



# PhD in INGEGNERIA DELL'INFORMAZIONE / INFORMATION TECHNOLOGY - 38th cycle

Research Area n. 4 - Telecommunications

**PNRR\_351\_PUBBL\_AMMIN Research Field: B5G/6G WIRELESS EVOLUTION FOR  
VEHICULAR SYSTEMS**

**Monthly net income of PhDscholarship (max 36 months)**

**€ 1300.0**

In case of a change of the welfare rates during the three-year period, the amount could be modified.

**Context of the research activity**

**Motivation and objectives of the research in this field**

Worldwide Public Administrations have a key role on spectrum management, and they typically drive the evolution of the B5G/6G systems, and Public Italian Administration (PA) is one of the key player. Objective of the PhD is to research on vehicular connectivity, and integrate the technical skills with a visiting experience to the PA to gain insight on the worldwide spectrum negotiations.

Research on Vehicle To Everything (V2X) communications aims to progress on cooperative perception and machine learning for beyond 5G V2X (B5G/6G) on high frequencies with rate  $\gg 1$ Gbps.

The candidate is required to be solid in communication and statistics.

Goals of the research are:1) Progress on the theoretical foundations in smart EM environment (metasurface and IRS).

2) Expand on B5G/6G V2X systems for cooperative machine learning.



<p><b>Methods and techniques that will be developed and used to carry out the research</b></p>	<p>The activity will start to gain knowledge and expertise in the theoretical and technological foundations of V2X systems and interference computations. During this time the candidate will be involved in the co-managements of the projects in the frame work of the Joint Lab Huawei-Politecnico di Milano. In year 2, the student will be involved in a cooperation program to develop an experimental test-bed for V2X connectivity. Late in year 2 the student will be involved as visiting the office managing the spectrum in National Ministry for Economic Development (MISE) to expand the vision on spectrum assignment and related negotiation. In year 3 the student will consolidate systems design skill and technological knowhow, and can expand her/his research on innovative solutions according to the academic and industrial vision on 6G systems, spent 6 months visiting.</p>
<p><b>Educational objectives</b></p>	<p>The objective is to consolidate the theoretical foundations of connectivity in high frequency system design (300GHz-300THz), technological knowhow and statistical signal processing and algorithms. Further aspects are the system v2X design and the technology application to next generation B5G/6G wireless system. The candidate should acquire the role and the capability to propose innovative solutions for next generation wireless system (B5G/6G). Applicants are preferred if already familiar with the following topics from graduate course link: <a href="http://spagnolini.faculty.polimi.it/?page_id=181">http://spagnolini.faculty.polimi.it/?page_id=181</a></p>
<p><b>Job opportunities</b></p>	<p>PA teams for spectrum licencing, PA new spectrum releases and allocation of new telecommunication services. R&amp;D in top telecommunication industry, 6G standardization and spectrum management for National entity. Academic and post-doc in highly reputed research groups.</p>
<p><b>Composition of the research group</b></p>	<p>1 Full Professors 2 Associated Professors 3 Assistant Professors 7 PhD Students</p>



<b>Name of the research directors</b>	Umberto Spagnolini
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<b>Contacts</b>	
Umberto Spagnolini Umberto.Spagnolini@polimi.it	

<b>Additional support - Financial aid per PhD student per year (gross amount)</b>	
<b>Housing - Foreign Students</b>	--
<b>Housing - Out-of-town residents (more than 80Km out of Milano)</b>	--

<b>Scholarship Increase for a period abroad</b>	
<b>Amount monthly</b>	650.0 €
<b>By number of months</b>	6

<b>National Operational Program for Research and Innovation</b>	
<b>Company where the candidate will attend the stage (name and brief description)</b>	Ministero dello Sviluppo Economico
<b>By number of months at the company</b>	6
<b>Institution or company where the candidate will spend the period abroad (name and brief description)</b>	Huawei Paris Research Center
<b>By number of months abroad</b>	6

**Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information**

#### ATTINENZA ALLA TEMATICA PRESCELTA

L'uso delle alte frequenze necessita di un accordo normativo nazionale e trans-nazionale, che giustifica la collaborazione con il MISE del dottorando per consentire di completare sia la conoscenza tecnica che quella normativa, per favorire la transizione digitale.

#### IMPRESA, CENTRO DI RICERCA, PUBBLICA AMMINISTRAZIONE (PER PA E PC) PRESSO CUI SI SVOLGERÀ L'ATTIVITÀ ESTERNA

Ministero dello Sviluppo Economico (MISE) a Roma, per 6 mesi, presso il gruppo di normativa nell'uso delle nuove frequenze B5G/6G: <https://www.mise.gov.it>

Collaborazioni pregresse: valutazione dell'impatto del servizio IMT 6GHz verso i servizi satellitari (2021-2022).

#### ENTE, UNIVERSITÀ, AZIENDA, CENTRO DI RICERCA PRESSO CUI SI SVOLGERÀ IL PERIODO DI STUDIO E RICERCA ALL'ESTERO

Huawei Paris Research Center svolge attività di ricerca sulla teoria della comunicazione wireless e sui metodi, è un centro di eccellenza in Europa con oltre 100 ricercatori.

Permanenza 6 mesi su tematiche affini, esiste un programma di collaborazione da oltre 3 anni



con un JRC con il Politecnico.

EDUCATIONAL ACTIVITIES (purchase of study books and material, including computers, funding for participation in courses, summer schools, workshops and conferences): financial aid per PhD student

5.300,25 Euro per student

TEACHING ASSISTANTSHIP: (availability of funding in recognition of supporting teaching activities by the PhD student)

There are various forms of financial aid for activities of support to the teaching practice. The PhD student is encouraged to take part in these activities, within the limits allowed by the regulations.

COMPUTER AVAILABILITY: individual use

DESK AVAILABILITY: individual use