

Field measurements in urban and suburban environments

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Abstract

In this thesis, the level of the electromagnetic radiation was studied in urban, suburban and rural environments in the area of Tripolis. The results were compared to the exposure limits set by the Greek legislation and to those proposed by the Bio-Initiative report.

Measurements setup

The Narda SRM-3000 Selective Radiation Meter (SRM) was used for the measurements (see Fig. 1).



Fig. 1: The Narda SRM3000 [5].

Initially, we used the SRM in Spectrum Mode (see Fig. 2) and by driving along specific routes around Tripolis we were able to determine locations with high field measurement. After evaluating these first results, we chose some specific places of interest: (a) places with increased radiation levels, and (b) places with special interest to the public such as schools and hospitals. A total number of nineteen (19) places were selected (see Fig. 3). Each measurement lasted six (6) minutes according to [6].

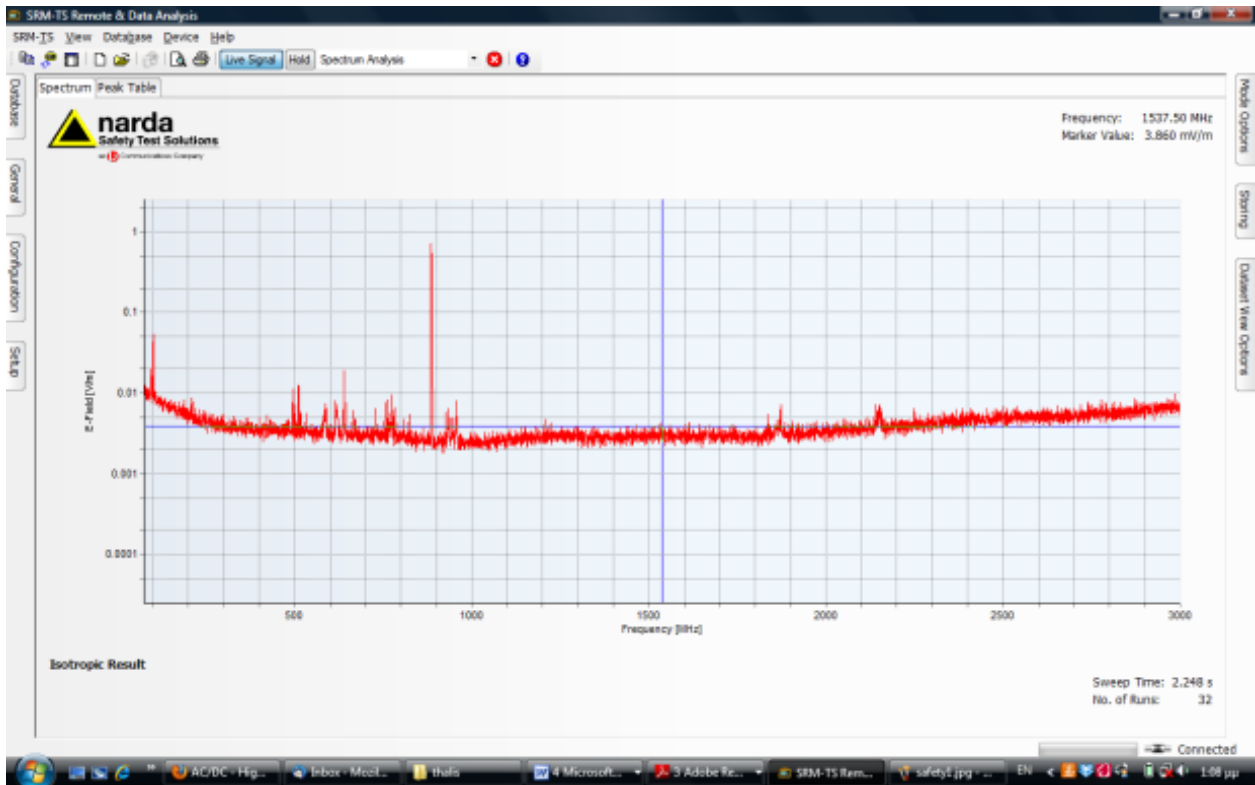


Fig. 2: The spectrum mode of the Narda unit. This measure was in the lab to test the spectrum mode option.

