Jingjing Zhang et al.[7] Due to CPW feeding, the bandwidth is expanded by 137% and the notch characteristics are attained in 5.1–5.9 GHz and 7–7.8 GHz. The antenna achieves triple band notched characteristics by etching a U-shaped slot and attaching two pairs of L-shaped side branches on the surface.

III. PROPOSED SYSTEM

The paper begins with an analysis of the design of a CPW-FED antenna and any variants that have been implemented using the same biological patch. For applications requiring large impedance bandwidth, CPW antenna is suggested in this chapter. Regarding the structure's orientation, the biomedical patch is inserted into the smaller-diameter biomedical curved structure shown in Fig 1.

The development of a basic Biomedical Curved Coplanar Waveguide (CPW) antenna is the main topic of this chapter. The effort focuses on enhancing wideband properties up to the 20GHz range. Here, the research has been done using square slots and taking into account how they affect the antenna characteristics.

The FR-4 epoxy substrate material is used to manufacture the Biomedical Curved CPW Fed Antenna with a loss tangent of 0.02 and r=4.4. The substrate's LS and WS dimensions are 44 mm by 40 mm and 1.6 mm in height, respectively. A pair of coupled ellipse shapes with dimensions of R1 16 mm and R2 15 mm are used. The substrate's 1 mm thickness includes the feed line. The evolution of antenna change over various iterations and its design equations are shown below in Figure 1 and layout of proposed Antenna is shown in figure 2.

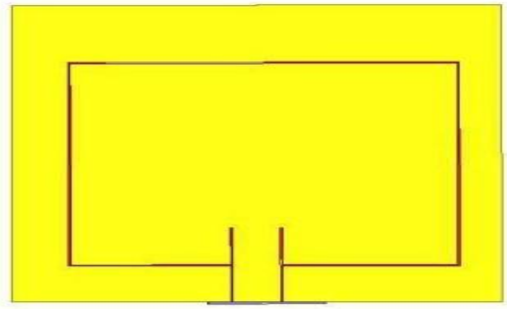

Figure 1: Evalution of proposed Antenna

The biomedical patch is used in this section, which modifies the antenna ground plane's geometry. Biomedical rings have been used to carry out the biomedical antenna and its analysis. In the initial version, the antenna is modified with two biological ring structures, producing broad characteristics up to 20GHz References [2][5][8][9].

Utilizing CST microwave studio, the final biomedical antenna capabilities have been examined. The figure shows the iteration-by-iteration procedure used to create the design antenna. After analyzing all iterations, it is clear that the final iteration will have excellent qualities for consideration in the intended applications. The proposed antenna's overall size and its iterative reflection coefficient features have been noticed in the results as shown in Figure 3, 4 and 5.

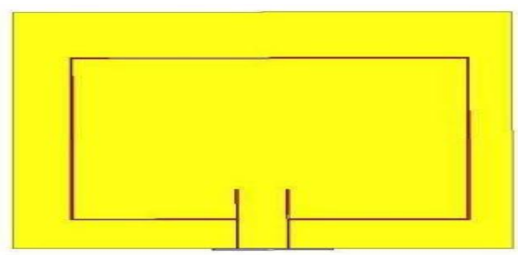

Figure 2: Layout of proposed Antenna

IV. RESULTS

The following are the outcomes of the Ansoft HFSS simulations of antennas 2 and 3.

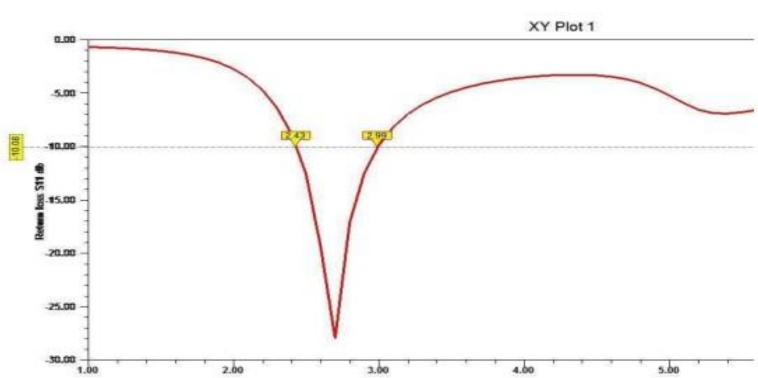

Figure 3: Return loss for base model

The first band frequency at 2.5 GHz with a return loss of -28 dB is shown in this plot. The fundamental antenna that we had envisioned is only functional for WLAN applications. This antenna is therefore only utilized in one application. The return loss vs. frequency curves are depicted in the results of the graph above.

