

PROJECT FINAL REPORT

Grant Agreement number: 230126

Project acronym: ACOST

Project title: Advanced Communication Systems and Technologies

Funding Scheme: Coordination and support actions (Support)

Period covered: from April 1st, 2009 to March 31st, 2012

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¹ Usually the contact person of the coordinator as specified in Art. 8.1. of the Grant Agreement.

4.1 Final publishable summary report

4.1.1 Executive summary

Within the framework of the FP7 Capacities Work Programme, the ACOST project is aimed at supporting the development and publicity of the research excellence of the Department of Radio Electronics (DREL), Brno University of Technology, in the field of Microwaves, Optoelectronics, Space Communications and Mobile Communications. The main goal of the ACOST project is to develop DREL as a recognized centre in CEE in research, technology and innovation in the area of Communication Systems and Technologies.

The overall strategy of the ACOST project is to *increase the knowledge and research excellence of DREL* by strengthening the research capacity at DREL and networking with leading EU research organizations, renewal of the technical equipment for strategic research areas, and strengthening the relations with industry for better entrepreneurship, innovation and technology transfer.

This strategy has been implemented in the following work packages:

- WP1: Preparation and implementation of a long-term strategy for DREL
- WP2: Strengthening the Human Resources research capacity
 - WP2 a) Increasing the research mobility (support of research fellowships at European universities, support of visiting professors)
 - WP2 b) Training and know-how exchange (organizing training seminars, support of attending scientific conferences, networking with industry)
 - WP2 c) Stimulation of employment (start-up support of new research positions)
- WP3: Renewal of research equipment of selected laboratories
- WP4: Organizing conferences and workshops
- WP5: Dissemination of project results (support of publication activities, publishing a scientific journal, industrial forum)

The main strategic impact of the ACOST project could be presented as follows:

- **Contribution to building the RTDI capacity in an EU convergence region:** by strengthening the human resources and technology environment at DREL, by enhancing further research-industry collaboration, and by fostering increased industry investments in research and scientific training;
- **Enhanced participation of the Czech Republic in the FP7 and integration into ICT ERA:** by networking with other research and academic institutions and industry and establishing new partnerships;
- **Better career and job opportunities for young scientists:** by matching the university curricula to industrial needs and including industrial specialists in PhD training;
- **Reinforcing the competitive advantages of Czech Republic** in Communication Systems and Technologies and increasing the competitiveness of the industry in this sector in EU.

4.1.2 Project context and objectives

Project objectives

The **main goal** of the ACOST project is to develop DREL as an important centre in CEE in research, technology and innovation in the area of Communication Systems and Technologies. Indeed, the **overall goal** of the project is to foster the integration of DREL into the ICT European Research Area and to contribute to the increased competitiveness in the CEE region and in Europe as a whole.

In order to achieve the main goal, the following objectives have to be implemented:

- Preparing a long-term RTDI strategy for the future development of DREL;
- Strengthening the Human Resources Research capacity of DREL;
- Rejuvenating the DREL staff;
- Strengthening the capacity of DREL for business exploitation of academic results and cooperation with industry;
- Improving the research environment of DREL;
- Stimulation of employment;
- Building a long-term collaboration of DREL with leading research organizations and enterprises in EU and CEE.

The first objective will underpin all project activities, and will define the areas where **strategic investments should be made in human resources, networking and capacity building**. The RTDI strategy will also provide the framework for future network and research activities, for two-way mobility visits and knowledge exchange in the field of communication systems and technologies, as well as the organization of conferences and seminars for spreading excellence and disseminating project results.

The **strengthening of the human resources research capacity** will be reached by learning-by-doing experience in top European research organizations, as well as by two-way short-term **mobility visits**. The research mobility will foster collaboration in the selected research areas between the individuals involved, their institutions, and finally their countries. In addition, together with the several **targeted trainings** foreseen, the mobility will enhance the interdisciplinary skills of DREL staff, and strengthen the industry-academia collaboration and activities of DREL. The project foresees also the opening of new positions for young researchers, thus contributing to the **stimulation of employment** and growth of the Department.

DREL also needs to **improve its research and technology environment** by obtaining new laboratory equipment within the framework of ACOST. DREL should become a more transparent research and innovation institution for the industry and its future partners. Modernized equipment will motivate excellent graduates to perform their research at their domestic university. Moreover, the education of undergraduates will be improved, which can increase the interest of industrial partners to support the university.

Finally, taking into account the need for **developing a strategic partnership** with EU universities and research institutions, the objective is to extend the existing partnerships to the mutual benefit of the organizations, their researchers and students. The initial European research partners for the ACOST project are the following: IMST GmbH (Germany), Delft University of Technology (the

Netherlands); ESIEE Paris, Université Paris-Est (France); Pforzheim University, Faculty of Engineering (Germany); Universidad de Cantabria, TEISA Department (Spain).

The focus will be also placed on finding strategic industrial partners, launching new FP7 collaborative projects, and developing academia-industry long-term research collaboration.

The project-specific objectives could be presented in measurable and verifiable terms through the following overall achievements envisaged:

- An RTDI Strategy in the area of Advanced Communication Systems and Technologies at DREL should be prepared within 6 months;
- The number of PhD students will be increased up to 36, up to 6 new researchers will be employed (2 of them will be female researchers);
- Mobility visits of researchers and the exchange of personnel with EU research organizations and industry will be increased up to 3 short-term visits per semester;
- Collaboration between Academia and Industry will be increased; up to 5 new joint projects will be started each year;
- The number of training and research seminars will be increased; up to 10 seminars will be organized each year;
- Up to 6 selected laboratory systems will be upgraded;
- Access to the specialized literature will be improved: online access to up to 5 selected journals and databases will be purchased;
- A scientific conference with international participation will be held annually.

Project context

The ACOST project is addressing the objectives of the REGPOT-2008-1 call, the FP7 thematic priorities and the EU policy objectives and actions for building the European Research Potential and creating the Knowledge-based Economy.

- The ACOST objectives fully correspond to the **FP7 Capacity program – Research Potential general objective**: *Stimulating the realization of the full research potential of the enlarged Union by unlocking and developing existing or emerging research potential in the European Union's convergence regions and outermost regions, and helping to strengthen the capacities of their researchers to successfully participate in research activities at EU level.*
- The ACOST objectives are also in accordance with the **ICT Work Program 2008 general vision and objectives** for 'improving the competitiveness of the European industry and enabling Europe to master and share future developments in ICT so that the demands of its society and economy are met'.
- The project is in keeping with the FP7 objectives related to the knowledge dissemination and transfer as a 'strong feature across the specific programs, with a particular emphasis on transferring knowledge between countries, across disciplines and from academia to industry, through the mobility of researchers'. ACOST foresees a special work package devoted to the dissemination and promotion of research results achieved within the project.
- ACOST takes into account that 'human resources are to a large extent the key of research efforts, excellence and performance'² and therefore pays particular attention to researchers,

² COM (2003) 436 final, Researchers in the European Research Area: one profession, multiple careers.

their mobility and career development. In addition, the project takes into account that EU has placed special financial instruments in FP6 and FP7 to support the mobility and training of researchers, which are, however, not fully exploited by researchers from New Member States and the Associated Candidate countries.³ ACOST plans to organize special trainings for researchers on how to best utilize them (i.e., writing proposals, managing projects, disseminating the knowledge, etc.).

- Also, ACOST is addressing the recent EC communication⁴ in terms of '*boosting technology transfer between research organizations and businesses*'. It takes into account that '*entrepreneurship education should be offered to provide training on how to manage intellectual property, interact with industry, start and run a business*' by building **interdisciplinary skills** of DREL staff, for example the need to foster the development of creativity, entrepreneurial and innovation skills, while facilitating the mobility of knowledge workers.

³ Research on the move, Impact Assessment of the Marie Curie fellowship schemes, 2005.

⁴ COM (2007) 182 final. Improving knowledge transfer between research institutions and industry across Europe: embracing open innovation.

4.1.3 Main results

4.1.3.1 Results in terms of supported activities

The ACOST project supported activities towards the achievement of the direct objectives specified in section 4.1.2. The following paragraphs summarize the results and activities performed within ACOST work packages.

WP1: Preparation of a long-term strategy for DREL

The RTDI strategy of DREL was prepared, discussed and approved as the main output of Work Package 1. The strategy provides the framework for a new organization of research activities, for networking, for two-way mobility visits and knowledge exchange in the field of communication systems and technologies.

The design of a communication system is a complex engineering task, which comprises hardware, software and system points of view. The design of communication systems has to consider energetic, spectral, security, economic and ecologic limits. The DREL has set itself the ambitious task of establishing research competencies in all these areas. This choice is motivated by the quite general observation that the present-day approach to solving the problems in communication systems is often only partial, with excessive focus on specific aspects, while more complex approaches that consider several aspects of digital communication systems are rare. Having taken note of this, the researchers of DREL attempt to break with the conventional, narrow outlook on the partial problems of communication technologies and to steer in the direction of a complex, systemic understanding of problems.

To use effectively research resources readily available, laboratories of DREL have been reorganized into two newly formed research groups:

1. **Microwave technologies:** The research group tackles physical problems of electromagnetic wave propagation in (sub)millimetre frequency bands, and researches into antennas and circuitry that can be used for the processing of high-frequency signals.
2. **Wireless and communication technologies:** The research group takes over the fundamental results generated by the group of microwave technologies and augments them with research results in the fields of systemic problems of wireless communication and protocols. At the same time, the group develops algorithms and circuitry for the processing of signals at intermediate and baseband frequency levels.

The strategy designed has been implemented successfully. Recent figures show a significant improvement in publication results and in opening new projects with both public and private funding.

WP2: Strengthening the Human Resources research capacity of DREL

WP2a: Increasing the research mobility at DREL

The work package was aimed at stimulating two-way mobility exchange visits of researchers and PhD students in order to exchange best practices and knowledge with European research universities and organizations. Networking of DREL with European institutions in the main areas of DREL research activities has been enhanced within this work package. The main DREL research

areas cover signal processing and wireless communication, optical communications, antennas and microwaves. The foreign institutions include both the original five partner institutions mentioned in Section 4.1.2 and new partners found as a result of progressive integration of DREL into ERA. Secondment of PhD students was supported for a period of up to 6 months and researchers for a period of up to two months.

