11TH INTERNATIONAL SCIENTIFIC CONFERENCE
ON DEFENSIVE TECHNOLOGIES
OTEH 2024
Serbia, Tara, 9-11 October 2024

DETERMINATION OF ELECTROMAGNETIC FIELD STRENGTH IN AREAS OF INCREASED SENSITIVITY AROUND RADIO TRANSMITTERS

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Abstract: *In the modern world, electromagnetic radiation has become very intense, so there is no space on the planet that it does not reach. Thus, the living world and people are continuously exposed to these radiations of different frequencies and wavelengths. In the last thirty years, numerous tests have been carried out in the world's most reputable laboratories, but so far no direct evidence has been found that these radiations are harmful to the human body, unless it is about radiation at small distances from the radiation source. The rapid development of electronic devices and equipment leads to the fact that people live and technical devices function in an environment where electromagnetic interference (EMI - Electromagnetic Interference) is increasingly pronounced. The presence and influence of electromagnetic fields is very harmful to human health. That's why the paper discussed tests to reduce the presence and influence of electromagnetic fields on the human body.*

Keywords*: electromagnetic radiation, non-ionizing radiation, ionizing radiation, test point, electric field.*

1. INTRODUCTION

Knowledge of radiation existed far in the past. Normally, at that time only the influence of natural radiation was taken into account. Although the people of that time were probably not even aware of what kind of radiation they were, and even gave them some supernatural properties and called them various names, such as "demon door", "devil's field" and the like, they were still aware of their negative impact on human life. health. They tried to protect themselves from the aforementioned radiations by avoiding places where there was a large amount of natural radiations, observing the relationship between animals and plants in selected places, trusting various fortune tellers, seers and talisman records. Unfortunately, part of this tradition, due to the low technical culture, has been retained by certain layers of the citizenry to this day. "When man is unable to understand natural phenomena, he tends to give them supernatural properties" Albert Einstein. Radiation is the transfer of energy via a particle or wave. Radiation transmitted by particles (neutrons, protons, mesons, etc.) is called corpuscular radiation, and that transmitted in the form of waves is called electromagnetic radiation. Electromagnetic radiation represents a change in the electromagnetic field as a function of time. This radiation is the carrier of electromagnetic interaction (force) and can be interpreted as a wave or as a particle, depending on the case. Particles that quantify electromagnetic radiation are photons. Each charge generates an electromagnetic field by changing the speed of movement. This information spreads through space at the speed of light and the properties of the corresponding electromagnetic wave are directly related to the dynamics of the change in charge movement. Alternatively, if we look at electromagnetic radiation as the emission of particles (photons), the energy they carry is directly related to the wavelength, that is, the frequency of the waves. The higher the frequency, the higher the energy of the photon. The exact relationship is described by Planck's relation E= hν where E is the energy of the photon, h is Planck's constant, and ν is the frequency of the wave. The properties of electromagnetic radiation depend on its wavelength and as such are divided into electric, radio and microwaves, then infrared, visible and ultraviolet light, X-rays and gamma rays. The entire range of wavelengths of electromagnetic radiation is called the electromagnetic spectrum.

The presence and influence of electromagnetic fields is very harmful to human health. With the intention of controlling and reducing electromagnetic interference to the smallest possible extent, a large number of standards have been adopted in the world to regulate this area.
The European Committee for Electrotechnical Standardization (CENELEC - European Committee for Electrotechnical Standardization) issued a document entitled "Human exposure to electromagnetic fields - High frequency (10 kHz to 300 GHz)" (ENV 50166-2) on November 30, 1994.

In addition to this document, there are other internationally adopted standards in this area (IRPA - International Committee for Non-Ionizing Radiation, IEC - International Electrotechnical Commission, IEEE - Institute of Electrical and Electronics Engineers, CISPR - Comite International Special des
Pertuations Radioelectrique).

JUS N.NO.205 - in the range from 30 MHz to 300 GHz, the norm for the general human population is 2 W/m2, i.e. 27.45 V/m.

