

Project profile

MIRANDELA

Millimetre-wave and radio-frequency integration in nanoelectronics for modern wireless



The ENIAC JU project MIRANDELA is building a complete digital, mixed-signal, analogue, radio frequency (RF) and millimetre-wave (MMW) platform for the design and production of chips for future wireless communications to address the challenge of transferring anything, from/to anybody, anywhere, at any time and through any path. Components in core CMOS technology and other processes will be characterised, optimised and modelled in the RF and MMW range as well as for analogue operation targeting very low power design of RF blocks and functions. Solutions will be developed to cut costs and time to market.

Sub Programme

- Nanoelectronics for Communications

Modern wireless communications from low-cost mobile phones in developing countries to highly sophisticated smart phones capable of handling large files and TV broadcasts require more processing capabilities to increase data transfer rates, greater flexibility towards a large variety of standards and more user friendly interfaces with analogue, radio frequency (RF) and millimetre-wave (MMW) circuits.

These improvements are achievable on a large scale thanks to new CMOS technologies with greatly reduced critical dimensions, capable of sustaining very high speeds and offering high storage capacity. Such technologies are particularly attractive for implementing low cost, high volume and wide application areas of wireless communications devices.

High level of innovation

However, lower production cost and higher product complexity are key factors for the success of semicon-

ductor and systems-integration companies. Volume market domination is more than ever related to low-cost, high-performance and reliable products with very short development and production cycle times. Thus, a high level of innovation is mandatory for success in the highly evolving and competitive communications world. A real breakthrough is essential for European players to maintain their competitive position.

With new CMOS technologies around the world offering ever higher integration density, clock frequency and memory capacity in a single chip, Europe can make a difference by adding low cost, high efficiency analogue and RF components.

Starting from a standard CMOS technology node such as 32nm to be shrunk to 28nm, the ENIAC JU project MIRANDELA will derive a new technology and design platform for the integration of analogue, RF and MMW components, blocks and functions together with the digital baseband on a same

chip. It will address the very promising mobile communications market as indicated by the evolution of smart phone sales.

In addition to traditional analogue RF design, several new ideas will be tried: MMW design in pure CMOS, very low power consumption RF design, digital-enhanced RF design, auto calibration of RF functions, software defined radio, cognitive radio, repairable functions and built-in self-test introduction.

The capability of these technologies for making highly integrated mobile communications terminals on a single chip will be demonstrated. Demonstrators will be realised in the 45/40nm as well as the 32/28nm CMOS nodes by capitalising on previous developments in other European projects.

Single-chip demonstrator

The ENIAC JU project will develop a single-chip mobile phone with radio and wireless connectivity functions integrated. This will be realised in the RF CMOS 45/40nm process and will be the cornerstone for initiating future developments. The building blocks and functions could be industrialised in real products at the end of the project with the 45/40nm process. Moreover, by capitalising on the expertise gained, the consortium will pursue developments in the 32/28nm technology node targeting die size and cost reduction. This constitutes one of the most concrete outcomes. Moreover, MMW function demonstrators will be developed taking advantages of the very high frequency-of-transition (FT) value achieved by

nano-CMOS transistors as well as results of previous European projects. These developments will allow very high data transfer in mobile communication devices over a short-range radio connection as well as on a multi-gigabit MMW wireless-access enabler for intelligent networking applications.

The target is to have such functions demonstrated and ready to be integrated on a single chip. Numerous RF and MMW transmitter/receiver functions made up of several building blocks developed in MIRANDELA will speed-up the design of future communications chips.

Reinforcing Europe's position

Success in this ENIAC JU project will reinforce the position of the European semiconductor industry in the mobile-phone RF chip market. MIRANDELA will not only address the power issues but will also allow a steadily increasing level of integration which will lead to low-cost single-chip transceiver solutions with the necessary multimode, multi-standard capability.

Moreover, the availability of advanced RF CMOS technologies will open the door to the interoperability between different fixed and mobile networks, provide a path to cope with several interfaces and facilitate the convergence between the wireless, public phone and Internet infrastructures. In addition, the advent of low-cost and low-power RF technologies will put Europe in a leading position to exploit new opportunities and to respond to emerging needs worldwide.

Nanoelectronics for Communications

Partners:

- Aalto University, School of Science and Technology
- Austrian Center of Competence in Mechatronics (ACCM)
- CATENA
- CEA-Leti
- CNRS-IEM
- DICE Danube Integrated Circuit Engineering
- EPFL
- Foundation for Research and Technology - Hellas (FORTH)
- Grenoble Institut National Polytechnique (G-INP)
- IMS
- Integrated Systems Development (ISD)
- ISEN-IEMN
- Politecnico di Milano, Dipartimento di Elettronica e Informazione
- Q-Free
- SINTEF
- ST-Ericsson Belgium
- ST-Ericsson Finland
- ST-Ericsson France
- ST-Ericsson Netherlands
- STMicroelectronics France
- STMicroelectronics Italy
- University of Modena e Reggio Emilia
- University of Pavia

Project co-ordinator:

- Jean-Louis Carbonero, STMicroelectronics

Key project dates:

- Start: May 2010
- Finish: April 2013

Countries involved:

- Austria
- Belgium
- Finland
- France
- Greece
- Italy
- The Netherlands
- Norway
- Switzerland
- United Kingdom

Total budget:

- €49.18 million



The ENIAC Joint Undertaking, set up in February 2008, co-ordinates European nanoelectronics research activities through competitive calls for proposals. It takes public-private partnerships to the next level, bringing together the ENIAC member states, the European Commission and AENEAS, the association of R&D actors in this field, to foster growth and reinforce sustainable European competitiveness.