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Design And Analysis Of Wideband Mimo Antenna Array For 5g Smartphone Applications

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Abstract - *Recently Multi-Input Multi-Output (MIMO) antenna array is presentedfor 5G devices. The paper focusses on the system that can operate at a wideband range that covers 3.5–5 GHz. Desirable antenna wideband capability is obtained by introducing slots in the patch where the overall antenna size is (130 mm × 74 mm). The technique of band enhancementof creating slots in the antenna is used so far. The simulated results of the presented paper of MIMO antenna array show that in the achieved wide band, the proposed design can achieve good antenna performances. The antenna gain and radiation pattern are demonstrated. The proposed Multi-Input Multi-Output (MIMO) antenna system presents small size, simple design and wider bandwidth. This MIMO antenna parameters have been studied with the HFSS software to obtain a better output.*

Key Words: **wideband, MIMO antenna, LTE, 5G mobile communication**

1. INTRODUCTION

MIMO (multiple input, multiple output) is an antenna technology for wireless communication in which there are multiple antennas on both source and destination called transmitter and receiver. The antennas at each end of the communications circuit are combined to minimize errors, optimize data speed and improve the capacity of radio transmissions by enabling data to travel over many signal paths at the same time. Creating multiple versions of the same signal provides more opportunities for the data to reach the receiving antenna without being affected by fading, which increases the signal-to-noise ratio and error rate. By boosting the capacity of radio frequency (RF) systems, MIMO creates a more stable connection and less congestion. MIMO is often used for high-bandwidth communications where it's important to not have interference from microwave or RF systems. For example, it's frequently used by first responders who can't always rely on cell networks during a disaster or power outage or when a cell network is overloaded. Apart from overcoming the few drawbacks of 4G LTE, 5G system offers the capacity to develop in the future for industry as well as users.

2. ANTENNNA DIMENSIONS

The designed antenna uses 0.8 mm FR-4 substrate with relative permittivity= 4.4 and loss tangent= 0.02 with the size 130mm x 74 mm. The radiation part is divided into two parts radiation monopole and L-shaped short circuit stub.

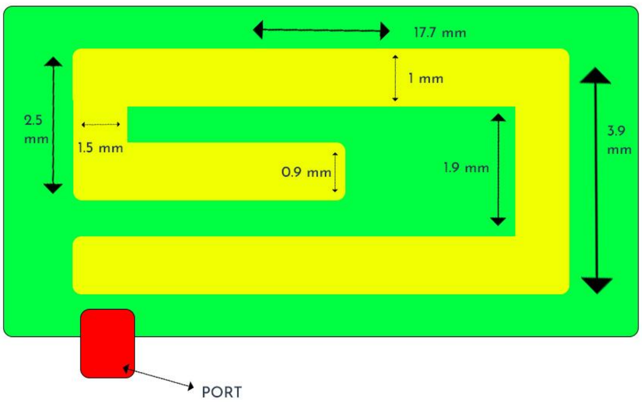

Fig -1: Dimension of MIMO antenna

3. DESIGN AND CONSTRUCTION

The specific structure of the antenna element is shown. The size of the antenna is 130mm X 74mm. The MIMO Antenna array is designed using the 4 antenna elements on 0.8 mm FR4substrate with relative permittivity of 4.4 and loss tangent of 0.02

The MIMO Antenna array is designed using FR-4 substrate with relative permittivity of 4.4 and loss tangent of 0.025 as shown in the fig 2 below.

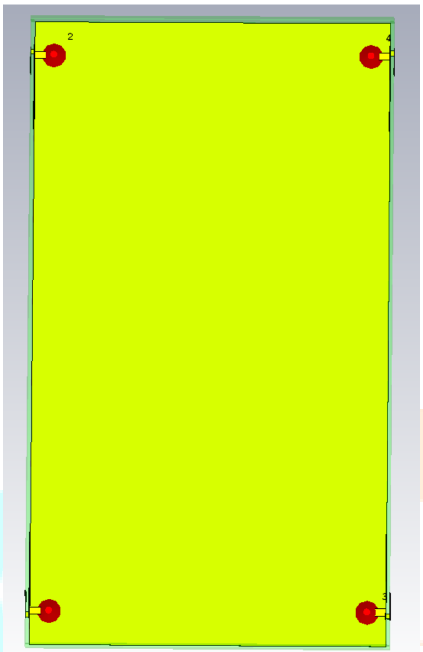

Fig -2: The top view of the MIMO antenna

4. RESULTS AND DISCUSSION

4.1 S Parameter

Using the HFSS the results of the proposed antenna structure have been simulated. Fig 3. Shows the simulated S11 parameter. S11 is defined as the reflection coefficient between the port impedance and the network's input impedance