The GSM system operates in the 900 MHz band (UHF

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DOI: 10.5937/OTEH24077M

band). The increased concentration of electromagnetic energy in this range causes effects on people that can be roughly classified into two basic categories:
- Thermal effects
- Stimulant effects

The intensity of the mentioned effects increases with the increase in the concentration of electromagnetic energy. As the distance from the radiation source increases, the impact of electromagnetic emission on the human body decreases. The influence of electromagnetic waves on the human body has a cumulative character. Their impact is directly proportional to the length of the exposure.

2. TERMS AND DEFINITIONS

Electric field strength - a vector quantity (E) that corresponds to the force exerted on a charged particle regardless of its movement in space, expressed in volts per meter (V/m).

Reference limit levels - levels of exposure of the population to electric, magnetic and electromagnetic fields that serve for practical assessment of exposure, in order to determine whether there is a probability that the basic limits will be exceeded. Reference limit levels are defined in the Rulebook on limits of exposure to non-ionizing radiation (Official Gazette RS No. 104/09).

Reference (limit) value (V/m) – Reference limit level of electric field strength for a certain frequency in accordance with Tab. 2 of the Rulebook on limits of exposure to non-ionizing radiation (Official Gazette of the RS No. 104/09).

Test location – Physical space where the test was performed. Most often, it is the location of the radio transmitter / radio base station, with its immediate surroundings (typically from 0 to 150m distance).
Test point - The position, typically in the vicinity of the radio transmitter, where the measuring antenna is placed and where the level of the electromagnetic field is measured.

Measured electric field strength – Electric field strength measured at the test point using measuring equipment. It is expressed in volts per meter (V/m).

Maximum (extrapolated) electric field strength – The maximum electric field strength that the source can generate in real operation, calculated based on the measured value and source parameters (N- number of channels (GSM), i.e., N-power coefficient (UMTS, CDMA, LTE) It is presented primarily for GSM, UMTS and CDMA sources, whose field strength depends on the current traffic (number of users).

$$Emax = E\sqrt{N} \quad (1)$$

In the case of LTE sources (in accordance with SRPS EN 50492, Annex L.), the maximum electric field strength is:

$$Emax = \sqrt{\frac{Nrs}{BF}}\sqrt{Ers\_PORT1^2 + Ers\_PORT2^2} \quad (2)$$

Ers_PORT1 – measured electric field strength value for antenna port 1 (RS – Reference Signal)

Ers_PORT2 - measured value of electric field strength for antenna port 2 (RS - Reference Signal)

BF - Power Boosting Factor

Nrs – the ratio of the maximum total output power of the base station to the reference signal power of the base stations.

Total electric field strength - Total electric field strength (measured or maximum) at a certain point calculated on the basis of all measured / maximum values at individual frequencies:

$$Esum = \sqrt{E^2 1 + E^2 2 + \cdots + E^2 n} \quad (3)$$

Exposure factor - The estimated human exposure parameter at a specified location for each operating frequency of a radio source, expressed in relation to the corresponding limit value. If the electric field strength is measured, the exposure factor is equal to the ratio of the square of the electric field strength and the square of the reference value:

$$\text{Exposure factor} = \frac{E^2}{E^2\ ref} \quad (4)$$

E – electric field strength at a certain frequency
$Eref$ – limit value of electric field strength at a certain frequency

Total exposure factor - The maximum value of the sum of the exposure factors of the equipment under test and all relevant sources in the frequency range 100kHz - 40GHz.

3. TEST METHODS

The examination method is based on the following standards:

- SRPS EN 50400:2008/A1:2013, - SRPS EN 50492:2010
- SRPS EN 50492:2010/A1:2014, - SRPS EN 50413:2010
- SRPS EN 50413:2010/A1:2014, - SRPS EN 50383:2012
- SRPS EN 50383:2012/AC:2013, - SRPS EN 5042:2008
- SRPS EN 61566:2009

In order to ensure the maximum relevance of the results, the determination of the zones that are most exposed to the electromagnetic field is carried out using:
-Calculation:
a. the area at ground level where the maximum field is expected is determined
b. the most exposed floors of the building are determined
- On-site measurements:
c. the spatial distribution of the field is determined
d. the most exposed zones are determined (the most exposed apartments, terraces or outdoor location)
e. points of maximum field are determined

The calculated exposure factor refers to the peak field values at the maximum field point, which the source can generate in the worst case within its operating conditions, in accordance with SRPS EN 50400 and SRPS EN 50383.

