



Enhanced Multicarrier Techniques for Professional Ad-Hoc and Cell-Based Communications

(EMPhAtiC)

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Plan for the use and dissemination of foreground, issue 1

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Abstract:

The present document is concerned with the D10.1.1 deliverable "Plan for the use and dissemination of foreground, issue 1" which will contain the main results obtained by the EMPhAtiC project. Each partner of the consortium listed its dissemination plan and exploitation strategy according to its own activity and mission. Efforts of EMPhAtiC consortium in disseminating the project results and the useful used tool are here detailed.

Keywords: Professional Mobile Radio systems, Public Protection and Disaster Relief, Filter bank based, Multicarrier Scheme, Spectrum Sharing, System cohabitation, Advanced waveforms, 3GPP LTE evolution

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Executive Summary

The plan for the use and dissemination of foreground is one of the compulsory reports that FP7 projects are required to present to the Commission. It summarises the consortium's strategy and concrete actions to protect, disseminate and exploit the foreground generated by a project. This first issue of the plan helps participants establish a basis for the dissemination and use of foreground, prepare to implement their strategy and conclude any necessary agreements.

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1. Introduction

Public Safety organisations are using radio communications systems for the day to day operational needs (called PP1: Public Protection in day to day mode), for exceptional events (called PP2: Public Protection in exceptional planned events: sports events, cultural events, demonstrations, etc.), and for disaster recovery conditions (called DR: Disaster Relief: exceptional unplanned events). These usages are called collectively as PPDR, which corresponds to Professional Mobile Radio (PMR) services for Public Safety organisations.

Today they use dedicated radio communications systems TETRA, TETRAPOL in Europe and in a large part of the world, APCO25 in North America) primarily for voice communications and also for low rate data transmissions. This is due to the technological limitations of currently deployed PMR /PPDR systems, which only use a small frequency bandwidth and have thus limited throughput.

In recent years Public Safety organisations in the UK, France, Netherlands and some other countries have been conducting trials on high-speed data communications, in line with the PMR evolution trend. There is clearly a need amongst these organisations to have in 5 to 10 years nationwide networks to support mission critical applications like those listed above.

Services like Imaging, Digital mapping / Geographical information services, Video (real time and slow scan), and data base access remote require much higher data rates than what the currently deployed PMR/PPDR systems can support. Broadband techniques using bandwidths in the range of 1.4, 3, or 5 MHz, such as the 3GPP LTE system, enable high data rate transmissions and demanding PPDR data applications. The above mentioned services and applications are becoming more and more important for the missions of Public Safety organisations.

1.1 *EMPhAtiC project motivation*

The EMPhAtiC project addresses the described trends and needs to upgrade the PMR/PPDR networks (TETRA, TETRAPOL, TETRA TEDS, APCO 25, ETSI dPMR, iDEN, and others) towards supporting broadband data communications services. The new required capacity can be achieved in two complementary ways: by obtaining new frequency bands for PPDR data services and by fitting a novel broadband data service within the scarcely available spectrum devoted to PMR systems. To satisfy the growing demands, both directions actually have to be followed. In EMPhAtiC project we focus on the latter approach, which can be seen as a very challenging evolution path, but also the most realistic opportunity to benefit from the advantages of latest developments in multicarrier waveforms and related signal processing techniques. One of the major issues is being able to introduce new broadband data services within the current frequency allocation, in coexistence and cohabitation with current PMR/PPDR systems.

1.2 *Vision & Objectives*

The considered coexistence scenario, with deployment of broadband data service in a band already occupied by narrowband PMR channels. In such scenario high flexibility and spectral agility in combination with efficient fragmented spectrum use are necessary requirements for the broadband system. To reach good spectral efficiency and minimize interferences between the different services, well-contained spectrum, providing improved adjacent channel protection, is critical. The general objectives of EMPhAtiC are:

- to propose an innovative technological solution allowing increased data throughputs for

Public Safety radio-communication systems in cohabitation with existing networks in the same frequency bands, to facilitate a smooth migration towards broadband systems.

