



AKOS

Workshop: “The future of the 470-694 MHz band within the EU”

Friday, 11 April 2025, Brussels

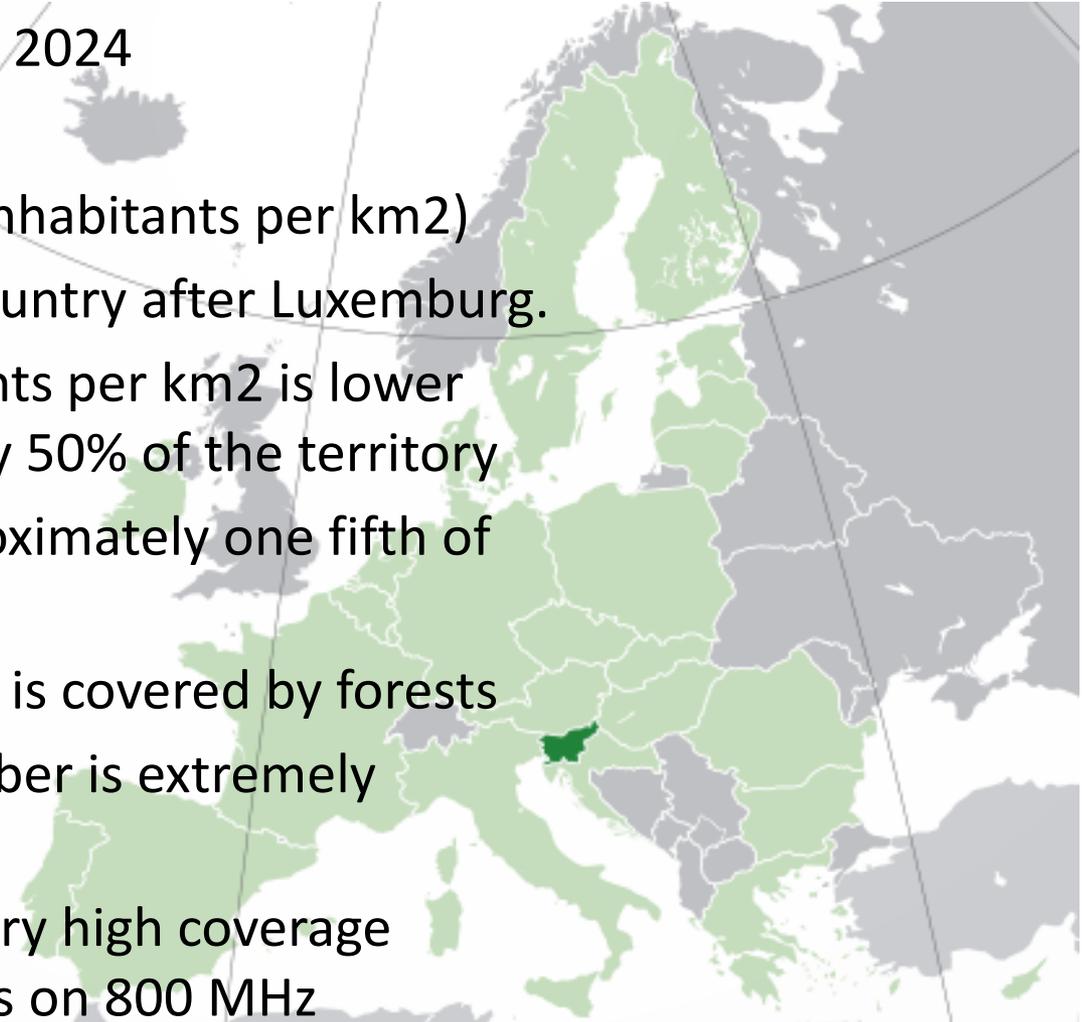
**Situation in Slovenian BS and MS Market
– usage in the band 470-694 MHz**

Meta Pavšek Taškov, AKOS

- ④ Facts and challenges in Slovenia
- ④ AKOS - Fields of activity
- ④ Projects from spectrum strategies 2019 - 2026
- ④ Convergence of Fixed and Mobile, Broadband Markets
- ④ Mobile coverage
- ④ Terrestrial linear TV Broadcasting market - current use of UHF band (470-694 MHz) in Slovenia
- ④ What is possible usages till WRC-31?



- ⦿ GDP: 29.753 EUR/pop in 2024
- ⦿ Land area ~ 20 000 km²
- ⦿ Population ~ 2 M (100 inhabitants per km²)
- ⦿ Second most rural EU country after Luxemburg.
- ⦿ The number of inhabitants per km² is lower than 10 in approximately 50% of the territory
- ⦿ Alpine area covers approximately one fifth of the country
- ⦿ One third of the country is covered by forests
- ⦿ The building of optical fiber is extremely expensive
- ⦿ Slovenia has imposed very high coverage obligations requirements on 800 MHz



Director

Telecommunications: Market regulation + Networks & services

Economic analysis

Spectrum management: Broadcasting + Mobile + Radiocomm.

Electronic media

Railway services

Postal services

Frequency spectrum measurements and control

Operator Control

Monitoring Infrastructure Investments

Legal Affairs

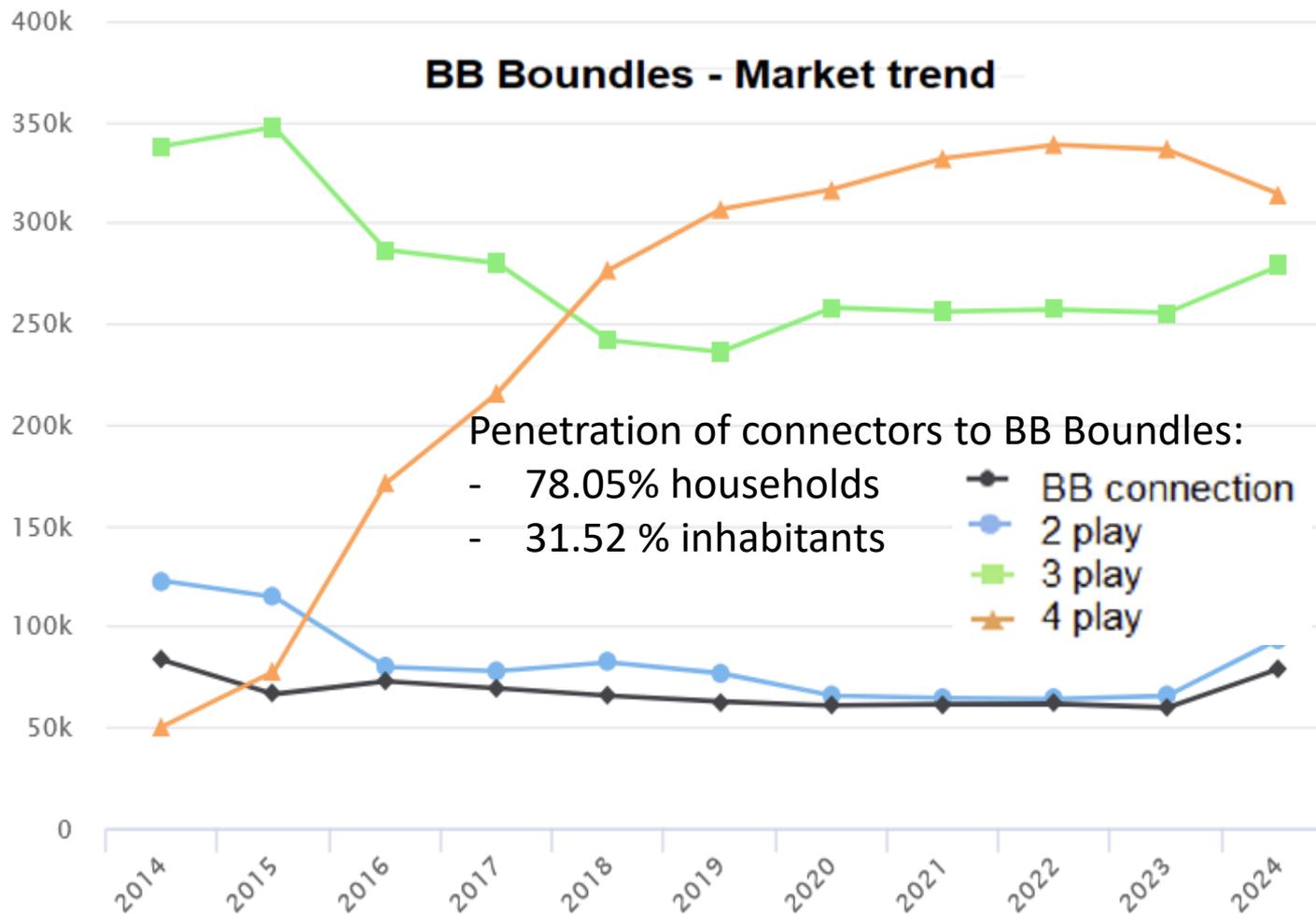
Supporting activities: HR, IT, accounting

