EMF RF level monitoring in the Republic of Serbia – the EMF RATEL network

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Let me introduce myself

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EMF RATEL sensors
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- Research team oriented to EMF investigation:
  - provide scientific expertise to Government agencies for non-ionizing radiation, as well as
  - Serbian Regulatory Agency for Electronic Communications and Postal Services – RATEL.

- Experimental Serbian Electromagnetic Field Monitoring Network – SEMONT:
  - development of SEMONT start in 2010,
  - the EMF RATEL is successor of experimental SEMONT system.

- Deeply involved in development of EMF RATEL network:
  - in charge for improvement and maintenance of EMF RATEL software-information logistic.

Outline

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- Introduction
- A – EMF RATEL network:
  - concept,
  - continuous monitoring.
- B – EMF RATEL sensors:
  - broadband monitoring,
  - service-based monitoring ,
  - data acquisition,
  - sensor installation and locations.
- C – Monitoring results dissemination:
  - public Internet portal,
  - administrative part,
  - open data portal.
- Continuous monitoring features
- Conclusion

Introduction (1/2)

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- The Serbian EMF legislation, related to the general public:
  - was systemized in 2009, relaying on the ICNIRP 1998 guidelines,
  - a set of documents is defined by the "*Law on non-ionizing radiation protection*",
  - ICNIRP 1998 reference levels are additionally lowered by factor of 2.5.
- Regarding occupational exposure:
  - the "*Law on safety and health at work*" is in charge,
  - ICNIRP 1998 limits are maintained, without any additional safety factor.
- The Serbian EMF legislation is focused only on whole-body exposure:
  - the ISO/IEC 17025 accredited laboratories perform appropriate EMF investigations,
  - measurements are mostly oriented to specific EMF source, during a short-time and in a spot.
- Implementation of ICNIRP 2020 is under the way:
  - through the project "*Analysis of measures for harmonization of national legislation with ICNIRP 2020 international recommendations for limiting exposure to electromagnetic fields*",
  - my research team leads this project.

Introduction (2/2)

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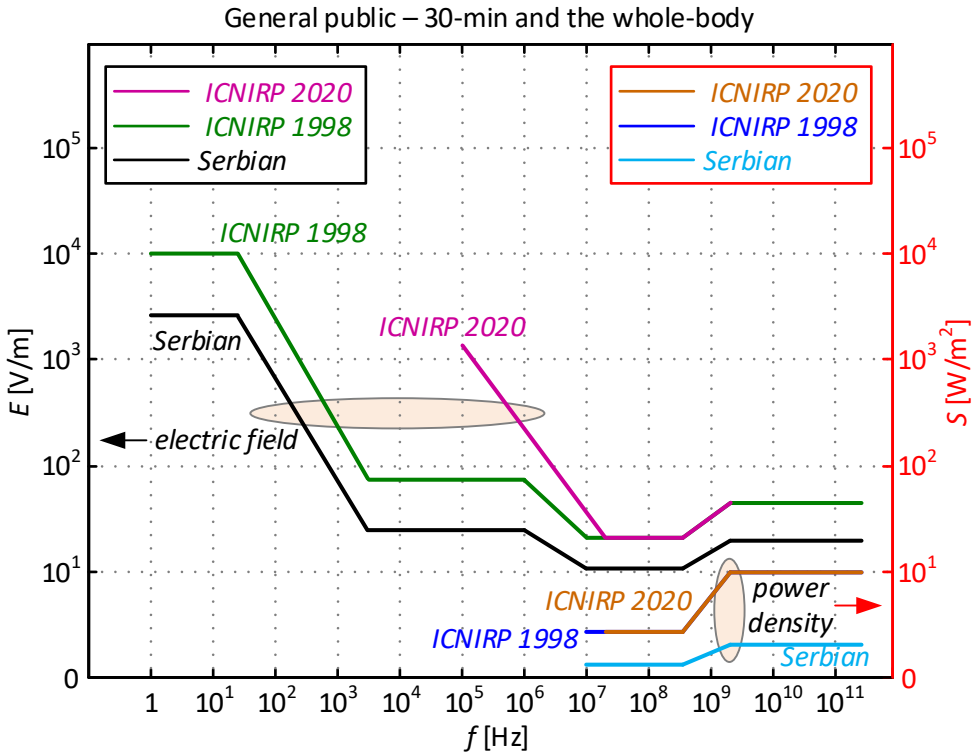
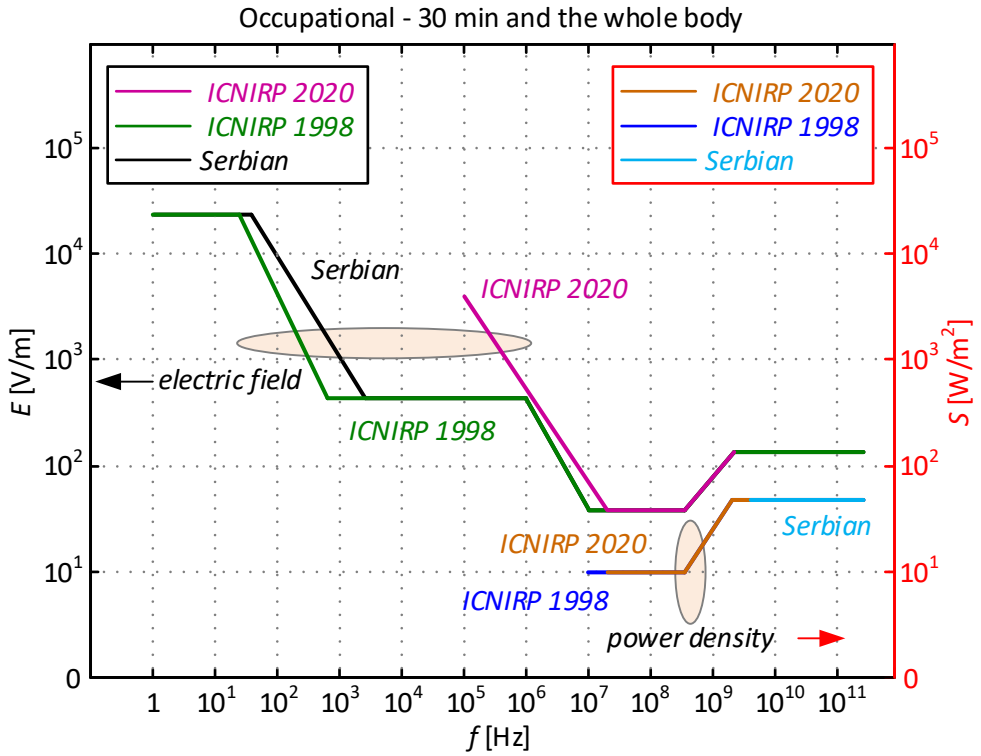
- Summary overview of Serbian limits versus ICNIRP recommendation:





- the ICNIRP basic limits are maintained in both cases.
- reference levels are lowered by 2.5 factor, regarding concerns of the general public.
- the Serbian legislation does not deal with local exposure.

A – EMF RATEL network (1/2)

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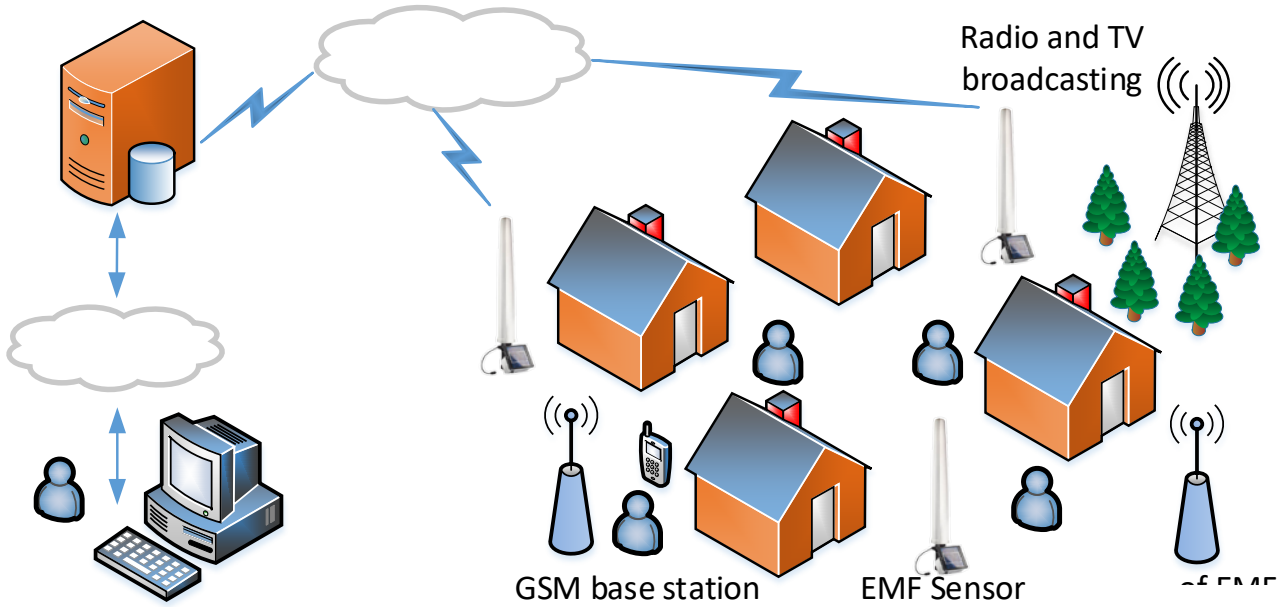
- The concept of EMF RATEL network:
  - the network is established on spatially distributed wireless monitoring sensors.



- EMF RATEL was launched by RATEL in 2017:
  - RATEL is responsible for running this network,
  - currently, 88 sensors are installed over the country.