Number of supported fellowships of DREL members:

2009	2010	2011	2012 (till end of March)
1	4	12	14

Visited universities and institutions:

European Organization for Nuclear Research (CERN), Switzerland
 ESIEE Paris, Université Paris-Est, France
 RheinMain University of Applied Sciences, Wiesbaden, Germany
 University of Cantabria, Santander, Spain
 Vienna University of Technology, Austria
 Aalborg University, Denmark
 Technical University of Darmstadt, Germany
 University of Calabria, Italy
 VTT Technical Research Centre of Finland, Finland
 University of Niš, Serbia
 University of Würzburg, Germany
 Graz University of Technology, Austria
 Queen Mary University of London, Great Britain
 Simula Research Laboratory, Norway
 ICT Research Center, La Coruña, Spain
 Blekinge Institute of Technology, Sweden

Number of supported visiting professors and postdoc researchers:

2009	2010	2011	2012 (till end of March)
1	1	6	1

Home institutions of invited researchers:

University of Applied Sciences Wiesbaden, Germany
 Vienna University of Technology, Austria
 University of Cantabria, Santander, Spain
 Pforzheim University of Applied Sciences, Germany
 CISC Semiconductor, Austria
 Tampere University of Technology, Finland
 Medical University of Gdansk, Poland
 Aalborg University, Denmark
 Johannes Kepler University Linz, Austria

The increased level of academic mobility has had a direct impact on the number of collaborative publications and the number of international research projects with the participation of DREL.

Number of peer-reviewed collaborative journal and conference papers:

2009	2010	2011	2012 (till end of March)
7	13	12	9

Number of new international projects with participation of DREL:

2009	2010	2011	2012 (till end of March)
1	0	6	0

WP2b: Knowledge transfer and Trainings

This work package was focused on the participation of research staff in European conferences within the strategic research areas of the Department, as well as on networking with industry. Within this package, ACOST aimed at further strengthening the interdisciplinary skills of DREL staff by inviting experts from industry and academia, and organizing seminars and trainings. In addition, the project supported internships of its researchers in industry. An important objective was also to increase the DREL staff's awareness of the EU funding opportunities, with a special focus on research funding through FP7.

- a) Support of participation in European conferences for training researchers and for presenting research results of DREL. Only active participations were supported.

Number of supported participations in conferences:

2009	2010	2011	2012 (till end of March)
7	4	8	1

- b) Organizing seminars and internships in industry.

Number of seminars and internships:

2009	2010	2011	2012 (till end of March)
4	6	9 1 internship	1 2 internships

Visited companies: ŠKODA AUTO a.s., Czech Republic
ON Semiconductor Belgium BVBA (Vilvoorde facility)

- c) Organization of training seminars on FP7 projects and other funding opportunities supported by European programmes.

The seminars concerned both the conceptual and the implementation phases, as well as partner search, providing detailed information on how to write a project proposal, how to compose a

consortium, how to manage a project, how to protect intellectual property as well as where to find all relevant information.

Number of FP seminars organized:

2009	2010	2011	2012 (till end of March)
-	1	2	3

WP2c: Stimulation of employment

The work package was focused on one of the main priorities of the project, which was the rejuvenation of the Department by opening new positions for researchers and also focusing on the increase of the female presence within DREL. An employment strategy was prepared within the comprehensive RTDI strategy, providing detailed provisions on the profiles that would be most suitable for continued efficient development of the Department.

a) Postdoc researchers

The project acted as an incubator for postdoc researchers. At the beginning, 80% of their personnel cost was covered by the project. When the researchers became involved in other newly opened research projects, the support by ACOST was decreased to 50%. After the end of ACOST all the new positions were retained. Their personnel cost is now covered by various projects and by the Department budget.

The increased integration in international research activities and collaborative projects with industry generates enough resources to open eight new postdoc positions including two positions for women. In addition, the academic staff of DREL has been significantly rejuvenated.

Opening new positions at DREL for postdoc researchers:

2009	2010	2011	2012 (till end of March)
2	2	3	1

b) Brain-gain programme

ACOST was successful in attracting researchers who spent some time at high-tech international companies or at renowned foreign universities. Their presence at DREL allows sharing their experience and knowledge with other members of the academic staff.

Two positions were opened in the brain-gain programme.

WP3: Renewal of research equipment

Three research laboratories of DREL were selected for upgrade funded from the ACOST project in the frame of Work Package 3. The main aim was to make the laboratories more competitive and to increase their chances to participate in collaborative research with foreign partners.

a) Laboratory of Experimental Satellites

The laboratory has been upgraded with three high performance measurement instruments – Cable and antenna analyzer Anritsu SiteMaster S332D, Noise figure analyzer Agilent N8975A, and Signal generator Agilent E8257D.

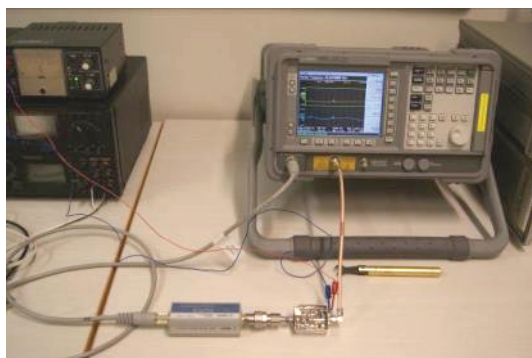
The Anritsu SiteMaster S332D cable and antenna analyzer features spectrum analysis capability and power meter capability in addition to return loss and cable loss measurements. The analyzer is used to verify the parameters of Yagi antennas for VHF, UHF and SHF bands. The Agilent N8975A noise figure analyzer gives an opportunity to get fast, accurate and repeatable noise figure measurements up to 26 GHz for developed low-noise blocks. The Agilent E8257D signal generator allows generating precise frequencies in the range from 250 kHz to 31 GHz with the great advantage of excellent phase noise performance.



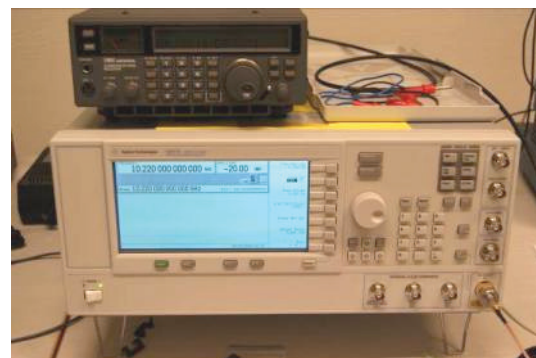
Part of antenna farm



Satellite command station



Low-noise preamplifier measurement
with Agilent N8975A



Signal generator Agilent E8257D

b) Laboratory of Mobile Communications

The laboratory has been upgraded with Wideband Radio Communication Tester Rohde&Schwarz CMW500 and Measuring system Rohde&Schwarz ROMES.

The ROMES equipment provides capabilities for extending the measurements to modern mobile networks such as UMTS and its evolution for high-speed data networks HSPA. The ROMES hardware and software are suitable for both quality of service measurement and for data throughput evaluation in various conditions. The CMW 500 radio communication tester provides capabilities for improvement in the area of physical layer simulation of the latest broadband wireless networks.



Throughput evaluation of the HSDPA transfer using the ROMES measurement system

c) Laboratory of Optical Communications

The new equipment includes the Newport M-ST-1200 stabilized optical table with I-800A damper, MicronViewer 7290A-06E camera, and a high-performance positioning device (M-IMS600PP linear drive with ESP301-1N controller and with MBT616/M multi-axis stage).

The stabilized optical table enables carrying out precise optical measurements without the influence of building vibration. The MicronViewer camera is sensitive in the near infrared spectrum with a spectral response of 400 nm to 2200 nm. Precise positioning devices together with other passive and active optical elements (e.g. Erbium Doped Fiber Amplifier) are used for research into fully photonic communication units and for the testing of transmitters and receivers for free-space optical communication.



Stabilized optical table with damper



MicronViewer IR camera

WP4: Organizing conferences and seminars

This work package was aimed at contributing to the research in the Czech Republic and within Europe. Diffusing the knowledge and research excellence was by way of organizing conferences at International level and thus exchanging high-level practice and knowledge. In addition, organizing such events helped to establish contacts with European researchers and make DREL more visible.

a) Organization of the Radioelektronika conference

DREL is the main organizer of the Radioelektronika international conference to strengthen relations with both universities and companies from neighbouring countries. It is a forum for presenting and sharing ideas covering all aspects of the modern radio technique and its applications in communications, industry, research, medicine, etc. The conference proceedings are published in IEEE Xplore, which is recognized as the top database of scientific publications in the area of electronics and communications. The support by ACOST helped to bring the conference to the European level. The conference Call for Papers was advertised in scientific media.

Scope of the conference: Electronic Circuits and Systems, Signal Processing and Applications, Microwaves and Antennas, Light Waves.

ACOST supported the conferences in the years 2010, 2011, and 2012.

Year	2010	2011	2012
Submitted papers	119	121	76
Accepted papers	91	91	59
Rejection rate	24%	25%	22%
Countries	12	11	13



Radioelektronika 2011



Radioelektronika 2012

The conference website is

<http://www.radio.feec.vutbr.cz/radioelektronika>

b) Organization of IEEE scientific workshop

DREL organises together with the Czechoslovakia Section of IEEE an annual scientific workshop. The workshop is an informal platform for meeting young researchers from Czech universities.

ACOST supported the workshop in the years 2009, 2010, and 2011.

c) Participation in organizing an international conference

In 2011 DREL participated together with Czech Technical University in Prague and the University of Nevada, Reno, USA in organizing the *13th International Symposium on Microwave and Optical Technology* (ISMOT 2011) in Prague.



ISMOT 2011

The main objective of ISMOT is to offer an international forum for the exchange of new ideas, thoughts, and implementations of technologies, and applications of microwave, optoelectronics, and related fields in industry, communications, science, research, medicine, etc. The research fields covered by ISMOT are in the areas of microwave components and circuits, optical components, microwave and optical communication systems, electromagnetic theory, antennas, microwave photonics and all the other topics of interest to microwave and optical communities.

In total, 167 papers were submitted, 125 accepted, and 42 papers were rejected. The rejection rate of ISMOT reached 25%. Selected papers will be published in the *International Journal of Microwave and Optical Technology* (IJMOT) as full-length papers.

WP5: Dissemination of results

The dissemination activities covered the whole period of the project and were aimed at increasing the transparency and visibility of DREL. A special focus was put on strengthening relations with industry. A general dissemination strategy was drawn up as a part of the comprehensive RTDI strategy.

The dissemination included the following concrete activities:

a) Organization of industrial forum

Thanks to the extensive contacts with industry, DREL was able to open, on average, 10 new collaborative projects each year. Several meetings were organized with representatives of some partner companies. Usually such a meeting was a part of a bigger event, typically a conference.