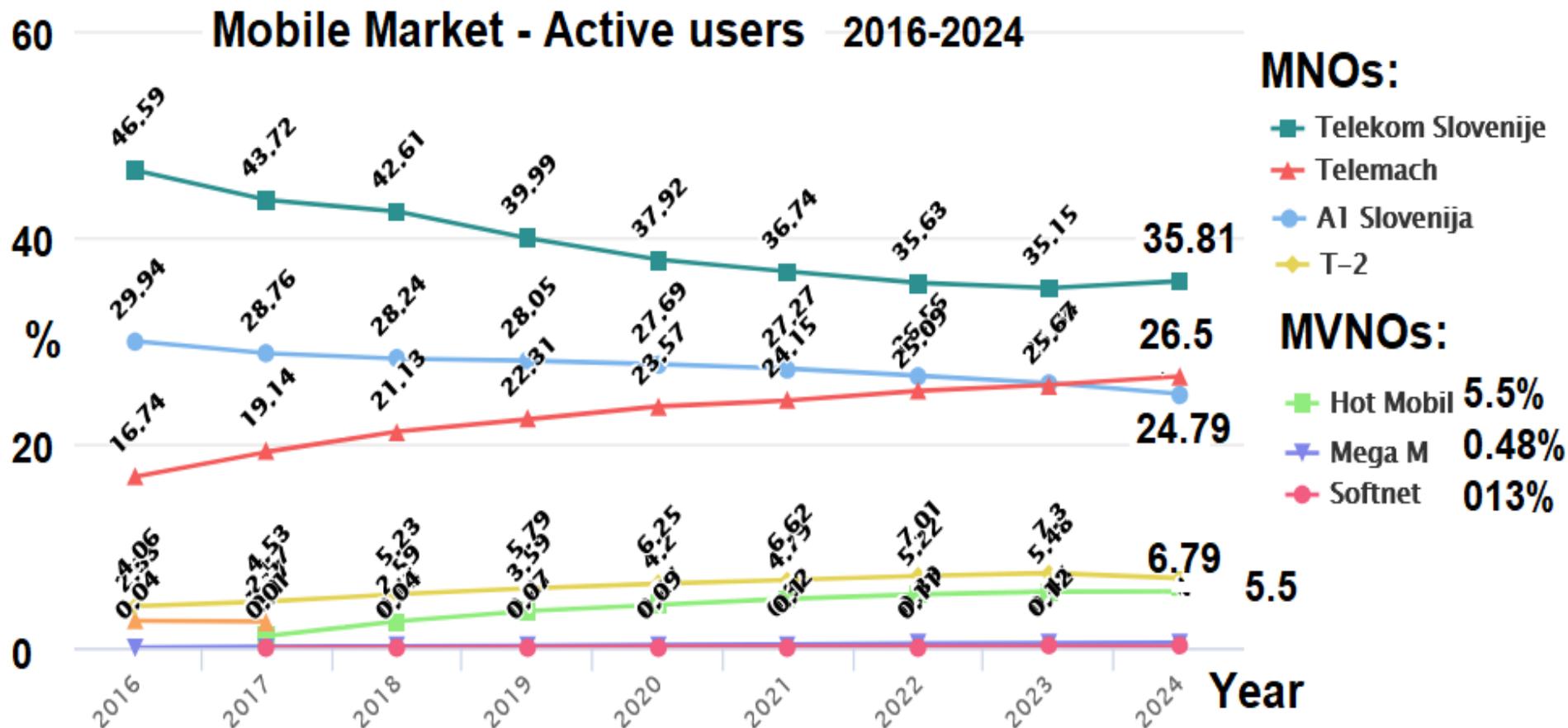
- 700+ Multiband Auction (700/1500/2100/2300/3600/26000 MHz) – 2021 
- Spectrum Strategy – 2021-2023
 - Action 1: WRC bands after adoption of EC DEC for 40 GHz band – public enquiry remaining 26 & 40 GHz , possible auction of upper 6 GHz band 
 - Action 5: 2021-2023 local Auction parts of 2300/3600 MHz for TRA-REC or verticals over private or public networks – 2024 (9 winners), an other public tender 2025 – in progress  
 - Action 6: in case of interest Auction 2 x 5 MHz in 410-430MHz for business critical 
 - Action 7: in case of interest help in assigning 2 x 5 MHz in 450-470MHz for PPDR 
 - Action 9: Assign locally parts of 3800-4200 MHz for verticals - service/technology neutral 
 - Action 11: Local Auction for remaining spectrum 10/12 GHz for MMDS/BWA- completed 2024 
 - Action 14: The need for more capacity in FS - refarming the bands for P-P fixed links- completed 2024 
- Spectrum Strategy 2024-2026
 - Action 4: In accordance with Article 4 of ECC DEC2017/899 use 4G/5G/6G in UHF channels in accordance with the GE 06 agreement or for public mobile technologies or for 5 G broadcasting, DTT protection in neighbouring countries at least until WRC-31  

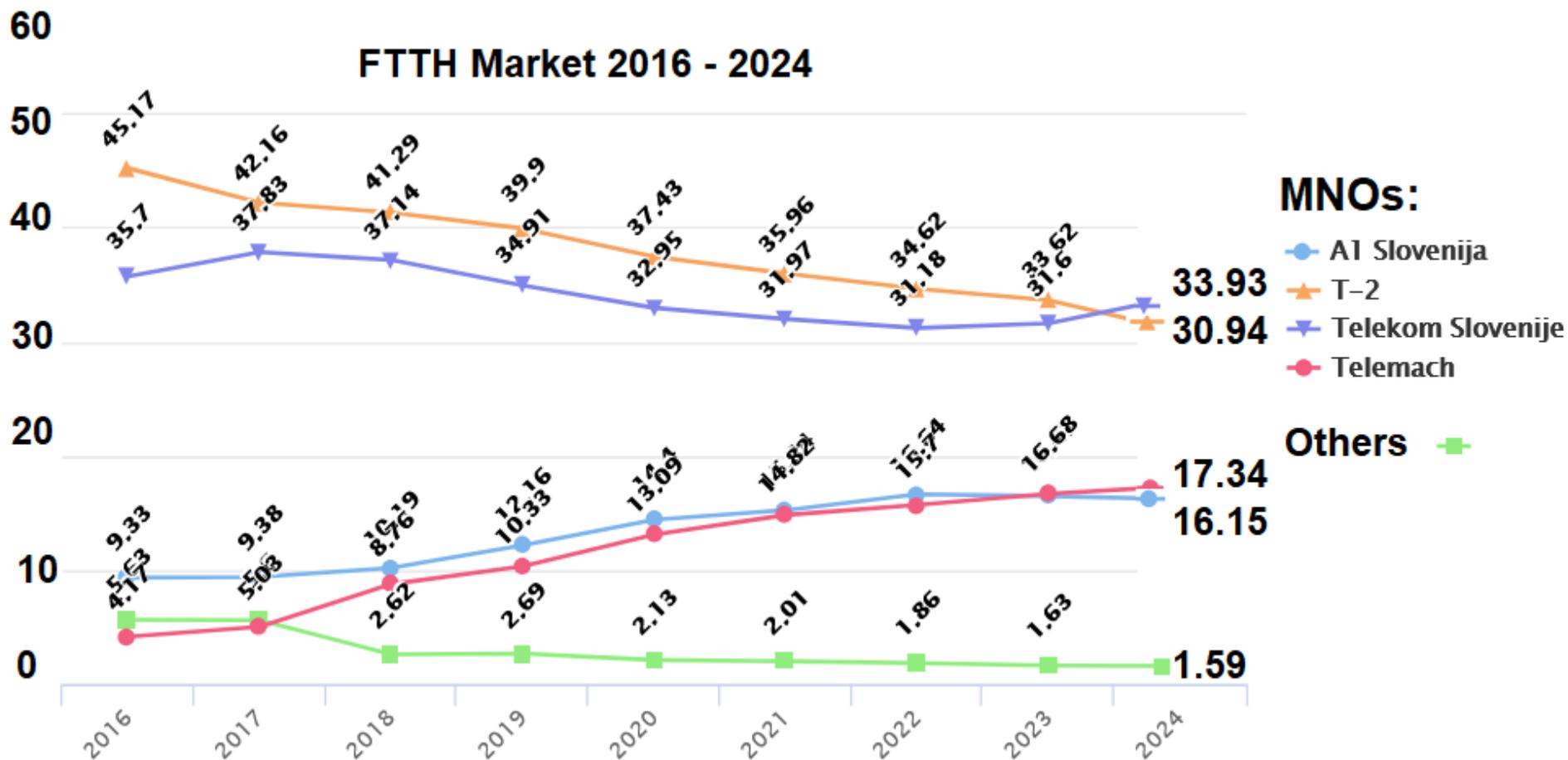
Convergence of Fixed and Mobile, Broadband Markets in Slovenia Q4/2024

