



# Deployment, Analysis and Optimization Tool for 5G Wireless Networks

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## Summary

The fifth-generation (5G) of wireless communications has established as the current paradigm for mobile networks. It has brought with it new killer applications such as machine-to-machine (M2M) communications, the internet of things (IoT) or the internet of vehicles (IoV). They all can be grouped in three classes: ultra-reliable and low-latency communication (uRLLC), massive machine type communications (mMTC) and enhanced mobile broadband (eMBB). In fact, 5G systems are designed to serve bit-rates in the order of gigabits per second with latencies below one millisecond, which is in part achieved thanks to the use of the millimeter waves (mmWaves) frequency band.

The use of mmWaves suppose a challenge for the service providers in order to perform deployments of new 5G wireless mobile networks. Attenuation at this band is substantially higher than for sub-6GHz, and the main propagation mechanisms (reflection, diffraction and scattering) suffer of a great detriment. Additionally, factors such as the deployment region (terrain topography, buildings geometry, vegetation...) or the atmospheric attenuation effects increases the difficulty on propagation analysis. Thus, it is necessary resort to simulation tools able to take into account all the possible effects and casuistic of the particular scenarios.

This work presents a new simulation tool to perform new 5G deployments at any geographical region. It takes into account the terrain topography and buildings geometry influence to carry out an exhaustive propagation analysis. The deployed network can be optimized for maximizing the coverage, and it follows the 3rd Generation Partnership Project (3GPP) recommendations. Once deployment is completed, its performance can be evaluated by studying mobile users along the simulation region. Parameters such as received power, signal to noise and interference (SINR) ratio and channel capacity are computed for each user at every simulation time. In the paper, it is also presented a use case of a new deployment at the city of Cuenca with a subsequent mobile users analysis.

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