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Effects Of The Dielectric Properties Changes In Newborn: The Case Of Exposure To An RFID System For Mother-Newborn Identity Reconfirmation

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Newborn exposure to electromagnetic fields (EMF) has been increasing as new technologies enlarges their application domain. However, the studies on newborns exposure assessment and possible health effect are still in their infancy. Little is known about the possible relation between EMF exposure and newborns' health, thus increasing the concern about their possible greater susceptibility to EMF.
To address this issue, an accurate modelling of the newborn is necessary; although in the last years some newborn models were made available, they usually refer to adult dielectric properties. In the last decade, several studies found that the dielectric properties of tissues vary as a function of age, since infancy is the period of most rapid postnatal growth and it is accompanied by major changes in body composition (i.e total body water content). However, the currently available dielectric models of newborns do not cover the whole frequency range and only in few cases the comparison among different models was made available. Therefore it's important to understand the extent to which the variation of dielectric data as a function of age would affect the results of dosimety, and consequently, the possible implication for the exposure of newborns to EMF.
This study attempts to fill this gap, investigating in a newborn model the change in dielectric properties in the lower part of the RadioFrequency (RF) range. This will be achieved comparing the exposure assessment in four different dielectric models; one based on traditional adult properties, two suggested by different authors [Wang et al. 2006; Dimbylow et al. 2010] and the last one proposed by the authors of this current study.
In order to explore a concrete application in the lower RF range, the comparison was made considering a specific RF source currently used in the neonatology units for application of RadioFrequency IDentification (RFID) systems for newborn-mother reconfirmation, based on passive inductive coupling at 13.56 MHz.
The influence on the exposure assessment was assessed comparing for each dielectric model the differences of a detailed matrix exposure (induced intra-corporal magnetic field, electric field and SAR averaged on different body parts) and of the tissue–specific field distribution. Computational techniques implemented by a commercial code (CST EM STUDIO) were used to estimate the EMF distributions in newborn realistic voxel models. The source (the RFID reader) was modeled as a coil, whose technical specifications were derived by reference to commercial devices.
This paper will present the results of these comparisons.