



Campaign 2013 PhD Subject Description

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Context: Environmental Sustainability & Sustainable Digital World

Location : Issy les Moulineaux - Paris

Title:

Study of the exposure of a population to a wireless communication network via dosimetric tools and statistics

State of art & context

As shown by TNS Sofres surveys the french population uses massively wireless communication systems. More than 80 % of French people have and use a mobile phone. Segments such as that of 18-25 years old are 100 % equipped. In 2010 the average duration of calls in France was 141 minutes per month. Despite this heavy and growing usage of wireless communication systems, electromagnetic waves continue to generate public concern even if no study has, to date, demonstrated any health impact. Recent debates in the National Assembly and TNS Sofres surveys show that concerns persist and that there is a lot of confusion around these issues, particularly around those related to the exposure assessment. Many studies related to exposure assessment were conducted and consider separately the exposure induced by mobile phones and the exposure induced by base stations. The exposure is often perceived as being mainly caused by base station antennas. Studies conducted by Orange Labs show that the exposure from base stations is very low, and that the global exposure should always consider both downlink and uplink. The exposure induced by E-fields emitted by mobile phones and base stations depends on the usage (location and type of mobile phone use - data, voice ..), the "distance" to access points, the technology, the network (eg macro vs small cell) and associated power management (eg managing handovers in 2G and 3G). Mobility, diversity of usages and technologies mean that, for one person, the overall exposure is the result of many configurations that depend on that person's habits and on network capacities. For example, the exposure of a person spending time in transit, working in a dense urban area and living in the suburbs will cover configurations different from those encountered by a person living in a large city and having the opportunity to go to work by foot. Therefore the study of the exposure of a population goes first through the segmentation of the different possible configurations and the evaluation of networks inducing exposure in these configurations. Great efforts have been conducted these last 20 years in the fields of numerical methods for evaluating the exposure associated to EM waves. Today progresses of computers, numerical methods, deformation tools and statistical methods allow to assess the exposure associated with this type of configurations (the work performed in this field by the research team of Orange Labs/WHIST lab has resulted in many publications), although further work is needed to fully manage the associated uncertainties. The analysis of the overall exposure of the population then goes through the weighting of different results depending on networks, technologies, population density, urban planning ...

Objectives / Expected Resultats / Technological challenges

The aim of the thesis will be to build via dosimetric and statistical tools an evaluation of the global exposure of a population by taking into account the different technologies and usages and analyze parameters that could be used to optimize the exposure level. This work is complementary and synergistic with the European FP7 project LEXNET (dedicated to reducing the exposure of a population induced by new networks). The challenge is to identify parameters characterizing the network (type, architecture ...), the population (use, density ..) and the urban planning (density, structure ..) that could be used in a model in order to assess the exposure (and thus that could be used to minimize this exposure in optimization studies).

Approche méthodologique proposée par le responsable technique

At first the goal will be to assess how to manage the variability of the parameters involved in the exposure of a population and to build typical exposure scenarios. Then the PhD student will have to consider the build of an index of exposure that can offer solutions to optimize this exposure.

We are therefore looking for following skills: telecommunication networks, electromagnetism, numerical method, and statistical methods.

Planning Global du déroulement de la thèse (*grandes lignes*)

The first year will be devoted to the literature and to the use of existing tools: FDTD, Polynomial Chaos, methods for evaluating the quality of construction of predictive models and configurations exposure.

The second year will be devoted to the analysis of parameters that can be used to construct an index of exposure which would be capable of acting to maximize exposure.

The past year will allow further challenges encountered the first 2 years. This past year will also be devoted to the synthesis of studies and thesis writing

Academic Partner (*CIFRE contract*)

TELECOM Bretagne – BREST - France

Secondary Contributions

Contribution to FP7-EU « LEXNET » project & national ANSES « Acte » project