# *Single Wideband Microstrip Patch Antenna for 5G Wireless Communication Application*

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*Abstract*— **A wide-band microstrip patch antenna for the next generation of wireless communication (5G) is proposed in this paper. The proposed antenna is benefited of a compact size of *30.7×22.4 mm²* at 6GHz frequency band. The proximity feed technique is used for the matching between radiating patch and the 50Ω microstrip feedline. Based on the simulation results at the chosen frequency, the proposed antenna can cover 5G requirements. The gain of 3.7dB with a directivity of 6.62 dB and a bandwidth of more than 500MHz are obtained from simulation which shows a good agreement between theory and simulation results.**

***Keywords—5G, microstrip patch, wideband***

## 1. INTRODUCTION

Currently, mobile data connectivity is an everyday requirement for almost everyone who uses a cellphone. Today, smartphones are mostly powered by networks based on the fourth generation technology, called 4G. However, the fifth generation of wireless (5G) is coming with a higher performance, higher data rate, lower latency and much more [2].

The next generation of wireless mobile communication is expected to achieve requirements never achieved by a previous types of communication. With today's increasing applications and demands, spectrum scarcity is increasing. Hence, the usage of frequency bands beyond what is used today is required in near future.

A sufficient frequency spectrum should be available in order to achieve 5G requirements. Currently, almost all International Mobile Telecommunications are deployed in the spectrum below 6GHz [2].

There are several frequency bands above 6GHz suggested for 5G use cases. At higher frequencies, communication signals are attenuated because of the atmospheric absorption of electromagnetic waves [1]. At frequencies above 10GHz, rain has a big attenuation effect on signals [4].

In the proposed 5G antenna, the frequency is chosen around 6GHz to avoid the aforementioned issues, and thus to save the cost and the energy required to overcome these issues.
This paper is arranged as the following: Section 2 describes the designed antenna; while section 3 demonstrates different simulation results and discussion.

## 2. ANTENNA DESIGN

The proposed antenna is designed and simulated using Computer Simulation Technology (CST) Microwave Studio 2014 (CST MS 2014). The designed antenna is a rectangular microstrip patch antenna, resonates best at 6.1 GHz

Fig. 1 shows the geometry of the proposed 5G antenna. The antenna with a ground length of Lg=22.36mm and a ground width of Wg=30.7mm is a fully copper grounded microstrip; built on a substrate of FR-4 with a dielectric constant of 4.3, loss tangent of 0.01 and a thickness of 1.6mm which is the substrate height. The patch has a length of L=11.18mm and a width of W=15.35mm, with a feed inset Fi=3.3mm and feed width Wf=3.5mm.

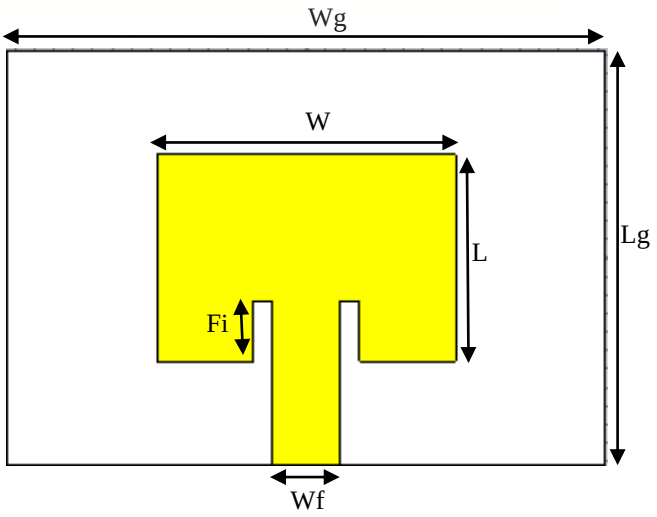


Fig. 1. Designed 5G microstrip patch wideband antenna geometry

The designed 5G microstrip patch wideband antenna is illustrated in Fig. 2. Microstrip patch antenna is used because it has low cost, low weight and its good feed characteristics. [3] In this paper, a rectangular patch is used, because it is convenient to analyze and design. Compared to other types of patch shapes, the rectangular patch has large impedance bandwidth due to its broader shape. [5]

