



Main Project Information

The mission of MAMMOET is to advance the development of Massive MIMO (MaMi), a new and highly promising trend in mobile access. MAMMOET will show the benefits - and will overcome the practical limitations - of MaMi and develop complete technological solutions leveraging on innovative low-cost and drastically more efficient and flexible hardware. Multiple-antenna (MIMO) technology for wireless communications is becoming mature and incorporated into emerging wireless broadband standards like long-term evolution (LTE). Therefore MAMMOET aims to bring MaMi from an initial promising concept to a highly attractive technology for usage in future broadband mobile networks.

MAMMOET will develop key enabling technology for wireless access based on MaMi, with the goal of enabling a radical increase in the spectral and energy efficiency of the future, and characterise MaMi channels through new measurements, resulting in new models. In order to achieve its overall goal, the project has five main objectives which include fundamental, experimental and standardisation elements. The **elaboration of system concepts and approaches, a flexible and effective signal processing, an efficient implementation, the prove of overall innovative concepts and enabling hardware** as well as the **proposal of MAMMOET solutions to standardisation bodies**.

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Message from the Coordinator

With this newsletter, we intend to open a new communication channel in order to provide news on the project progress and discuss ongoing topics relevant to MAMMOET for both internal and external project partners, stakeholders and all other interested bodies. For more detailed information we warmly invite you to have a look on our project website which we constantly keep up to date with the latest project related news: www.mammoet-project.eu. The project has successfully started with the Kick-Off meeting in January 2014 in Villach and since then the project has been in its initial stages of formation.

The MAMMOET project has a well-balanced and focused Consortium - 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.



Start Date: 1 January 2014
End Date: 31 December 2016
Duration: 36 months
Project Reference: 619086
Project Costs: € 4.384.904
Project Funding: € 3.047.000

Consortium: 8 partners (4 countries)
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Project Website:



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Project Progress

In order to maximize the efficiency of MAMMOET and focus on real-world impact throughout the project, we have designed a simple yet target structure. The whole project is broken down into 5 work packages, which are further structured in tasks:

WP1: “System approach, scenarios and requirements”

WP1 analyses and proposes deployment scenarios of MaMi consistent with the service provision needs expected for the future and characterise MaMi channels through new measurements, resulting in new models.

WP2: “Efficient FE solutions (IC solutions, Compensation/Calibration)”

The aim of this WP is to 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 (Algorithms, Architecture & Design)”

The objective in WP3 is developing 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

WP4 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, Dissemination, Standardisation and Exploitation”

The aim of this WP is to disseminate the results in publications, cooperate with standardisation bodies and take care of the overall administration of MAMMOET.

Ongoing Activities

The MAMMOET project has kicked-off with great enthusiasm. The scene for the overall project is being set, starting with essential top-down system considerations and scientific and organizational infrastructure establishment:

1. **System scenarios** are defined on a high-level, they are being prioritized and further detailed. The operator and system integrator in the project are taking the lead in this context, and inputs from other initiatives working on roadmaps (e.g. the FP7 METIS project) have been built upon.
2. An overall **system simulation framework approach and structure** have been agreed on, detailing the main signal processing blocks which will be completed with actual solutions in the future.
3. The investigation of how **antenna selection** may help to **bring down HW complexity** in real channels was performed. Basic investigations on power efficiency of MIMO and on high efficiency PA which are suitable for MIMO systems have been conducted **Trade-off analyses** on transmission waveforms are being made and assessed. Especially, the feasibility and potential (energy efficiency) gains of using (pure) constant envelope signals is being investigated.
4. **Communication infrastructure** has been set up for both internal and external information sharing and interaction. Our website has been created to be **a place of interest and consultation** for advances in the project specifically and massive MIMO technology in the broader sense.

Moreover, specific work on essential new components has started. A number of key elements to be considered for MaMi scenarios were covered, including frame structure, type of channel models, presence of non-idealities, exploration on the power efficient transmitter, etc. The real-life test-bed at ULUND, which will be used in the project, is under construction. The measurement campaign on channel characteristics is being planned and the silicon design environment has been put in place.

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Submitted Deliverables & Milestones

D2.1 "PDK (tech files, lib files, flow) preliminary version"

This deliverable provides the general information on the principles about Design Packages (DP) and their handling within MAMMOET including the released technology set provided to the partners

D5.1 "Project quality plan and internal IT communication infrastructure including project website"

This deliverable briefly describes the website and its functionality. Further it describes the tools provided within the IT infrastructure to facilitate cooperation and coordination.

MS1 "Successful project start"

MS1 includes the successful Kick-off meeting as well as the 1st General Assembly Meeting. All legal requirements are ready and the internal communication infrastructure was set up.

Upcoming Deliverables & Milestones

D1.1 "System scenarios, and requirements specifications"

D3.1 "First assessment of baseband processing requirements for MaMi systems"

MS2 "Specification & system concepts"

Events

MAMMOET present at past events:

- 12th-13th March 2014: **Workshop on Smart Antennas**, Erlangen / Germany (Invited talk given by Erik G. Larsson)
- 17th March 2014: **Department of Electrical Engineering Linköping University**, Linköping / Sweden (Invited talk given by Emil Björnson)
- 19th March 2014: **Newcom# Spring School - Advanced Signal Processing Techniques for Heterogeneous Networks**, Pisa / Italy (Lecture given by Erik G. Larsson)
- 6th April 2014: **Wireless Evolution Beyond 2020 Workshop at the WCNC 2014**, Istanbul / Turkey (Invited talk given by Emil Björnson)
- 25th April and 26th May 2014: **KTH Royal Institute of Technology**, Stockholm / Sweden (Invited talk given by Emil Björnson)
- 25th-28th May 2014: **IEEE Communication Theory Workshop 2014**, Piscadera Bay / Curaçao (Invited talk given by Erik G. Larsson)

Upcoming events:

- 22nd - 25th June 2014: LIU members plan to publish a paper at the **IEEE International Workshop on Signal Processing Advances in Wireless Communications** in Toronto / Canada
- 23th June 2014: Franz Dielacher will give an overview presentation about MAMMOET at the **NetWorld2020 Experts Workshop** in Bologna / Italy
- 23th - 26th June 2014: MAMMOET team members will attend to the **European Conference on Networks and Communications** in Bologna / Italy.
- 9th-10th September 2014: **MAMMOET Technical Meeting** in Lund / Sweden
- 3rd-5th December 2014: MAMMOET partners will attend to the **symposia on Massive MIMO at the GlobalSIP conference** in Atlanta / USA.
- 8th-12th December 2014: MAMMOET partners will attend to the **IEEE GLOBECOM 2014** in Austin Texas / USA

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