Network of Excellence

NEWCOM#
Network of Excellence in Wireless Communications#

FP7 Contract Number: 318306

WP3.2 – Education and Training

D32.1
Report on Education and Training Activities during Year 1

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This deliverable describes the education and training activities by NEWCOM# researchers within WP3.2 during the first project year. During this time, 2 summer schools, 1 EuWIn training session, and 1 Emerging Topic Workshop have been organized. The deliverable provides summaries of these events and some background information regarding the organizational procedures.

Keywords: summer school, winter school, emerging topic workshop, training session, EuWIn

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Version history

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Executive Summary

There are three main types of education and training activities in WP3.2 of NEWCOM#:

- Seasonal Schools teach new concepts and theories in the form of lectures
- Training Sessions of the European Lab on Wireless Communications for the Future Internet (EuWIn) provide hands-on coaching on real hardware platforms
- Emerging Topics Workshops stimulate an exchange of scientific ideas on recent hot areas in the field

During the first year of NEWCOM#, two Summer Schools, one Training Session, and one Emerging Topic Workshop have been organized by NEWCOM# researchers, with strong administrative support from the recently established European Association of Communications and Networking (EurACoN). The details of these events are as follows:

- Seasonal School; Eurecom, Sophia Antipolis (France); May 28-30, 2013; 60 attendees
- Seasonal School; Poznan Univ. Technology (Poland); Sept. 18–20, 2013; 48 attendees
- Training Sessions; Eurecom, Sophia Antipolis (France); May 31, 2013, 60 attendees
- Emerging Topics Workshops; Univ. Bologna (Italy); July 8-10, 2013; 65 attendees

All events attracted a large number of attendees and have been a huge success with the participants due to the high quality of the technical programs. All WP3.2 milestones during year 1 have thus been achieved.
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List of Acronyms

CDMA .......................... Code Division Multiple Access
ETW .......................... Emerging Topics Workshop
EurACoN ..................... European Association of Communications and Networking
EuWIn ...................... European Lab of Wireless Communications for the Future Internet
FPGA .......................... Field-Programmable Gate Array
GEDOMIS .................... GEneric hardware DemOnstrator for MIMO Systems
GNSS .......................... Global Navigation Satellite System
HetNet .......................... Heterogeneous Network
LTE .......................... Long-Term Evolution
SDR .......................... Software-defined Radio
1. Introduction

Education and training are key integration activities within NEWCOM#. These activities are subsumed in WP3.2 (lead by Gerald Matz of VUT) and are considered as fundamentals for achieving excellence in research. There are three types of events organized within this WP, each corresponding to a task:

Task 3.2.1 Seasonal schools; lead by Roberto Verdone (CNIT)

Task 3.2.2 EuWIn training sessions; lead by Sylvain Azarian (Supelec)

Task 3.2.3 Emerging topics workshops (ETW); lead by Miquel Payaró (CTTC)

The European Lab of Wireless Communications for the Future Internet (EuWIn, the experimental branch of NEWCOM#) and the European Association for Communications and Networking (EurACoN, http://www.euracon.org) play key roles in these activities. Specifically, EuWIn provides the infrastructure, facilities, and equipment for the hands-on training sessions and EurACoN acts as the administrative backbone of the seasonal schools and ETWs. Specifically, EurACoN has been providing extraordinary administrative support, taking care of booking the catering, accommodation, and restaurants; preparing hand-outs, CDs, and badges; advertising the school via posters, leaflets, and a webpage; and issuing invoices and attendance certificates.

The seasonal schools typically last for several days and consist of short-courses and tutorials on advanced topics in wireless communications. These courses are given by leading international experts from within and outside NEWCOM#. In addition, there may be discussion sessions that give PhD students the opportunity to exchange ideas with their peers and with senior experts.

