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Time Domain Based Compact Dual Band MIMO Antenna System for LTE Smartphone Applications

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ABSTRACT—The design of an eight-port MIMO antenna at the sub-6-GHz(LTE 42/43 and 46)bands for fifth-generation(5G) smartphone is presented. First,based on the Babinet's principle, a microstrip slope antenna (MSA) is designed from its counterpart complementary structure, microstrip patch antenna (MPA) to operate over the LTE 46 band. The IFAs are additionally equipped with a parasitic radiating element that allows them to operate at the specific three LTE bands,a proposed single antenna, namely RMS, is achieved. For MIMO operation, two antennas are mounted on a practical PCB (100–40). When shifting their location on the PCB, several antenna layouts are tested. Simulated and experimental results are conducted to examine the performance of the designed MIMO antenna. Good isolated, acceptable gain, and efficiency are obtained over the bands of interest which verify the suitability of the proposed system for MIMO smartphone applications.

KEYWORDS- MIMO, MSA, MPA, RMSA, PCB

I. INTRODUCTION

A Fractal 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 utilized as a guiding device in free space is also mentioned. Coaxial cable or a waveguide are utilized as the guiding mechanism or transmission line to transfer electrical or electromagnetic energy from the receiving wire source to the Fractal Antenna receiver [1].

Faraday's initial experiment, which served as the inspiration for the Fractal Antenna, showed the entire link between electrical coupling and magnetic in the 1830s.He maneuvered the electromagnet around a cable's coil that was connected to the galvanometer. The electromagnet's movement causes a period of most of the previous designs are interested in single-band operations except for which consider dual-band antenna design for 5G smartphone terminals operating below sub-6GHz spectrum. Long term evolution (LTE) communications bands, especially LTE (3.4-3.8 GHz) and LTE (5.150-5.925 GHz) are the standard bands for the future sub-6 GHz 5G systems.

According to the various geometries that have evolved over time, fractal antennas come in a wide variety. Heinrich Hertz's work, which was published in the late 1880s, offered experimental confirmation of Maxwell's theory of electromagnetic waves and presented a number of fundamental types of fractal antennas, some of which are still in use today for a variety of purposes, including telecommunication, satellite communication, broadcasting, radar, two-way radio, and other uses. At the moment, wireless communications frequently use fractal antennas.

Modern communication makes extensive use of Microstrip patch Fractal Antennas due to its remarkable benefits, including their inexpensive cost, small size, simplicity of PCB fabrication, and simplicity of microwave device integration. Patch fractal antennas have various uses since they create low cross polarization. The fundamental design of a patched microstrip fractal antenna is a dielectric substance (substrate) with stature/thickness (h) between the ground plane and the fix. Fix reception equipment can operate between 100MHz and 100GHz.

II. LITERATURE SURVEY

Based on the Babinet principle, we constructed an eight-port MIMO antenna in this article for LTE band smartphone applications.. MIMO antenna systems are currently receiving more attention from researchers working in the field of mobile communications. Dual- or tri-polarized antennas have been proposed in MIMO antenna designs to improve their isolation properties. The microstrip patch antenna (MPA), which serves as a smartphone antenna's counterpart, has been successfully designed [2].

In this article we designed of an eight-port MIMO antenna at the LTE bands for smartphone applications based on Babinet's principle, a microstrip slot antenna(MSA) is designed from its complementary structure. To operate an LTE band. Currently in mobile communications, there is increased interest by researchers for multi-input-multi-output(MIMO) antenna systems. MIMO antenna designs have been proposed for improving their isolation characteristics by using dual- or tri-polarized antennas. A smartphone antenna is successfully designed from its counterpart from its counterpart microstrip patch antenna (MPA) [3].

An multiple-input multiple-output (MIMO) wireless method is a advancement in the usage of antenna arrays in wireless systems. Represented by the multiple-input multiple-output (MIMO) wireless method. Two novel microstrip MIMO antenna have been proposed and presented in this article. The objective is to design a compact and dual-broadband MIMO antenna module appropriate for many wireless devices including WLAN, LTE and WiMax Lots of researches have been done to design a MIMO antenna having the reqired size and minimum coupling for a specific applications, including many approaches to minimize the coupling under size constrain [4].

III. PROPOSED SYSTEM

In this communications, we present a compact dual-band antenna-system for LTE multi-input and multi-output(MIMO) mobile handsets. The radiators consists of 3D Inverted-F—Antenna (IFAs) folded on the non-metalized part of the printed circuit Board(PCB) and operating in the 700 MHz band.

The functioning bands with the measured S11 lower than 6 dB that encompass all GSM 850/900, GPS, DCS, PCS, UMTS, LTE 2300/2500, and 2.4 GHz WLAN bands are 740-965 and 1380-2703 MHz. A fairly simple decoupling structure of the slotted and protruded ground increases the effective bandwidth while reducing the coupling between two closely spaced parts..