In the case of the need for a detailed examination of the level of exposure to high-frequency non-ionizing radiation within a certain space, a six-minute spatial averaging procedure is applied to assess the exposure of the whole body in accordance with SRPS EN 50492, which is described in detail in the internal document "TU-IEM-VF Methodology of testing high-frequency EM fields".

4. MEASURING EQUIPMENT

In accordance with the requirements of the SRPS EN 61566 t6.2.3 and SRPS EN 50492 t8.2 standards, when measuring in complex field conditions (there are signals from multiple sources of different/unknown directions and polarizations), it is mandatory to use an isotropic measuring probe. The applied measuring instruments meet the technical conditions prescribed by these standards.

The frequency range (27MHz - 3GHz) of the equipment for frequency selective measurement enables the measurement of all relevant high-frequency signals and the precise determination of total exposure:

Table 1. Frequency range

Radio FM	TV VHF DVB-T2	CDMA	TV UHF DVB-T2	LTE 800	GSM/UMTS 900	GSM/LTE 1800	UMTS 2100
87 – 109	174 -230	420 – 430	470 – 790	791 -821	935 - 960	1805 -1880	2110 -2170 MHz

Broadband measurement (100kHz - 8GHz) and Frequency selective measurement (27 MHz - 3GHz) is carried out using the following measuring equipment:

Figure 1. Broadband instrument for measuring electric field strength and spectrum analyzer

4.1 Location description

The radio base station "NP37/NPU37 Sjenica 2", of the mobile operator Tekekom Srbija, is located within a business building, at Milorad Jovanovića bb, in Sjenica. The Ericsson RBS2116 radio base station is used for coverage in the GSM900 range, and the NSN Flexi base station in the UMTS2100 range. The RBS cabinet is located in a room in the attic of the building in question. The transceiver configuration is 2+2+4 for the GSM900 system and 2+2+2 for the UMTS2100 system. The antenna system is three-sector with azimuths 10°/120°/260°, respectively by sector. It consists of a total of 3 panel antennas, manufactured by Kathrein, in each of the sectors, one type 80010485, (which works in the bands of 880 - 960 MHz and 1920 - 2180 MHz). The height of the antenna bases from the ground level is 16.0m, for all sectors. The antennas are located on the support, on the roof of the building in question. Electrical tilts, respectively by sector, amount to 6°/6°/6° for the GSM900 system and 4°/4°/4° for the UMTS2100 system. Mechanical tilts, respectively by sectors 0°/0°/0° for both systems. The location also houses the equipment of the mobile operator Telenor.

Table 2. Equipment data

GSM900

Sector designation		NP37D1	NP37D2	NP37D3
Cabinet			*Ericsson* 2116	
Carrier configuration[1]		2	2	4
Transmitter output power[2][W]		40	40	18
Transmitter serial number[3]		/	/	/
Antenna type		K 800 10485	K 800 10485	K 800 10485
Antenna heigh [m]		16.0	16.0	16.0
Azimuth (°)		10	120	260
Tilt	Electric tilt(°)	6	6	6
	Mechanical tilt(°)	0	0	0
Feeder type		½"	½"	½"
Feeder length [m]		15	15	15

UMTS2100

Sector designation		NPU37A,I	NPU37B,J	NPU37C,K
Cabinet			*NSN Flexi*	
Carrier configuration [4]		2	2	2
Transmitter output power[5][W]		20	20	20
Transmitter serial number[6]		/	/	/
Antenna type		K 800 10485	K 800 10485	K 800 10485
Antenna heigh [m]		16.0	16.0	16.0
Azimuth (°)		10	120	260
Tilt	Electric tilt(°)	4	4	4
	Mechanical tilt(°)	0	0	0
Feeder type		½"	½"	½"
Feeder lenght [m]		15	15	15