ETW are held in order to foster the exchange of ideas regarding new trends in wireless communications research and to provide a platform for PhD students to identify suitable thesis topics. The ETWs are also an ideal meeting point for interaction with the industry. Practical training sessions at the EuWIn facilities allow the participating PhD students to gain hands-on experience regarding various wireless hardware platforms. Like seasonal schools, training stages will be open to NEWCOM# beneficiaries and to affiliate partners. The first seasonal school was originally planned for M6 but eventually took place in M7. This slight delay was due to the original time-line having been extremely tight and by the necessity to avoid collisions between this NEWCOM# event and a number of important conferences and workshops in the area of wireless communications and networking. For similar reasons, the Emerging Topics Workshop in Bologna was held in M8 (rather than in M9 as planned) and the second seasonal school took place in M11 instead of M12.

In this deliverable, we report the education and training activities in the first year of NEWCOM#. Section 2 provides information of the first two seasonal schools. Section 3 discusses the EuWIn training sessions performed so far. Section 4 gives details about the first ETW. A summary is provided in Section 5.
2. Seasonal Schools

Winter and summer schools are organized following the successful examples of the predecessor project NEWCOM++. These seasonal schools are dedicated to fundamental topics of specific relevance to the joint research pursued in Track 1 and typically last for several days. The seasonal schools consist of lectures on basic and state-of-the-art concepts, taught by NEWCOM# experts. PhD students can thus benefit from the integrated expertise of the NEWCOM# consortium that complements the guidance provided by the direct PhD supervisor. The courses can be complemented with student discussion (or poster) sessions that are organized to foster the exchange of scientific ideas and improve the networking of PhD students. Whenever possible and appropriate, courses will be videotaped or video-streamed.

2.1 First Seasonal School in Sophia Antipolis

2.1.1 Key Facts

**School Title:** Interference Management for Tomorrow's Wireless Networks  
**Chairs:** Maxime Guillaud (VUT), Marios Kountouris (Supelec), Florian Kaltenberger (Eurecom)  
**Venue:** EuReCom, Sophia Antipolis (France)  
**Date:** May 28-30, 2013  
**URL:** [http://www.euracon.org/imss2013](http://www.euracon.org/imss2013)

2.1.2 Keynote Speakers

*Bruno Clerckx (Imperial College)*  
"Interference Management in Wireless Networks: From Theory to Practice"  
*M. Gastpar (EPFL/UC Berkeley):*  
"Interference Management: The Compute-and-Forward Perspective"  
*David Gesbert (EURECOM)*  
"Feedback and Cooperation in interference-limited networks"  
*Jakob Hoydis (Alcatel-Lucent Bell Labs)*  
"Massive MIMO and HetNets: Benefits and Challenges"  
*Syed A. Jafar (UC Irvine)*  
"Topological interference management for wireless interference networks"  
*Slawomir Stanczak (TU Berlin)*  
"Distributed Interference Management and Identification for Wireless Networks "

Except for David Gesbert, all speakers where from non-NEWCOM# institutions. Thus, there was a substantial know-how transfer from outside to NEWCOM# researchers. The details of the programme are shown in Figure 2-1.
2.1.3 School Summary

The NEWCOM# Summer School on Interference Management for Tomorrow’s Wireless Networks attracted more than 60 participants (see Figure 2-2 and Table 2-1) to EURECOM’s new campus in Sophia-Antipolis, France, for three days of talks and scientific exchange. Six keynote speakers (from NEWCOM# partners as well as from outside institutions) gave half-day tutorials about recent and upcoming developments around the topic of interference management. Prof. Bruno Clerckx (Imperial College, London) discussed practical, standards-related aspects of interference management in cellular networks, as well as ways to make interference useful through energy harvesting. Prof. Michael Gastpar (EPFL and UC Berkeley) discussed relaying strategies in the presence of interference based on the compute-and-forward approach. Prof. David Gesbert (EURECOM) tackled the topic of physical layer cooperation between users and feedback in interference-limited networks. Dr. Jakob Hoydis (Alcatel-Lucent Bell Labs) analysed and discussed the relative merits of massive MIMO and heterogeneous networks to increase the area spectral efficiency of future networks. Prof. Syed A. Jafar (UC Irvine) discussed recent progress in topological interference management. Finally, Prof. Slawomir Stańczak (TU Berlin) discussed joint power control and beamforming for resource allocation and interference management. All talks were video-streamed via the XiMinds platform (www.ximinds.com) and the course material has been made available at the EurACoN website.
A poster session was also organized, where 8 participating Ph.D. students presented and discussed their work with the community. Finally, ample time was left for informal interactions among the participants and with the speakers. The feedback (see Figure 2-3) from the participants praised the school’s technical program and the quality of the presentations, as well as the local organization and the quality of the social dinner.

