



AKOS

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

Friday, 11 April 2025, Brussels

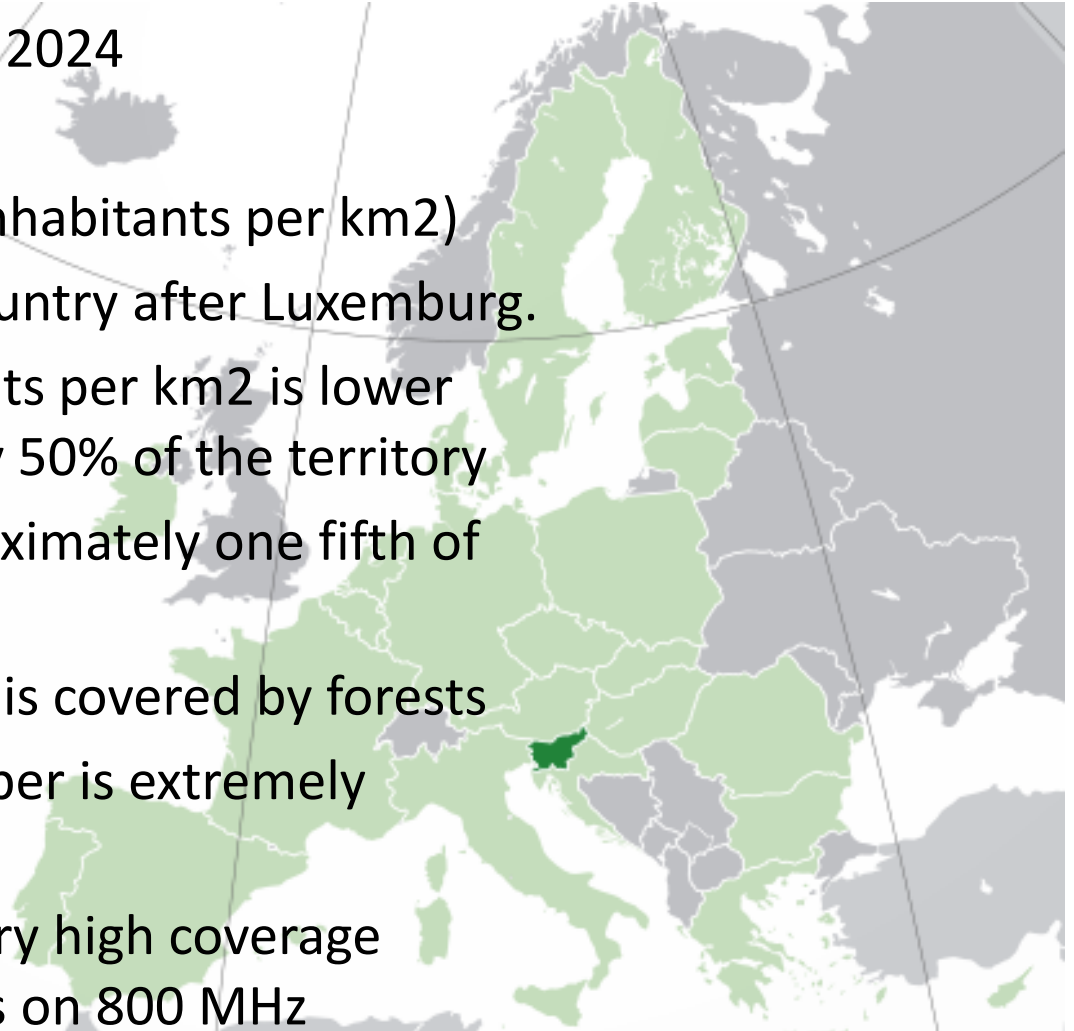
**Situation in Slovenian BS and MS Market
– usage in the band 470-694 MHz**

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 Luxembourg.
- ⦿ 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

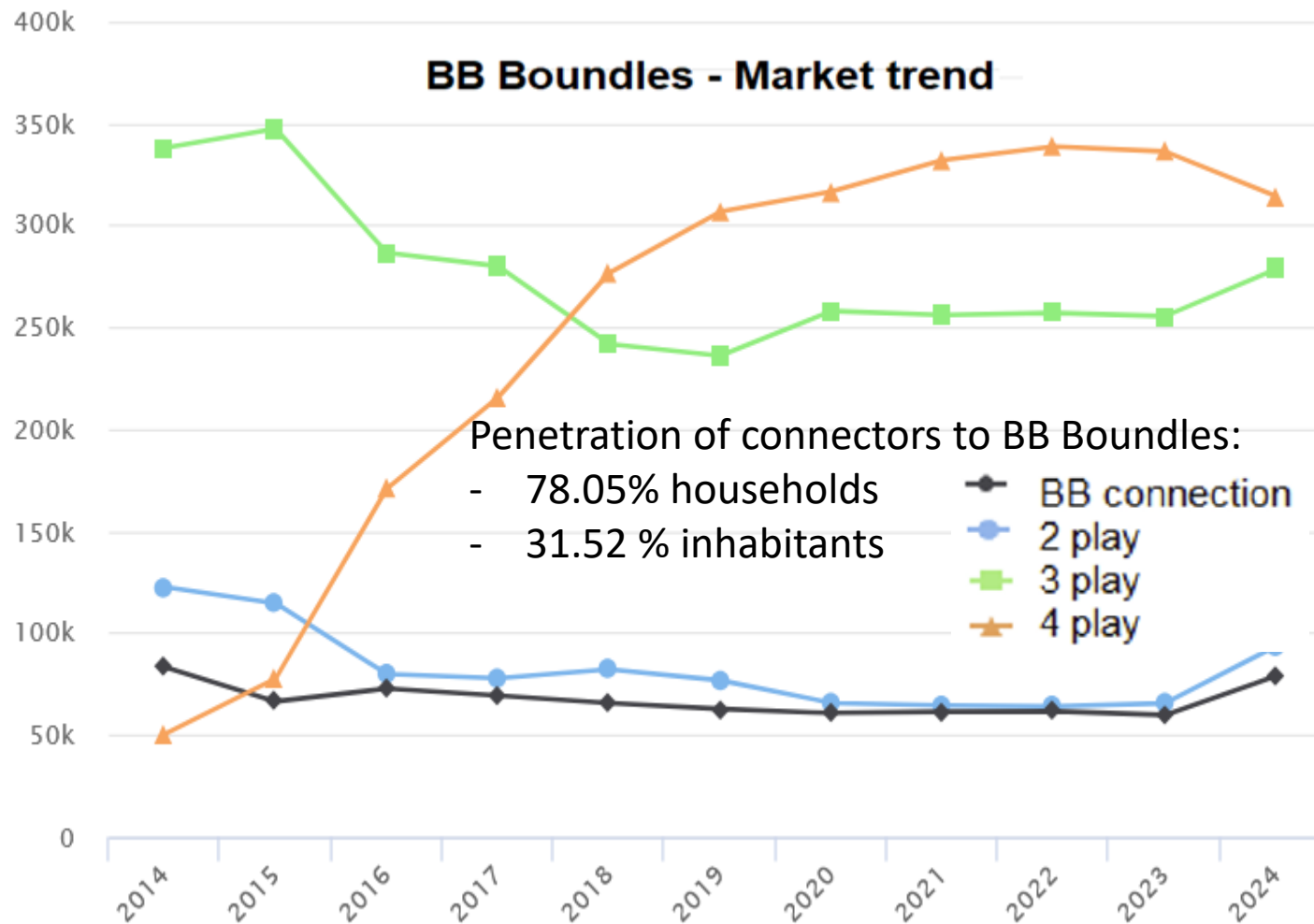
Projects from spectrum strategies – 2019 - 2026 - Actions

