



# Policy and regulatory measures to ensure interference free communication

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Minsk, 10. April 2019.

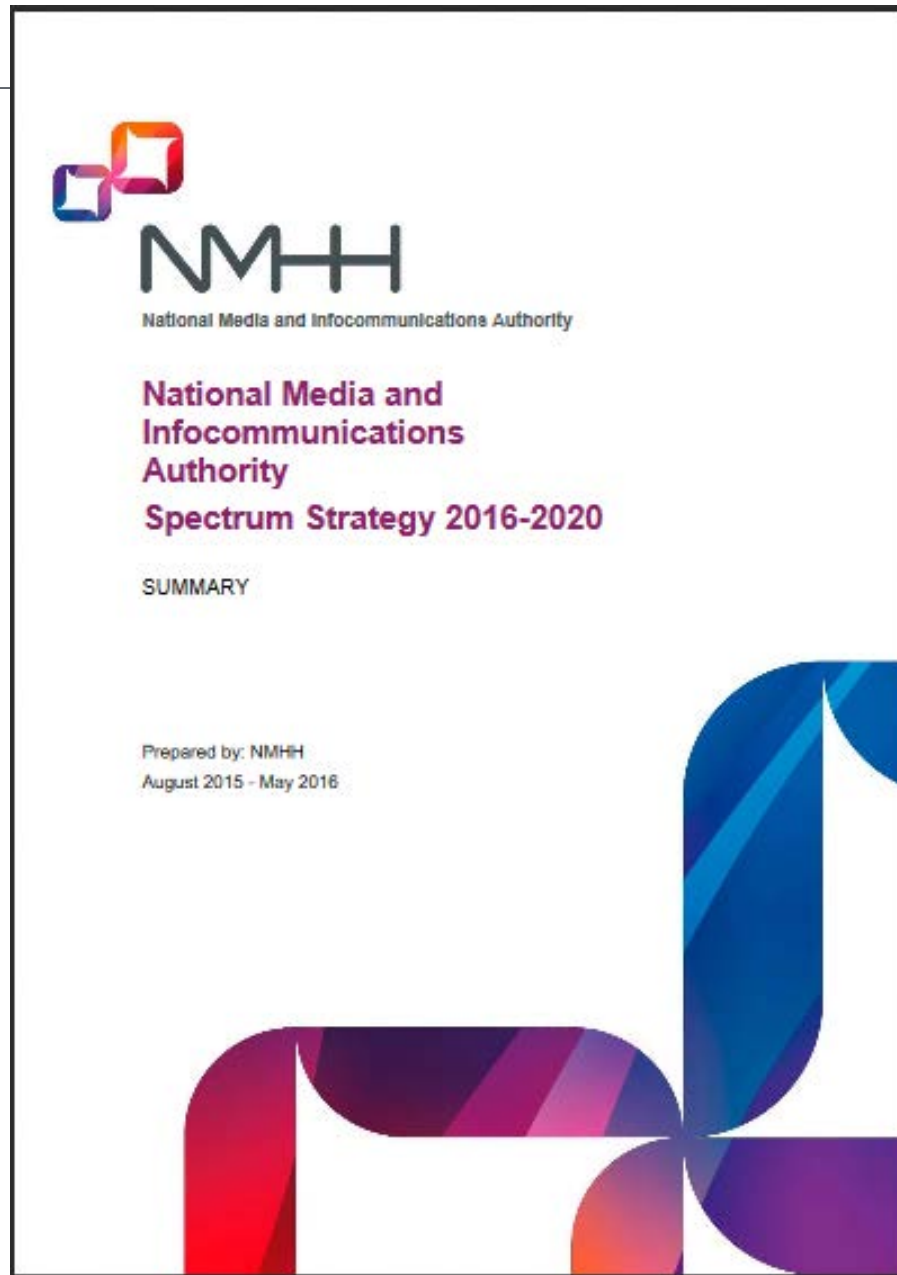
"Ignoranti, quem portum petat, nullus suus ventus est."

(„The wind is never favorable to those who don't know where they are going.”)



Lucius Annaeus Seneca

# Role of the Strategies at our Authority



## **1. Meeting the increasing demands in mobile broadband**

For mobile services and to ensure the continuing advancement of mobile broadband, spectrum must be provided and assigned as needed.

## **2. Meeting the demands of terrestrial audiovisual broadcasting and digitalisation**

Spectrum required for terrestrial audiovisual broadcasting, the continuing advancement of broadcasting, the digitalisation of radio broadcasting must be ensured in line with demands expected at national, regional and local levels alike.

## **3. Meeting the demands of narrow and broadband PPDR applications**

Demands for spectrum necessary for the operation and development of PPDR applications must be met and narrow band spectra must be kept available for future applications for at least another 10 years, while preparing for surges in

demand for broadband and taking into account the possible frequencies both currently available and newly released (sale of the 700 MHz band, future regulations of the 410-430 and 450-470 MHz bands).

## **4. Preserving the value of non-civilian radiocommunications and meeting relevant demands:**

Demands for spectrum for the development of non-civilian radiocommunications must be met.

## 5. Shared or collective spectrum use

A possible expansion of shared or collective radio spectrum use must be evaluated.

## 6. Supporting the early adaptation of innovative and advanced technologies

It is important to support the early adaptation of innovative and advanced technologies.

## 7. Ensuring an efficient and quality spectrum management

The legislative framework and conditions pertaining to spectrum management must be drafted and maintained to a high standard. Harmonisation tasks relating to spectrum management must be performed to a high standard.

