PROJECT PROFILE

# A107: A silicon application platform for radio communications (4G-RADIO)

**HIGH SPEED COMMUNICATION SYSTEMS**

**Partners:**

Agilent Technologies Belgium
(formerly Sirius Communications)
Cefriel
Cissoid
Fraunhofer IIS
IMST
Infineon Technologies
Robert Bosch
STMicroelectronics
Uni Linz
Uni Louvain
Uni Mons

**Project leader:**

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**Key project dates:**

Start: 1 July 2001
End: 30 April 2005

**Countries involved:**

Austria
Belgium
Germany
Italy

**Maintaining European leadership in the face of growing competition from Japan and the USA continues to be a challenge for the microelectronics industry. The MEDEA+ A107 4G-RADIO project is aimed at the development of digital baseband, analogue and radio frequency solutions with circuit libraries and reconfigurable digital building blocks, to implement the physical layer of a wide range of wireless communications applications using various modulation schemes. The forecast new solutions, together with associated cell libraries for RF functions and reusable intellectual property base-band modules, will considerably shorten the development time of chipsets and/or system-on-chip (SoC) solutions.**

Over recent years, progress in semiconductor technology and system design, together with the development of new algorithms, has given wireless communications significant momentum, despite the rather gloomy market situation since 2000. In addition, the exploding demands of the Internet have led to the introduction of new services and even to a new communications-based way of life.

Europe pioneers the development of wireless communication technologies. The third generation (3G) of cellular phone provides higher rates of data transmission to meet the growing demand for interconnection with the Internet. Beyond that, the need for wireless communication is appearing in many other areas of life – including the home, office and car.

This leadership position in the domain of wireless communications can be maintained by:

- Continuing technological leadership in 3G against strong competition from US and Japanese industries;
- Promoting innovative wireless communications systems based on standards such as Bluetooth and HiperLAN;
- Developing very competitive wireless equipment solutions able to interconnect with a large range of wireless systems, including 2G, 3G, Bluetooth and HiperLAN, where cost, size and autonomy will be the key factors for commercial success; and
- Preparing solutions for 4G wireless communications technology.

The partners in this MEDEA+ project have all made a significant contribution to European leadership in this field. They have a successful tradition of co-operation in research and development activities in ESPRIT, IST and EUREKA programmes, and are recognised as worldwide leaders in their areas of competence.

## Defining the next generation

Research and development are taking place all over the world to define the next generation (4G) of wireless broadband multimedia communications systems. Present communications systems are primarily designed for one specific application such as speech on a mobile phone or high-rate data in a wireless local area network (WLAN).

In an attempt to integrate all of these services and applications in a single mobile terminal,

the International Telecommunication Union (ITU) developed a family of 3G wireless telecommunications technologies and grouped in the IMT-2000 task group. IMT-2000 standards are supposed to provide a wide range of telecommunications services requiring user bit rates of up to 2 Mb/s.

Mobile terminals for 4G have not only to ensure continuity from 3G in terms of applications and services capabilities but also to achieve the objective of having a single worldwide wireless terminal.

With this in mind, the major technical challenge for 4G is to be able to provide its customers with information rates exceeding 2 Mb/s in a multi-mode and multi-standard context. The key factors driving current growth in the mobile cell phone market rely on the technological advancements that make terminals smaller, cheaper and more reliable. In the future, those advancements will require improved signal processing techniques as well as innovative digital and radio frequency (RF) circuit design. Libraries of building blocks will be developed on a general reusability scheme, targeting several application areas such as next generation cellular phone (UMTS, 4G), short-distance wireless interface techniques such as HiperLAN/2 and Bluetooth as well as wireless automotive applications. Using the common libraries, target applications will be prototyped and demonstrated through laboratory tests for each of these markets.

## Tackling major challenges

For the European companies involved, the key challenges of this project are to:

- Develop low-cost, high-performance integrated architectures, tailored to radio communications applications to validate RF and baseband cells and architecture at behavioural level;
- Make sure that the proposed system architectures and building blocks are reusable for further applications in other wireless communications systems;
- Provide a flexible, complete function library for the design of the physical layer of advanced radio communications;
- Demonstrate the relevance of this library with the rapid design of turnkey chipsets for huge markets such as cellular phone, indoor distribution techniques, outdoor access techniques, satellite communications and automotive applications;
- Take commercial boundary conditions such as cost and time-to-market into account at all levels of technical developments; and
- Have an impact on standardisation bodies working mainly on cellular phones – including advanced techniques such as smart antennas and multi-user detection.

The 4G-RADIO project provides the basis of technology for future multifunction and multi-standard terminals that combine broadband cellular phones with access to various other standards. This will provide an efficient combination of always-on broadband access to the public wireless network together with the link to local area networks.

## Wireless technologies essential

It is becoming evident that wireless technologies are required for product acceptance in certain fields. This is particularly so in: wide area networks such as GSM with services for voice, SMS and now WAP; private households, where almost no wiring infrastructure is available; in European offices, where although high-quality wiring infrastructures are standard in corporate networks, there is a demand to replace connecting cables with wireless transmission, due to the proliferation of laptop computers and to rapidly changing working groups; and in public places, which will require local wireless transmission technologies such as Bluetooth – for example, every bus stop in a town could have a base station to enable the arrival time of the next bus to be displayed on a mobile phone.

While wireless technologies are essential, the development of the next generation of silicon devices is a big challenge. Multi-standard single-chip solutions are required to solve the stringent requirements of future portable terminals – such as GPRS/Bluetooth for low rate applications and UMTS/HiperLAN for high rate applications; compact size; low power consumption; and low cost.

## Boosting European leadership

Huge markets are expected to benefit from reusable intellectual property (IP) building blocks developed in this project, which is intended to combine the latest silicon and software technologies with the creation of inventive architecture to ensure Europe wins the business. Exploitation of the results will stimulate European industry in terms of employment (particularly skilled labour), new opportunities and the overall improvement of Europe's capabilities.

Because this project addresses all of the MEDEA+ fundamentals (advanced silicon technology, innovative architecture, IP library, standards and demonstrators), it will also contribute strongly to the overall MEDEA+ objectives.

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