PRACTICAL LARGE SCALE ANTENNA SYSTEMS FOR 5G CELLULAR COMMUNICATIONS

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Introduction. In order to increase capacity and reduce power consumption for future cellular networks, new cellular architectures and radio access schemes will be required. Two important technologies for future 5G networks include Cloud-Radio Access Networks (C-RAN) [1] and Large Scale Antenna Systems (LSAS) with hundred's of low power radios to increase the cell capacity with multi-user MIMO multiplexing and beamforming. Although LSAS in theory [2] promises large capacity gains at the fraction of the power consumed by the current macro-basestations; there are many practical challenges that need to be overcome before LSAS can be successfully integrated into current and future cellular networks including: 1) low-power beamforming algorithms and 2) irregular array beamforming. This project examines each challenge and proposes possible solutions.

Materials and methods. The current research stage is restricted to algorithm, mathematical, and electromagnetic field modeling. Different hybrid beamforming algorithms are devised mathematically, joint energy and spectral efficiency of different network architectures and LSAS systems are modeled in Matlab, and the irregular LSAS geometries are simulated in a 3D electromagnetic field simulation platform. LSAS prototypes are currently being built and tested by China Mobile for measurement of phase and amplitude calibration and to help standardize measurement procedures.

Results and discussion. A hybrid beamforming algorithm was designed such that the cost and power consumption of the 5G network is minimized while still maintaining optimal capacity. Irregular antenna arrays were simulated and preliminary results are presented

Conclusions. Future communication systems will most likely use LSAS to reduce network power consumption and increase cell capacity. By overcoming these major problems, it will be possible to include LSAS as a macro base-station technology in 5G and 6G cellular networks.

References.

1. I, C.L.; Rowell, C.; Han, S.F.; Xu, Z. K.; Li, G.; Pan, Z. G. "Toward green and soft: a 5G perspective," *Communications Magazine, lEEE* , vol.52, no.2, pp. 66-73, February 2014.
2. F. Rusek, D. Persson, B. K. Lau, E. Larsson, T. Marzetta, O. Edfors, and F. Tufvesson, "Scaling up Mimo: Opportunities and Challenges with very Large Arrays," *lEEE Signal Processing Magazine,* vol. 30, no. 1, pp. 40-60, Jan 2013.3.