## 8. Establishing a flexible and open institutional structure, attending to communication tasks at a high standard

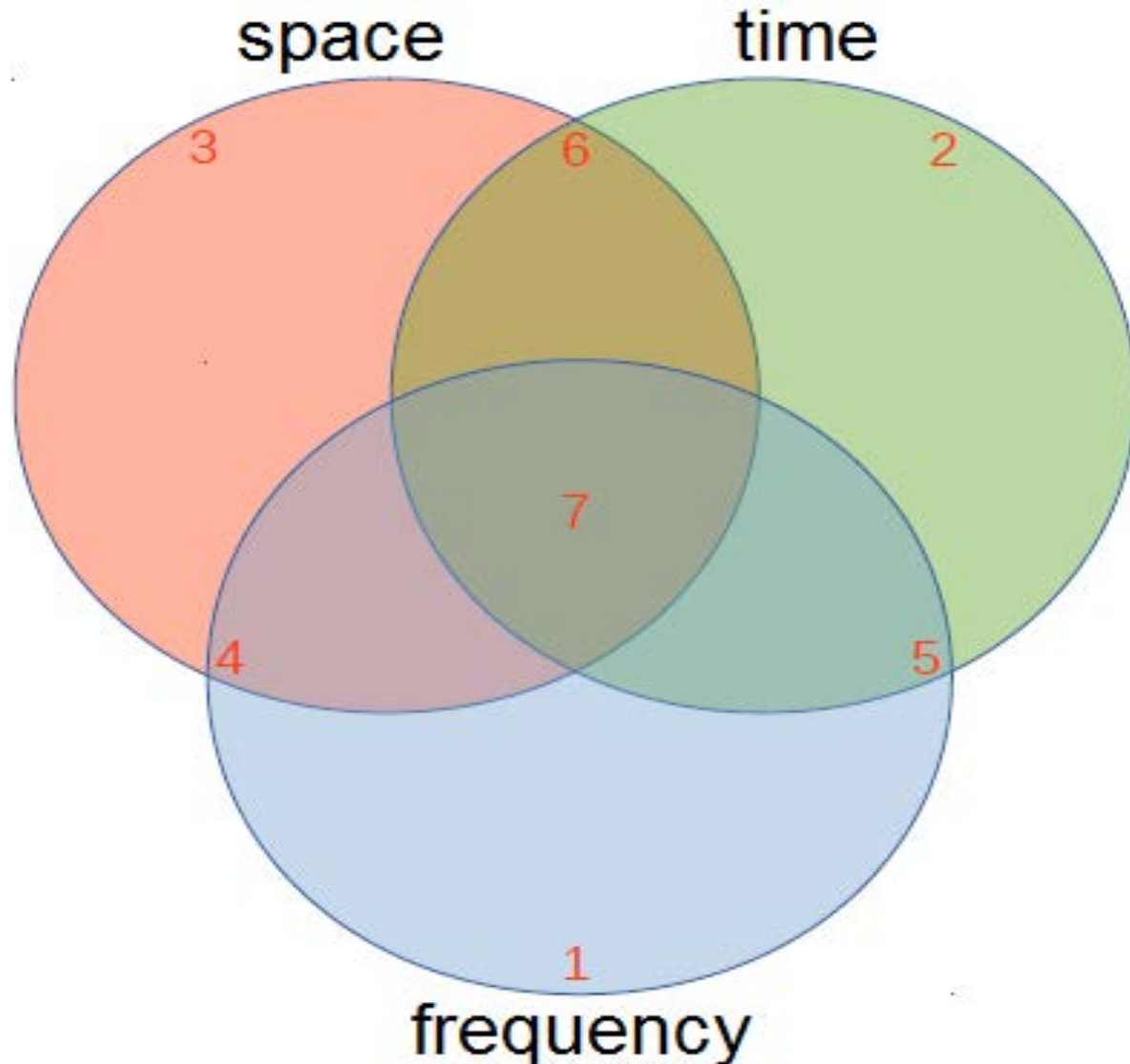
## 9. Meeting demand for spectrum

Ample spectrum must be made available to meet the continuously changing social and economic demands for frequencies.

## 10. Ensuring the smooth and interference-free use of spectrum and carrying out measurements related to spectrum management

11. The legislative framework for spectrum management must be drafted and maintained to a high standard, with a focus on continuous advancement in regulations and efficiently representing national interests

Common dimensions of individual frequency usages



## SHARED use

Section 1 to 6.

One or two dimensions are the same

## COLLECTIVE use

Section 7.

Each dimension is used collectively

## Main concepts identified at EU level:

Shared Use

- Shared use

CUS  
(Common use of  
spectrum)

- The model for collective use of spectrum

LSA  
(Licenced Shared  
Access)

- Licensed Shared Access based on space-time sharing

Both EU level obligations and national requirements can result in the application of these



## Regulatory approach

Aim: creating of possibility of introducing of new radiocommunications system

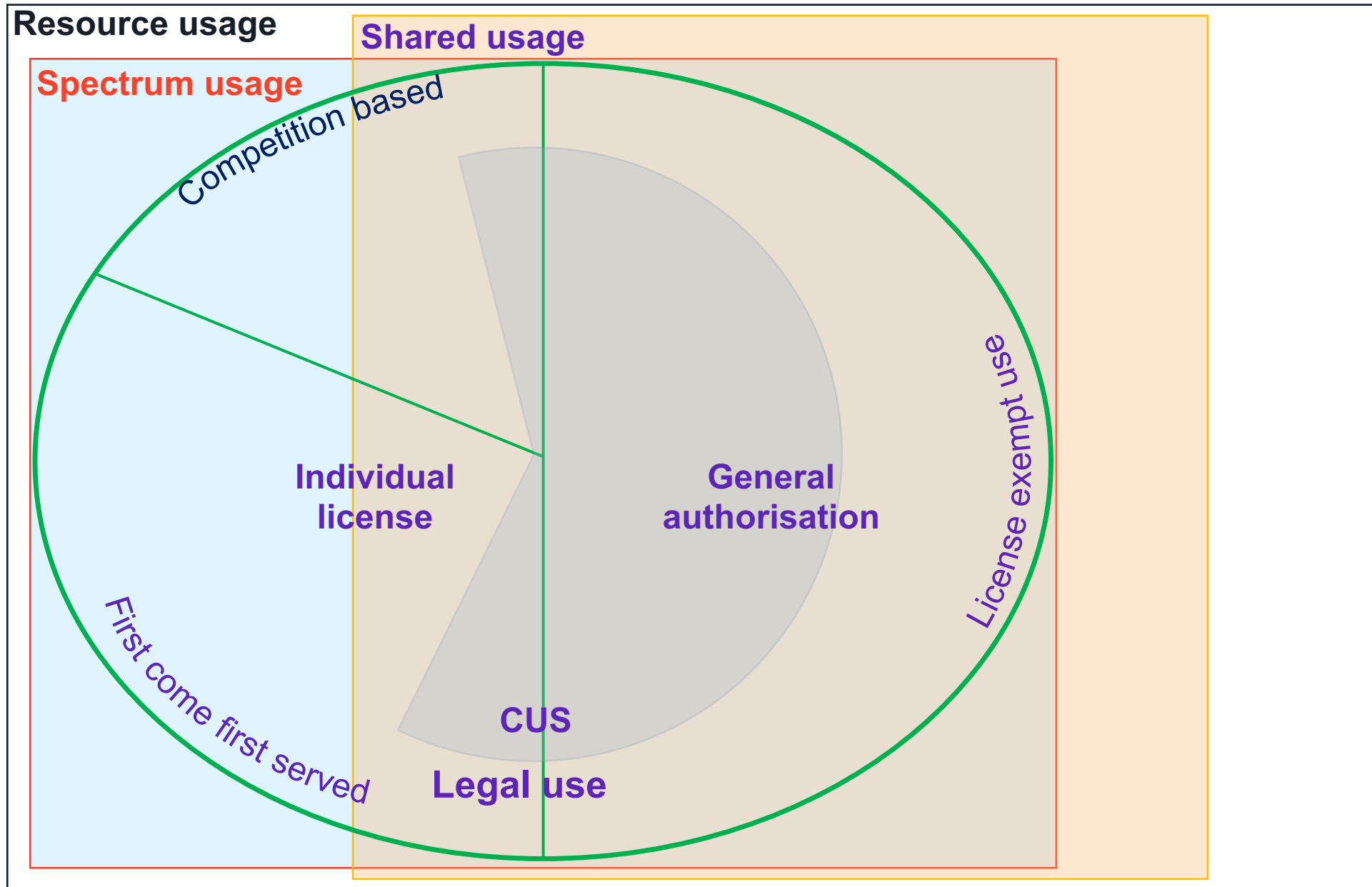
- for new users with the following conditions:
  - Individual license
  - protection of incumbent applications

in bands where incumbent frequency usage exist

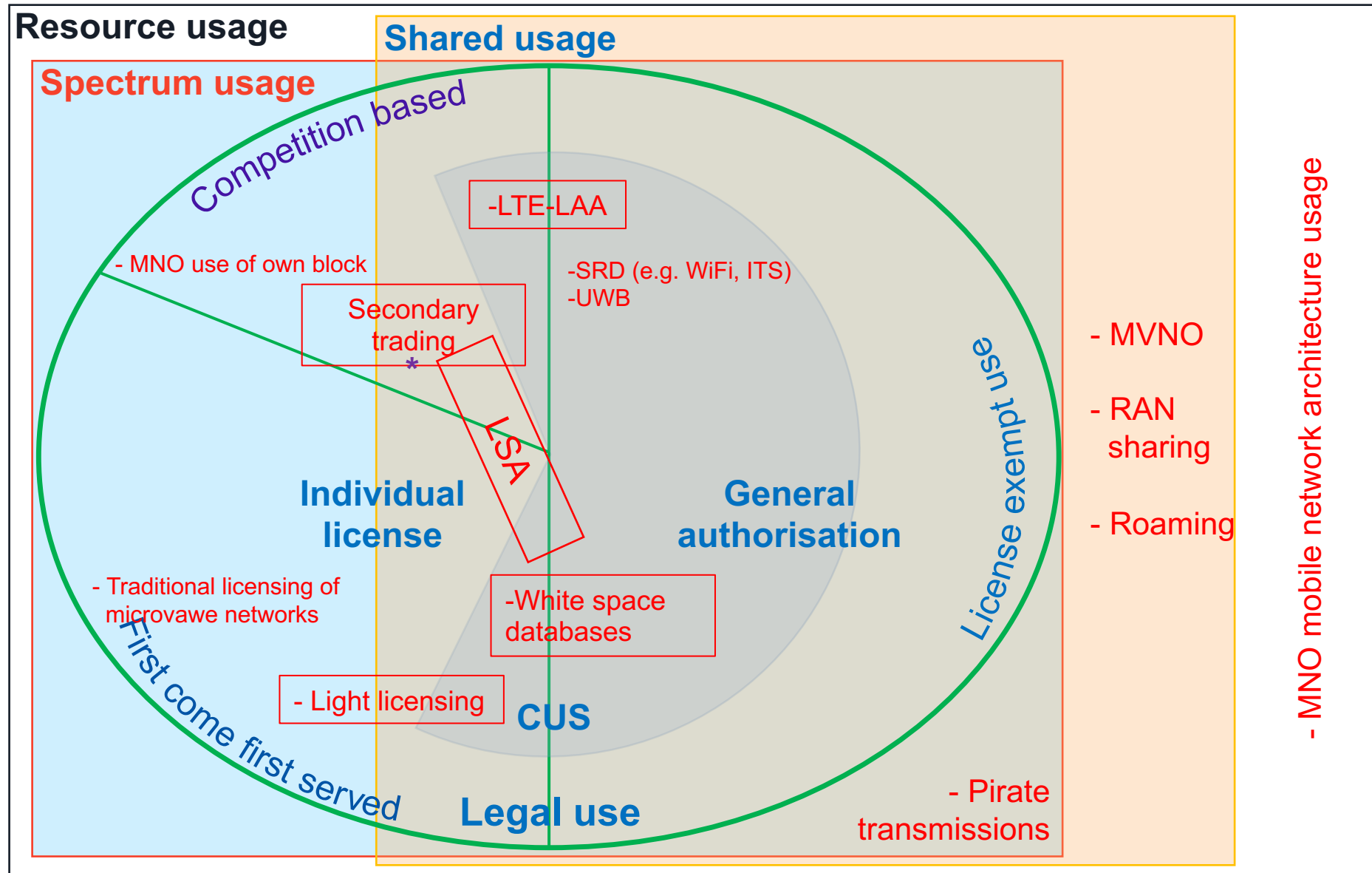
- it is currently
- it is identified for the future