- 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

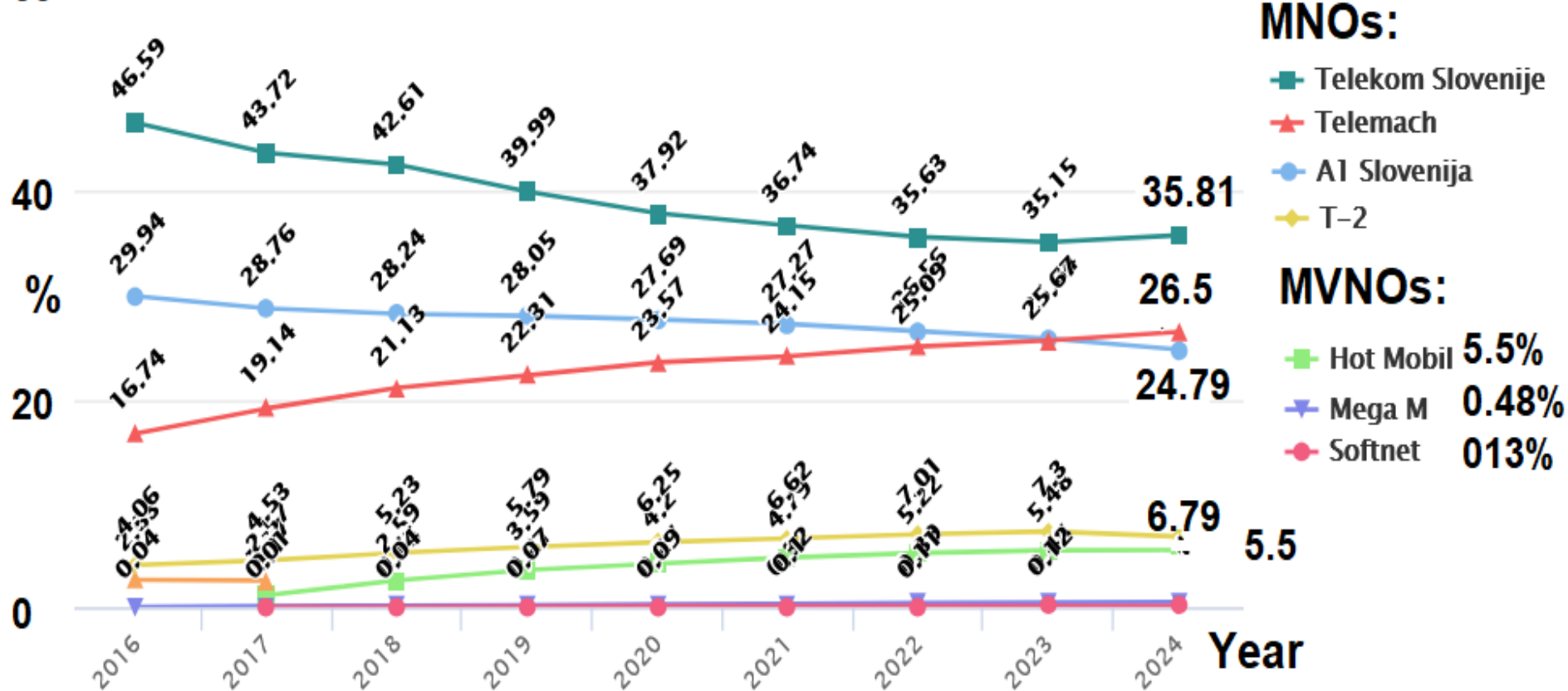
4 MNOs who all have as well fixed networks and providing 4-play bundles:

