

Job Description for Position: CS-1

CentraleSupélec (CS), is seeking to appoint a high-caliber doctoral candidate to join the Marie Skłodowska-Curie Doctoral Network “Wireless Networks at Optical Speed with Deterministic Performance” (TeraWireless). The selected candidate will work under the supervision of Prof. Marco Di Renzo.

About the TeraWireless project

Future networks will support several applications that require extending fiber-optic quality of experience to wireless links. This means connectivity at extremely high data rates with deterministic performance (guaranteed requirements in terms of reliability and time response). Virtual avatar presence, traffic control, autonomous driving, remote health monitoring, cyber physical systems for intelligent transportation, industrial automation are only a few examples of anticipated use cases. Owing to the large amount of available bandwidth, the European Telecommunications Standards Institute has identified terahertz (THz) as a key technology for future wireless networks. TeraWireless is the first EU training-through-research industrial doctoral network of doctoral candidates and senior supervisors fully committed to lay the theoretical, algorithmic, and architectural foundations for enabling THz systems at optical speed with deterministic performance. TeraWireless will 1) put forth the innovative ultra-MIMO (multiple-input multiple-output) technology for increasing the data rate and link reliability through spatial multiplexing and superdirective beamforming, and will pioneer the development of electromagnetic and communication models for evaluating its performance in low-scattering THz channels, where multipath propagation cannot be exploited, by integrating sensing, localization, communication capabilities; 2) leverage the emerging concept of semantic and goal-oriented communications by folding message semantics and goals of communication within communication layers; 3) develop innovative physics-based ML solutions for energy-efficient, robust, reliable, and explainable-by-design implementations; 4) make available to the research community the EU’s and world’s first open-access and open-source simulation environment - integrating ray tracing, link-level, and system-level features - for evaluating and optimizing THz large-scale deterministic networks at optical speed.

Position title: CS-1- Electromagnetic models for U-MIMO THz communications with mutually coupled elements.

Research project: CS-1 will introduce new electromagnetic models and evaluate the fundamental limits of subwavelength arrays with tunable elements spaced less than half-wavelength. In contrast to current designs, CS-1 will consider antenna elements driven by tunable impedances and will compute analytical expressions of the current distribution departing from Hallen’s integral-differential equation based on the induced electromagnetic field method. The models will account for U-MIMO orientations, polarization of fields, the substrate, electronic circuits, Floquet modes. Based on the new current distributions, a channel model will be developed to unveil the performance limits.

Objectives: Develop new communication models and evaluate the fundamental limits of dense antenna-arrays with coupling effects. Electromagnetic models for dense antenna-arrays with radiating elements spaced at sub-wavelength distances.

Location of workplace: CentraleSupélec, campus in Rennes (France), Avenue de la Boulaie, CS 47601, F-35576 Cesson-Sévigné CEDEX (<https://www.centralesupelec.fr/campus/rennes>).

PhD enrolment: The selected applicant will be enrolled into the Ph.D. program at CentraleSupélec, campus in Rennes (France).

Working Time: Full-time.

Duration: Fixed-term (3 years).

Salary: In agreement with the MSCA-DN financial regulations, including living, mobility, and family allowances (https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/wp-call/2021-2022/wp-2-msca-actions_horizon-2021-2022_en.pdf).

Secondment: CS-1 will spend a research period of duration 18 months at industrial partners of the TeraWireless project. The planned secondment for CS-1 is expected to be at RANPLAN Wireless (UK) and British Telecom (UK).

Job requirements

- 1) An undergraduate degree and a postgraduate Master's degree (or equivalent) in information engineering, electronic or electrical engineering, mathematics, electromagnetics, or a physical sciences subject.
- 2) Solid background in communication theory, wireless communications, signal processing. Knowledge of electromagnetics, antennas, and metamaterials is a plus.
- 3) Excellent mathematical skills and background.
- 4) High proficiency in Matlab, and other programming software (e.g., Mathematica, CST, HFSS or COMSOL).
- 5) Excellent written and verbal communication, including presentation skills.
- 6) Highly proficient English language skills.
- 7) Excellent organizational skills, attention to details and the ability to meet deadlines.
- 8) Ability to think logically, create solutions and make informed decisions.
- 9) Willingness to work collaboratively in a research environment.
- 10) Willingness to travel and work across Europe.

