

WIRELESS TECHNOLOGIES: THE UPCOMING 5G TECHNOLOGY IN INDIA, ITS CHALLENGES AND EFFECTS ON HUMANS

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Abstract - In today's world there is a continuously increasing demand for high data rates and mobility by various wireless applications and therefore the need for fifth generation (5G) technology which is expected to be deployed beyond 2020 in India. The key system components which makes 4G technology are LTE Advanced, WiMAX 2, IPv6 support and advanced antennas systems. We are aware of the 3G and 4G technology's benefits but they have their own harmful effects on living beings. Therefore this study proposes the challenges in implementation and possibility of harmful effects of the forthcoming 5G technology on human body.

Key words: Radio Frequency Radiation(RFR), Millimeter waves(mm waves)

1. INTRODUCTION



Fig -1: Future of 5G

We live in an era that relies heavily on technology from cellphones to laptops have now become essential part of our work and lives as well. Various wireless technology such as cellphones are commonly used, and exposure to radio-frequency radiation (RFR) is widespread, including in public spaces.

Media transmission and systems administration has been and will be one of the center advances in helping the

development of humankind and innovation. A competitive economy permits purchasers to request greater, quicker, more grounded regular administrations and organizations are happy to fulfill their customers' demands. Technology has gotten endless advances in innovation throughout the years. For instance, 1G innovation presented to us the cell phones. The 2G arrange presented to us the capacity to get as well as send information across cell phones. At that point 3G innovation carried us to the portable web and 4G made it quicker. Presently with more individuals associated than any other time with the tech world, telecom transporters are making progress towards a 5G networks that will redefine the high speed wireless communications among people.

2. WIRELESS TECHNOLOGIES

2.1. THIRD GENERATION(3G TECHNOLOGY):

In 1998, 3G was pre-industrially propelled in Japan by NTT DoCoMo for testing purposes and marked as FOMA. Later in October 2001, it was generally propelled economically on W-CDMA standard which depends on GSM. The maximum speed of 3G was evaluated to associate with 2 Mbps for immobile gadgets and 384 Kbps in moving vehicles. 3G empowered cell phones to give quicker correspondence, send/get enormous messages and messages, give quick web perusing, video gushing and greater security among others. It was broadly founded on CDMA2000 (Code-division various access) and EDGE advancements. The frequency band is 1.8 - 2.5GHz. The family of this generation includes of UMTS(Universal Mobile Telecommunications System), High Speed Downlink Packet Access (HSPDA), and High Speed OFDM Packet Access (HSOPA). Most 3G networks operate in the 800 MHz, 850 MHz, 900 MHz, 1,700 MHz, 1,900 MHz and 2,100 MHz bands.

2.2. FOURTH GENERATION(4G TECHNOLOGY):

The cutting edge 4G came around 2010 out of two classifications 4G and 4G LTE (alluded to as just LTE. With speeds quicker than 3G, 4G transmission capacity is 200 mbps, which means the download time for a full-length film being around 10 minutes. Network latency disappeared and all transmission is done in packet form. This brought shockingly better quality for voice calls as the information transmitted in the unadulterated packet form because of Orthogonal Frequency Division Multiple Access (OFDMA) multiplexing technique. 4G offers HD quality video calls, remotely coordinating with better quality and internet gaming streams, made sure about and intelligible voice communication, and so on. After 4G, 4G LTE(Long Term Evolution) was introduced. LTE was the redesign of the 3G network's architecture for further reducing the network latency issues. 4G VOLTE(Voice Over Long Term Evolution) is an extension in LTE network to fully digitize voice telephony in packet form from circuit switched technology.

2.3. FIFTH GENERATION(5G TECHNOLOGY):

5G is the following emphasis of 4G Long Term Evolution (LTE) systems. It will empower essentially more prominent portable rates, timing as much as 20 gigabits per second (gbps) with short of what one millisecond latency. The 5G arrangement proposes to include frequencies in the microwave range in the low-(0.6 GHz – 3.7 GHz), mid-(3.7GHz – 24 GHz), and high-band frequencies (24 GHz and higher) for quicker interchanges. This will proceed to empower constant network for mission-basic and possibly life-sparing gadgets and applications. 5G vows to give unavoidable network in the most difficult and remote regions of the world whether on land, sea or air noticeable all around, therefore making it clear why it will be a transformation rather than a development.

5G network will connect Internet of Things (IoT) devices (basically a computing device that has a unique identifier that connects wirelessly to a network and have the ability to transmit data) with a variety of speed and data volume requirements hence making them easily accessible and interactive as well.

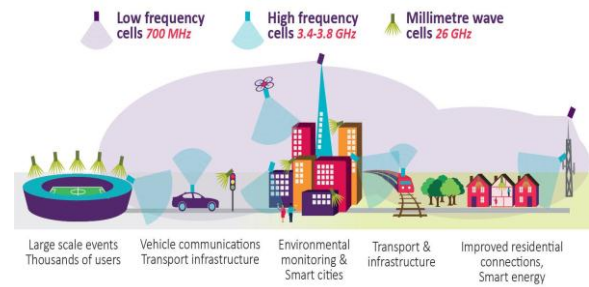


Fig-2: Frequency ranges for wireless communication

The range for 5G not just covers bands under 6 GHz, but also groups at present utilized for 4G LTE systems, yet in addition stretches out into higher frequency bands not considered before for mobile correspondences. It is the utilization of bands groups in the range of 24 GHz to 100 GHz, known as millimeter wave (mmWave).

