A Literature Survey on Objection and Opportunities of 5G Wireless Communication Applications

[1]Kausar Parveen, [2]Mohammad Sabir, [3]Surbhi Mehta

[1]M.Tech. Scholar, [2,3]Assistant Professor
ECE Department
GITS Udaipur, India

***Abstract*: The wide-ranging demand for wireless telecommunication and data substitute through wireless devices has presided to major acquirement in antenna designing. The aim of the research paper is to present the framework of a source, objections, opportunities, and general description of the antenna used in wireless telecommunication applications. In this proposed paper we will throw light on various topics related to mobile communication and 5G technology such that, advantages and its benefit. Also, a precise configuration of comparisons between the antennas designed parameters and generation from 1G to 5G. This paper is also a summary of other surveyed paper based on 5G techniques and antenna designing.**

***Index Term*: 5G Technology, Wireless communications, Antenna design.**

I. INTRODUCTION

Wireless communication has advanced so rapidly in the latest session; it calls for minor apparatus mounting multiband communication. As a necessary part of the communication network, an antenna has most important design consequence. Planner inverted-F antennas (PIFAs) are most applicable to be utilized in wireless devices [3]. In mobile technology, 5G represent the 5th generation. 5th generation will feed us with very high-rise bandwidth. The 5G technology is much better than all other generation i.e. 1G, 2G, 3G, 4G technology. The speed of 5th generation is equal to the millimeter wave band [1].

5G is going to be the foremost powerful and higher technology in upcoming future. The speed of 5G technology is 100mbps to 1gbps with high information rates as compare to previous versions and the best quality of service. 5G will be much better than the 4G technology [1]. There has been a transparent shift from fastened to mobile cellular telecommunication, particularly since the flip of the century. By the top of 2010, there have been over fourfold additional mobile cellular subscription than fastened telephone lines in which each mobile network operators and vendors have felt the importance of economic networks with equally economical style. This result in network coming up with an optimization connected services coming back into sharp focus [2].

Mobile communication is deliberated joined of the quickest developing section of the communications business. With the appearance of the Internet of Things (IoT) and realistic UHD services, it's foretold that mobile traffic can witness one thousand-fold increase by the year 2020. This spectacular rise needs forceful improvement in mobile network capability beyond this 3G/4G networks to the subsequent generation of wireless radio standards [7].

On the opposite hand, with massive bandwidth in the millimeter wave (mmWave) band from 30GHz to 300 GHz, millimeter wave (mmWave) communications have been suggested to be an significant part of the 5G mobile network to provide multi-gigabit communication services such as high definition television (HDTV) and ultra-high definition video (UHDV). The maximum number of the latest research is based on the 28 GHz band, the 38 GHz band, the 60 GHz band, and the E-band (71–76 GHz and 81–86 GHz). Because of progression of mm-wave networks, many challenges such as high propagation loss, directivity, sensitivity to blockage, and dynamics due to the mobility of mmWave communications want new consideration and perception in infrastructure and agreement to meet with these issues. A survey of millimeter wave communications of 5G is described in this paper. The characteristics of mmWave communications are summarized. Through surveying the existing solution we get some issues about mm-Wave communications. System design involves the nonlinear distortion of power amplifiers, phase noise, IQ imbalance, highly directional antenna design, and integrated circuits are some challenges faced in before research. Many methods from physical to network layer has proposed to get over obstructions. The effective network performance and a powerful network is achieved in a smart way by combining its advantages and disadvantages. The prospective applications of mmWave networks in the 5G involve the tiny cell access, cellular access, and wireless broadband. Propose design guidelines in architectures and protocols for mmWave communications is examined in some open research challenges. MillimeterWave frequencies involving the multiple input & multiple-output (MIMO) technique and the full-duplex technique is initiated and discussed in form of advantages and problem with newly physical layers technique. In the moreover networks, mmWave communications bear to coexist into alternative networks, like that LTE and WiFi network (HetNets), connection and coordination within a different type of networks become vital to analyze the capability of heterogeneous networking[10,11,12,13,7,5].

This paper includes millimeter wave characteristics and applications in section II , the challenges and existing solution of 5th generation techniques in section III, problems and future directions in section IV and lastly, outcomes are sum up in section V [7,12].