Figure 2-2: Organizers and attendees of the 1st NEWCOM# Seasonal School.

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Table 2-1: Provenance of the attendees of the 1st NEWCOM# Seasonal School.

Figure 2-3: Feedback for the 1st NEWCOM# Seasonal School and Training Sessions.
2.2 Second Seasonal School in Poznan

The second school took place only a short time before this deliverable was prepared.

2.2.1 Key Facts

**Title:** Green Wireless Communications  
**Chairs:** Hanna Bogucka (PUT), Magdalena Mendlikowska-Humerczyk (PUT), Adrian Kliks (PUT)  
**Venue:** Poznan University of Technology, Poland  
**Date:** Sept. 18–20, 2013  
**URL:** [http://www.euracon.org/gwcss2013](http://www.euracon.org/gwcss2013)

2.2.2 Keynote Speakers

- **Hanna Bogucka (Poznan University of Technology)**  
  Multi-layer green wireless communications

- **Honggang Zhang and Jacques Palicot (Supelec)**  
  Cognitive radio for green communications

- **Luis M. Correia (IST/INOV-INESC, U. Lisbon)**  
  Green cellular networks

- **Régis Esnault (Orange Labs)**  
  Energy-efficient wireless platforms and electronics

- **Yan Zhang (Simula Research Laboratory, Norway)**  
  Wireless communications and smart grids

- **Christine Morin (INRIA)**  
  Green computing

![Figure 2-4: During a session of the 2nd NEWCOM# Seasonal School.](image-url)
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<td>9.00-10.30</td>
<td>1 – part A Multi-layer green wireless</td>
<td>Hanna Bogucka Poznan University of Technology, Poland</td>
</tr>
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<td>communications</td>
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<td>10.45-12.15</td>
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<tr>
<td>12.15-13.45</td>
<td>Lunch</td>
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<tr>
<td>13.45-15.15</td>
<td>2- part A Cognitive radio for green</td>
<td>Honggang Zhang/Jacques Palicot Supelec, France</td>
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<td>Yan Zhang Simula Research Laboratory, Norway</td>
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<td>10.45-12.15</td>
<td>5– part B Wireless communications and smart grids</td>
<td>Yan Zhang Simula Research Laboratory, Norway</td>
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<td>12.15-13.45</td>
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<td>6- part A Energy-efficient wireless platforms and electronics</td>
<td>Régis Esnault</td>
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<td>Régis Esnault</td>
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Figure 2-5: Programme of the 2nd NEWCOM# Seasonal School.
2.2.3 School Summary

The second thematic school organized under the auspices of NEWCOM# was devoted to the latest results and upcoming developments in the area of Green Wireless Communications. Making wireless communications more energy-efficient is currently one of the hottest research topics in the fields, as it tends to be the practical way for more efficient exploitation of natural resources in the global scale. As the ICT industry consumes around 2% of the total used energy, and huge part of it has to be attributed to wireless communication systems, in particular base stations, it is rational to put strong effort on further reduction of energy consumption in that sector of economy. Such an approach leads not only to better environment protection but also reduces the cost of network management. Moreover, in the advent of Internet-of-Things and Smart Cities, where billions of devices are foreseen to communicate over the air, the need of efficient energy utilization is one of the key research aspects. The school lasted for three days, with six top experts in the field covering a half-day each with tutorials (see Figure 2-5). Each tutorial was followed by student discussions. It is worth noting that two of the six speakers came from industry. The school gathered 48 attendees. A survey was conducted to assess the satisfaction of the participants. The results of the survey are shown in Figure 2-6; in general the survey revealed that the majority of participants rated the school as very good to excellent.