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



Market shares of the 4 MNOs in Mobile Markets

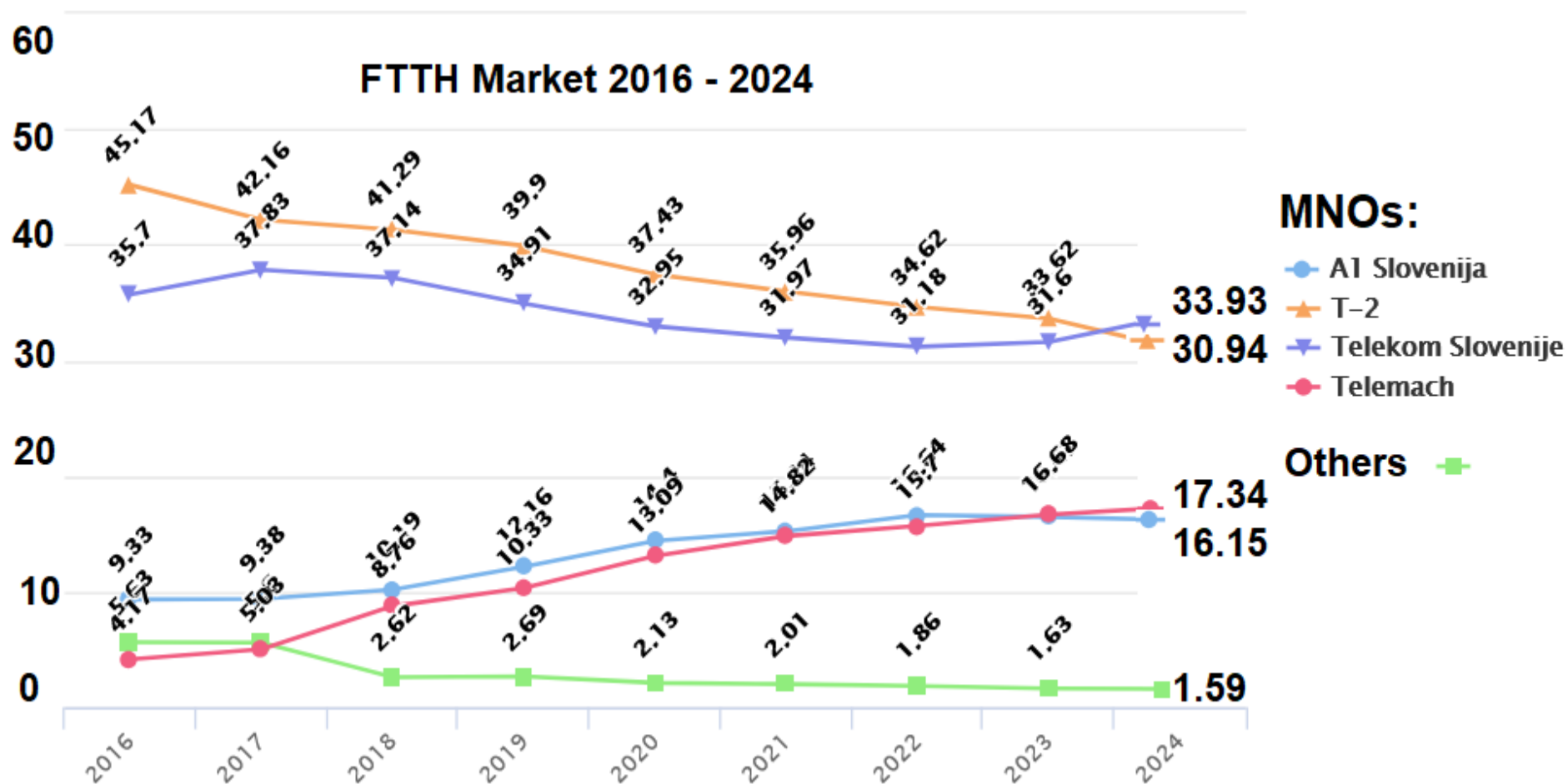
Mobile Market - Active users 2016-2024



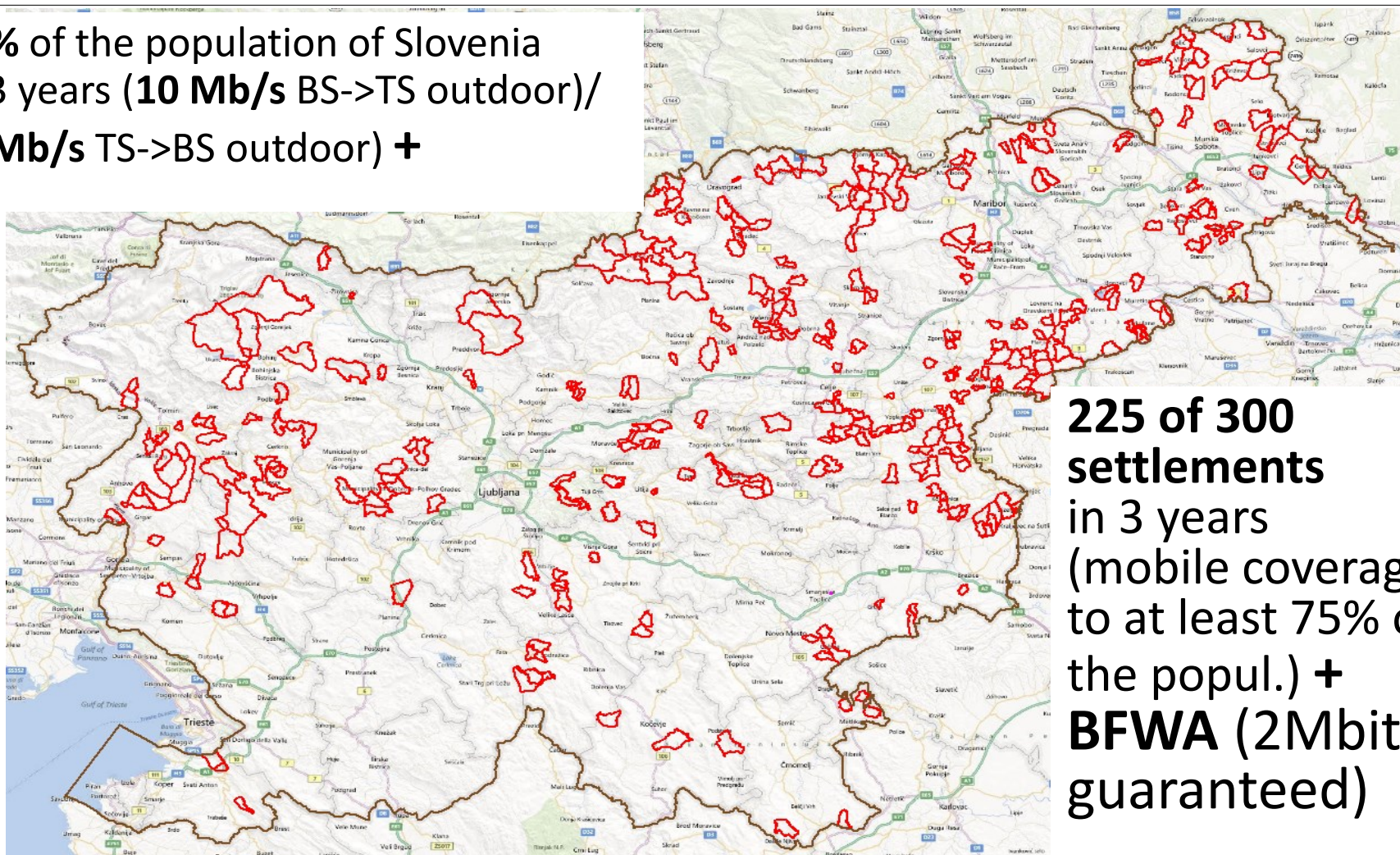


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Market shares of the 4 MNOs in Fixed Markets



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:

