Design of a compact 28GHz Antenna for 5G Communication

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***Abstract*—: 5G communication systems are emerging due to the need for faster data rates and larger bandwidths. 5G require systems that of low profile, light weight and capable of achieving high bandwidths to ensure high efficiency. The 28GHz frequency band was selected for the study due to the low atmospheric absorption around this frequency and cost-effectiveness. The study presented a single element low profile microstrip antenna operating in the 28GHz frequency band. The proposed antenna was printed on a Rogers RT5880 substrate with dielectric constant of 2.2 and a loss tangent of 0.0009. The antenna consists of a rectangular radiating patch fed by a 50Ω microstrip line. In other to increase the gain of this antenna while maintaining a low compact profile, four rectangular-shaped slots were introduced on the patch. The positions of these slots were optimized using Computer simulation technology (CST) software. The antenna provided a gain of 7.67 dB with return loss of above -30dB. The antenna showed good radiation characteristics with radiation efficiency of 98% and achieved high bandwidth up to 2GHz.**

Keywords—28GHz, 5G Antenna, Microstrip, Slot Antenna

I. INTRODUCTION

The global increase in the development and application of embedded systems, more especially in mobile and wearable devices, has necessitated the need for fast and reliable wireless networks for communication between these devices. The advent of Internet of Things (IoT), an offshoot of embedded technology has further buttressed the need for an enhanced machine to machine (M2M) duplex communication system to support these technologies. Over the years, in order to ensure effective and efficient communication amongst devices, antennas (a metallic device, as rod or a wire, for transmitting and receiving radio waves) of diverse forms and types have been designed [1]. However, these antennas have been plagued by other forms of limitation ranging from antenna size, bandwidth constrains, power needs and signal propagation amongst others [2][3]. To solve these challenges a Microstrip Antenna was developed.

The microstrip antenna (also called a printed antenna) is a type of antenna design, fabricated using microstrip techniques on a printed circuit board (PCB). They have become very popular and increasingly used in recent times due to their thin planar profile which can be incorporated into the surfaces of consumer products, aircraft and missiles. Their ease of fabrication using printed circuit technology, the ease of integrating this antenna on the same board with the rest of the circuit and the possibility of adding active devices such as microwave integrated circuits (ICs) to the antenna itself has made their use even more attractive for Communication Engineers and professionals alike.

The deployment of the microstrip antenna in the mobile industry has brought about a dramatic growth in communication systems globally. It has evolved from analog to digital 2G (GSM), to high data rate cellular wireless communication such as: 3G (WCDMA), packet optimized 3.5G (HSPA) and 4G (LTE and LTE advanced) networks. [4]. Conventional 4G network technology uses frequency band of 2 - 8GHz providing a bandwidth of 5 - 20MHz. However, the continuous popularity of IoT has demanded higher communication speed as a necessity for seamless data transfer. To support this large data traffic, 5G network technology was introduced as the latest possible solution [5]. With the introduction of 5G network, microwave bands will be used to achieve high data rates and increase the user capacity and experience [6].

The purpose of this paper is to design a 5G microstrip patch antenna. This paper presents a 28GHz microstrip patch antenna for effective and efficient application in 5G mobile communication networks.

II. LITERATURE REVIEW

Over the years, in a bid to resolve the challenges associated with the effective and efficient design of microstrip patch antennas, various individuals have carried out different researches and have come up with designs to provide a lasting solution to the challenges in communication networks. Some of the areas researched upon include the size of the antenna, design of the patch, feeding techniques and efficiency of the antenna amongst others. So far, frequency band of 28GHz has been identified as efficient in network design due to low oxygen absorption at that frequency[7], [8]. Several antennas have been developed

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