A – EMF RATEL network (2/2)

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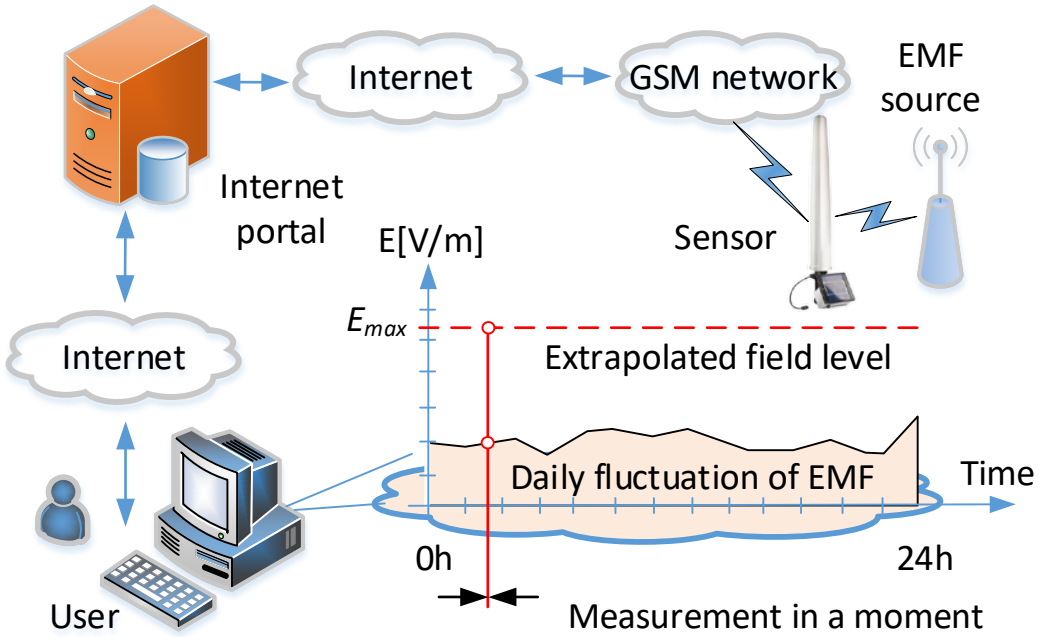
- EMF RATEL network performs continuous EMF monitoring (24/365):
  - daily EMF fluctuation is in a focus.



- Classical measurements require extrapolation for exposure assessment:
  - those measurements are performed in a moment and have no detailed insight in behavior of EMF,
  - also, it can be questionable does and when the EMF source radiate with maximal power.

B – EMF RATEL sensors (1/4)

Introduction
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- The EMF RATEL broadband monitoring is performed by two type of sensors:

- Narda AMB 8059,
- E field probe EP-1B-03,
- 100 kHz to 7 GHz,
- currently 65 sensors,

- Wavecontrol MonitEM,
- E field probe WPF8,
- 100 kHz to 8 GHz,
- currently 21 sensors.

- International Telecommunication Union (ITU)-T recommendation:
  - K.83 – “Monitoring of electromagnetic field levels” (06/2020 – page 26 with EMF RATEL).

- ITU-T K.83 gives guidance on:
  - how to make long-term measurements for the monitoring of EMFs in the selected areas that are under the public concern, in order to show that EMFs are under control and under the limits.

- The purpose of this Recommendation is to provide clear approach and easily available data, concerning EMF levels, particularly in form of results of continuous measurement.

B – EMF RATEL sensors (2/4)

Introduction
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- The EMF RATEL service-based EMF monitoring is performed by:
  - Narda AMS 8061 monitoring station + EHA-2B-01 electric field probe (100 kHz – 6 GHz),
  - simultaneous EMF monitoring in up to 20 independent, programable, frequency sub-bands,
  - broadband monitoring in service-frequency sub-band (service-based monitoring).

› **ITU-T K.83 compliant**
› Monitors individually programmable frequency bands
› Internal modem for wireless communication
› USB / Ethernet data transfer
› SD memory card
› Temperature / air humidity sensor
› GPS sensor
› PC software with alarm functions
› Autonomous power supply from solar cells

No.	Frequency sub-band	Telecommunication service
1.	87 MHz – 108 MHz	FM radio
2.	430 MHz – 470 MHz	Functional radio links
3.	470 MHz – 790 MHz	Digital TV (DVB-T2)
4.	790 MHz – 821 MHz	Mobile 4G download (DL)
5.	832 MHz – 862 MHz	Mobile 4G upload (UL)
6.	880 MHz – 915 MHz	Mobile 2G/3G UL
7.	925 MHz – 960 MHz	Mobile 2G/3G DL
8.	1710 MHz – 1780 MHz	Mobile 2G/4G UL
9.	1800 MHz – 1880 MHz	Mobile 2G/3G DL
10.	2110 MHz – 2170 MHz	Mobile 3G DL
11.	2400 MHz – 2500 MHz	Wi-Fi
12.	2520 MHz – 2660 MHz	Mobile 4G – NSA 5G UL/DL
13.	3400 MHz – 3800 MHz	Mobile 5G DL/UL
14.	5200 MHz – 5800 MHz	Wi-Fi

RATEL – "Decree on determining the allocation plan of radio frequency bands", Official gazette of RS, no. 89, 2020,

B – EMF RATEL sensors (3/4)

Introduction
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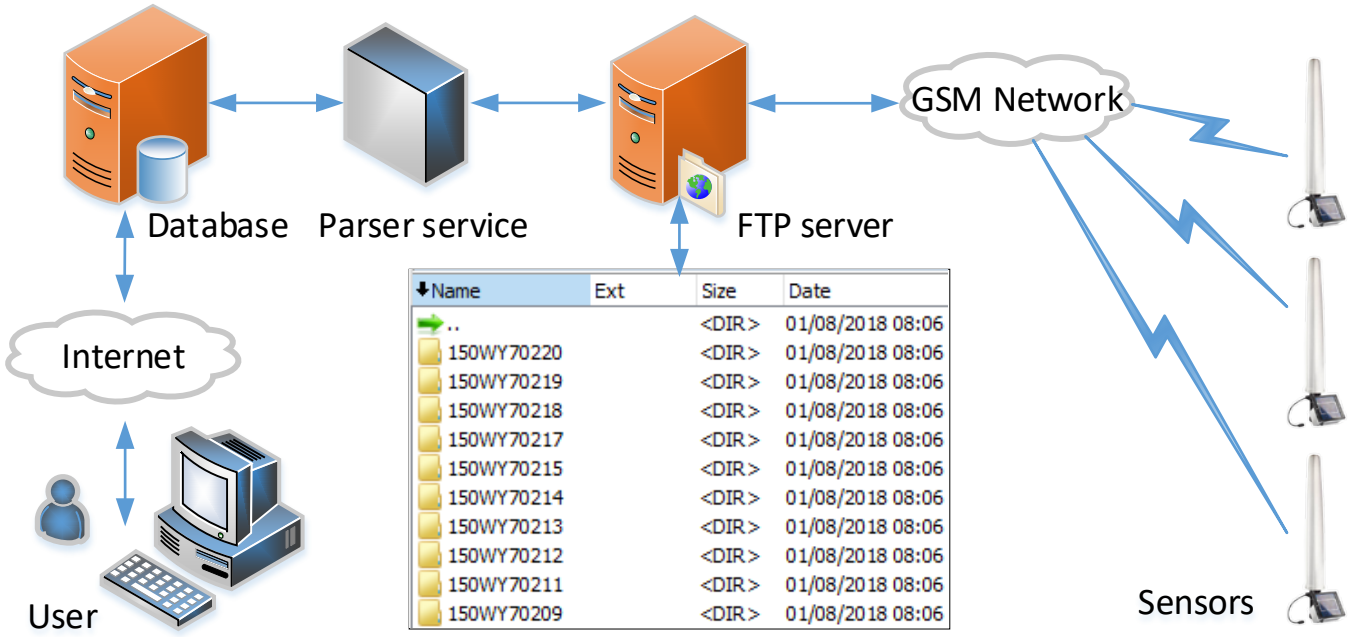
- Data acquisition – Narda sensors:
  - measurement results are daily transferred to the centralized database,



- GSM modem allows Internet access over the existing mobile telephony network,
- the measurement results are packed into specially formatted “.D59” and “.D61” files,
- dedicated parser function is required for processing of these “.D59” and “.D61” files.

B – EMF RATEL sensors (3/4)

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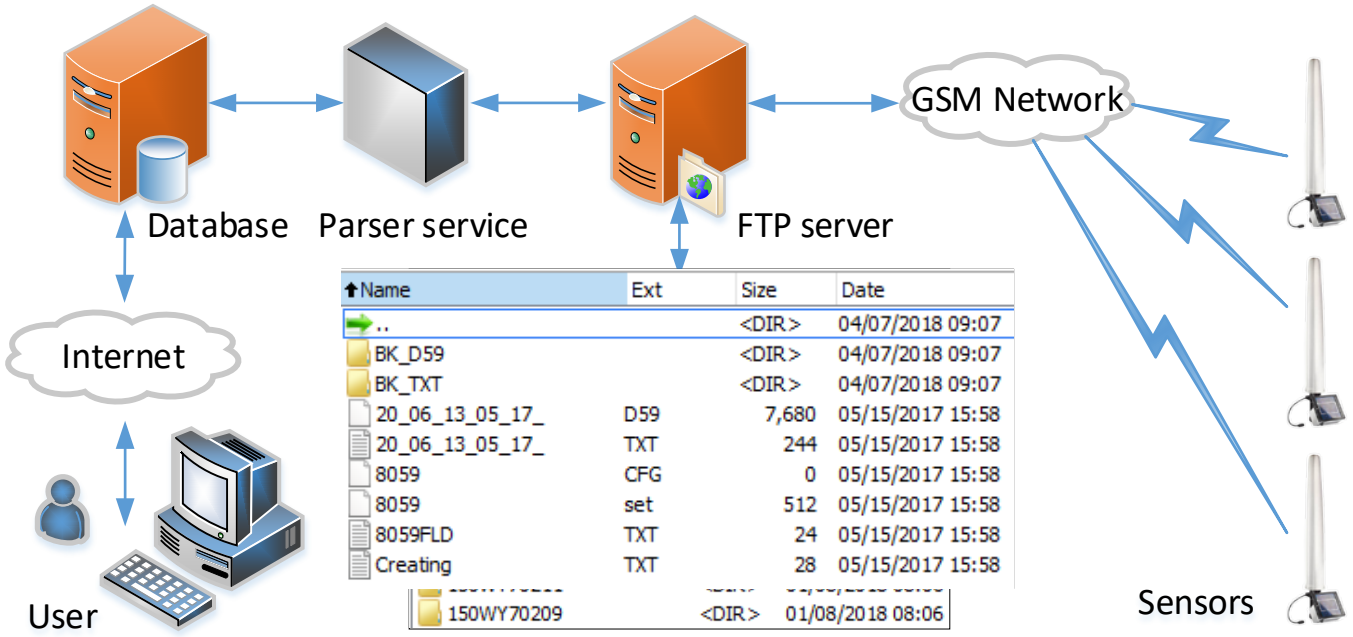

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B – EMF RATEL sensors (4/4)

Introduction
EMF RATEL network
EMF RATEL sensors
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- Sensor installation and locations:
  - sensitive zones of special interest: schools, kindergartens, hospitals and public institutions,
  - sensor installation is based on a goodwill of the site owner.

