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Antenna Technologies Aspects For 5G

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ABSTRACT

The 5G wireless mobile networking technology is being investigated by the researchers to improve the performances of mobile services by increasing the data rates and reducing transmission delays. Due to rapid increase of mobile user's, they need more features on their mobile phones such as efficient communication, reduced traffic, comfort to use various applications etc. Service providers are in need to satisfy the needs of mobile users which can be done with help of 5G technology. 5G is operated at millimetre range in that we can provide large amount of bandwidth with high frequency range. This paper is based on the study of suitable antenna design for 5G technology for the use of wireless communication and measurements of various parameters of such antenna design for achieving such goals is also studied.

Key Term:- **5G Security,*Mobile communication,Micro strip patch antenna, Millimeter wave spectrum***

I. INTRODUCTION

Nowadays, we are witnessing an increase in the usage of mobile equipment like smart phones, tablets, and laptops. This has induced an important expansion of the mobile data traffic. The increase in the number of mobile equipments that use wireless connectivity is expected to continue in the future, which will put a huge pressure on the currently established 3G and 4G mobile communication networks. Therefore, researchers agree that these technologies will become unable to meet the tremendous expansion of the mobile service demands. To overcome this issue, the researchers and industrial communities are working on the development of the new generation of mobile technology named as the 5G mobile network. 5G technology provides very high bandwidth, better Quality of Service, reduced latency, optimum capacity and wide band of spectrum availability. The main target of the new standard is to enhance the capacity and the transmission performances by 1000 times compared to the existing technologies. To achieve this, the research community has a broad agreement that the higher ranges of the electromagnetic spectrum must be considered to enable increased data rates and that the 5G concept will not be based on a single technology but it will be the result of a combination of many innovative internetworking schemes that will collaborate to meet the required performances. Design of Antenna is one of the most important cornerstones for 5G development and applications.

II. LITERATURE REVIEW

To design a suitable antenna for 5G networks certain parameters are to be considered such as operating frequency, antenna size, polarization, manufacturing cost, bandwidth. Antennas can be very large or very small. They have a wide range of varied applications, from radio astronomy to deep-space communications to indoor personal communications. There are many antennas which are used in existing (4G) or future wireless

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communication systems (5G), including short-range point-to-point wireless connectivity , digital cellular networks, wireless senor networks, global navigation satellite systems ,wireless networking for Internet access, mobile broadcasting systems, body-centric wireless communication systems, milli-meter-wave personal area networks, milli-meter wave automotive sensors, and terahertz biosensor and surveillance systems[1]. Some of them are as follows:-

1. Directional Antenna with mm wave spectrum

Directional antennas have a variety of capabilities that enable them to vary their transmission range and orientation, it also have smaller interference, good spatial reuse, greater transmission range, and improved network capacity. A directional antenna can reach faster in the direction of a target node. Moreover, the smaller the transmission spread the lower the communication cost. This is a great advantage of directional antennas. In Directional antennas, the resulting network has to be modelled by a directed graph. To ensure connectivity the antenna orientations of the individual nodes must be chosen so that the resulting directed graph is strongly connected [2].

2. Circularly polarized antenna:-

By using circularly polarized antennas, it is possible to prevent polarization mismatch losses which in turn enhance the connection reliability between remote devices. Wearable wireless devices and applications for them are generally aimed at maximizing the quality of service. This can be achieved by providing freedom of movement, hands-free devices and a more flexible platform. However, mobility causes many challenges in mobile communication systems. For example, arbitrary alignments of transmitting and receiving antennas may cause polarization mismatch losses. On the other hand, the user's mobility may impose some misalignment, which often change the characteristics of the integrated flexible antenna, and in turn leads to performance deterioration. Since utilizing a circularly polarized antenna is one way of preventing mismatch losses, the current research is aiming at developing such antennas with capability of integration within wearable devices.

3. Array antenna for 5G mobile phones

Antenna array is modified with sub array which is placed along the mobile phone to cover wide area. This technique will avoid traffic rate. Linear phased array antenna with omni directional radiation pattern covers wide space in 5G mobile phones. Three identical sub arrays which is placed by the side of mobile phones gives high gain [5].