through a sharing rule, a certain level of service quality guarantee can be provided

# Categorization of resource usage



# Categorization of resource usage



\* : Active RAN sharing with spectrum sharing

(Examples are written in red)

- MNO mobile network architecture usage



Nemzeti Média- és Hírközlési Hatóság

## NATIONAL ROADMAP

FOR THE UTILISATION OF  
THE VHF III. (174–230 MHz)  
AND THE UHF (470–790 MHz)  
FREQUENCY BANDS

THE FUTURE OF  
DIGITAL BROADCASTING  
AND MOBILE BROADBAND  
FREQUENCY USE OPTIONS

20 August 2017

[http://english.nmhh.hu/document/190192/uhf\\_vhf\\_3\\_national\\_roadmap\\_eng.pdf](http://english.nmhh.hu/document/190192/uhf_vhf_3_national_roadmap_eng.pdf)

# Issues relevant to terrestrial digital television broadcasting

The winning applicant of the tender for the national digital television broadcasting network for the frequency band 470–694 MHz and the free-to-air broadcasting station operating licence needs at least one year of preparation before launching the service. Therefore, the winner of the tender must be published by 5 September 2019 at the latest. **(ongoing)**

NMHH considers viewer interest as the top priority in the tendering procedure for the utilisation of the 470–694 frequency band, which in this particular case means access to public service content in the same format and under the same terms and conditions. Due to the possibility offered by the technological upgrade, the winning applicant can make its own business decision to develop and deploy its terrestrial broadcasting network. **(2 DVB-T MPEG-4 and 3 DVB-T2 HEVC)**

Due to the need for uniform frequency management of the spectrum remaining after the clearance of the 700 MHz frequency band on 5 September 2020, the broadcasting station operating tender for audiovisual media services broadcast via local coverage broadcasting are practical and advisable to run parallel with the operating tender of the national terrestrial digital television broadcasting network.

(33 local TVs existing in our country - ongoing)

Protection for Hungarian broadcasting (including PMSE applications) must be provided until 2032 taking into consideration that as a result of a tender procedure the rights of use are obtained for 12 years according to the to the regulation in force.

In order to **minimise the domino effect** and with due consideration to the obligation to cooperate, the Hungarian plans for the introduction of MFCN, which also comply with the minimum technical harmonisation conditions and state that broadcasting will stop on 5 September 2020 in the 700 MHz frequency band, will be specified in NMHH Decree 7/2015 (XI.13.) on the national frequency allocation and the rules of using frequency bands. This amendment does not reflect the provisions that serve as the conceptual basis of the award procedure facilitating the utilisation for MFCN purposes.

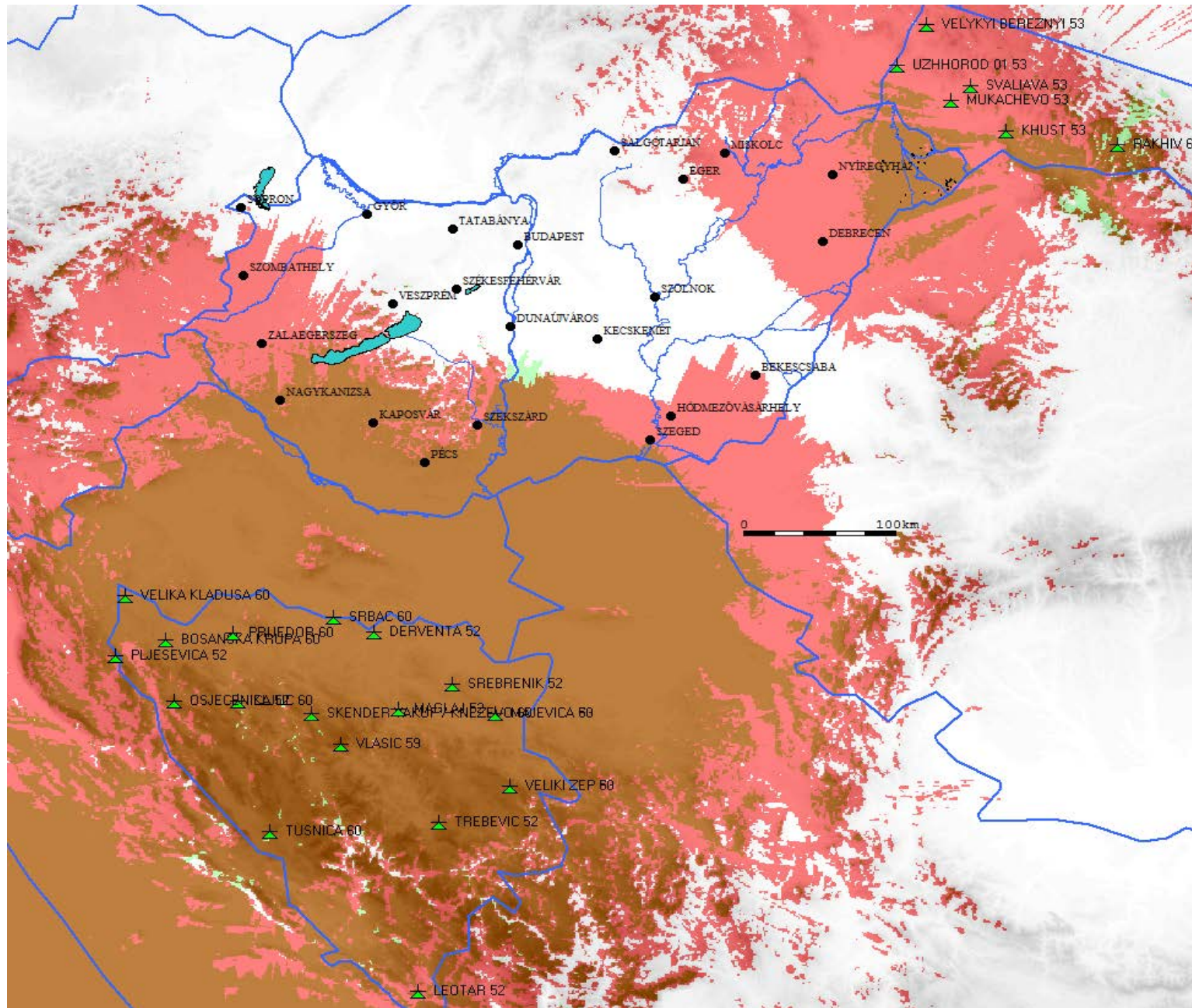


NMHH makes available the **2x25 MHz** (5 x 2x5 MHz blocks) of the spectrum within the 700 MHz frequency band for FDD based MFCN within the frame of an award procedure to ensure that from 6 September 2020 frequency use for MFCN purposes becomes possible in most areas of the country.