II. CHARACTERISTICS OF MILLIMETER WAVE COMMUNICATION

Millimeter-wave (mmWave) cell frameworks, that work in the 30-300 GHz band, is by all accounts a favorable possibility for cutting edge 5G cell framework, which is relied upon to help information rates of numerous Gb/s. Be that as it may, utilizing mmWave requires managing the proliferation properties and the channel impedances of the high recurrence groups. Significant obstructions of mmWave proliferation are higher way misfortune because of higher transporter recurrence, diminished dispersing which in turns lessens the accessible assorted variety, and expanded impact of blockage because of more fragile non-viewable pathway ways. What's more, the impact of commotion control is progressively articulated because of the use of bigger data transfer capacities. [7]

A. Way Loss

The free space way misfortune is subject to the transporter recurrence fc. Expanding the bearer recurrence will decrease the reception apparatus measure. Thus the powerful opening of the radio wire scales by a factor of $\lambda/2\ 4\pi$, while the free space way misfortune develops with fc 2. Thus, expanding the transporter recurrence fc from 3 to 30 GHz, will correspondingly include a power loss of 20 dB paying little heed to the transmitter-beneficiary separation. Furthermore, keeping the reception apparatus gap consistent at the two closures will shockingly diminish the free way misfortune with fc 2 .

TABLE I. 5G Wireless Achievement (proposed)[4]

SPECIFICATION	EFFICIENCY(PROPOSED)
Network power	Ten Thousand Times Present Network
High Information Rate	Ten giga byte per second
Mobile phone range	Hundred mega byte per second
Retardation	< 1 mega byte per second

B. Blockage

Microwave signals are less helpless against blockages yet they blur because of diffraction. Interestingly, mmWave uncovered kaleidoscopic spread and endures less diffraction than the microwave signals, making them significantly more powerless to blockages. This will result in an about bimodal channel as indicated by the need and presence of viewable pathway. Ongoing investigations demonstrate that, with the expansion in the transmitter and recipient remove the way misfortune increments to 20 dB/decade under observable pathway spread, yet plunges to 40 dB/decade in addition to an additional blocking loss of 15-40 dB for non-viewable pathway. This will result in an extensive scale downside that can't be skirted with little scale decent variety countermeasures. [7]

C. Climatic and Rain Absorption

A noteworthy obstacle to mmWave interchanges is weakening because of rain, foliage, and climatic absorption. Atmospheric constriction because of oxygen assimilation or substantial rain can be on the request of 10-20 dB/km. For instance, inside the 60-GHz band, the ingestion because of air and rain is outstanding, particularly the 15 dB/km oxygen assimilation. It tends to be seen that the 28 GHz and 38 GHz groups at the scope of 200 m experience the ill effects of low rain constriction and oxygen ingestion, while their impact is critical in the 60 GHz and 73 GHz groups. It tends to be likewise observed that the NLOS transmission has extra spread misfortune contrasted and the LOS transmission in each of the four classifications.

The future age remote systems require frameworks with wide band capacities in different conditions to fulfill various applications as keen matrix, individual interchanges, home, vehicle, and office organizing. Its adaptability makes it especially good for use in cell phone, hand held gadgets, air ships, marine art, trains and autos. [7,11,10]

III. CHALLENGES AND EXISTING SOLUTIONS

To maximize spectral efficiency and battery power shall being allowed the system to update the opportunities and requirement of the terminal by getting a new method of design parameter. In the 4G commercial pattern, a major subject is linked to privacy and protection, developing industry grade of perfection and meeting them in all reality of the technique, handling with cell-phone restriction, upgrading low use knowledge reported by the consumer for plenty other phones and essentially the deficiency of understanding of mobile data services among people. 5G Wireless acquire major objections comprise barrage of Traffic, the eruption of numerous devices and multiple of necessity such as retardation, reliability and poor rate, and power utilization. One Super core with massive capacity could be linked to entirely channel operators like as GSM, CDMA, Wi-max, Wireline etc. Single network infrastructure is realized by the super core. All interconnecting charges and complexities problem which is faced by network operators will be removed by a super core concept. A number of network entities in the end to end connection and latency regarded will be demonetized by the super core.[2]

To analysis the fabrication issues, it is classified into three main classes.

1) The incorrect rate of relative dielectric permittivity εr:

Substrates used for antenna design do not state values of εr over and above 10GHz. This matter becomes a key question when designing at mmWave frequencies. Designing of patch depend on εr.

2) Connector - stripline soldering: During the soldering, noise is developed default. Due to these multiple design issues become faced.

