MAMMOET: Massive MiMO for Efficient Transmission

MAMMOET will advance the development of massive MIMO (MaMi), a new and promising direction in mobile access. The diverse consortium includes partners from Austria, Belgium, Sweden and Spain.

Main Objectives

The Internet of the future will rely, to a large extent, on mobile networks. Mobile data grew by 70% in 2012 and is predicted to grow 13-fold in the next 5 years. This puts a very high demand on the development of mobile access technology. MAMMOET will advance the development of Massive MIMO (MaMi), a new and most promising direction in mobile access. MaMi makes a clean break with current technology by using several hundreds of base station antennas that operate phase-coherently together, simultaneously serving many tens of low-complexity single-antenna terminals in the same time-frequency resource.

The goals of the MAMMOET project are:

- to demonstrate that MaMi can increase both data rates and the overall spectral efficiency by up to ten times, while decreasing the transmitted radiofrequency (RF) power by many orders of magnitude;
- the extensive use of inexpensive low-power components, reduced latency, simplification of the multiple-access layer, and robustness to interference;
- to drastically reduce emitted RF power so that the total energy consumption of a mobile network is lowered when implemented with simple, low power hardware developed in MAMMOET.

MAMMOET will substantially contribute to the development of practical MaMi systems and secure a leading position for European industry in its exploitation.

The academic and research institute partners include pioneers in MaMi and groups with extensive experience in circuit design for wireless communications. The industrial partners are leaders in their fields and cover the entire chain from component manufacturing to systems development and service provisioning.
Technical Approach

MAMMOET targets substantial progress in MaMi technology, to enable practical network systems offering radical capacity and overall energy efficient gains. It is organised in a simple yet targeted structure so as to maximise efficiency:

WP1 (System Approach, Scenarios and Requirements): will analyse and propose deployment scenarios of MaMi consistent with the service provision needs expected for the future, and characterize MaMi channels through new measurements, resulting in new models.

WP2 (Efficient Front-End Solutions): will create two fundamental enablers: efficient and flexible transmitter modules suitable for systems with a large number of antennas, including silicon prototypes; and secondly algorithms for dealing with non-reciprocity in time-division duplex (TDD) access.

WP3 (Baseband Solutions): will develop new methods for hardware-friendly signal shaping in multiuser MaMi systems, including new computationally efficient algorithms and hardware solutions for MaMi baseband signal processing.

WP4 (Validation and Proof-of-Concept): will validate the project’s overall goals in terms of system performance vs. power and cost, and deliver a proof of concept for the major innovation, both for the digital signal processing (DSP) solutions and the energy (power) efficient front-ends.

WP5 (Project Management including Dissemination, Standardisation and Exploitation): will disseminate the results in publications, influence in standardisation bodies and will take care of the overall administration of MAMMOET.

Expected Impact

The following targets can be identified:

- Compared to conventional access technology, MaMi offers increases in spectrum efficiency (as measured by sum-capacity) of about 10 times, and simultaneously a reduction in radiated power of more than 100 times. This leads to an improvement in radiated energy efficiency (bits/J) of more than 1000 times, both on the uplink and the downlink.

- The research in MAMMOET spans a wide range of TRLs (technology readiness levels). The composition of the consortium, consisting of industry, institutes, academic partners and operators will enable a rapid development of cutting edge ideas developed in the fundamental research into mature technology that will be standardised and commercialised. This is a key enabler for reinforcement of the European industry in the fields of mobile and wireless broadband systems, and Future Internet technologies.

- MAMMOET comprises several standardisation activities.

- MAMMOET proposes a new approach to the concept of radio spectrum use flexibility for wireless access. The MaMi technology developed in MAMMOET inherently offers the possibility to switch between different modes of operation: running at reduced power consumption when the demand for traffic is low, resulting in significant reductions of operating electrical energy expenses, or at a high spectral efficiency mode when the cell aggregated throughput must be maximized.

Key Issues

Specifically, MAMMOET will:

- investigate the practical limitations of MaMi;
- develop complete technological solutions leveraging on innovative low-cost and drastically more efficient and flexible hardware.