694 – 703	703 – 708	708 – 713	713 – 718	718- 723	723- 728	728- 733	733- 738	738- 743	743- 748	748- 753	753- 758	758- 763	763- 768	768- 773	773- 778	778- 783	783- 788	788- 791
guard band	Uplink						Duplex gap					Downlink					guard band	
							Duplex gap	SDL										
9 MHz	30 MHz (6 x 5 MHz blocks)						5 MHz	20 MHz (max. 4 x 5 MHz blocks)				30 MHz (6 x 5 MHz blocks)					3 MHz	

NMHH is not planning to run an award procedure before 2020 to introduce the SDL in the duplex gap.

Initiating MFCN (including PPDR radio application) coordination agreements with the neighbouring countries till 31 July 2017. (Finished – fine tuning)



When creating the strategy for the wireless broadband utilisation of the 700 MHz frequency band, due consideration must be given to all mobile bands and other related issues, especially the broadband needs of PPDR radio applications.

In addition to the 700 MHz frequency band, future utilisation of the **1452–1492 MHz** and **2300–2400 MHz** bands, the sub-bands available for distribution in an award procedure of the **2100 MHz**, **2600 MHz** and the **3400–3800 MHz** frequency bands as well as the frequency licences in the 2100 MHz (UMTS) and the **26 GHz bands** to expire in late 2019 need to be taken into account to “compile” a frequency set to be offered for distribution in the award procedure.





Radio spectrum -sales schedule	3400-3800 MHz	1452-1492 MHz	2300-2400 MHz	700 MHz	2100 MHz	2600 MHz	26 GHz
Mode of sales	Auction	Tender	Tender	Auction	Tender, Auction	Auction	Tender
Band segments to be sold	3410-3590 MHz 3600-3800 MHz <i>(part of band in 2016, ongoing in 2019)</i>	1452-1492 MHz band	?	<i>708-733/763-788 MHz; and max 5X2X5MHz</i>	1965-1980/2155-2170 MHz or 1920-1980/2110-2170 MHz <i>(3X2X5 MHz ongoing in 2019)</i>	2600-2615 MHz <i>ongoing in 2019</i>	24549-24605/25557-25613 MHz; 25249-25445/26257-25453 MHz
Possible ways of utilizing the band (applications)	MFCN (3410-3590 MHz TDD, 3600-3800 MHz TDD)	MFCN - SDL	LSA MFCN/PMSE	MFCN	MFCN	MFCN	digital point-point, point-multi point
Date of liberation		<b>Beyond 2020</b>	<b>Beyond 2020</b>	September 5, 2020			April 30, 2019
Date of opening		<b>Beyond 2020</b>	<b>Beyond 2020</b>	September 5, 2020			April 30, 2019
Date of sale	Q 1 2016 <b>Ok.</b> Q 3 2019 <b>Ongoing.</b>	<b>Beyond 2020</b>	Q 2 2018 -2019 <b>Beyond 2020</b>	Q 2 2018 -2019	Q 2 2018 -2019	Q 2 2018 -2019	Q 2 2018 -2019 <b>Beyond 2020</b>



NEMH

Nemzeti Média- és Hírközlési Hatóság

## Measurement plan of National Media and Infocommunications for 2019

### Authority

Measurement department

**Maker:** Gáspár Emőd  
head of department

**Reporter:** Balogh János  
head of department

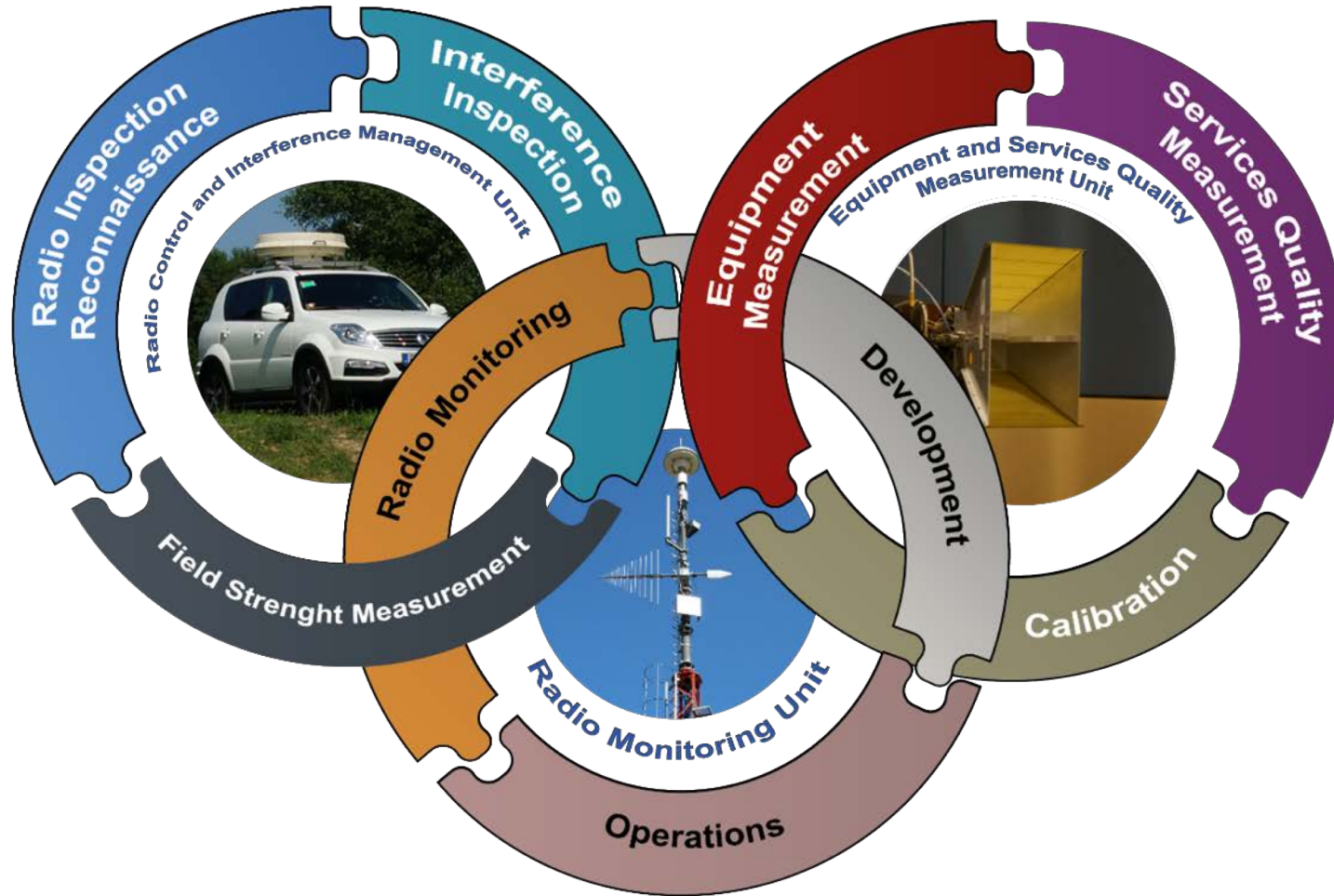
**Approved:** Vári Péter  
deputy general director

Budapest, 3 March, 2019

# Measurement Affairs in our Authority

General overview of the Hungarian National Radio Measurement and Interference Investigation Service





Role	Engineers	Technical staff
Radio monitoring	10	6
Radio inspection and investigation	8	2
Interference elimination	7	1
Field strength measurements	3	-
Measurement for market surveillance	10	2
Calibration	3	-
Methodology development and facilities management	3	1
Administration assistance	3	1
Management	4	-
<b>Department of Measurement Affairs</b>	<b>51</b>	<b>13</b>

# Spectrum monitoring

Radio monitoring unit

## Compliance with license conditions:

- Signal strength or field strength
- Carrier frequency accuracy
- Bandwidth (monitoring)
- Intermodulation products
- Spurious emissions
- Unlicensed, harmful transmissions
- Location of transmissions