2.4. Possible Ill-Effects Of Radiations On Human Body:

- Millimeter waves (MMWs) are for the most part ingested inside 1 to 2 millimeters of human skin and in the surface layers of the cornea. Subsequently, the skin or close surface zones of tissues are primary targets of the radiation.
- 5G high range can drives change of cells and instigates tumors which may later become cancerous. Exposure to the 5G radiation causes an increase in Reactive Oxygen Species(ROS). Reactive Oxygen Species (ROS) are a typical part of cell procedures and cell signaling. Overproduction of ROS if not balanced can cause formation of free radicals that can oxidize and cause damage to DNA, proteins and mitochondria.
- A US National Toxicology Program study noticed that male rodents presented to RFR for nine hours every day more than two years created uncommon types of tumors in the mind and heart, and both genders created DNA harm. The analysts noticed that the expanded hazard to the rodents was generally little, yet on the off chance that the discoveries are meant people, the across the board increment in cellphone use could have significant effect on people.
- Cataract is one of the primary reason for blindness. The radiation from 5G applications can cause the eyes to receive radiation and can damage the eyes. An

experiment was conducted at the Medical Research Institute of Kanazawa Medical University which reported that antennas of 60GHz Millimeter Waves(MMW) caused thermal injuries in rabbits eyes.

- 5G range may likewise prompt electromagnetic affectability. Electromagnetic sensitivity has the accompanying attributes migraines, sleep deprivation, dazedness, sickness, absence of concentration, heart palpitations, and discouragement.

2.5. Cities that have halted the 5G technology implementation:

- Brussels, the first major city which halted the 5G technology implementation due to side effects on health .
- UK Frome Town Council has an ethical duty to ensure general wellbeing and the neighborhood condition. Until there is increasingly free logical agreement that 5G remote radiation is harmless to people and the earth FTC receives the prudent standard and won't embrace the turn out of 5G.
- In USA District of Columbia, the US Court of Appeals for the District of Columbia Circuit issued a decision substantially setting back the efforts of the Federal Communications Commission to expedite the deployment of 5G technology.
- In Bangladesh, the High Court gave 12-point mandates remembering inconvenience of a boycott for establishment of versatile or media transmission towers on the housetops of local location, instructive organizations, clinics, prison premises, legacy destinations, play areas and worship places.
- Netherlands 4 April 2019 Members of Parliament in the Netherlands demand that radiation research must be done before any endorsement of the 5G arrange.
- Switzerland Geneva tenth April 2019 Geneva embraces a movement for a ban on 5G, approaching the Council of State to demand WHO to screen autonomous logical investigations to decide the hurtful impacts of 5G.

2.6. Reports and Studies of mobile phone's radiation on humans:

- An investigation of Mobile Phone Base Station Tower settings next to school structures has discovered that high introduction of male learners to RFR from these pinnacles was related with postponed fine and gross motor skills, spatial working memory, and concentration in young adults, contrasted with male learners who were covered with low RFR (1).
- A recent examination indicated a likely unfavorable impact of RFR cerebrum portion on teenagers' psychological capacities including spatial memory that include mind districts uncovered during mobile phone use (2).
- An extensive review of numerous published studies confirms non-thermally induced biological effects or damage (e.g., oxidative stress, damaged DNA, gene and protein expression, breakdown of the blood-brain barrier) from exposure to RFR (3), as well as adverse (chronic) health effects from long-term exposure (4).
- Indeed, an expanding number of individuals have created group based on side effects ascribed to introduction to RFR (e.g., cerebral pains, weakness, lost appetite, sleeping disorders), a condition named as Microwave Sickness or Electro-Hyper-Sensitivity (EHS) (5-6).

3. Challenges of Implementing 5G Technology in India:

In India, 5G technology was supposed to launch in the year 2020. Few mobile phones and devices which supports 5G technology were also launched in India in 2020 but with high end pricing.

Some challenges that might occur while implementing 5G technology in India are:

- As per the reports to be believed, the government was prepared to auction 5G spectrum in the April-June quarter of the year 2020. This means that the telecommunication companies in India will have to bear the expense of buying the spectrum in order to launch their 5G services. The Telecom Regulatory Authority of India has suggested a base cost of 5G

wireless transmissions at INR 492 crore and has proposed an offer of a base 20 MHz squares. This implies a telco would spend near INR 10,000 crore for 20MHz and near an astounding INR 50,000 crore for 100 Mhz.

- Next challenge is the infrastructure demands that must be met in India so as to make 5G technology a success in India. At present, the country has close to 2.5 million fibre route kilometres. The Department of Telecommunications (DoT) aims to increase it to three-fold to 7.5 million route kilometres by year 2022.
- Another challenge is the energy requirements of 5G networks. The high energy consumption in wireless systems and devices can increase CO₂ emissions indirectly which is considered as a major threat to environment.

4. CONCLUSIONS

This paper studies the increasing demand for high data rates in wireless communication and various steps taken to fulfill the same. In this era wherein we humans are becoming more dependent on technology and speed, more the telecom companies are bringing in solution to meet the demands. 3G, 4G and now 5G technology is booming everywhere in the world. Undoubtedly 5G will bring in lots of advancements in our lives in terms of medical care, IoT devices, Virtual Reality (VR), Artificial Intelligence (AI) and so on. But at the same time the government have to consider all the negative effects that can affect human body in long term use due to 5G Technology's Millimeter wave and electromagnetic radiations. Few cities around the world have already halted the implementation of 5G because of its ill effects on human and environment.

The paper proposes that more research is required on the side effects of 5G radiations on humans as well as environment before implementing 5G technology in India so that it can be considered as more fruitful.

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