The following table summarizes the frequency bands considered during our measurements.

	Service Name	Lower Frequency [Hz]	Upper Frequency [Hz]
1	Undefined	75000000	87500000
2	FM - RADIO	87500000	108000000
3	TV-VHF	108000000	230000000
4	Undefined	230000000	400000000
5	TETRA	400000000	470000000
6	TV - UHF	470000000	885000000
7	GSM 900	885000000	960000000
8	Undefined	960000000	1710000000
9	GSM 1800	1710000000	1885000000
10	UMTS	1885000000	2200000000
11	Undefined	2200000000	2400000000
12	WIFI- RLAN	2400000000	2483500000
13	Undefined	2483500000	3000000000

Table 1: Frequency Bands supported by Narda SRM



Fig. 3: The map of Tripolis and the points of interest.

In the final stage of our work, we narrowed our interest to the “sensitive” areas for the public (e.g. schools, hospitals) that showed increased levels of electric field strength. For these places we performed two additional 60 minutes measurements, one at 10:00 and one at 13:00 (peak hour). Again the average and the maximum value were considered for each band from 75 to 3000 MHz.

Results

In Fig. 4, an indicative measurement held at the Panarkadiko Hospital in Tripolis (see pin No 07 in Fig. 3) is shown. The main source of E/M radiation is clearly the GSM 900 that is used for cellular coverage.