## Band (channel) usage data

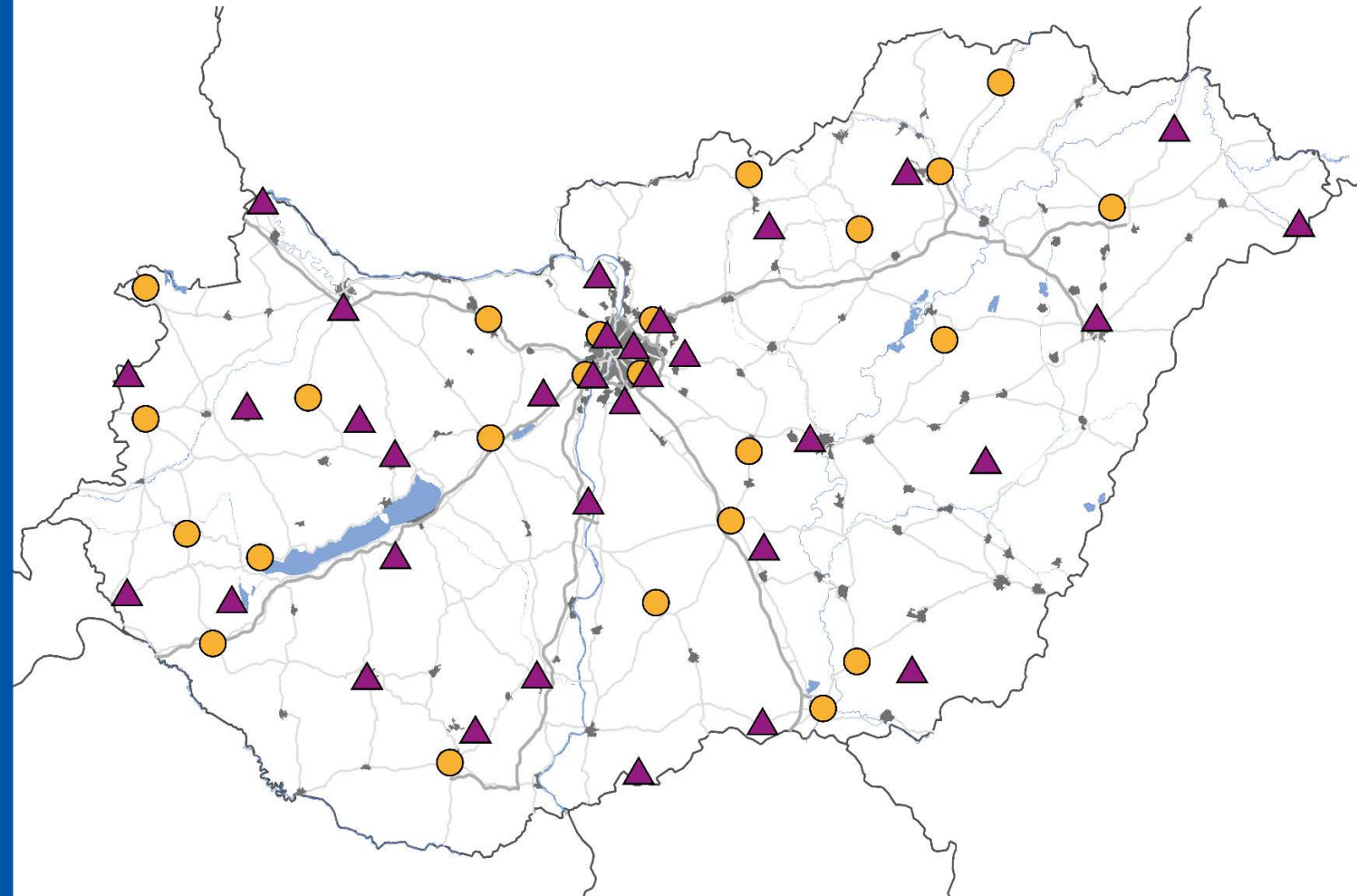
- Free channel search
- Channel or frequency occupancy

## Data of coverage

- Distribution of field strength
- Quality of transmission

## Identification (signal classification)

## Signal analysis



▲● Fixed monitoring stations in Hungary

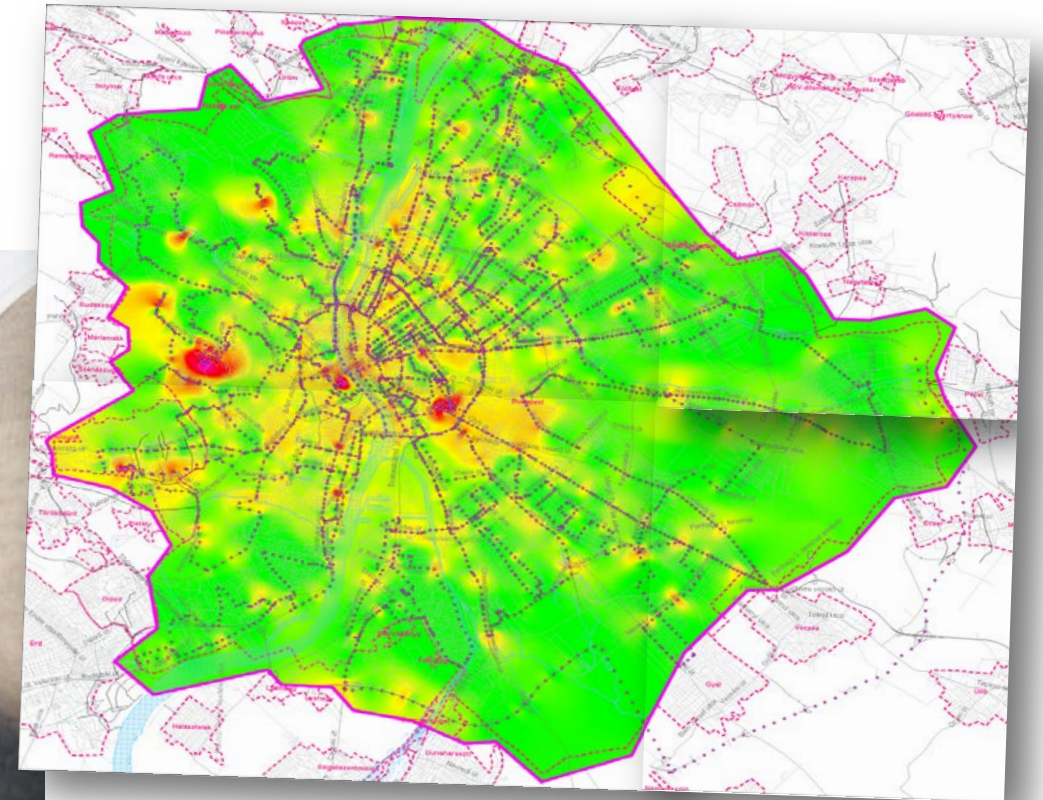


- 55 fixed monitoring stations
- 4 mobile monitoring systems
- 33 EMF measurement probes
- 1 satellite monitoring station
- 1 low frequency monitoring station





- Measurement programs, campaign with publication
- Path-registering measurements (mobile measurements)



# Radio Inspection

Radio Control and Interference Management Unit





- 3 DVB-T coverage vehicles
- 4 Mobile Broadband measurement vehicles
- 4 Interference measurement vehicles
- 4 Radio Inspection vehicles



