

Agenda item: 7.3.5.3
Source: KT Corp.
Title: Additional Features on Above 6GHz Channel Model
Document for: Discussion and Decision

1. Introduction

A study item 'Study on channel model for frequency spectrum above 6GHz' was approved in RAN #69 meeting [1]. According to the study item description in [2], RAN1 will develop a channel model(s) for frequencies up to 100 GHz taking into account the outcome of RAN-level discussion and discussion in the '5G' requirement study item. During RAN-level discussion [3], the following features were mentioned by multiple companies and could be considered as essential for >6GHz

- (1) Foliage, atmosphere and rain attenuations as a function of frequency
- (2) The blockage caused by the static objects and moving objects such as human body and vehicle: The blockage attenuation generally increases with frequency
- (3) The spatial consistency which involves the evolutionary features and the correlation of channels between adjacent UEs or links on the large and small scale. This is useful for support of massive MIMO, mobility and beam tracking (time consistency)
- (4) Support of large bandwidth (possibly up to 10% of carrier frequency)
- (5) Support of 3D beamforming with large arrays

In this contribution, KT's view on the above features for > 6GHz channel modelling is provided.

2. Discussion on Additional Features

The foliage, atmosphere and rain attenuation

As presented in our companion contribution [4], the main use case of above 6GHz new RAT would be eMBB services in UMi scenario. Since typically base stations in such scenario would be located outdoor and serve both indoor and outdoor UEs, one important requirement for >6GHz network deployment should be robustness in natural environment and phenomenon such as foliage, atmosphere and rain. Therefore, in order to provide an accurate guidance for >6GHz network deployment, it is proposed that >6GHz channel modelling should take into account such extra loss caused by the foliage, atmosphere and rain attenuation

Blockage

In case of UMi scenario, as mentioned above, since base stations are usually located outdoor, O2I would be an important case for channel modeling in addition to O2O. In such O2I case, blockage due to glass window, iron door, or wall would naturally affect the network deployment. Even for indoor deployment scenario, it would not be cost-efficient way if every separate room has to have its own AP. That is, blockage property between different rooms should be considered for >6GHz indoor deployment. Therefore, the effect of such blockage should be well-studied in >6GHz channel modeling campaign. Table 1 is an initial measurement results for propagation loss at 28GHz caused by different blocking materials. Based on results, it is observed that different materials would result in different propagation losses.

Table 1: Propagation loss caused by different block materials

Blockage Case	Propagation loss at 14m distance
Free space	-84.3dB
Iron door	-125 dB
Concrete wall	-112 dB
Glass window	-104 dB

Other features

In our view, two key features which could realize eMBB services on above 6GHz would be massive number of MIMO antennas and large assignable bandwidth. For efficient support of massive MIMO, spatial properties for MU-MIMO and 3D beamforming should be considered in >6GHz channel modelling. Additionally, since channel properties in frequency domain would affect >6GHz new RAT design which should be able to support large frequency bands, such propagation characteristics for large bandwidth have to be properly captured in channel modelling.

3. Conclusion

Having discussed above, it is proposed that:

Proposal: The following features should be reflected in above 6GHz channel modeling

- *The foliage, atmosphere and rain attenuation*
- *Blockage*
- *Spatial properties for massive MIMO and 3D beamforming*
- *Support of large bandwidth*

4. References

- [1] Report of 3GPP TSG RAN meeting #69
- [2] RP-152257, "New Study Item Proposal: Study on channel model for frequency spectrum above 6 GHz", CMCC, 3GPP TSG RAN meeting #69
- [3] RP-152212, "Report of RAN email discussion about >6GHz channel modelling", Samsung, 3GPP TSG RAN meeting #70
- [4] R1-160833, "Scenarios on Above 6GHz Channel Modelling", KT Corp., TSG RAN1 meeting #84.