

# Overview of 5G MIMO Antenna

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## ABSTRACT

This paper provided a foundation of knowledge on 5G antennas. The review paper is used to identify areas of prior scholarship to prevent duplication, identify inconsistencies and also used to analyze conflicts in previous studies. The main objectives of the work are to review the recent research and development trends and highlight antenna structure, material, design parameters and application and also a comparative analysis of the 5G MIMO Antenna.

## Key words

5G, massive Multiple input multiple output (MIMO), LTE (long term evolution), Data rate, Data traffic, Multipath propagation.

## 1. INTRODUCTION

The 5G Technology is the fifth generation of the internet. The expansion of 5G generation wireless Technology. This will be wireless communication with almost no limitations. It can be called the real wireless world. It has incredible transmission speed for transferring data and receiving data. A 5G network will be able to handle 1 core times more call and data traffic than the current 3G or 4G network. Data download speeds on 5G networks are likely to be several hundred times more than 4G. 5G Mobile Technology will change the means to use cell phones with very high bandwidth. 5th generation technology provides facilities like a camera, MP3 recording, video player, large phone memory, audio player etc. which can be never imagined for children rocking fun with Bluetooth technology and online gaming. All the technology that comes under the field of telecommunications so far, this technology is very fast. Uploading and downloading speed of 5G technology are going to be improved very much compared to 3G and 4G technology which can change the infrastructure of wireless communication. MIMO antenna plays an important role in 5G technology.

## 2. MIMO Antenna

MIMO (multiple input, multiple output) is an antenna for wireless communications. MIMO is one of the most common forms of wireless, and it played a key role in antennas at each end of the communications circuits are optimize data speed, combined to minimize errors, and improve the capacity of transmissions (both transmitter and receiver antenna) by enabling data to travel over many signal paths at the same time.

MIMO in LTE (long-term evolution) offers faster data rates and more dependable data delivery. Before transmission data can be separated into individual streams. There are two primary types of MIMO, one is a single-user (SU) and another one is a multiuser (MU). In single-user systems, data streams can only interact with one device on the network at a time. In multiuser-user systems, data streams can only interact with many devices on the network at a time.

## 3. SURVEY OF 5G MIMO ANTENNA

Multiple-input-multiple-output (MIMO) is an advanced technology for multiplying the capacity of a radio link using multiple transmit and receive antennas to achieve multipath propagation. MIMO was initially proposed in the early 90s as a feasible solution that can overcome the data rate limitation experienced by single-input-single-output (SISO) systems. MIMO can be used in different networks to improve channel capacity, system reliability and transmission speed of data by utilizing the highest capacity of the wireless communication systems. The massive MIMO system is believed to be a key enabler for fifth-generation (5G) communications. Due to the limited space and aesthetic reasons, compact MIMO antennas are required in mobile terminals as well as base stations. As antenna elements are close to each other, (electromagnetic) mutual coupling between antenna elements becomes inevitable. Table 1 shows a comparative analysis of the 5G MIMO antenna.

**Table -1: Comparative analysis of 5G MIMO Antenna**

S.No	Author(Year)	Type of Antenna	Material	Antenna Structure	Design Parameters	Application
1.	M. Hussain <i>et al.</i> 2021 [1]	Dual Band Antenna	Roger/RT duroid 5880	Two - Slots	Res. Frequency 25.8 – 29.9 GHz and 41.8 – 52GHz 25.8 – 29.9 GHz and 41.8 – 52GHz Dimension 15 mm×15 mm×0.79 mm	mobile and satellite communications.
2.	C. You, D. Jung, M. Song and K. -L. Wong 2018 [2]	A compact broadband and dual-band antenna	FR4	hybrid loop antenna	Frequency 3.3~4.2 GHz. dual-loop antenna to cover 2.4~2.5 and 5.1~5.9 GHz	5G Smart phones.
3.	Z. Ren, S. Wu and A. Zhao 2019 [3]	A 4-antenna array for multiple-input multiple-output	FR4	four triple band antennas	5G new radio n77 (3.3-4.2GHz) and n79 (4.4-5GHz), and 5GHz	5G mobile terminals
4.	D. Serghiou, M. Khalily, V. Singh, A. Araghi and R. Tafazolli 2020 [4]	Sub-6 GHz Dual-Band 8 × 8 MIMO Antenna	FR-4	Dual band 8*8 MIMO antenna	17.85 × 5 mm <sup>2</sup> and can operate in 3100-3850 MHz for the low band and 4800-6000 MHz for the high band ( S <sub>11</sub>   < 10 dB)	5g smart antennas
5.	K. Yan, P. Yang, F. Yang, L. Y. Zeng and S. Huang 2018 [5]	Dual Band Antenna	Barium Carbonate	T-ship open-slot antenna	7×15.5 mm <sup>2</sup> for operating at fifth-generation (5G) band (3.3-3.6 GHz and 4.8-5.0 GHz),	5G smart phones for Dual band MIMO
6.	P. Xingdong, H. Wei, Y. Tianyang and L. Linsheng 2014 [6]	multibeam antenna system	Silicon dioxide	The 64-channel highly integrated active multibeam antenna	5.8 GHz with 64 RF Channels and 256 antenna elements	MIMO applications in 5G wireless communications
7.	C. F. Zhou, J. X. Sun and H. Li 2021 [7]	novel multiple-input-multiple-output	FR-4	eight loop antenna elements-T-shaped slots	operated at 3.3~5.5GHz	5G smart phone.
8.	W. -Y. Li, W. Chung, F. -R. Hsiao and P. -S. Chen 2020 [8]	A compact coupled-fed loop MIMO antenna	FR-4	two adjacent parasitical switch integrated folded monopole	3.5 GHz band 33.7 × 5.5 mm <sup>2</sup>	5G notebook PC applications
9.	X. -. T. Yuan, Z. Chen, J. Li and T. Yuan 2020 [9]	A Compact Dual-Band and High-Isolation	FR-4	two folded stubs	3.5-GHz band (3400–3600 MHz) and 5-GHz band (4800–5000	5G smart phone

