PROJECT RESULTS

CA118 | Critical communications deployed in public safety and disaster relief are readied for major upgrades [FITNESS]

FITNESS prepared current European and global mission-critical radio communications (used typically for public safety and disaster relief) for new data applications and features, and the use of smart devices. Crucially, to achieve all of this, radio communication systems needed to move from operating exclusively in the narrowband, to working in a mixed environment of multistandard narrowband and broadband. That was this project's focus.

The public-safety community needs a mission-critical radio network to cover professional mobile radio (PMR) highly secured applications (police, fire services, ambulance), and professional applications (such as utilities, fleet management, factory-site service). Importantly, mission-critical communication fulfils five key requirements demanded by end-users:

1. Resilient and high-availability infrastructure;
2. Reliable communication with an extremely short setup time;
3. End-to-end secure communication with modifiable encryption;
4. Terminal-to-terminal communication support (direct mode);
5. Point-to-multipoint communication support (group communication).

Today, there are more than a thousand mission-critical radio networks in over 120 countries, including public safety networks and those in industrial areas. Voice and data services are currently provided by different digital narrowband PMP technologies – such as TETRA, TETRAPOL and APCO-25 (a suite of standards for public-safety digital mobile radio communications) – which were originally dedicated to voice services and later adjusted for narrow bandwidths (initially used by analogue radio).

While these technologies are very efficient for voice, they are not suitable for data because of limited capabilities and capacity. Finding a solution was imperative because public-safety users need new data applications and features, and also to connect smart devices. Furthermore, there are new system requirements for these communications systems: typically, high availability, interoperability and scalability, together with increased resilience, trustworthiness, efficiency and security.

Now, an enhanced version of TETRA called TEDS (TETRA Enhanced Data Service) was initially deployed to provide wideband data services and to improve the data rate. However, a much better solution makes use of the long term evolution (LTE) standard deployed in wireless broadband communication for mobile devices and data terminals. But this meant technical challenges involved in moving from an exclusive narrowband operating environment, to a mixed narrowband-broadband one.

Low-cost and versatile PMR multi-standard platform

FITNESS researched and developed a low-cost and versatile PMR multi-standard platform (narrowband; and LTE for PMR broadband) with additional PMR-dedicated functionality for geolocation. The project also involved important advanced research in architecture, processes and techniques. A case in point is the use of envelope tracking in designing radio-frequency amplifiers to ensure the highest efficiency. Importantly, a key project goal was to have all critical components integrated in a single 3D platform.

Project deliverables included:

- For narrowband: 5 demo-boards for components test; 3 CMOS chips and 1 demonstrator;
- For broadband: 12 demo-boards for components test; 4 SOI chips; 8 SIPs; 5 (BI) CMOS chips and 5 demonstrators;
- For geolocation: 4 demo-boards for components test; 2 (BI)CMOS chips; and 1 demonstrator.

Key project activities involved:

- Investigating an innovative architecture for a CMOS low-cost, narrowband, multi-standard PMR chip. This IC is a transceiver, fully compliant with all existing narrowband PMR standards (TETRAPOL, TETRA (1 & 2), TEDS and APCO-25, and which addresses both 400 MHz and 800 MHz bands;
- Validating the design of critical building blocks and their system re-configurability through the demonstrators of standalone test-chips;

PROJECT CONTRIBUTES TO

- Communication
- Safety and security
- Energy efficiency
- Digital lifestyle
- Design technology

PARTNERS

Airbus Defence & Space
NXP Semiconductors
BeSpoon
Mikroelektronik (MKR-IC)
CEA-Leti
IMS Bordeaux
ISEP Paris
Telecom Bretagne

COUNTRIES INVOLVED

France
Turkey

PROJECT LEADER

Sami Aissa
Airbus

KEY PROJECT DATES

January 01, 2015 - December 31, 2018

- Studying power-efficiency improvements through envelope tracking;
- Designing a high-power, reconfigurable CMOS power amplifier (PA) compatible with envelope-tracking power efficiency;
- Integrating a radio frequency (RF) transceiver and a high power reconfigurable CMOS PA fully compliant with long-term evolution (LTE) broadband and PMR standards, addressing both 400 MHz and 700 MHz bands;
- Developing a technique for 'tuning' the radio antenna to ensure maximum efficiency over a range of frequencies;
- Integrating the chipset that handles indoor and outdoor positioning;
- Designing a 3D platform which combines heterogeneous technologies that allow high-level integration of different systems-on-chip (SoCs) dedicated to PMR in a single, low-cost system-in-package (SiP).

Towards closer collaboration

FITNESS partners actively participated in the ETSI and 3GPP standardisation bodies, and in some 30 workshops, forums, symposiums and conferences. These were prime events to promote the project, but also disseminate knowledge gained. This knowledge included such areas as RF specifications, multi-standards architecture, frequency bands, innovations in CMOS and SOI processes, and packaging. What is more, thanks to FITNESS, there is now a real opportunity to cross national boundaries and create the critical mass needed to move from the current approach of using a mix of integrated circuits and discrete components, to proper chip integration. Notably, all of this requires investment and cooperation between European industry and educational and research institutions.

European societal, business and financial benefits

FITNESS will provide Europe's emergency services with state-of-the-art communications. By developing PMR broadband capability while preserving backwards compatibility and allowing new interoperability with existing narrowband PMR systems, FITNESS will help meet public-safety communities' requirements. It does this by supporting the European effort to deploy next-generation PMR wireless applications and improve the capacity, security and efficiency of mission-critical services, such as police, fire and ambulance.

There are also business and financial spin-offs. According to Markets & Markets, a research company, the public safety and security market size was valued at US$ 247.55 billion in 2016 and is projected to reach US$ 532.39 billion by 2022, at a compound annual growth rate (CAGR) of 14.0%. The deployment of broadband technology and the know-how of products in the US 700 MHz band, as well as in the European 400MHz band, creates an opportunity for European companies to further improve their business and also secure a competitive advantage.

European leadership potential

And finally, there is European interest in the geolocation function (featured in FITNESS) in connection with the smart-manufacturing initiative, Industry 4.0. This project will deliver the very first radio to deploy indoor and outdoor geolocation, providing European emergency services with state-of-the-art locating functionality, combined with extended operational ranges. This is a unique occasion for Europe to build a leadership position in precise indoor-location systems, an area that was first pioneered by US players with solutions that are now expensive and not integrated enough to address the challenges of the current market.

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CATRENE (E! 4140), the EUREKA Cluster for Application and Technology Research in Europe on NanoElectronics, will bring about technological leadership for a competitive European information and communications technology industry.

CATRENE focuses on delivering nano-/microelectronic solutions that respond to the needs of society at large, improving the economic prosperity of Europe and reinforcing the ability of its industry to be at the forefront of the global competition.