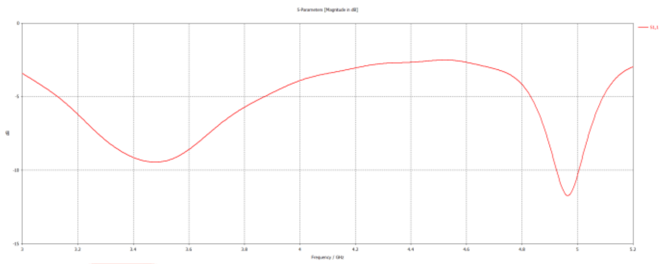

Fig -3: Simulated S11 parameter

4.2 Radiation Performances

The MIMO antenna is simulated with the HFSS software which shows the result in the x and y direction which can be shown in fig.4 at 3.5 GHz and fig.5 at 5 GHz. As can be seen from both the figures the radiation is almost unidirectional. The simulated 3D patterns at the frequencies 3.5 GHz, 5 GHz are shown in fig. 6, fig.7 and in fig.8. and fig.9 shows surface current distribution at 5 GHz and 3.5 GHz.

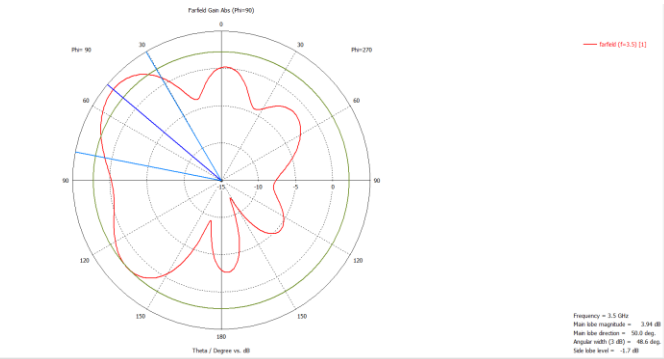

Fig -4: Simulated radiation pattern in the xy plane at 3.5GHZ

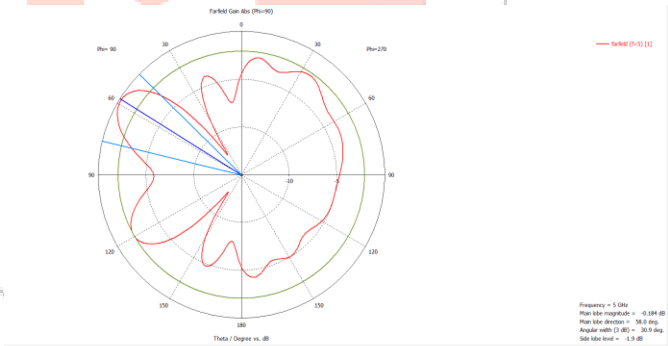

Fig -5: Simulated radiation pattern in the xy plane at 5

GHZ

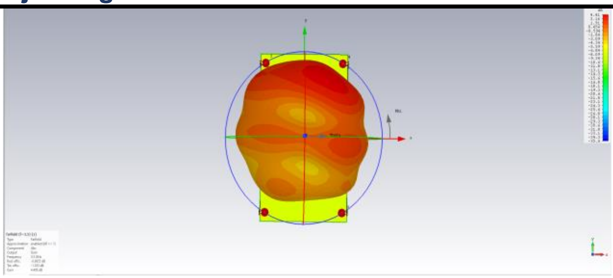

Fig -6: Simulated 3D Gain at 3.5 GHz

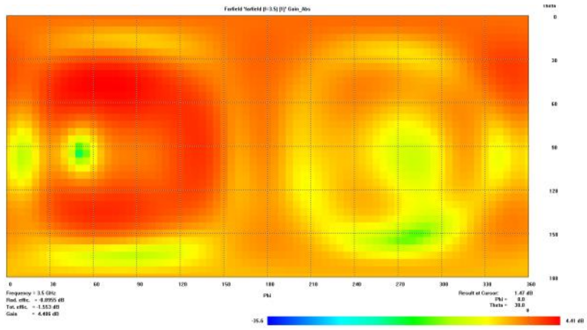

Fig -8: Surface current density at 5 GHz

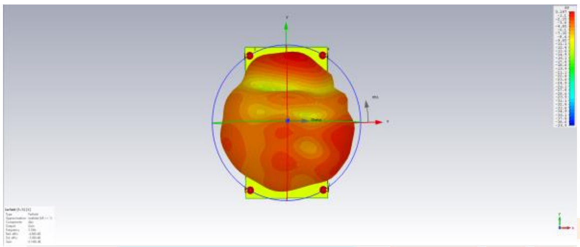

Fig -7: Simulated 3D Gain at 5 GHz

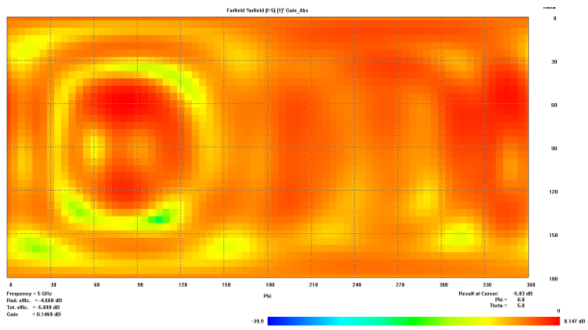

Fig -8: Surface current density at 3.5 GHz

5. CONCLUSIONS

A 8x8 element wideband (4.9–6.2 GHz) MIMO antenna hasbeen designed using 8 single 46.42 mm^2 slotted microstrip line fed planar patch antennas on FR-4 substrate of the size200 mm x 97 mm x 3 mm. Impedance matching and close ended and open ended slot is used designing to achieve frequency adjustment, compactness and good performance.

The bandwidth of 1.3 GHz, covering 4.9–6.2 GHz band with 4.6 dBi peak gain of the antenna, isolation >16 dB and return loss <-11dB is achieved. This antenna design of array can beused for 5G communication to various applications.

