Chapter 1
Metamaterials-Based Antenna for 5G and Beyond

Smrity Dwivedi
IIT BHU, India

ABSTRACT

As per demand of high speed and wide bandwidth, there is a wide need to improve the antenna performances and take advantage of a new technology; nevertheless, passive and active devices operating at high frequencies are a big challenge. In the present era of the digital world, demand for IoT-based smart devices has seen having tremendous growth. Basically, these devices involve real-time human-to-machine communication and interaction. Communication of uninterrupted quality depends on the high bandwidth and speed of the internet. The development of 5G wireless network technology is the response to the crucial factors that lead to this demand because of its ability to provide extremely fast internet speed, high bandwidth, high performance, reduced latency, and high reliability and better gain. Metamaterials (LHM) hold great promises for such devices and for many applications like medical, technologies, communications, defense, etc. Metamaterials have interest properties, making them more amenable to transmit and receive in small quantities.

INTRODUCTION

In todays era, the innovation to 5G wireless technology enabled IoT devices at a millimetre-wave band will revolutionize the electronics and telecommunication field (John Colaco et al. 2021). This and technologies of wireless communications is one of the biggest human achievements in terms of 5G and IoT technology. Now, 5G technology and IoT technology thinking will become reality for smart devices

DOI: 10.4018/978-1-6684-8287-2.ch001

(A. Helena et al. 2020). It could be a big dream come true and a game-changer for humans particularly in the field of education, health, agriculture, autonomous vehicles, industry and many other related applications. Hence, in this proposed chapter, author has elaborated a design and analysis with specifications of metamaterials based antenna for 5G and beyond technologies for various 5G enabled advanced IoT Devices. IoT-based smart devices are usually expanding their support for Internet access (broadband) beyond devices, such as smart/mobile phones, laptops, and so on. The IoT based smart devices have been amalgamated with cutting-edge technology to manage and communicate smoothly using 5G and beyond wireless technologies. 5G wireless technologies grasps an important role in setting up the platform for real-time communications of IoT devices due to its potential to offer greater bandwidth with millimetre bands compared with 4G or 3G wireless technology previously. 5G wireless network technology combines the spectrum and access networks to meet the customer's capacity and coverage needs to fulfill the demand (G. GSMA 2019). The internet of everything specifies the synchronisation of various smart electronic devices such as tablets, smartphones, laptops, multiple machines such as smart vehicles equipped with sensors with IoT communication, and wireless or wired connection of consumer appliances connected through the internet (G. GSMA 2019) in present era. 5G technology will provide massive support for IoT devices as a useful part of the human digital world as the digital population is growing more than the human population as per need. The latest 5G enabled IoT smart device's trends are extending to sensor-based IoT competencies to actuators, robots, and drones for distributed synchronization system. The biggest and crucial challenge facing 5G enabled IoT devices is cyber security as hackers proliferate and infiltrate and target the server's proxy. Hence secured communication of a machine to a machine has a dynamic role in emerging IoT smart devices (J W. Ejaz et al. 2016). During the COVID-19 epidemic, this advancement would also allow real-time video and audio quality data for patient data analysis and wireless uninterrupted communication of detected health parameters. In this chapter, few designs have been given for antennas for effective multi-band operation useful for 5G based IoT devices and applications. In this chapter, antenna loaded the metamaterial SRR structure on the microstrip patch to boost the performance has discussed. The performance is then analysed in comparison with and without loading metamaterial SRR structure.

CONCEPT OF METAMATERIAL

There has been a great deal of attention given in the field of metamaterials over a past few years (C. L. Holloway et al. 2009; V. G. Veselago 1968). Metamaterials are fully synthetic materials developed to get unique properties not normally found in