- to develop an efficient and highly flexible/variable filter-bank processing structure for use in heterogeneous environments with irregularly fragmented spectrum.
- enable a flexible spectrum use for mobile broadband applications, while taking into account commercial and regulatory opportunities and constraints.
- development and use in PMR/PPDR context of advanced multicarriers waveforms and signal processing techniques and find applications in various other scenarios of flexible spectrum usage and cognitive radio.
- Radio scene analysis for flexible spectrum usage is also an important technological objective.
- demonstration of the superiority of the EMPhAtiC architecture when compared to prior known solutions.

1.3 Concentration and Audience

The results obtained in the EMPhAtiC project will benefit all parties in the wireless arena:

- **Academia and research centers** first contributing with their solid backgrounds in this field, will benefit from EMPhAtiC to improve their research profiles. The work will stipulate dissemination of this knowledge to undergraduate and PhD students. This will generate skilled engineers, which will be well prepared to start their professional career in the wireless sector.
- **Industrial partners** The benefits of the Project for Industrial Partners will be felt in the areas of improved products and solutions available through the Project. This will allow the parties to take advantage of improved system performance due to new ideas before their competition. Therefore, the target (from industrial point of view) is improve the positioning of European industry in the PMR domain in terms of research, technology mastery and evolution for the future. Two major worldwide companies, CASSIDIAN and TCS, are major actors in the EMPhAtiC projects and they are strong and prime players in the domain of PMR. Dynamic SMEs working in the domain of broadband mobile radio communications are also involved in the development of the European industrial potential in the PMR/PPDR domain and to support European industry positioning on mobile wireless broadband systems.
- **Users** who will eventually be offered optimised services and because of the higher flexibility and efficiency resulting from advance wireless systems providing high quality of services.
- **Society** The European Industry has been in the forefront of wireless technologies for example with the early introduction and standardization in the nineties of the Digital Mobile Solution of GSM. The early adoption of new technologies has proven an enormous success for the involved industries first and lastly for the society they are serving. The society can take advantage in advance of other competing countries of an improved service and a technological prestige that finally rubs on other aspects of the economical toil.

The focus of EMPhAtiC is to improve efficiency of mobile broadband networks especially in term of radio coverage and capacity. This target is the keystone for reducing the cost of deployment of radio networks for PMR applications, and also more generally for Broadband Mobile Radio networks. This enables major cost savings in radio network deployment, especially in suburban and rural areas, by minimizing the number of radio sites required. This lowers also the cost of communications onto mobile radio networks by using more efficiently the scarce resource of radio frequencies.

2. EMPhATiC Exploitation & Dissemination approach

The project explicitly recognizes the importance of disseminating project results. In fact, it constitutes one major contribution to the entire wireless communications community. The project contains several tasks with scientific value, and it is in the interest of research-oriented partners to publish these results in the open literature. Moreover, the involved partners carry out dissemination in order to provide an advanced physical layer analysis, allowing both SMEs and universities/research centers to compare the achieved results with those solutions coming from the market and thus leading to a possible improvement and refinement of present and future wireless communication implementations. This provides benefits to all involved parties: manufacturers/SMEs may have inputs to allow improvements in their products, those with business relations with operators in general, they may have available advanced physical layer, protocols and architectures for mobility and cooperative relaying at higher layers and acquire more rapidly background on these key topics, universities and research centers may have the opportunity and the basis to develop and include new features in their physical layer concepts related to future broadband PMR and PPDR systems and design for a better and more efficient utilization of the spectrum and, finally, end-users will eventually experience a general improvement and growing service capabilities in the PMR band, and a better provision of the QoS. Each partner has, for these reasons, a strong motivation and commitment for distributing information about the project and its results.

