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Characterization of far-field and near-field exposure of the population for RF-EMF in realistic configurations of ICT usages

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Abstract.

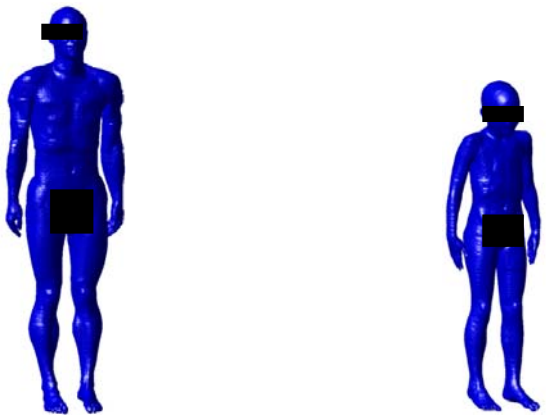
The study presented in this paper is part of a larger study within the European FP7 project LEXNET framework. The project LEXNET aims at considering new technologies and architectures for minimizing the global exposure of a population to radiofrequency electromagnetic fields. In the framework of the project a new exposure metric named Exposure Index (EI) is proposed. The EI quantifies the global exposure of a population induced by both mobile devices and base station antennas or wireless access points. The EI requires a set of SAR values (whole-body and local-body) for typical postures and usages of mobile devices in a population. In our study, we assessed these SAR values by 3D electromagnetic simulations. We used an adult and a child numerical model in two postures (sitting and standing) and in three usages (voice, data and laptop).The whole-body SAR for each exposure configuration was evaluated at four different frequencies (400, 900, 1940 and 2600MHz).

INTRODUCTION

More than 6 billion of people over the world are nowadays using telecommunication devices emitting radiofrequency (RF) electromagnetic fields (EMF). This rise of wireless communication device usages has been accompanied by an increase of the general public concern, despite existing protection limits to protect the general public from known EMF adverse health effects [1]. Large efforts have been carried out in order to assess, on one side, the exposure induced by wireless devices and, on the other side, the exposure induced by base stations. But studies considering together both exposures are rare [2].The study presented in this paper is part of a larger study within the European FP7 project LEXNET framework [3]. The project LEXNET aims at proposing a new exposure metric named the Exposure Index (EI) considering the exposure as a whole, induced by both wireless devices and base stations or access points, with the purpose of developing new architectures and technologies for minimizing the day to day global exposure of a population to RF-EMF. In the framework of LEXNET project our study aims at characterizing near-field and far-field exposure of an adult and a child, at different radiofrequencies, for different wireless devices and usage configurations. The first section describes the selected postures of the human body models, the used RF sources, and the numerical methods. Then, we analyze the whole-body Specific Absorption Rate (SAR) induced for different usages and for far-field and near-field exposure at four different frequencies. Finally, we draw conclusions.

MATERIALS AND METHODS

Two numerical whole-body voxel models from the Virtual Family [4] are used in this study: an adult male model, 34 years old, named “Duke”, and a child female model, 8 years old, named “Eartha” (Fig. 1). All models have the same resolution of 2x2x2mm^3.



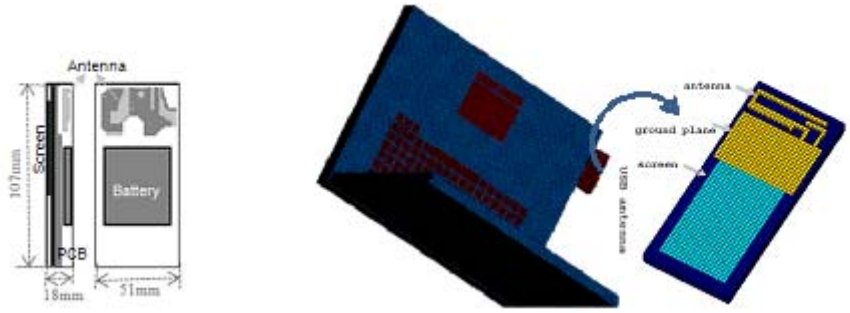
a) Adult model (Duke, 34 y.o.) b) Child Model (Eartha 8 y.o.)

Figure 1. (a) Adult and (b) child numerical whole-body models used in the study

Using a deformation tool (EMPIRE Poser), we created, for each model, typical postures and wireless device usages: a “voice” configuration when using a mobile phone close to the head for voice communication, a “data” configuration when using a mobile phone or a tablet for webbrowsing or text messaging and a “laptop” configuration when using a laptop on the knees. (Fig. 2).

Figure 2. Different postures and usages for the child model.

We simulated the SAR for a mobile phone model and a model of a laptop with a dongle shown in Figure 3 [5].



a) Mobile phone model b) Laptop with dongle

Figure 3. Different sources

SAR calculations were performed using three 3D electromagnetic simulation software suites, all based on the Finite Difference in Time Domain (FDTD) method [6].

RESULTS

Whole-body SAR results for the typical postures of a person and usages of wireless communication devices will be presented in our final paper.

CONCLUSIONS

SAR values calculated in our study will be used as inputs for assessing the Exposure Index developed within the FP7 project LEXNET and which aims at evaluating the exposure of a population incurred by a wireless network as a whole from base stations to individual devices.

ACKNOWLEDGMENTS

This work was conducted in the framework of the European FP7 LEXNET Project.

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