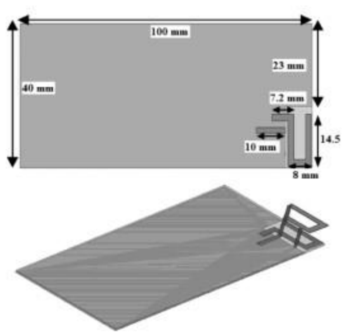

Figure 1: Top view of the Printed Circuit Board (PCB)

Figure 1 shows a top view of the printed circuit board (PCB), a three-dimensional view of a single antenna (with PCB dimensions), and dimensions for printed antenna components [5].

The geometry of the single band antenna is shown in figure 2. The structure is an IFA folded with dimensions of 100 40 on top of a FR4 substrate, and it closely matches the ground plane of a real mobile phone. The substrate has a loss tangent of 0.02, a relative permittivity of 4.4, and a thickness of 0.8 mm. To obtain the best matching possible, HFSS is used. Figure 3 displays the calculated and simulated reflection coefficients for the dual-band antenna .

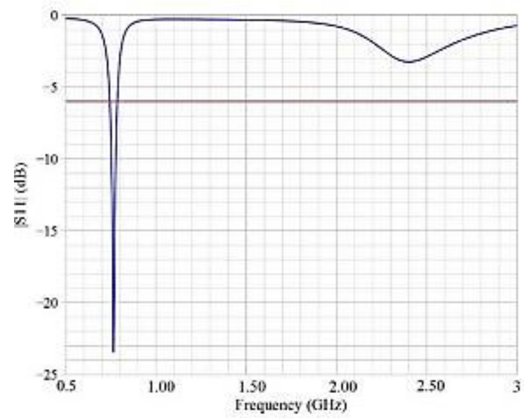

Figure 2: IFA's simulated reflection coefficient

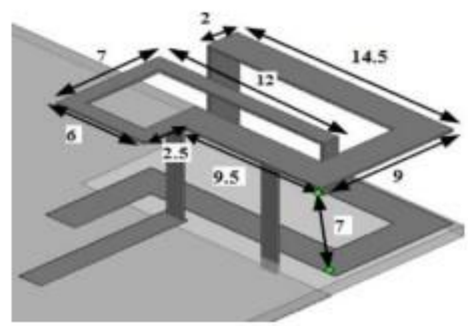

Figure 3: Dual-band antenna (4.5 mm in length when the parasitic element is folded).

IV. RESULT

Agilent System Vue was used to analyze our MIMO antenna-systems in terms of channel capacity using a geometry-based channel method (WINNER II). The WINNER II channel model is a geometry-based stochastic model, according to. A double model of a directional channel is another name for it [6]. The model specifies the directions of the rays rather than the actual locations of the scatterers, much like the well-known spatial channel model (SCM).

According to [3] [5] at the bottom of the page provides the channel impulse response from the transmitter antenna element to the reception antenna element and for the cluster. The UxS MIMO channel's time-variant impulse response matrix is the outcome of this (see figure 4).