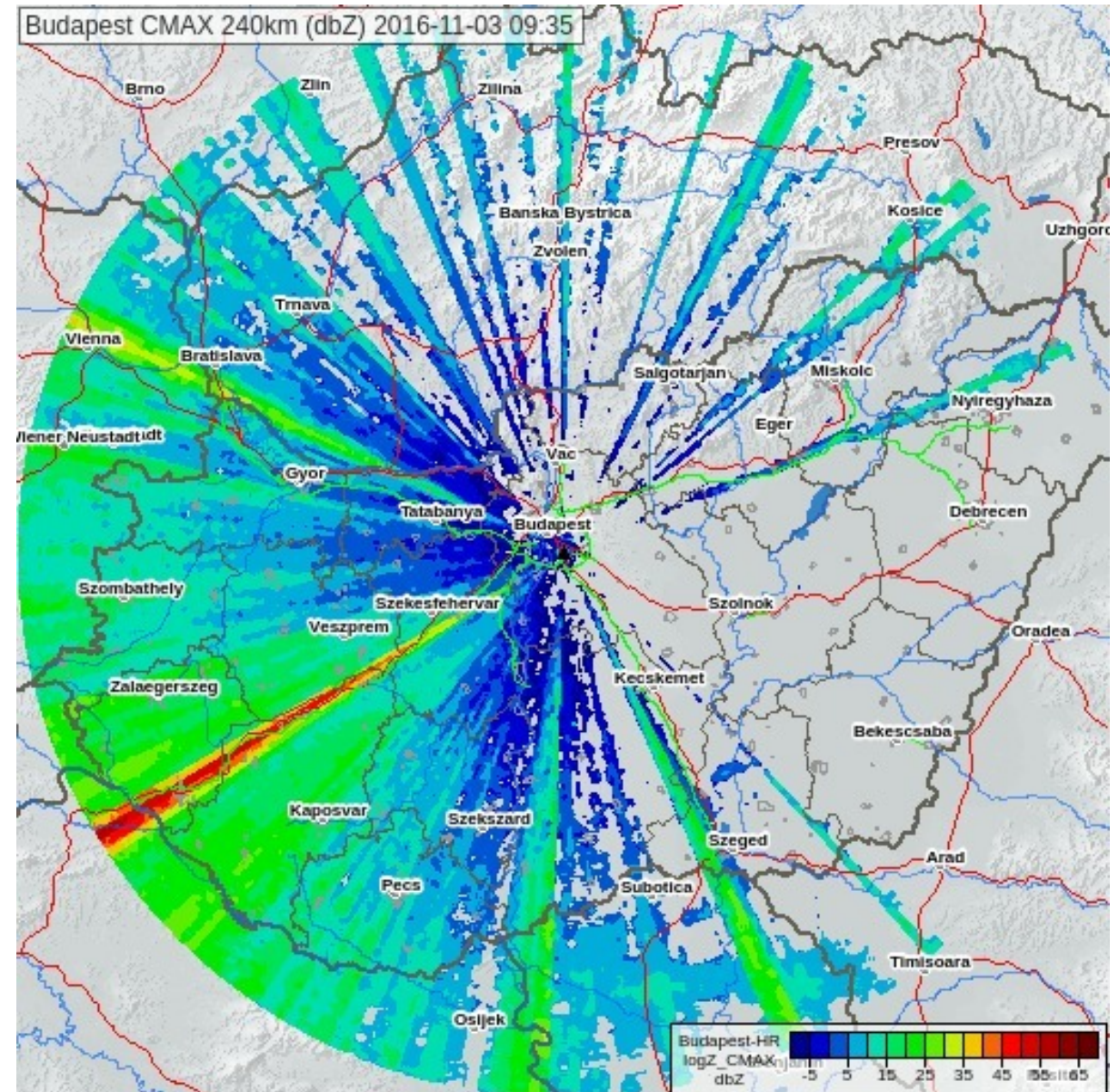


Main types of interference cases solved and measurements done by the Radio Control and Interference Management Unit:

- DECT 6.0 and 5.5 GHz RLAN interferences
- Mobile service providers interferences (i.e.: repeaters)
- DVB-T drive test
- Mobile broadband measurements



- Based on existing European legislation 5GHz RLANs can use the same frequencies as meteorological radars:
  - **primary user:** meteorological radar
  - **tertiary user:** RLAN (shall not cause harmful interference to primary user)
- Despite the fact that the latest regulations require the use of DFS (Dynamic Frequency Selection), the previously installed RLANs don't have this capability (or it can be switched off).
- The signal of the continuously radiating RLANs results in strong interferences on the radar.



Budapest at the end of 2016



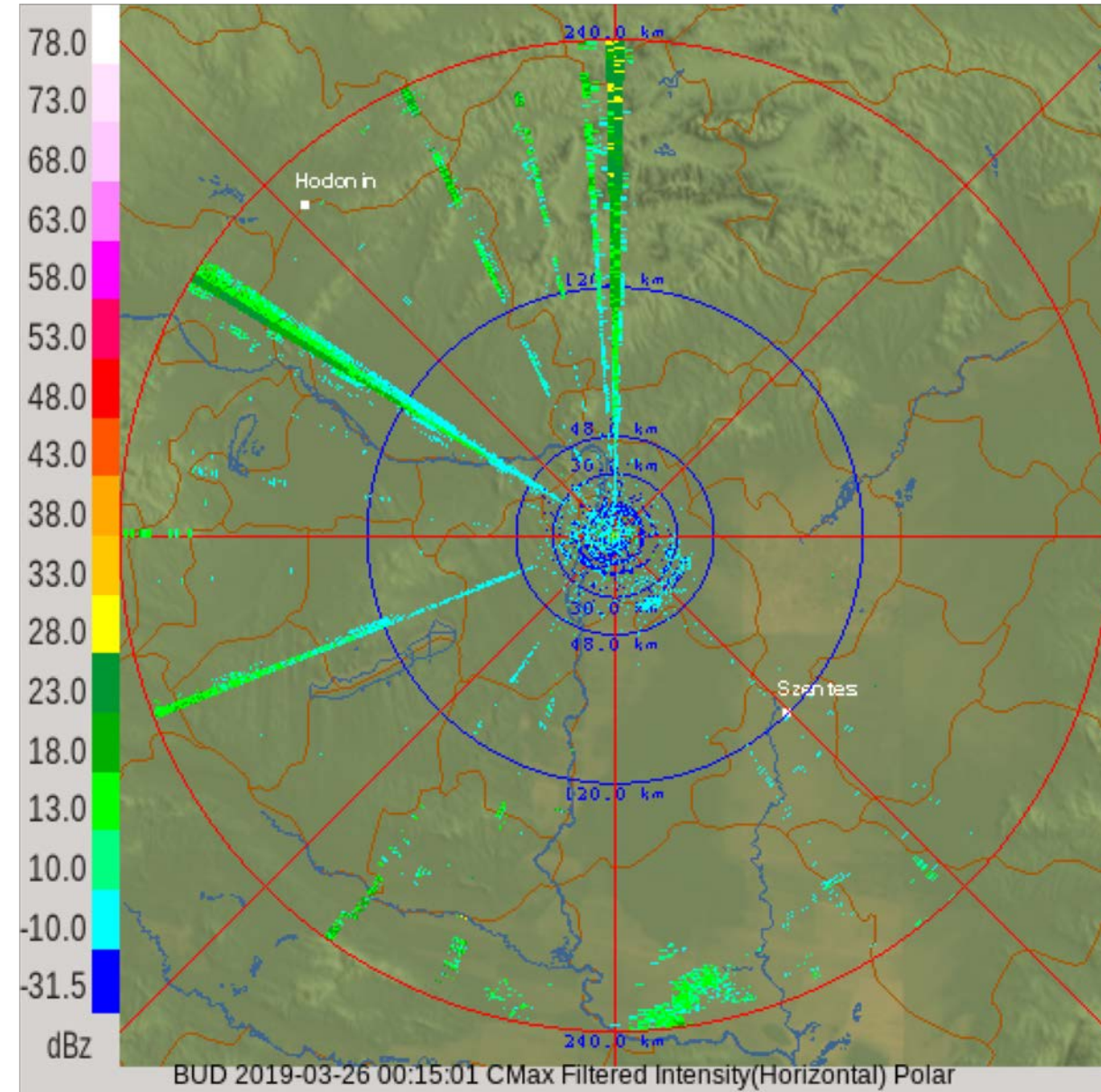
We are locating the interference sources using professional measurement equipment:

- R&S spectrum analyzer and direction finding system
- NARDA IDA2 portable signal analyzer
- Netscout AirCheck G2 Wireless Network Tester

together with:

- Built-in RLANs (Ubiquiti, MikroTik, Cambium)
- Self-developed analytical software
- Google Maps application

This resulted more than 200 discovered sources of interference in the area of the 4 meteorological radars in Hungary.



