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FDTD Evaluation of the SAR Distribution in a Human Head Near a Mobile Cellular Phone

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Abstract: In this study, Finite-Difference Time-Domain (FDTD) method is used to calculate the Specific Absorbtion Rate (SAR; defined as the power absorbed by unit mass of the tissue) distribution in a human head near a hand-held cellular phone. A three dimensional FDTD algorithm is built in cartesian coordinates. A discrete human head model, derived from a Nuclear Magnetic Resonance (NMR) image by semi-automatic algorithm, is located within FDTD volume together with a discrete hand-held receiver model. FDTD simulations are carried out for both european GSM (operating at 900MHz) and DECT (operating at 1.8GHz) systems with a quarter-wavelength antenna, mounted on top of the hand-held cellular phone. A new and an effective way of calcuating input, radiated and absorbed power distributions is introduced where time-domain Poynting vector is traced over a closed virtual surface surrounding the discrete phone and head models. SAR distributions for various vertical and horizontal slices of the human head are calculated and are shown to agree with the available calculation and measurement results. The computational results are interpreted in terms of international safety guideliness for human health.

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