

## DC12

*Individual Research Project title* – **Sensing bounds and algorithms for perceptive cell-free networks with hybrid intelligent surfaces**

*Lead beneficiary (place of employment)* – **UNIVERSIDAD AUTONOMA DE BARCELONA (UAB)**, EDIF A, CAMPUS DE LA UAB BELLATERRA CERDANYOLA V, CERDANYOLA DEL VALLES 08193, Spain,

*Secondment at* – **INSTITUTO DE TELECOMUNICAÇÕES (IT)**, CAMPUS UNIVERSITARIO DE SANTIAGO UNIVERSIDADE DE AVEIRO, GLORIA E VERA CRUZ, 3810 193, Portugal and **ERICSSON AB (ERS)**, TORSHAMNSGATAN 23, STOCKHOLM, 164 80, Sweden,

*Supervisory team* - Academic: Gonzalo Seco-Granados (UAB); Industry: Dr. Gabor Fodor (ERS), Mentor: Prof. Rui Dinis (IT)

*Project tasks and objectives* - The objective is to derive the bounds and corresponding trade-offs between communications and positioning capabilities of the networks. We will consider networks that include the presence of hybrid (i.e. with active and passive) structures. The bounds will be used to choose the system parameters optimizing certain application-dependent key performance indicators. Next, channel estimation, sensing and positioning algorithms that are both practical and approach the bounds will be developed. Near-field and wide-band effects will be considered. Special attention will be devoted to the hardware impairments, which are nowadays one of the limiting factors in the use of large antenna systems and intelligent surfaces, since their real behavior strongly deviates from the standard models. The effect of hardware impairments will be analyzed, and they will be considered in the derivation of robust sensing/positioning algorithms.

**The hired researcher will spend the first 18 months at Ericsson (Stockhol, Sweden), the next 3 months at Instituto de Telecomunicações (Aveiro, Portugal), and the final 15 months at Universitat Autònoma de Barcelona (Bellaterra, Spain).**

*Expected Results* - Statistical tools for the performance analysis and optimization of the communications and sensing capabilities of cell-free networks with hybrid intelligent surfaces. Characterization of the effects of hardware impairments. Development of robust low-complexity integrated communications and sensing algorithms.

*Planned secondment objectives* - to develop models for joint communications and sensing that capture the effects the hardware limitations at cellular base stations and to include nonlinear effects and other hardware imperfections in the developed bounds.

*Eligibility* - University master's degree and be eligible to enroll in a PhD program. Knowledge in fields related to Telecommunications (or closely related disciplines) is appreciated. A high level of English language is required. International experience is appreciated. Research experience and good communication skills are appreciated. Not have resided or carried out their main activity (work, studies, etc.) in Spain for more than 12 months in the 36 months immediately before the recruitment date. Non EU-candidates should have preferably an EU working permit.

*Evaluated criteria* –

- Study records, including Bachelor and Master
- Work & research experience
- Motivation
- Letters of recommendation
- Positive attitude, previous mobility experience, good communication skills
- English proficiency and other languages

*Preferred starting date*- September 2024

*Trial period* – 6 months

*Target degree* - PhD degree from — **UNIVERSIDAD AUTONOMA DE BARCELONA**

*Approximate gross salary* –

2770 € for a fellow without family

3270 € for a fellow with family (e.g., married or in recognized relationship or with children)

*Working and living conditions* –

Detailed information about Spain: <https://www.oecdbetterlifeindex.org/countries/spain/>

Detailed information about Portugal: <https://www.oecdbetterlifeindex.org/countries/portugal/>

Detailed information about Sweden: <https://www.oecdbetterlifeindex.org/countries/sweden/>

**UNIVERSIDAD AUTONOMA DE BARCELONA** is a public university known for its excellence in research and quality in teaching, and is a reference centre in Europe. The UAB is located only 25 minutes via public transportation from Barcelona's city centre, a cosmopolitan metropolis lying on the shores of the Mediterranean Sea. The main campus is located in Bellaterra, in the heart of one of the main industrial and technological poles of Mediterranean Europe.