Meetings organized (all in Brno):

September 16th, 2010, on the occasion of the NIMT 2010 conference

April 19th, 2011, on the occasion of the Radioelektronika 2011 conference

April 17th, 2012, on the occasion of the Radioelektronika 2012 conference

The forum includes the following companies:

RACOM s.r.o., ON Semiconductor Czech Republic, Freescale Semiconductor Czech Republic, T-Mobile Czech Republic a.s., C-com Ltd., ŠKODA AUTO a.s., METRA BLANSKO, a.s., PBS Velká Bíteš a.s., ERA a.s., RAMET C.H.M. a.s., Continental Automotive Systems Czech Republic, OMICRON s.r.o., TESLA Holding a.s., CISC Semiconductor GmbH, Miracle Group, spol. s r.o.

b) Contacts with secondary schools

DREL organizes popularization lectures for students and visits schools to provide information about the study at the Faculty of Electrical Engineering and Communication. Strengthening the contacts with technical schools helps DREL to increase the number of freshmen, as the university is now experiencing the impact of the “population gap” from the early 1990s. DREL is highly interested in such contacts in order to improve the quality of pool of people for recruiting potential new researchers.



Visit to Dobruska



Open house for secondary schools

Three events were organized within this task:

- 12/03/2010 - Visit to the secondary school in Dobruska (presentation of activities of DREL),
- 14/09/2010 – Open house for secondary schools at laboratories of DREL (150 participants),
- 27/06/2011 – Open house for secondary schools at laboratories of DREL (90 participants).

c) Support of publication activities

DREL is a co-editor of the *Radioengineering*⁵ scientific journal - proceedings of Czech and Slovak Technical Universities - and houses the journal editor's office. *Radioengineering* is intended for publishing papers describing original research and development in the field of radio engineering.

The most significant result of the continuous development of the journal is its inclusion in the Thomson-Reuters *Journal Citation Report* with growing impact factor.

Year	Impact factor
2010	0.312 (JCR 2009)
2011	0.503 (JCR 2010)

The work package also included support of publication activities of members of DREL. In legitimate cases ACOST covered the publication fee. The support was strictly limited to journals with an impact factor. An English linguist has been hired in a competition to correct English grammar of papers submitted to journals and conferences.

d) Support of communication materials

In the September 2010 issue of the *Research Review* magazine an advertisement for ACOST activities was published. The magazine is distributed in 3400 copies. Additional 2500 copies were handed out at the ICT 2010 conference in Brussels

http://ec.europa.eu/information_society/events/ict/2010/

The magazine was selected from three competitive tenders on the basis of the best price. Its address is

<http://www.theparliament.com/magazines/research-review/>

⁵ www.radioeng.cz

4.1.3.2 Results in terms of ACOST strategy

The overall strategy of the ACOST project was to *increase the knowledge and research excellence of DREL* by strengthening the research capacity at DREL and networking with EU research organizations, renewal of the technical equipment for the strategic research areas, and strengthening the relations with industry for better entrepreneurship, innovation and technology transfer.

The achievement of the strategic goal of the project can be demonstrated on the following levels:

- Increasing research excellence.
- Networking with EU research universities and institutions.
- Strengthening the innovation and technology transfer.
- New positions for young researchers and sustainable development of DREL.

a) Increasing research excellence

The quality of research activities is usually evaluated by the number of papers in prestigious journals, by the number of citations and responses, and by the number of patents and prototypes. The following table shows a positive trend in publication activities, where the number of papers in high-impact journals (indexed in JCR) and the number of citations have grown during the ACOST project (years 2009 through 2012).

Papers published by members of DREL and citations.

Year	Journals - IF ¹⁾	Journals - other	Conferences ²⁾	Books	Citations ³⁾
2007	4	40	179	-	78
2008	1	50	238	2	95
2009	7	63	217	3	148
2010	37	43	181	1	160
2011	30	19	166	1	286
2012 (May 1st)	11	7	25	-	58

¹⁾ Journals indexed in the Thomson-Reuters *Journal Citation Report* at the time of publishing.

²⁾ The figures include all peer-reviewed conference papers (national and international).

³⁾ All the citations found, i.e. Web-of-Science, Scopus, and individually found citations in journals and conference proceedings.

b) Networking with EU research universities and institutions

The academic mobility exchange visits performed within Work Package 2a have had a positive impact on integrating DREL into European research activities. This can be demonstrated by the number of collaborative publications and the number of international projects with the participation of DREL.

Number of peer-reviewed collaborative journal and conference papers.

Year	Papers
2007	1
2008	7
2009	7
2010	13
2011	12
2012 (May 1st)	9

The intensified contacts with European research institutions have proved to be the key condition for increased participation of DREL laboratories in international research activities. The most convincing results are the newly opened international projects with the participation of DREL:

Project title: **Research and modelling of advanced methods of image quality evaluation**
Project ID: AKTION 54p18 (Czech-Austrian science collaboration)
State: Finished (01/07/2009 – 30/06/2010)

Project title: **Agile RF Transceivers and Front-Ends for Future Smart Multi-Standard Communications Applications (ARTEMOS)**
Project ID: **270683-2** (JTI-CP-ENIAC, consortium of 43 universities and companies)
State: Active since 2011

Project title: **WiNeMO: Wireless Networking for Moving Objects**
Project ID: COST Action IC0906
State: Active since 2011

Project title: **European Network on Quality of Experience in Multimedia Systems and Services (QUALINET)**
Project ID: COST Action IC1003
State: Active since 2011

Project title: **Versatile, Integrated, and Signal-aware Technologies for Antennas (VISTA)**
Project ID: COST Action IC1102
State: Active since 2011

Project title: **Optical Wireless Communications – an Emerging Technology**
Project ID: COST Action IC1101
State: Active since 2011

Project title: **Cooperative Radio Communications for Green Smart Environments**
Project ID: COST Action IC1004
State: Active since 2011

c) Strengthening innovation and technology transfer

Research projects for industry are one of the key activities of DREL, comprising collaborative projects and direct research contracts. Thanks to the extensive contacts of DREL with industry, the projects represent a significant income for the Department and play an important role in attaining sustainable conditions for future development. In addition, the projects represent the best opportunity for PhD students to develop their contacts with companies in order to find a job shortly after graduating. The objective was to open up to 5 new projects each year.

Newly opened projects with industry

Year	Projects
2009	7
2010	13
2011	10
2012 (May 1 st)	7

d) New positions for young researchers and sustainable development of DREL

One of the main priorities of the project was rejuvenating the Department by opening new positions for researchers and focusing also on increased female presence within DREL.

The project acted as an incubator for postdoc researchers. At the beginning, 80% of their personnel cost was covered by the project. When the researchers became involved in other newly opened research projects, the support by ACOST was decreased to 50%. After the end of ACOST all the new positions were retained. Their personnel cost is now covered by various projects and by the Department budget.

The increased integration into international research activities and collaborative projects with industry generates enough resources to open eight new postdoc positions, including two positions for women. In addition, the academic staff of DREL has been significantly rejuvenated.

Opening new positions at DREL for postdoc researchers:

2009	2010	2011	2012 (till end of March)
2	2	3	1

ACOST was successful in attracting researchers who spent some time at high-tech international companies or at renowned foreign universities. Their presence at DREL allows sharing their experience and knowledge with other members of academic staff. Two positions were opened in the brain-gain programme.

4.1.3.3 Results of research teams

In accordance with implemented RTDI strategy, research at DREL has been reorganized into two research groups:

1. **Microwave technologies:** The research group tackles physical problems of electromagnetic wave propagation in (sub)millimetre frequency bands, and researches into antennas and circuitry that can be used for the processing of high-frequency signals.
2. **Wireless and communication technologies:** The research group takes over the fundamental results generated by the group of microwave technologies and augments them with research results in the fields of systemic problems of wireless communication and protocols. At the same time, the group develops algorithms and circuitry for the processing of signals at intermediate and baseband frequency levels.

The following paragraphs provide a brief overview of the activities of both groups in the years 2009 through 2012, followed by a list of relevant publications.

Microwave technologies

- **Research into novel methods of analysis, modelling and optimization of microwave structures;**
 - Wideband measurement system working as microwave sixport.
 - Composite single/double negative materials, design of planar resonant structures exploiting lumped capacitance and distributed capacitance, applications of tuned periodical structures.
 - Development of novel methods for solving time-domain integral equations, modifications of time-domain finite elements for an efficient analysis of wideband and multiband electromagnetic structures in a wide band of frequencies.
 - Modified methods for multi-objective optimization based on genetic algorithms and intelligence of swarms.
 - Analytic relations for pulse electromagnetic fields radiated by narrow slots on a dielectric substrate.
- **Research, design and optimization of antennas;**
 - New method for solving numerical procedures for the calculation of electromagnetic field distributions in the vicinity of antennas with greater efficiency and with greater accuracy of results.
 - Numerical models of microwave antennas and transmission lines with the distributed amplification based on $A^3 B^5$ semiconductors.
 - Synthesis of multiband structures with electromagnetic band gaps.
 - Design of a multiband antenna based on the Sierpinski monopole principle.
 - Research into microstrip patch antennas based on the substrate integrated waveguide technology.
- **Research into advanced communication devices for experimental satellite links;**
 - Dish antenna with circular polarization and integrated low-noise amplifier for use in experimental communication using radio wave reflection from the Moon surface.
 - Design of FM transmitter and transponder for the CUBESAT experimental satellite.



Omnidirectional conical Sierpinski-type antenna



Parabolic dish feed with circular polarization and integrated low-noise amplifier.