2.1 Dissemination Strategy and Tools

The strategy for information dissemination and exploitation of the project results, for the consortium as a whole, is illustrated in Figure 2-1. Both targeted dissemination directed to other specific projects with related interests (and selected by the Project Coordination Program) and broad dissemination of information are envisaged. The following sections show a plan for future papers to be presented or published in workshops, conferences, technical journals but also more details of the dissemination strategy of the EMPhAtiC Project. An R&D work cannot be considered concluded if all the results are only disseminated within the scientific community. Following this objective it is absolutely necessary to carry out these activities:

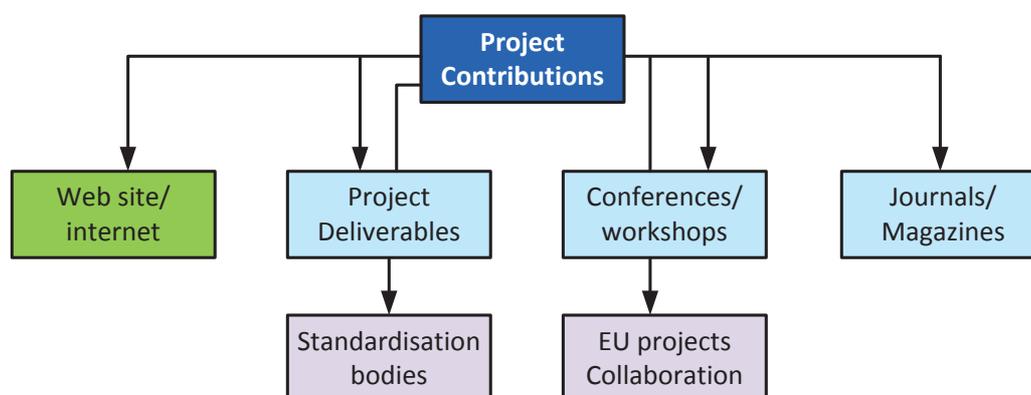


Figure 2-1: Strategy for dissemination and knowledge exploitation of the EMPhAtiC project foreground

2.1.1 Website

EMPhAtiC activated the web page related to the set-up of electronic dissemination tools. Web site $\{http : //www.ict - emphatic.eu/\}$ is meant to attract the attention of the public to the project. With growing knowledge and results from the project, EMPhAtiC web site is continuously reinforced for being a useful tool and important source of information for industry and research community, and enhances public awareness on the topics. The web site, which is regularly updated, contains a general description of the project including its objectives, technical approach, and expected results. Both public deliverables and a list of the papers which have been presented at relevant conferences, workshop or published in international journals are available here. For copyright reasons, full papers may not always be straightforwardly downloaded from the website. In this latter case, a link to the author(s) home page is provided. Corresponding papers may then be downloaded from these websites. A private section of the web site is acting as an Intranet for the partners as a repository for the finished and working documents of the consortium.

2.1.2 EMPhAtiC logo and factsheet

A logo has been developed at early stages of the project and translate the spectral characteristics of the physical layer to be studied and also the multi-cellular approach. The EMPhAtiC logo will be used for any (internal or external) deliverable, report and dissemination tools.

Leaflets will be prepared during the project to give an overview, the main objectives, ensure easy recognition of the project members and its outcomes.

2.1.3 Dissemination into the scientific community

The dissemination process, managed by Work Package 10 and approved through Project Management Team (PMT) and the General assemblies (GA) decisions, will take fully advantage of this new Era of information:

- Long papers versions to Journals,
- Concise version papers to conferences and letters,
- 3 White Papers summarizing and synthesizing major key results from the project each year,
- Submission of public information to some Technological Intelligence websites,
- Organization of Workshops, lectures, and participation in summer/winter schools jointly with other NoEs from the FP7 projects (e.g. ICT-ACROPOLIS), and the European Cooperation in Science and Technology (COST) Actions as one of the longest-running European frameworks supporting cooperation among scientists and researchers across Europe (e.g. COST Action TERRA, COST Action IC902, COST Action 2100, etc.),
- Organization of Demonstrations to specific events with strategic and/or technological impact (e.g. IEEE, ITU, IST-Summit, etc.) In line with its obligations regarding dissemination of results and achievements, the Coordinator insures that all public documents (including, but not restricted to, the following material: trials; animations of simulation results; presentations, animated/voice-over or not; promotional material (leaflets, posters, etc.); press releases etc.) generated by the project are duly collected in a Dissemination Package which is associated with the periodic reports.

