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On the Road to 6G



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Session 6: Regulator's perspective on spectrum sharing -
Slovene vision

Meta Pavšek Taškov, AKOS, Slovenia, Head of Mobile Communications



SHARING THEORY - sharing is multidimensional strategic issue. It consists of:

- ④ Intra-service sharing - Multi-Tier sharing
- ④ Inter-service sharing Single-Tier sharing
- ④ Sharing between operators (MNOs) Single-Tier sharing.

ROLE OF AKOS IN PROMOTING SHARING

- ④ a) Sharing of physical infrastructure for networks;
- ④ b) Network sharing (active including spectrum pooling and/or passive);
- ④ c) Passive infrastructure sharing and local agreements on national roaming;
- ④ d) Use of energy-efficient processes- proposals for future regulatory development in Slovenia and EU

CONCLUSIONS





AKOS SHARING THEORY - Intra-service sharing

- ④ National intra-service sharing - Mobile industry - exploring innovative ways of sharing between incumbents and new users of e.g. mobile service.
- ④ 5G will allow mobile operators to dynamically allocate bandwidth to different technologies (i.e. 4G and 5G) - efficient way to introduce 5G (especially for the initial deployment) in existing mobile bands,.
 - ④ For accommodating vertical needs - offer network slicing to deliver xMBB, mMTC and uMTC) for different 5G use cases (e.g. industry 4.0) without regulatory impacts.
- ④ Cross-border intra-service sharing
 - ④ Pan European verticals (ITS, PPDR) and regional cross-border services - cross-border co-operation and roaming support of slices for specific vertical requires:
 - ④ minimum required KPIs
 - ④ minimum vertical specific coverage.
 - ④ There is a need to develop the legal provisions and conditions for joint authorization procedure and allocation of similar radio spectrum blocks for cross-border verticals.



- ④ Classic inter-service scenarios are:
 - ④ Sharing between co-primary services, where the incumbent service (treated as tier 1 service) and newly identified service with primary allocation (e.g. IMT – treated as Tier 2 service). For these services, it is supposed scenario with known locations.
 - ④ Sharing between licence exempt services (Tier 3 services – unknown locations)
- ④ The need for introduction of more complex sharing scenarios
 - ④ One of the most complex is sharing between co-primary services and existing secondary services. The incumbent service (treated as Tier 1 service), newly identified service with primary allocation (e.g. IMT – treated as Tier 2 service) with known locations shared as well with existing licence exempt services (Tier 3 services) with unknown locations. For such complex scenario new techniques can be implemented.



- ③ **Dynamic sharing**, where there is uncertainty about the timing and location of incumbent usage, is very complicated from a mobile perspective, especially when usage is intensive or unpredictable. It greatly reduces the value of spectrum for mobile use and makes its use difficult for mobile operators when it comes to ensuring a certain quality of service.
- ③ However, **static sharing** may increase the overall supply of spectrum available for mobile demands. The bands, which can be made available with a static sharing approach, or at least a limited dynamic way, may be worth exploring.
- ③ **The solution** for inter-service sharing **could be a «toolbox»** covering all the relevant scenarios – good praxis from Defence sector:
 - ③ started sharing parts of radio spectrum under transparent, fair, agreed and reciprocal conditions.
 - ③ Support new approaches: Cognitive Radios (CR), Cognitive Radars, and Artificial Intelligence (AI), Dynamic Spectrum Management (DSM).



- ① Sharing between operators (MNOs) Single-Tier sharing consists of:
 - ① Sharing of physical infrastructure for networks;
 - ① Network sharing (active and/or passive), multi-operator sites for mobile networks;
 - ① Business arrangements on national roaming



- ④ AKOS supports the means for reduction of the environmental footprint of electronic communications networks, by promoting following sharing activities:
 - ④ a) Sharing of physical infrastructure for networks;
 - ④ b) Network sharing (active including spectrum pooling and/or passive);
 - ④ c) Passive infrastructure sharing and local agreements on national roaming;
 - ④ d) Use of energy-efficient processes- proposals for future regulatory development in Slovenia and EU.



