Design of a MIMO Antenna for Broadband 5G Using Stepped Cut at Four Corners Method

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***Abstract*—A MIMO antenna using SCFC Method for the Broadband 5G communication is proposed in this paper. The proposed antenna consists of two antenna, it operating at 14000- 16000 MHz. The antenna designed in this letter are different from any design of 5G antennas, the antenna of this paper is used based on operating frequency and bandwidth requirement , it can be applied for the IOT technology needed. According to the simulation results, a total bandwidth of the antenna is 2.348 MHz, and the VSWR is 1.26 with Gain 1.23 dB over the band- frequency of 14000-16000 MHz, it will met the needs of IOT for future 5G applications.**

***Index Terms*—Stepped Cut at Four Corners, 5G operation, MIMO antenna**

I. INTRODUCTION

In order to meet the needs of modern 5G wireless communication system, study of the 5G smartphone antenna has great application value. 5G has become a hot spot in the field of mobile communications both at home and abroad. In early 2013, the EU launched the METIS (mobile and wireless communications enablers for the 2020 information society) project for 5G in the 7th framework plan [1], China and South Korea set up IMT-2020 (5G) Propulsion Team and 5G Technology respectively. At present, various countries in the world are conducting extensive discussions on the development vision, application requirements, key technical indicators and enabling technologies of 5G [2].

NTT DoCoMo and Ericson have tested the 5G communication design with a frequency of 15 GHz. Some advantages of 15 GHz are attenuation caused by rain and the air attenuation tends to be smaller than the higher frequency. One consequence of the use of high frequencies in 5G communication is the increasingly tight wavelength emitted and the relatively high signal propagation losses. In addition, high user mobility will result in high multipath fading. Therefore, one technique to overcome multipath fading is by using an MIMO (Multiple Input Multiple Output) system antenna system that uses more than one antenna both on the sender and receiver side [3].

In this paper, a broadband MIMO antenna for Broadband which consist of two elements is proposed. The proposed antenna can operating in the frequency band of 14000-16000 MHz, with center frequency of 15000 Mhz . Using the Stepped Cut at Fours Corners method, we can find and calculate the desired bandwidth and get more accurate results. It makes the requirement bandwidth for IOT 5G more easier to calculate for the antenna dimension.

II. DESIGN AND CHARACTERISTICS OF THE ANTENNA

The structure and dimensions of the proposed antenna broadband is shown in Fig.1. As is seen, the antenna system consisting of two patch with defected shape. The single antenna is designed and can be operated in the bands of 14000-16000 MHz This method is used to design microstrip antennas that work on broadband frequencies. The four corners of the rectangular patch will be cut to get the desired bandwidth. In this method the lower frequency (FL) and upper frequency (FH) must be determined to get the bandwidth range. The value of the length and width of the patch will be calculated and made based on the two frequencies. From the calculation, the patch size on FH will be smaller than the patch size in FL. Because the size of the FL patch is larger, the FL patch will be the main patch. The position of the FH patch coordinate must be entered in the FL patch coordinate position [4].

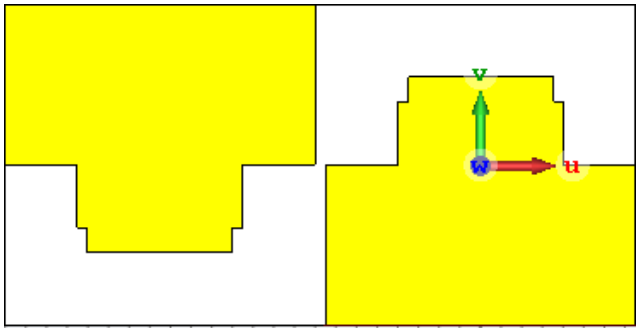

Fig. 1. The proposed antenna broadband structure and design.

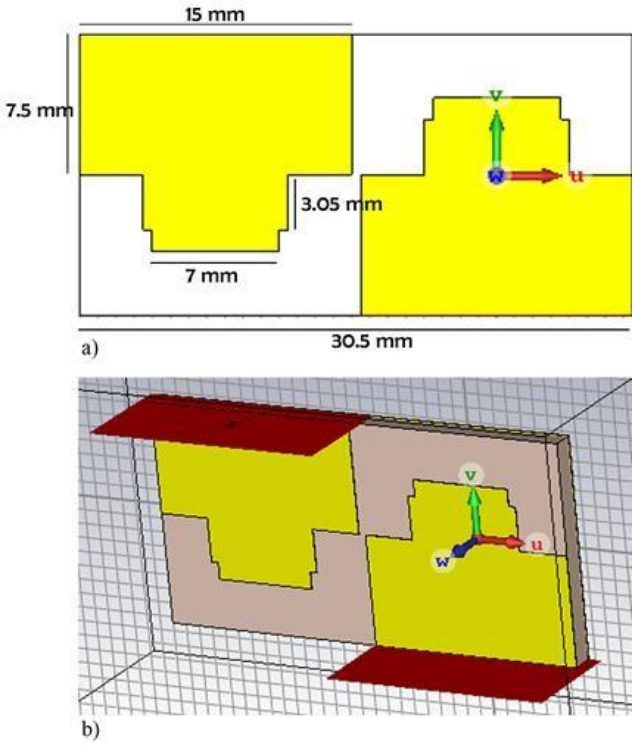

Fig. 2. The detailed antenna structure. (a) Calculation antenna model. (b) Antenna model side view.