*Figure 2-6: Feedback results of the 2nd NEWCOM# Seasonal School.*
2.3 Outlook: Third Seasonal School in Barcelona

From Nov. 25 to Nov. 28, 2013, the third NEWCOM# School, dedicated to “Fundamental research through experimentation on channel modelling, localization, and mesh networks,” will be held in conjunction with EuWIn training sessions at the premises of CTTC in Castelldefels/Barcelona (Spain). Top scholars and industry representatives will share their insights on the interactions between fundamental research (theory) and experimentation (practice) in the fields of channel modelling, localization, and mesh networks.

3. EuWIn Training Session

In addition to the seasonal schools, lab training sessions on actual experimental hardware platforms are held at the facilities of EuWIn in order to transfer experimental and implementation know-how. The idea is to allow PhD students to gain hands-on experience on the various measurement and testbed platforms and thereby establish close ties between Tracks 1 and 2 of NEWCOM# with the goal of cross-fertilization between these two tracks. The training sessions capitalize on previous experience and know-how of the main players in teaching hardware and software implementation skills for various wireless communication platforms.

3.1 Training Session at Eurecom, Sophia-Antipolis

3.1.1 Key Facts

Title: Interference Management for Tomorrow's Wireless Networks
Chair: Florian Kaltenberger (Eurecom)
Venue: Eurecom, Sophia Antipolis (France)
Date: May 31, 2013

3.1.2 Trainers and Labs

Javier Arribas (CTTC)
Interference mitigation in GNSS signal acquisition through antenna arrays

Oriol Font (CTTC)
Interference mitigation in HetNet systems: From theory to practice

Florian Kaltenberger (EURECOM)
Introduction to OpenAir4G and ExpressMIMO2 radios

Figure 3-1: Equipment (left) and trainer (right) in a training session.
3.1.3 Training Sessions Summary

The first training sessions were offered in connection with the first seasonal school at Eurecom in Sophia-Antipolis (see Figure 2-1) involving the same (>60) participants. Hands-on sessions involving the hardware of the EuWIn@CTTC and EuWIn@EURECOM labs were held by Dr. Javier Arribas and Dr. Oriol Font (CTTC), on interference mitigation in GNSS signal acquisition and in HetNets, respectively, and by Prof. Florian Kaltenberger (EURECOM) on the OpenAirInterface platform (see Figure 3-1). A detailed description of the training activities is provided below and some feedback is shown in Figure 2-3. Further details regarding the number and provenance of the participant can be found in Section 2.1.3.

The first lab addressed the signal acquisition problem using antenna arrays in the general framework of global navigation satellite systems (GNSS) receivers. GNSSs provide the infrastructures for a myriad of applications that demand a robust and accurate positioning service. Despite that the code-division multiple access (CDMA) modulation of GNSS offers limited protection against radio frequency interference (RFI), an interference that exceeds the processing gain can easily degrade receivers’ performance or even deny completely the service. A single-antenna receiver can make use of time and frequency diversity to mitigate RFIs, even though the performance is compromised in the presence of wideband interferences. Antenna arrays receivers can benefit from spatial-domain processing, and thus mitigate the effects of interfering signals. In this tutorial, a state-of-the-art array-based acquisition algorithm using a well-established statistical detection theory framework was presented, its real-time implementation feasibility using both FPGAs and software-defined radio (SDR) techniques was demonstrated, and performance measurements in realistic scenarios were given.

The second lab addressed the challenges of implementing and demonstrating interference management in a real-time HetNet scenario with high performance prerequisites. Precisely, its aim was to raise awareness on the myriad of issues encountered when embarking in the challenging task of implementing the physical layer of a high performance real-time system that demonstrates an interference management scheme applied to a HetNet application scenario. Details of the low-level real-time FPGA implementation were given together with a full description of the hardware setup, which was hosted in the GEDOMIS testbed of CTTC (http://engineering.cttc.es/gedomis). Finally, the versatile system prototyping possibilities that the GEDOMIS testbed is able to offer for implementing the physical layer of either real-time or offline wireless communication systems were presented.