Dissemination of project's results by means of publications in scientific workshops, journals and magazines in the field of telecommunications systems is undoubtedly an effective way to reach a wide community of both academic and industrial people interested in issues tackled by the EMPhAtiC project. Journals, in fact, mostly concentrate on theoretical and experimental papers, while magazines focus on practical applications in research, design and specification. The increasing spreading of on-line publications further favours the dissemination through this channel.

2.1.4 Scientific Journals and Magazines

A list of scientific journals and magazines, which are relevant for the EMPhAtiC activities, include (although it is not limited to):

- **IEEE Transactions on Wireless Communications**

The IEEE Transactions on Wireless Communications is major archival journals, which publishing original papers that advance the state-of-the art and applications of wireless communications.

- **IEEE Journal on Selected Areas in Communications (J-SAC)**

Each issue of the IEEE Journal on Selected Areas in Communications (J-SAC) is devoted to a specific technical topic and thus provides to J-SAC readers a collection of up-to-date papers on that topic. The technical topics covered by J-SAC issues span the entire field of communications and networking.

- **IEEE Wireless Communications**

IEEE Wireless Communications is designed for individuals working in the communications and networking communities. It covers technical and policy issues relating to personalize, location independent communications in all media (and combinations of media), and at all protocol layers. Both wired and wireless communications will be covered as well as computing, the mobility of people, communicating devices, and personal services.

- **IEEE Network**

The primary purpose of IEEE Network, which is published bimonthly, is to inform readers on topics of interest to the networking community. As such, IEEE Network provides a focus for highlighting and discussing major computer communications issues and developments. The articles are intended to be of a survey or tutorial nature, slanted towards the practical, and comprehensible to the non-specialist.

- **IEEE Transactions on Vehicular Technology**

IEEE Transactions on Vehicular Technology publishes papers dealing with electrical and electronics technology in vehicles and vehicular systems. Its scope is defined by the areas of Communications, Transportation Systems, and Vehicular Electronics.

- **IEEE Communications Magazine,**

This magazine considered by many to be their most important member benefit, provides timely information on all aspects of communications: monthly feature articles describe technology, systems, services, market trends, development methods, regulatory and policy issues, and significant global events.

– **IET Communications Journal**

IET Communications covers the fundamental and generic research for a better understanding of communication technologies to harness the signals for better performing communication systems using various wired and/or wireless media. This Journal is particularly interested in research papers reporting novel solutions to the dominating problems of noise, interference, timing and errors for reduction systems deficiencies such as wasting scarce resources such as spectra, energy and bandwidth.

– **Transactions on Emerging Telecommunications Technologies (ETT)**

To be the focus in Europe of outstanding contributions from researchers and engineers working in the field of information technology, the ETT journal concentrate papers on the various applications of telecommunications: Communication networks, Communication theory, Information theory, Mobile networks, Optical communications, Cryptography/security, Signal processing, Transmission systems, Wireless communications.

– **Wireless Networks journal (Springer)**

Mobile Networks and Applications technical scope reflects the emerging symbiosis of portable computers and wireless networks, addressing the convergence of mobility, computing and information organization, its access and management. In approving Special Issues, the Journal places an equal emphasis on the various areas of nomadic computing, data management, related software and hardware technologies, and mobile user services, alongside more "classical" topics in wireless and mobile networking. The journal documents practical and theoretical results, which make a fundamental contribution.

2.1.5 Conferences, Symposia and Workshops

Conference attendance/participation is a fundamental part of a R&D work is the dissemination of the different obtained results and let to know to the scientist community the different achieved progresses. Thematic conferences and workshops constitute another important way for disseminating and spreading the project results. A list of conferences and workshops, which are relevant for the EMPhAtiC activities, will be included in this section and the total list actualised in the next deliverable 10.1.2. The list of conferences, symposia and workshops (although it is not limited to) are: Future Networks and Mobile Summit, IEEE PIMRC, IEEE VTC-Spring/Fall, IEEE ICC, IEEE Globecom, IEEE ICASSP, IEEE SPAWC, EWC, IEEE WCNC, ICT, ISWCS, EUSIPCO, ICWMC, IEEE CrownCom, IEEE CAMAD, and WWRF.