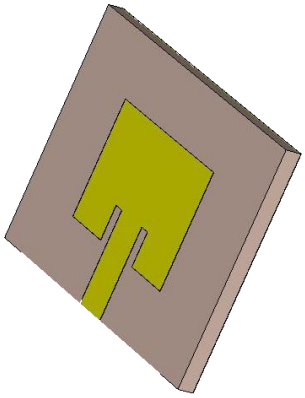

Fig. 2. Designed 5G microstrip patch wideband antenna geometry

## 3. Simulation Results and Discussion

From the proposed design, a clean bandwidth of more than 500MHz is obtained. This shows that the proposed antenna can handle the 5G bandwidth requirements.

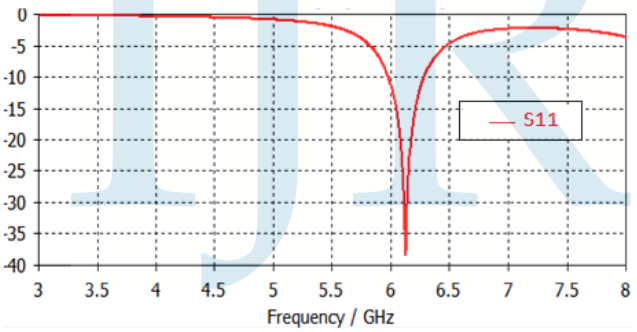


Fig. 3. Reflection coefficient S11 of proposed 5G antenna

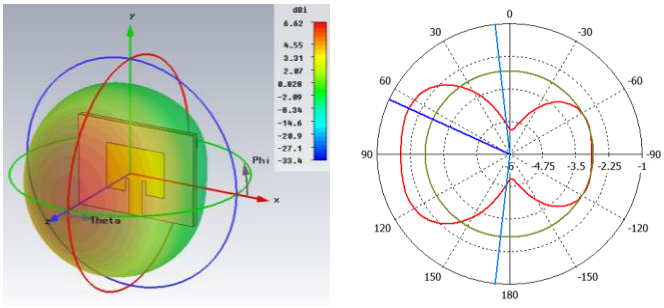


Fig. 4. Farfield radiation pattern of proposed 5G antenna

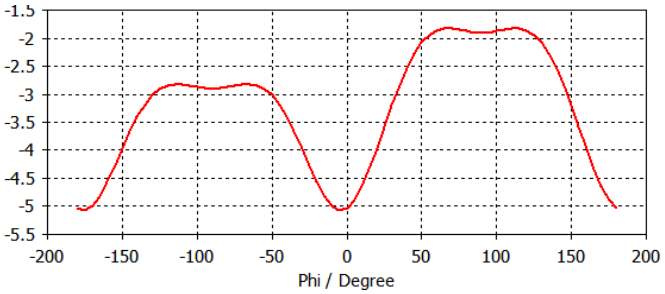


Fig. 5. Directivity of the proposed 5G antenna

Fig. 3. Shows the designed antenna's return loss (S11) plotted vs the frequency. A reflection coefficient magnitude of -38dB is obtained at 6.1GHz frequency. Illustrated in Fig. 4. is the farfield radiation pattern of the proposed antenna, the three dimensional view is shown with a directivity of 6.62 dB along with the polar plot. Fig. 5. demonstrates the Cartesian plot of the directivity with a half power beamwidth of 167.2 degrees and a side lobe level of -1dB.

## 4. Conclusion

The fifth generation of wireless communication will change the world to a smart connected platform. However, the term 5G is not used in any present technologies. Research is conducted on different frequency spectrums and designing proper antennas. In this paper, the microstrip patch antenna is studied as a candidate antenna for 5G. The proposed antenna resulted in a wide bandwidth, high gain and directivity. Due to high performance and simplicity in fabrication, the proposed antenna is suitable for the future 5G wireless communication.

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