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



| | | A1 Brezžični net + TV S+D | | A1 Brezžični net + TV S+D | | A1 Brezžični net + TV S+D | | A1 Brezžični net + TV S+D | |
|-------------|--------------------------|------------------------------|---|------------------------------|---|------------------------------|--|------------------------------|--|
| TV programi | | S | | L | | S | | L | |
| 1 | SLO 1 HD | ○ | ⊗ | ✓ | ✓ | | | | |
| 2 | SLO 2 HD | ○ | ⊗ | ✓ | ✓ | | | | |
| 3 | SLO 3 HD | ○ | ⊗ | ✓ | ✓ | | | | |
| 4 | Kanal A HD | ○ | ⊗ | ✓ | ✓ | | | | |
| 5 | POP TV HD | ○ | ⊗ | ✓ | ✓ | | | | |
| 6 | Planet TV HD | ○ | ⊗ | ✓ | ✓ | | | | |
| 7 | Kino HD | ○ | ⊗ | ✓ | ✓ | | | | |
| 8 | Brio HD | ○ | ⊗ | ✓ | ✓ | | | | |
| 9 | STAR Channel | ○ | ⊗ | x | ✓ | | | | |
| 10 | STAR Life | ○ | ⊗ | x | ✓ | | | | |
| 11 | STAR Crime | ○ | ⊗ | x | ✓ | | | | |
| 12 | CineStar | ○ | ⊗ | x | ✓ | | | | |
| 13 | CineStar Action&Thriller | ○ | ⊗ | x | ✓ | | | | |
| 14 | Planet Eva HD | ○ | ⊗ | x | ✓ | | | | |
| 15 | AMC HD | ○ | ⊗ | x | ✓ | | | | |
| 16 | STAR Movies | ○ | ⊗ | x | ✓ | | | | |
| 17 | Filmbox Premium HD | ○ | ⊗ | x | ✓ | | | | |
| 18 | Filmbox Stars HD | ○ | ⊗ | x | ✓ | | | | |
| 20 | Planet TV 2 HD | ○ | ⊗ | x | ✓ | | | | |
| 21 | Gold TV | ○ | ⊗ | x | ✓ | | | | |
| 22 | Arena TV HD | ○ | ⊗ | x | ✓ | | | | |
| 23 | Aktual TV | ○ | ⊗ | x | ✓ | | | | |
| 24 | TV Veseljak Golica | ○ | ⊗ | x | ✓ | | | | |
| 25 | Nova24TV HD | ○ | ⊗ | ✓ | ✓ | | | | |
| 26 | Nova24TV 2 HD | ○ | ⊗ | ✓ | ✓ | | | | |
| 27 | AXN | ○ | ⊗ | x | ✓ | | | | |
| 28 | AXN Spin | ○ | ⊗ | x | ✓ | | | | |
| 29 | BBC First HD | ○ | ⊗ | x | ✓ | | | | |
| 30 | Viasat Epic Drama HD | ○ | ⊗ | x | ✓ | | | | |
| 31 | Eurochannel HD | ○ | ⊗ | x | ✓ | | | | |
| 32 | TV 1000 | ○ | ⊗ | x | ✓ | | | | |
| 33 | Dive | ○ | ⊗ | x | ✓ | | | | |
| 34 | Klasik TV | ○ | ⊗ | ✓ | ✓ | | | | |
| 35 | TV 3 HD | ○ | ⊗ | ✓ | ✓ | | | | |
| 36 | Dizi HD | ○ | ⊗ | x | ✓ | | | | |
| 100 | BBC Earth HD | ○ | ⊗ | x | ✓ | | | | |
| 102 | National Geographic HD | ○ | ⊗ | x | ✓ | | | | |
| 103 | NGC Wild HD | ○ | ⊗ | x | ✓ | | | | |
| 104 | Animal Planet HD | ○ | ⊗ | x | ✓ | | | | |
| 105 | Discovery Channel HD | ○ | ⊗ | x | ✓ | | | | |
| 107 | Discovery ID HD | ○ | ⊗ | x | ✓ | | | | |
| 108 | Travel HD | ○ | ⊗ | x | ✓ | | | | |
| 109 | LH TV HD | ○ | ⊗ | x | ✓ | | | | |
| 110 | Viasat Nature HD | ○ | ⊗ | x | ✓ | | | | |
| 111 | History HD | ○ | ⊗ | x | ✓ | | | | |
| 112 | Viasat History HD | ○ | ⊗ | x | ✓ | | | | |
| 113 | Viasat Explore | ○ | ⊗ | x | ✓ | | | | |
| 114 | DeVincl Learning | ○ | ⊗ | x | ✓ | | | | |
| 115 | Arte | ○ | ⊗ | x | ✓ | | | | |
| 116 | 24 Kitchen HD | ○ | ⊗ | x | ✓ | | | | |
| 117 | TLC HD | ○ | ⊗ | x | ✓ | | | | |
| 118 | CSI | ○ | ⊗ | x | ✓ | | | | |
| 124 | Agro TV HD | ○ | ⊗ | x | ✓ | | | | |
| 125 | Balkan Trip HD | ○ | ⊗ | x | ✓ | | | | |
| 200 | Š 1 HD | ○ | ⊗ | x | ✓ | | | | |
| 201 | Š 2 HD | ○ | ⊗ | x | ✓ | | | | |
| 202 | Š 3 HD | ○ | ⊗ | x | ✓ | | | | |
| 203 | Arena Sport 1 HD | ○ | ⊗ | x | ✓ | | | | |
| 204 | Arena Sport 2 HD | ○ | ⊗ | x | ✓ | | | | |
| 206 | Eurosport HD | ○ | ⊗ | x | ✓ | | | | |
| 210 | Eurosport 2 HD | ○ | ⊗ | x | ✓ | | | | |
| 211 | Sport 1 | ○ | ⊗ | ✓ | ✓ | | | | |
| 216 | Trace Sports | ○ | ⊗ | x | ✓ | | | | |
| 217 | Motorvision HD | ○ | ⊗ | x | ✓ | | | | |
| 218 | Nautical Channel HD | ○ | ⊗ | x | ✓ | | | | |
| 300 | TV 3 | ○ | ⊗ | ✓ | ✓ | | | | |
| 301 | RTS | ○ | ⊗ | ✓ | ✓ | | | | |
| 302 | Tele MHD | ○ | ⊗ | ✓ | ✓ | | | | |
| 303 | TV Koper-Capodistria HD | ○ | ⊗ | ✓ | ✓ | | | | |
| 304 | Vaš kanal | ○ | ⊗ | ✓ | ✓ | | | | |
| 305 | TV As | ○ | ⊗ | ✓ | ✓ | | | | |
| 306 | VTV | ○ | ⊗ | ✓ | ✓ | | | | |
| 307 | TV Celje | ○ | ⊗ | ✓ | ✓ | | | | |
| 308 | SIP TV | ○ | ⊗ | ✓ | ✓ | | | | |
| 309 | TV Idea | ○ | ⊗ | ✓ | ✓ | | | | |
| 310 | NET TV | ○ | ⊗ | x | ✓ | | | | |
| 311 | TV Nakupi | ○ | ⊗ | ✓ | ✓ | | | | |
| 312 | Vitel | ○ | ⊗ | ✓ | ✓ | | | | |
| 313 | Galeja TV | ○ | ⊗ | ✓ | ✓ | | | | |
| 314 | Plink.SI | ○ | ⊗ | ✓ | ✓ | | | | |
| 315 | BK TV | ○ | ⊗ | ✓ | ✓ | | | | |
| 316 | Prva TV | ○ | ⊗ | ✓ | ✓ | | | | |
| 317 | Ptujska TV | ○ | ⊗ | ✓ | ✓ | | | | |
| 318 | Zdrava TV | ○ | ⊗ | ✓ | ✓ | | | | |
| 319 | Oron TV | ○ | ⊗ | ✓ | ✓ | | | | |
| 320 | Savinjska TV | ○ | ⊗ | ✓ | ✓ | | | | |
| 321 | TV Beltinci | ○ | ⊗ | ✓ | ✓ | | | | |
| 322 | Megafon | ○ | ⊗ | ✓ | ✓ | | | | |
| 323 | Exodus | ○ | ⊗ | ✓ | ✓ | | | | |
| 324 | Koroška TV HD | ○ | ⊗ | ✓ | ✓ | | | | |
| 325 | Ljubljana TV HD | ○ | ⊗ | ✓ | ✓ | | | | |
| 326 | Kolot TV | ○ | ⊗ | ✓ | ✓ | | | | |
| 327 | ePosavje | ○ | ⊗ | x | ✓ | | | | |
| 328 | ETV HD | ○ | ⊗ | ✓ | ✓ | | | | |
| 329 | Tržišče TV | ○ | ⊗ | ✓ | ✓ | | | | |
| 330 | HRT 1 HD | ○ | ⊗ | ✓ | ✓ | | | | |
| 331 | HRT 2 HD | ○ | ⊗ | ✓ | ✓ | | | | |
| 332 | RTL Hrvatska HD | ○ | ⊗ | x | ✓ | | | | |
| 333 | RTL Hrvatska 2 | ○ | ⊗ | x | ✓ | | | | |
| 334 | RT Srbije HD | ○ | ⊗ | ✓ | ✓ | | | | |
| 335 | RTCG | ○ | ⊗ | ✓ | ✓ | | | | |
| 336 | RTK | ○ | ⊗ | ✓ | ✓ | | | | |
| 337 | Hayat | ○ | ⊗ | ✓ | ✓ | | | | |
| 338 | OBN | ○ | ⊗ | ✓ | ✓ | | | | |
| 339 | BN TV | ○ | ⊗ | x | ✓ | | | | |
| 340 | Kristal TV | ○ | ⊗ | ✓ | ✓ | | | | |
| 350 | ORF 1 HD | ○ | ⊗ | ✓ | ✓ | | | | |
| 351 | ORF 2 HD | ○ | ⊗ | ✓ | ✓ | | | | |
| 352 | ARD | ○ | ⊗ | ✓ | ✓ | | | | |
| 353 | ZDF | ○ | ⊗ | ✓ | ✓ | | | | |
| 354 | 3 SAT | ○ | ⊗ | ✓ | ✓ | | | | |
| 355 | RAI 1 HD | ○ | ⊗ | ✓ | ✓ | | | | |
| 356 | RAI 2 | ○ | ⊗ | ✓ | ✓ | | | | |
| 357 | RAI 3 | ○ | ⊗ | x | ✓ | | | | |
| 358 | Duna TV | ○ | ⊗ | ✓ | ✓ | | | | |
| 359 | Bloomberg Adria | ○ | ⊗ | ✓ | ✓ | | | | |
| 370 | Top TV | ○ | ⊗ | ✓ | ✓ | | | | |
| 371 | BBC News | ○ | ⊗ | x | ✓ | | | | |
| 372 | CNN | ○ | ⊗ | x | ✓ | | | | |
| 373 | Bloomberg | ○ | ⊗ | x | ✓ | | | | |
| 374 | TV 5 Monde | ○ | ⊗ | x | ✓ | | | | |
| 375 | France 24 HD | ○ | ⊗ | x | ✓ | | | | |
| 377 | TV E | ○ | ⊗ | ✓ | ✓ | | | | |
| 378 | Euronews | ○ | ⊗ | x | ✓ | | | | |
| 379 | Al Jazeera Balkans | ○ | ⊗ | ✓ | ✓ | | | | |
| 380 | 1+1 News | ○ | ⊗ | ✓ | ✓ | | | | |