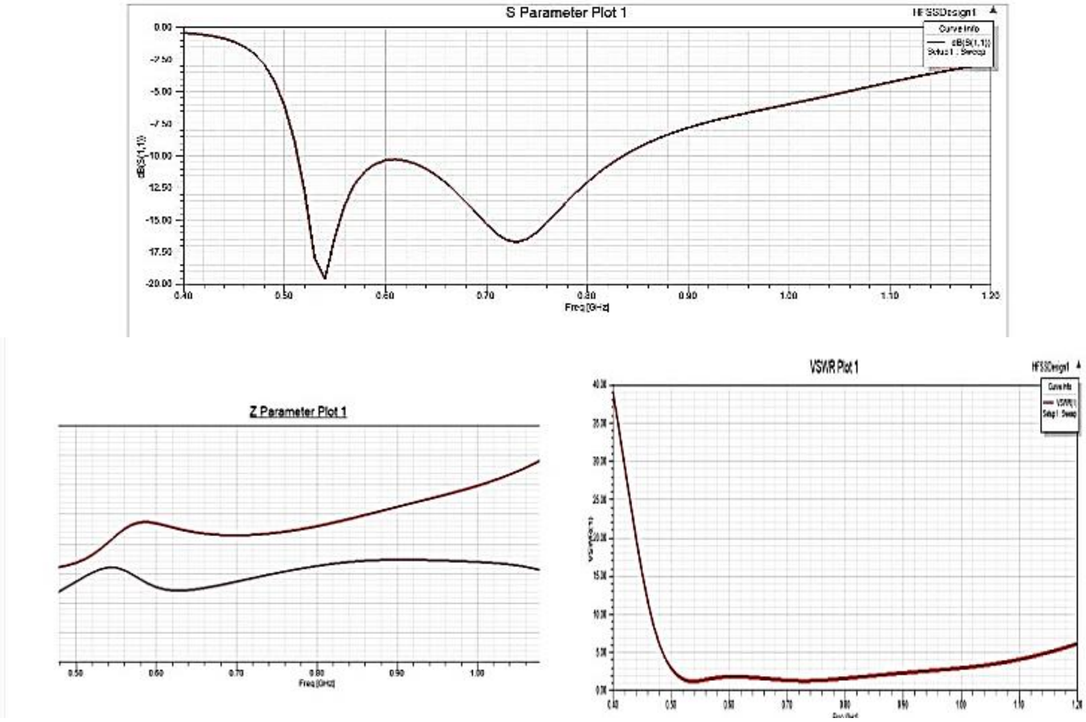

Figure 4: UxS MIMO channel's time-variant impulse response matrix is the outcome

However, "position 1" performs the best in terms of channel capacity because it has the highest LTE low band efficiency. In actuality, our plan was to create MIMO systems that maximized antenna distance. This was validated with the knowledge that MIMO performance will be systematically.

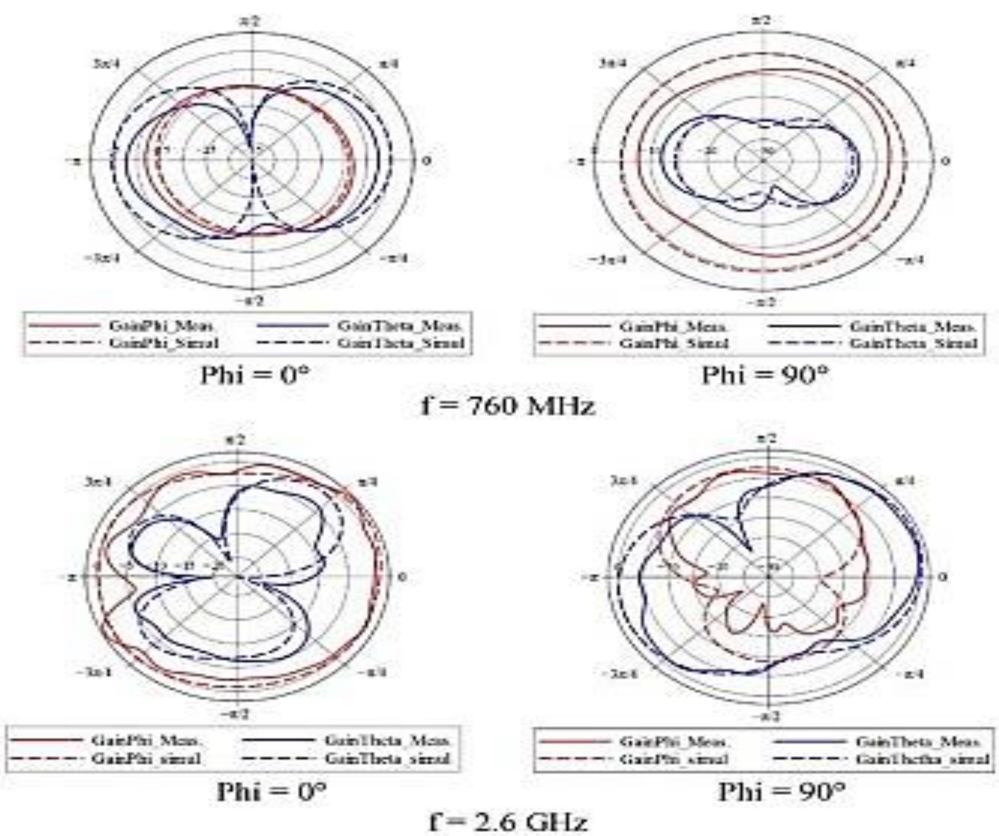

Figure 5: Single Dual Band Antennas Simulated

Figure 5 shows the single dual band antennas simulated and measured gain patterns.

V. CONCLUSION

In this communication, novel, small dual-band MIMO designs with diverse antenna configurations were proposed for LTE mobile devices. A single antenna element with a 3D IFA and a parasitic element is suggested to provide dual-band LTE functionality. After testing several antenna placements over the ground plane, two designs were selected for construction and performance testing.The channel capacity of the LTE high band MIMO structures was evaluated using Agilent's SystemVue software [7-9]. Our strategy to continually pursue high port-to-port isolation for better MIMO systems was backed by the results of simulations and tests. Due to their compact design, our MIMO systems are suitable for forthcoming LTE mobile devices.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest

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