		MIMO Antenna			MHz)	
10.	Z. Ren, A. Zhao and S. Wu, 2019 [10]	A dual-band antenna	FR-4	eight antenna elements	low band (3.3-3.6GHz) and high band (4.8-5.0GHz)	
11.	L. Zhu, H. -s. Hwang, E. Ren and G. Yang 2017 [11]	dual-band 2x2 MIMO antenna	FR-4	monopole mode and folded loop mode	frequency allocations at 3.3-3.6 and 4.5-5 GHz	wearable device applications
12.	M. -Y. Li, Z. -Q. Xu, Y. -L. Ban, Q. -L. Yang and Q. -Q. Zhou 2016 [12]	Eight-port dual-polarized MIMO antenna	FR4	four pairs of orthogonally dual-polarized loop type antenna	operating in the 2.6-GHz band (2550-2650 MHz)	5G smart phone
13.	E. Sandi, W. Djatmiko and R. K. Putri, 2019 [13]	microstrip antenna	FR-4	multiple U-slots	frequency 28 GHz	C-Band and X-Band
14.	J. Thakur, 2018 [14]	planar antenna 4x4 MIMO	FR4	small-size wide band antenna	1710 MHz to 6 GHz	5G mobile phone and laptops.
15.	N. Shoaib, S. Shoaib et,al., 2018 [15]	Patch antenna	Rogers RT-5880	H-shaped	resonate at 25.2 GHz	smart watches and dongles
16.	W. Zhang et,al.,2018 [16]	Dual-band MIMO antenna	FR-4	L-shaped	operating at 3300–3600 MHz and 4800–5000 MHz.band-frequency of 3300–3600 MHz and 4800–5000 MHz,	5G mobile phone
17.	N. O. Parchin et al., 2019 [17]	eight-port/four-resonator slot antenna	FR-4	square-ring slot	operate at 3.6 GHz	5G mobile
18.	M. C. Jose et al., 2019 [18]	linearly polarized MIMO antenna	Rogers Duroid 5880	Square patch 2X2 array MIMO antenna	center frequency of 28 GHz frequency range of 26.69- 30.29 GHz	5G wireless communication network
19.	Y. Zhu, et al.,2020 [19]	a dual-band dual-polarized antenna	Ferrite	rectangular ring resonator, ferrite choke ring, and novel baffle structure	operating at 3.3-5.0 GHz band (upper band UB) 0.69-0.96 GHz band (lower band LB)	5G base station
20.	Y. Liu, et al., 2019 [20]	eight gap-coupled IFA antenna	FR-4	T-shape slots etch	operating at 3.5 GHz band (3400-3600 MHz)	5G mobile phones

#### 4. CONCLUSION:

5G is a new revolutionary technology. It helps in the country's digital growth and development. In India this technology is also being introduced which will boost GDP, social, economic, education, defense etc., and also the rapid rise of our nation will be faster. 5G technology will help to incorporate artificial intelligence into our daily life. Compared to earlier generations, 5G is significantly more potent. 600 MHz, 700 MHz, 800 MHz, 900 MHz, 1800 MHz, 2100 MHz, 2300 MHz, and 2500 MHz are some of the low-band frequencies. The mid-band frequency, on the other hand, is 3300MHz. Last but not least, the spectrum also includes mm Wave, a high-band frequency with a range of up to 26 GHz.

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