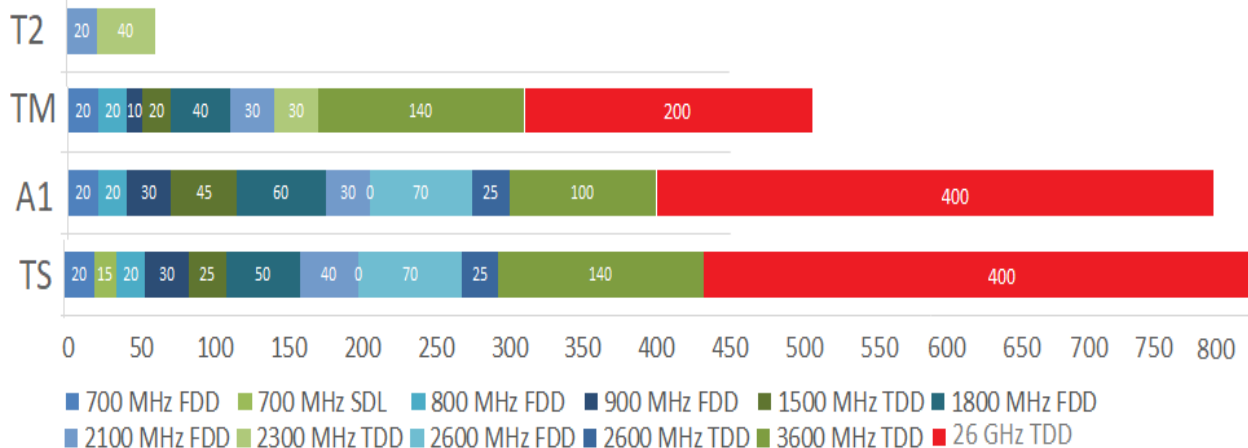
Source: <https://www.a1.si/a1-brezicni-net>,
<https://www.a1.si/a1-brezicni-net-tv>



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MNO spectrum holdings and deployment

Assigned spectrum by MNO



Own own outdoor BS locations No.

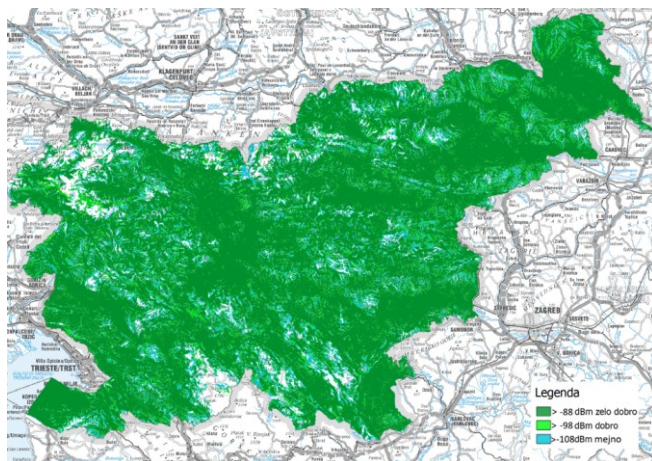
| Operater | Total | GSM | UMTS | LTE | NR |
|-------------------|-------|------|------|------|-----|
| A1 Slovenija | 1156 | 1152 | | 1152 | 670 |
| Telekom Slovenije | 1353 | 1336 | | 1346 | 651 |
| Telemach | 1148 | 1146 | 1147 | 1146 | 163 |
| T-2 | 146 | | 146 | 146 | 12 |

| | A1 | 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 | |

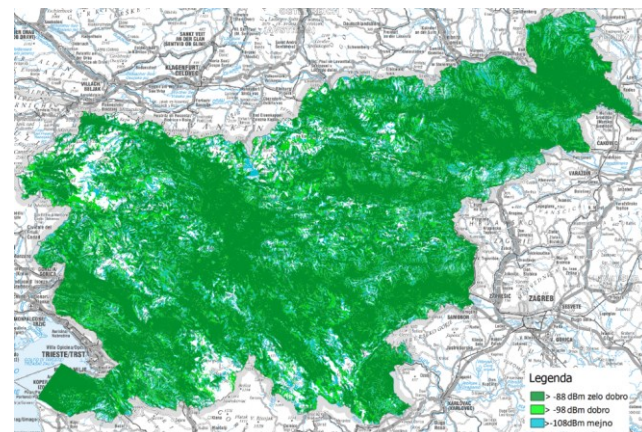
Source: AKOS Report January 2025

https://www.akos-rs.si/fileadmin/user_upload/dokumenti/Raziskave_analize_porocila_in_statistika/RE_Spekter/Pokritost_s_storitvami_mobilnih_tehnologij_avgusta_2024.pdf

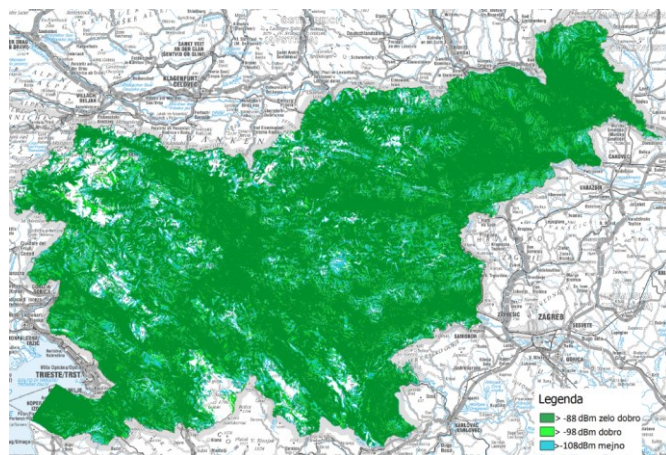
A1:2025
>99%
population
and 93.65
% of the
territory of
Slovenia



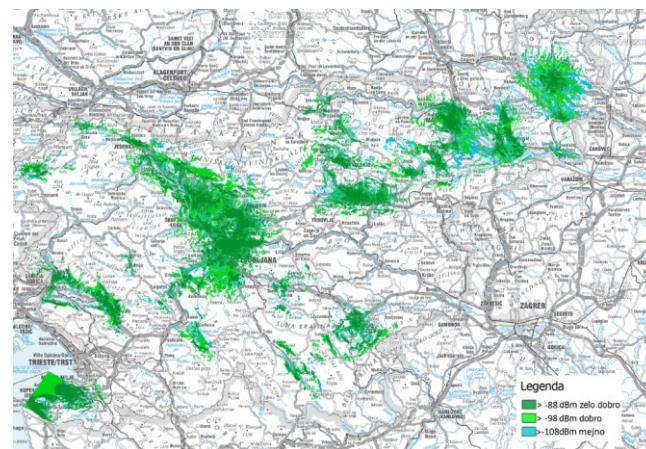
TS:2025
>99%
population
and 97.45%
of the
territory of
Slovenia



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,

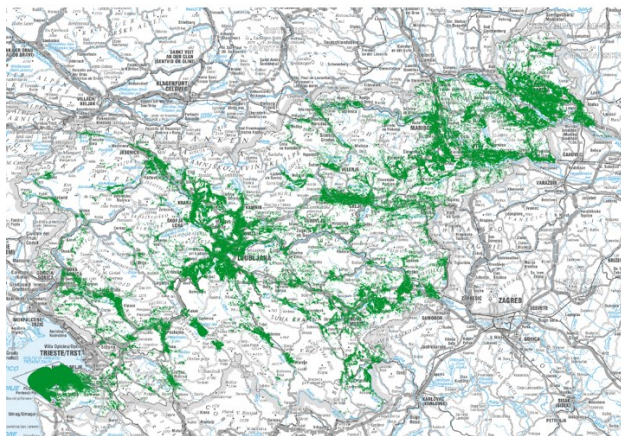
Good: -98 dBm ,satisfactory: -108 dBm



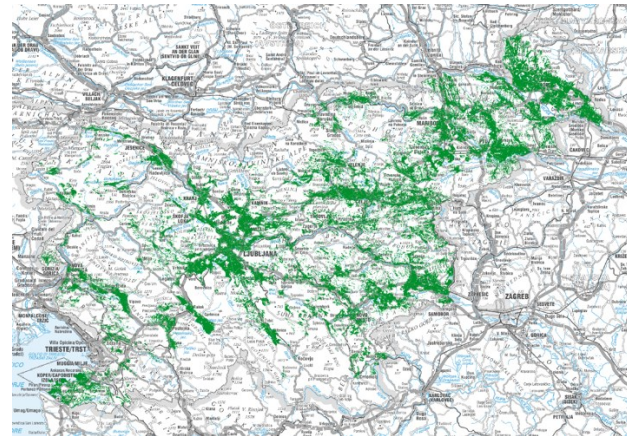
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eMBB 5G Coverage (2300 & 3600 MHz)