The third lab gave an introduction to OpenAirInterface, the experimental SDR platform of Eurecom. Students got on-hand experience with Eurecom’s new radio cards called ExpressMIMO2. They heard about the basic functionality of the cards and how to operate them in both real-time and non real-time. The goal of the lab session was to perform basic LTE cell synchronization using signals acquired with the ExpressMIMO2 card using the Octave API. The lab also taught the basics of LTE in order to be able to perform this operation.
4. Emerging Topics Workshop

NEWCOM# organizes once per year a workshop dedicated to emerging topics in wireless communications which possibly also touch on other disciplines (mathematics, physics, life sciences, etc.). In contrast to seasonal schools, the focus of Emerging Topic Workshops (ETWs) is on recent developments and open problems that are specifically suited as potential topics for PhD theses. These events are a meeting point for interaction with the industry with the specific aim of harmonizing the interests of young NEWCOM# researchers and the practical needs of the European industry in wireless (and neighbouring) businesses. The structure of ETWs is a combination of expert talks and student presentations. Invited speakers, who typically are internationally recognized top experts from within and outside NEWCOM#, give expert talks. The student presentations are supposed to further stimulate the discussion and help with the identification of PhD thesis topics. Like with Seasonal Schools, the administrative aspects of ETWs are taken care of by EurACoN.

4.1 First ETW in Bologna

A year 1 highlight in WP 3.2 was the ETW in Bologna, held in conjunctions with the EuWin Inaugural Event and a NEWCOM# Track 2 Meeting.

4.1.1 Key Facts

Title: Fundamental Research Through Experimentation  
Chairs: Davide Dardari (CNIT/Bologna), Florian Kaltenberger (Eurecom), Raymond Knopp (Eurecom), Miquel Payaro (CTTC), Roberto Verdone (CNIT/ Bologna)  
Venue: University of Bologna, Italy  
Date: July 8-10, 2013

4.1.2 Keynote Speakers

Roberto De Bonis (Telecom Italia)  
Wireless Communication for Smart City Applications: From Theory to Practice  
Jean Luc Peron (Thales Group)  
Experimental Activities in TCS: Past Results and Future Perspectives  
Sergio Beker (Huawei)  
Resource and Function Orchestration and Federation in Future Networks  
Alain Sibille (Telecom ParisTech)  
The Backscattering Channel in an UWB RFID System of Tags and Readers  
Leandro Navarro (UPC)  
Community-Lab: A Community Networking Environment  
Luis Muñoz Gutiérrez (Univ. Cantabria)  
Smart Santander: An Internet of Things Experimentation and Innovation Platform in the Context of the City

4.1.3 Workshop Summary

Organizing this ETW in conjunction with the EuWin Opening Ceremony and with a Track 2 Meeting ensured that the experimental activities within NEWCOM# are promoted and that
the exchange with the theoretical work in Track 1 was further fostered. The ETW included four sessions (cf. Figure 4-1). The first one was mostly dedicated to talks by industry representatives (Thales, Huawei, Telecom Italia). In the second session representatives of other EC projects gave presentations and discussed experimental results. The last two sessions included talks given by NEWCOM# researchers on experimental platforms and activities carried out prior to the EuWin inauguration (see Figure 4-2 for the full programme).

There were 65 attendees in this event (including students, researchers, guests from industry and other EC projects), coming from Italy, Belgium, France, Germany, Greece, Spain, Poland, and the US.

![Figure 4-1: A session during the 1st NEWCOM# Emerging Topics Workshop.](image)

