Spectrum and Energy efficiency through multi-band Cognitive Radio

SACRA addresses the implementation of a multi-band cognitive radio technology for spectral and energy-efficient broadband communications and targets, as major outcome, a proof-of-concept.

At A Glance: SACRA

Spectrum and Energy efficiency through multi-band Cognitive Radio

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EC Contribution: €3.77m

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Main Objectives

Energy efficiency and flexibility in the use of radio spectrum are two major research challenges for the development of future wireless communications technologies. To address these challenges, SACRA project is designing and implementing a multi-band cognitive radio technology for future broadband communication devices.

SACRA develops a cognitive radio technology that is able to perform an optimal joint resource allocation on two separate frequency bands of the radio spectrum. The objective is to distribute the user data flows in an optimal way, based on measurements of radio spectrum occupancy and other inputs of interest. To support such cognitive operation, an advanced hardware platform is needed: SACRA addresses jointly these different aspects in one project to guarantee a coherent system approach towards a target scenario of interest defined at the beginning of the study. The innovation and impact brought by SACRA project are therefore in the combination of innovative approaches on radio frequency front-end and base band components design with new cognitive radio algorithms integrated into a single demonstrator platform.

The innovation brought by SACRA is in the combination of advanced hardware design with new cognitive radio algorithms to be integrated into a demonstrator platform.

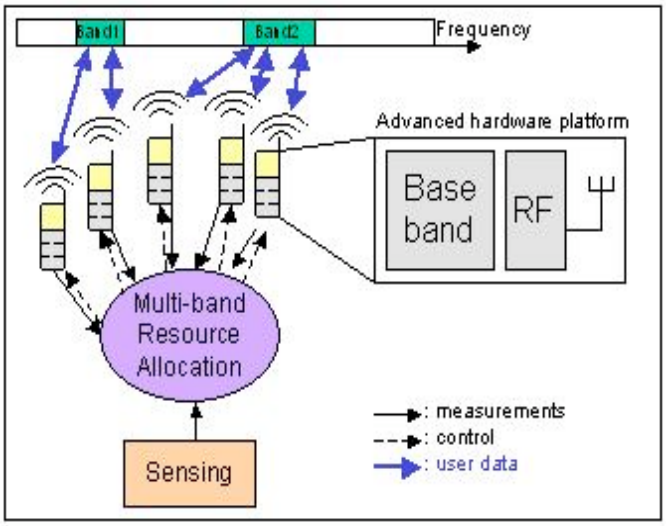
The main SACRA objective is to develop this demonstrator in order to validate the complementary enabling techniques designed for cognitive systems to increase the overall system gain (throughput/power compromise), especially for IMT-advanced target. The demonstration is scheduled in 2012 and will be a major technical achievement as well as a valuable tool to promote the SACRA approach. Operators, manufacturers and regulators will be invited to workshops where SACRA partners intend to demonstrate a cognitive radio network based on the SACRA platform including wideband RF power efficient solutions for dual-band communications and spectrally efficient radio resource management compared to state-of-the-art technology. The resulting SACRA platform should be able to communicate in real-time, over the air, with a real IP application on top of the protocol stack. Finally, the SACRA platform will be proposed to address the next challenges in the wireless communications domain.

Technical Approach

In SACRA project, the technical approach consists first in the definition of a target scenario for the study, in the specification of global system requirements (architecture, target figures, characteristics) and in the definition of working assumptions, parameters and hypothesis (WP1).

Based on this common framework, the different enabling techniques are studied and beyond-state-of-the-art solutions are proposed. WP2 addresses the sensing and access techniques and especially advanced space-time frequency polarization coding schemes. WP3 is dedicated to the radio resource management and provides interference management and allocation techniques for multi-band operation. WP4 addresses the design of antenna and radio frequency parts: integrated RF receiver front-end and versatile ADC, compact multi-band dual polarized multiple antennas, architecture for an integrated RF transmitter, DAC and power amplifier pre-distortion. WP5 will address the flexible base band design by providing a framework for embedded software design and validation. All these studies will allow to finally form a compound system integrated in a single platform, to be validated and tested in the scope of WP6. In WP1, the system specifications will be refined along the project, taking into account the results achieved in the enabling techniques related studies. WP1 will finally provide a recommended system definition, with associated techno-economical study.

Dissemination of the project results, especially through workshops and proposals to standardization is addressed in WP7.



Key Issues

Cognitive radio aims at improving the way the radio spectrum is used. Today's approach is based on dividing the spectrum into small pieces, each for a specific purpose. Since the applications use their spectrum to a limited extent, this leads to the unwanted situation of under-utilization of this scarce radio resource. As radio communications needs grow constantly, the current approach is reaching its limits. Consequently, cognitive radio and dynamic spectrum allocation are becoming key technologies and key research activities in the field of wireless communications.

SACRA addresses this key issue by proposing a system approach based on both innovative algorithms and advanced hardware components to support flexible communications on several bands, allowing an optimized use of the radio frequency spectrum in the considered bands.

Expected Impact

The cognitive radio concept is expected to become the most important technique able to improve the efficiency of the radio spectrum use and a key enabler to support the Future Internet. It will represent a crucial technology on the way to future high-capacity wireless communications networks, and thus major impacts are expected. Jointly with other European projects on cognitive radio related topics, SACRA will help to support a European leadership in the area of wireless technologies.

SACRA will support energy efficiency and flexibility in the use of spectrum resources, which are major research challenges for future wireless communications, as highlighted by the European Commission Work Programme.

As SACRA is addressing both the study and the design of hardware components to support the cognitive radio approach, it will provide key technology close to a product for coming wireless devices. Considering the crucial need for wireless technology to cover the growing capacity demand, wide market opportunities can therefore be foreseen.

In order to make applicable the concept of cognitive radio, the findings of SACRA will provide inputs to standardization groups (3GPP Release 10+, IEEE SCC41, ETSI RRS and follow-up). The project will thus contribute to the development of global standards for future networks. SACRA outcomes, and especially the demonstrator, will also be of interest for regulation bodies, as they will help them to build new regulation policies according to what is technically feasible with future wireless technology based on cognitive radio concept.