

Evaluation Of Electromagnetic Fields For Frequencies 900 MHz-1 800 MHz In Tirana

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Abstract: The massive use of mobile phone, as a communication tool nowadays, is accompanied the ever increasing interest of the public and researchers for the possibly impact on human health, as a result of exposure to the electromagnetic fields that accompany these devices. Therefore knowing the level of exposure electromagnetic fields of this electronic equipment has been and will be in the future interest object to the public, and the subject of study for the researchers. In this paper are presents the results of measurements of electromagnetic fields for the frequencies 900 MHz - 1800 MHz, used in mobile telephone in Tirana. These frequencies are included in the area radio frequency (RF) and Microwave (MW) (300 Hz - 300 GHz), in the spectrum of electromagnetic waves and belong to non-ionizing radiation. The measurements were performed in different areas of Tirana. The purpose is to assess the level of exposure electromagnetic fields, especially near areas where mobile antennas are mounted, construction of dynamic digital mapping and comparison with the permitted levels of the exposure defined by the International Commission of Non Ionizing Radiation Protection ICNIRP. Through this publication the aim of the authors is to provide real information and reliable for the population.

Index Terms: radio frequency electromagnetic field and microwave, spectrum of electromagnetic waves, Non-ionizing radiation.

1 INTRODUCTION

The developments of science, advancement of technology is accompanied with the produce and uses the electronic equipment, which have facilitated and modernized the lives of people. Electronic equipment used in radio and television transmissions, in communication and broadcasting the satellite, work with the frequencies that are part in the Radio Frequency (RF) and MicroWave (MW) (300 Hz – 300 GHz), in the spectrum of electromagnetic waves and belong to non-ionizing radiation. Common sources of artificial fields RF include: monitors and video equipment (3–30 kHz), radio AM (30 kHz-3 MHz), radio FM (87-105MHz), mobile telephony (900-1800 MHz), television (47–230 MHz e 470–862 MHz), microwave oven (0,3-3 GHz), the radars, satellite

communication (3 - 30 GHz). In studies on the environmental impact of electromagnetic fields, the spectrum of electromagnetic waves of RF usually divided into: low frequency: from 300 Hz to 10 kHz; and high frequency: from 10 kHz to 300 GHz. Nowadays mobile telephony has become the most important tool of human communication. In order to ensure people service with the quality, mobile phone companies have installed their antennas anywhere, even near residential areas. The presence of numerous antenna, especially near residential areas, of course is accompanied the ever increasing interest of the public and researchers for probably the emergence of adverse effects to human health, that can be caused by exposure to electromagnetic fields associated with these devices. In the current scientific literature, based on numerous laboratory studies in vivo and in vitro, and in epidemiological studies, are presented various reports, and often contradictory. In more than 25 reports of original studies [1] on use of mobile phones and the risk of brain tumours [2], [3], the researchers reported a relatively strong association between use of mobile or cordless phones and an increased risk of brain tumour [4]. While several other studies report no adverse effect on human health [5], [6]. Regardless all these, the exposure to non ionizing radiation is nowadays the main environmental and health concern. Two fundamental issues face each other: the public health care and technological progress. In Albania for the protection of the population and employees apply established norms of the International Commission on Non-Ionizing Radiation Protection (ICNIRP). The aim of the authors in this paper is evaluate the electromagnetic field near areas where are mounted mobile's antennas in Tirana, comparison with the permitted levels of exposure determined by International Commission on Non-Ionizing Radiation Protection (ICNIRP) [7], and giving a real information and reliable for the population.

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2 MATERIAL AND METHODS

Measurements were performed with the instrument C.A 43 Electrical Field Meter (Fig.1).



Fig. 1
CA43 Electrical Field Meter

This is a small device, by which we measure the electric field intensity and power density a source RF that radiates in the frequency band from 100 kHz to 2.5 GHz. The values of the electric field intensity that can be measured by this device vary from 0.1 to 200 V / m, and power density values vary from 0.1 to 2 mW/cm². With this device is possible to measure the intensity of the electric field and power density generated by all mobile operators operating in the area of measurement, without differentiation of any mobile operator. Measurements for evaluating of electromagnetic field, emitted by mobile phone masts are mainly concentrated in the central city of Tirana. The measurements are performed according to a standard procedure, recommended by International Commission on Non-Ionizing Radiation Protection. Determination of area is done depending on the positioning of antennas of the different mobile phone' operators. Measurements were performed in the time interval from 11.00 to 14.30, in which believed to have a peak-call from mobile subscribers. The device used allows to measure the maximum, minimum and average values (AVG) of the electric field intensity (E) and power density (S). The average values (AVG) of two physical sizes (E, S), are averaging of successive measurements, carried out in the time interval of 0.1s during the period of 6 minutes. Based on all European and international standards, values measured in the frequency range 900 MHz - 1 800 MHz must be presented every 6 minutes. Data recorded on apparatus and from here through a connection can be transferred to a PC.