4 MNOs who all have as well fixed networks and providing 4-play bundles:

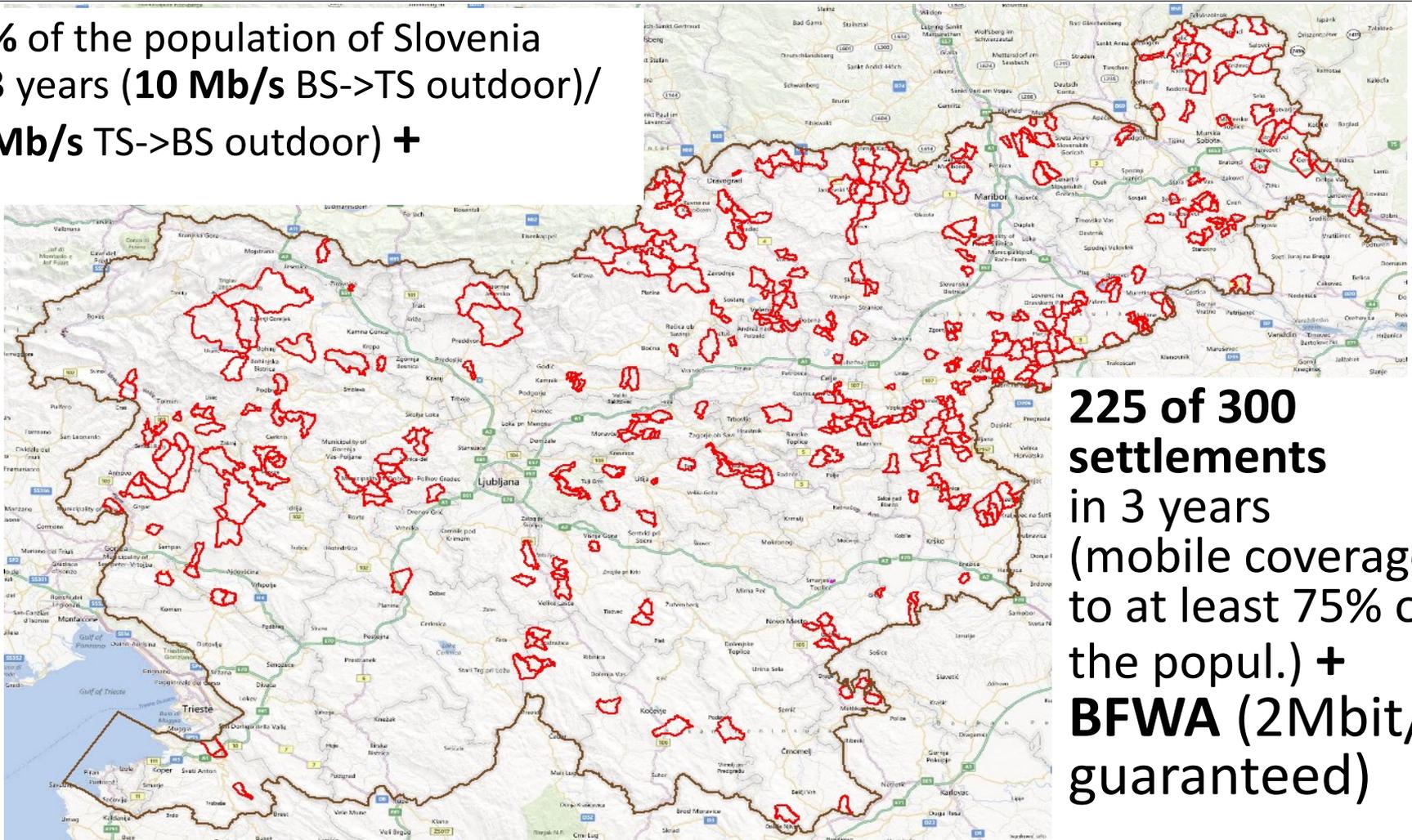
- Internet,
- TV,
- fixed and
- mobile telephony







95% of the population of Slovenia in 3 years (10 Mb/s BS->TS outdoor)/ (2 Mb/s TS->BS outdoor) +



225 of 300 settlements in 3 years (mobile coverage to at least 75% of the popul.) + BFWA (2Mbit/s guaranteed)

These obligations may be fulfilled using any frequencies at disposal.

A1 and TS offer 5G/IPTV



Example, A1 wireless offer:

- ① For TV over 4G/5G: **A1 Brežični Net 20.99 €/m + TV L 34.99 €/m or S 40.99 €/m**
- ② LTE internet 40/5 Mb/s user experience (200 GB/month: 20/5 Mb/s guaranteed) (>200GB/month 2/1 Mb/s guaranteed)
- ③ Up to 150 channels, unlimited data transfer/m
- ④ Modem **1 €/m** :