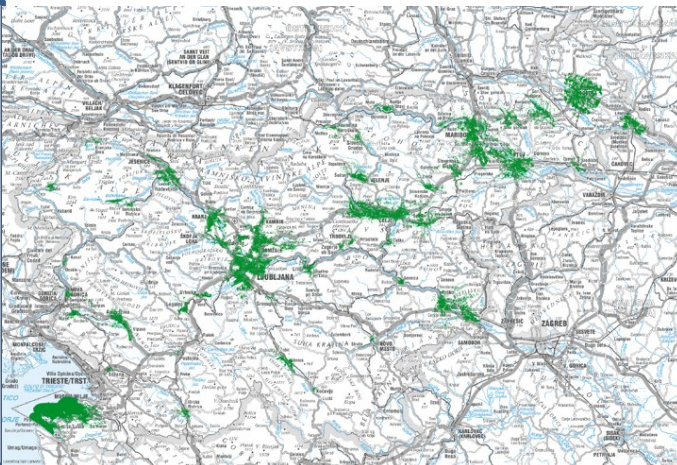
A1:2025
70.93 %
population
and 19.20%
of the
territory of
Slovenia



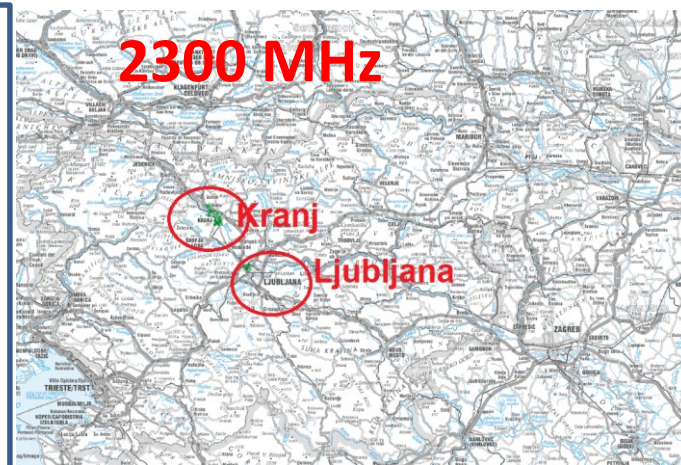
TS:2025
64.98%
population
and 18.21%
of the
territory of
Slovenia



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

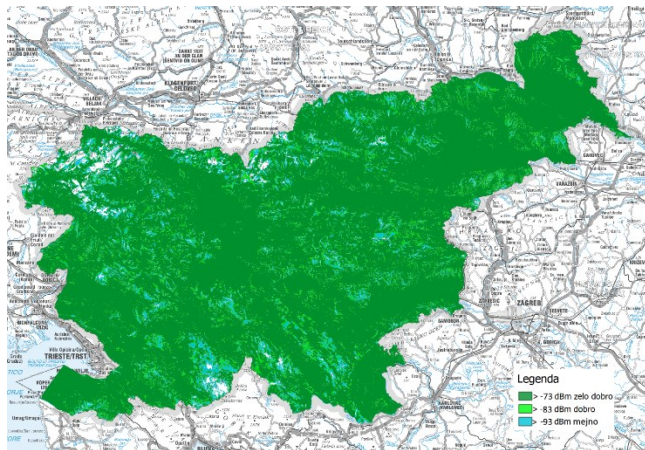


T-2:2025
0.94 %
population
and 0.05 %
of the
territory of
Slovenia

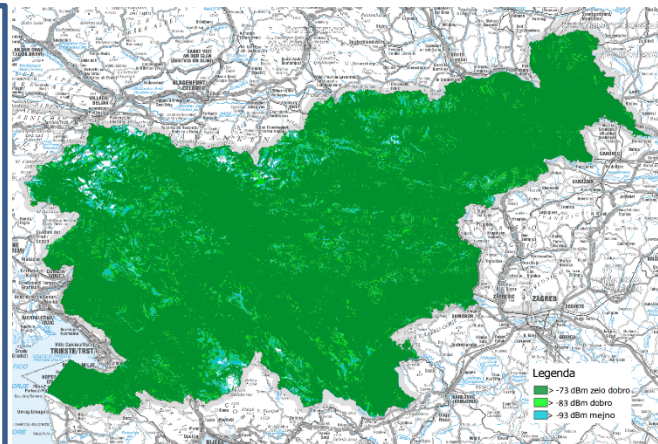


eMBB – support for extreme data rates (max. DL 20 Gb/s and target user experience of 100 Mb/s, max. UL 10 Gb/s and 50 Mb/s user experience), delays at the user < 4 ms

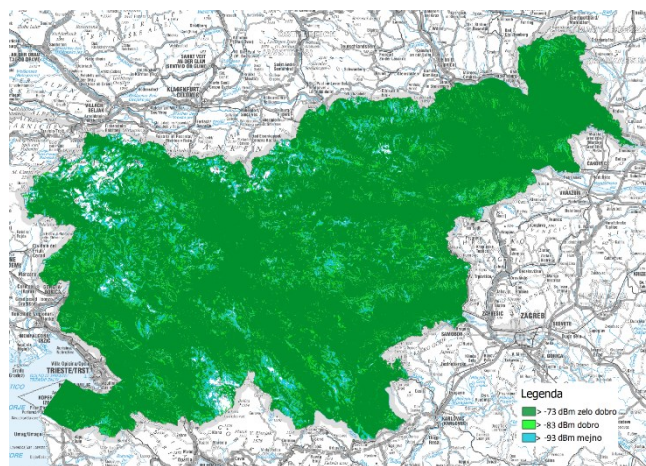
A1:2024 2G
>99%
population
and 98.21%
of the
territory of
Slovenia



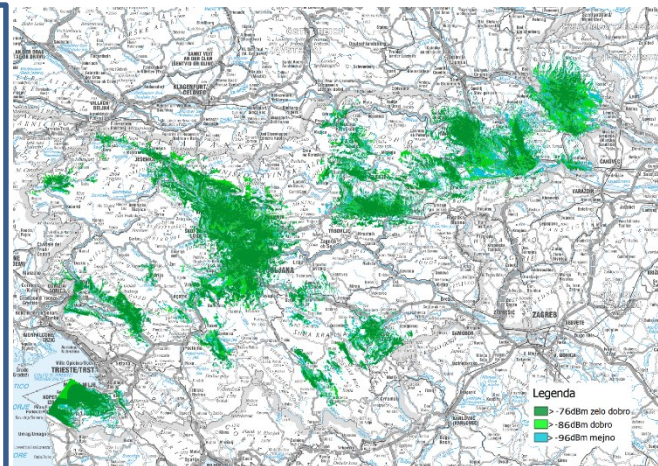
TS:2024 2G
>99%
population
and 98.91%
of the
territory of
Slovenia



