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ATTENUATION ANALYSIS IN 5G CELLULAR NETWORKS

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Abstract— **5G is the Fifth Generation technology. It has many advanced features potential enough to solve many of the problems of our mundane life. It is beneficial for the government, as it can make the governance easier; for the students, as it can make available the advanced courses, classes, and materials online; it is easier for the common people as well, as it can facilitate them the internet everywhere.**

In this project we are going to analyze different attenuation parameters like frequency,speed,latency,bandwidth,distance,line rate,channel capacity,rain,fog,cloud etc.

Serious effort towards reduction of attenuation of the parameter mentioned above will be taken by us.

Index terms- **latency, bandwidth,attenuation,effects of attenuation on environment.**

I. INTRODUCTION

5G radio access will consist of evolved versions of existing radio access technologies,such as HSPA and LTE,and other complementary new technologies,operating and interacting in fully integrated way.The aim of our project is to analyze different attenuation parameters and improving these parameters.5G will provide very high mobile-broadband services everywhere.Smart antennas including large number of steerable directional antennas, more spectrum and coordination between base stations will provide such high service levels.5G will be amazingly fast and will provide high data rate.For industrial communication and societal functions,such as traffic safety,healthy and smart city management,the reliability requirement cannot always be today's radio networks.5G will support ubiquitous things

communicating.5G will large no of small, low cost devices with long battery life time.Energy efficiency will be greater importance in the future and should be main target of all 5G radio access solution.

A. ARCHITECTURE

As shown in the following image, the system model of 5G is entirely IP based model designed for the wireless and mobile networks. The system comprising of a main user terminal and then a number of independent and autonomous radio access technologies. Each of the radio technologies is considered as the IP link for the outside internet world. The IP technology is designed exclusively to ensure sufficient control data for appropriate routing of IP packets related to a certain application connections i.e. sessions between client applications and servers somewhere on the Internet.

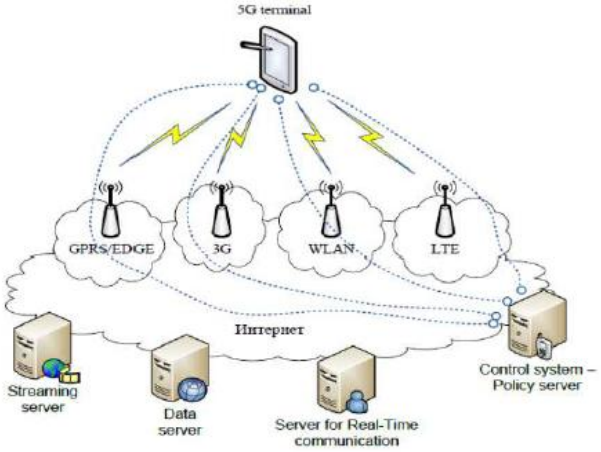


Figure 1: System model of 5G

II. ATTENUATION

Attenuation is a general term that refers to any reduction in the strength of a signal.Attenuation occurs with any type of signal whether digital or analog.Sometimes called loss,Attenuation is the natural consequence of signal transmission over a long distance.

III. ATTENUATION ISSUES:

The millimeter-wave bands - they range from around 3mm to 30mm in wavelength - are also Absorption by rainfall climbs rapidly from 2GHz to 100GHz, making this region of the spectrum unattractive for long-distance radio communication. It is also a difficult region of spectrum to serve. Only recently have low-cost silicon processes reached the level of development where they can be used in handsets that support such high frequencies. If you restrict the use of 20GHz-plus signals to relatively short distances, some of the problems go away. It is a common myth that rainfall and oxygen absorption

will attenuate these frequencies too much. Over distances of a few hundred meters, there is some loss but far from enough to wreck the technology's chances. In densely populated areas, that is already a long distance. Even macro-cells are less than 400m apart in urban environments. There are also sweet spots in the spectrum, such as 28GHz and 38GHz.

IV. EFFECTS OF PARAMETER ON ATTENUATION:

Frequency-The rate at which something occurs over a particular period of time or in a given sample"an increase in the frequency of accidents due to increased overtime".Frequency-dependent attenuation and dispersion may alter the spectral

characteristics of the waveform, thereby distorting the locations of markers and introducing variations in sound-speed estimates.

Latency-Latency is the amount of time a message takes to traverse a system.In a computer network is an expression of how much time it takes for a packet of data to get from one designated point to another. It is sometimes measured as the time required for a packet to be returned to its sender.If latency increases attenuation increases.

Bandwidth-Bandwidth is the difference between upper and lower frequencies in a continuous set of frequency.It is typically measured in hertz.

$$B=(fH-fL)/fC.$$

The broadening effect of probing pulse light on the apparent attenuation of the oscillation measured with picoseconds ultrasonic. The attenuation of the oscillation is sensitive to bandwidth and the apparent oscillation coefficient increases as the bandwidth increases.