Table 3. Environmental conditions

Examination time	Temperature (°C)	Air humidity (%)	Weather conditions
15:00 – 19:30 (28.09.2016)	18.9	51	sunny
09:00 – 09:30 (29.09.2016)	18	40	sunny

In order to minimize the influence of the environment on the results, when measuring, the measuring antenna is at least 1m away from reflective surfaces (if there are sources below 300MHz), or 0.5m (if all sources are above 300MHz).
During the detailed test, the operator is not present near the measuring antenna.

4.2 Identification of sources of electromagnetic radiation

Based on data from the RATEL (Republic Agency for Electronic Communications) database, the following sources of electromagnetic radiation were registered in the immediate vicinity of the test location (up to 150m away):

Table 4. Registered sources of EM radiation

Operator	Frequency	Location
Telekom Srbija	939.5000 MHz - 949.1000 MHz	SJENICA,M.JOVANOVIĆA nn. ,KP 754
	2125.0000 MHz - 2140.0000 MHz	SJENICA,MILORADA JOVANOVIĆA nn.
	23331.0000 MHz	MIL. JOVANOVIĆA NN., KP 754, NP37
Telenor	1805.1000 MHz - 1815.1000 MHz	SJENICA,M.JOVANOVIĆA nn.
	949.3000 MHz - 958.9000 MHz	SJENICA,M.JOVANOVIĆA nn.
	2110.0000 MHz - 2125.0000 MHz	SJENICA,MILORADA JOVANOVIĆA nn.
	949.3000 MHz - 958.9000 MHz	MILORADA JOVANOVIĆA nn.
	23142.0000 MHz	MILORADA JOVANOVIĆA nn.
	2110.0000 MHz - 2125.0000 MHz	MILORADA JOVANOVIĆA nn.
Radio AMARO	94.5000 MHz	SJENICA

By checking the RATEL database, it was determined that there are no sources in the 100kHz - 30MHz and 3GHz - 6GHz bands in the vicinity of the test site.
In the vicinity of the location, there are directed radio links of the mobile operator Telekom Srbija (23GHz) and Telenor (23GHz).

4.2 Visual inspection

A visual inspection identified the registered sources of electromagnetic radiation from the RATEL database:

OBSERVED SOURCE – Telekom Srbija & Telenor antenna system (SJENICA,MILORADA JOVANOVIĆA nn.)	*OBSERVED SOURCE – The radio AMARO antenna system (SJENICA)*

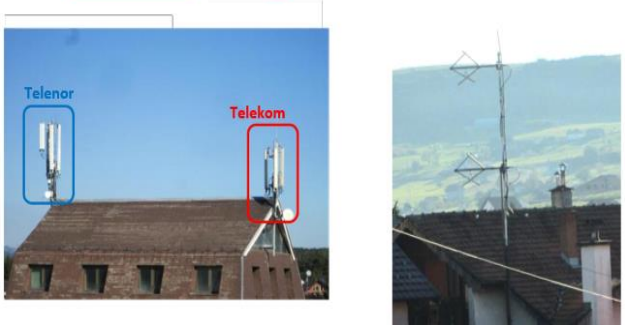


Figure 2. Registered sources of EM radiation

5. DETERMINATION OF THE DOMAIN OF EXAMINATION

The relevant testing domains include zones of increased sensitivity (In accordance with the definition from the "Regulations on limits of exposure to non-ionizing radiation" Official Gazette RS 104/09) located in the directions of radiation and in the immediate vicinity of the antennas of the tested radio transmitter. For tall objects (buildings) the range of the most exposed heights / floors is determined. These are the parts of the building that are in the direction of the antenna's direct radiation beam or closest to it. The following objects / zones of importance for the investigation were observed at the location:

Table 5. Objects of importance for testing

No.	Description of the residental buildong / residental zone	Distance from the transmitter (m)
D1	Objects and surroundings of the site at ground level, in the direction of the third sector of the azimuth 260°	Up to 150m
D2	Objects and surroundings of the site at ground level, in the direction of the third sector of the azimuth 120°	Up to 150m
D3	Objects and surroundings of the site at ground level, in the direction of the third sector of the azimuth 10°	Up to 150m
D4	Elementary school „12. Decembar" (Nova nn)	od 50-200m
D5	Object SP0 (Milorada Jovanovića nn)	/

All results of the preliminary scan represent current measured field values and refer exclusively to the period in which the measurement was made.

5.1 Preliminary scan indoors-exposed objects

In each exposed object, a preliminary scan of the electric field strength is performed in the rooms, in order to determine the distribution of the field and to determine the zone-room in which the field is maximum. The results of this scan are given in the table:

Table 6. preliminary scan of closed space

Mark	Date	Desctription of the test zone	E_mean value (V/m)[11]	E_max (V/m)[12]
D1-1	28.09.2016.	Building under construction SP02, III floor, planned terrace of the apartment	2.59	2.92
D1-2		Building under construction SP02, III floor, planned living room	1.80	2.42
D2-1		Object S17 (Milorada Jovanovića No. 14), III floor, apartment 14, terrace	3.47	4.37
D2-2		Object S17 (Milorada Jovanovića No.14), III floor, apartment 14, living room	0.57	2.37
D3-1		Object S02 (Ahmeta Abdagića No. 52), IV floor, apartment 22, terrace	2.26	2.87
D3-2		Object S02 (Ahmeta Abdagića No. 52), IV sprat, stan22, living room	1.02	1.16
D4-1		Elementary school „12.decembar" (Nova nn), II floor, chemistry classrom	0.55	0.68
D4-2		Elementary school „12.decembar" (Nova nn), I floor, classrom 14.	0.45	1.90
D4-3		Elementary school „12.decembar" (Nova nn), II floor, corridor	1.16	2.43
D4-4		Elementary school „12.decembar" (Nova nn), II floor, classroom 10	0.08	1.41
D4-5		Elementary school „12.decembar" (Nova nn), ground floor, TIO classroom	0.71	0.90
D4-6		Elementary school „12.decembar" (Nova nn), ground floor , sports hall	0.23	0.50
D4-7		Elementary school „12.decembar" (Nova nn), ground floor, classroom 5	0.75	1.21
D4-8		Elementary school „12.decembar" (Nova nn), ground floor, classroom 3	0.60	1.26
D4-9		Elementary school „12.decembar" (Nova nn), ground floor , classroom 1	0.47	0.88
D4-10		Elementary school „12.decembar" (Nova nn), ground flooor, Serbian language classrom	1.78	2.14
D5-1	29.09.2016.	Object SP0 (Milorada Jovanovića nn), IV floor, office 11	1.41	1.69
D5-2		Object SP0 (Milorada Jovanovića nn), IV floor, Office 10	1.67	1.77
D5-3		Object SP0 (Milorada Jovanovića nn), IV floor, corridor	1.06	1.40

[11] Mean measured strength of el. fields in the range 100kHz - 8GHz

[12] Maximum measured strength of el. fields in the range 100kHz – 8GHz

5.2 Preliminary scanning in an open area-suburban residential zone, surroundings of the transmitter

The distribution of the electric field in the vicinity of the location is determined by scanning the space with a broadband instrument for measuring the strength of electricity. fields (in the range 100kHz - 8GHz). The results of the preliminary broadband test in an open space are shown in the following picture:

Figure 3. Spatial distribution of the field in the vicinity of the antenna system

6. TEST RESULTS AT MAXIMUM FIELD POINTS

Based on the results of the preliminary scan, the most exposed zones were determined. In the general case, a precise location of the point of the maximum field was additionally carried out within each selected test zone in a closed space. At the selected position in the open space, a broadband measurement is performed at three heights and the most exposed height is determined at which frequency selective measurement is performed in order to determine the field level from individual sources in detail, as well as to estimate the total exposure.