3) Construction mechanical imprecision and faults: In 5th generation antenna design is too small parameter considered, so during fabrication of antenna many design issues and the incorrect final result is fine.
To design microstrip patch antenna there is a good radiation pattern, resonant frequency, polarization, and impedance. Acceptance and formation mmWave is major issues. The high frequency of millimeter wave band is a big objection for traveling media, atmospheric and free space path loss. To resolve this problem acute propagation loss, directional antennas are at both transmitter and receiver to achieve a high antenna gain[12].

IV. APPLICATIONS OF MMWAVE COMMUNICATIONS

The Microstrip patch antennas are well known for their performance and their robust design, fabrication and their extent usage. The advantages of this Microstrip patch antenna are to overcome their de-merits such as easy to design, light weight etc., the applications are in the various fields such as in the medical applications, satellites and of course even in the military systems just like in the rockets, aircrafts missiles etc[6].
Some of these applications are discussed as below:

Mobile and satellite communication application: Mobile communication requires small, low-cost, low profile antennas. Microstrip patch antenna meets all requirements and various types of microstrip antennas have been designed for use in mobile communication systems..
Global Positioning System applications: Nowadays microstrip patch antennas with substrate having high permittivity sintered material are used for global positioning system.. It is expected that millions of GPS receivers will be used by the general population for land vehicles, aircraft and maritime vessels to find there position accurately
Radio Frequency Identification (RFID): RFID uses in different areas like mobile communication, logistics, manufacturing, transportation and health care . RFID system generally uses frequencies between 30 Hz and 5.8 GHz depending on its applications. Basically RFID system is a tag or transponder and a transceiver or reader.
Radar Application: Radar can be used for detecting moving targets such as people and vehicles. It demands a low profile, light weight antenna subsystem, the microstrip antennas are an ideal choice.
Rectenna Application: Rectenna is a rectifying antenna, a special type of antenna that is used to directly convert microwave energy into DC power. Rectenna is a combination of four subsystems i.e. Antenna, ore rectification filter, rectifier, post rectification filter. in rectenna application, it is necessary to design antennas with very high directive characteristics to meet the demands of long-distance links[9].
Medicinal applications of patch: It is found that in the treatment of malignant tumors the microwave energy is said to be the most effective way of inducing hyperthermia. The design of the particular radiator which is to be used for this purpose should posses light weight, easy in handling and to be rugged. Only the patch radiator fulfils these requirements.
Tele-Medicine: 4G and 5G will support remote health monitoring of patients. A user need not go to the hospital instead a user can get videoconference assistance for a doctor at anytime and anywhere.
Crisis management: Natural disasters can cause breakdown in communication systems. In today's world it might take days or weeks to restore the system.
Education: For people who are interested in lifelong education, 4G provides a good opportunity. People anywhere in the world can continue their education through online in a cost effective manner.
Artificial Intelligence: More applications combined with artificial intelligent (AI) as human life will be surrounded by artificial sensors which could be communicating with mobile phones.
Economic growth: Economic growth is supported because these technology changes allow consumers and businesses to benefit from high-value wireless data and content services. This relationship had not yet been explicitly quantified yet.[1,2]

a. 5G techniques deal with global access and high quality service portability due to high error tolerance.
b. It supports almost 65000 connections at a time with good gigabit speed.
c. 5G generation bear the bi-directional and accurate traffic statistics , many more uses like internet, multimedia & other boardband services
d. Milimeter wave band have high resolution for insane mobile phone users and large bandwidth.
e. 5G technology offer transporter class gateway with unparalleled consistency. [8]

The next generation applications are set to evolve in a multiplatform environment. 4G applications will be available across various wireless technologies like LTE, Wi-Fi, etc. and also in devices like cell phones, laptops, e-readers, digital cameras, printers and so on. 4G applications are very likely to be extended and improved versions of the existing 3G services, but it is still unclear what the capacity of 4G will hold for the mobile world. [2]

V. CONCLUSION

This paper talks about on the issues identified with the plan of an essential microstrip structure: a fix receiving wire. Notwithstanding when this receiving wire geometry indicates less prohibitive manufacture needs of goals and precision concerning other microstrip structures, creation limitations can altogether impact this radio wire highlights, for example, thunderous recurrence and radiation effectiveness.
We quickly examine on three classifications of configuration issues. In Sections we show two handy execution instances of a solitary fix radio wire worked at 28GHz (LMDS band) and 60GHz that portray a method for appeasing creation limitations and configuration challenges. At long last, ends close this paper.