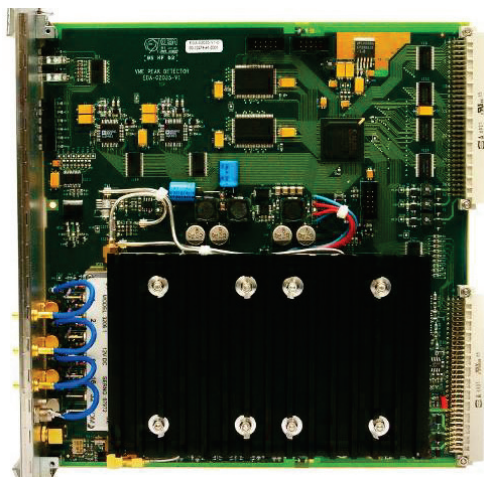
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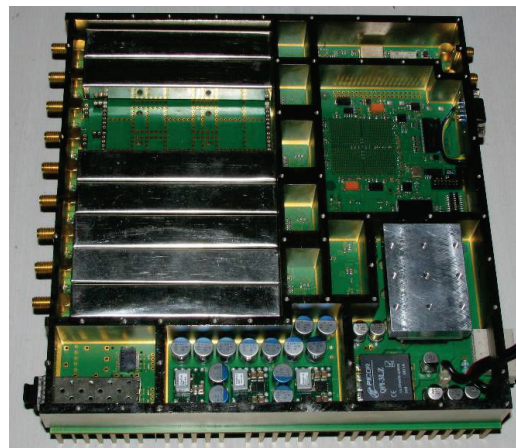
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Wireless and communication technologies

- **MIMO systems and physical layer signal processing;**
 - Methods for reducing the peak-to-average power ratio (PAPR).
 - Cognitive radio. Detection of wireless communication signals exploiting the cyclostationary properties of received signals. Spectrum sensing detectors for the application of dynamic spectrum allocation.
 - Flexible hybrid frequency synthesis architecture with switched integer-N and fractional-N mode for the frequency band 800 MHz to 6 GHz.
 - Energy efficient concepts for low-power wireless devices that are based on radio frequency identification (RFID).
- **Mobile networks and multimedia;**
 - Wireless system at very low bit rates for video transmission.
 - Video compression methods based on the multi-dimensional discrete cosine transform.
 - Subjective and objective test procedures for video quality evaluation in 3D HDTV. Qualitative aspects of scalable video codecs.
 - Development of LTE uplink link level simulator (in cooperation with TU Vienna). The simulator consists of a complete processing chain defined by 3GPP LTE Rel. 8 standard.
- **Free-space optical systems**
 - Optical beams for FSO application.
 - Evaluation of FSO performance and system properties in turbulent atmospheric transmission media.
 - The effect of atmospheric aerosols on the qualitative link parameters.
- **Analogue and digital circuits for communication systems**
 - New topologies of active filters and oscillators.
 - New active blocks and their integrated implementation.
 - Current-mode signal processing. Nonlinear applications.
 - Blind-oversampling CDR methods.
 - FPGA for fast signal processing.



Detector with phase shifter for CERN LHC



Nine-channel software-defined radar receiver.

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4.1.4 The potential impact of the project and the main dissemination activities

Advanced communication technologies are seen by the EU as one of the core elements of competitiveness and knowledge-based economy. With the revised i2010 initiative⁶, the EU is facing the challenges of contemporary communications development, and making the most of taking the opportunities for its business, citizens and society as a whole. With full awareness of the current needs in the area of communications, ACOST addresses the main EU challenges and contributes to further developing content and communication services.

In relation to the Capacity programme, the outcome of ACOST could be presented as follows:

- **Contribution to building the RTDI capacity in an EU convergence region:** by strengthening the human resources and technology environment at DREL, by enhancing further research-industry collaboration, and fostering increased investments by the industry into research and scientific training;
- **Enhanced participation of Czech Republic in the FP7 and integration into ICT ERA:** by networking with other research centres and industry and establishing new partnerships;
- **Increased networking with European research and industry entities:** by enhancing human resources mobility, exchanging information and knowledge, better visibility of research and innovation results at DREL;
- **Better career and job opportunities for young scientists:** by matching the university curricula to industrial needs and including industrial specialists in PhD training;
- **Reinforcing the competitive advantages of the Czech Republic** in Advanced Communication Systems and Technologies and increasing the competitiveness of the industry in this sector in EU.

The expected impact would not be achieved without relying on external funding and without a European dimension underlying the project activities, such as: building human resources research capacity, improving the scientific and technology environment of DREL, developing a Departmental research strategy, enhancing networking and establishing partnership with EU research and academic organizations, developing contacts with industry.

4.1.4.1 Impact at level of Department and University

The designed RTDI strategy has created a framework for better organizing and carrying out research at DREL and has contributed to a more effective usage of financial and human resources and better responding to industrial and societal needs. Thus, ACOST facilitated linking DREL research activities with defined national and European priorities, and building stable and multiple bridges between research, development, education and training. It assisted in strengthening the capacity of DREL for business exploitation of academic results and cooperation with industry, which resulted in opening more channels for the funding of DREL.

Further, ACOST has strengthened the human resources of DREL through research visits, research and training seminars, new job offers, etc. ACOST has contributed to strengthening the network of RTD partners of DREL.

⁶ COM(2005)229 final.

ACOST strongly supported the DREL's ambition to become an important research centre in the field of communication systems, which would indirectly contribute to strengthening the steering core of Brno University of Technology, expanding its partnerships, especially those with industries, diversifying its funding base and, finally, developing a higher entrepreneurial culture of its research and management staff.

4.1.4.2 Impact at regional level

The region of South Moravia has the reputation for being the home of electronics industry presented by research centers of Honeywell, Tyco, ON Semiconductor, Flextronics, etc., aircraft industry (avionics components produced by Evektor, Moravan, Let, Ramet, PBS, Mesit, etc.), high-tech industry (electron microscopes by FEI, etc.), communication industry (Siemens, Motorola, Telefonica, T-Mobile, etc.), and the like.

A high percentage of researchers employed by those companies are former students of the department. Due to the intensive connection with its graduates, the Department can contribute to the common research of the community in the region. Thus, ACOST contributes to strengthening the academia–industry links in the area of communications, and further enhancing the intersectorial mobility of researchers.

Inventions and innovations created by this community directly influence the prosperity and living standards of citizens in the region. Therefore, a better quality and a higher quantity of inventions and innovations contribute to the economic and social cohesion of the whole region. An indirect effect for the research system could also come out from linking the industry with the university by increasing the industrial contribution in research.

4.1.4.3 Impact at European level

Of added value to ACOST would be focusing on the research integration of a prominent and dynamic department of the second most prestigious Technical University in Czech Republic of solid traditions in the field of communications systems with leading European research institutions in the similar field.

A substantial impact of ACOST is also the promotion of mobility of young researchers in Europe, and the contribution to the practical implementation of EU mobility strategy⁷ focusing on the intersectorial mobility of researchers. Taking into account the FP7 action lines the project gives the researchers the main directions of European research and EU funding programmes. Thus, ACOST contributes to building a **genuine European market for researchers**. Further, it would also have a **structuring effect**, by emphasizing the research and training needs in the Czech Republic and encouraging further knowledge transfer to the whole CEE region.

⁷ A mobility strategy for the European Research Area, COM(2001),331.

4.1.4.4 Main dissemination activities

The dissemination strategy of the ACOST project was outlined as part of the Comprehensive RTDI strategy for DREL. The basic idea consists in using communication means appropriate for the basic orientation of DREL, i.e. for a research institution engaged in both basic and applied research. Therefore, the dissemination channels used can be divided into the following three categories:

1. **Basic research:** support of publishing scientific papers
 - Publication of a scientific journal.
 - Organizing international scientific conferences.
 - Support of publishing in international journals and support of attending international conferences.
2. **Applied research:** increasing the DREL visibility for prospective industrial partners
 - Web pages presenting research laboratories and successful past projects.
 - Industrial forum for developing contacts with industry on personal basis.
3. **Recruitment of researchers:** increasing young people's awareness of DREL
 - Contacts with secondary schools.
 - Support of conferences for young scientists.
 - Advertisements in media.

1. Dissemination activities in basic research

The activities of the ACOST project were aimed at increasing the “visibility” of DREL to the scientific community through various forms of support of publication activities.

Publication of a scientific journal

DREL is a co-editor of the *Radioengineering*⁸ scientific journal - proceedings of Czech and Slovak Technical Universities - and houses the journal editor's office. *Radioengineering* is intended for publishing papers, describing original research and development in the field of radio engineering.



Web pages of Radioengineering

⁸ www.radioeng.cz

The journal was included in the Thomson-Reuters *Journal Citation Report* in 2009. The benefit to DREL consists in the automatic linkage of a solid scientific journal with the department's name in the scientific community. The increasing impact factor shows the ability of the journal to attract good-class papers.

Organizing international scientific conferences

DREL is the main organizer of the annual **Radioelektronika** international conference to strengthen relations of both universities and companies from European countries. It is a forum for presenting and sharing ideas covering all aspects of the modern radio technique and its applications in communications, industry, research, medicine, etc. The conference Call for Papers is advertised in the IEEE database.

The conference proceedings are published in IEEE Xplore, which is recognized as the top database of scientific publications in the area of electronics and communications, and is also indexed in the Conference Proceedings Citation Index of Thomson-Reuters.

Implementing its dissemination strategy, DREL participated in organizing the 13th *International Symposium on Microwave and Optical Technology* - ISMOT-2011, which is organized biennially by the University of Nevada, Reno, USA and a selected university from the host country. The research fields covered by ISMOT are in the area of microwave components and circuits, optical components, microwave and optical communication systems, electromagnetic theory, antennas, microwave photonics and all the other topics of interest to microwave and optical communities. A very important role is played today by various applications of electromagnetic field, microwave and optical technologies in communications, industry and medicine.

Both conferences were able to attract authors of papers from many countries. Similarly to journal *Radioengineering* the conferences help to increase the "visibility" of DREL, i.e. they allow to present activities of the Department and to find research partners on personal basis.

Support of publications activities

Support of publication activities included:

- Covering publication fees in scientific journals. The support was strictly limited to journals with the impact factor.
- Hiring a linguist to correct English grammar of papers submitted to journals and conferences. Good English is a necessary condition for any paper acceptance.
- Support of attending European conferences.

In April 2012, a special issue of *Radioengineering* devoted to the ACOST project was published. It contains 10 selected papers covering all areas of research activities at DREL, which were supported by the ACOST project.

Radioengineering

Proceedings of Czech and Slovak Technical Universities
and URSI Committees

April 2012, Volume 21, Number 1

ISSN 1210-2512

Part III:

Special Issue on
Advanced Communication Systems and Technologies

Papers:

Guest Editorial, <i>Z. Kolka</i>	373
Reliable and Efficient Procedure for Steady-State Analysis of Nonautonomous and Autonomous Systems, <i>J. Dobes, V. Biolkova</i>	374

Special issue of Radioengineering on ACOST

2. Dissemination activities in applied research

Industry-funded research projects represent a key factor of sustainable development of DREL. The need for increasing industry-funded research has intensified in connection with recent significant cuts in public expenditures. DREL searches actively for new contacts with the help of two tools: public presentations of its competences and organizing industrial forums.

Web pages of DREL and ACOST

Web has become a primary source for obtaining information in modern society. DREL maintains specialized web pages devoted to presenting its activities and competence. After being indexed by search engines (e.g. Google) the information gets publicly available to any potentially interested person.

DREL pages include presentations of research laboratories highlighting its competence and equipment. Presentations of earlier successful projects are the best advertisement of skill and competence of research teams.

Industrial forum

DREL organizes an industrial forum to obtain feedback related to the quality of education and the quality of research provided by the Department. At the forum, potential projects, which companies and universities take part in, are discussed.

Several times a year a meeting is organized with representatives of some partner companies. Since 2009 the industrial forum has been organized as a part of the Radioelektronika conference, where

representatives of companies have an opportunity to see the presentations of research results and to discuss possible new projects with representatives of research teams.

