Visualization Tool of the Urban Microcell Radio Propagation Paths

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According to the raise of the carrier frequency, the design of the cell site tends to be more specific, since various objects in the environment become electrically large. The ray tracing prediction of the propagation channel has been widely utilized, in the conventional ultra high frequency (UHF) band, by considering the simplified building structure. According to the increase of the carrier frequency, more detailed structures of the environment such as surface irregularity and small objects are not negligible in terms of radiowave scattering. The behavior of the propagation channel tends to be more site-specific, and the prediction of the channel property is getting more important in the site planning. Therefore more complex techniques are needed to visualize these small objects.

Various extensions of prediction methods have been proposed such as physical optics, effective roughness model, and hybrid T-matrix method. To explore more details about the scattering mechanisms, it is crucial to compare with the measured channel properties. The authors have conducted the 24×24 MIMO channel sounding at 11 GHz with bandwidth of 400 MHz in indoor and outdoor environments [1]. A parametric model in double-directional and delay domains is introduced and a high resolution maximum likelihood parameter estimation is applied to extract the angles of departure, arrival, and delay time of individual path. In the indoor environment, a measurement-based ray tracing (MBRT) combined with the geometry based clustering has been implemented to identify the interacting objects (IO) and interaction loss (IL)[2]. However, it is more complicated to conduct MBRT in the outdoor scenario due to difficulty of modeling the larger environment with more detail of the surface of the objects. This study aims at the empirical identification of the IOs in the urban microcell environment. 3D townscape is captured by using the mobile mapping system through laser scanner. Angles of arrival and departure of paths are utilized to identify the specific IOs visually.

This tool has been developed to visualize IOs to facilitate detailed analysis of the urban mobile radio channel for microwave frequencies that have been omitted in many ray tracing simulators. We modeled the equipment test using a cone with respect to its height 3 meters above ground. At every snapshot, based on the extracted angular information, the propagation path is traced and we could finally identify the IO. The proposed approach can effectively provide detailed information in the geometry and the location of the IO.
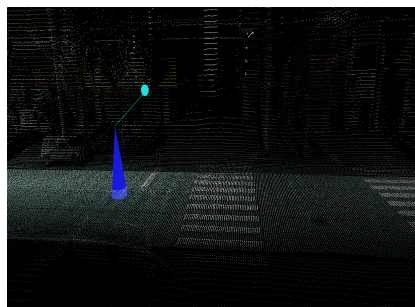

Figure 1. Visualization of the equipment test, propagation path and the IO

References

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