4. Wideband antenna

The main advantage of wideband antenna is high bandwidth, very low cost, easy fabrication and low sensitivity to manufacturing imperfectness. Wideband communication systems also have the promise of reduced fading from multi-path, and low power requirements [3]. Wideband antenna of rectangular shaped antenna with microstrip line feed is used for the 5G technology. Operating frequency of this antenna is at 6GHz, gain as 3.7dB with directivity of 6.62 dB and 500MHz bandwidth. Antenna parameters are measured to satisfy the needs of 5G technology and also some parameters like atmospheric absorption of waves due to rain fall or wind which may cause losses of information [4].

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5. Wideband slotted patch antenna for 5G

Rectangular wideband slotted micro-strip patch antenna is designed for 5G technology. It is operated with the frequency of 5GHz. MIMO technology is implemented to increase the quality of service, gain. This antenna design is suited well for 5G cellular mobile phones [6].

ANTENNA SOLUTION FOR FUTURE 5G

Due to rapid increase of mobile user's, they need more features on their mobile phones such as efficient communication, reduced traffic, comfort to use various applications etc. Service providers are in need to satisfy the needs of mobile users. In order to provide such new features and also to avoid shortage of spectrum 5G technology is introduced. Due to the scarcity of bandwidth mm wave spectrum is used for 5G technology. Mm wave spectrum could support simultaneous use of mobile phones and it is operated at 30 to 300 GHz has attracted attentions in wireless communication. Different types of antennas are designed for 5G technologies are analyzed based on type of antenna, techniques and materials used for antenna design and their advantages. While design of an antenna with low loss tangent substrate will increase antenna efficiency and will reduce microstrip losses. This paper is presenting design of circular microstrip patch antenna. With this design, Resonance frequency of this antenna is at 6.9 GHz which shows in fig 1.

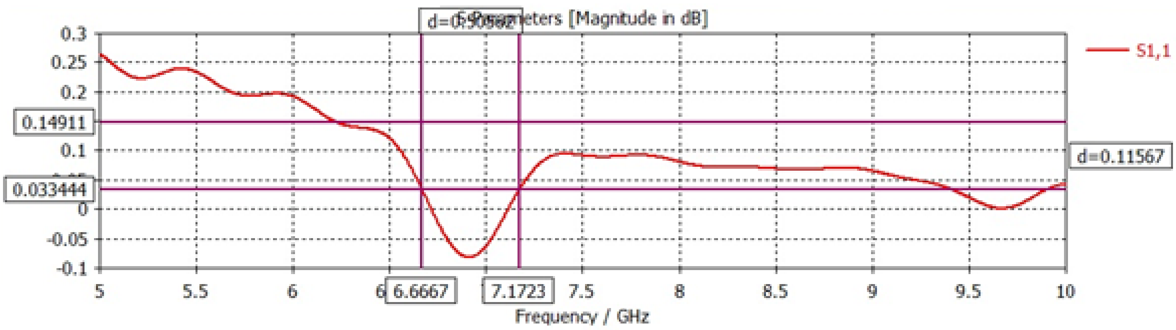

Fig1 S-Parameter of Proposed Antenna

The proposed design is of a planar structure, which comprises three layers. The top layer is circular microstrip patch, middle layer is substrate and the lower level is ground. The upper layer contains the matching circuit, which is realized by a single microstrip line to provide matching in all operation modes. A variety of design parameters can be optimized for improved bandwidth and impedance matching. The ground and patch used for both layers is perfect electric conductor (PEC) is an idealized material exhibiting infinite electrical conductivity or, equivalently, zero resistivity whereas substrate used for middle layer is FR4 having loss tangent of 0.022. Resonant coupling between the feed structure, slot and middle patch is responsible for the first minimum seen in the S11 plot of Fig1. The Q of this antenna can be adjusted by varying the substrate thicknesses, slot width or patch width. The far-field radiation pattern seen in Fig 2 reveals a fair amount of back-end radiation. This effect could be eliminated by adjusting the aperture width, or perhaps by adding another substrate backing layer. The 2D azimuthal cuts for the radiation pattern and power radiated by antenna are seen in Fig 3and Fig 4 respectively.