| TV programl | | A1 Brežični net + TV |
|-----------------------------|-----|----------------------|----------------------|----------------------|----------------------|
| | | 5+10 | 5+10 | 5+10 | 5+10 |
| | | S | L | S | L |
| 1 SLO 1 HD | 0 0 | ✓ | ✓ | | |
| 2 SLO 2 HD | 0 0 | ✓ | ✓ | | |
| 3 SLO 3 HD | 0 0 | ✓ | ✓ | | |
| 4 Kanal A HD | 0 0 | ✓ | ✓ | | |
| 5 POP TV HD | 0 0 | ✓ | ✓ | | |
| 6 Planet TV HD | 0 0 | ✓ | ✓ | | |
| 7 Kino HD | 0 0 | ✓ | ✓ | | |
| 8 Brio HD | 0 0 | ✓ | ✓ | | |
| 9 STAR Channel | 0 0 | x | ✓ | | |
| 10 STAR Life | 0 0 | x | ✓ | | |
| 11 STAR Crime | 0 0 | x | ✓ | | |
| 12 CineStar | 0 0 | x | ✓ | | |
| 13 Cinestar Action&Thriller | 0 0 | x | ✓ | | |
| 14 Planet Eva HD | 0 0 | x | ✓ | | |
| 15 AMC HD | 0 0 | x | ✓ | | |
| 16 STAR Movies | 0 0 | x | ✓ | | |
| 17 Filmbox Premium HD | 0 0 | x | ✓ | | |
| 18 Filmbox Stars HD | 0 0 | x | ✓ | | |
| 20 Planet TV 2 HD | 0 0 | x | ✓ | | |
| 21 Gold TV | 0 0 | x | ✓ | | |
| 22 Arena TV HD | 0 0 | x | ✓ | | |
| 23 Aktual TV | 0 0 | x | ✓ | | |
| 24 TV Veselejak Golica | 0 0 | x | ✓ | | |
| 25 Nova24TV HD | 0 0 | ✓ | ✓ | | |
| 26 Nova24TV 2 HD | 0 0 | ✓ | ✓ | | |
| 27 AXN | 0 0 | x | ✓ | | |
| 28 AXN Spin | 0 0 | x | ✓ | | |
| 29 BBC First HD | 0 0 | x | ✓ | | |
| 30 Viaset Epic Drama HD | 0 0 | x | ✓ | | |
| 31 Eurochannel HD | 0 0 | x | ✓ | | |
| 32 TV 1000 | 0 0 | x | ✓ | | |
| 33 Dive | 0 0 | x | ✓ | | |
| 34 KlasiK TV | 0 0 | ✓ | ✓ | | |
| 35 TV 3 HD | 0 0 | ✓ | ✓ | | |
| 36 Dizi HD | 0 0 | x | ✓ | | |
| 100 BBC Earth HD | 0 0 | x | ✓ | | |
| 102 National Geographic HD | 0 0 | x | ✓ | | |
| 103 NGC Wild HD | 0 0 | x | ✓ | | |
| 104 Animal Planet HD | 0 0 | x | ✓ | | |
| 105 Discovery Channel HD | 0 0 | x | ✓ | | |
| 107 Discovery ID HD | 0 0 | x | ✓ | | |
| 108 Travel HD | 0 0 | x | ✓ | | |
| 109 LH TV HD | 0 0 | x | ✓ | | |
| 110 Viaset Nature HD | 0 0 | x | ✓ | | |
| 111 History HD | 0 0 | x | ✓ | | |
| 112 Viaset History HD | 0 0 | x | ✓ | | |
| 113 Viaset Explore | 0 0 | x | ✓ | | |
| 114 DeVincl Learning | 0 0 | x | ✓ | | |
| 115 Arte | 0 0 | x | ✓ | | |
| 116 24 Kitchen HD | 0 0 | x | ✓ | | |
| 117 TLC HD | 0 0 | x | ✓ | | |
| 119 CSI | 0 0 | x | ✓ | | |
| 124 Agro TV HD | 0 0 | x | ✓ | | |
| 125 Balkan Trip HD | 0 0 | x | ✓ | | |
| 200 Š 1 HD | 0 0 | x | ✓ | | |
| 201 Š 2 HD | 0 0 | x | ✓ | | |
| 202 Š 3 HD | 0 0 | x | ✓ | | |
| 203 Arena Sport 1 HD | 0 0 | x | ✓ | | |
| 204 Arena Sport 2 HD | 0 0 | x | ✓ | | |
| 206 Eurosport HD | 0 0 | x | ✓ | | |
| 210 Eurosport 2 HD | 0 0 | x | ✓ | | |
| 211 Sport 1 | 0 0 | ✓ | ✓ | | |
| 216 Trace Sports | 0 0 | x | ✓ | | |
| 217 Motorvision HD | 0 0 | x | ✓ | | |
| 219 Nautical Channel HD | 0 0 | x | ✓ | | |
| 300 TV 3 | 0 0 | ✓ | ✓ | | |
| 301 RTS | 0 0 | ✓ | ✓ | | |
| 302 Tele.MHD | 0 0 | ✓ | ✓ | | |
| 303 TV Koper-Capodistria HD | 0 0 | ✓ | ✓ | | |
| 304 Veš kanal | 0 0 | ✓ | ✓ | | |
| 303 TV As | 0 0 | ✓ | ✓ | | |
| 306 VTV | 0 0 | ✓ | ✓ | | |
| 307 TV Celje | 0 0 | ✓ | ✓ | | |
| 308 SIP TV | 0 0 | ✓ | ✓ | | |
| 309 TV Idea | 0 0 | ✓ | ✓ | | |
| 310 NET TV | 0 0 | x | ✓ | | |
| 311 TV Nakupi | 0 0 | ✓ | ✓ | | |
| 312 Vitel | 0 0 | ✓ | ✓ | | |
| 313 Galeja TV | 0 0 | ✓ | ✓ | | |
| 314 Plink.SI | 0 0 | ✓ | ✓ | | |
| 315 BK TV | 0 0 | ✓ | ✓ | | |
| 316 Prva TV | 0 0 | ✓ | ✓ | | |
| 317 Ptujška TV | 0 0 | ✓ | ✓ | | |
| 318 Zdrava TV | 0 0 | ✓ | ✓ | | |
| 319 Oron TV | 0 0 | ✓ | ✓ | | |
| 320 Savinjska TV | 0 0 | ✓ | ✓ | | |
| 321 TV Beltinci | 0 0 | ✓ | ✓ | | |
| 322 Megafon | 0 0 | ✓ | ✓ | | |
| 323 Ekodus | 0 0 | ✓ | ✓ | | |
| 324 Karoška TV HD | 0 0 | ✓ | ✓ | | |
| 325 Ljubljana TV HD | 0 0 | ✓ | ✓ | | |
| 326 Kolut TV | 0 0 | ✓ | ✓ | | |
| 327 ePosavje | 0 0 | x | ✓ | | |
| 328 ETV HD | 0 0 | ✓ | ✓ | | |
| 329 Tržič TV | 0 0 | ✓ | ✓ | | |
| 330 HRT 1 HD | 0 0 | ✓ | ✓ | | |
| 331 HRT 2 HD | 0 0 | ✓ | ✓ | | |
| 332 RTL Hrvatska HD | 0 0 | x | ✓ | | |
| 333 RTL Hrvatska 2 | 0 0 | x | ✓ | | |
| 334 RT Srbije HD | 0 0 | ✓ | ✓ | | |
| 335 RTCG | 0 0 | ✓ | ✓ | | |
| 336 RTK | 0 0 | ✓ | ✓ | | |
| 337 Hayat | 0 0 | ✓ | ✓ | | |
| 338 OBN | 0 0 | ✓ | ✓ | | |
| 339 BN TV | 0 0 | x | ✓ | | |
| 340 Kristal TV | 0 0 | ✓ | ✓ | | |
| 350 ORF 1 HD | 0 0 | ✓ | ✓ | | |
| 351 ORF 2 HD | 0 0 | ✓ | ✓ | | |
| 352 ARD | 0 0 | ✓ | ✓ | | |
| 353 ZDF | 0 0 | ✓ | ✓ | | |
| 354 3 SAT | 0 0 | ✓ | ✓ | | |
| 355 RAI 1 HD | 0 0 | ✓ | ✓ | | |
| 356 RAI 2 | 0 0 | ✓ | ✓ | | |
| 357 RAI 3 | 0 0 | x | ✓ | | |
| 358 Duna TV | 0 0 | ✓ | ✓ | | |
| 359 Bloomberg Adria | 0 0 | ✓ | ✓ | | |
| 370 Top TV | 0 0 | ✓ | ✓ | | |
| 371 BBC News | 0 0 | x | ✓ | | |
| 372 CNN | 0 0 | x | ✓ | | |
| 373 Bloomberg | 0 0 | x | ✓ | | |
| 374 TV 5 Monde | 0 0 | x | ✓ | | |
| 375 France 24 HD | 0 0 | x | ✓ | | |
| 377 TV E | 0 0 | ✓ | ✓ | | |
| 378 Euronews | 0 0 | x | ✓ | | |
| 379 Al Jazeera Balkans | 0 0 | ✓ | ✓ | | |
| 380 1-1 News | 0 0 | ✓ | ✓ | | |

Source: <https://www.a1.si/a1-brezzicni-net>,
<https://www.a1.si/a1-brezzicni-net-tv>



Assigned spectrum by MNO

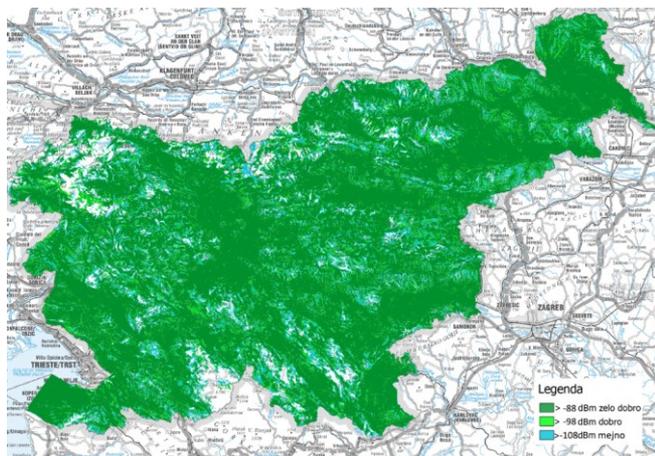


| | A1 | TS | TM | T-2 |
|------------------|------|------|------|-----|
| GSM 900 | 3195 | 3495 | 2895 | |
| GSM 1800 | | 156 | 2993 | |
| UMTS 900 | | | 3076 | |
| UMTS 2100 | | | 821 | 487 |
| LTE 700 | | 919 | 1703 | |
| LTE 800 | 3120 | 3042 | 3036 | |
| LTE 900 | | 1034 | | |
| SDL 1500 | 529 | | | |
| LTE 1800 | 4980 | 3335 | 3045 | |
| LTE 2100 | 1350 | 1573 | 1201 | 486 |
| LTE 2300 | | | 60 | 930 |
| LTE 2600 | 615 | 291 | | |
| NR 700 | 1850 | 914 | | |
| NR 2300 | | | | 42 |
| NR 2600 | | 532 | | |
| NR 3600 | 1310 | 757 | 466 | |

