ELECTROMAGNETIC EFFECTS ON A HUMAN BRAIN DUE TO CELLULAR PHONES

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Electromagnetic waves of frequencies between 825MHz and 960MHz are used in Cellular Technology. These waves contain high energy. Constant exposure to such radiation is a cause for public health concern.

Work is being carried out to analyse the effects on the human brain due to exposure to electromagnetic waves from the use of cellular phones. The user receives signals at the high frequency end and transmits signals at the low frequency end, within the allowed frequency band.

The key issue in this problem is how much of electromagnetic energy is absorbed and where it is deposited. The Specific Absorption Rate or the **SAR** value usually quantifies this. At a specific location,

$$SAR = [\sigma |E|^2] / \rho$$

where σ is the tissue conductivity, ρ is the tissue mass density and **E** is the rms value of the internal electric field intensity. Thus the localized SAR is directly related to the electric field intensity at that location. Therefore our efforts have been to estimate the electric field intensity distribution inside the brain, due to an incident electromagnetic wave.

We modeled the brain by "cubic spheres" and solved the electromagnetic wave equation for incident "uniform plane waves". The equation is an integral equation and has to be solved using numerical techniques. Using the **Method of Moments**, the integral equation was solved and the electric field distribution obtained for a specific value of incident electric field. As the σ, ε & ρ values for the human brain were not available, the relevant values for a dog's brain were used to estimate the SAR values.

Our preliminary results indicate that the SAR values are very small inside the brain and that the values are higher near the outer layers of the brain.
The SAR value increases with increasing incident field. Near a cell boundary, the mobile unit operates at a high power level and therefore produces a high field intensity. This would increase the SAR value significantly.
The SAR value also increases with decreasing frequency and the mobile unit transmits at a lower frequency.