The forum includes the following companies:

RACOM s.r.o., ON Semiconductor Czech Republic, Freescale Semiconductor Czech Republic, T-Mobile Czech Republic a.s., C-com Ltd., ŠKODA AUTO a.s., METRA BLANSKO, a.s., PBS Velká Bíteš a.s., ERA a.s., RAMET C.H.M. a.s., Continental Automotive Systems Czech Republic, OMICRON s.r.o., TESLA Holding a.s., CISC Semiconductor GmbH, Miracle Group, spol. s r.o.

Thanks to the extensive contacts with industry, DREL is able to open approximately 10 new collaborative projects each year. During the period of ACOST, a total of 37 new projects of applied research with industrial participation were started.

3. Dissemination activities in recruitment of researchers

All the new research positions opened at DREL were announced publicly (in accordance with the Czech law), but it is a fact that the majority of accepted applicants graduated from Brno University of Technology. Additionally, universities experience today the impact of a “population gap” from the early 1990s. That is why DREL is highly interested in increasing and improving the quality of the pool of people to choose from.

Contacts with secondary schools

The Czech Republic has a long and successful tradition of secondary technical education. DREL organizes Open houses, popularization lectures for students, and visits to schools to provide information about the study.

Support of conference for young scientists

DREL organizes together with the Czechoslovakia Section of IEEE an annual scientific workshop during summer months. The workshop is an informal platform for meeting young researchers from Czech universities.

Advertisements in media

In the September 2010 issue of the *Research Review* magazine an advertisement for ACOST activities was published. The magazine is distributed in 3400 copies. Additional 2500 copies were handed out at the ICT 2010 conference in Brussels. The magazine was selected from three competitive tenders on the basis of the best price. Its address is

<http://www.theparliament.com/magazines/research-review/>

DREL has implemented a number of instruments to attract both young and experienced researchers.

4.1.5 Contact information



Project title: Advanced Communication Systems and Technologies

Beneficiary: Brno University of Technology
Antonínska 548/1
601 90 Brno
Czech Republic

Scientific representative: Prof. Zdenek Kolka
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Tel: +420 541 149 148

Fax: +420 541 149 244

E-mail: kolka@feec.vutbr.cz

Project website address: <http://www.radio.feec.vutbr.cz/acost/>
<http://www.urel.feec.vutbr.cz> (website of DREL)

4.2 Use and dissemination of foreground

4.2.1 Section A (public) – dissemination activities

The knowledge generated within the project is of two types:

- **Open knowledge** that could be accessible to any interested party and would be of benefit to that party. The knowledge will be disseminated free.
- **Specific knowledge** developed by DREL with dedicated exploitation in mind. It will be managed by DREL with a view to preserving and exploiting it, including further research within European projects and possible commercial joint ventures.

Indeed, ACOST is committed to informing the research and business communities about the newly obtained knowledge within the project and to disseminating the best practices explored under the project. The target audience is defined as broadly as possible by researchers and other academics, research, government and business organisations, especially SMEs, in the Czech Republic, CEE and the EU as a whole. The general public is also addressed as it will be the final consumer of research outcomes applied in new services and products.

The basic idea behind the dissemination strategy consists in using communication means appropriate to the basic orientation of DREL, i.e. a research institution engaged in both basic and applied research, which continuously searches for talented researchers. Therefore, the dissemination channels used can be divided into the following three categories:

1. Dissemination activities towards scientific community

- Support of publishing papers in international journals and proceedings of renowned conferences.
- Publishing the *Radioengineering* scientific journal.
- Organizing international scientific conferences.

2. Dissemination activities towards prospective industrial partners and customers

- Training activities for industry
- Organizing seminars with experts from industry and academia.
- Web pages presenting DREL expertise, research laboratories, and successful finished projects.
- Industrial forum for developing contacts with industry on personal basis.

3. Dissemination activities to support recruitment of talented researchers

- Contacts with secondary schools.
- Support of conferences for young scientists.
- Advertisements on the Web.

4.2.1.1 Dissemination activities towards scientific community

A solid publication and citation record is a key factor for possible participation in international research projects. Therefore DREL pays great attention to supporting and improving publication activities.

Support of publishing

DREL will continue to support the publishing of research papers in international scientific journals and proceedings of renowned international conferences. This represents the most appropriate tool for disseminating research results.

DREL has hired a linguist to correct English grammar in papers submitted to journals and conferences as good English is a necessary condition for the acceptance of any paper. In legitimate cases, the Department will cover the publication fees in journals or registration fees at conferences.

Scientific journal Radioengineering

DREL is a co-editor and co-publisher of the *Radioengineering* scientific journal⁹ and houses the journal editor's office. *Radioengineering* is intended for publishing papers describing original research and development in the field of radio engineering. The most significant result of the continuous development of the journal is its inclusion in the Thomson-Reuters *Journal Citation Report* in 2009 with growing impact factor (0.312 in JCR 2009 and 0.503 in JCR 2010).

DREL will continue in the personnel support of the journal, where several members of academic staff serve as editors. The benefit resulting for DREL from publishing *Radioengineering* consists in the automatic linkage of a solid scientific journal with the Department's name in the scientific community. The increasing impact factor shows the potential of the journal to attract good-class papers.

Organizing international scientific conferences

DREL is the main organizer of the annual international conference **Radioelektronika** intended to strengthen relations between universities and companies from European countries. It is a forum for presenting and sharing ideas covering all aspects of the modern radio technique and its applications in communications, industry, research, medicine, etc. The conference Call for Papers is advertised in the IEEE database. The conference proceedings are published in IEEE Xplore, which is recognized as the top database of scientific publication in the area of electronics and communications, and are also indexed in the Conference Proceedings Citation Index of Thomson-Reuters.

Similar to the *Radioengineering* journal, the conference helps to increase the visibility of DREL, i.e. it allows us to present the activities of the Department and to find research partners on personal basis.

4.2.1.2 Dissemination activities towards prospective industrial partners and customers

Research projects for industry represent a key factor of sustainable development of DREL. The need for increasing industry-funded research has intensified in connection with recent significant cuts in public expenditures, including cuts in the educational system. DREL searches actively for new opportunities of industry-funded research with the help of several already established tools.

⁹ www.radioeng.cz

Training activities

DREL provides targeted trainings for researchers and engineers from both SMEs and large companies in the area of communication systems. The offered expertise is available on the Department's web pages. The training topics include the latest advances in theory, practical aspects of communication system design, as well as targeted trainings in the use of various software products.

Organizing seminars

Seminars with experts from industry and academia have been established as another regular activity at DREL. Experts are invited to present a specific topic from research activities of their company or university. Admission to the seminars is open to anyone. Such seminars represent, in fact, a two-way interchange of information, i.e. an informal platform for strengthening the relation between academic and industrial partners.

Web pages

DREL takes into account that the Web has become a primary source of obtaining information in modern society. DREL maintains specialized web pages devoted to presenting its activities and competence. After being indexed by search engines (e.g. Google) the information gets publicly available for any potentially interested person. An added value would be to increase the visibility of DREL research activities to the industry and thus support the knowledge transfer between industry and academia on both national and international levels. DREL is thus also contributing to knowledge sharing and scientific collaboration within ERA.

DREL pages include presentations of research laboratories highlighting their competence and equipment. Presentations of successful finished projects are the best advertisement of the skills and competence of research teams.

Industrial forum

DREL organizes an industrial forum to obtain feedback related to the quality of research and education as provided by the Department. At the forum, potential projects that companies and universities take part in are discussed.

Several times a year, a meeting is organized with representatives of some partner companies. Since 2009 the industrial forum has been organized as a part of the Radioelektronika conference, where representatives of companies also have an opportunity to see the presentations of research results and to discuss possible new projects with representatives of research teams.

4.2.1.3 Dissemination activities to support recruitment of talented researchers

Being a research institution, the future development of DREL depends on the excellence of its researchers. Therefore DREL seeks continuously for young talented people. Within ACOST, several activities have been implemented in this direction. These activities will continue in future.

Contacts with secondary schools

At present, universities are confronted with the population gap from the early 1990s. That is why DREL is highly interested in increasing and improving the quality of the pool of people to select from. DREL organizes popularization lectures for students and visits to secondary schools to provide

information about study. In addition, talented students have the opportunity to work on specialized research projects led by a member of the academic staff of the university.

Support of conferences for young scientists

DREL organizes together with the Czechoslovakia Section of IEEE an annual scientific workshop during summer months. The workshop is an informal platform for meeting young researchers from Czech universities.

4.2.1.4 Socio-economic context

South Moravia has the reputation of being the home of electronics industry, aircraft industry, high-tech industry, communication industry, etc. A high percentage of researchers employed by those companies are former members and students of the Department. Due to the intensive connection with its graduates, the Department can contribute to the common research of the community in the region. Thus, the activities started by ACOST will contribute to strengthening the academia–industry linkages in the area of communications and enhancing the intersectorial mobility of researchers.

Inventions and innovations created by this community directly influence the prosperity and living standards of citizens in the region. Therefore, a better quality and a higher quantity of inventions and innovations contribute to the economic and social cohesion of the whole region. An indirect effect for the research system could also come from linking the industry with the university by increasing the industry's share in research.

TEMPLATE A1: LIST OF SCIENTIFIC (PEER REVIEWED) PUBLICATIONS, STARTING WITH THE MOST IMPORTANT ONES

No.	Title	Main author	Title of the periodical or the series	Number, date or frequency	Publisher	Place of publication	Year of publication	Relevant pages	Permanent ID ¹⁰	Is/Will open access ¹¹ provided to this publication?
1	Error Analysis at Numerical Inversion of Multidimensional Laplace Transforms based on Complex Fourier Series Approximation	BRANČÍK, L.	IEICE Transactions on Fundamentals of Electronics Communications And Computer Sciences	Vol. E94A(2011), No. 3, 2011	J-STAGE	Japan		999 - 1001		No
2	Modified Polar Sigma-Delta Transmitter for Multi-Radio Applications	SUAREZ PENALOA, M.L.	EURASIP Journal on Wireless Communications and Networking	Vol. 2010, September 2010	Hindawi Publishing Corporation			1 - 9		Yes
3	An Introduction to Free-space Optical Communications	HENNIGER, H.	Radioengineering	Vol. 19, No. 2, June 2010	Společnost pro radioelektronické inženýrství	Czech Republic	01/06/2010	203 - 211		Yes
4	Utilization of NILTs in Simulation of Nonlinear Systems Described by Volterra Series	BRANČÍK, L.	Przegląd Elektrotechniczny (Electrical Review)	Vol. 86, No. 1, January 2010	Wydawnictwo SIGMA-NOT	Poland	11/01/2010	68 - 70		No
5	Calculation and Comparison of Turbulence Attenuation by Different Methods	DORDOVÁ, L.	Radioengineering	Vol. 19, No. 1, April 2010	Společnost pro radioelektronické inženýrství	Czech Republic	01/04/2010	162 - 167		Yes

¹⁰ A permanent identifier should be a persistent link to the published version full text if open access or abstract if article is pay per view) or to the final manuscript accepted for publication (link to article in repository).