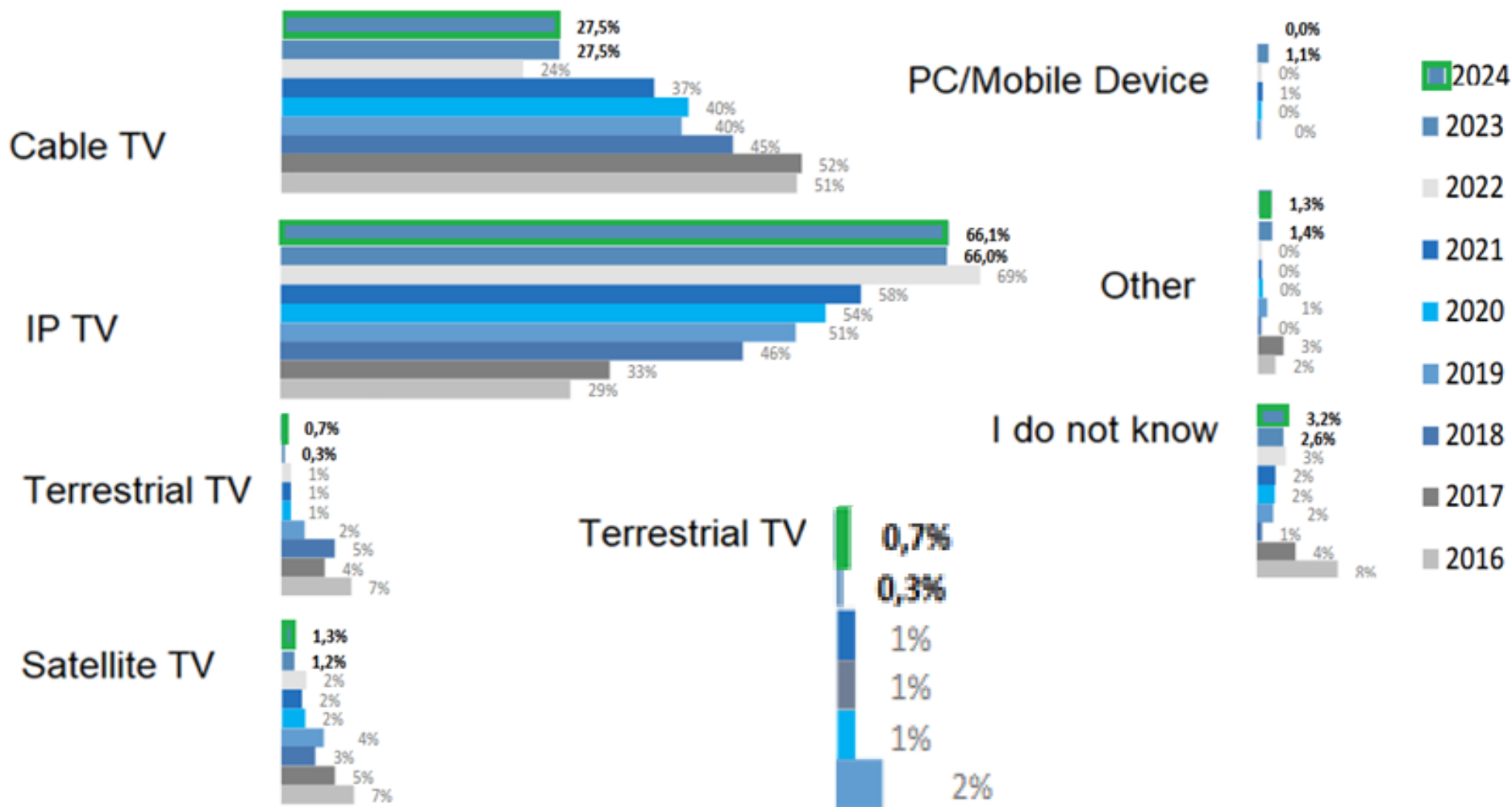
TM:2024
2G&3G
>99%
population
and 97.62%-
2G, 95.9%-
3G of
Slovenia



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?

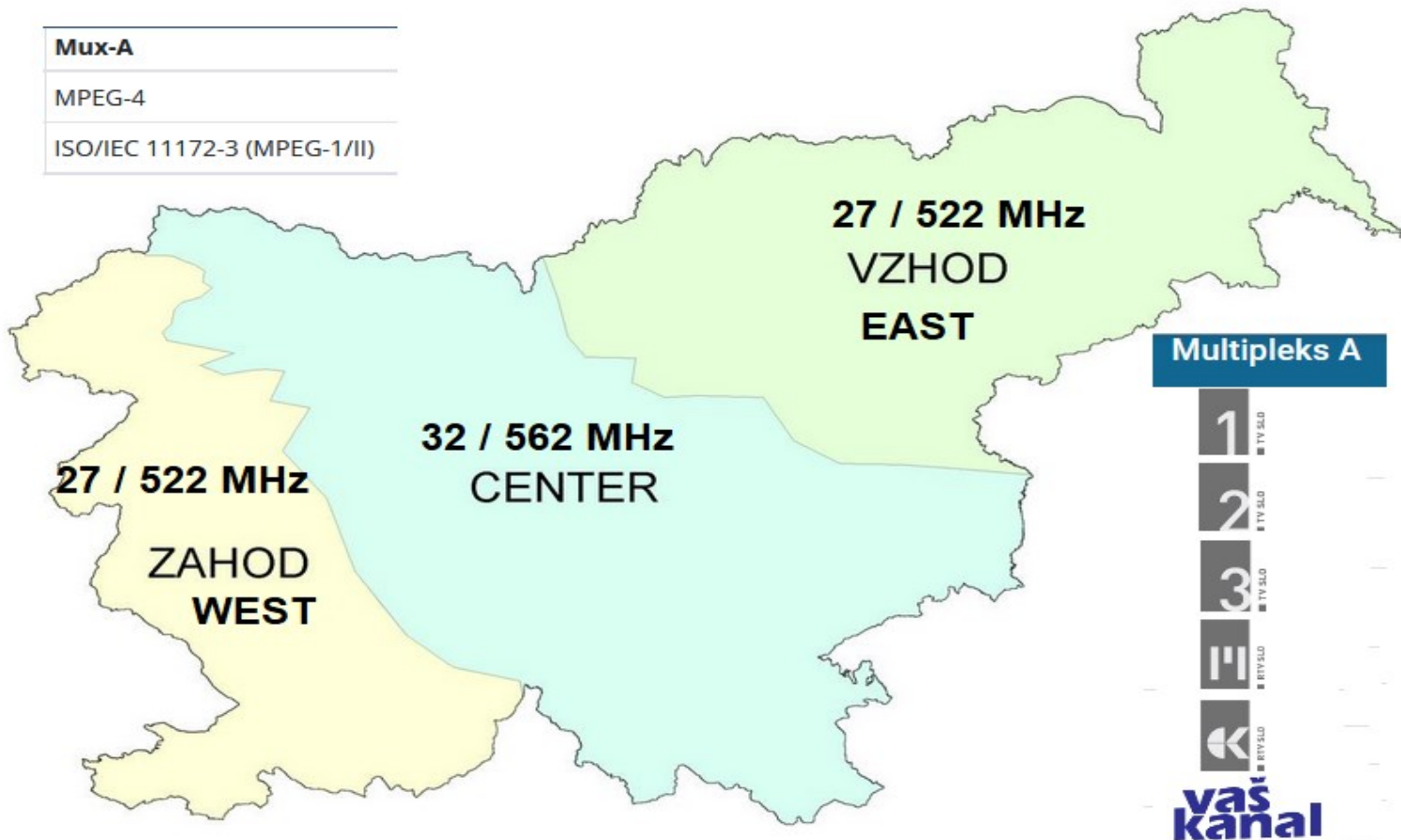




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Terrestrial linear TV Broadcasting market