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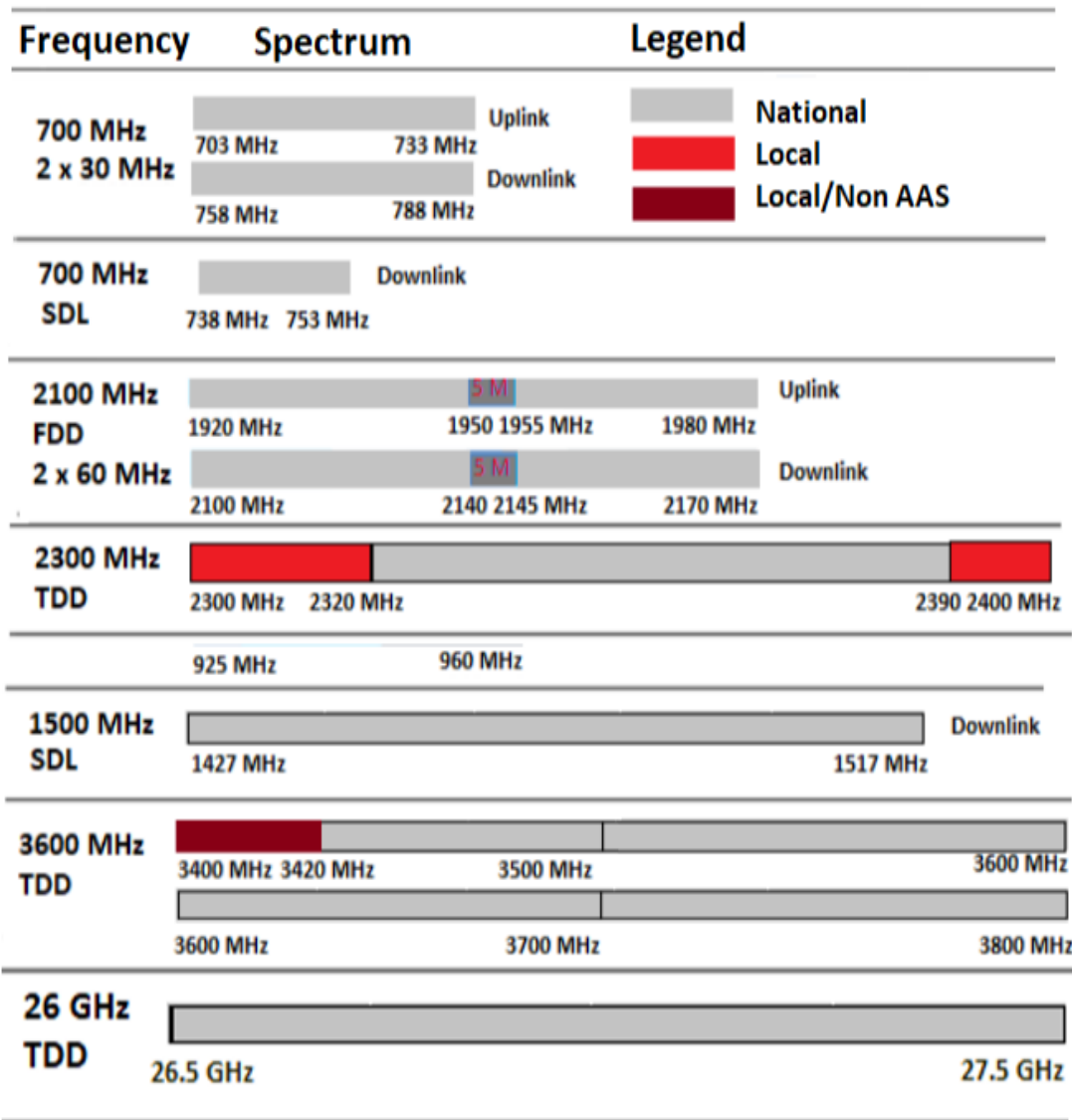
a) Sharing of physical infrastructure for networks

State of play of network sharing on coverage- there is passive sharing described in ECA-1, which ease coverage:

- ④ Operators share passive infrastructure (i.e. towers) based on commercial agreements and one-to-one principle.
- ④ On the mobile market passive infrastructure sharing (base stations locations, masts) is based on commercial agreements; where the sharing is usually based on simple sharing of one passive infrastructure element for another equal passive infrastructure element. The agency did not have to decide in any dispute resolution and did not get any such initiative. Many of mobile network sites are shared among mobile operators, in all cases on a fully commercial basis on a quid pro quo principle.
- ④ Symmetric regulation is transposed into the Article 91 of ECA-1C, which stipulates the same as Article 12 of the FWD.
- ④ For now AKOS did not impose the obligation to the operators regarding the sharing of infrastructure. Agency must cooperate with the administrative unit of the municipality to do that.
- ④ However, AKOS is publishing the notifications for co-investors on the website.
- ④ ECA-1C in Article 92 stipulates that AKOS shall impose an obligation of shared use of installations in buildings or of first distribution point if this is outside of the building in accordance with the same procedure as a shared use, previously described as from Article 91.



AKOS b) Network sharing (active and/or passive)



- ④ AKOS has in its Public tender with public auction with the goal to improve coverage of Slovenian territory and in order to reduce impact on environment, promoted the following sharing options:
 - ④ sharing of passive or active infrastructure or spectrum pooling,
 - ④ business agreement on national roaming,
 - ④ joint deployment of infrastructure for the provision of networks and services based on the use of radio frequency spectrum.