Budapest now

# Measurement laboratory

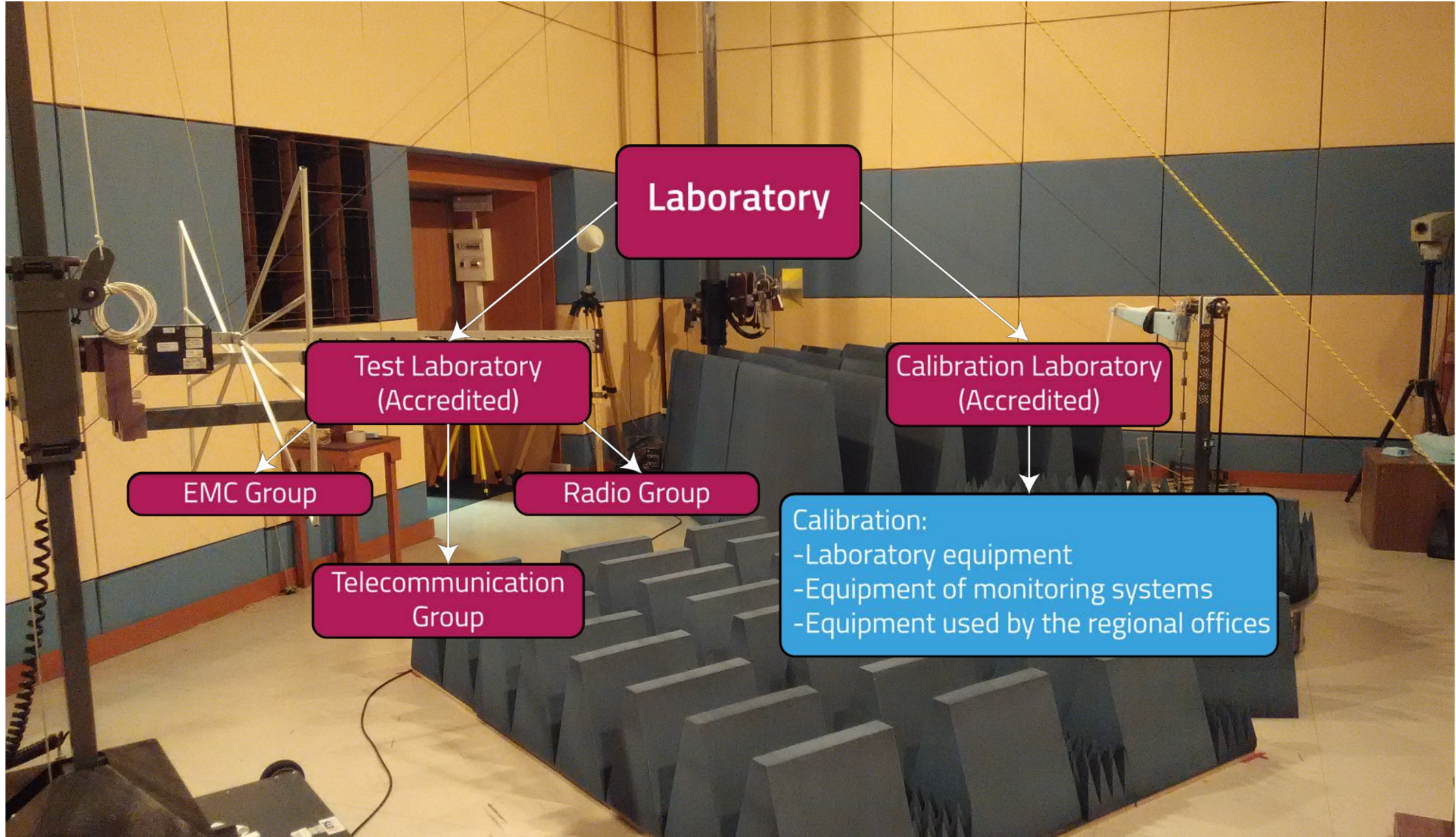
Equipment and Service Quality Measurement Unit



- Market surveillance measurements
- Measurements for supporting frequency management decisions (protections between different services etc.)
- Measuring and analyzing the quality parameters of broadband internet services
- Test laboratory does accredited measurements according to ISO/IEC 17025



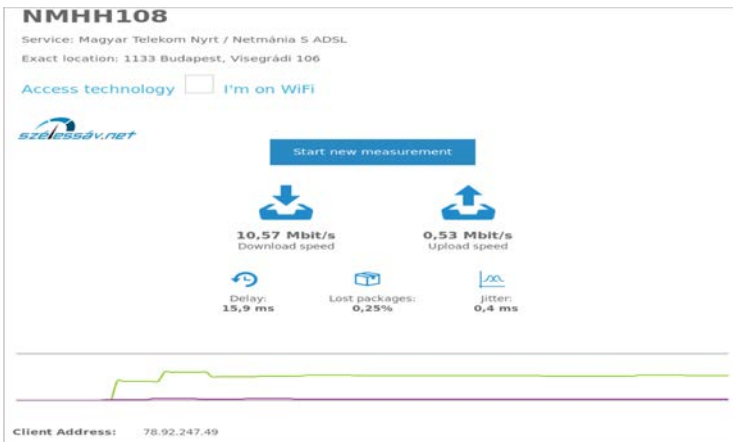




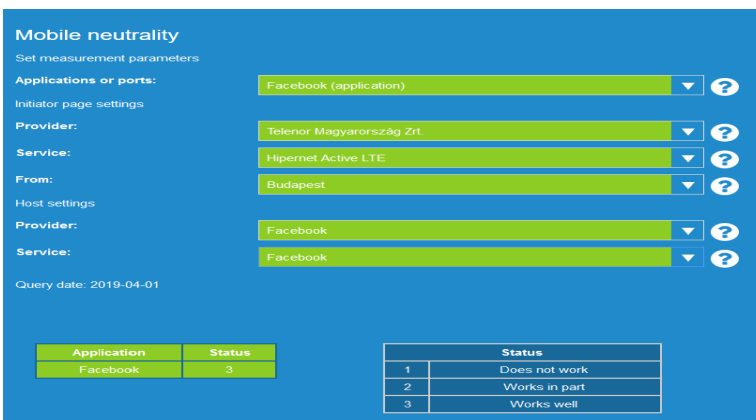


## Measurement elements

Software download-, upload speed,  
latency, packet loss, jitter 123.000  
results per month



## Mobile net neutrality



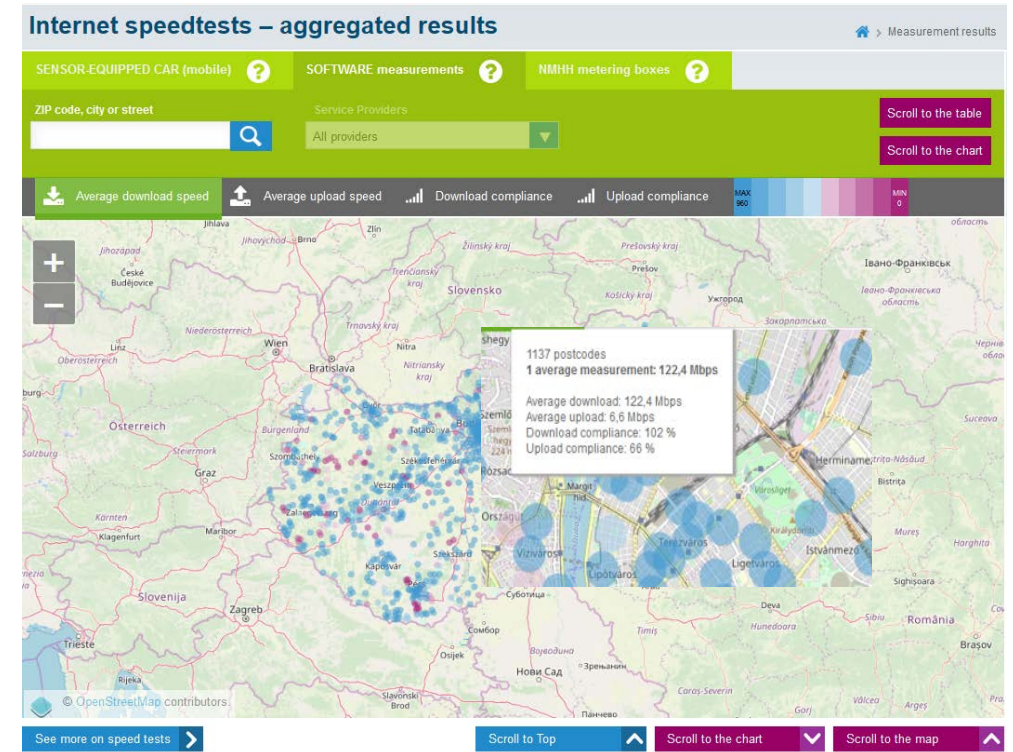
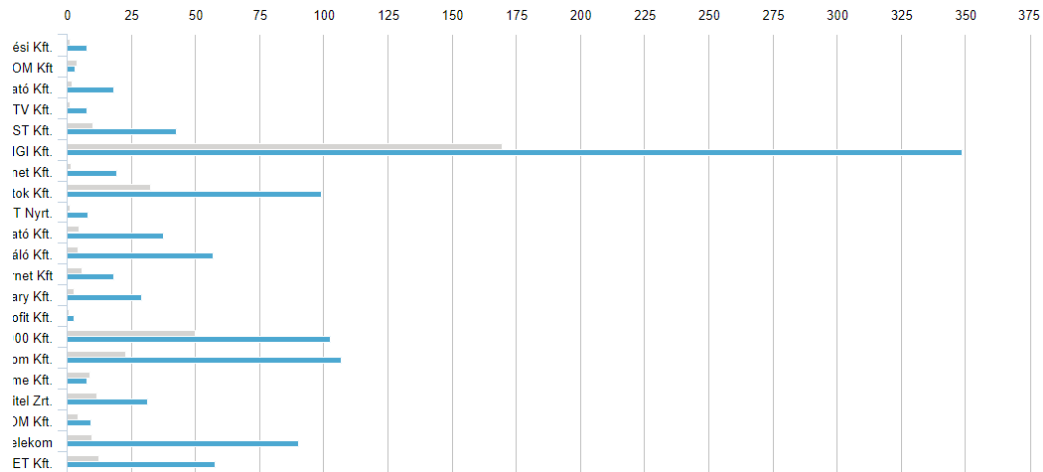
Hardware tools: speed, latency packet loss, jitter  
and net. neutrality (port scan)