Duties and Responsibilities

- 1) Undertake postgraduate research in support of the agreed doctoral research project.
- 2) Work closely with the academic supervisors to ensure the compatibility of the individual project with the overall goals of the TeraWireless project.
- 3) Present and publish research in both academic and non-academic audiences.
- 4) Attend and participate in academic and non-academic conferences, events and seminars.
- 5) Attend and participate in all training events and supervisory meetings.
- 6) Be seconded to other network partners as necessary to fulfil the grant obligations.
- 7) Prepare progress reports and similar documents on research for funding bodies, as required.
- 8) Contribute to the delivery and management of the wider program, including attending and participating in program committee meetings.
- 9) Actively contribute to the public engagement and outreach activities of the project.

As job descriptions cannot be exhaustive, the Researcher may be required to undertake other duties, which are broadly in line with the above duties and responsibilities.

Eligibility requirements

- The applicant must be a doctoral candidate (i.e. not already in possession of a doctoral degree at the date of the recruitment).

- At the time of recruitment, the researcher must not have resided or carried out their main activity (work, studies, etc.) in the country of their recruiting organization for more than 12 months in the three years immediately prior to the recruitment date. Compulsory national service and/or short stays such as holidays are not taken into account.

Selection Process

The selection and recruitment process will be in accordance with the European Charter and Code of Conduct for the Recruitment of Researchers. The recruitment process will be open, transparent, impartial, equitable, and merit-based. There will be no overt/covert discrimination based on race, gender, sexual orientation, religion or belief, disability or age. To this end, the following selection criteria will be considered:

- 1) Curriculum
- 2) Academic performance (diplomas, university transcripts, etc.)
- 3) Research and industrial experience
- 4) Awards and fellowships
- 5) Publications and patents
- 6) Research, leadership, and creativity potential
- 7) English knowledge
- 8) Other relevant items based on the specific candidate

The application deadline is **9 August 2025**. All applications will be analyzed after the application deadline, and the shortlisted candidates will be invited to a teleconference interview. At the end of the selection process, all the applicants will be informed of the outcome of their application by return email.

Disclaimer

By applying for this position, the applicants:

- 1) give their consent to circulate their application and personal data within the members of the consortium.
- 2) declare to fulfil the eligibility requirements defined above.
- 3) agree to spend a secondment period of 18 months at industrial partners of the TeraWireless consortium.
- 4) agree that they will comply with the planned Ph.D. enrollment.

How to Apply

Each application must include the following material:

- a) Curriculum vitae setting out the educational qualifications as well as any additional scientific achievements and publications. The CV must clearly indicate the applicant's vitae name, surname, gender, date of birth, nationality, country of residence in the last three years).
- b) A copy of the passport.
- c) Evidence of English proficiency.
- d) Copy of Bachelor's and Master's certificates.
- e) Copy of Bachelor's and Master's transcripts.
- f) Any additional material useful for the assessment of the candidate (e.g., recommendation letters, research project/statement in agreement with the requirements specified in previous text).

All material must be included in one compiled pdf file. The file should be named indicating the surname of the applicant and (in order of preference) the three preferred positions for which the applicant is applying, i.e. Surname_Position1_Position2_Position3.pdf (e.g. Surname_CNIT1_CS2_UPRC1) The file should be uploaded through the TeraWireless recruitment website <https://www.terawireless.eu/job-positions>.

Applications must be submitted according to the following procedure:

- 1) Registration and submission of the application material to the TeraWireless recruitment website (<https://www.terawireless.eu/job-positions>).
- 2) Parallel application and submission of the application material to the attention of Prof. Marco Di Renzo, to be sent to msca_terawireless_cs_application@centralesupelec.fr.

Note: Both steps 1) and 2) are mandatory for the application to be considered as admissible.

Further Information

For more information, please contact Prof. Marco Di Renzo (marco.direnzo@centralesupelec.fr).



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