



University of Oulu's response to draft RSPG Opinion on "The development of 6G and possible implications for spectrum needs and guidance on the rollout of future wireless broadband networks"

University of Oulu thanks the RSPG for the opportunity to provide comments on the RSPG's draft Opinion on 6G. University of Oulu has done 6G research in 6G Flagship program since 2018, and we welcome the first European level regulatory developments on 6G. This response provides feedback on the current draft opinion and points out possible new topics to be included into the opinion and considered in future RSPG work.

While the draft report heading identifies "the development of 6G", "possible implications for spectrum needs", and "guidance on the rollout of future wireless broadband networks", the actual contents present important information about 5G spectrum management approaches in the EU member countries. There is not much about potential implications for 6G spectrum aspects based on the presented 5G status. A more descriptive heading would be to include the terms "5G status" and "possible implications for 6G" to avoid a mismatch between the heading and the actual content.

The discussion on potential 6G spectrum issues is very cautious and there is no proper discussion on possible spectrum bands for 6G. High spectrum bands are not adequately discussed considering the amount of on-going research activity both in Europe and globally in the sub-THz bands for 6G. The only 6G spectrum discussion on pages 28-29 is about 7-30 GHz range, emphasizing the limitations to what should be considered for studies for 6G.

It would be important to introduce more flexibility into 6G spectrum awards to allow different deployment models using spectrum sharing technologies and models. The development of 6G should target increased flexibility and automation so that underused and unused spectrum can be put to work and to provide spectrum access to local networks. Examples include locally operated networks in remote/rural areas. Also, the use of mobile communication systems for mission critical users is expected to continue, which would require the deployment of small scale ad hoc mobile

communication networks in areas that do not have coverage. Other deployment models that are not mentioned in the draft opinion include for example offshore operations and unmanned aircraft systems (UASs). Spectrum management for these types of networks also calls flexibility and automation. These sharing based spectrum access models could be included into Section 5.4.

The topic of sustainability is not properly considered in the draft opinion. It only comes up in 6G Flagship and Hexa-X project inputs. Recent 6G statements emphasize sustainability as a guiding principle, including e.g. EU-US Trade and Technology Council’s (TTC) 6G Outlook, which states that *“6G technologies must also be an enabler for sustainability, considering environmental, social, and economic perspectives. A reduced carbon footprint and energy efficiency will be important design goals for 6G networks. More broadly, 6G should allow for reduced energy consumption across all sectors of the economy and society. Ideally, 6G technologies will generate less pollution and reduce other environmental impacts to better contribute to long-term social sustainability while maintaining economic feasibility.”* It would be important to make sustainability a key element in the European regulatory work on 6G and consequently for RSPG to consider what it means in spectrum policy making in order to develop sustainable spectrum management principles.


The annex includes important information from member states about 5G spectrum awards. However, the contents of the annexes are very diverse with differing levels of accuracy. For example, member states’ spectrum policies are important and appear to be accurate, but sentences in other locations are stakeholder opinions without stating the source mischaracterizing the markets. It would be important to clarify the role of the annex so that the statements from the annex are not taken as the opinion of the RSPG when in fact they present stakeholder’s own opinions that are neither referenced or fact checked.

Please find here the latest version of Figure 2:

Goals and expected impact	Users and developers	Usage scenarios	Technological enablers	Capabilities and measures
<i>Why are we developing 6G?</i>	<i>Whom are we doing 6G for? Who are doing 6G?</i>	<i>What purpose are the users using 6G for? How are the users using 6G?</i>	<i>How do we make 6G function?</i>	<i>How is 6G measured?</i>
Human-centricity and inclusivity	Humans	Immersive communication	Emerging technologies	Key performance indicators (KPIs)
Social, environmental and economic sustainability	Machines	Hyper reliable and low-latency communication	Enabling technologies	Key value indicators (KVIs)
Trustworthiness	Organizations (public & private)	Massive communication	Embedding technologies	
Resilience and sovereignty	Communities	Ubiquitous connectivity		
		Integrated artificial intelligence and communication		

In the following we provide more detailed comments on selected parts of the draft opinion.