Channel capacity-channel capacity is the tight upper-bound on the rate at which information can be reliably transmitted over a communication channel.

$$C=\log2\ (1+(S/N))$$

Attenuation due to oxygen,water vapor,fog,cloud and rain has significant effect on radio link which is operating in a millimeter frequency range.Channel capacity due to that decreases.

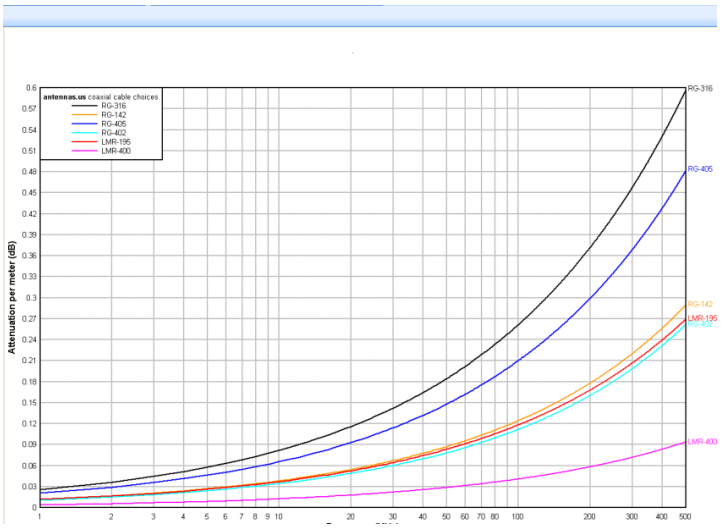
Line Rate-The line rate is a physical layer term that has nothing to do with the line cards or switching fabrics.It indicates the actual speed with which the bits are send on to the wire.

Attenuation due to rain-The electromagnetic wave attenuation due to rain(the rain attenuation) is one of the most noticeable components of excess losses,especially at frequencies of 10 GHz and above.Attenuation due to rain is depend on frequency and rainfall intensity or rain rate. The methods of prediction of the rain attenuation can be grouped into two groups the physical models and the empirical models.The physical models attempt to reproduce the physical behavior involved in the attenuation processes while the empirical methodologies are based on measurement databases from stations in different climatic zones within a given region.The empirical methods are used widely and frequently with the best success.Two main causes of attenuation are scattering and absorption. When the wavelength is large compared to the size of raindrop,scattering is predominant.

Attenuation due to clouds-The effect of rain attenuation is greater than that of clouds in many cases,but clouds occur more often than rain.In clouds, water droplet are generally less than 0.01cm in diameter.In ,it was mentioned that cloud attenuation was primarily due to absorption by the cloud droplets and scattering losses were secondary. With increase in operating frequency the attenuation due to cloud also increase, but as the temperature of the clouds decreases the attenuation value increases

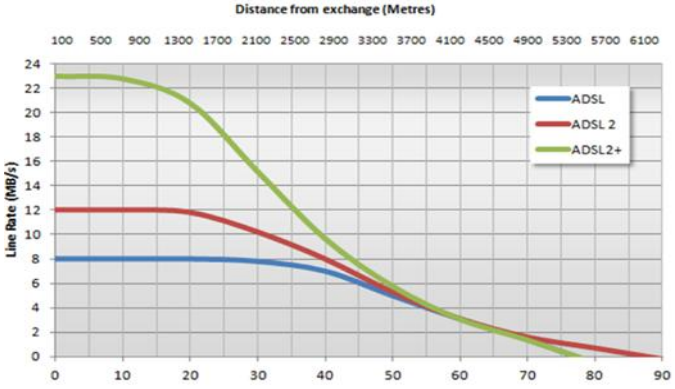
Attenuation due to fog-The influence of the fog on the attenuation of the electromagnetic waves can to lead to the perturbation of the wireless communication. It was mentioned that fog may be one of dominant factors in determination of the reliability of millimeter wave systems,especially in coastal areas,where dense moist fog with high liquid content happen frequently. Fog results from the condensation of atmospheric water vapor into water droplet that remain suspended in air.Attenuation due to fog is a complex function of particle size distribution distribution,density, index of refraction, wavelength.

V. RESULT



Frequency(Ghz)

As frequency increases, attenuation also increases exponentially.



Attenuation(db)

As line rate value increases,value of attenuation signal goes on decreasing exponentially.

VI. CONCLUSION

This is a sincere effort towards the process of engendering the conceptual information of 5G network. The work comes as an initial skeletonization of the network, so as to assist people researching in 5G to progress with their work.

The research is padded with an assumption that the 5G network belies a faster and a colossal support towards connectivity which has been a major lacuna in the existing 5G network.

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