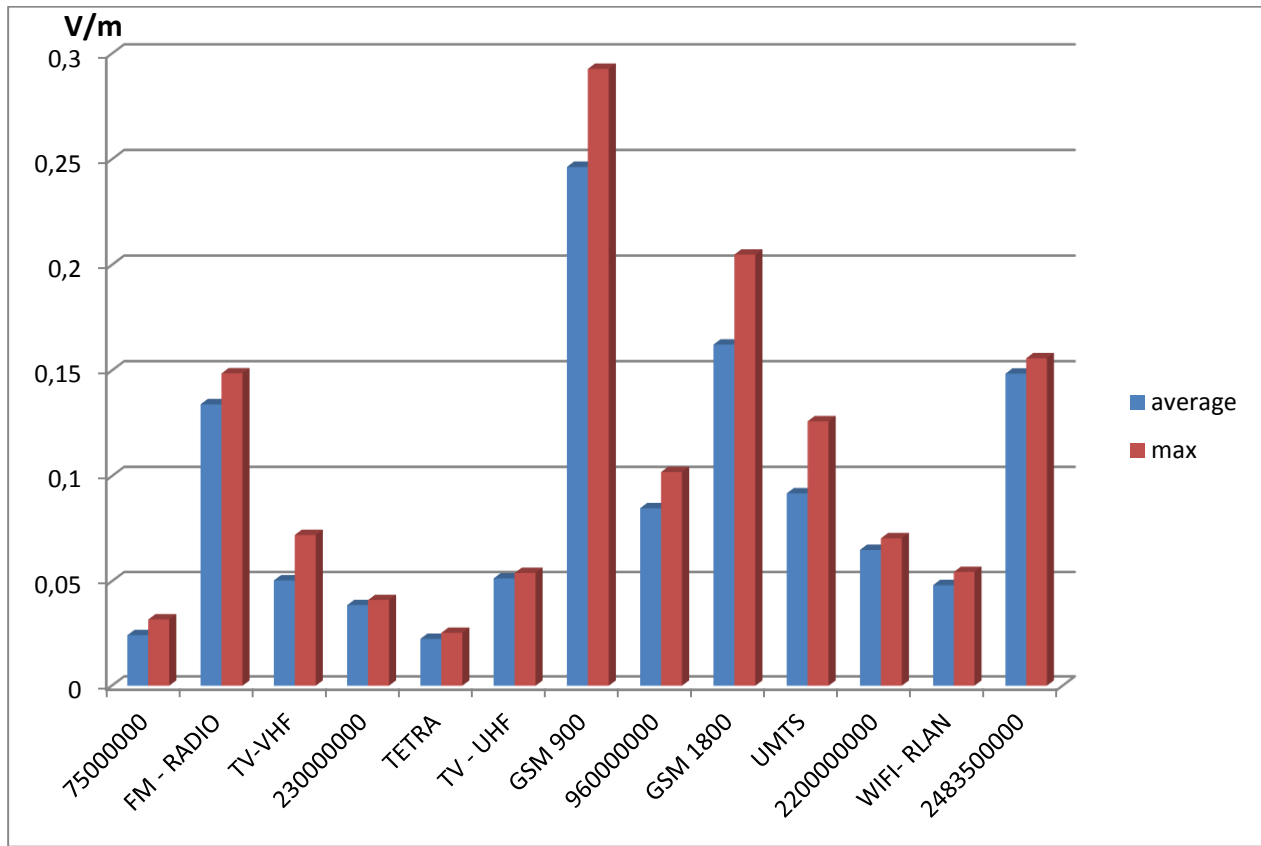


Fig. 4: The average and maximum value of electromagnetic radiation in V/m near Panarkadiko Hospital of Tripolis.

Our results were compared to the exposure limits set by the Greek legislation [1] and to those proposed by the Bioinitiative report [2].

Table 2 shows the 19 regions where measurements took place. The 1st and 2nd columns describe to point of interest (Fig.3), the 3rd column shows the maximum average value that was measured along with the corresponding band. Note that the most E/M “polluted” band of each point of interest differs. In the next column there is the limit by the Greek legislation for the specific frequency band. The 5th column shows the SRM measurement for the entire bandwidth (75MHz-3GHz) and the same information is depicted in Fig. 5. while the last column shows the exposure limit set by the Bioinitiative Report.

Pin (Fig.3)	Name	Measurement (V/m) Max Value (per Band)	Exposure Limit according to Greek Legislation	Measurement (V/m) Entire SRM Bandwidth(75MHz -3GHz)	Exposure Limit according to BioInitiative Report (V/m)
1	Ag. Vasileiou	1.007-GSM 1800	49.9	1.462	0.614
2	Kolokotroni	0.624-GSM 900	35.6	0.838	
3	Hondos Center	4.033-GSM 1800	49.9	5.918	
4	KEP	0.734-GSM 1800	47.6	0.745	
5	OTE 1	0.496-GSM 1800	49.9	0.558	
6	OTE 2	1.120-GSM 1800	49.9	1.163	
7	Hospital	0.246-GSM 900	35.6	0.397	
8	8th kindergarten	0.150-(2483,5-3GHz)	51	0.242	
9	4th kindergarten	0.148-(2483,5-3GHz)	51	0.294	
10	stadium	0.149-(2483,5-3GHz)	51	0.294	
11	stadium (back)	0.220-GSM 900	35.6	0.368	
12	1st high school	0.149-(2483,5-3GHz)	51	0.240	
13	playground	0.627-(960-1710)	47.6	0.644	
14	2nd high school los	0.170-GSM 900	35.6	0.317	
15	2nd high school nlos	0.149-(2483,5-3GHz)	51	0.236	
16	IKA	0.149-(2483,5-3000)	51	0.258	
17	St George's forest	0.167-FM-RADIO	0.3	0.223	
18	Industrial Zone	0.360-GSM 1800	49.9	0.471	
19	university	0.297-FM-RADIO	0.3	0.382	