Detailed comments on the main body of the draft opinion



Item 2.a. *“Intra network Dynamic Spectrum Sharing enables a MNO to share its spectrum resources on demand in real-time between 4G and 5G (later expected for 6G) technologies within their spectrum blocks.”* University of Oulu would like to remind that spectrum sharing is much more than the so-called “dynamic spectrum sharing” concept of this draft opinion. In fact, the term “Intra network Dynamic Spectrum Sharing” is not in line with spectrum sharing terminology since it presents sharing between a single MNO’s two networks (4G and 5G). This is commonly known as “intra-operator spectrum sharing” instead of “intra network Dynamic Spectrum Sharing”. The presented concept is MNO’s internal matter and a small subset of spectrum sharing scenarios. It is unclear why this sharing model is emphasized so much in the draft opinion. It would be important to present other spectrum sharing scenarios for 6G including both vertical spectrum sharing with incumbent spectrum users and horizontal spectrum sharing with different local deployments. Activities around different spectrum sharing approaches are on-going especially in the US and their role will increase in 6G. Europe needs to be active in this development.

Item 3. *“Recognises the increasing needs for vertical and local spectrum.”* It is unclear what the term “vertical spectrum” means. A clearer way could be to use the terminology that is used in the heading of Section 3 in Annex 1 “*spectrum for verticals and local networks*”.

Item 5. *“Recognises that technology neutrality and spectrum sharing are applicable and the existing harmonised bands for ECS will be also made available for 6G.”* This item conflates two separate topics, namely “technology neutrality” and “spectrum sharing”, into one item, and then limits the consideration in its current formulation to intra-operator spectrum sharing. It would be important to expand item 5 or add a new item highlighting the importance of spectrum sharing for 6G including both vertical and horizontal spectrum sharing dimensions (i.e., sharing between systems having different levels of spectrum access rights, and sharing between systems with the same level of spectrum access rights).

Item 9. *“Recommends to the European Commission, taking into account RSPG recommendations, with the help of Member States, to work towards a strategy, involving all active stakeholders (research institutes, manufacturers, MNOs, spectrum users' associations, etc.), to facilitate the timely launch of 6G services across the EU.”* It is important to develop mechanisms to include the voices of end users and the creators/developers of the devices and services that they will use in the process in order to take into account the importance of human perspective in 6G design. Relying solely on companies and operators that make and operate the systems to relay the end user perspective was not sufficient, and a broader perspective is needed to ensure 6G’s success.

Detailed comments on the annex part of the draft opinion

2.1.1 State of Play of the 700 MHz band. *“This frequency band benefits from EU harmonisation and synergies with other regions including economies of scale. As the band was harmonised in the EU in 2016 before the availability of 5G equipment in 2020, it has been initially used by 4G in some EU Member States and later started to be used by 5G. However, due to the size of the frequency band (small bandwidth), the 5G performance (bitrate/speed) is lower than in the higher bands, e.g., 3.6 GHz, although operators can use carrier aggregation with other bands (e.g., 800 MHz), within technology neutrality framework.”* Here, “5G performance” means “bitrate/speed”, which is a narrow approach. It would be important to consider other 5G performance related aspects such as coverage, which in the 700 MHz band is favorable.

4.2 Main research topics. *“6G services studied in the research projects include: ...”* The list includes more techniques than services so it could be expanded to “6G technologies and services studied in the research projects include:”. Currently, spectrum related research topics are missing from the list. Please, add: “channel models, spectrum bands, spectrum access models and spectrum sharing techniques for 6G”.

5.1 Experience with the provision of wireless broadband services using unlicensed spectrum including management of interferences. *“Use of unlicensed spectrum is mainly targeted towards consumers use and non-critical systems and is less suited for enterprise customers.”* A large number of enterprise networks use unlicensed spectrum and can enable several enterprise and vertical use cases. Thus, this kind of statement creates confusion.

6.4 Use of current harmonised mobile bands for 6G. *“... At this stage, there is no technical evidence that 5G and 6G technologies will be able to share the same band.”* The so called “dynamic spectrum sharing” concept in 5G has already introduced intra-operator spectrum sharing that allows an MNO to share its spectrum between its 4G and 5G networks. Statements undermining the capability of 6G to share with 5G are too early, indicating that future 6G technologies would be less capable than the current 5G technology.

Respectfully,

University of Oulu, Finland

Jouko Niinimäki, Rector

Essi Kiuru, Administrative director

Tämä dokumentti on allekirjoitettu sähköisesti UniOulu Sign-järjestelmällä
This document has been electronically signed using UniOulu Sign

Päiväys / Date: 21.08.2023 12:50:19 (UTC +0300)

Oulun yliopisto

Essi Kiuru

Organisaation varmentama (UniOulu käyttäjätunnus)
Certified by organization (UniOulu user account)

Certified by organization

Päiväys / Date: 21.08.2023 13:13:15 (UTC +0300)

Oulun yliopisto

Jouko Niinimäki

Organisaation varmentama (UniOulu käyttäjätunnus)
Certified by organization (UniOulu user account)

Certified by organization