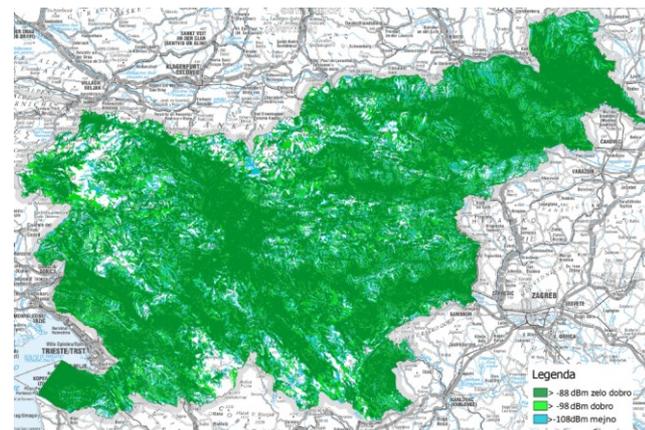
Own own outdoor BS locations No.

| Operater | Total | GSM | UMTS | LTE | NR |
|-------------------|-------|------|------|------|-----|
| A1 Slovenija | 1156 | 1152 | | 1152 | 670 |
| Telekom Slovenije | 1353 | 1336 | | 1346 | 651 |
| Telemach | 1148 | 1146 | 1147 | 1146 | 163 |
| T-2 | 146 | | 146 | 146 | 12 |

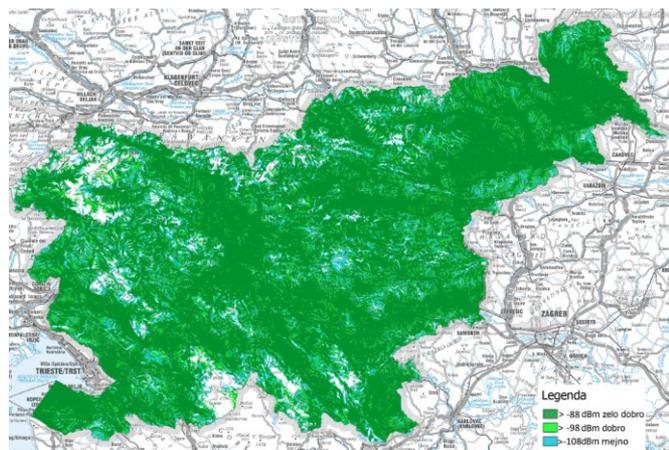
A1:2025
 >99%
 population
 and 93.65
 % of the
 territory of
 Slovenia



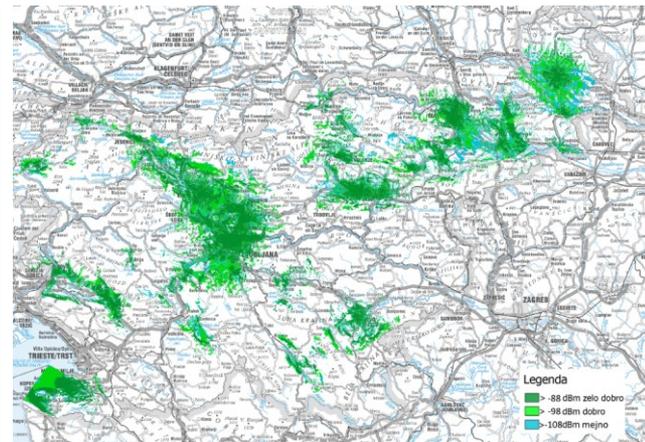
TS:2025
 >99%
 population
 and 97.45%
 of the
 territory of
 Slovenia



TM:2025
 >99%
 population
 and 93.6%
 of the
 territory of
 Slovenia



T-2:2025
 56,54 %
 population
 and 19,55 %
 of the
 territory of
 Slovenia



30 Mbit/s DL, 3Mbit/s UL->RSRP -108 dBm

BoR (18)237: Excelent:-88 dBm,

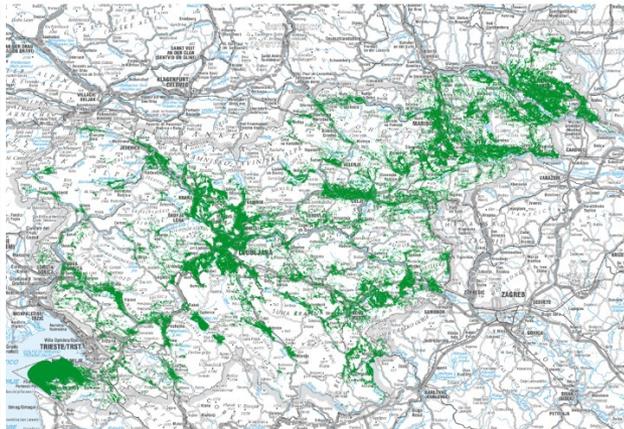
Good: -98 dBm ,satisfactory: -108 dBm



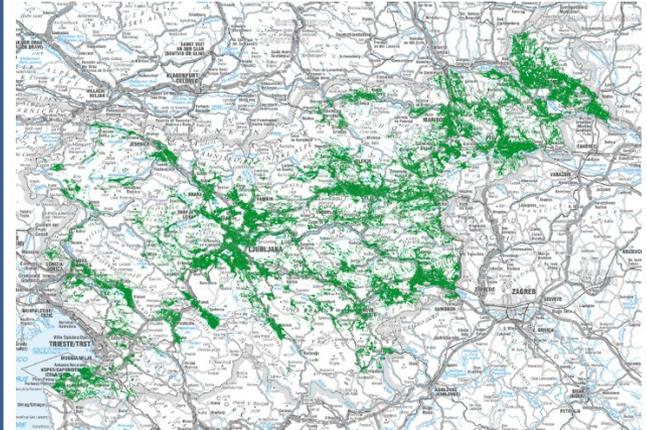
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eMBB 5G Coverage (2300 & 3600 MHz)

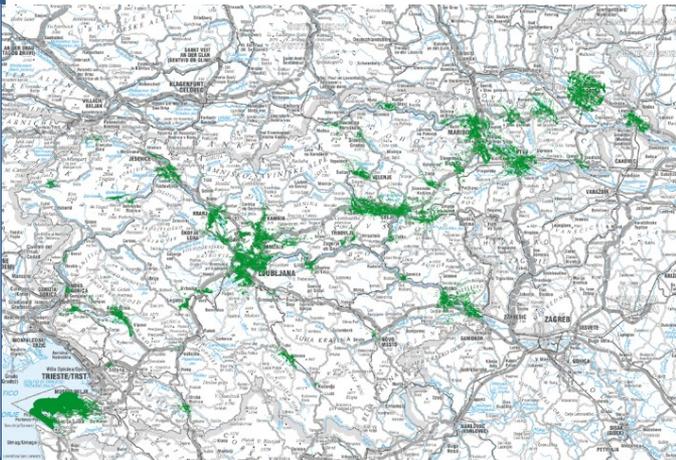
A1:2025
70.93 %
population
and 19.20%
of the
territory of
Slovenia