This paper concentrated on the structure of mID-wave radio wires for 5G remote frameworks. The destinations and necessities of mID-wave radio wires for 5G were assessed. Late advances in mID-wave radio wire configuration were accounted for and plan rules were talked about. Specifically, four unique plans that were accounted for as of late in the writing have been recognized dependent on their alluring attributes that help 5G prerequisites and applications.

REFERENCES

[1]**Palak Sharma; Megha Verma; Neha Sundriyal & Jyoti Chauhan , "**5G Mobile Wireless Technology**"** in International Journal of Research (IJR) Vol-1, Issue-9, October 2014 ISSN 2348-6848,pp: 631-634.

[2] **Pankaj Sharma, "**Evolution of Mobile Wireless Communication Networks-1G to 5G as well as Future Prospective of Next Generation Communication Network**"** in IJCSMC, Vol. 2, Issue. 8, August 2013, pg.47 – 53, ISSN 2320–088X.

[3] **Sunakshi Puri, Kiranpreet Kaur, and Naveen Kumar, "**A Review of Antennas for Wireless Communication Devices**"** in International Journal of Electronics and Electrical Engineering Vol. 2, No. 3, September, 2014,pp:199-201.

[4] **Ms. Lopa &J. Vora, "**EVOLUTION OF MOBILE GENERATION TECHNOLOGY: 1G TO 5G AND REVIEW OF UPCOMING WIRELESS TECHNOLOGY 5G**"**in International Journal of Modern Trends in Engineering and Research (IJMTER) Volume 02, Issue 10, [October – 2015] ISSN (Online):2349–9745 ; ISSN (Print):2393-8161, pp: 281-290.

[5] **Dileep Kumar shukla, Shrish Bajpai& Kamran Akhtar, "**A Review and study of the design technique of Microstrip Patch Antenna Technology**"** in Int. Journal of Engineering Research and Applications www.ijera.com ISSN : 2248-9622, Vol. 5, Issue 3, (Part -2) March 2015, pp.46-49.

[6] **Dr.Sunil Kumar and Arti Sethi , "**A Review on Slot Loaded Micro strip Patch Antenna for Wireless Communication Applications**"** in IJISET - International Journal of Innovative Science, Engineering & Technology, Vol. 3 Issue 3, March 2016, pp:71-74.

[7] **Fatimah Al-Ogaili and Raed M.Shubair, "**Millimeter-Wave Mobile Communications for 5G: Challenges and Opportunities**"** in Electrical and Computer Engineering Department, Khalifa University, UAE {fatema.alogaili; raed.shubair} @kustar.ac.ae,pp:1-2.

[8] **Ms. Reshma S. Sapakal and Ms Sonali S. Kadam,** "5G Mobile Technology" in International Journal of Advanced Research in Computer Engineering & Technology (IJARCET) Volume 2, Issue 2, February 2013, pp: 568-571, ISSN: 2278-1323.

[9] **Abhishek Gupta, Dr Anupam Gupta and Sarthak Gupta , "5G :** The future Mobile Wireless Technology by 2020**"** in International Journal of Engineering Research & Technology (IJERT) , ISSN: 2278-0181 , Vol-2, Issue 9, September 2013 , pp:1245-1249.

[10] **Rappaport, T.S.; Shu Sun; Mayzus, R.; Hang Zhao; Azar, Y.; Wang, K.; Wong, G.N.; Schulz, J.K.; Samimi, M.; Gutierrez, F**., "Millimeter Wave Mobile Communications for 5G Cellular: It Will Work!," in Access, IEEE, vol.1, no., pp.335-349, 2013

[11] **Y. Niu, Y. Li, D. Jin, L. Su, and A. V. Vasilakos**, "A survey of millimeter wave (mmWave) communications for 5g: Opportunities and challenges."

[12] **David Alvarez Outerelo, Ana Vazquez Alejos, Manuel Garcia Sanchez, Maria Vera Isasa, "**Microstrip Antenna for 5G Broadband Communications: Overview of Design Issues**"**in IEEE Comm.Magazine,Pages:2443-2444,in 2015

[13] **Shivangi Verma, Leena Mahajan, Rajesh Kumar, Hardeep Singh Saini and Naveen Kumar, "**A Small Micro strip Patch Antenna for Future 5G Applications**"** in IEEE 5th International Conference on Reliability, Infocom Technologies and Optimization (ICRITO) (Trends and Future Directions), Sep. 7-9, 2016, Pages: 460-463