Deployment options for providing indoor coverage in high frequency bands

MSc. Thesis project at Wireless Access Networks, Ericsson Research

Background

With the continuous growth in connected devices and the need for larger bandwidth channels and greater data speeds, operating at high frequencies can be advantageous for future mobile communications in general, and for 5G-networks in particular.

The main reason for looking into higher frequencies is to find new spectrum to use, which will hopefully manifest in much wider bands than what is currently used for mobile systems. However, there are reasons to be skeptical about the use of higher frequency bands in some deployments due to the challenging path loss characteristics as these waves are subject to several loss factors, starting from the high atmospheric attenuation, rain fade, foliage attenuation, building and wall penetration, diffraction and body/obstruction loss.

While some of the mentioned loss aspects may be considered as minor problems for lower frequency bands, their impact may become severe in high frequency ranges. This increased path loss limits potential communications range, however high frequency waves allow for smaller frequency reuse distances, larger bandwidth and small beam width allowing for higher gain values, which in turn can compensate to some extent for the experienced higher path-loss.

Hence, different deployment solutions would result in different performance potentials in terms of indoor coverage, user experience as well as cost and energy efficiency.

Assignment

One area currently under investigation is the outdoor-to-indoor coverage at frequencies above 6 GHz. Previous studies have shown that it is possible to provide such coverage by outdoor deployments at certain frequency ranges. However, comparing outdoor and indoor deployment solutions in terms of coverage and deployment density would give an insight into the effectiveness of each of these solutions in high frequency bands.

The assignment is to assess the feasibility, e.g. in terms of required node density, for different deployment alternatives. As more advanced antenna configurations are foreseen in high frequency bands, functionalities such as beam forming may also be considered in the work. The student is strongly encouraged to propose the suitable deployments to be implemented as well as the methodology and the metrics of the evaluation work.

The implementation work is to be done in a MATLAB-based simulator, thus extensive programming skills and good knowledge of communication systems are required.

Deliverables

Background information and technical support on the implementation platform and environment will be provided. The student is expected to be self-motivated and work independently on the assignment. Deliverables expected at the end of the thesis work include clearly-documented working code and a final thesis report. The student will also be expected to provide a presentation on the main findings internally within Ericsson.

The assignment is based at Ericsson Research's premises in Kista, Stockholm, and starts around January 12th 2015. The task is expected to take approximately 6 months to complete.

For more information, contact:
eliane.semaan@ericsson.com or Tel: +46 10 715 90 05
anders.furuskar@ericsson.com or Tel: +46 10 714 36 79
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