ARTEMOS

Agile RF Transceivers and Front-Ends for Future Smart Multi-Standard Communications Applications

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ARTEMOS is co-financed by ENIAC under work programme 2010 SP2 (wireless communication)
**Project details:**

This project aims at developing architecture and technologies for implementing agile radio frequency (RF) transceiver capacities in future radio communication products. These new architecture and technologies will be able to manage multi-standard (multi-band, multi-data-rate, and multiwaveform) operation with high modularity, low power consumption, high reliability, high integration, low costs, low PCB area, and low bill of material (BOM).

This will not just require smart RF architectures in advanced CMOS and BiCMOS technology, but also need incorporating of e.g. MEMS technologies and novel simulation methodology for achieving these complex optimizations.

Multi-standard multi-band terminals integrating all standards (e.g. GSM/EDGE, UMTS, LTE) and beyond that additional wireless communication systems for mobile devices (such as Wi-Fi, GPS, WirelessHD, WirelessUSB, NFC, PMR, all digital TV standards, etc.) in a single radio architecture with the lowest number of external SAW or BAW filters and power amplifiers. Frequency agile high dynamic range digital friendly RF architectures suitable for nanoscale (Bi)CMOS together with tunable filters are the key innovations proposed for this project.

Today, the analog RF frontend simply duplicates the circuitry for each band. Due to the severe signal constraints in a cell phone and limitations of the current technologies and architectures, it is not possible to create an integrated solution.

A tunable RF frontend is required which can cover all bands and bandwidths in a range from 0.3GHz to 5GHz, meeting all specifications within a mobile device. This requires homogeneous or heterogeneous integration of a set of complete new tunable architectures and technologies (high-Q on-chip inductors, tunable MEMS capacitors, MEMS switches and resonator or tunable BAW/SAW filters and integrated passive devices processes) with existing (Bi)CMOS technologies.

The complexity requires new advancements in the simulation techniques and modelling aspects to enable these multiple new technologies.

The ARTEMOS consortium with partners in the full value-chain from semiconductor suppliers, system-on-chip (SoC) communication domain, research and universities, is confident that the realization of its ambitious objectives will assist Europe to achieve technological leadership in domains that are targeted by ENAv.

**Objectives:**

Telecommunications are evolving towards personal communication networks, whose objective can be stated as the ubiquitous availability of communication services to transfer anything, at anytime, anywhere, to anyone, via any-path available, by means of a pocketable communication terminal.

Consequently there is on the one hand a market pull by an increasingly connected world population asking for mobile access to the vast information resources through of the internet and/or mobile phones, while on the other hand there is a market push from the industry delivering all kinds of communication standards, products and applications.

These circumstances call for frequency-agile, multi-standard and multi-band terminals integrating the cellular standards GSM/EDGE, UMTS, LTE and additional wireless communication standards, as well as low voltage micro-architectures. Frequency agile high dynamic range digital friendly RF architectures suitable for nanoscale (Bi)CMOS together with tunable filters are the key innovations proposed for this project.

**Strategy:**

To achieve ARTEMOS objectives, the overall project structure is organized into 5 main central activities relating and focusing on different tasks. A transverse activity is dedicated to System Architecture & Control enabling by 3 other main activities dedicated to RF design at building blocks and function level being:

- Active blocks for Agile RF Solutions,
- Tunable Passive Front-End Solutions and
- Modern Functions.

These 3 activities provide components for the last main activities dedicated to a Full Application Demonstrator. In addition, an activity dedicated to Methodology & Simulation Tools is provided at each design level. The relation between these various workpackages is illustrated in the figure below.

**Technical Approach:**

The technical and scientific work will be sub-divided in seven work packages:

**WP1:** System Architecture and Control

WP 1 is carrying the system concept (Use cases, RF HW & SW system architecture, technical constraints, top level specifications, etc.) and system control (Scheduling protocol & HW, HW configuration, Protocol/modem interfaces and related modern functions, RF SW drivers, Control IF’s, etc.).

**WP2:** Enabling Active Building Blocks for Agile RF solutions

WP 2 is intended to enable and develop active building blocks for the modern functions covered in WP4.

The range of activities in WP2 includes concept and circuit architecture development, simulation, physical design and lab characterization.

**WP3:** Tunable Passive Frontend Solutions

WP 3 will develop and deliver passive front-end solutions. The goal is to create an innovative RF front-end and filtering solution including the PA, filtering and antenna function by utilizing tunable/reconfigurable features.

**WP4:** Modern Functions

WP 4 is developing the hardware and the functions on top of the WP2 active building blocks. While WP3 is dedicated to the passive front-end, the WP4 is developing the modern functions.

**WP5:** Methodology & Simulation tools

WP 5 is developing the key ingredients as prototype software to provide methodology & simulation tools for RF, mixed signal and digital solutions to the gaps in the software suites of commercial vendors.

**WP6:** Full Application Demonstrator

WP 6 is intended to implement full application demonstrators by covering Tunable TRx + front-end for LTE(-A) & WLAN.

**WP7:** Project Management & Dissemination

WP 7 is dealing with project management and dissemination.

To cover all the various and different topics addressed in each WP due to the large consortium, all WP will be organized on sub-WP level with dedicated tasks and responsibilities. This work structure allows for the technical objectives to be reached more efficiently and guarantees high quality deliverables. It will also improve the technical coherence of whole work, facilitate collaborations between partners, and particularly maintain the ARTEMOS project manageable.
Consolidation:

The ARTEMOS project has a large consortium, including all major European players in wireless communication hardware. It has a perfect mix of large companies, SMEs, institutes and universities. Budget-wise the industry accounts for 60%, SME for 15%, and research and universities for 25% of the total budget. The total of 37 partners are spread over 12 countries. Every partner will be working on a leading edge technology, covering a key function within one or more wireless communication building blocks. Also the complete industrial supply chain is covered from simple components and antennas to frontend modules, transceivers and baseband chips as well as a cell phone manufacturer to complete the full application.