RTV Slovenia MUX A



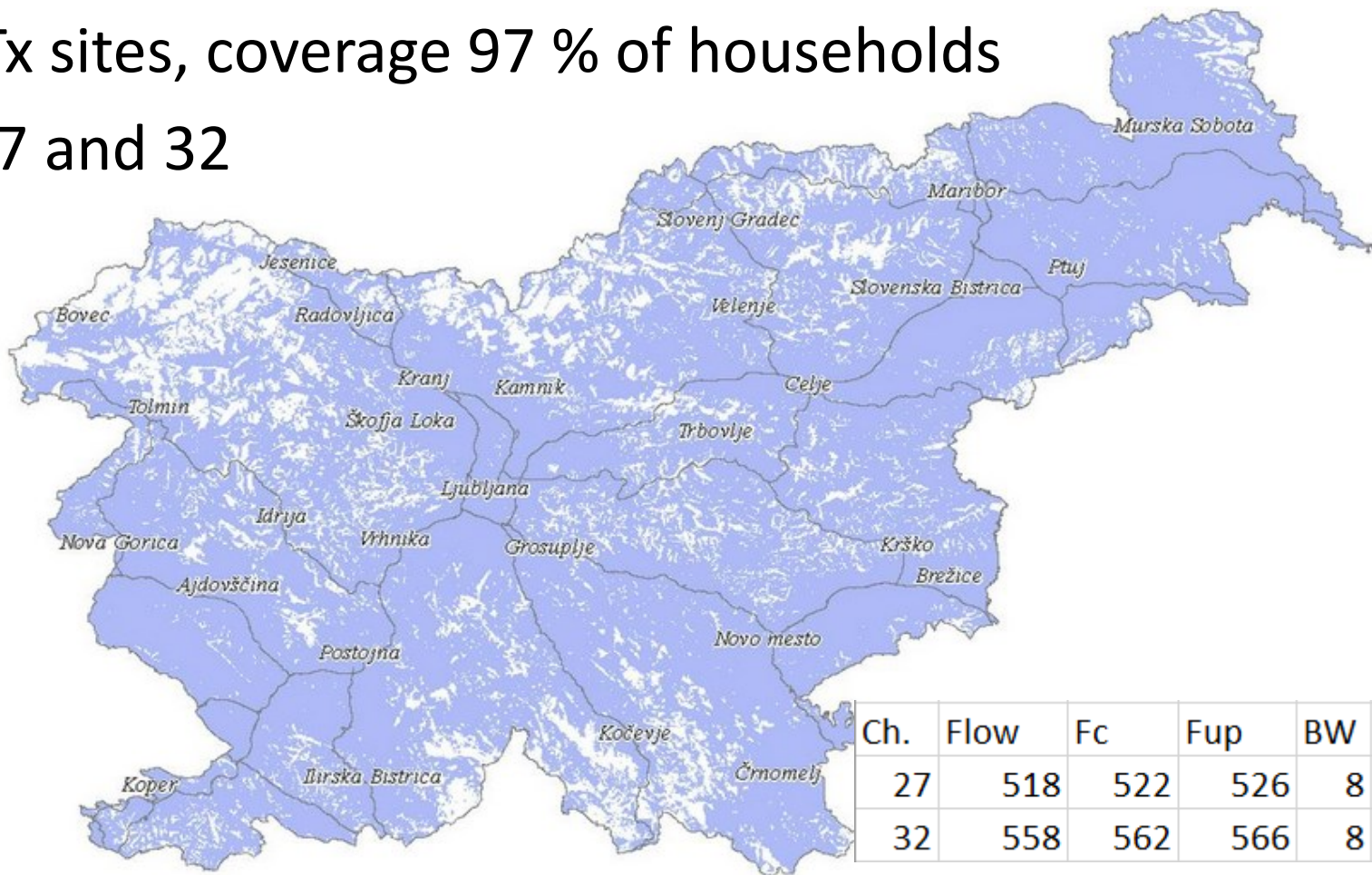
Source: <https://www.rtv slo.si/oz/oddajanje/dvbt/opis/538583>
<https://www.rtv slo.si/oz/oddajanje/dvbt/programi/543636>



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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



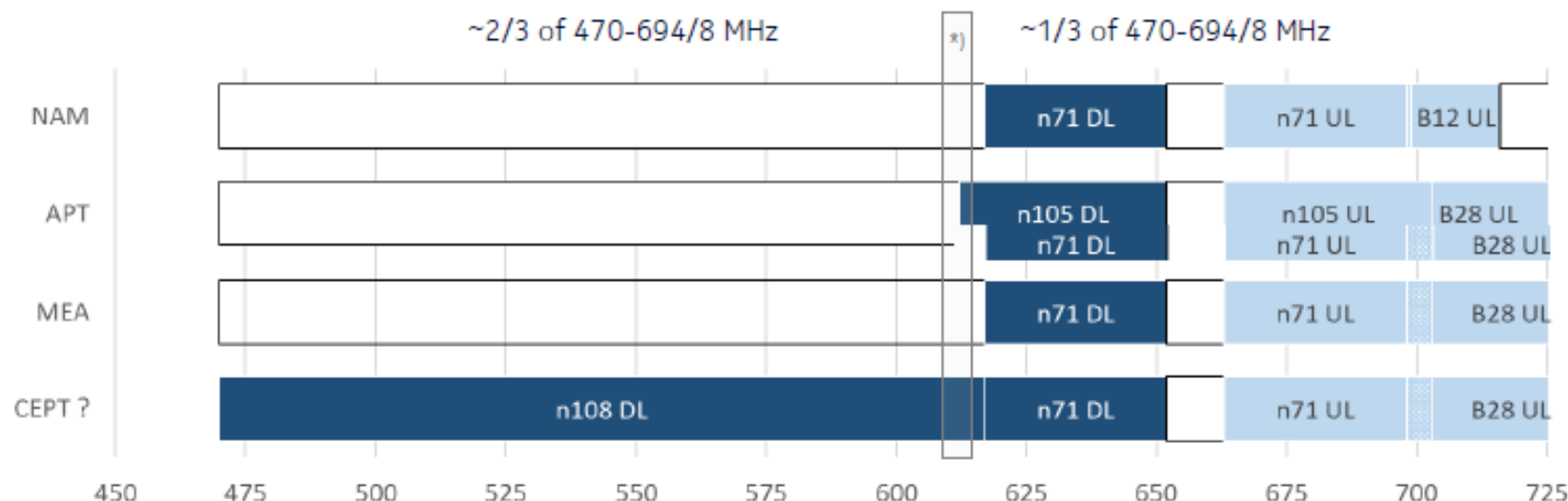
- ④ 17 speakers
- ④ 60 participants from 9 countries
- ④ 3 sessions:
 - ④ Regulatory framework
 - ④ 5G Broadcast / Multicast Operators Trials (RAI, ARD, Yle, OIV)
 - ④ 5G Broadcast / Multicast Manufacturers Trials (Rhode Swartz, 5G Mag, Qualco, Nokia, Ericsson)
- ④ The need to converge to open possibility 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

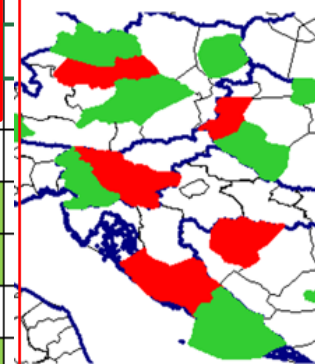


- 600 MHz FDD opportunities in various regions, considering broadcast use in neighboring countries, (n71: DL 617-652MHz, UL 663-698 MHz; n105: DL 612-652MHz, UL 663-703 MHz)
- DL opportunities including 5G Broadcast and mobile supplemental DL in co-existence with broadcast in neighboring countries or 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 | | |

Channel 41



Band 71 DL

- 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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