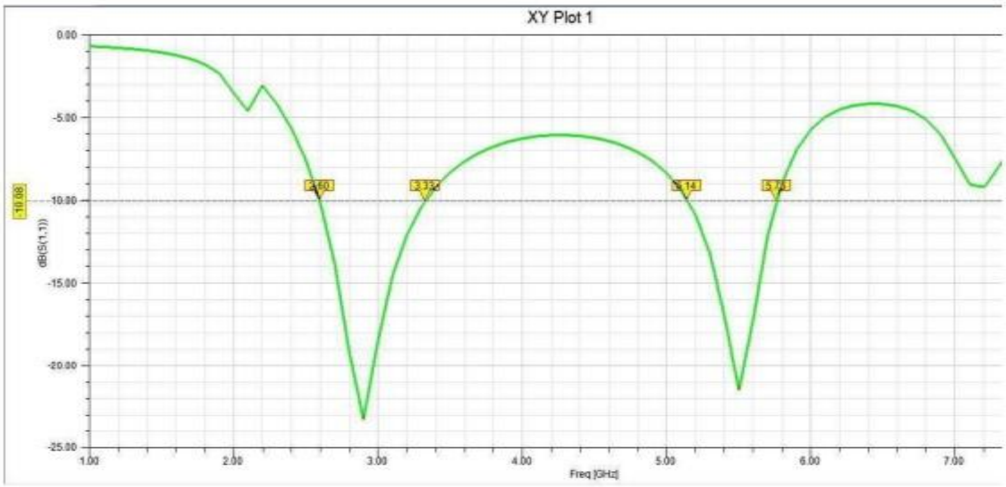

Figure 4: Return loss for second model

The first band frequency, which ranges from 2.6 GHz to 3.33 GHz, has a return loss of 24 dB, while the second band frequency, which ranges from 5.14 GHz to 5.73 GHz, has a return loss of 22 dB. The image shows the notation of return loss versus frequency. The antenna is going to operate at two separate frequencies, which is said to be operating of dual band frequencies like Upper WLAN.

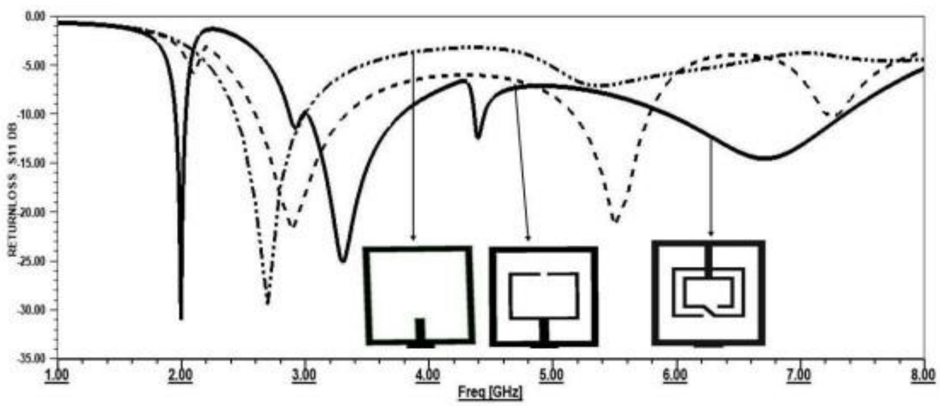

Figure 5: Return loss for final proposed model

V. CONCLUSION

The conclusion offers a summary of the complete body of research. In this study, attempts have been made to develop a multiband monopole antenna with a ground-defected structure and split-ring resonators that is inspired by meta materials. While antenna 4 runs at two frequency bands, covering applications like upper WIMAX and S-Band applications, antenna 3 is designed for a single band application that operates at a frequency of 2.4GHz.

Antenna 4 can operate in several bands, including LTE, as well as for WLAN applications. By adding a complementing rectangular split ring resonator, antenna 4 demonstrated a superior return loss plot than antenna 2. The suggested antenna has a gain of 9 dB at notch band frequency, making it suitable for its intended use. The suggested antennas benefit from a straightforward structure that makes manufacturing them simple.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest

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