Table 2: Measurements and Exposure Limits

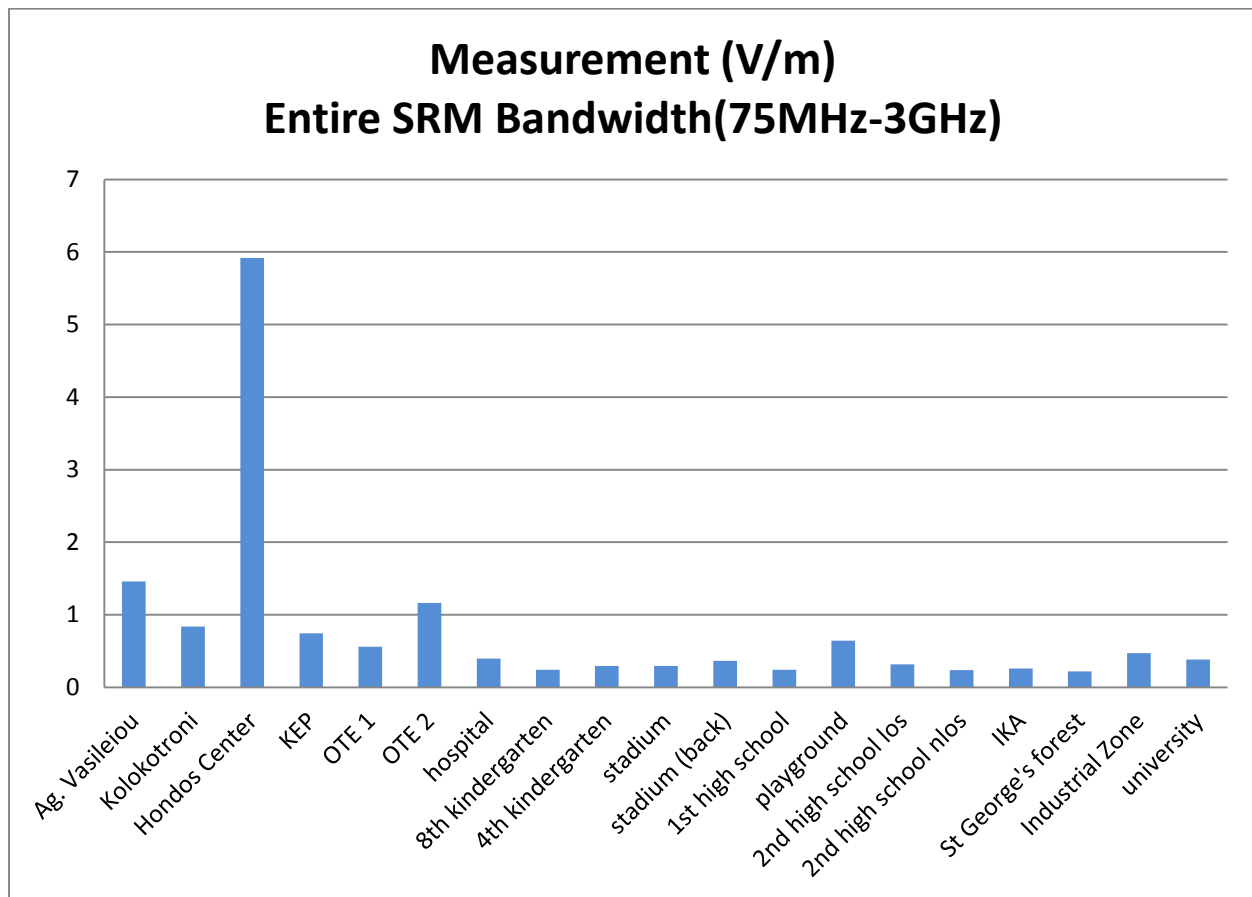


Fig. 5: The E field measurement for the entire SRM bandwidth.

Conclusions

The highest level of radiation was detected in urban environment (pin:3, label:Hondos Center). However, even in this location the measured E field was comfortably less than the limit set by the Greek laws. On the other hand, in 6 of the 19 locations the measurement we took was higher than the limit proposed by the Bioinitiative Report and 5 of them can be found in the urban section of Tripolis.

References

- [1] EEAE, <http://www.eeae.gr/gr/index.php?pvar=php/ni/ni&map=ni0>
- [2] Bioinitiative report, BioInitiative 2012 Report Issues New Warnings on Wireless and EMF.
[OnLine: <http://www.bioinitiative.org/media/press-releases/>]
- [4] Ελληνική Επιτροπή Ατομικής Ενέργειας ΕΕΑΕ, Έκθεση μετρήσεων των επιπέδων της υψίσουχνης ηλεκτρομαγνητικής ακτινοβολίας σε διάφορες θέσεις στο περιβάλλον σταθμών βάσης κινητής τηλεφωνίας στο Δήμο Ιλίου του Ν. Αττικής, 2012
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[6] ICNIRP Guidelines For Limiting Exposure to Time-Varying Electric, Magnetic and Electromagnetic Fields (up to 300 GHz).

[OnLine: <http://www.icnirp.org/cms/upload/publications/ICNIRPemfgdl.pdf>]