

# HUMAN EXPOSURE ASSESSMENT IN THE VICINITY OF GSM BASE STATION ANTENNA

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## ABSTRACT

The tremendous interest of the public in mobile communication systems, manifest itself in the specification of the mobile network and the introduction of new systems such as Edge and universal mobile communication system (UMTS). To ensure user safety, international recommendations such as International Commission on Nonionizing Radiation Protection (ICNIRP) Guidelines have been elaborated to define the authorized limits of exposure for electro-magnetic fields. Basic restrictions on exposure are provided for both general public and workers exposed in the work place. The assessment of the radiated fields in the vicinity of base-station (BS) antennas can be carried out using simple calculation methods and simulations, both approaches are complementary, and allow one to scan the entire volume surrounding the antenna. Availability of reliable simple calculation methods provide assistance in evaluating human exposure to electromagnetic fields from base station antenna. The simulation approach is of particular interest since it can be used to verify practical measurements results, on one hand, and to extrapolate these results outside the accessible volume where measurements cannot be performed. This paper gives a brief examination of selected methodologies for making prediction, in the context of reference levels verification, of the power density in the vicinity of a typical base station panel antenna commonly used for cellular telephony in the GSM 900MHz band. We start with a simulation of the antenna considering all its characteristics as the directivity, VSWR, characteristic impedance as well as the horizontal and vertical beam-widths of the radiation pattern, and then attention is turned to simple calculation models more suitable for routine environmental evaluation for RF exposure. The antenna was then fed with power levels similar to a typical power levels in GSM base stations. Two approximate formulas for radiated power density calculation are compared and their accuracy and range of applicability are discussed. These are, Specifically, the far field model and the cylindrical-wave model, the results obtained from the simulation are compared with those of both models. Then the radiation from the antenna model was used to estimate the safety distance from the antenna main beam that will ensure compatibility with standard power density guidelines for safe human exposure for both public and workers. Finally, the validity distance of the measuring instruments used for power density assessment is analyzed by comparing the use of electric E-field probe and magnetic H-field probe in measurements. The software used for simulation is "Zeland", specialist in electromagnetic simulation and design automation, version IE3D 10.14.