3 LOCATION OF PLACES

Measurements of the intensity values of the electric field and power density of the electromagnetic field RF, are mainly concentrated in the central city of Tirana. To evaluate the

electric field intensity and power density were selected primarily areas near the mobile phone antennas as well as residential areas, with a large number of residents. In fig. 2 are presented the satellite map geographic distribution of the places where measurements are taken in Tirana (Fig.2).

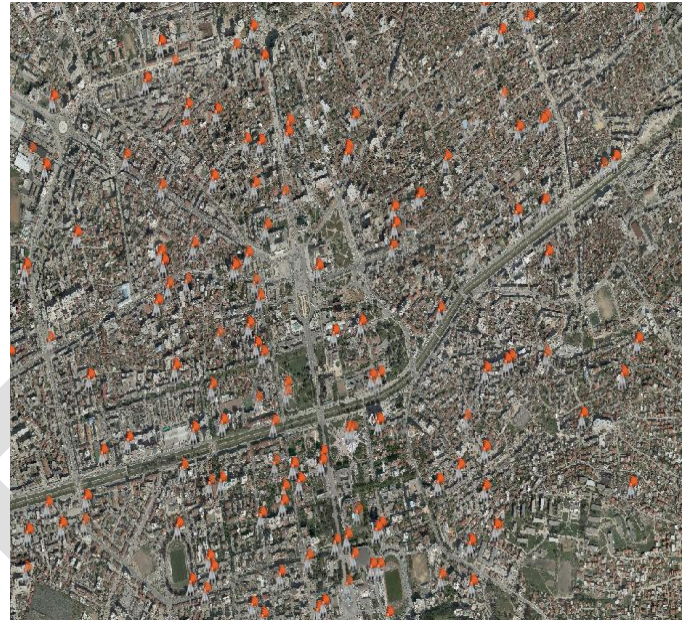


Fig.2. Geographic map of distribution of the places where measurements are taken

Map is obtained through system GIS generated in Google Earth. Measurements of the electric field intensity E (in V/m), and power density (in W/m²) in some areas of Tirana, near the base antennas of the mobile phone, are presented in the tables in Appendix. Measurements were carried out in the time interval 1100 – 1430, with a period of 6 min.

4 THE MEASUREMENTS

From the measured values of the electric field intensity E, is calculated magnetic field intensity H, by the expression:

$$H = \frac{E}{Z}$$

Where: $Z = 377 \Omega$, is characteristic of the environment resistance. The measured values of the electric field intensity E (in V/m), power density (in W/m²) and calculated values of the magnetic field intensity H (in A/m), in some areas of Tirana, near the cellular phone antennas, are compared with reference values set out in the Recommendation of the Council of the European Union and the International Commission on Non-Ionizing Radiation Protection (ICNIRP) in about the population exposure limits to electromagnetic fields (up to 300 GHz). According to the recommendations of reference values for each frequency band used from mobile phone are [Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic and Electromagnetic Fields (Up To 300 GHz) 1998]:

In band GSM 900 Mhz

The intensity of the electric field: $E = 41,25 \text{ V/m}$
 The intensity of the magnetic field: $H = 0,111 \text{ A/m}$
 The power density: $S = 4,5 \text{ W/m}^2$

In band GSM 1800 MHz

The intensity of the electric field: $E = 58,34 \text{ V/m}$
 The intensity of the magnetic field: $H = 0,157 \text{ A/m}$
 The power density: $S = 9 \text{ W/m}^2$

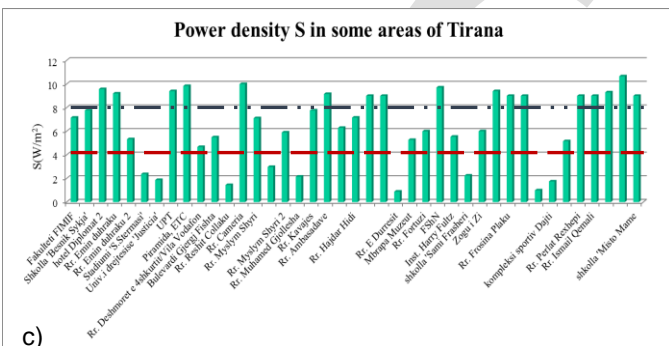
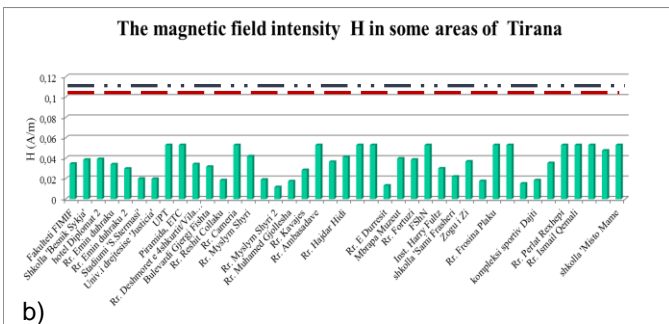
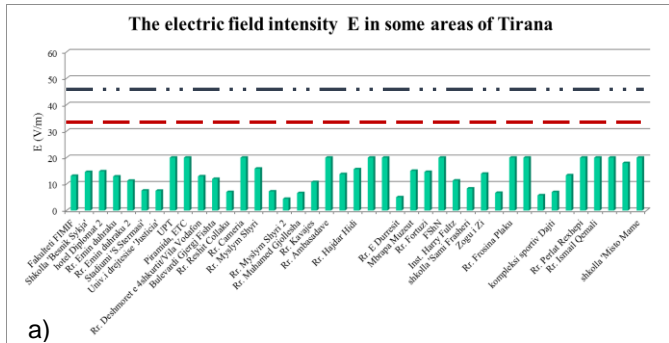


