

PUBLIC



FP7-ICT Future Networks
SPECIFIC TARGETTED RESEARCH PROJECT
Project Deliverable

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Abstract: During this fourth semester, the dissemination activity has mainly consisted in the publication of papers at the conferences whose scope includes the technical area of the project and the preparation of special sessions in conferences scheduled for the first semester of 2010. A contribution was presented at the November meeting of the standardization group ITU-R/WP5A. An FBMC primer was drafted and posted on the project website, with the objective to provide an easy access to the main aspects of physical layer.

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1 INTRODUCTION

This document describes the actions of dissemination taken by the phydyas project members during the third semester.

List of partners:

Beneficiary Number *	Beneficiary name	Beneficiary short name	Country
1(coordinator)	Conservatoire National des Arts et Métiers	CNAM	France
2	Technische Universität München	TUM	Germany
3	Tampere University of Technology	TUT	Finland
4	Université Catholique de Louvain	UCL	Belgium
5	SINTEF - Trondheim	SINTEF	Norway
6	Centre Tecnologic de Telecomunicacions de Catalunya	CTTC	Spain
7	Research Academic Computer Technology Institute	RA-CTI	Greece
8	University of Napoli Federico II	UNINA	Italy
9	CEA-LETI	LETI	France
10	Agilent-Belgium	AGI	Belgium
11	Alcatel-Lucent Swindon	ALUK	United Kingdom
12	Alcatel-Lucent Deutschland	ALUD	Germany
13	COMSIS	COMSIS	France

2 JOURNAL ARTICLES AND CONFERENCE PAPERS

The following articles and papers were presented or submitted during the second semester of 2009 by the partners, in relation with their work in the project.

Journal articles

T. Fusco, L. Izzo, A. Petrella and M. Tanda, "Blind symbol timing estimation for OFDM/OQAM systems," IEEE Transactions on Signal Processing, vol. 57, no. 12, pp.4952-4958, December 2009.

T. Fusco, A. Petrella and M. Tanda, "Joint symbol timing and CFO estimation for OFDM/OQAM systems in multipath channels," EURASIP Journal on Advances in Signal Processing, Special issue on Filter Banks for Next-Generation Multicarrier Wireless Communications, Volume 2010.

C.Lélé and D.LeRuyet, "Decoding schemes for FBMC with single delay STTC", submitted to EURASIP JASP, June 2009.

H. Zhang, D. Le Ruyet, M.Terré « Spectral efficiency comparison between OFDM/OQAM and OFDM based CR networks", to be published in "Wireless Communications and Mobile Computing", Wiley, 2009.

A.M.Kuzminskiy, Y.I.Abramovich, "Decentralized dynamic spectrum allocation based on adaptive antenna array interference mitigation diversity, " accepted for IEEE Trans. on Signal Processing, 2009.

Conference papers

T.Ihalainen, A.Viholainen, T.H.Stitz, M.Renfors and M. Bellanger, "Filter Bank Based Multi-Mode Multiple Access Scheme for Wireless Uplink", Proc.of EUSIPCO'09 conference, Glasgow, August 2009.

A.Viholainen, T.Ihalainen, T.H.Stitz, M.Renfors and M. Bellanger, "Prototype filter design for filter bank based multicarrier transmission", Proc.of EUSIPCO'09 conference, Glasgow, August 2009.

A.Ikhlef and J. Louveaux, "Per subchannel equalization for MIMO FBMC/OQAM systems," Proc. of the conference IEEE PACRIM09, Victoria, Canada, August 2009.

A. M. Kuzminskiy, Y. I. Abramovich, "Performance bounds for dynamic spectrum allocation based on adaptive antenna array interference mitigation diversity," in Proc. IEEE-SSP, Cardiff, Sept. 2009.

A.M.Kuzminskiy, Y.I.Abramovich, "Randomized decentralized "good neighbor" DSA based on adaptive antenna array interference mitigation diversity," accepted for ICASSP, 2010.

A.M.Kuzminskiy, Y.I.Abramovich, "Rule-breaks effect on decentralized rule-regulated "good neighbor" DSA based on adaptive antenna array interference mitigation diversity" submitted to DySpan, 2010.

3 SPECIAL SESSIONS AND WORKSHOPS

Workshops

The main achievements of the project were presented at the RAS workshop on 28-29/09/2009, in the areas of

- next generation mobile technology,
- cognitive radio and network technologies.

TUT presented PHYDYAS activities in a workshop on cognitive radio organized by Nokia Research Center on Nov. 25, 2009. Different units of Nokia and Finnish research organization active in the field were widely represented in the workshop.

special sessions at conferences

EW2010- European Wireless - 12/15 April 2010 - Lucca (www.ew2010.org)

The contents of the Phydyas session is as follows.

Session title: Multicarrier physical layer – The Phydyas project

Tutorial introduction: “Multicarrier physical layer for cognitive radio” by M.Bellanger

Talks:

- 1) F.Schaich, “FBMC in the WiMAX context”
- 2) M.Najar, ” Performance Comparison between FBMC and OFDM in MIMO Systems under Channel Uncertainty”
- 3) M.Renfors, “ FBMC and the Alamouti scheme”
- 4) D.Le Ruyet, “ML decoding in MIMO-FBMC”
- 5) Q.Bai, N.Passas and J.Nossek, “Scheduling and resource allocation on OFDM and FBMC systems: an interactive approach and performance comparison”
- 6) D. Xenakis, D. Tsolkas, N. Passas, and L. Merakos, “Dynamic resource allocation in adaptive multiuser multicarrier systems”

A demonstration will be proposed by partners AGI, SINTEF and CTTC.