2.1.6 Others

CTTC has already established a dissemination portal. The periodically web site actualisation lists the CTTC's conference papers related with EMPhAtiC project (<http://www.cttc.es/project/enhanced-multicarrier-techniques-for-professional-ad-hoc-and-cell-based-communications/>).

3. Partner's Specific dissemination and exploitation plan

Exploiting any outcome from the STREP project should focus on promoting the European leadership and influence worldwide. Hereafter some examples of such planned exploitation plan by some of key partners.

CTTC

The CTTC, being a non-profit research institute, does not plan for a direct commercial exploitation of the project results stemming from the EMPhAtiC. However, CTTC's participation in this project is expected to stimulate a number of technology transfer and IPR generation activities which are at the core of its mission. The generation of an IPR portfolio is one of the most important outcomes of research and a cornerstone in the process of planning for the return of investment in long- and mid-term R&D activities. Next, from CTTC's participation in the EMPhAtiC project, our staff will become more knowledgeable in a variety of technologies and systems such as TETRA and/or ETSI BRAN, WiMAX, LTE, LTE-A, mesh networking, etc. Clearly, this will facilitate the establishment of new strategic partnerships with companies (network operators, equipment manufacturers, SMEs, etc.), both at the national and international levels. These strategic alliances facilitate a bidirectional exchange of information on R&D trends and technological needs, access to labs and R&D equipment in favourable conditions, temporary hosting of R&D personnel, etc. Very often, today's strategic partnerships constitute the seed for tomorrow's industrial contracts which EMPhAtiC is expected to stimulate, as well.

CNAM

As the coordinator of ICT FP7 European project PHYDYAS, CNAM has become a leader in research on filter-bank modulations. The EMPhAtiC project will help CNAM maintain its expertise and its position in the future. CNAM has also contributed to standardization at ITU-R on filter-banks. In the EMPhAtiC, CNAM will participate with CASSIDIAN in PMR standardization. Consequently, the project will not only be exploited for research dissemination through scientific publications in journals and international conferences, but also for standardization.

TUM

Will exploit the results in parallel and future research projects, with special emphasis on the application of FB based multicarrier systems on 5th generation wireless communications. The main results will also have an impact on the contents of graduate level courses.

TUT

Will intend to exploit the results of the project in parallel and future and research activities, both in academic and industry driven projects. One planned concrete case study is the application of the proposed variable filterbank scheme for efficient spectrum exploitation and spectrum sensing in 2.4 GHz ISM band.

UCL Will exploit the results for further research activities in the topic. In particular, a starting project on the use of FB-MC in optical transmission could benefit from these results. In addition, this could also help improve some graduate courses and set bases for master student theses.

CTI

The participation of CTI in the EMPhAtiC project will allow training PhD students as well as postdoc researchers in modern signal processing and communications subjects, such as sparse signal processing in FB-based multicarrier, radio resource management and cognitive radio, especially in the little studied PMR application context. Previous research experience in these topics (including the PHYDYAS project) will be refined and extended, also incorporating parallel research activities of the group and enriching them with the project's tools and applications. Interacting with the other partners within the project is expected to promote collaboration, ex-

tend knowledge and expertise (especially in the PMR application context), and provide material for more future research projects in the area.

ITU

The research results of the EMPhAtiC project will be exploited to graduate Master and PhD students in the Department of Electrical Engineering and Information Technology, Communications Research Laboratory, at ITU. Moreover, the project results will fuel a continuously on-going revision of the graduate curriculum in communications and signal processing, where we have just started a new international Master's program. The topics of the project are of significant interest to the industry, and it is expected that the project will strengthen collaboration with industrial partners and with research institutes. Finally, the knowledge built up in the project will, together with the knowledge available at ITU, form the basis for the definition of future research projects to be carried out together with other European partners.