Fig. 3 The results of measurement: (a) electric field intensity E (in V/m); (b) magnetic field intensity H (in A/m); (c) power density S (W/m^2)

In the graphs of Fig.3, are presented values of the electric field intensity E (in V/m), the magnetic field intensity H (in A/m) and power density (in W/m^2), in some areas of Tirana near the stations of the mobile phone. The red and blue lines represent limit respectively for the frequencies 900 MHz and 1 800MHz.

The digital map distribution of the electric field intensity E in some areas of Tirana (a)

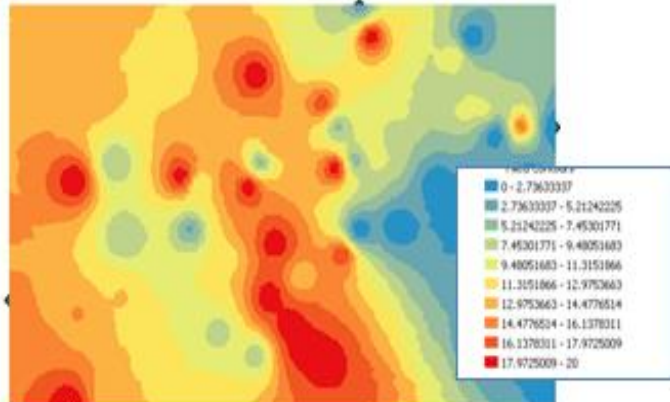
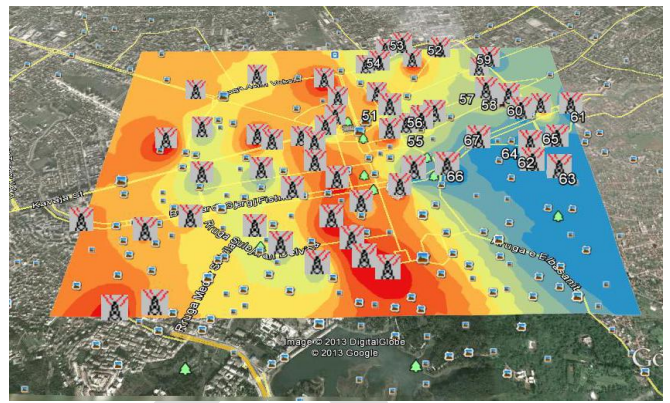


Fig. 4. Digital map of the distribution of (a) the electric field intensity E (V/m); (b) power density S (W/m^2)

In the Fig.4 are presented the digital map distribution of the electric field intensity E and the power density S in some areas of Tirana

5 DISCUSSION AND CONCLUSION

By comparing the measured values of electromagnetic fields near areas where are mounted antennas mobile in some areas of Tirana, with the levels recommended by the ICNIRP can say that:

- the intensity E of the electric field, near areas where are mounted antennas mobile in Tirana, are within values of allowed, sometimes even lower than the recommended level for frequencies 900-1 800 MHz (for frequency 900 MHz, $E = 41.45 \text{ V/m}$ and for frequency 1 800 MHz, $E = 58.34 \text{ V/m}$);
- the intensity H of the magnetic field, near areas where are mounted antennas mobile in Tirana, are within values of allowed, sometimes even lower than the recommended level for frequencies 900-1 800 MHz (for frequency 900 MHz, $H = 0.111 \text{ A/m}$ and for frequency 1800 MHz, $H = 0.157 \text{ A/m}$).
- power density of electromagnetic field near areas where are mounted antennas mobile in Tirana, is near the borders of the allowed values, has even areas where there passed this level. Although the measurements results that the level of power density in some areas of Tirana has passed the somewhat the level determined by the ICNIRP, probably

requires special attention and the constant repetition of measurements, so that confident in the results are given and provide a more reliable information to the public

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APPENDIX:

Measurements of the electric field intensity E (në V/m), and power density (në W/m²) in some areas of Tirana, near the base antennas of the mobile phone, are presented in the following tables.