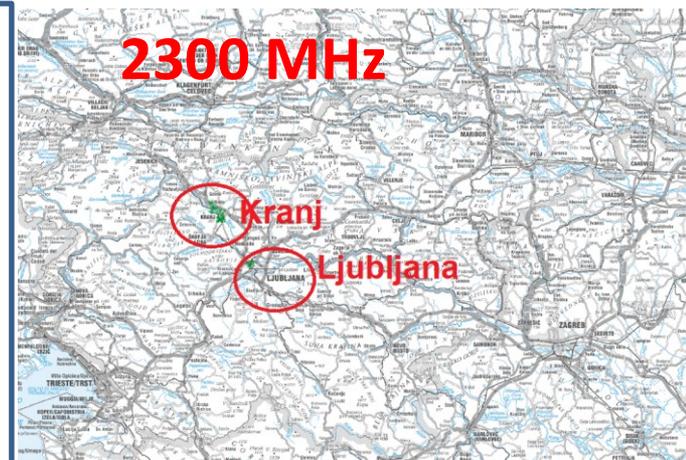
TS:2025
64.98%
population
and 18.21%
of the
territory of
Slovenia



TM:2025
42.93%
population
and 6.01%
of the
territory of
Slovenia



T-2:2025
0.94 %
population
and 0.05 %
of the
territory of
Slovenia

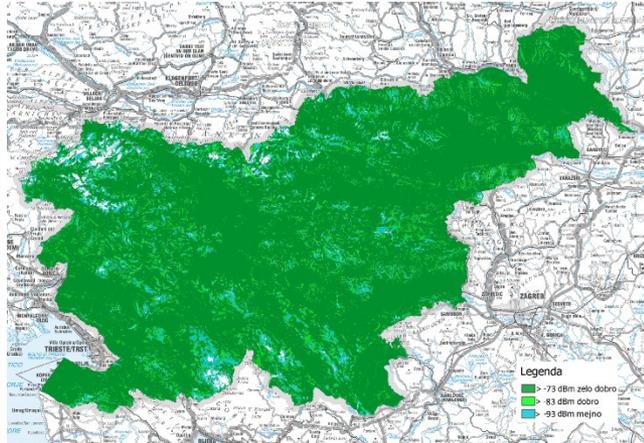


eMBB – support for extreme data rates (max. DL 20 Gb/s and target user experience of 100 Mb/s, max. UL 10 Gb/s and 50 Mb/s user experience), delays at the user < 4 ms

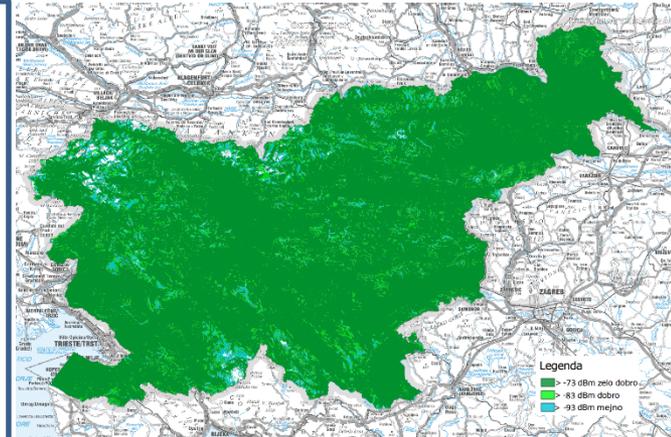
Source: AKOS Report January 2025

https://www.akos-rs.si/fileadmin/user_upload/dokumenti/Raziskave_analize_poročila_in_statistika/RT_Spekter/Pokritost_3_stoletvami_mobilnih_tehnologij_avgusta_2024.pdf

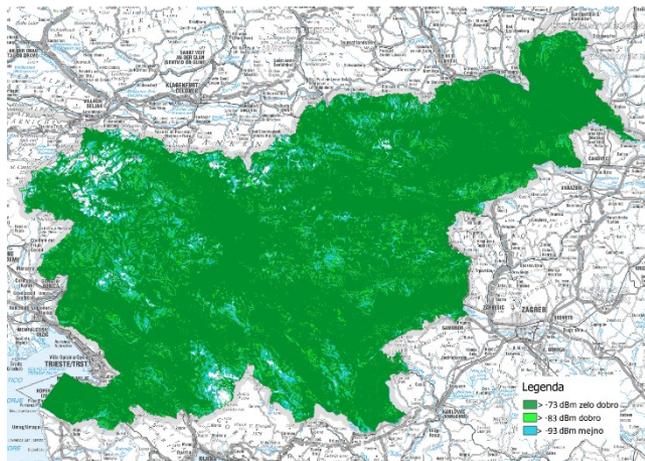
A1:2024 2G
 >99%
 population
 and 98.21%
 of the
 territory of
 Slovenia



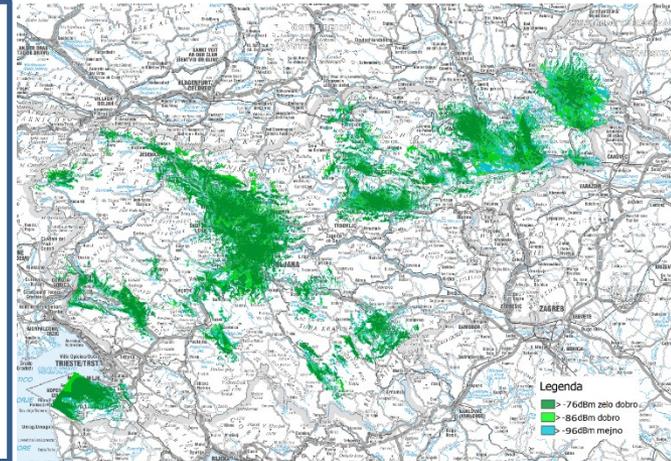
TS:2024 2G
 >99%
 population
 and 98.91%
 of the
 territory of
 Slovenia



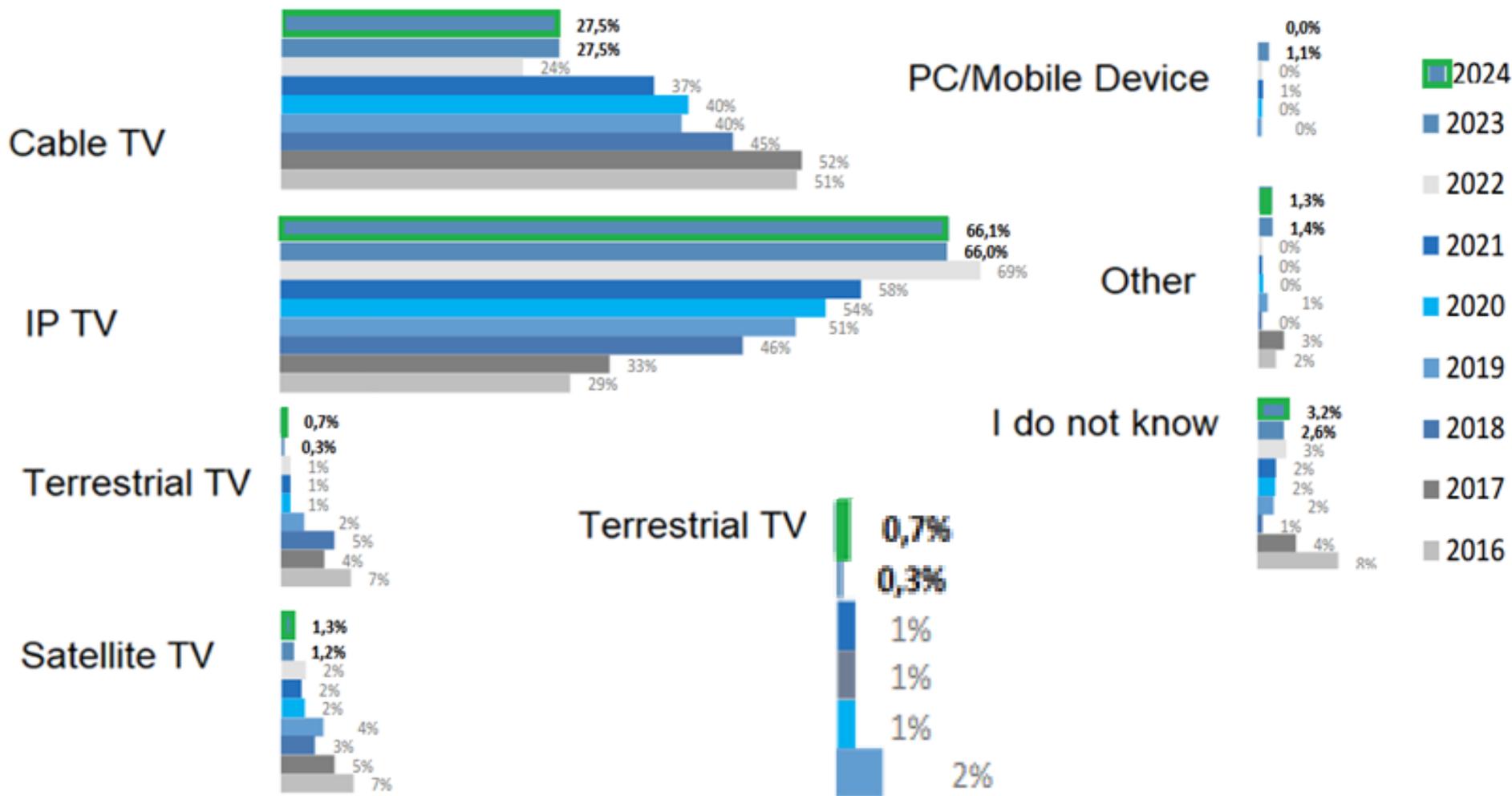
TM:2024
 2G&3G
 >99%
 population
 and 97.62%
 2G, 95.9%
 3G of
 Slovenia