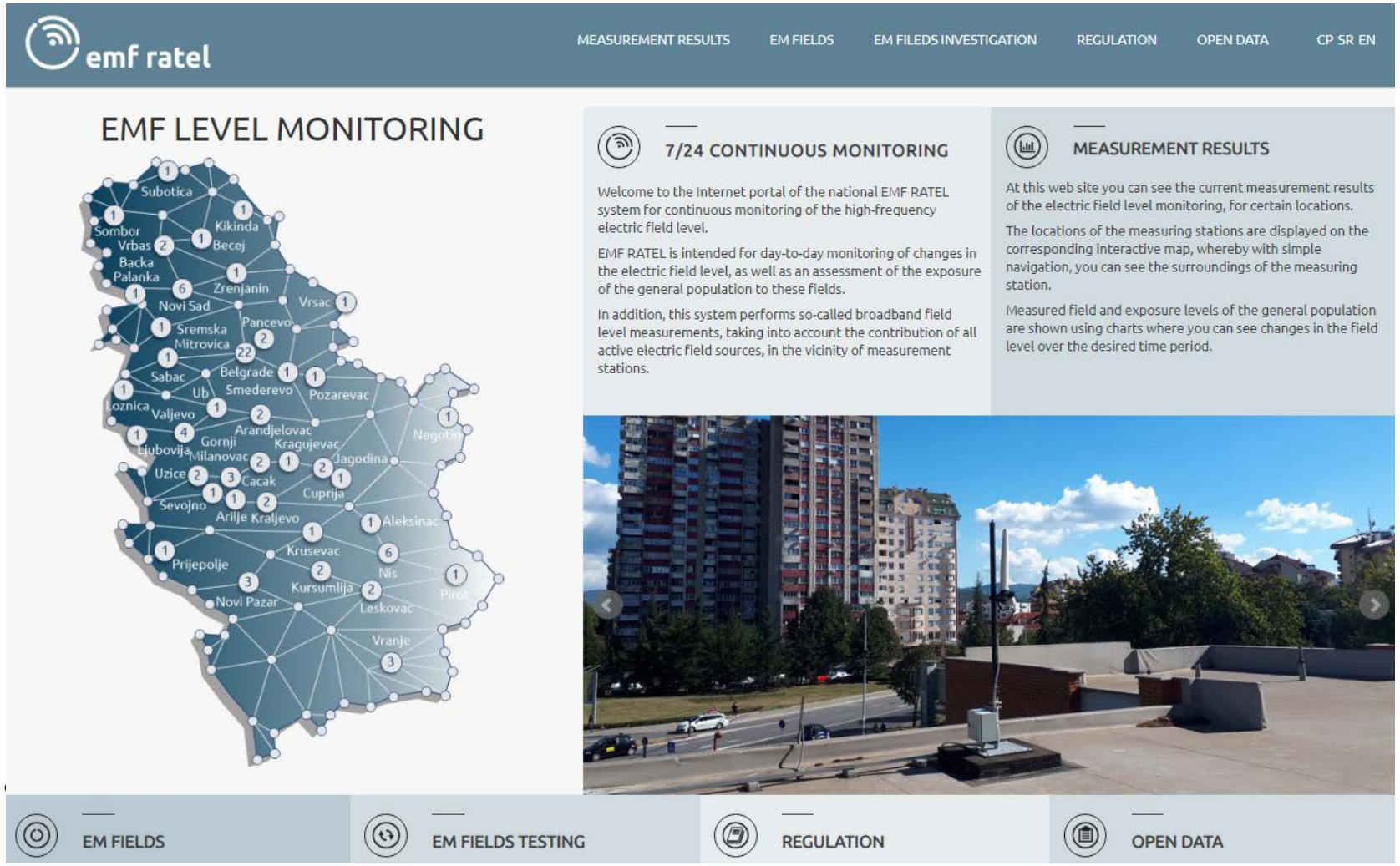
- AC supply + solar panel,
- solar panel – primary,
- battery below threshold
  - switch to AC.

- mini construction project
  - concrete plinth,
  - plastic mast.

C – Monitoring results dissemination (1/3 - a)

Introduction
EMF RATEL network
EMF RATEL sensors
Dissemination (1/12)
Features
Conclusion

- Public Internet portal of EMF RATEL is available on: https://emf.ratel.rs



Menu:
- Measurement results
- EMF fields
- EMF investigation
- Regulation
- Open data

C – Monitoring results dissemination (1/3 - b)

Introduction
EMF RATEL network
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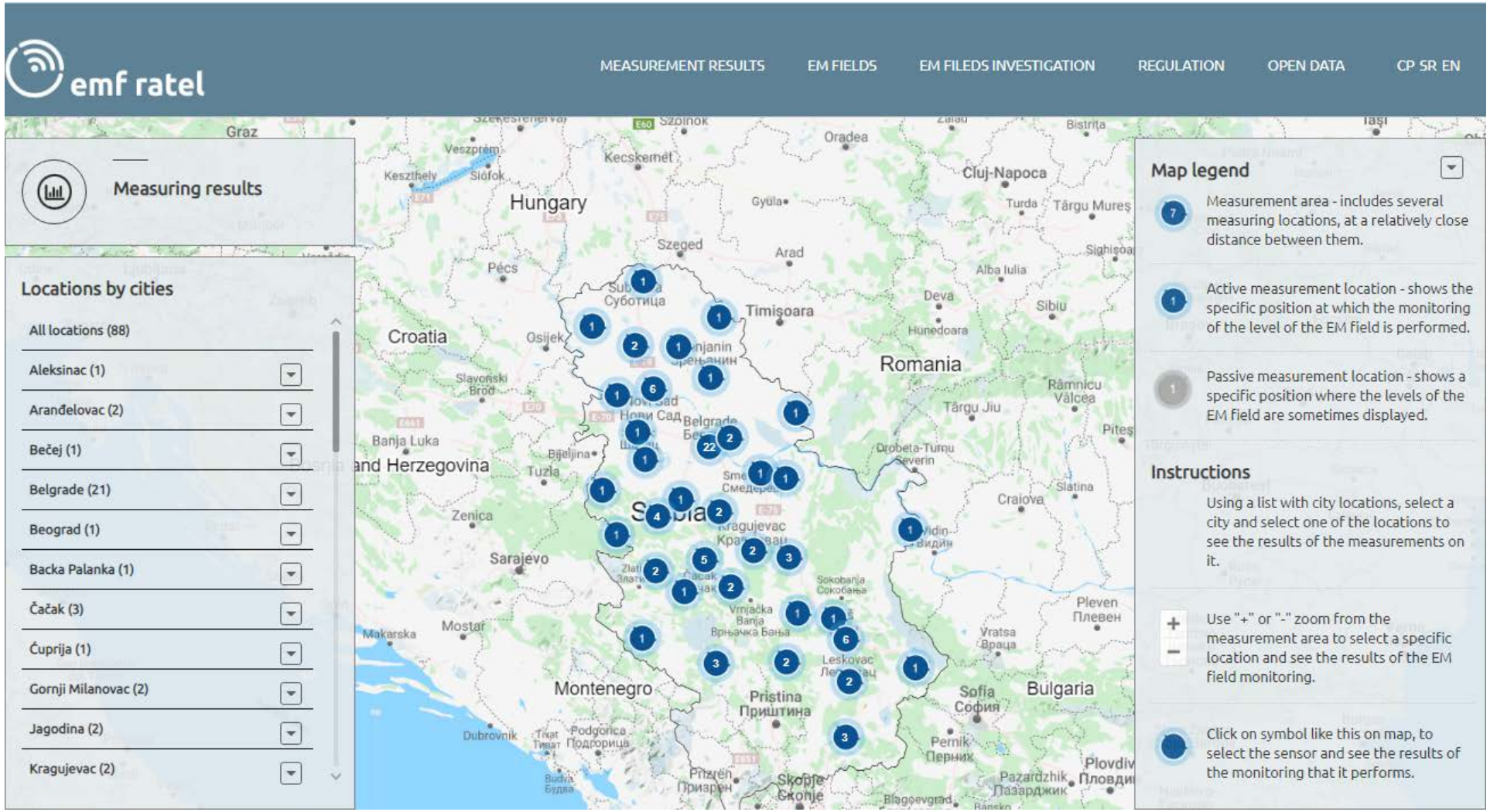
Dissemination (2/12)
Features
Conclusion

- Internet portal – measurement locations:



C – Monitoring results dissemination (1/3 - c)

Introduction
EMF RATEL network
EMF RATEL sensors
Dissemination (3/12)
Features
Conclusion

- Internet portal – measurement results – broadband monitoring:

- Three clicks to get results,
- field limits,
- measurement uncertainty
- exposure levels,
- search function,
- export data,
- sensor info,
- location info.
- Measurements are performed every 6 minutes – SRPS EN 50413:2010/A1:2014.
- Uncertainty in measurement - JCGM 100:2008.

C – Monitoring results dissemination (1/3 - c)

Introduction
EMF RATEL network
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Dissemination (3/12)
Features
Conclusion

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- exposure levels,
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- Uncertainty in measurement - JCGM 100:2008.

C – Monitoring results dissemination (1/3 - d)

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Dissemination (4/12)
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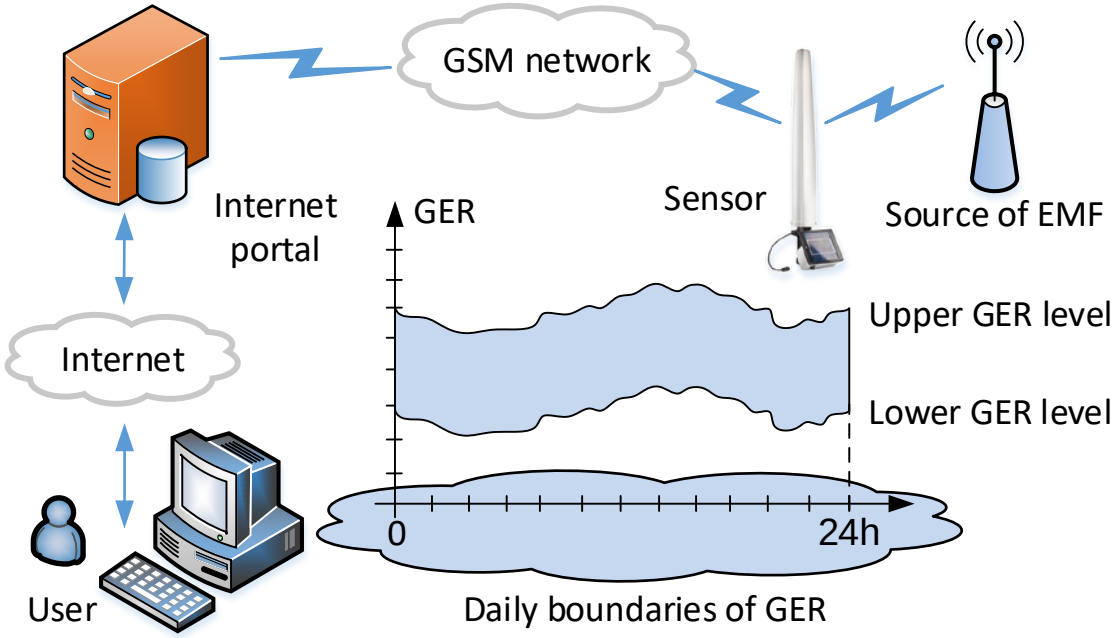
- Exposure assessment:
  - Adaptive Boundary approach* is used, calculating upper and lower Global Exposure Ratio (*GER*) boundaries.