N R	Places	IntensityE (V/m)			Power density (x10 ⁻² W/m ²)		
		Min.	Max	AVG	Min.	Max	AVG
1	Fakulteti FIMIF	6.67	20	13.12	115.4	2000	715
2	Rr. I.Tomini	8.19	20	14.59	122.4	1436	779
3	Hotel Diplomat2	7.37	20	14.83	387	2000	957
4	Rr. E.Duhraku	11.88	13.89	12.88	563	2000	2000
5	Rr. E.Duhraku2	5.24	17.23	11.27	87.1	1286	533
6	Stad:S.Stermasi	5.4	15.98	7.56	14.6	633	237
7	Univ.'Justicia'	3.49	13.68	7.49	30.9	782	187.5
8	UPT	20	20	20	2000	2000	2000

9	Piramida,EC T	1473	20	20	1025	2000	1884
10	Vila Vodafone	6.89	20	12.94	174.2	1142	467
11	Bulevardi Gj.Fishta	5.19	20	11.96	16.4	2000	549
12	Rr.R.Collaku	2.46	15.55	7	23.3	578	144.7
13	Rr.Cameria	20	20	20	2000	2000	2000
14	Rr. M.Shyri	5.8	20	15.86	131.3	2000	711
15		1.24	20	7.22	16.9	868	298
16	Rr. M.Shyri2	1.57	14.9	4.42	6.2	363	590
17	Rr. M.Gjollasha	2.22	14.35	6.6	6.1	2000	216
18	Rr. Kavajes	3.25	20	10.76	93.1	2000	777
19	Rr. Ambasadave	7.46	20	20	4.61	2000	1816
20		6.22	20	13.79	452	1018	629
21	Rr. H.Hidi	1.28	20	15.63	43	2000	716
22		20	20	20	2000	2000	2000
23		20	20	20	2000	2000	2000
24	Rr. Duresit	2.07	9.58	5.03	30.8	333	88.7
25	Mbrapa Muzeut	7.77	20	15.02	215	1196	527
26	Rr. Fortuzi	4.42	20	14.6	141.7	1523	600
27	FShN	9.58	20	20	124.9	2000	1671
28	Inst.H.Fultz	3.94	20	11.34	66.8	1582	554
29	Shkolla S. Frasherri	2.28	17.35	8.33	54.2	1011	225
30	Zogu i Zi	8.05	20	13.93	231	1197	601
31		3.44	11.93	6.68	27.4	399	1140
32	Rr.F.Plaku	20	20	20	2000	2000	2000
33		20	20	20	2000	2000	2000
34		1.32	13.43	5.75	7.4	263	100
35	Komp. sportiv Dajti	1.24	20	6.98	29.3	480	174.8
36		4.36	20	13.34	257	1229	516
37	Rr.P.Rexhepi	1.24	20	20	435	2000	2000
38	Rr.I.Qemali	20	20	20	2000	2000	2000
39		20	20	20	2000	2000	2000
40		2.56	20	17.95	516	1940	1066
41	Shkolla M. Mame	2.27	20	20	2000	2000	2000
42	Rr. E Dibrës	1,25	18,98	7,44	33,2	814	267
43	Medreseja	3,15	20	9,04	42,8	875	250
44	Rr. Ferit Xhajko	14,84	20	20	690	2000	2000
45	Rr. Siri Kodra	1,24	15,51	5,61	14,4	1130	116,7
46	Rr. Sh. Dishnica	4,47	20	12,24	192,4	2000	750
47	Tregu "A.	4,89	20	11,2	6,6	2000	467

	Rustemi"			4			
48	Rr. Qemal Stafa	4,63	18,0 6	11,3	213	1350	550
49	Rr. Hoxha Tasim	3,25	13,2 4	8,35	69,3	1268	305
50	Rr. Bardhyl	5,59	20	16,7 1	280	2000	971
51	Brryli	1,49	16,1 7	6,4	7,2	1034	87,2
52	Materniteti "K. Glozheni	1,28	20	11,4 4	242	1647	308
53	Rr. T.Shkurti	1,24	5,23	3,02	6,8	128, 5	25,5
54	Rr. H. Mara	1,36	20	9,61	66,9	2000	140 9
55	Rr. E Elbasanit	3,69	20	10,2 3	3,8	2000	334
56	Shkolla "1 Maji"	1,24	20	8,2	30,8	2000	378
57	P. Mani Karburant"	1,53	20	8,9	9,2	2000	438
58	Fusha "Ali Demi	1,58	20	10,4 9	14,3	1875	670