T-2:2024 3G
 60.91 %
 population
 and 26.7 %
 of the
 territory of
 Slovenia



Broadcasting landscape in Slovenia 2024- What kind of TV you have in your house hold?

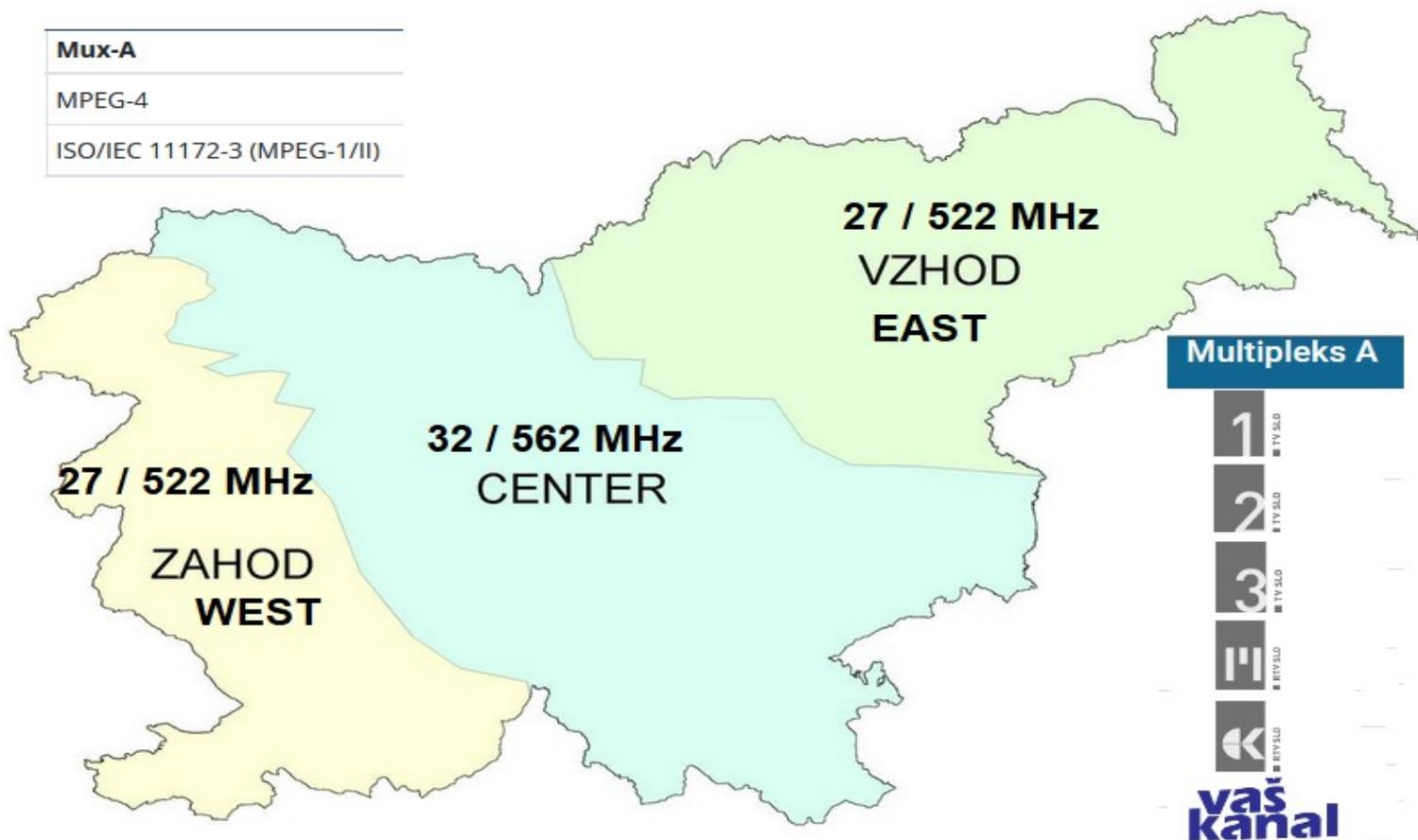




AKOS

Terrestrial linear TV Broadcasting market

RTV Slovenia MUX A



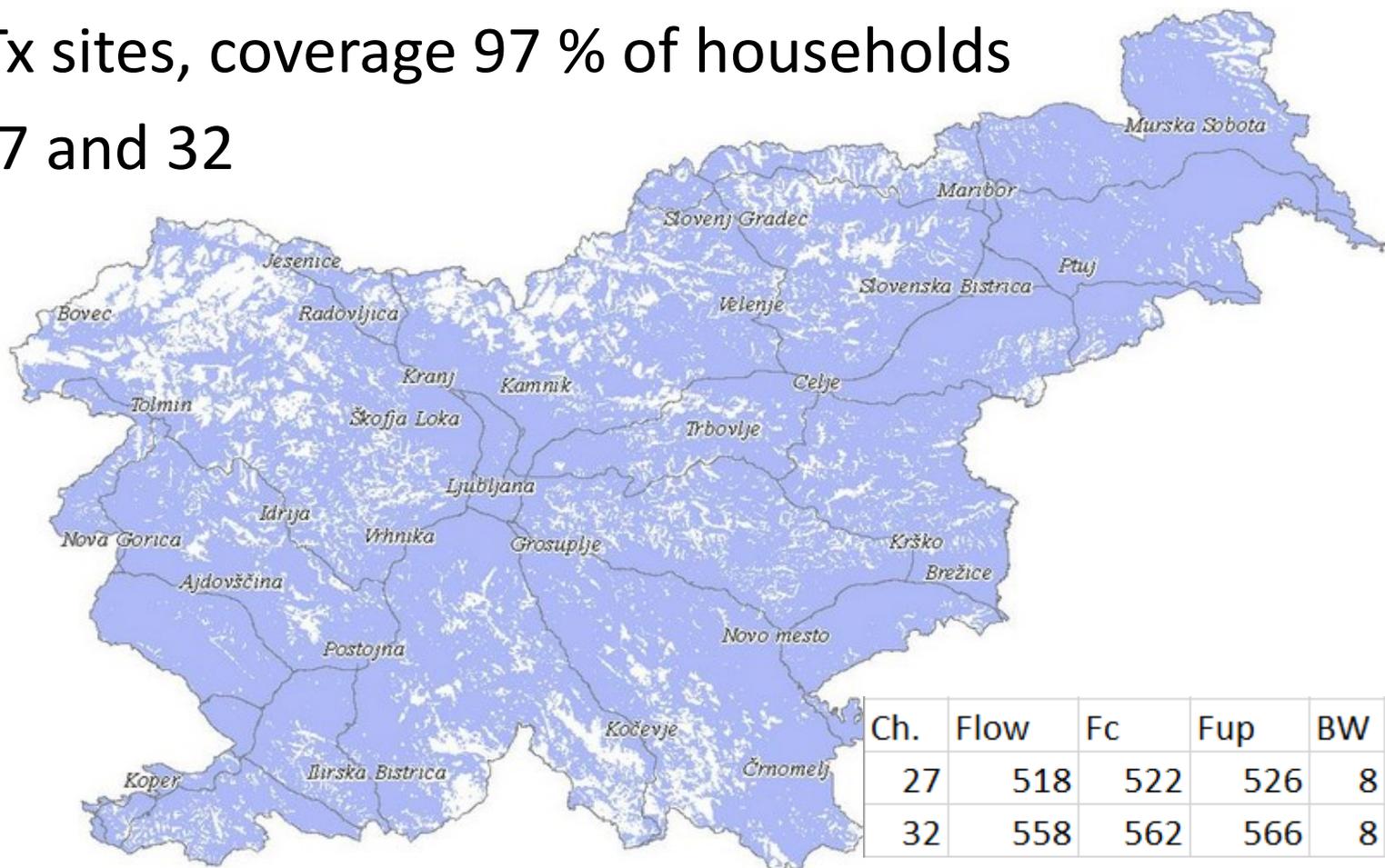
Source: <https://www.rtv slo.si/oz/oddajanje/dvbt/opis/538583>
<https://www.rtv slo.si/oz/oddajanje/dvbt/programi/543636>