Mobile Internet quality meas. system  
(Swissqual) 2.800.000 measurements per  
month

## Displaying of measurement results

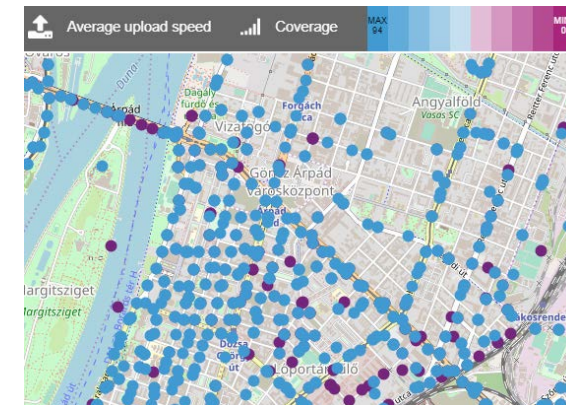
- The own results of the user (for registered users) and aggregated results of all users of last 3 months.
- Mobile internet, fixed line software based, and hardware based measurement results displayed.
- Results are displayed in the form of zoom able map, downloadable tables and time-graphs.
- Aggregated measurement results on the map.
- Filtering data: service provider, internet service...
- Network neutrality measurement results.



### Average test results in tabular form

Aggregated results of the area visible in the above map. Coordinates of the area: N 44.892645621955, E 25.98595059375 | Today's date: [2019-04-01]

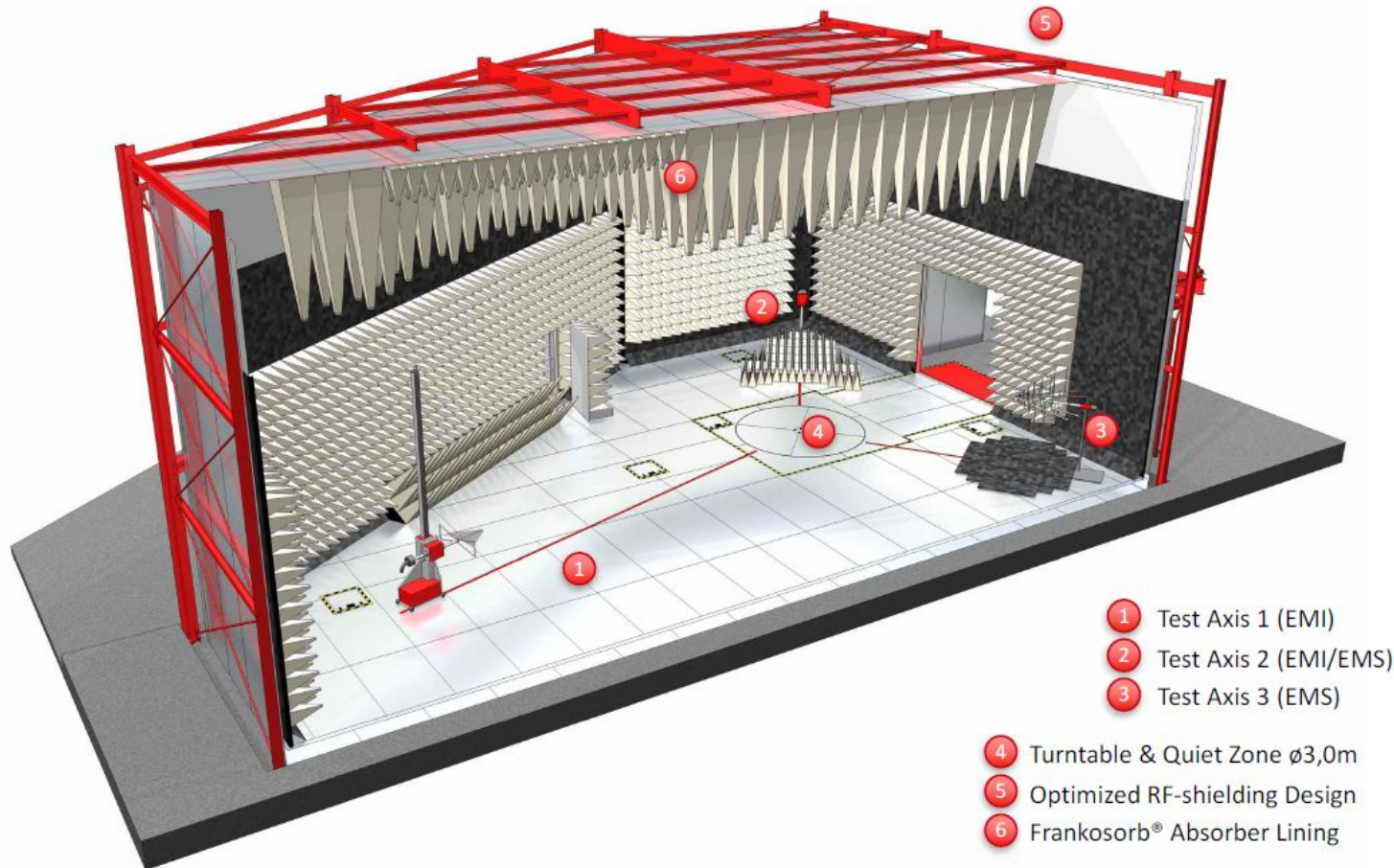
Service	Download	Upload	Down %	Up %	Ping	Packetloss	Jitter
screening for ...	screening for ...	screening for ...	screening for ...	screening for ...	screening for ...	screening for ...	screening for ...







SAC-10 Plus TRITON



- All required EMI/EMS tests in one chamber
- 25 MHz – 18 GHz
- Multiple test axis
- No need to modify the test setup
- Cost saving and future-proof investment

- 1 Test Axis 1 (EMI)
- 2 Test Axis 2 (EMI/EMS)
- 3 Test Axis 3 (EMS)

- 4 Turntable & Quiet Zone  $\varnothing 3,0\text{m}$
- 5 Optimized RF-shielding Design
- 6 Frankosorb® Absorber Lining



More planned chambers:

- Reverberation chamber for WLAN equipment measurements
- Radio determination equipment measurements : 18 GHz - 110 GHz
- Radio equipment measurements: 25 MHz – 40 GHz
- Field probe calibration: 400 MHz – 10 GHz
- TEMPEST
- GTEM cell



...in response to Seneca, we have a good plan.

