Antenna Systems for 5G

Introduction: As the modern life style has been completely transform by the advent of wireless communications and by data hungry devices like smart phones, tablets and sensors will lead to a shortage in bandwidth. By analyzing the exponential increase in data rate, one can easily anticipate the paramount problem that all the cellular providers will face, the limited spectrum. Currently, the allocated spectrum is cut into small slices of frequency below 5 GHz with limited bandwidth which means that the base station towers can only transmit a certain amount of capacity even with the modern 4G systems.

The key to mitigate this growing spectrum shortage is using the higher frequency bands. Even though the standardization efforts have just started, there is a clear interest from operators and equipment manufacturers for some bands [1]. The millimeter wave bands, such as the 28 GHz and 38 GHz bands, have huge bandwidth available to alleviate the growing need for data rate[1].

One of the key features of 5G Systems is the use of these millimeter bands along with physical highly directional beamforming antennas at both the mobile device and base station[2][3]. The project proposed here aims to address the design challenges facing these high gain steerable beam arrays, similar to the one presented in figure 1. The project can cover the base-station antenna design. The focus will be on the antenna elements design constituting the array, on the beamforming mechanism and on the interaction between the antenna and the high frequency wireless channel. The targeted implementation is an electrically large array for handheld terminal thus consideration must be given to the design with respect to the typical use scenarios, the interaction with other electrical components inside the handset or with the user.

Figure 1. Array design with measured radiation performance [4].
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Prerequisites: Knowledge of signal processing, radio propagation mechanisms, basic electromagnetics and antenna properties.

Possible Outcome:

During the project work, it is expected that the student will learn:

- Advanced antenna design, simulation, manufacturing and measurement;
- Propagation characteristics of the wireless medium at high frequency;
- System perspective over the antenna design and algorithms to cope with different scenarios encountered in practice like beam-forming for interference cancelation or user-effect mitigation;
- Characterization of the antenna in a communications system considering the whole chain;

Number of student: 1.

Duration: Long Thesis.

References:


