

Bachelor Thesis

Estimation of the Influence of Antenna Locations in Vehicles on the 5G Mobile Network Connectivity

Future smart-city applications depend on reliable mobile network connectivity. In the case of transportation and mobile applications in general, antennas need to be mounted on or in vehicles. These often primarily consist of conductive materials, so significant signal degradation is expected depending on the antenna location and the vehicle's orientation toward the base station [1, 2]. That is also the case for industrial logistics vehicles connected by a 5G campus network and smartphones located in a vehicle. In previous works, the attenuation characteristics of buildings in the case of LTE attached smart grid sensors were evaluated [3].

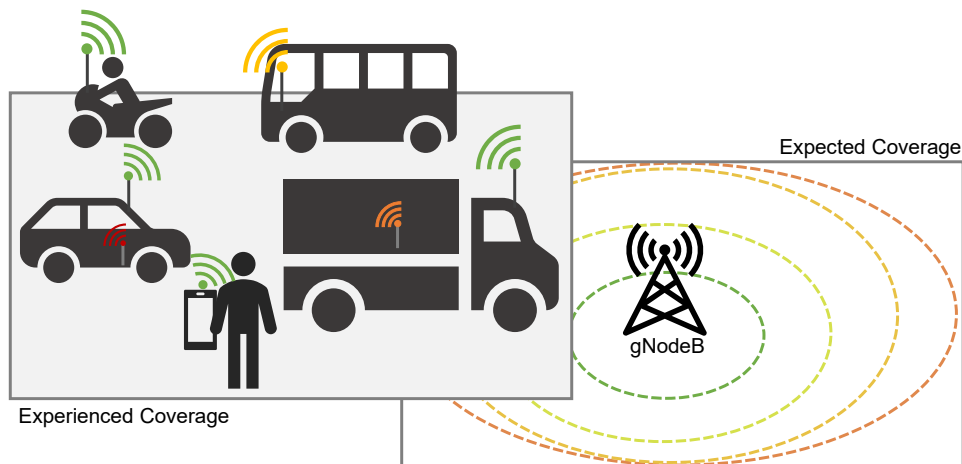


Figure 1: Varying signal strength dependent on the vehicles location and orientation and the antenna location in the vehicle.

The main task of this thesis is the practical measurement of the impact of the signal dampening depending on the vehicle type, antenna location and orientation. These measurements can be executed in our own 5G campus network and in public mobile networks. In the second step, the knowledge of the amount of dampening can be used to assess possible limitations of the area of application depending on the available link budget, vehicle and needed signal strength. This assessment can be performed with the help of existing vehicular measurement data in the Dortmund city area.

Requirements

- Interest in 5G Mobile networks
- Excellent English skills are highly desirable; Willingness to write thesis in English is a plus
- Basic Python and LaTeX/TikZ skills

References

- [1] Saul Friedner, "In-car Mobile Signal Attenuation Measurements," LS telcom UK, London, Nov. 2017. Accessed: Nov. 07, 2022. [Online]. Available: https://www.ofcom.org.uk/__data/assets/pdf_file/0019/108127/in-car-mobile-signal-attenuation-report.pdf
- [2] T. Berisha *et al.*, "Measurement and analysis of LTE coverage for vehicular use cases in live networks," in *2017 IEEE-APS Topical Conference on Antennas and Propagation in Wireless Communications (APWC)*, Sep. 2017, pp. 260–263. doi: 10.1109/APWC.2017.8062296.
- [3] S. Monhof, S. Bocker, J. Tiemann, and C. Wietfeld, "Cellular Network Coverage Analysis and Optimization in Challenging Smart Grid Environments," in *2018 IEEE International Conference on Communications, Control, and Computing Technologies for Smart Grids (SmartGridComm)*, Aalborg, Oct. 2018, pp. 1–6. doi: 10.1109/SmartGridComm.2018.8587552.