GER boundaries are calculated as:

$$GER_{low} = \left(\frac{E_m}{E_{ref\,\max}(f_1)} \right)^2 \quad and \quad GER_{up} = \left(\frac{E_m}{E_{ref\,\min}(f_2)} \right)^2,$$

Application of boundary approach leads to the assessment of the range where the real exposure can be found, since:

$$GER_{low} \le GER_{real} \le GER_{up}.$$

*D. Kljajic, N. Djuric, "The adaptive boundary approach for exposure assessment in a broad-band EMF monitoring", Measurement, vol. 93, pp. 515–523, Nov. 2016, doi: 10.1016/j.measurement.20¬16.07.055.

- The method of assessment is conditioned by the fact that broadband monitoring is performed – unknown frequencies in present EMF spectrum.

C – Monitoring results dissemination (1/3 - e)

Introduction
EMF RATEL network
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Dissemination (5/12)
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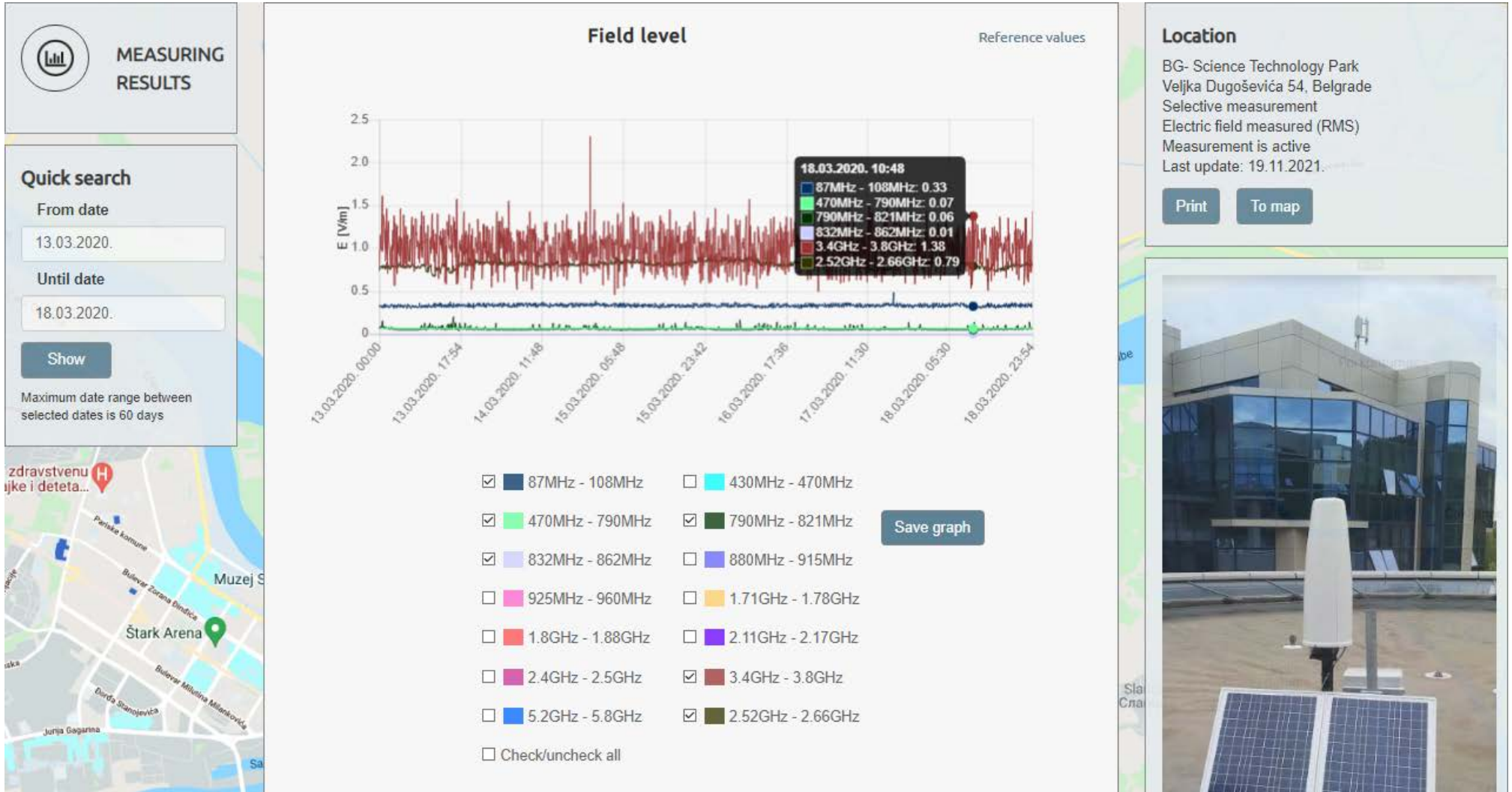
- Internet portal – measurement results – service-based monitoring:



C – Monitoring results dissemination (1/3 - e)

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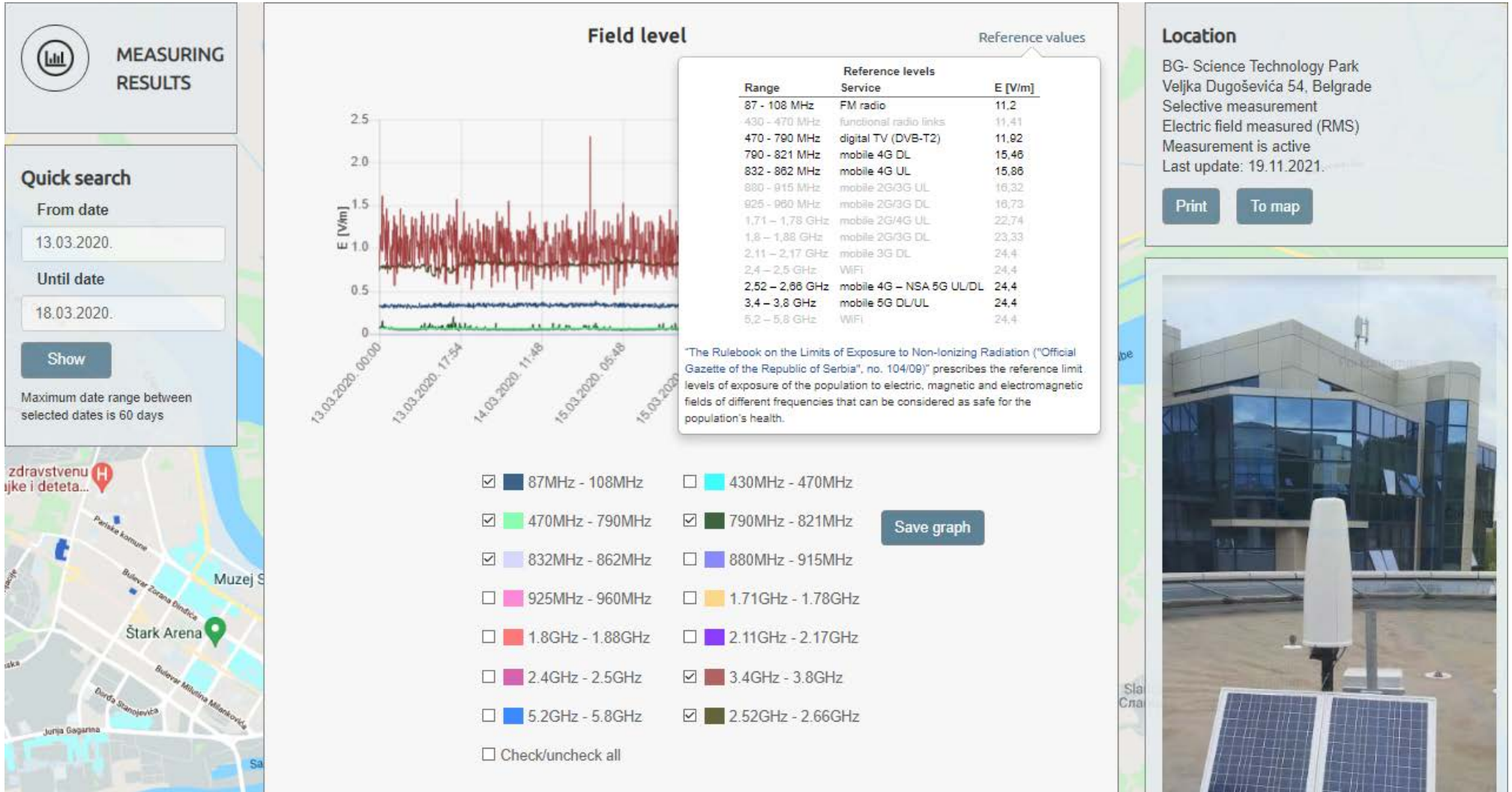
- Internet portal – measurement results – service-based monitoring:



C – Monitoring results dissemination (1/3 - f)