SINTEF During the EMPhAtiC project SINTEF will acquire and contribute to knowledge on use of filterbanks in communication systems in general and in PMR and LTE-like systems in particular. This knowledge is crucial for continuous maintenance of relevant skills that is required to serve future customers. Software modules that are developed during the project will contribute to the database of systems that can be exploited in future projects.

UNS The UNS-FTN will exploit the results of the conducted research for extending the Wireless Communications graduate studies curriculum, and strengthening its research and development potential towards participation in future projects funded by EC, along the collaboration with industry organizations. By further internal developments of an algorithmically unified multi-mode transceiver configuration and development of relevant IP portfolio, a basis will be made for creation of a university spin-off company.

CASSIDIAN

As explained in previous sections, demonstrating the potential of FBMC techniques will allow to propose our customers a secured migration path from existing PMR systems to evolved and future systems, including of course broadband radio communications and associated new services.

TCS

The results of the projects would be exploited in various ways in Thales Communications & Security. From a research perspective, the global findings of the project and the simulators developed for clusterized ad-hoc networks will be used as a starting point for future investigations in broadband wireless systems of the next generation, like adaptation of 3GPP LTE-Advanced for high data rate security specific systems such as PMR. Concerning TCS products, these studies could provide inputs for the next generation of TCS professional radios by providing PHY and MAC algorithms validated by system level performance. These products are sold widely in the world and contribute to maintain the European industrial leadership.

Bitgear

Business model Bitgear is practising is mostly based on offering customisation services on top of its existing and proven IP. With this in mind the exploitation approach of project outcomes will primarily be to utilise them to upgrade existing in-house IP, such as COFDM or OFDM-A cores. Obviously, the upgrade would be performed with relevant techniques devised during the life-cycle of this project, thus advanced filterbank design or channel estimation could be used. In the same time, with the upgrade of the IP, the participation of Bitgear in a project targeting PMR would allow for extension of business activities from the commercial telecommunications arena, where most of the activities are at the present, to more demanding arenas of professional radios, which would on a longer run generate new business opportunities.

Magister

Magister Solutions is a consulting company specialized in wireless systems research. This project enables us to widen our areas of expertise in the areas of FB multicarrier, cognitive networks and PMR systems and their management. As our personnel are active contributors in scientific conferences and journals, the project also enables us to exploit the results for research dissemination. All this is expected to strengthen the co-operation with our current (inter)national partners, but also to broaden our future partner base.

3.1 Contributions to standards and regulation as well as the related IPRs

- CASSIDIAN is the first PMR manufacturer in the world with a strong position in Europe with the current PMR technologies: TETRA, TETRAPOL and APCO25. CASSIDIAN is providing Infrastructure equipment (Base Stations and Core Network) and terminals for PMR networks for Public Safety (PPDR: Public protection - Disaster Relief) and for Professionals and Utilities (PUT).
- CASSIDIAN is strongly involved in the standardization of PMR systems in ETSI TETRA and in ETSI ERM TGDMM. CASSIDIAN is especially involved in the standardization of future broadband PMR systems in ETSI TETRA WG4. CASSIDIAN is also actively following 3GPP LTE standardization work. CASSIDIAN is also actively participating in frequency regulation bodies (CEPT/ECC WG FM) and especially in the group dealing with PPDR (CEPT/ECC FM49: Frequency Management).
- As far as standardization is concerned, the main task within the consortium will be to promote as much as possible the advantages and main benefits of the adoption of this filter-bank and enhanced OFDM approaches for future standard evolutions of radio-communications systems.
- In this aim, we will have to provide clear description of addressed schemes, and eventually propose contribution to the standardisation process of future releases. This work will mainly concern working group ETSI TETRA WG4 in which CASSIDIAN-EADS takes part, but could also be seen in the 3GPP context, as a very first step of topics to be discussed. This TETRA WG4 working group is dedicated to the air-interface and is composed of the companies involved in TETRA and more generally PMR systems. CASSIDIAN takes part in different "work items" like TEDS (TETRA Enhanced Data Service) and Broadband PMR. TETRA WG4 is notably in charge of SRDoc Broadband, which is a document describing and specifying the frequency needs for Broadband PMR for Public Safety (PPDR: Public Protection Disaster Relief). WG4 is then considering technical aspects and frequency management aspects concerning Broadband for PMR PPDR systems, TETRA WG4 is then strongly concerned and interested in potential performances and gains which will be demonstrated through the EMPhAtiC project.