AKOS Spectrum holdings after Auction

700 MHz FDD	2x10 MHz Telekom Slovenije	2x10 MHz Telemach	2x10 MHz A1 Slovenija
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700 MHz M2M	2x3 MHz Bee TN
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700 MHz SDL	15 MHz Telekom Slovenije
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800 MHz FDD	2x10 MHz Telekom Slovenije	2x10 MHz Telemach	2x10 MHz A1 Slovenija
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900 MHz FDD	2x5 MHz Telemach	2x15 MHz A1 Slovenija	2x15 MHz Telekom Slovenije
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1500 MHz SDL	25 MHz Telekom Slovenije	20 MHz Telemach	45 MHz A1 Slovenija
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1800 MHz FDD	2x30 MHz A1 Slovenija	2x25 MHz Telekom Slovenije	2x20 MHz Telemach
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2100 MHz FDD	2x15 MHz A1 Slovenija	2x15 MHz Telemach	2x20 MHz Telekom Slovenije	2x10 MHz T-2
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2300 MHz TDD	20 MHz	40 MHz T-2	30 MHz Telemach	10 MHz
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2600 MHz FDD	2x35 MHz Telekom Slovenije	2x35 MHz A1 Slovenija
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2600 MHz TDD	25 MHz Telekom Slovenije	25 MHz A1 Slovenija
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3400 MHz TDD	20 MHz	140 MHz Telekom Slovenije	40 MHz Telemach
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3600 MHz TDD	100 MHz Telemach	100 MHz A1 Slovenija
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26 GHz TDD	200 MHz Telemach	400 MHz A1 Slovenija	400 MHz Telekom Slovenije
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AKOS b) Network sharing (active and/or passive) – conditions (1)

- ④ Active sharing and frequency pooling, including dynamic spectrum sharing, is permitted within a framework that does not limit infrastructural competition, for:
 - ④ **challenging areas of Slovenia:**
 - National Parks and remote settlements
 - Road and railway tunnels
 - Critical road sections
 - regions of Slovenian border
 - regions exceeding 60% of active railways with passenger, roads and regional roads category I and II,
 - historical monuments and other buildings under protection of Cultural heritage,
 - small cells if there are building restrictions,
 - indoor
 - **network densification needs** to secure very high capacity base stations offering Gigabit speeds:
 - road and city infrastructure (e.g., lamp posts, traffic lights ...)
 - railway and energy infrastructure
 - in dense venues (convention centers, concert halls, stadiums, bus and train stations, shopping malls, factories, ports, airports ...)

Dynamic spectrum sharing - sharing of spectrum between license holders or between the license holder and the lessee, at a specific location, whereby the spectrum can be dynamically redistributed between them.



AKOS b) Network sharing (active and/or passive) – conditions (2)

- ④ Sharing is permitted in accordance with competition law principles. The existence of distortions of competition will be monitored by AKOS or the body responsible for the protection of the competition within the scope of its jurisdiction.
- ④ AKOS will monitor the development on the market and in technology and may in the case of a significant change in Slovenian mobile market and based on the license holders' initiative adjust the sharing conditions adequately amend licenses.
- ④ **For the 26 GHz band**, frequency pooling and active sharing, including dynamic spectrum sharing, are permitted everywhere, with a pre-emptive right in favour of the DARF holder on its assigned sub-band, and active sharing between all holders of DARF including dynamic spectrum sharing, is permitted.



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c) Passive infrastructure sharing and local agreements on national roaming

EECC Art. 61

- ① In circumstances where market-driven deployment of infrastructure for the provision of networks or services that rely on the use of radio spectrum is subject to insurmountable economic or physical obstacles for operators, and therefore access to networks or services by end-users is not possible, AKOS shall impose on a license holder who has acquired radio spectrum in this public tender in such an area for the period of license's validity obligations related to sharing passive infrastructure or obligations to conclude localised roaming access agreements.
- ② In circumstances where access to and sharing of passive infrastructure alone is not sufficient to resolve this issue, AKOS may impose obligations for sharing active infrastructure and include them in the licenses.

The objective of this measure is to avoid distortion of competition in areas where other operators have no option of obtaining access to locations commercially on existing network and building a new location is subject to insurmountable economic or physical obstacle.



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d) Vision of possible development of new licensing & coordination regimes

Vision on future development:

- ④ Licensing regimes for **local networks** could be **flexible**, may be **service & technology neutral**
- ④ **New light licensing** regime based on an **automated platform** could be possible alternative for auctions **in dedicated bands and local usage**
- ④ Possible **digitalisation** of the **light licensing processes**: automation of first come/first served licensing **based on AI**
- ④ **operators** could be **encouraged** to invest in **self organised networks using AI** to **configure and maintain networks**, allowing **dynamic spectrum sharing**
- ④ **When new sharing** mechanism between **co-primary services** and **existing secondary services** with **unknown locations** are **developed and tested**, **digitalised sharing (static and dynamic)** and digitalised **coordination** process within frequency bands **could be promoted**
- ④ **The last step** is digitalisation of **cross-border coordination** processes based on **AI**.



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Conclusions

Contacts:

META PAVŠEK TAKOV

Head of Mobile Department

Tel: +386 1 583 63 63

Fax: + 386 1 511 1101

e-mail: meta.pavsek-taskov@akos-rs.si