Introduction
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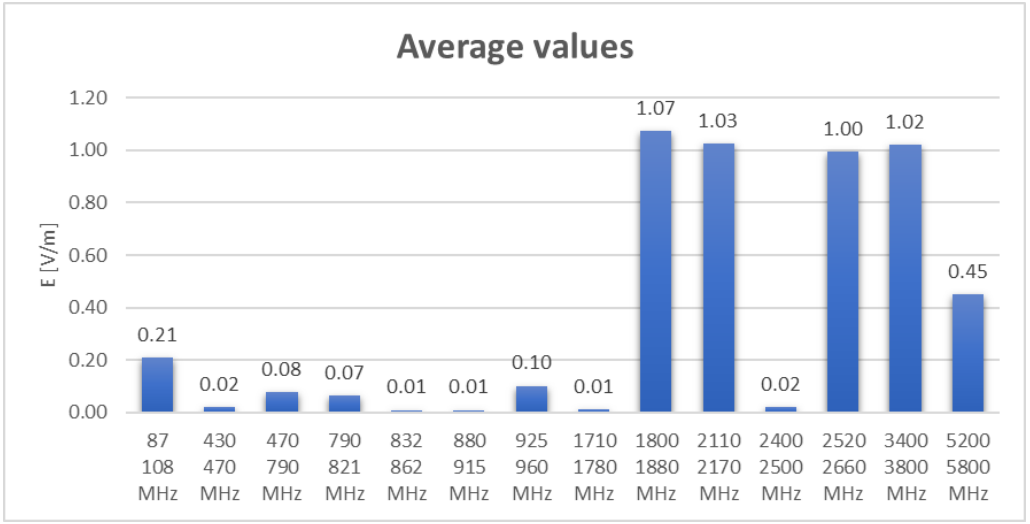
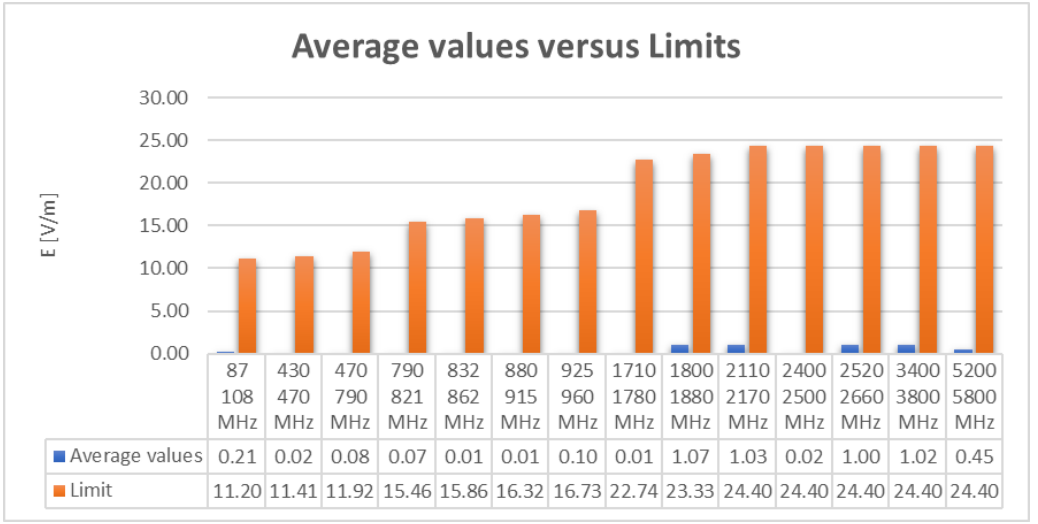
- Initial results of 5G EMF monitoring:
  - from November 1th, 2019 till March 19th 2020, in which 5G network was tested is Serbia.





	87 108 MHz	430 470 MHz	470 790 MHz	790 821 MHz	832 862 MHz	880 915 MHz	925 960 MHz	1710 1780 MHz	1800 1880 MHz	2110 2170 MHz	2400 2500 MHz	2520 2660 MHz	3400 3800 MHz	5200 5800 MHz
Average values	0.21	0.02	0.08	0.07	0.01	0.01	0.10	0.01	1.07	1.03	0.02	1.00	1.02	0.45
Limit	11.20	11.41	11.92	15.46	15.86	16.32	16.73	22.74	23.33	24.40	24.40	24.40	24.40	24.40

- EMF values are acquired in testing period:
  - it can be presumed that levels will be the same during the full utilization of 5G technology.

- The 5G is to be implemented in Serbia during 2022:
  - additional EMF monitoring campaign, in order to obtain EMF levels of fully functional 5G.

C – Monitoring results dissemination (2/3 - a)

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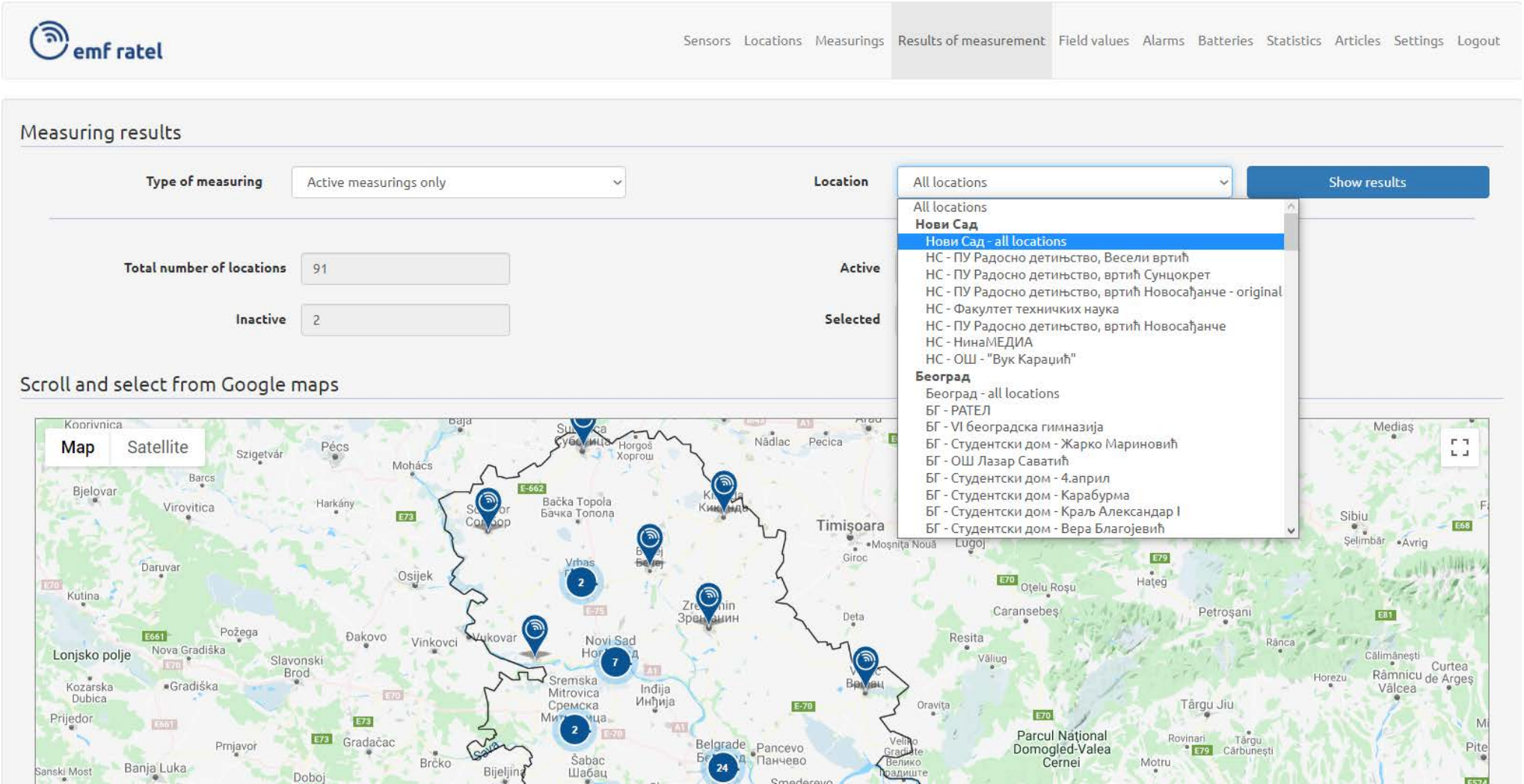
- Information logistic for system – admin part:


emf ratel
Sensors
Locations
Measurings
Results of measurement
Field values
Alarms
Batteries
Statistics
Articles
Settings
Logout
Measuring results
Type of measuring
Active measurings only
Location
All locations
Show results
All locations
Нови Сад
Нови Сад - all locations
НС - ПУ Радосно детињство, Весели вртић
НС - ПУ Радосно детињство, вртић Сунцокрет
НС - ПУ Радосно детињство, вртић Новосађанче - original
НС - Факултет техничких наука
НС - ПУ Радосно детињство, вртић Новосађанче
НС - НинаМЕДИА
НС - ОШ - "Вук Караџић"
Београд
Београд - all locations
БГ - РАТЕЛ
БГ - VI београдска гимназија
БГ - Студентски дом - Жарко Мариновић
БГ - ОШ Лазар Саватић
БГ - Студентски дом - 4.април
БГ - Студентски дом - Карабурма
БГ - Студентски дом - Краљ Александар I
БГ - Студентски дом - Вера Благојевић
Total number of locations
91
Active
Inactive
2
Selected
Scroll and select from Google maps
Map
Satellite
Timişoara
Novi Sad
Belgrade
Osijek
Subotica
Szeged
Pécs
Mohács
Bačka Topola
Vukovar
Vinkovci
Đakovo
Slavonski Brod
Sremska Mitrovica
Šabac
Pančevo
Zrenjanin
Kikinda
Resita
Caransebeș
Petroșani
Târgu Jiu
Sibiu
Mediaș
Oradea
Arad
Lugoj
Deta
Hațeg
Oțelu Roșu
Parcul Național Domogled-Valea Cernei
Banja Luka
Brčko
Bijeljina
Doboj
Gradačac
Prijedor
Lonjsko polje
Požega
Virovitica
Bjelovar
Daruvar
Kutina
Osijek
Harkány
Mohács
Szigetvár
Pécs
Baja
Nădlac
Pecica
Giroc
Moșnița Nouă
Vârșeț
Oravița
Orșova
Drobeta-Turnu Severin
Rovinari
Târgu Cărbunești
Motru
Horezu
Râmnicu Vâlcea
Curtea de Argeș
Călimănești
Avrig
Șelimbăr
Ocna Sibiului
Ocna Mureș
Alba Iulia
Aiud
Turda
Cluj-Napoca
Dej
Bistrița
Reghin
Târgu Mureș
Sighișoara
Mediaș
Copșa Mică
Blaj
Sebeș
Petroșani
Vălișoara
Lupeni
Vulcan
Uricani
Petrila
Lonea
Aninoasa
Bumbești-Jiu
Târgu Cărbunești
Rovinari
Motru
Horezu
Ocnele Mari
Băbeni
Râmnicu Vâlcea
Curtea de Argeș
Călimănești
Avrig
Șelimbăr
Sibiu
Mediaș
Copșa Mică
Blaj
Sebeș
Alba Iulia
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Turda
Cluj-Napoca
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Ocna Sibiului
Ocna Mureș
Vârșeț
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Târgu Jiu
Caransebeș
Petroșani
Hațeg
Oțelu Roșu
Deta
Resita

C – Monitoring results dissemination (2/3 - b)

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- Field values overview:

emf ratel

Sensors | Locations | Measurings | Results of measurement | Field values | Alarms | Batteries | Statistics | Articles | Settings | Logout

Field values - from 06.11.2021 until 20.11.2021

Full list | MonitEM sensors | Set date range | Print

Search:

No.	On front	Sensor	Sensor Type	Measuring city	Location	Last value [V/m]	Last update date	Min value [V/m]	Min value date	Max value [V/m]	Max value date	Actions
1.	Yes	150WY70201	8059	Крагујевац	КГ - Градска управа Крагујевац	3.320	19.11.2021 12:00	2.070	06.11.2021 04:30	3.780	08.11.2021 20:54	Details
2.	No	150WY70202	8059	Нови Сад	НС - ПУ Радосно детињство, вртић Новосађанче - original	0.000		0.000		0.000		Details
3.	Yes	150WY70204	8059	Нови Сад	НС - ПУ Радосно детињство, Весели вртић	2.180	19.11.2021 12:00	1.130	09.11.2021 06:00	2.480	17.11.2021 14:54	Details
4.	Yes	150WY70205	8059	Београд	БГ - ОШ Лазар Саватић	2.760	19.11.2021 12:30	2.320	08.11.2021 16:00	3.080	08.11.2021 00:30	Details
5.	Yes	150WY70206	8059	Ниш	НИ - Правно пословна школа	3.140	19.11.2021 13:00	2.750	17.11.2021 05:06	3.430	17.11.2021 14:36	Details
6.	Yes	150WY70207	8059	Београд	БГ - Студентски дом - Жарко Мариновић	2.470	19.11.2021 15:06	1.580	14.11.2021 13:36	2.900	19.11.2021 09:12	Details
7.	Yes	150WY70208	8059	Београд	БГ - Студентски дом - Краљ Александар I	0.850	19.11.2021 10:00	0.530	12.11.2021 06:06	1.140	14.11.2021 17:42	Details
8.	Yes	150WY70209	8059	Београд	БГ - Студентски дом - 4.април	5.320	19.11.2021 14:30	2.860	06.11.2021 04:48	6.550	17.11.2021 12:12	Details
9.	Yes	150WY70212	8059	Нови Сад	НС - Факултет техничких наука	1.910	19.11.2021 15:00	0.820	18.11.2021 01:42	2.400	17.11.2021 14:18	Details
10.	Yes	150WY70213	8059	Београд	БГ - VI београдска гимназија	0.480	19.11.2021 14:42	0.320	09.11.2021 05:18	0.690	18.11.2021 22:54	Details
11.	Yes	150WY70214	8059	Београд	БГ - Студентски дом - Карабурма	2.320	19.11.2021 10:00	1.370	12.11.2021 05:12	3.180	14.11.2021 21:48	Details
12.	Yes	150WY70215	8059	Ниш	НИ - ПУ Пчелица, вртић Бамби	1.200	19.11.2021 15:12	0.780	12.11.2021 05:12	1.420	10.11.2021 18:12	Details

C – Monitoring results dissemination (2/3 - c)

Introduction
EMF RATEL network
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Dissemination (9/12)
Features
Conclusion

- Alarms and batteries overview:
  - Comprehensive overview for last 14 days:

emf ratel

Sensors | Locations | Measurings | Results of measurement | Field values | Alarms | Batteries | Statistics | Articles | Settings | Logout

Alarms - Last 14 days

Full list | MonitEM sensors | Set number of days | Print

in last reading 0 - no alarm; 1 - alarm detected
in last 14 days alarm detected

Search:

No.	On front	Sensor	Measuring location	Last update	ABAT	ARH	ATMP	ALCK	APRB	AWRN	AALR	TXON	USB	CHG	ETH	Actions
1.	No	000WX70302	БГ - ОШ Дринка Павловић - пасив	13.11.2019 12:12	0	0	0	0	0	0	0	0	0	0	0	Details
2.	Yes	000WX70303	БГ - Научно технолошки парк	19.11.2021 08:00	0	0	0	0	0	0	0	0	0	0	0	Details
3.	Yes	031ZY01001	БГ - ОШ Дринка Павловић	20.11.2021 00:36	0	0	0	0	0	0	0	0	0	0	0	Details
4.	Yes	150WY70201	КГ - Градска управа Крагујевац	19.11.2021 12:00	0	0	0	0	0	0	0	0	0	0	0	Details
5.	No	150WY70202	НС - ПУ Радосно детињство, вртић Новосађанче - original	29.10.2021 11:00	0	0	0	0	0	0	0	0	0	0	0	Details
6.	Yes	150WY70204	НС - ПУ Радосно детињство, Весели вртић	19.11.2021 12:00	0	0	0	0	0	0	0	0	0	0	0	Details
7.	Yes	150WY70205	БГ - ОШ Лазар Саватић	19.11.2021 12:30	0	0	0	0	0	0	0	0	0	0	0	Details
8.	Yes	150WY70206	НИ - Правно пословна школа	19.11.2021 13:00	0	0	0	0	0	0	0	0	0	0	0	Details
9.	Yes	150WY70207	БГ - Студентски дом - Жарко Мариновић	19.11.2021 15:06	0	0	0	0	0	0	0	0	1	1	0	Details
10.	Yes	150WY70208	БГ - Студентски дом - Краљ Александар I	19.11.2021 10:00	0	0	0	0	0	0	0	0	0	0	0	Details
11.	Yes	150WY70209	БГ - Студентски дом - 4.април	19.11.2021 14:30	0	0	0	0	0	0	0	0	0	0	0	Details
12.	Yes	150WY70212	НС - Факултет техничких наука	19.11.2021 15:00	0	0	0	0	0	0	0	0	0	0	0	Details

C – Monitoring results dissemination (2/3 - c)

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  - Comprehensive overview for last 14 days:

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Batteries - Last 14 days

Full list | MonitEM sensors | Set number of days | Print

8059: min = 3.9 V and max = 5.02 V; 8061: min = 11.09 V
in last 14 dates range exceeded

Search:

No.	On front	Sensor	Measuring location	Last value [V]	Last update date	Min value [V]	Min value date	Max value [V]	Max value date	Actions
1.	No	000WX70302	БГ - ОШ Дринка Павловић - пасив	13.566	13.11.2019 12:12	0.000		0.000		Details
2.	Yes	000WX70303	БГ - Научно технолошки парк	13.433	19.11.2021 08:00	12.635	06.11.2021 05:48	13.699	11.11.2021 13:42	Details
3.	Yes	031ZY01001	БГ - ОШ Дринка Павловић	13.699	20.11.2021 00:36	13.699	06.11.2021 00:00	13.699	06.11.2021 00:00	Details
4.	Yes	150WY70201	КГ - Градска управа Крагујевац	4.791	19.11.2021 12:00	3.938	12.11.2021 21:54	4.791	06.11.2021 12:48	Details
5.	No	150WY70202	НС - ПУ Радосно детињство, вртић Новосађанче - original	4.344	29.10.2021 11:00	0.000		0.000		Details
6.	Yes	150WY70204	НС - ПУ Радосно детињство, Весели вртић	4.750	19.11.2021 12:00	4.222	06.11.2021 16:12	4.791	10.11.2021 12:42	Details
7.	Yes	150WY70205	БГ - ОШ Лазар Саватић	4.791	19.11.2021 12:30	4.263	09.11.2021 07:30	4.791	06.11.2021 11:30	Details
8.	Yes	150WY70206	НИ - Правно пословна школа	4.750	19.11.2021 13:00	4.019	14.11.2021 02:12	4.791	06.11.2021 12:36	Details
9.	Yes	150WY70207	БГ - Студентски дом - Жарко Мариновић	4.750	19.11.2021 15:06	4.507	06.11.2021 15:12	4.791	15.11.2021 12:00	Details
10.	Yes	150WY70208	БГ - Студентски дом - Краљ Александар I	4.263	19.11.2021 10:00	3.532	18.11.2021 22:36	4.791	06.11.2021 12:54	Details
11.	Yes	150WY70209	БГ - Студентски дом - 4.април	4.791	19.11.2021 14:30	4.060	16.11.2021 18:24	4.831	13.11.2021 13:36	Details
12.	Yes	150WY70212	НС - Факултет техничких наука	4.344	19.11.2021 15:00	4.060	08.11.2021 15:06	4.669	10.11.2021 15:54	Details

C – Monitoring results dissemination (2/3 - d)

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- Statistics - example:
  - electric field values vs arbitral threshold:

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Above threshold (threshold = 1 [V/m])

Full list | Min max | Set new threshold | Print

Total records: Below threshold = 27.77 [%] :: Above threshold = 72.23 [%]

Search:

No.	Sensor	Measuring location	Below threshold [%]	Above threshold [%]
1.	150WY70201	КГ - Градска управа Крагујевац	45.18	54.82
2.	150WY70202	НС - ПУ Радосно детињство, вртић Новосађанче - original	26.16	73.84
3.	150WY70204	НС - ПУ Радосно детињство, Весели вртић	15.40	84.60
4.	150WY70205	БГ - ОШ Лазар Саватић	36.28	63.72
5.	150WY70206	НИ - Правно пословна школа	3.28	96.72
6.	150WY70207	БГ - Студентски дом - Жарко Мариновић	26.69	73.31
7.	150WY70208	БГ - Студентски дом - Краљ Александар I	11.71	88.29
8.	150WY70209	БГ - Студентски дом - 4.април	7.88	92.12
9.	150WY70212	НС - Факултет техничких наука	38.79	61.21
10.	150WY70213	БГ - VI београдска гимназија	99.58	0.42
11.	150WY70214	БГ - Студентски дом - Карабурма	18.52	81.48
12.	150WY70215	НИ - ПУ Пчелица, вртић Бамби	13.89	86.11

C – Monitoring results dissemination (2/3 - e)

