Estimation of SAR for Multiple-Input and Multiple-Output Antenna Systems

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Specific Absorption Rate (SAR) is a measure of the rate at which radio frequency (RF) energy is absorbed by the body when exposed to a radio-frequency electromagnetic field. It is commonly used to measure the power absorbed from cell phone radiation and during MRI scans. The SAR values depend on the geometry of the body parts exposed to the RF energy as well as the RF emissions.

The Multiple-Input and Multiple-Output (MIMO) system is one of several forms of smart antenna technologies, which use multiple antennas at both the transmitter and receiver to improve communication performance. During the operation of such MIMO systems, the emission power from each antenna can be adaptively changed. Consequently, the SAR distribution in the near field by human models also varies. Therefore, it is almost impossible to measure all possible SAR distributions within human models for all possible MIMO operation modes.

In this talk, a new SAR estimation method is explored for compliance testing in MIMO antenna configurations. The method is based on a decomposition and superposition procedure. The analysis of the SAR from the MIMO system is simplified by decomposing the excitation of the multiple antennas into several single-antenna excitations, where only one antenna in the MIMO system is excited. The objective is to obtain a worst-case estimate of the SAR from the MIMO system by measuring the SAR values produced by the individual antennas. Since practical SAR measurements only measure the magnitude of the electric field, an optimization procedure is developed to estimate the worst-case SAR bounds for the MIMO system. The method is verified by calculations with MIMO systems and human models.