Figure 4. Positions of test points

Test point T1

Measurement start time:	15:51 (28.09.2016)	GPS Lat:	/	GPS Lon:	/
Position of the point:	Building under construction SP02, III floor planned terrace of the apartment				

Distance from reflective objects				Local environmental conditions			
The wall	ceiling	Metal fence	vehicles	Other	Leaves	Moist soil	People	other
1.2m	2.5m	-	-	-	ne	ne	ne	-

Local electromagnetic field sources present:	Fluo bulbs	WiFi	Phone	Microwave	TV/comp.
is there?	no	no	no	no	no
Active during measurment?	no	no	no	no	no


Broadband measurment 100kHz – 8GHz:	The most exposed heigh (m)	1.5	Esr (V/m)	2.59

Test point T2

Measurement start time:	16:07 (28.09.2016)	GPS Lat:	/	GPS Lon:	/
Position of the test point:	object S17 (Milorada Jovanovića No. 14), III floor, apartment 14, terrace				

Distance from reflective objects					Local environmental conditions			
wall	cealling	Metal fence	vehicles	other	leaves	Moist soil	people	other
1m	1m	1m	-	-	no	no	no	-

Local electromagnetic field sources present:	Fluo bulbs	WiFi	phone	microwave	TV/comp.
Is there?	no	no	no	no	no
Active during measurmen?	no	no	no	np	no


Broadband measurment 100kHz – 8GHz:	The most exposed heigh (m)	1.5	Esr (V/m)	3.47

Test point T3

Measurement star time:	16:31 (28.09.2016)	GPS Lat:	-	GPS Lon:	-
Position of the point:	Object S02 (Ahmeta Abdagića 52), IV floor, apartment 22, terrace				

Distance from reflective objects					Local environmental conditions			
wall	cealing	Metal fence	vehicles	Other	Leaves	Moist soil	people	other
1m	1m	1m	-	-	no	no	no	-

Local electromagnetic field sources present:	Fluo bulbils	WiFi	phone	microwave	TV/comp.
Is there?	no	no	no	no	no
Active during measurment?	no	no	no	no	no

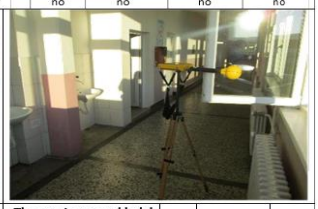

Broadband measurment 100kHz – 8GHz:	The most exposed heigh (m)	1.5	Esr (V/m)	2.26

Test point T4

Measurement start time:	17:47 (28.09.2016)	GPS Lat:	/	GPS Lon:	/
Position of the test point:	Elementary school „12.decembar" (Nova nn), II floor, corridor				

Distance from reflective objects					Local environmental conditions			
wall	celling	Metal fence	vehicles	other	leaves	Moist soil	people	other
1m	1.5m	-	-	-	no	no	no	-

Local electromagnetic field sources present:	Fluo bulbs	WiFi	phone	microwave	TV/comp.
Is there?	no	no	no	no	no
Active during measurment?	no	no	no	no	no

Boardband measurement 100kHz – 8GHz:	The most exposed heigh (m)	1.5	Esr (V/m)	1.16

Test point T5

Measurement start time:	18:01 (28.09.2016)	GPS Lat:	/	GPS Lon:	/
Position of the test point:	Elementary school „12.decembar" (Nova nn), ground floor , Serbian language classroom				

Distance from reflective objects					Lokalni uslovi okruženja			
wall	celling	Metal fence	vehicles	other	leaves	Moist soil	people	other
1m	1.5m	-	-	-	no	no	no	-

Local electromagnetic field sources present:	Fluo bulbs	WiFi	phone	microwave	TV/comp.
Is there?	no	no	no	no	no
Active during measurment?	no	no	no	no	no


