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An efficient MIMO antenna for C-band Wireless Communication

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ABSTRACT

In this paper, an efficient MIMO antenna with single-band operating in C-band (4.8 - 5.0 GHz) has been proposed for wireless communications. The proposed design consists of four antennas and it is parallel to the edge of the system which is unlike conventional 5G antennas. It can be easily applied to the new technology used in mobile phones i.e. bezel-less mobile phones. The simulation result shows a reflection coefficient of less than -15 dB with a bandwidth of 0.2 GHz (4.8 - 5.0 GHz), and it will cater to 5G communication applications.

Keywords— *5G communication, MIMO, Antenna, Single band*

1. INTRODUCTION

With the end goal to address the issues of present-day 5G mobile communication framework, investigation of 5G cell phone is important. 5G communication has turned into a hotspot in the areas of mobile communications both at abroad and home. At present, numerous nations on the planet are leading broad research and exchanges on the improvement, vision, key specialized pointers, application necessities and empowering advancements of 5G communication. With advancement of mobile 4G communication framework, individuals' necessities for more speed of mobile communication are quickly expanding. With the end goal to address every one of these issues, the improvement and research of 5G antenna are simulated. High-speed data transmission can be possible using multi-cell array and miniaturization antennas but create challenges in designing of mobile phone antennas. In the future, there is a possibility of having multi-mode 4G or 5G with multiple antennae in smartphones.

A MIMO Antenna with its antenna elements orthogonal to the mobile frame was proposed in [1]. The importance of MIMO antennas is explained and simulated in [2, 3]. A circular antenna was constructed using neural networks in [4]. In [5], MIMO antenna with eight elements, PIFA-based system was presented. It covers a 3500 MHz frequency band and the isolation is only 7.4dB between various antennas. In this work, a MIMO antenna with band, comprising four parallel elements has been proposed. This antenna operates at 4.8-5.0 GHz. The antennas are placed along all four side ends of the phone in order to encounter the necessities of a Bezel-less smartphone antenna design.

2. PROPOSED DESIGN AND SPECIFICATIONS

The dimensions and design of the proposed design are shown in figure1. As seen in figure 2 the design is a rectangular one with a rectangular cavity in between. The designed single antenna was operated at 4.8 - 5.0 GHz. The antennas are placed on all edges of the substrate parallel to the circuit board and perpendicular to the side edge of the smartphone as shown in the 3D view in figure 4. In accordance with the upcoming ultra-thin and modern smartphones, the mobile phone is just 5 mm height. All the antenna elements will have the same design and dimensions. The antenna frames are parallel to the ground and the port is orthogonal to the ground, and the dimensions of the antenna are 13.699 mm × 9.559 mm calculated in figure 4.

The substrate is FR4-epoxy with relative permittivity of 4.4 (loss tangent 0.02) and the dimension is 130 mm × 74 mm. figure 1 is designed and simulated for 5GHz. figure 1 shows the top view of the MIMO antenna, figure 2 is the enlarged view of the single antenna and figure 3 is the 3D view of the proposed structure.

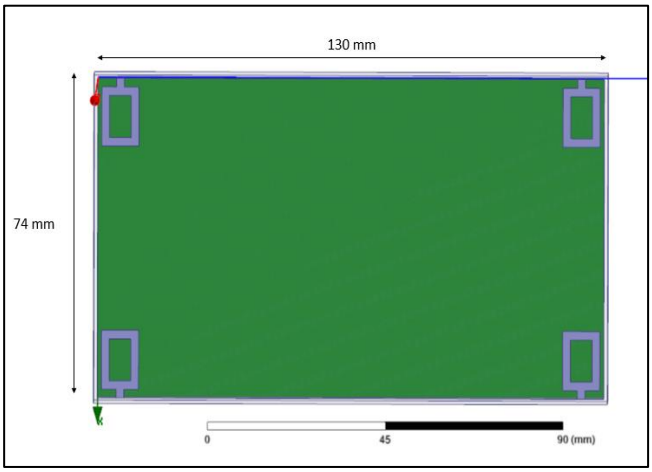

Fig. 1: Top View of the proposed structure

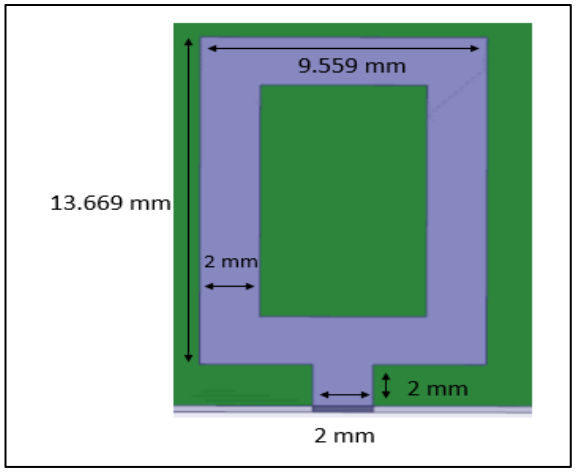

Fig. 2: Single Element View

The transmission coefficients are plotted in figure 5 which are much less than -20 dB and hence suitable for smartphone applications. Figure 6 shows the antenna efficiency which is found to be 85% at the operating frequency. The Envelope Correlation Coefficient (ECC) of the four antennas is plotted in figure 7 which is close to 0 in the operation frequency band which is good for the MIMO operation.