<table>
<thead>
<tr>
<th>July 8</th>
<th>Time</th>
<th>Speaker(s)</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>14h30</td>
<td>R. De Bonis, Telecom Italia</td>
<td>Wireless Comm. for Smart City Applications: From Theory to Practice</td>
<td></td>
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<tr>
<td>15h00</td>
<td>J. Peron, Thales C&amp;S</td>
<td>Experimental Activities in TCS: Past Results and Future Perspectives</td>
<td></td>
</tr>
<tr>
<td>15h30</td>
<td>S. Beker, Huawei</td>
<td>Resource and Function Orchestration and Federation in Future Networks</td>
<td></td>
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<tr>
<td>16h00</td>
<td>BREAK</td>
<td></td>
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<tr>
<td>16h30</td>
<td>L. Navarro, UPC</td>
<td>Community-Lab: a Community Networking Testbed</td>
<td></td>
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<tr>
<td>17h00</td>
<td>L. Munoz, UniCantabria</td>
<td>SmartSantander: An Internet of Things Experimentation and Innovation</td>
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<tr>
<td></td>
<td></td>
<td>Platform in the Context of the City</td>
<td></td>
</tr>
<tr>
<td>17h30</td>
<td>A. Sibille, Telecom ParisTech</td>
<td>The Backscattering Channel in an UWB RFID System of Tags and Readers</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>July 9</th>
<th>Time</th>
<th>Speaker(s)</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>09h00</td>
<td>C. Buratti, UniBO</td>
<td>From Smart Lighting to Smart City: Lessons Learnt From a City Test Bed</td>
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<tr>
<td>09h20</td>
<td>G. Pasolini, UniBO</td>
<td>Building a Smarter Future: the WILAB Experience</td>
<td></td>
</tr>
<tr>
<td>09h40</td>
<td>F. Dovis, PoliTO</td>
<td>Study of Anti-Jamming and Anti-Spoofing Techniques for Satellite Navigation Receivers</td>
<td></td>
</tr>
<tr>
<td>10h00</td>
<td>C. Fernandez, CTTC</td>
<td>Experimental Activities With GNSS-SDR</td>
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</tr>
<tr>
<td>10h20</td>
<td>BREAK</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11h00</td>
<td>C. Oestges, UCL</td>
<td>Multi-Dimensional Channel Sounding: Methods, Challenges and Recent Results</td>
<td></td>
</tr>
<tr>
<td>11h20</td>
<td>M. Payaro, CTTCE</td>
<td>Recent Experimental Activities With the GEDOMIS® Demonstrator</td>
<td></td>
</tr>
<tr>
<td>11h40</td>
<td>F. Kaltenberger, Eurecom</td>
<td>Lessons Learnt From the OpenAirInterface</td>
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</tr>
<tr>
<td>12h00</td>
<td>P. Giaccone, PoliTO</td>
<td>Investigating the Efficiency of D2D Comm. Through the WiFi Direct Platform</td>
<td></td>
</tr>
</tbody>
</table>

![Figure 4-2: Program of the 1st NEWCOM# Emerging Topics Workshop.](image)
5. Conclusions

During the first 12 months of NEWCOM#, there has been broad commitment and participation in several education and training activities. Specifically, there have been the following events:

- Summer School on “Interference Management for Tomorrow's Wireless Networks”
  Venue: Eurecom (France); Date: May 28-30, 2013; Attendees: 60
- Summer School on “Green Wireless Communications”
  Venue: Poznan Univ. Technology (Poland); Date Sept. 18–20, 2013; Attendees: 48
- Training Sessions at EuWiIn@Eurecom
  Venue: Eurecom (France); Date: May 28-30, 2013; Attendees: 60
- Emerging topic Workshop on “Fundamental Research Through Experimentation”
  Venue: Univ. Bologna (Italy); Date: July 8-10, 2013; Attendees: 65

All events were highly successful in terms of quality of the technical program and number of attendees. The feedback provided by the participants was throughout positive. All events were also used as a means to involve relevant industry, specifically by inviting industry people to give Keynote Talks.

Much of the success of the above events can be attributed to the fact that administrative aspects have been taken care of in a professional manner by EurACoN, thereby allowing the NEWCOM# researchers to focus on the organization of the technical program. This approach will also be used to organize the next event, which is a Winter School on “Fundamental research through experimentation on channel modelling, localization, and mesh networks” at the premises of CTTC in Casteldefels, Spain.
Comments and suggestions for the improvement of this document are most welcome and should be sent to:

deliverable@newcom-project.eu

http://www.newcom-project.eu