Širokopojasno merenje 100kHz – 8GHz:	Najizloženija visina (m)	1.5	Esr (V/m)	1.78

TEST POINT T6

Mesurment start time:	18:31 (28.09.2016)	GPS Lat:	43°16'21.0'' N	GPS Lon:	20°0'13.2'' E
Position of the test point:	Path in the park, next to playground, in the III sector, 50m from the location				

Distance from reflective objects					Local environmental conditions			
wall	celling	Metal fence	vehicles	other	leaves	Moist soil	people	other
-	-	2m	-	-	no	no	no	-

Local electromagnetic field sources present:	Fluo bulbs	WiFi	phone	microwave	TV/comp.
Is there?	no	no	no	no	no
Active during measurment?	no	no	no	no	no


Broadband measurment 100kHz – 8GHz:	The most exposed heigh (m)	1.5	Esr (V/m)	2.36

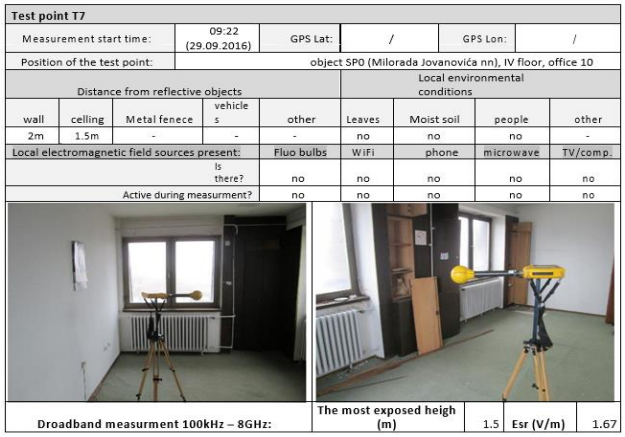


Figure 5. Tested points

6.1 Assessment of compliance of the investigated source with reference values

Based on the "Regulations on sources of non-ionizing radiation of special interest, types of sources, method and period of their examination", Sl. Gazette 104/09, sources of special interest are considered sources of electromagnetic radiation whose electromagnetic field in the zone of increased sensitivity reaches at least 10% of the amount of the reference limit value prescribed for that frequency.

Table 7. The electric field strength of the Telekom GSM900 base station

Telekom GSM900			
TEST POINT	Electric field strength (V/m)	Reference value (V/m)	percentage (%)
T1	2.30	16.86	13.7
T2	2.87	16.86	17.0
T3	1.46	16.86	8.7
T4	0.51	16.86	3.0
T5	0.83	16.86	4.9
T6	0.99	16.86	5.9
T7	1.11	16.86	6.6

The test results show that the electric field strength of the Telekom GSM900 base station in the test points T1 and T2 is higher than 10% of the reference limit value for the given range.

Table 8. The electric field strength of the Telekom ***UMTS2100*** base station

Telekom UMTS2100			
TEST POINT	Electric field strength (V/m)	Reference value (V/m)	Percentage (%)
T1	1.66	24.40	6.8
T2	1.07	24.40	4.4
T3	1.19	24.40	4.9
T4	0.98	24.40	4.0
T5	0.44	24.40	1.8
T6	0.38	24.40	1.5
T7	0.30	24.40	1.2

The test results show that the electric field strength of the Telekom UMTS2100 base station in all test points is lower than 10% of the reference limit value for the given bands.

7. CONCLUSION

The test results show that the total maximum electric field strength in the GSM900 range, in all test points, is lower than the reference value for the GSM900 range (16.8 V/m prescribed by the Rulebook on limits of exposure to non-ionizing radiation).

The test results show that the total maximum electric field strength in the UMTS2100 range, in all test points, is lower than the reference value for the UMTS2100 range (24.4 V/m prescribed by the Rulebook on limits of exposure to non-ionizing radiation).

Based on the obtained results, it can be concluded that the examined source meets the requirements of the Rulebook on limits of exposure to non-ionizing radiation, in terms of total exposure.

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