III. SIMULATED RESULTS

The simulated results were performed by using CST Studio Suite. Fig.3 shows the simulated VSWR parameters for the proposed antenna broadband. As seen in Fig.3, the VSWR of two antennas are less than 1.5 in the desired frequency range of 14-16 GHz, indicating that acceptable bandwidth is obtained. The total bandwidth between antennas are presented in Fig.3, it shows about 13.613 MHz as lower frequency and 15.961 MHz as upper frequency. The difference between that is 2.348 Mhz, which is acceptable for prove that the method is succeeded to find the desire bandwidth and it can be used for IOT technology needed .

The obtained gain and return loss of the two antennas is presented in the Fig.4 and Fig.5. The obtained return loss is less than -10 dB and the mutual coupling is less than -20 dB in the operation band ,which is good for the MIMO operation. But for gain, its still lack. It can be overcome by increasing the number of mimo antenna for more gain. The result suggest that the proposed antenna broadband are suitable for practical MIMO operation and can be used for future technology.

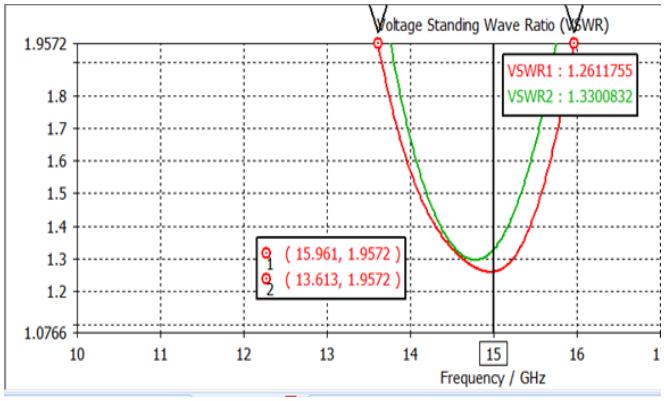

Fig. 3. Simulated VSWR and Bandwidth.

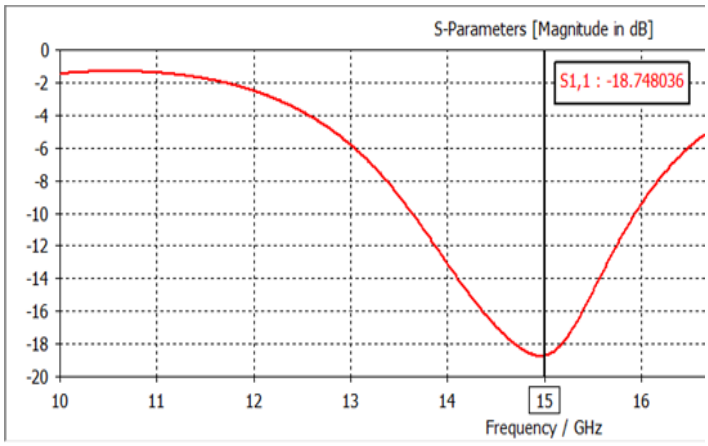

Fig. 4. Simulated Return Loss

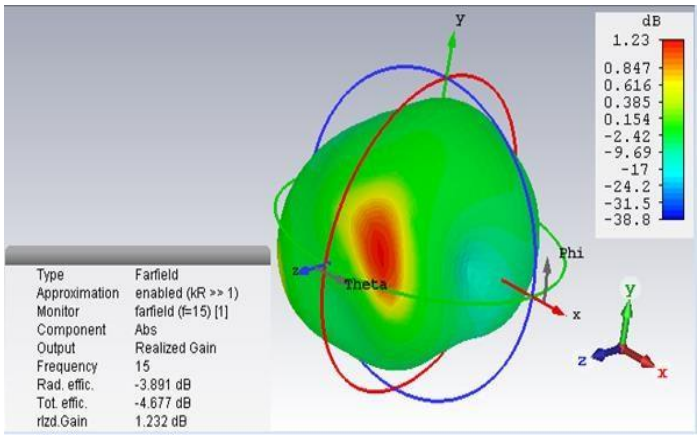

Fig. 5. Simulated Antenna Gain

IV. CONCLUSION

A stepped cut at four corners with two-antenna MIMO broadband for 5G technology is proposed. The proposed antenna is used for large bandwidth requirements for IOT industry, in line with the trend of a real time technology with high data rates, the method is proposed to prove that the desired frequency range is equal to the desired bandwidth. But the gain of the proposed antenna is still lack and need more improvement.

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