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REFERENCES

[1]. Dewar, C., & Warren, D. (2014). Understanding 5G: Perspectives on future technological advancements in mobile. GSMA Intelligence, 1-26.

[2]. Andrews, J. G., Buzzi, S., Choi, W., Hanly, S. V., Lozano, A., Soong, A. C., & Zhang, J. C. (2014). What will 5G be? IEEE Journal on selected areas in communications, 32(6), 1065-1082.

[3]. Brown, G. (2016). Exploring 5G new radio: use cases. Capabilities & timeline. Qualcomm White Paper, 1-12

[4]. Chen, S., & Zhao, J. (2014). The requirements, challenges, and technologies for 5G of terrestrial mobile telecommunication. IEEE communications magazine, 52

[5]. 36-43. [5].Ericson White Paper GFMC: 18:000530, (2018). Advanced antenna systems for 5G networks.

[6]. Zhao, A., & Ren, Z. (2019). Wideband MIMO antenna systems based on coupled-loop antenna for 5G N77/N78/N79 applications in mobile terminals. IEEE Access, 7, 93761- 93771.

[7]. Li, J., Zhang, X., Wang, Z., Chen, X., Chen, J., Li, Y., & Zhang, A. (2019). Dual-band eight- antenna array design for MIMO applications in 5G mobile terminals. IEEE Access, 7, 71636- 71644.

[8]. Ren, Z., & Zhao, A. (2019). Dual-band MIMO antenna with compact self-decoupled antenna pairs for 5G mobile applications. IEEE Access, 7, 82288-82296.

[9]. Ren, Z., Wu, S., & Zhao, A. (2018). Coexist design of sub-6GHz and millimeter-wave antennas for 5G mobile terminals. In 2018 International Symposium on Antennas and Propagation (ISAP), 1-2.

[10]. Khan, M. N., Gillani, S. O., Jamil, M., & Iftikhar, T. (2018). Multi Antenna Systems for 5G Mobile Phones. International Journal of Electrical and Information Engineering, 12(4), 299-30