Interaction of Emerging Mobile Telecommunication Systems and the Human Body

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Abstract

Emerging telecommunication systems, with new devices (such as handsets, hands free sets, laptops, wearable PC's and base stations) and new transmission techniques are going to modify the exposure of the population to electromagnetic fields.

A significant amount of research has been carried out to understand the interaction of non-ionizing radiation emitted by the telecommunications systems with the human body. Definitive answers about the risk to humans's health have not been reached yet.

Although the risk for human health is currently thought to be low, there is a need to clarify these interactions. These studies are likely to be relevant in other areas of medical research, and to improve technical specifications in order to reduce emissions.

A complete analysis of the problem is quite difficult and complex: different zones of the human body are under exposure; different "modes of use" can change the amount of the emission that can reach the body; other electronic devices can interfere. The number of possible variables that can change the distribution of the exposure is large.

Our work involves analyzing typical scenarios and the worst cases and developing new techniques and standards for the compliance testing of personal communication devices. The approach to the problem can be divided into two interconnected parallel proceedings:

NUMERICAL MODELING: models have been developed, tested and improved to reproduce and predict the Non - Ionizing Radiations (NIR) exposure to the human body. The Finite Difference Time Domain Technique (FDTD) is used.

EXPERIMENTAL VALIDATION: physical phantoms and human volunteers have been used for exposure measurements.

We have begun analyzing the use of hands free kits: measuring and simulating the Specific Absorption Rate (SAR) in different modes of operation. Initially we have developed and tested a model for the mobile, analysing the strength of the magnetic and electric coupling of the mobile with the wire. Currently this is using a "simplified" rectangular body model, for speed and flexibility, whilst still giving reliable results for certain scenarios. The aim is to check the importance of the presence of the rest of the body for calculating the SAR in the head, and to check the relevance of the presence of gaps between the wire of the hands free kit and the body.

These results are being validated through experimental measurements. The current along the wire of the hands free kit in different 'mode of use' has been measured and a direct value of SAR has been obtained using the IndexSAR SARA2 system.