Near Field Antenna Measurements for Cellular Phone Certification

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The RF exposure of a cell phone user is limited by the Federal Communications Commission Report and Order of August, 1996. The limit is 1.6mW/g averaged over any 1g of Tissue. The limit is Based on the C95.4 1999 IEEE/ANSI Human Safety Standard. IEEE in cooperation with the FCC has established a method for testing the exposure from a cell phone. The method is based on a dosimetric system which measures the RF Energy deposited in simulated human head tissue contained within a flat phantom. The measurement system needs to be calibrated before testing in order to obtain compliance with the FCC limit. The MOG was charged with perfecting the system.

Theoretical Computation Of Fields Near a Dipole

Plane Wave Field Expansion Theory

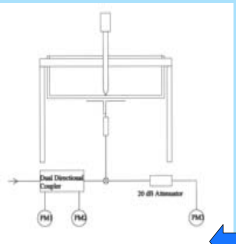
We can compute the SAR(Watts/kg) in an absorbing phantom near a dipole antenna using a plane wave superposition model

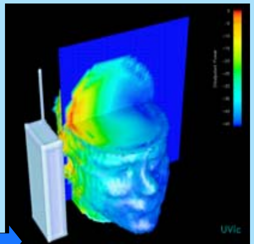
$$SAR = \frac{\sigma |E|^2}{\rho}$$

σ= conductivity of the dielectric medium
ρ= density of the dielectric medium

$$E = \sqrt{E_x^2 + E_y^2 + E_z^2}$$

The Ultimate Goal: Characterization of SAR in the Human Head from a Cell Phone





Courtesy of the University of Victoria

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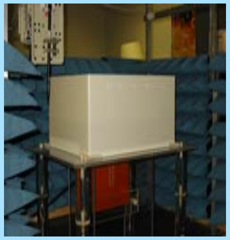
The hypothesis that is being tested is that the amount of power that is deposited by cellular phones into human head tissue will not be detrimental to health. The aim of this study is to illustrate this both through experimental data and theoretical calculations. It will be shown that the SAR levels measured at frequencies of 900MHz and 1800MHz are well below the threshold for dangerous radiation exposure levels for humans

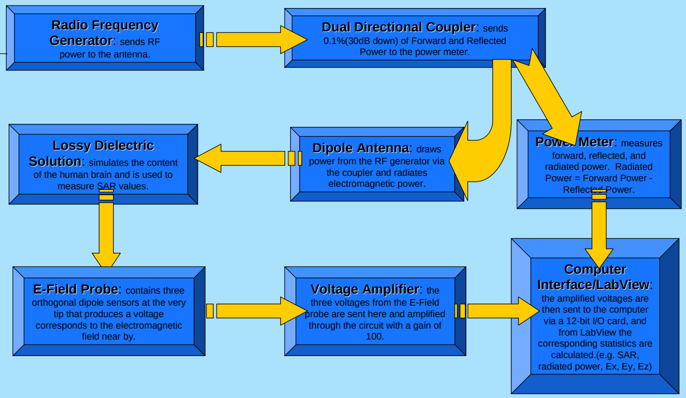
Views of Experimental Setup



SAR Measurement System

System Components

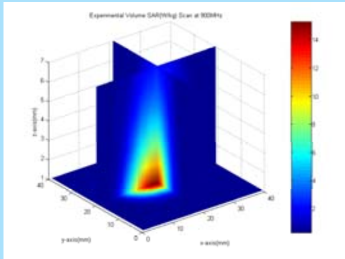
Flow Chart of Major Components

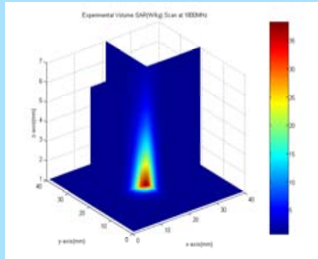


Experimental Data

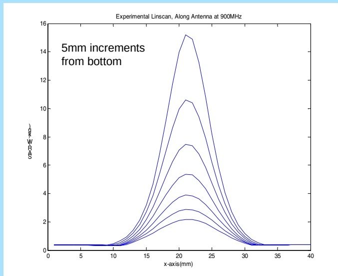
Experimental area scan in lossy solution (scale in W/kg):
Forward Power = 205 mW, Frequency = 1800MHz
Forward Power = 277mW, Frequency = 900MHz

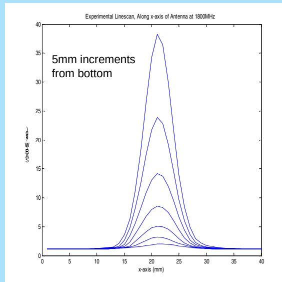
Experimental Volume SAR profile (normalized to 1W radiated power):





Experimental line scan over dipole axis in respective frequency solutions.





Conclusions

- A near-field antenna measurement system and an accurate computer model of the system have been assembled..
- A method of moments theory can be used for modeling.
- The system can be used for accurate calibration of dosimetric measurements

Future Work

- Move to human head dosimetric model.
- Calibration of the entire system in terms of power radiated
- Accurate calibration of field probes, take into account linearity considerations.
- Determine optimal geometry, yielding largest average SAR.