AKOS

Current use of UHF band (470-694 MHz) in Slovenia - Coverage of DTT MUX A

- 162 Tx sites, coverage 97 % of households
- Ch. 27 and 32

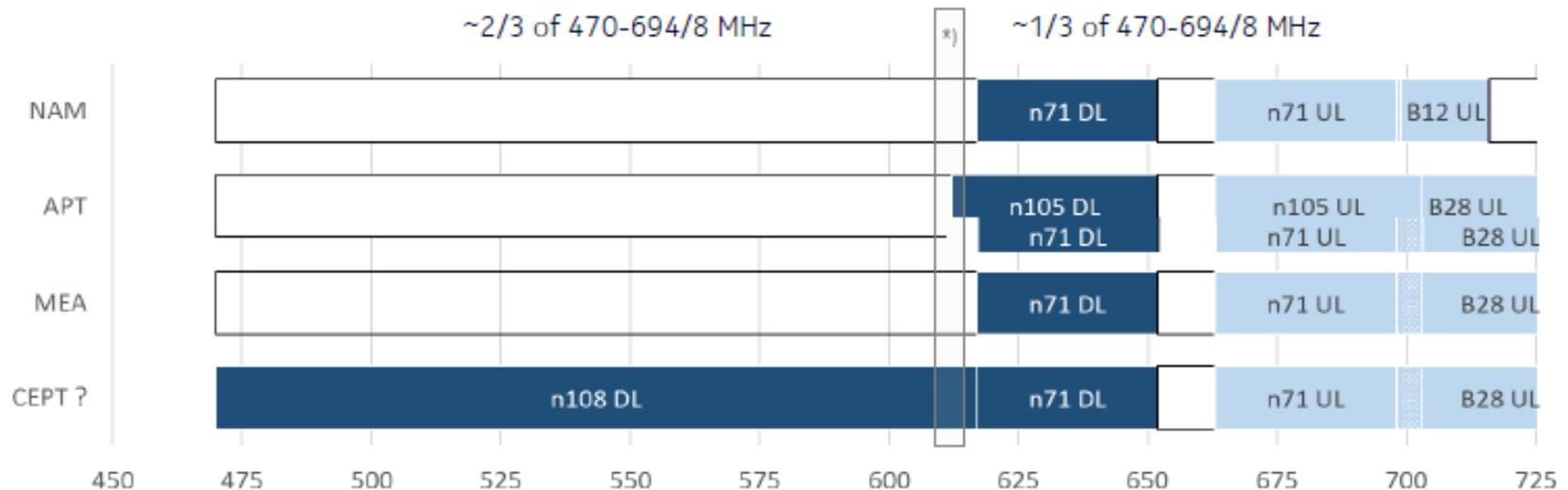


- ④ 17 speakers
- ④ 60 participants from 9 countries
- ④ 3 sessions:
 - ④ Regulatory framework
 - ④ 5G Broadcast / Multicast Operators Trials (RAI, ARD, Yle, OIV)
 - ④ 5G Broadcast / Multicast Manufacturers Trials (Rhode Swartz, 5G Mag, Qualco, Nokia, Ericsson)
- ④ The need to converge to open possibility for large enough market to open band 108 (DL – only) and to possibly combine linear TV 5G broadcasting with IPTV on demand over 5G



- ④ WRC-23 has under agenda item 1.5, through footnote 5.15B - secondary mobile allocation for the band 470-694 MHz - opened possibility to deploy mobile service in accordance with the Geneva 2006 Agreement and the Geneva 2006 Plan.

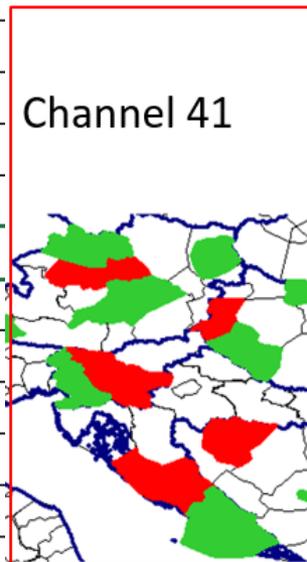
Global 470-69x MHz opportunities



- 600 MHz FDD opportunities in various regions, considering broadcast use in neighboring countries, (n71: DL 617-652MHz, UL 663-698 MHz; n105: DL 612-652MHz, UL 663-703 MHz)
- DL opportunities including 5G Broadcast and mobile supplemental DL in co-existence with broadcast in neighboring countries or even within the same country, considering potential future 600 MHz FDD, evolving in CEPT, applicable globally (n108: DL 470-698 MHz)

Frequency plan – channels in frequency band 470 – 694 MHz – SVN MUXes:

| Ch. | Flow | Fc | Fup | BW | | Ch. | Flow | Fc | Fup | BW | | |
|-----|------|-----|-----|----|-----------------------|-----|------|-----|-----|----|-----------------------|----------------------|
| 21 | 470 | 474 | 478 | 8 | | 35 | 582 | 586 | 590 | 8 | Zahod (West) & Center | +VTV (Ravne , Celje) |
| 22 | 478 | 482 | 486 | 8 | | 36 | 590 | 594 | 598 | 8 | | |
| 23 | 486 | 490 | 494 | 8 | | 37 | 598 | 602 | 606 | 8 | Vzhod (East) | |
| 24 | 494 | 498 | 502 | 8 | | 38 | 606 | 610 | 614 | 8 | Center & Vzhod (East) | |
| 25 | 502 | 506 | 510 | 8 | | 39 | 614 | 618 | 622 | 8 | | |
| 26 | 510 | 514 | 518 | 8 | Ljubljana | 40 | 622 | 626 | 630 | 8 | | |
| 27 | 518 | 522 | 526 | 8 | MUX A | 41 | 630 | 634 | 638 | 8 | Zahod (West) & Center | |
| 28 | 526 | 530 | 534 | 8 | | 42 | 638 | 642 | 646 | 8 | | |
| 29 | 534 | 538 | 542 | 8 | | 43 | 646 | 650 | 654 | 8 | | |
| 30 | 542 | 546 | 550 | 8 | | 44 | 654 | 658 | 662 | 8 | Vzhod (East) | |
| 31 | 550 | 554 | 558 | 8 | Zahod (West) | 45 | 662 | 666 | 670 | 8 | Center & Vzhod (East) | |
| 32 | 558 | 562 | 566 | 8 | MUX A | 46 | 670 | 674 | 678 | 8 | | |
| 33 | 566 | 570 | 574 | 8 | Zahod (West) & Center | 47 | 678 | 682 | 686 | 8 | Ljubljana | |
| 34 | 574 | 578 | 582 | 8 | | 48 | 686 | 690 | 694 | 8 | | |



- ④ Test licenses and licenses till WRC-31 could be issued for:
 - ④ Testing of 5G broadcasting (as well mobile and nomadic usages)
 - ④ IPTV
 - ④ Testing of other 4G/5G applications e.g.: m-IoT, C-V2X , broadband PPDR.
 - ④ Evaluating coexistence in the field between 5G supplementary downlink and 5G broadcasting (the same technology), when using principles defined in mobile cross-border recommendations and agreements,
 - ④ Cross border projects/testing with e.g. RAI, ORF, .



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