¹¹ Open Access is defined as free of charge access for anyone via Internet. Please answer "yes" if the open access to the publication is already established and also if the embargo period for open access is not yet over but you intend to establish open access afterwards.

					inženýrství					
6	The PAPR and Simple PAPR Reduction of the 2D Spreading Based Communication Systems	BLUMENSTEIN, J.	Radioengineering	Vol. 19, No. 1, April 2010	Společnost pro radioelektronické inženýrství	Czech Republic	01/04/2010	27 - 31		Yes
7	Multicriteria Optimization of Antennas in Time-Domain	LÁČÍK, J.	Radioengineering	Vol. 19, No. 1, April 2010	Společnost pro radioelektronické inženýrství	Czech Republic	01/04/2010	105 - 110		Yes
8	Blind Oversampling Data Recovery with Low Hardware Complexity	KUBÍČEK, M.	Radioengineering	Vol. 19, No. 1, April 2010	Společnost pro radioelektronické inženýrství	Czech Republic	01/04/2010	74 - 78		Yes
9	Modeling of the Phase Noise in Space Communication Systems	BARAN, O.	Radioengineering	Vol. 19, No. 1, April 2010	Společnost pro radioelektronické inženýrství	Czech Republic	01/04/2010	141 - 148		Yes
10	All-pass filters employing differential OpAmps	BIOLEK, D.	Electronics World	Vol. 116, No. 1891, July 2010			10/07/2010	44 - 45		No
11	A Complete Video Coding Chain Based on Multi-Dimensional Discrete Cosine Transform	FRÝZA, T.	Radioengineering	Vol. 19, No. 3, September 2010	Společnost pro radioelektronické inženýrství	Czech Republic	01/09/2010	421 - 428		Yes
12	A Novel Bandpass Filter Using a Combination of Open-Loop Defected Ground Structure and Half-Wavelength Microstrip Resonators	VÁGNER, P.	Radioengineering	Vol. 19, No. 3, September 2010	Společnost pro radioelektronické inženýrství	Czech Republic	01/09/2010	392 - 396		Yes
13	Hierarchical classification tree modeling of nonstationary noise for robust speech recognition	ZELINKA, P.	Information Technology and Control	Vol. 39, No. 3, 2010	Kaunas University of Technology	Latvia	01/10/2010	202 - 210		Yes
14	Pulsed electromagnetic field	ŠTUMPF,	Radio Science	Vol. 39, RS5005,	AGU			1 - 9		No

	radiation from a narrow slot antenna with a dielectric layer	M.		October 2010						
15	Grounded capacitor current mode single resistance-controlled oscillator using single modified current differencing transconductance amplifier	BIOLEK, D.	IET Circuits, Devices and Systems	Vol. 4, No. 6, November 2010	IET			496 - 502		No
16	Improvement of RF Vector Modulator Performance by Feed-forward Based Calibration	TOŠOVSKÝ, P.	Radioengineering	Vol. 19, No. 4, December 2010	Společnost pro radioelektronické inženýrství	Czech Republic	01/12/2010	627 - 632		Yes
17	Performance of Pilot Aided Channel Estimation Technique in 2D Spreading Based Systems	BLUMENSTEIN, J.	Radioengineering	Vol. 19, No. 4, December 2010	Společnost pro radioelektronické inženýrství	Czech Republic	01/12/2010	507 - 510		Yes
18	Modeling of the Simultaneous Influence of the Thermal Noise and the Phase Noise in Space Communication Systems.	BARAN, O.	Radioengineering	Vol. 19, No. 4, December 2010	Společnost pro radioelektronické inženýrství	Czech Republic	01/12/2010	618 - 626		Yes
19	On the derivation of Piecewise-Linear Chaotic Oscillators using Simulated Annealing Method and Hspice	SLEZÁK, J.	Przegląd Elektrotechniczny (Electrical Review)	Vol. 87, No. 1, January 2011	Wydawnictwo SIGMA-NOT	Poland	10/01/2011	262 - 265		Yes
20	Sinusoidal Oscillator based on Adjustable Current Amplifier and Diamond Transistors with Buffers	ŠOTNER, R.	Przegląd Elektrotechniczny (Electrical Review)	Vol. 87, No. 1, January 2011	Wydawnictwo SIGMA-NOT	Poland	10/01/2011	266 - 270		Yes
21	Simulator for radio resources management functions in CDMA systems	KEJÍK, P.	Simulation Modelling Practice and Theory	Vol. 19, No. 2, February 2011	Elsevier	Netherlands		752 - 761		No
22	Evaluation of Electromagnetic Immunity of Layered Structures by Neural Networks	KOUDELK A, V.	Microwaves Antennas & Propagation, IET	Vol. 5, No. 4, March 2011	IET			482 - 488		No
23	Topology Reduction for Approximate Symbolic Analysis	KOLKA, Z.	Radioengineering	Vol. 20, No. 1, April 2011	Společnost pro radioelektronické inženýrství	Czech Republic	01/04/2011	252 - 256		Yes

					nicke inženýrství					
24	Analysis of Resolution in Aerial Earth Surface Photography	ŘÍČNÝ, V.	Radioengineering	Vol. 20, No. 1, April 2011	Společnost pro radioelektronické inženýrství	Czech Republic	01/04/2011	126 - 129		Yes
25	Four-Phase Oscillators Employing Two Active Elements	BIOLKOVÁ, V.	Radioengineering	Vol. 20, No. 1, April 2011	Společnost pro radioelektronické inženýrství	Czech Republic	01/04/2011	334 - 339		Yes
26	Behavioral Modeling of Memcapacitor	BIOLEK, D.	Radioengineering	Vol. 20, No. 1, April 2011	Společnost pro radioelektronické inženýrství	Czech Republic	01/04/2011	228 - 233		Yes
27	Chaotic Oscillators with Single Polynomial Nonlinearity and Digital Sampled Dynamics	PETRŽEL A, J.	Przegląd Elektrotechniczny (Electrical Review)	Vol. 87, No. 6, 2011	Wydawnictwo SIGMA-NOT	Poland	06/05/2011	161 - 163		Yes
28	Modeling deterministic chaos using electronic circuits	PETRŽEL A, J.	Radioengineering	Vol. 20, No. 2, June 2011	Společnost pro radioelektronické inženýrství	Czech Republic	01/06/2011	438 - 444		Yes
29	Time and Laplace-domain methods for MTL transient and sensitivity analysis	BRANČÍK, L.	COMPEL The international journal for computation and mathematics in electrical and electronic engine	Vol. 30, No. 4, 2011	Emerald			1205 - 1223		No
30	An example of easy synthesis of active filter and oscillator using signal flow graph modification and controllable current conveyors	ŠOTNER, R.	Journal of Electrical Engineering	Vol. 62, No. 5, September-October 2011	Versita, Warsaw	Poland		258 - 266		Yes
31	Experimental study of the sampled labyrinth chaos	GÖTTHANS, T.	Radioengineering	Vol. 20, No. 4, December 2011	Společnost pro radioelektronické inženýrství	Czech Republic	01/12/2011	873 - 879		Yes

					inženýrství					
32	OFDM Signal Detector Based on Cyclic Autocorrelation Function and its Properties	ŠEBESTA, V.	Radioengineering	Vol. 20, No. 4, December 2011	Společnost pro radioelektronické inženýrství	Czech Republic	01/12/2011	926 - 931		Yes
33	Impact of vocal effort variability on automatic speech recognition	ZELINKA, P.	Speech Communication	Vol. 54, No. 6, January 2012	Elsevier	Netherlands		732 - 742		No
34	Analysis of Temporal Effects in Quality Assessment of High Definition Video.	SLANINA, M.	Radioengineering	Vol. 21, No. 1, April 2012	Společnost pro radioelektronické inženýrství	Czech Republic	01/04/2012	63 - 69		Yes
35	Testing QoE in Different 3D HDTV Technologies	SLANINA, M.	Radioengineering	Vol. 21, No. 1, April 2012	Společnost pro radioelektronické inženýrství	Czech Republic	01/04/2012	445 - 454		Yes
36	Study of Adjustable Gains for Control of Oscillation Frequency and Oscillation Condition in 3R-2C Oscillator	ŠOTNER, R.	Radioengineering	Vol. 21, No. 1, April 2012	Společnost pro radioelektronické inženýrství	Czech Republic	01/04/2012	392 - 402		Yes
37	Electromagnetic Band Gap Structures: Practical Tips and Advice for Antenna Engineers	KOVÁCS, P.	Radioengineering	Vol. 21, No. 1, April 2012	Společnost pro radioelektronické inženýrství	Czech Republic	01/04/2012	414 - 421		Yes
38	In-system Jitter Measurement Based on Blind Oversampling Data Recovery	KUBÍČEK, M.	Radioengineering	Vol. 21, No. 1, April 2012	Společnost pro radioelektronické inženýrství	Czech Republic	01/04/2012	403 - 407		Yes
39	Overview of Parallel Platforms for Common High Performance Computing	FRÝZA, T.	Radioengineering	Vol. 21, No. 1, April 2012	Společnost pro radioelektronické inženýrství	Czech Republic	01/04/2012	436 - 444		Yes