4. Preliminary dissemination activities

EMPhAtiC consortium is actually doing its steps in the dissemination of the preliminary achieved results from all the project work packages. Hereafter are the resumed dissemination activities during this short period of the time life of the project:

1. **Workshop proposal for the Tenth International Symposium on Wireless Communication Systems (ISWCS'2013) conference on:** *"Advanced Multicarrier Waveforms and Mechanisms for Future Ad-Hoc and Cell-Based Systems,"* a Full day workshop.

Workshop chairs are:

- Faouzi Bader**, CTTC, Barcelona, Spain.
- Markku Renfors**, Tampere University of Technology (TUT), Finland.
- Didier le Ruyet**, Conservatoire National des Arts et Métiers (CNAM)
- Philippe Mège**, CASSIDIAN, Paris, France

2. **Submitted Special Issues to:** EURASIP Journal on Advances on Signal Processing (ASP) Special Issue proposal on: **Advances in flexible multicarrier waveforms for future wireless communications**. Guest editors: Kofidis, L. (Unipi, Greece); Renfors, M. (TUT, Finland); Siohan, P. (Orange Labs, France); Harris, F. (San Diego, USA); and Bader, F. (CTTC, Spain)

3. **Invited paper (accepted) at the IEEE VTC-Spring 2013 conference.**

Invited paper accepted for the Special session on Physical Layer Transmission Technologies Track/Category: Non-orthogonal Modulation promoted by the ICT-5GNOW project. Accepted paper title in: *"On the Use of Filter Bank Based Multicarrier Modulation for Professional Mobile Radio"* by M. Renfors, F. Bader, L. Baltar, D. Le Ruyet, D. Roviras, P. Mège, M. Haardt, and T. Hidalgo.

4. Presentation of EMPhATiC project objectives and technical challenges at the European commission RAS (**Radio Access and Spectrum**) cluster dissertation meeting on 9-10 October 2012, in Brussels-Belgium.

5. **Submitted papers:**

- 2 papers submitted to the Future Network and MobileSummit 2013
- 2 papers submitted to IEEE VTC-Fall 2012
- 1 paper submitted to IEEE SPAWC 2013
- 1 paper submitted to IEEE ICC 2013
- 1 paper submitted to IEEE ISWCS 2013
- 1 paper submitted to IEEE ICASSP 2013

Glossary and Definitions

Acronym	Meaning
3GPP	Third Generation Partnership Project
APCO25	Association of Public Safety Communications Officials Project 25
ETSI	European Telecommunications Standards Institute
ETSI pDMR	ETSI private Digital Mobile Radio
FB-MC	Filter Bank-based Multi-Carrier
iDEN	integrated Digital Enhanced Network
IEEE	Institute of Electrical and Electronics Engineers
ITU-R	International Telecommunication Union Radiocommunication sector
IMT	International Mobile Telecommunications-Advanced
LTE	Long term Evolution
LTE-A	Long Term Evolution - Advanced
PMR	Personal Mobile Radio
PPDR	Public Protection and Disaster Relief
pDMR	private Digital Mobile Radio
TETRA	TErrestrial Trunked RAdio
TETRA TEDS	Tetra Enhanced Data Service
TETRAPOL	A digital FDMA PMR system developed by Matra/EADS
QoS	Quality of Service
WiMAX	Worldwide Interoperability for Microwave Access
WWRF	Wireless World Research Forum