Crowncom - 9/11 June – Cannes (www.crowncom2010.org)

(Cognitive radio oriented wireless networks and communications)

The organization of a special session, about the impact of the physical layer and the associated opportunistic scenario, has been proposed by Carlos Bader and accepted by the

conference committee. The definition of the contents is in progress.

Eusipco 2010

Contributions will be submitted for the special session “Multirate signal processing” organized by Heinz Göckler.

4 FUTURE NETWORK AND MOBILE SUMMIT 2010

The conference will take place in Firenze, on June 16-18. The following papers have been submitted by partners

- 1) FBMC simulation and demonstrator – SINTEF-ALUD-AGI-CTTC
- 2) Efficiency of FBMC in burst transmission – CNAM
- 3) Spectrum monitoring schemes for FBMC cognitive radios – TUT
- 4) OFDM and FBMC performance comparison for multistream MIMO systems- CTTC

A booth has been reserved at the exhibition by Jürgen Vandermot who will coordinate the participation by AGI, SINTEF and CTTC. In addition of the Phydias demonstrator, as a complement, a MIMO equipment supplied by COMSIS will be presented.

5 STANDARDIZATION

Cognitive radio was introduced on the agenda of the World Radio Conference (WRC) in 2007 and a question was put to ITU-R, in order to advance the issue and prepare the next meeting, WRC 2011. It was stated that the corresponding studies should be completed by the year 2010.

Question ITU-R 241-1/5, entitled “Cognitive radio systems in the mobile service”, includes the following sub-question:

Q7: what spectrum sharing techniques can be used to implement cognitive radio systems to ensure coexistence with other users?

The question is handled by study group 5 and working party WP5A, which organizes two meeting per year to discuss the contributions submitted by the members.

At the November meeting in Geneva, a contribution entitled: “Cognitive radio systems in the land mobile service – technical characteristics and functionalities of cognitive radio systems” was presented by the project coordinator. The text is given in annex 1.

The standardization of power line communications (PLC) at IEEE has also been considered. None of the partners is a member of the standardization group IEEE P1901. However, the standardization group relies on the annual conference ISPLC for technical contributions. Thus, the following paper has been submitted by CNAM and TUT: “OFDM and FBMC transmission techniques: a compatible high performance proposal for broadband power line communications”. The paper will be presented at ISPLC2010 in March 2010.

6 PATENTS

A patent has been filed during the semester.

“Multicarrier Digital Transmission System Using Filter banks and Data Frequency Spreading”, filed by CNAM, on 02/10/2009.

A patent will be filed this semester.

“Efficient estimation/compensation of increased time-delays without extra pilot tones”, by ALUD.

7 WEBSITE (<http://www.ict-phydvas.org>)

The July deliverables have been made available in the public area of the website.

A document entitled “FBMC physical layer: a primer” has been posted on the public area. The objective is to give an easy access to the main characteristics of the Phydvas physical layer and show how it can be exploited. It explains that FBMC is just an evolution of OFDM, and it should be easy to read for those familiar with OFDM.

The introduction of new materials will be studied by CNAM. In particular, slides concerning simulation results and the demonstrator should be presented, possibly before the EW 2010 exhibition in April.

8 EXPLOITATION PLAN OF INDUSTRIAL PARTNERS

CEA-LETI

In CEA-LETI, the PHYDYAS project will contribute to increase the know-how of the teams working on FBMC system design and compensation algorithms. Some specific results, such as new compensation algorithms or techniques, may be patented and afterwards published. The main objective of CEA-LETI in this project will be to make a technology transfer covered by a license, which entitles partners to draw on CEA-LETI know-how and patents. The license fees will be further used to fund new research projects. One possible alternative for results exploitation might be the creation of a spin-off company as it has been done in a recent past in other areas (more than 20 successful startups created thanks to technology transfer).

Alcatel-Lucent

- Development of patentable techniques for efficient resource sharing and cognitive radio.
- From a long-term perspective, the proposed "good neighbour" rule-regulated spectrum sharing strategy aims at influencing the value chain and the business model of wireless operators.

- Analysis of mixed "good neighbour"/"selfish" networks gives qualitative support for development of incentives and regulations for rule-regulated spectrum sharing wireless networks.
- FBMC may be a possible evolution of actual and future OFDM based networks (e.g. LTE, WiMAX, power line communications, DSL, optical core, optical access). Provided that FBMC proves to guarantee performance improvement with justifiable complexity, FBMC should be pushed within future standardization bodies. On-going standardization procedures (LTE advanced, 802.16m) have advanced beyond the fundamental characteristics of the physical layer.
- Once FBMC has found its way into any standardization body covering a topic within the portfolio of Alcatel-Lucent, this technique should be implemented.

Annex 1: ITU contribution- 5A/360-E (see companion document)