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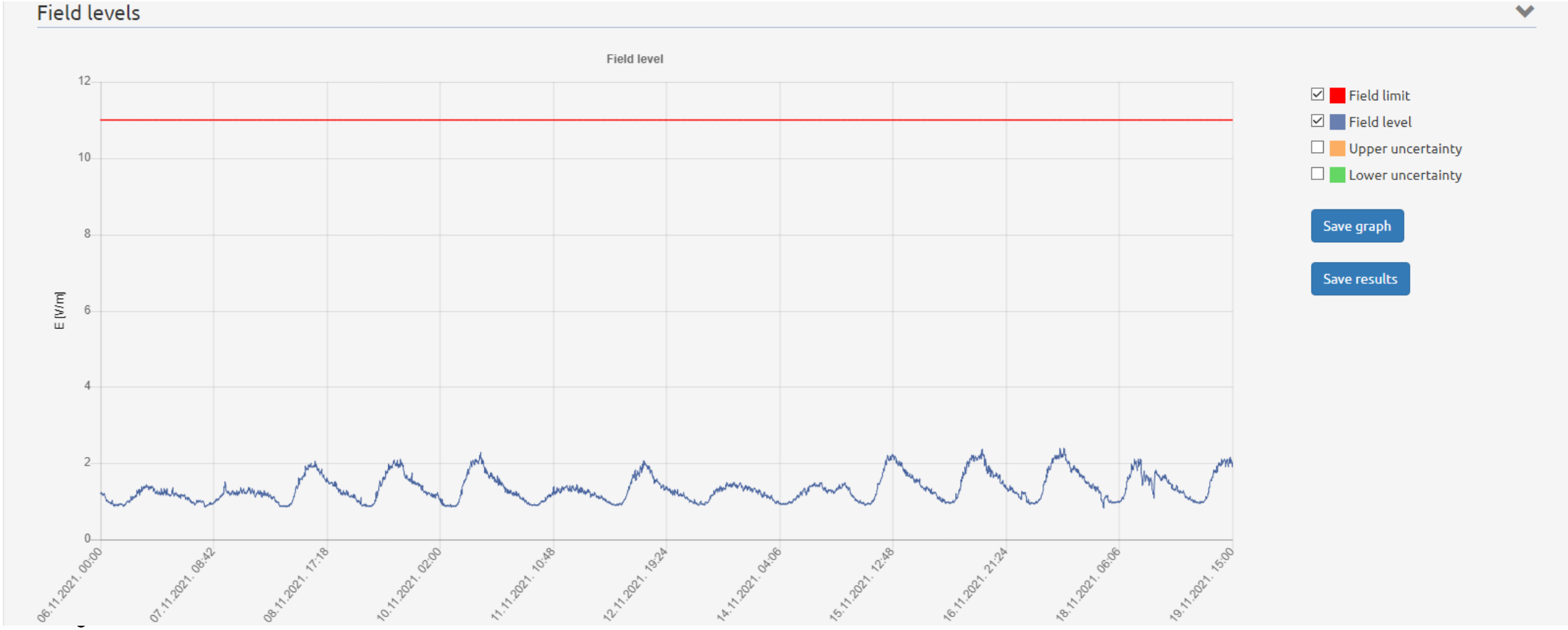
- Regarding specific location:
  - several elements can be observed (field level, exposure, alarms, PERTs, battery).



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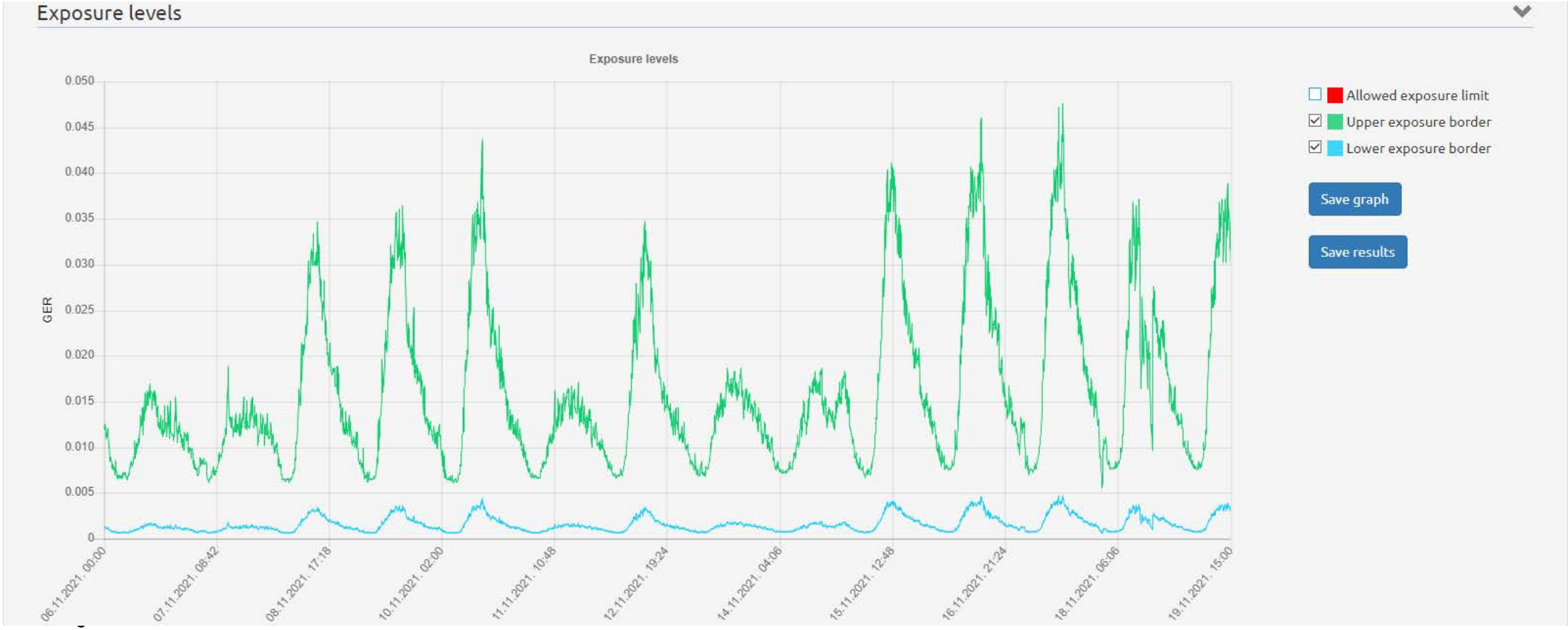

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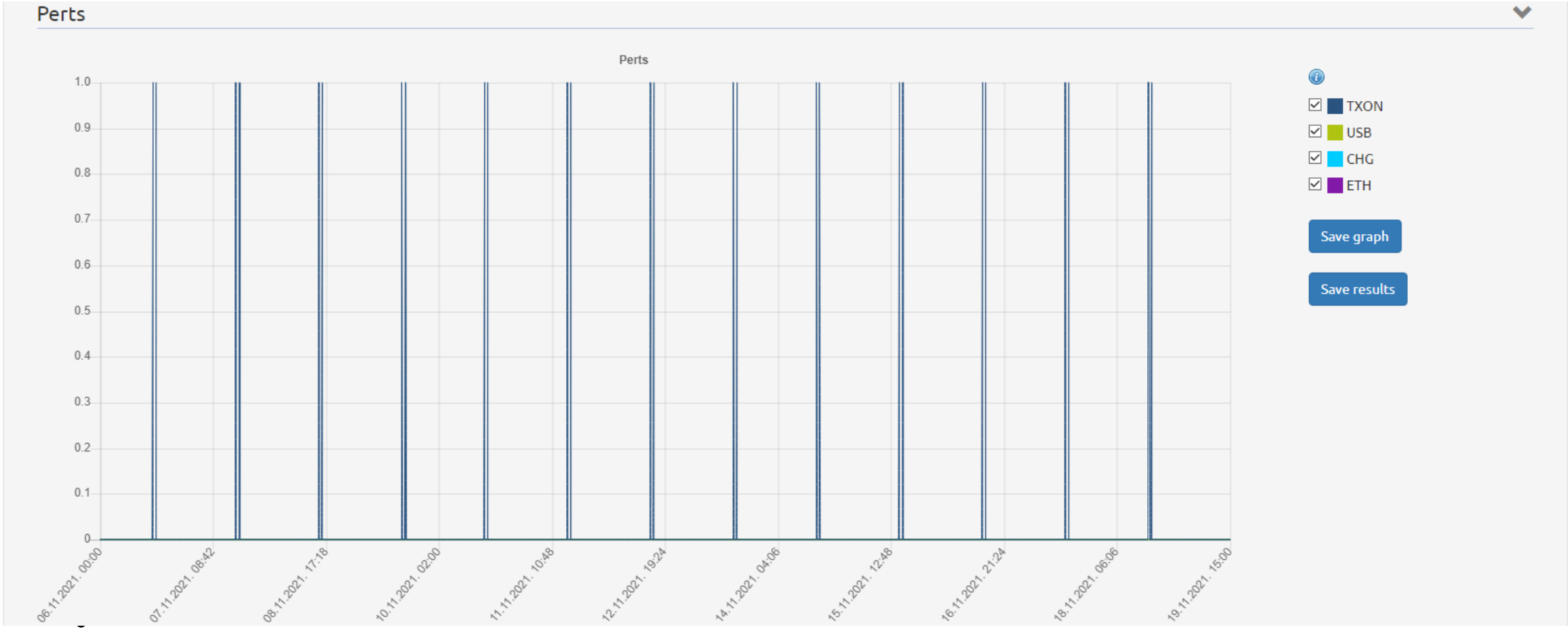

C – Monitoring results dissemination (2/3 - e)

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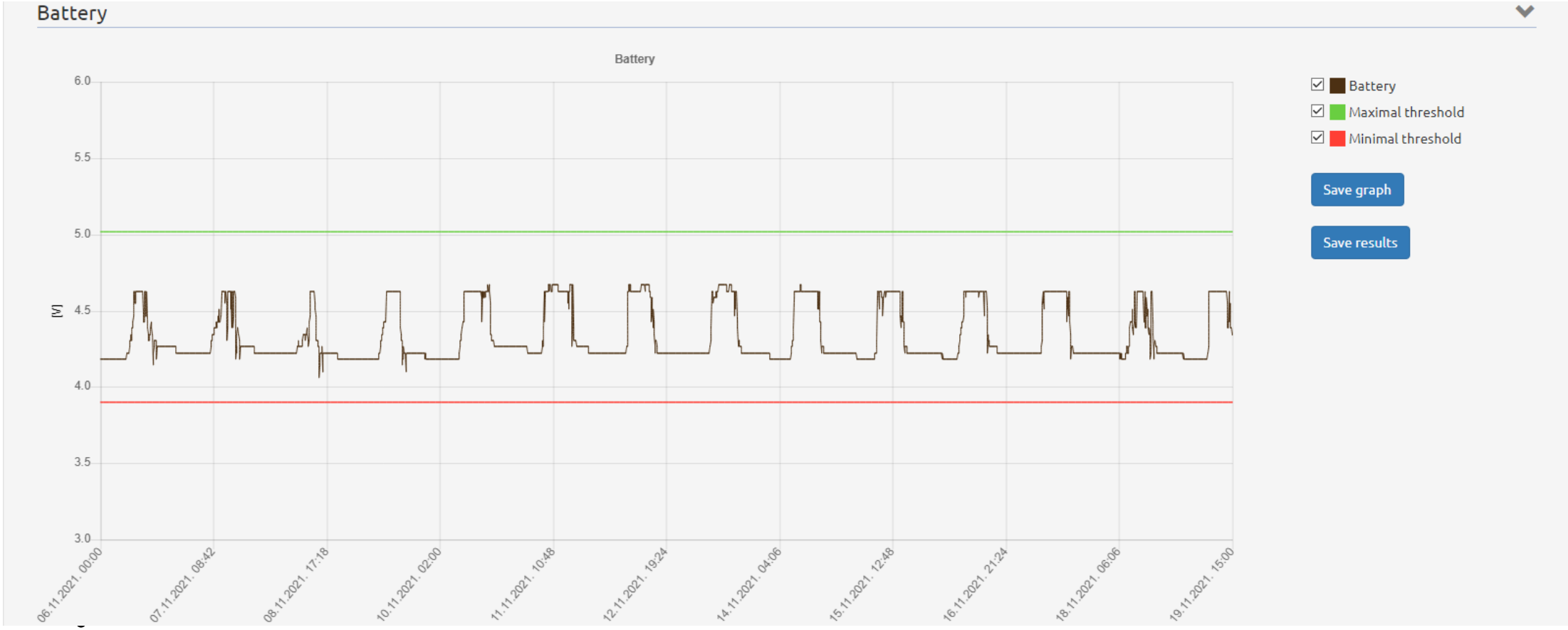

C – Monitoring results dissemination (3/3)

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- Open data features:
  - measurement results are linked with Governmental Open Data portal and publicly available.