40	Optimal piecewise-linear approximation of the quadratic chaotic dynamics	PETRŽEL A, J.	Radioengineering	Vol. 21, No. 1, April 2012	Společnost pro radioelektronické inženýrství	Czech Republic	01/04/2012	20 - 28		Yes
41	Analysis and Simulation of the Transmission Distortions of the Mobile Digital Television DVB-SH Part 2: Satellite mode DVB-SH-B with TDM	POLÁK, L.	Radioengineering	Vol. 21, No. 1, April 2012	Společnost pro radioelektronické inženýrství	Czech Republic	01/04/2012	126 - 133		Yes
42	Band-monitoring Payload for a CubeSat Satellite	VÁGNER, P.	Radioengineering	Vol. 21, No. 1, April 2012	Společnost pro radioelektronické inženýrství	Czech Republic	01/04/2012	430 - 434		Yes
43	Application of Iterative Fourier Method in Cylindrical Phaseless Antenna Measurement Technique	PUSKELY, J.	Radioengineering	Vol. 21, No. 1, April 2012	Společnost pro radioelektronické inženýrství	Czech Republic	01/04/2012	422 - 429		Yes
44	Immediate Analysis of Periodic Steady States in Switched DC-DC Converters via SPICE	BIOLEK, D.	Radioengineering	Vol. 21, No. 1, April 2012	Společnost pro radioelektronické inženýrství	Czech Republic	01/04/2012	386-391		Yes
45	Reliable and Efficient Procedure for Steady-State Analysis of Nonautonomous and Autonomous Systems	DOBEŠ, J.	Radioengineering	Vol. 21, No. 1, April 2012	Společnost pro radioelektronické inženýrství	Czech Republic	01/04/2012	374 - 385		Yes
46	Novel processing of Tipping-Bucket Rain Gauge Records - Examples from Czech Republic	FIŠER, O.	Atmospheric Research	Vol. 92, No. 3, May 2009	Elsevier			283 - 288		No
47	Transient and sensitivity analysis of uniform multiconductor transmission lines via FDTD methods	BRANČÍK, L.	Proceedings of the XV. International Symposium on Theoretical Electrical Engineering (ISTET 2009)	24/06/2009		Lubeck, Germany, 2009	24/06/2009	109-113		No
48	Improving Convergence of	DOBES, J.	Proceedings of European	23/08/2009	IEEE		23/08/20	476-479		No

	Algorithms for Solving Systems of Circuit Algebraic-Differential Equations		Conference on Circuit Theory and Design ECCTD09				09			
49	Analysis of Spectrum Utilization in Suburb Environment: Evaluation of Potentials for Cognitive Radio	VALENTA, V.	Proceedings of International Conference on Ultra Modern Communications (ICUMT 2009)	12/10/2009		Saint Petersburg, Russia	12/10/2009	52-57		No
50	Survey on Spectrum Utilization in Europe: Measurements, Analyses and Observations	VALENTA, V.	Proceedings of the 5th International Conference on Cognitive Radio Oriented Wireless Networks and Co	9/06/2012		Cannes, France	09/06/2012	101-105		No
51	Technique of 3D NILT based on Complex Fourier Series and Quotient- Difference Algorithm	BRANČÍK, L.	17th IEEE International Conference on Electronics, Circuits, and Systems	12/12/2010	IEEE	Athens, Greece	12/12/2010	207-210		No
52	Time-Domain Simulation of Multiconductor Transmission Line Systems	BRANČÍK, L.	Proceedings of the Joint INDS11 & ISTET11	24/07/2011		Austria, Klagenfurt	24/07/2011	216-221		No
53	Mutators for Transforming Nonlinear Resistor Into Memristor	BIOLEK, D.	Proceedings of the 20th European Conference on Circuit Theory and Design (ECCTD 2011)	28/08/2011	IEEE	Linköping, Sweden	28/08/2011	509-512		No
54	Hybrid dual-mode frequency synthesis for cognitive multi-radio front-ends	VALENTA, V.	Wireless Personal Communications	Vol. 64, No. 1, 2012	SpringerLink			197 - 210		No

LIST OF DISSEMINATION ACTIVITIES								
No.	Type of activities ¹²	Main leader	Title	Date	Place	Type of audience ¹³	Size of audience	Countries addressed
1	Workshops	DREL	IEEE workshop Králíky 2009	31/08/2009	Králíky, Czech Republic	Scientific community (higher education, Research)	77	Czech Republic, Slovak Republic
2	Conference	DREL	20th International Conference Radioelektronika 2010	19/04/2010	Brno, Czech Republic	Scientific community (higher education, Research) - Industry	120	Worldwide
3	Workshops	DREL	Industrial Forum	19/04/2010	Brno, Czech Republic	Scientific community (higher education, Research) - Industry	20	Czech Republic, Germany
4	Workshops	DREL	IEEE workshop Králíky 2010	30/08/2010	Králíky, Czech Republic	Scientific community (higher education, Research)	43	Czech Republic, Slovak Republic
5	Conference	DREL	21st International Conference Radioelektronika 2011	19/04/2011	Brno, Czech Republic	Scientific community (higher education, Research) - Industry	100	Worldwide
6	Workshops	DREL	Industrial Forum	19/04/2011	Brno, Czech Republic	Scientific community (higher education, Research) - Industry	20	Czech Republic, Germany, Austria
7	Workshops	DREL	IEEE workshop Vsacký Cáb 2011	29/08/2011	Vsetín, Czech Republic	Scientific community (higher education, Research)	37	Czech Republic, Slovak Republic
8	Conference	DREL	13th International	20/06/2011	Prague, Czech Republic	Scientific community	125	Worldwide

¹² A drop down list allows choosing the dissemination activity: publications, conferences, workshops, web, press releases, flyers, articles published in the popular press, videos, media briefings, presentations, exhibitions, thesis, interviews, films, TV clips, posters, Other.

¹³ A drop down list allows choosing the type of public: Scientific Community (higher education, Research), Industry, Civil Society, Policy makers, Medias ('multiple choices' is possible).

			Symposium on Microwave and Optical Technology - ISMOT-2011			(higher education, Research)		
9	Conference	DREL	22nd International Conference Radioelektronika 2012	17/04/2012	Brno, Czech Republic	Scientific community (higher education, Research) - Industry	76	Worldwide
10	Workshops	DREL	Industrial Forum	17/04/2012	Brno, Czech Republic	Scientific community (higher education, Research) - Industry	20	Czech Republic, Germany, Austria
11	Workshops	DREL	Industrial Forum	16/09/2010	Brno, Czech Republic	Scientific community (higher education, Research) - Industry	15	Czech Republic
12	Articles published in the popular press	DREL	Presentation of ACOST in Research Review magazine, Issue 14, September 2010	01/08/2010	Brussels, Belgium	Scientific community (higher education, Research) - Industry - Civil society - Policy makers - Medias	5900	European wide
13	Publication	DREL	Special Issue of Radioengineering on ACOS T	01/04/2012	Brno, Czech Republic	Scientific community (higher education, Research) - Industry		Worldwide
14	Web sites /Applications	DREL	Web pages of ACOST and DREL	01/04/2009	http://www.radio.feec.vutbr.cz/acost http://www.urel.feec.vutbr.cz	Scientific community (higher education, Research) - Industry - Civil society - Policy makers - Medias		Worldwide

4.2.1 Section B (Confidential¹⁴ or public: confidential information to be marked clearly)

Part B1

TEMPLATE B1: LIST OF APPLICATIONS FOR PATENTS, TRADEMARKS, REGISTERED DESIGNS, ETC.					
Type of IP Rights ¹⁵ :	Confidential Click on YES/NO	Foreseen embargo date dd/mm/yyyy	Application reference(s) (e.g. EP123456)	Subject or title of application	Applicant (s) (as on the application)
Registered designs	Yes		Not assigned yet (application prepared in May 2012)	Electronically tunable oscillator with fractal elements	Brno University of Technology, Dr. Jiří Petržela, Tomáš Gotthans.

¹⁴ Note to be confused with the "EU CONFIDENTIAL" classification for some security research projects.

¹⁵ A drop down list allows choosing the type of IP rights: Patents, Trademarks, Registered designs, Utility models, Others.

Part B2

Type of Exploitable Foreground ¹⁶	Description of exploitable foreground	Confidential Click on YES/NO	Foreseen embargo date dd/mm/yyyy	Exploitable product(s) or measure(s)	Sector(s) of application ¹⁷	Timetable, commercial or any other use	Patents or other IPR exploitation (licences)	Owner & Other Beneficiary(s) involved
General advancement of knowledge	Effective methods for design, simulation, and optimization of microwave structures including planar antennas, metamaterials, and integrated structures		No	Applications in automotive industry (car-to-car communication, anticollision radars, new integrated antennas, UWB application inside cars, etc.), in communication industry (new systems working above 100 GHz, miniature mobile terminals, etc.), and in medical area (implantable antennas, body-area networking).	C26.3 - Manufacture of communication equipment, C26.4 - Manufacture of consumer electronics, C29.1	2012: Ongoing project for a major car maker	Planar modular antenna (Registered design at Czech Industrial Property Office, No. 21185)	Brno University of Technology
General advancement of knowledge	Modeling and simulation of advanced mobile networks		Yes	Tools for the development and optimization of new modulation and coding techniques for mobile applications.	C26.3 - Manufacture of communication equipment	2011-Ongoing project with T-Mobile CZ	Not foreseen	Brno University of Technology, TU Vienna
General advancement of knowledge	Components and techniques for Free-space optical communication		No	Techniques for optimum optical beam generation, as well design of optical transmitter and receiver	C26.3 - Manufacture of communication equipment	2012: Start of two projects with a communication equipment manufacturer	Not foreseen	Brno University of Technology
General	New active blocks and		No	Integrated active blocks	C26.1.1 -	2012: Preparation	Electronically tunable	Brno University of

¹⁹ A drop down list allows choosing the type of foreground: General advancement of knowledge, Commercial exploitation of R&D results, Exploitation of R&D results via standards, exploitation of results through EU policies, exploitation of results through (social) innovation.

¹⁷ A drop down list allows choosing the type sector (NACE nomenclature) : http://ec.europa.eu/competition/mergers/cases/index/nace_all.html

Type of Exploitable Foreground ¹⁶	Description of exploitable foreground	Confidential Click on YES/NO	Foreseen embargo date dd/mm/yyyy	Exploitable product(s) or measure(s)	Sector(s) of application ¹⁷	Timetable, commercial or any other use	Patents or other IPR exploitation (licences)	Owner & Other Beneficiary(s) involved
advancement of knowledge	topologies for analog signal processing			for analog signal processing whose applications include analog frequency filters, oscillator and amplifiers.	Manufacture of electronic components	of a project with a manufacturer of integrated circuits	oscillator with fractal elements (application for a registered design, May 2012)	Technology

Title: **Novel methods of analysis, modeling and optimization of microwave structures**

Type of foreground: General advancement of knowledge

IPR portfolio: *Planar modular antenna* [Registered design at Czech Industrial Property Office, No. 21185]
Methodology of the design of electromagnetic structures (antennas, high frequency transmission lines, passive and active microwave circuits) [certified methodology by ISO 9001, Reg. No. CZ – 2212/2011]

Description:

The research group of Microwave technologies has successfully developed new effective methods for design, simulation, and optimization of microwave structures including planar antennas, metamaterials, and integrated structures. The possible applications range from classical communication systems to terahertz and UWB applications.

Nowadays, microwave structures represent a field with a great commercial potential. The industry is interested in small yet effective integrated planar antennas, ultrawideband structures, and application for millimeter and terahertz bands. The foreground can be exploited in automotive industry (car-to-car communication, anticollision radars, new integrated antennas, UWB application inside cars, etc.), in communication industry (new systems working above 100 GHz, miniature mobile terminals, etc.), and in medical area (implantable antennas, body-area networking). The group has finished several industry-funded research contracts.