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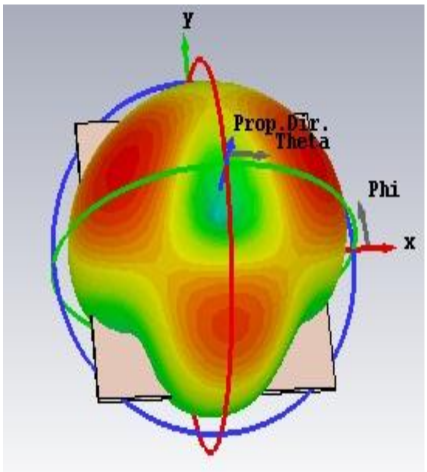

Fig2: 3D Far-Field Radiation Pattern For Proposed Antenna.

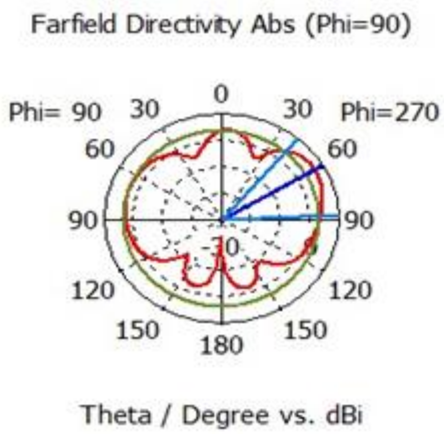

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Fig 3 2D Azimuthal Cuts For The Radiation Pattern

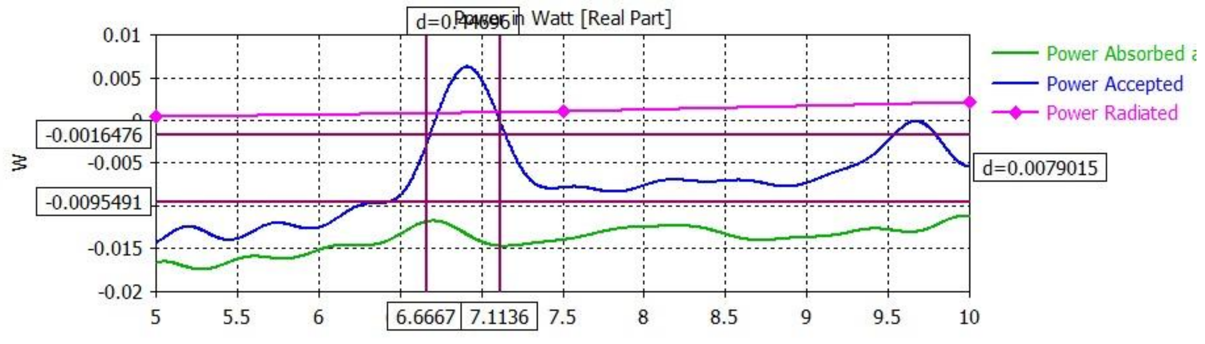

Fig 4 Power Radiated By Antenna

III. CONCLUSION

5G provides accurate global positioning, wide range of bandwidth, good coverage and high quality of service and low latency in wireless communication. In this paper, various antennas are discussed for the application of new 5G mobile phones. Through modeling and simulation, a wideband micro strip circular patch antenna is proposed. This design can further optimize using by different optimization tools. Given more time, parameterization of each component dimension can be used to achieve better results. This optimization can done by defining performance goals, parametric variables, and various constraints in order to achieve an optimal design. Different substrate thicknesses and permittivities can also be changed. Furthermore, additional resonant structures could be added, with the trade-off of greater design complexity. This antenna design is tested in real time environment that produce better signal outage reduced path loss and return loss. Antenna array can be introduced to improve overall performance of the antenna.

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