UAB is the top Spanish university according to the [2024 QS World University Ranking](#).

UAB caters to all aspects of university life. The campus is a true city of knowledge with almost 50,000 inhabitants: students, lecturers, researchers and administrative staff. It is organised with all the necessary services for the university community: residence halls (2,100 places), specialised libraries, a language learning centre, sport facilities (with a gym, pools, football pitch, etc.), healthcare centre, restaurants, stores and cafés. The international dimension of the UAB can be seen by the number of students enrolled from abroad, especially in master's degrees with 2,105 international students (35%), and PhD programmes with 1,692 international students (33%). There are over 45 master's degrees taught 100% in English.

UAB promotes innovation, employability and entrepreneurship. It strives to foster research and transfer in all areas of knowledge and works closely together with the surrounding business and industrial community.

The hired researcher will join the [SPCOMNAV](#) research group, which is among the most recognized groups in the field of positioning techniques using either satellite or terrestrial signals. It pioneered the use of 4G/5G cellular signals for positioning, and it is now involved in the definition of positioning techniques for beyond 5G and 6G.

Website: <http://www.uab.cat>, <http://spcomnav.uab.cat>

**INSTITUTO DE TELECOMUNICAÇÕES:** Instituto de Telecomunicações (IT) is a private, non-profit organization of public interest, and a State Associate Laboratory since 2001. IT is a partnership of six universities, one polytechnic institute and two companies involved in research and development in the field of Telecommunications:

- \* Instituto Superior Técnico (IST);
- \* University of Aveiro (UA);
- \* University of Coimbra (UC);
- \* University Institute of Lisbon (ISCTE);
- \* University of Porto (UP);
- \* University of Beira Interior (UBI);
- \* Polytechnic Institute of Leiria (IPL);
- \* Altice Labs (AL);
- \* Nokia Solutions and Networks (NSN).

IT's mission is to create and disseminate scientific knowledge in the field of telecommunications. It is actively involved in fundamental and applied research in telecommunications, both at national and international level, and is committed to fostering higher education and training, by hosting and tutoring graduate and postgraduate students. Scientific expertise in IT spans across the following areas:

- \* Wireless Technologies
- \* Optics and Photonics
- \* Information and Data Sciences

- \* Networks and Services
- \* Basic Sciences and Enabling Technologies

Website : <https://www.it.pt/>

**L M ERICSSON AB** is a provider of networking and telecommunications products and services. The company offers services, software, and infrastructure in the areas of mobility, broadband, and cloud. Ericsson's products and services assist telecom operators and other businesses improve operational efficiency. The company's primary offering includes network infrastructure for mobile and fixed communication, such as 2G, 3G, and 4G radio networks, and IP core and transport networks. Ericsson also offers learning services, support services, network roll-out, device and network testing, core and cloud consulting, and digital transformation consulting services. The company has business presence in Europe, North America, Asia-Pacific, Latin America, Africa and the Middle East. Ericsson is headquartered in Kista, Stockholm, Sweden

Website: <https://www.ericsson.com/en>

*Additional information:*

The selected DC for this position will have to additionally complete these steps after she/he gets the positive decision about her/his application, in order to comply with the Spanish legislation on registering to a PhD degree with a Spanish university:

1. Those who are in possession of a foreign academic qualification, which has not already been declared equivalent to an Spanish degree, have to enclose all the documents translated and legalized by the competent Italian representation in accordance to the set of rules in force relating to the admission of foreign students to the courses in Spanish Universities, which are useful to enable the Commission that guarantees admission to the doctoral program, to assess the equivalence in compliance with current legislation in this field in Spain and in the country where the qualification was issued and with the treaties or international agreements concerning the recognition of qualifications for further studies.
2. Non-EU citizens will have to enclose to the application form all the titles translated and legalized by the Spanish Embassy in accordance with the applicable standards for the admission of foreign students to Spanish Universities