Title: **Modeling and simulation of advanced mobile networks**

Type of foreground: General advancement of knowledge

Description:

Contemporary communication systems are characterized by an ever-increasing demand on broadband connection of mobile terminals in order to provide qualitatively new type of service to end customers. The development and optimization of new modulation and coding techniques relies on reliable models of mobile channels. The research team of the Laboratory of mobile communications has developed an LTE uplink link

level simulator in cooperation with TU Vienna. The simulator consists of the complete processing chain defined by 3GPP LTE Rel. 8 standard. The simulator is implemented in Matlab and is available for downloading (<http://www.nt.tuwien.ac.at/about-us/staff/josep-colom-ikuno/lte-uplink-link-level-simulator/>). It is free for academic use, but a license is required for a commercial use.

The research results can be exploited in connection with the deployment of LTE in near-future mobile networks. The size of mobile-communication market gives an optimistic view of a possible commercialization of this foreground.

Title: **Components and techniques for Free-space optical communication**

Type of foreground: General advancement of knowledge

Description:

The development of municipal network infrastructure is characterized by increasing requirements of broadband connectivity, specifically in the Last-Mile networks. This trend will continue in the next couple of decades. The main attraction of FSO technology is the bandwidth comparable to optical fibers. In addition, the optical band used for communication is still license-free. The research group within the Laboratory of Optical communications has developed techniques for the optimum optical beam generation, as well improved the design of optical transmitters and receivers. The knowledge obtained can be exploited in design of new-generation FSO units.

The most attractive application is the combination of FSO and millimeter wave radio link for obtaining carrier-grade availability. Both FSO and millimeter wave links depend strongly on weather, i.e. either technology alone is not able to provide a sufficient availability. The commercialization of these results has already started.

Title: **New active blocks and topologies for analog signal processing**

Type of foreground: General advancement of knowledge

IPR portfolio: Electronically tunable oscillator with fractal elements (application for a registered design, May 2012, ID not yet assigned)

Description:

One of the greatest challenges in design of mobile terminals is the decreasing of power consumption, which brings a longer operating time with a given battery capacity. The research group within the Laboratory of analog and digital circuits has successfully proposed a number of new integrated active blocks characterized by low supply voltage, high bandwidth, or low offsets. Applications of these blocks include analog frequency filters, oscillator and amplifiers, which can be used in design of integrating circuits.

In 2012, a project is being preparer with a manufacturer of integrated circuits.

4.3 Report on societal implications

A General Information *(completed automatically when Grant Agreement number is entered.)*

Grant Agreement Number: 230126

Title of Project: Advanced Communication Systems and Technologies

Name and Title of Coordinator: Prof. Zdeněk Kolka

B Ethics

1. Did your project undergo an Ethics Review (and/or Screening)? If Yes: have you described the progress of compliance with the relevant Ethics Review/Screening Requirements in the frame of the periodic/final project reports? Special Reminder: the progress of compliance with the Ethics Review/Screening Requirements should be described in the Period/Final Project Reports under the Section 3.2.2 'Work Progress and Achievements'	No
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2. Please indicate whether your project involved any of the following issues (tick box) :	
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RESEARCH ON HUMANS

• Did the project involve children?	No
• Did the project involve patients?	No
• Did the project involve persons not able to give consent?	No
• Did the project involve adult healthy volunteers?	No
• Did the project involve Human genetic material?	No
• Did the project involve Human biological samples?	No
• Did the project involve Human data collection?	No

RESEARCH ON HUMAN EMBRYO/FOETUS

• Did the project involve Human Embryos?	No
• Did the project involve Human Foetal Tissue / Cells?	No
• Did the project involve Human Embryonic Stem Cells (hESCs)?	No
• Did the project on human Embryonic Stem Cells involve cells in culture?	No
• Did the project on human Embryonic Stem Cells involve the derivation of cells from Embryos?	No

PRIVACY

• Did the project involve processing of genetic information or personal data (eg. health, sexual lifestyle, ethnicity, political opinion, religious or philosophical conviction)?	No
• Did the project involve tracking the location or observation of people?	No

RESEARCH ON ANIMALS

• Did the project involve research on animals?	No
• Were those animals transgenic small laboratory animals?	No
• Were those animals transgenic farm animals?	No
• Were those animals cloned farm animals?	No
• Were those animals non-human primates?	No

RESEARCH INVOLVING DEVELOPING COUNTRIES

• Did the project involve the use of local resources (genetic, animal, plant etc)?	No
• Was the project of benefit to local community (capacity building, access to healthcare, education etc)?	No

DUAL USE

• Research having direct military use	No
• Research having the potential for terrorist abuse	No

C Workforce Statistics		
3. Workforce statistics for the project: Please indicate in the table below the number of people who worked on the project (on a headcount basis).		
Type of Position	Number of Women	Number of Men
Scientific Coordinator		1
Work package leaders	1	5
Experienced researchers (i.e. PhD holders)	1	11
PhD Students		3
Other	2	4
4. How many additional researchers (in companies and universities) were recruited specifically for this project?		8
Of which, indicate the number of men:		7

D Gender Aspects

5. Did you carry out specific Gender Equality Actions under the project?

☐
X

Yes
No

6. Which of the following actions did you carry out and how effective were they?

	Not at all effective	Very effective			
☐ Design and implement an equal opportunity policy	☐ ☐ ☐ ☐ ☐	☐			
☐ Set targets to achieve a gender balance in the workforce	☐ ☐ ☐ ☐ ☐	☐			
☐ Organise conferences and workshops on gender	☐ ☐ ☐ ☐ ☐	☐			
☐ Actions to improve work-life balance	☐ ☐ ☐ ☐ ☐	☐			
☐ Other:					

7. Was there a gender dimension associated with the research content – i.e. wherever people were the focus of the research as, for example, consumers, users, patients or in trials, was the issue of gender considered and addressed?

☐ Yes- please specify

☐ No

E Synergies with Science Education

8. Did your project involve working with students and/or school pupils (e.g. open days, participation in science festivals and events, prizes/competitions or joint projects)?

X Yes- please specify

Open days for secondary schools

☐ No

9. Did the project generate any science education material (e.g. kits, websites, explanatory booklets, DVDs)?

☐ Yes- please specify

X No

F Interdisciplinarity

10. Which disciplines (see list below) are involved in your project?

X Main discipline¹⁸: 2.2

☐ Associated discipline¹⁸:

☐ Associated discipline¹⁸:

G Engaging with Civil society and policy makers

11a Did your project engage with societal actors beyond the research community? (if 'No', go to Question 14)

☐
X

Yes
No

11b If yes, did you engage with citizens (citizens' panels / juries) or organised civil society (NGOs, patients' groups etc.)?

☐ No

☐ Yes- in determining what research should be performed

¹⁸ Insert number from list below (Frascati Manual).

☐ Yes - in implementing the research ☐ Yes, in communicating /disseminating / using the results of the project					
11c In doing so, did your project involve actors whose role is mainly to organise the dialogue with citizens and organised civil society (e.g. professional mediator; communication company, science museums)?				☐ ☐	Yes No
12. Did you engage with government / public bodies or policy makers (including international organisations)					
☐ No ☐ Yes- in framing the research agenda ☐ Yes - in implementing the research agenda ☐ Yes, in communicating /disseminating / using the results of the project					
13a Will the project generate outputs (expertise or scientific advice) which could be used by policy makers?					
☐ Yes – as a primary objective (please indicate areas below- multiple answers possible) ☐ Yes – as a secondary objective (please indicate areas below - multiple answer possible) ☐ No					
13b If Yes, in which fields?					
Agriculture Audiovisual and Media Budget Competition Consumers Culture Customs Development Economic and Monetary Affairs Education, Training, Youth Employment and Social Affairs		Energy Enlargement Enterprise Environment External Relations External Trade Fisheries and Maritime Affairs Food Safety Foreign and Security Policy Fraud Humanitarian aid		Human rights Information Society Institutional affairs Internal Market Justice, freedom and security Public Health Regional Policy Research and Innovation Space Taxation Transport	
13c If Yes, at which level?					
☐ Local / regional levels ☐ National level ☐ European level ☐ International level					

H Use and dissemination		
14. How many Articles were published/accepted for publication in peer-reviewed journals?	47	
To how many of these is open access ¹⁹ provided?	36	
How many of these are published in open access journals?	36	
How many of these are published in open repositories?	0	
To how many of these is open access not provided?	11	
Please check all applicable reasons for not providing open access:		
X publisher's licensing agreement would not permit publishing in a repository ☐ no suitable repository available ☐ no suitable open access journal available ☐ no funds available to publish in an open access journal ☐ lack of time and resources ☐ lack of information on open access ☐ other ²⁰ :		
15. How many new patent applications ('priority filings') have been made? <i>("Technologically unique": multiple applications for the same invention in different jurisdictions should be counted as just one application of grant).</i>	0	
16. Indicate how many of the following Intellectual Property Rights were applied for (give number in each box).	Trademark	0
	Registered design	1
	Other	0
17. How many spin-off companies were created / are planned as a direct result of the project?	0	
<i>Indicate the approximate number of additional jobs in these companies:</i>		
18. Please indicate whether your project has a potential impact on employment, in comparison with the situation before your project: X Increase in employment, or ☐ Safeguard employment, or ☐ Decrease in employment, ☐ Difficult to estimate / not possible to quantify X In small & medium-sized enterprises X In large companies ☐ None of the above / not relevant to the project		
19. For your project partnership please estimate the employment effect resulting directly from your participation in Full Time Equivalent (FTE = one person working fulltime for a year) jobs:	<i>Indicate figure:</i> 4 ☐	
Difficult to estimate / not possible to quantify		

¹⁹ Open Access is defined as free of charge access for anyone via Internet.
²⁰ For instance: classification for security project.

I Media and Communication to the general public		
20. As part of the project, were any of the beneficiaries professionals in communication or media relations? ☐ Yes ☒ No		
21. As part of the project, have any beneficiaries received professional media / communication training / advice to improve communication with the general public? ☐ Yes ☒ No		
22 Which of the following have been used to communicate information about your project to the general public, or have resulted from your project?		
☐ Press Release ☐ Media briefing ☐ TV coverage / report ☐ Radio coverage / report ☒ Brochures /posters / flyers ☐ DVD /Film /Multimedia	☒ ☐ ☐ ☒ ☒ ☐	Coverage in specialist press Coverage in general (non-specialist) press Coverage in national press Coverage in international press Website for the general public / internet Event targeting general public (festival, conference, exhibition, science café)
23 In which languages are the information products for the general public produced?		
☒ Language of the coordinator ☐ Other language(s)	☒ ☐	English