

Features of Millimeter Wave Communication

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The development of mobile communication networks accompanied by the rise of key technologies from 1G to LTE era. At the same time, the key technologies meet business needs and promote the network function continues to developing. Similarly, the development of 5G can not be separated from support of key technologies. This paper will introduce two kinds of 5G physical layer key technologies (Millimeter wave communication and Massive MIMO technology). Millimeter wave communication is a kind of microwave communication which length range of wave between 1~10 mm and radio frequency range between 30~300 GHz.

Table I has shown the characteristics of millimeter wave and microwave. The radio wave dissemination distance is a few kilometers when at 30GHz. But, if the radio frequency increase to 60GHz, dissemination distance only has 0.8 km. At the same time, millimeter wave is a very high frequency electromagnetic waves. Atmospheric absorption and rainfall decline has a great interference for millimeter wave propagation. Why the telecommunication organizations still researching millimeter wave communication technology all over the world, because of the characteristic which millimeter wave has a short wavelength and propagation stability is higher than decimeter microwave is suitable for dense base station layout.

The problem from path loss is a common phenomenon in all of wireless communication systems, signals easily to be interference during propagation from adjacent wireless channel. The model of propagation from radio wave path loss could expressed, as in $P \text{ (dB)} = 32.44 + 20\ln d + 20\ln f$ (1), d in km and f in MHz. It can be found that the propagation path loss increasing as the radio wave frequency increasing. Currently, 5G millimeter wave technology still in phase of demonstrating and piloting time, the process of developing millimeter waves exist many problems should be considered, as follow: 1. Millimeter wave spectrum has greater pass loss in propagation to Compare with 300MHz-3GHz wireless mobile communication spectrum which used by LTE. However, according to another 5G new techniques which named beam-forming can concentrate energy in a small area to get a higher signal gain to solve the problem of path loss in propagation. 2. Signal loss from a building penetration. The ability of low-band wireless signals in penetration is more powerful to compare with high-frequency. This is the reason why wireless signal will have much energy loss when penetrating the building.