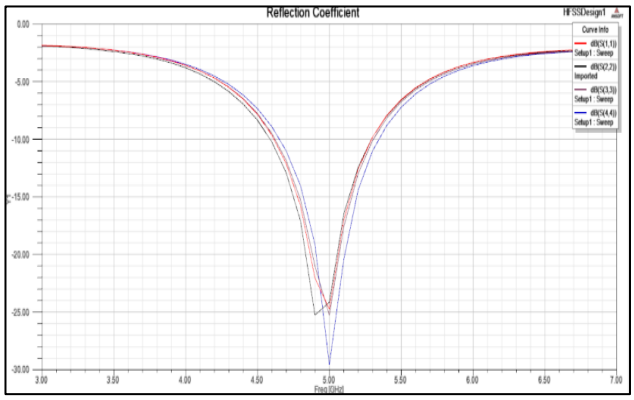

Fig. 4: Reflecton Coefficient

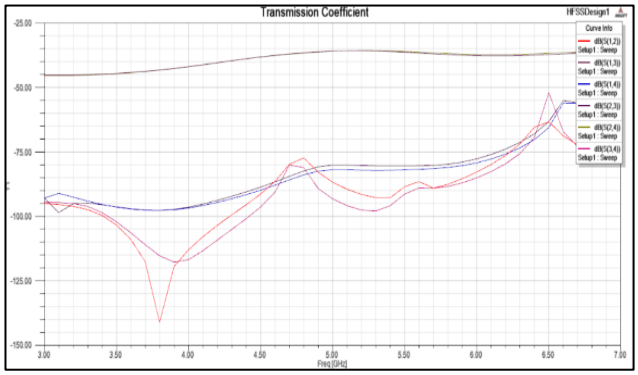

Fig. 5: Transmission Coefficient

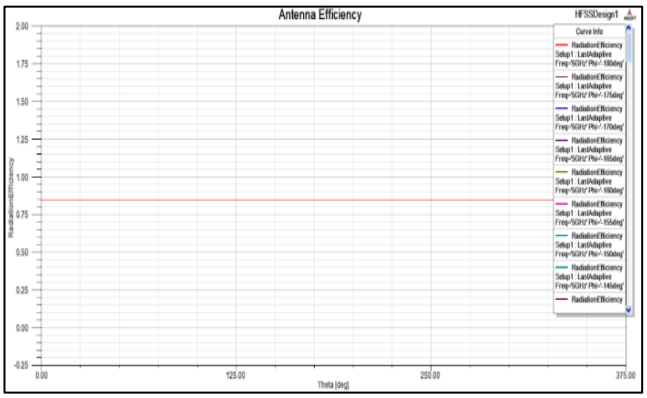

Fig. 6: Antenna Efficiency

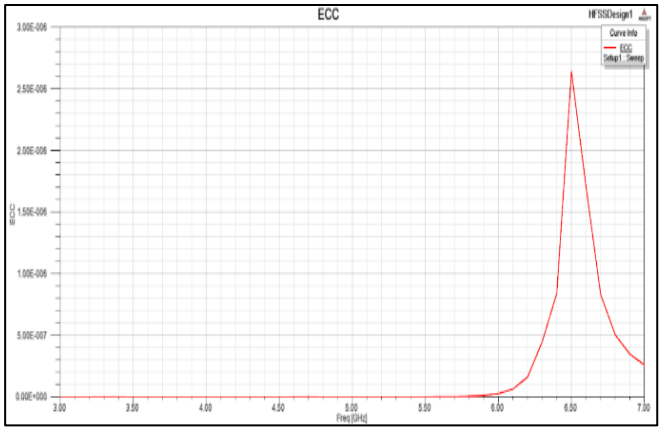

Fig. 7: ECC vs Frequency

Table 1: Comparison of the proposed structure

Parameter	Ref. [1]	Proposed work
Frequency Band	Dual Band (3.3-3.6, 4.8-5 GHz)	Single Band (4.8-5 GHz)
Unit Size	3.9 mm ×17 mm	13.699 mm × 9.559 mm
Reflection Coefficient	>-10 dB	>-15 dB
Transmission Coefficient	>-15 dB	>-20 dB
Efficiency	About 85 % with a dip after 4.7 GHz	Constantly 85 %
Envelope Correlation Coefficient	Close to 0.01 till 4.7 GHz and 0 after that	Close to 0 for the entire graph

4. CONCLUSION

A single band MIMO antenna with four antennas has been proposed for wireless communications in the C-band. The proposed design is placed on the top frame, parallel to the screen, on the backside of the smartphone. The reflection coefficients meet the requirements and are below -15 dB, and the transmission coefficients are much below -20 dB. The antenna size is small, and the ECC is very low, ideal for the next generation of mobile communication.

5. REFERENCES

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