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# Assessment of GSM HF-Radiation impact levels within the residential area of Craiova city

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**Abstract**

The present study aims at analyzing the level of exposure to non-ionizing radiation for the population inside central residential area of Craiova, Romania This type of EM (electromagnetic radiation) is generated mainly by GSM (Global System for Mobile Communication) technology of wireless communication based on the electromagnetic emitters (GSM antennas) needed for covering wider territorial areas. They produce constant pulsed microwave radiation even when nobody is using the phone, affecting the people inside and outside public and residential buildings. Contributions in this filed show that there is a direct link between continuous exposure to microwave radiation from cell phone towers and serious health problems over the years. The paper is based on selective measurements of HF radiations within GSM 900-1800 MHz range at cell towers and at distance both inside and outside residential buildings within the study area. In most cases the exposure zones were located in the vicinity of base stations antenna where recorded levels of HF radiation were superior to recommended values. One main objective is to establish some residential compliance exposure zones inside the study area in relation with international regulations and standards concerning GSM radiation limits.


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*Keywords:* non-ionizing radiation, EMF radiation, GSM, compliance zone, non thermal effects, residential areas, environment, Craiova, Romania

## 1. Introduction

Nowadays cities are facing large scale electromagnetic pollution due to GSM technology for wireless

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communication. In this respect, cities face the most intense electromagnetic pollution in terms of non-ionizing radiation due to the presence of transmitters for mobile communication in crowded areas. This type of sources registered constantly growing in last years because of the large number of mobile services providers and antennas sites. Health effects of cell phone radiation were scientifically approached by James C. Lin, concerning electromagnetic field in living systems [1] which provides a fundamental understanding of (RF) electromagnetic interaction with biological systems. There is to be considered also (Lyn McLean, 2011) with basic information concerning safe life in a world of electromagnetic pollution [2]. Main contributions in the assessment of HF radiation levels are the studies of Thomas Haumann, Uwe Munzeberg, based on power density measurements in residential areas close or far to antennas sites, which point out HF-Radiation levels of GSM cellular phone towers urban environmnet [3], Damiano Urbinello 2014 [4] with a comparison of electromagnetic (RF-EMF) mean exposure levels in outdoor areas across four European cities but also the studies carried out by GAE Vandenbosch [5], R.K Singh with the assessment of electromagnetic radiation from base station antennas which focuses on equivalent isotropically radiated power calculations [6].

Official international and national standards on exposure limits to non-ionizing HF radiation are mainly based on ICNIRP recommendations with reference limits for potential exposure to EMF [7] and STOA Commission for European Parliament (STOA, 2001) [8]. Similar studies show that cell towers transmit radiation 24 hours/day, so most people living within 15 meters radius from the tower will receive 10,000 times stronger signal than required for mobile communication [9]. They indicated also that present threshold limits prescribed by ICNIRP are considered to be rather too generous and are to be reviewed in order to comply with biological limits [10,11,12]. Some published exposure limits in Russia and some eastern European countries have been generally more restrictive than existing or proposed recommendations for exposure developed in North America and other parts of Europe [13].

The purpose of this paper is to selectively measure EM radiation generated by GSM activity and to indicate the magnitude of radiation levels at the source (antennas base stations) and at the distance both in direct and indirect line of sight. One of the main objectives is to establish some residential compliance exposure zones inside the study area in relation with international regulations and standards of GSM radiation limit

## 2. Methods

Assessment of exposure levels can be approached by measurement, by numerical calculation or by electromagnetic software simulation. All these methods have almost similar level of uncertainty and accuracy depending on the method and equipment or software used [14,15].

The methodology is focused on three main directions:

- Identification of a representative residential area with high density of base stations antenna and establishment of measuring sites for HF GSM [900/1800 MHz] radiation
- Power density ($\mu W/m^2$) measurements in selected areas performed with **8GHz RF EMF Strength Meter** only for down-link frequencies of the GSM cellular base stations optimized for 900 MHz, 1800 MHz.
- data analysis and establishment of some residential compliance exposure zones inside the study area. Recorded values will be related to international regulations and standards of GSM radiation limits.

### Study area

Craiova is a medium-sized city located in the south-western part of Romania. Its territory stretches along the Jiu Valley and is located at the contact of Getic Piedmont and Oltenia Plain. The administrative territory covers and area of almost 85 square kilometres and has a relative plane morphology with altitudes varying between 60-120 meters.

In Craiova most GSM base stations antennas are mounted near the residential and office buildings in order to provide with good mobile phone coverage for users. A base station and its transmitting power are designed in such a way that mobile phone should be able to transmit and receive enough signal for proper communication up to a few kilometres. The cell tower transmits in the frequency range of 869 - 894 MHz (CDMA), 935 - 960 MHz (GSM900) and 1805 - 1880 MHz (GSM1800) [16].

For the purpose of this study, it was selected a central territorial unit of Craiova representative for the density of GSM base stations antenna **(fig. 1)**