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Sensors Locations Measurings Results of measurement Field values Alarms Batteries Statistics Articles Settings Logout

Open data

Full list | Measurements list | Results of measurement | Add new measurement

Search:

No.	Location name	Measuring name	CSV link	JSON link	XML link	Actions
1.	АЕ - Национална служба за запошљавање	АЕ - Национална служба за запошљавање	Download Copy link	Download Copy link	Download Copy link	Details
2.	АЛ - Центар за културу	АЛ - Центар за културу	Download Copy link	Download Copy link	Download Copy link	Details
3.	АР - Буковичка бања	АР - Буковичка бања	Download Copy link	Download Copy link	Download Copy link	Details
4.	АР - Висока технолошка школа	АР - Висока технолошка школа	Download Copy link	Download Copy link	Download Copy link	Details
5.	БГ - ОШ Светозар Марковић	Светозар Марковић	Download Copy link	Download Copy link	Download Copy link	Details
6.	БГ - VI београдска гимназија	VI београдска гимназија	Download Copy link	Download Copy link	Download Copy link	Details
7.	БГ - Графичка школа	Графичка школа	Download Copy link	Download Copy link	Download Copy link	Details
8.	БГ - Дом културе	Дом културе	Download Copy link	Download Copy link	Download Copy link	Details
9.	БГ - Земун стадион	Земун стадион	Download Copy link	Download Copy link	Download Copy link	Details
10.	БГ - Научно технолошки парк	БГ - НТП	Download Copy link	Download Copy link	Download Copy link	Details
11.	БГ - ОШ "Ћирило и Методије"	ОШ "Ћирило и Методије"	Download Copy link	Download Copy link	Download Copy link	Details
12.	БГ - ОШ Бранко Радичевић	Бранко Радичевић	Download Copy link	Download Copy link	Download Copy link	Details

C – Monitoring results dissemination (3/3)

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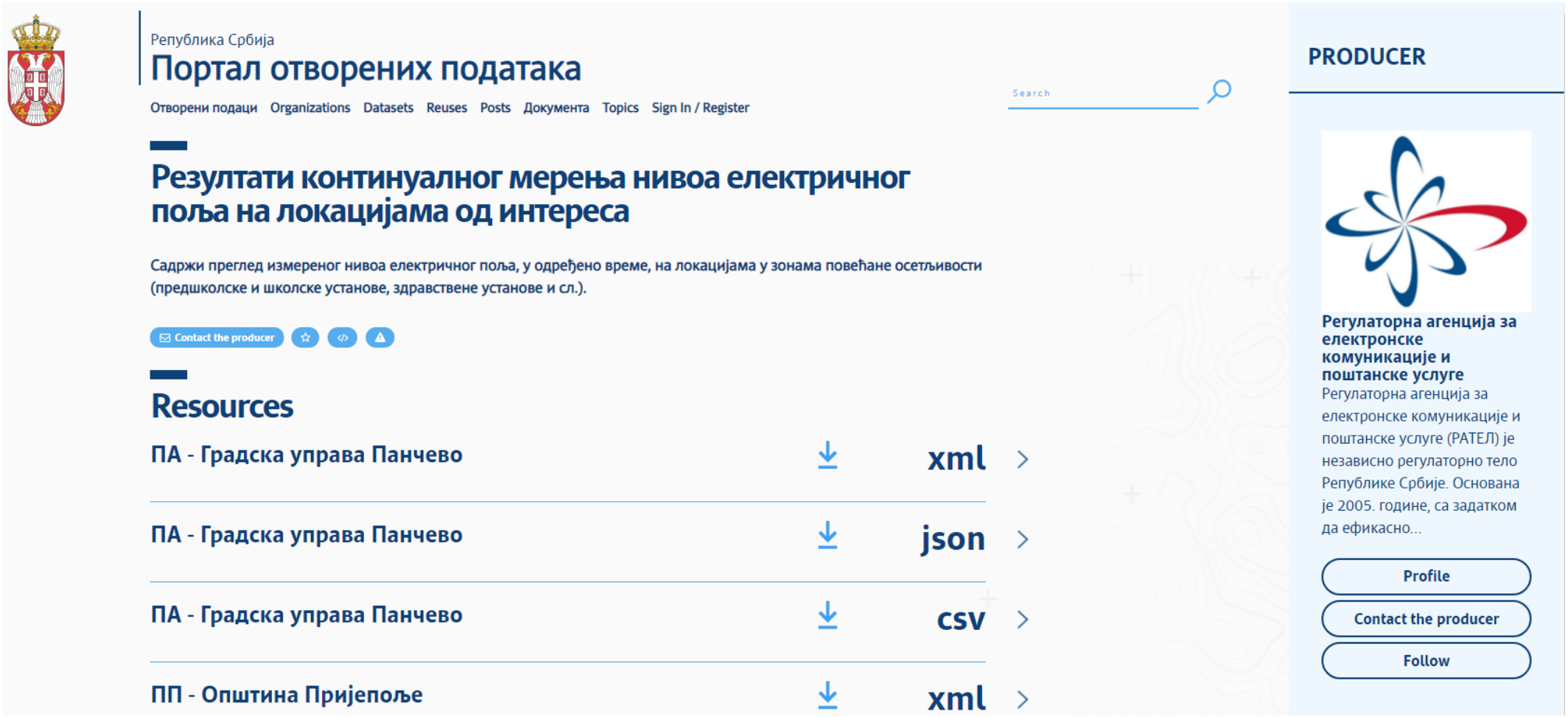
- Open data features:
  - measurement results are linked with Governmental Open Data portal and publicly available.



Continuous monitoring features

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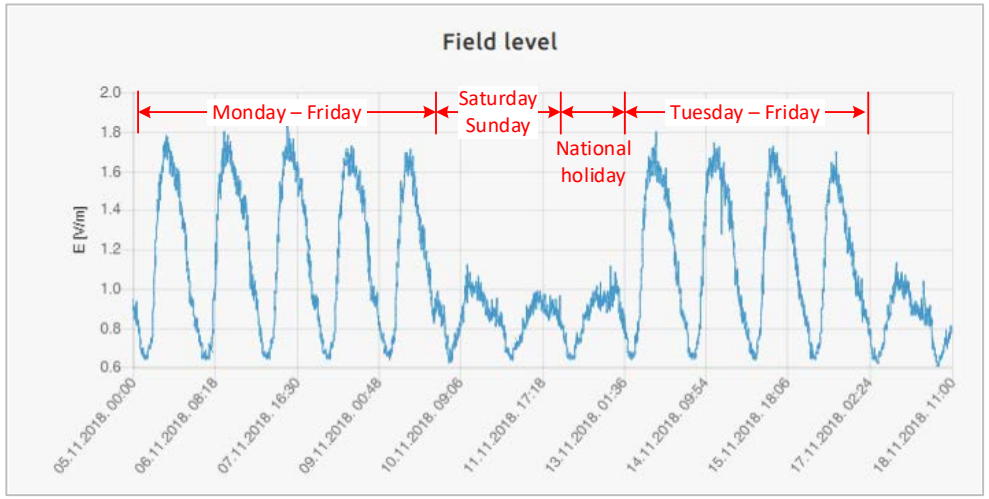
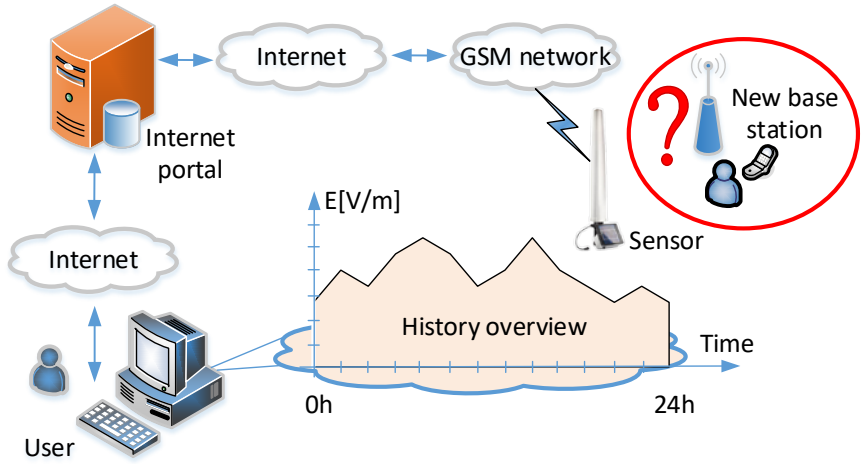
- Long-term monitoring is able to provide information on EMF fluctuation:



EMF history overview



Installation of a new EMF source on location

- 24/365 monitoring,
- past + present + predicted field levels for location,
- EMF register for locations of interest,
- better control of EMF,
- better control where and when new EMF source can be installed,
- etc…

Conclusion

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- EMF RATEL monitoring network offers:
  - continuous EMF monitoring (broadband + broadband per telecommunication services),
  - service-based approach can provide comparison between EMF levels of 5G and 2G/3G/4G networks.
- Systems intends to improve the quality of human life:
  - in approaching intensive EMF radiated environment,
  - particularly for regions, where social awareness on EMF and environment could be additionally increased,
  - demanding feature to timely inform the public on existing EMF levels and their influence on health.
- EMF RATEL become a useful and user-friendly tool for:
  - the general population, interested on daily EMF fluctuation, as well as for
  - regulatory agencies, which are in charge for regulation and protection of environment from possible harmful level of non-ionizing radiation.
- Finally, this system and its features can serve as an appropriate mediator:
  - between normal requests of the general population for the EMF safe living environment and
  - commercial operators that require additional EMF sources, in order to improve their telecommunication infrastructure.

Thank you for your attention.

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