Draft RSPG Report on 6G Strategic vision

Nokia’s response to the Public Consultation

December 2024

1 Introduction

Nokia welcomes the opportunity to comment the draft RSPG Report on the "6G Strategic vision". This response complements the contributions provided via industry associations of which Nokia is member and observer, namely GSA and GSMA and ConnectEurope respectively. We encourage RSPG to proactively support the shaping of a European Union ambitious 6G vision that includes early considerations of spectrum needs to facilitate the successful launch and operations of 6G and its future development.

Nokia sees the 6G spectrum roadmap[1] as central to the 6G strategic vision and its execution if Europe's aim is to lead in the 6G era. We therefore support RSPG's goal to finalize the 6G strategic vision and to launch a 6G spectrum roadmap during the 2026-2027 working period to identify the frequency bands that need to be made available for the launch of 6G and its future development.

The European spectrum policy intertwine with the high-level policy goals of the European Union of technology leadership in the 6G research and successful early deployment. The RSPG vision on 6G should consider and reflect recent policy initiatives from the European Commission. The Draghi Report on the future of European competitiveness and the Letta report on the future of the Single Market – central to the new Commission's mission - call for urgent actions to ensure European competitiveness and investments, including through spectrum policy. Therefore, RSPG's 6G strategic vision and roadmap should empower European competitiveness and encourage future investments in 6G for Europe to gain technology leadership. A clear long-term regulatory strategy and roadmap for 6G spectrum is necessary for Europe and its Member States to benefit from the ongoing EU-funded and national research programs and to encourage the European industry stakeholders to continue the necessary investments in innovation.

As each of the previous generations of mobile technology, 6G will benefit from timely access to new harmonised spectrum for the initial deployments and to deliver the full capabilities and services to the European citizens and businesses. New spectrum in low, mid and high bands will respond the various needs for coverage and capacity necessary to provide 6G connectivity and features in both dense areas and rural environments and will be used at different stages of the deployment of the networks.

Aligned with our views expressed on many occasions, including in response to the RSPG consultation on the opinion on "The development of 6G and possible implications for spectrum needs and guidance on the rollout of future wireless broadband networks" of August 2023, we underline two aspects that RSPG should take into account in developing its 6G Strategic vision and the spectrum needs for the successful launch and development of 6G in Europe:

[1] Including the timely consideration, identification, and release of adequate harmonised spectrum bands

- Mobile traffic will continue to grow in absolute terms in the 2025-2030 period and some mobile networks will require additional spectrum before the end of the decade to accommodate the traffic growth, as densification and spectrum refarming all together with the technology enhancement will not be sufficient.
- For the initial launch of 6G and its further development new low and mid bands are needed to provide services in a sustainable economic and environmental manner. Efficient and sustainable 6G deployment calls for the reuse of the existing mobile infrastructure grids with new spectrum with large-carrier bandwidths and with standard power equipment.

The RSPG should consider these aspects when identifying and planning new frequencies for mobile and their availability and associated technical conditions to accommodate timely and efficiently both 5G/5G-Advanced traffic prior to 2030 and ensure successful launch of 6G from 2030 onwards across the European Member States.

In Nokia's view the spectrum bands of outmost importance are:

- The upper 6 GHz band (6425-7125 MHz) as new primary mid-band spectrum even before 2030 for macrocellular deployments with standard power, reusing the existing C-band grids, ideally securing ~200 MHz per network operator.
- The sub-700 MHz that will allow to sustainably upgrade the existing site grids to higher performance and capacity in rural areas and hard to reach places, reducing the digital inequality.
- Additional spectrum from the 7.1-8.4 GHz range will complement the upper 6 GHz to evolve 6G capabilities while equally reusing the existing mobile networks' infrastructure.

The figure below synthesizes our views:

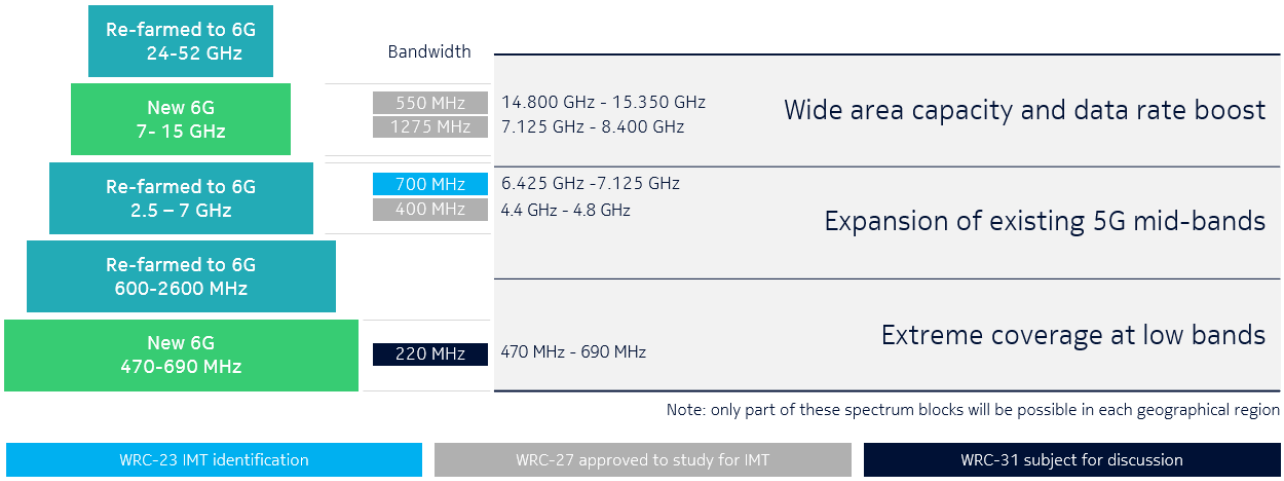

Figure1. Overview of spectrum bands for 6G deployments

Note: while we indicate the upper 6 GHz band for 6G deployments, we acknowledge that it can also be used prior to 2030 to address advanced 5G and respond to increased network capacity needs

In the longer term the 6G can benefit of access to several hundreds of MHz of new spectrum per operator in the 6-15 GHz range. This spectrum may just address the needs

over a new decade – assuming a leap in radio technology performance – but only if coupled with sustainable and affordable macro deployments. As a critical deployment baseline, operators need to be able to deploy 6G in the new higher band spectrum utilizing the existing macro site grid and achieve comparable coverage to 5G mid-band. This will only be possible with more extreme MIMO configurations that expand capacity beyond what 5G is capable of.

Access to new spectrum bands for 6G marks the opportunity of deployments without legacy constraints from existing cellular deployments; it is therefore important for 6G to be designed to utilize those from day one. The recent Nokia White Paper Coverage evaluation of 7–15 GHz bands from existing sites provides an analysis comparing the overall system performance and cell edge coverage at 3.5, 7 and 13 GHz bands from existing urban macro cell sites, confirming that these new mid-bands are promising for the deployment of 6G on existing macro sites. For frequencies from the 7-15 GHz range, the 6G numerology can be derived from the 5G NR numerology with some extensions, enabling wider channel bandwidth up to 400 MHz for substantial capacity enhancements.

Therefore, we see as crucial for RSPG to proactively consider in its strategy work the inclusion of these bands and the adequate conditions attached to attain the goal of shaping a European Union ambitious 6G vision and facilitate the successful launch and operations of 6G and its future development.

Below we provide our generic comments and on specific sections of the document under public consultation.

2 Generic comments

We thank the RSPG for the document under consultation that provides a summary of inputs and views from stakeholders, development status update for 5G and 6G, and technology options including sharing, NTN, RLAN. However, we are of view that the RSPG 6G Vision needs to provide more concrete conclusions and proposals to support its European stakeholders achieving the ambitious 6G goals of leadership of the Union, leveraging the important EU- and national- funded research programs and fostering future investments in the fast rollouts of national 6G networks as soon as 2030s.

3 Specific comments

The report resumes in **chapter 1.1** the views of the stakeholders needing “of 200 MHz for each MNO in mid band spectrum” to enable the “implementation of 6G use cases that require more capacity than 5G services”. To correctly reflect positions expressed by MNOs, we propose the text to be modified to read as:

> “Stakeholders stated a need of 200 MHz *contiguous* for each MNO in mid band spectrum*, e.g. in upper 6GHz, with conditions that allow the use in macro base*

stations without undue power restrictions. This would enable implementation of 6G use cases that require more capacity than 5G services and provide reasonable coverage in suburban/urban areas utilising the same base station towers as for 3.5 GHz. Further, operators have expressed their need for more spectrum to provide increased network capacity in the coming years."

We see important to reflect entirely the MNOs' position and the fact that the regulatory conditions of the upper 6 GHz band need to support the deployment of macrocellular equipment without undue power restriction, reusing existing infrastructure grid, and be available when/where needed, including to provide additional network capacity even before the arrival of 6G.

It was equally highlighted the need for regulatory certainty and clear roadmap that includes new pioneer bands to prevent spectrum fragmentation, support the enablement of a unified ecosystem for network and end user equipment, and thus creating economies of scale.

These aspects should be emphasized in the 6G Strategic vision and in the conclusions in **section 1.2** and considered when defining the roadmap and the regulatory framework for the spectrum for 6G.

As highlighted in the **chapter 2** on lessons learned from the 5G development, the availability of the primary and pioneer bands for 5G played a significant role in the fast deployment of 5G networks. We see the same role for primary and pioneer bands for 6G to allow the rapid rollout and take up of 6G. We also agree that DSS played an important role in the transition from 4G to 5G and we expect that MRSS (Multi RAT Spectrum Sharing) to play a similar role in allowing refarming of spectrum and a smooth transition from 5G towards 6G, but availability of harmonised primary band(s) remains essential.

Section 2.3 emphasizes the potential role of NTN in the 5G and 6G context to extend mobile coverage in under-/un- served areas. We agree that satellites may provide such services in uncovered or sparsely populated areas where mobile coverage is not economically viable or to address temporary needs in case of disasters and emergency situations. However, as underlined also by RSPG, the NTN does not provide the same quality of service as the terrestrial cellular networks. We therefore would like to highlight the supplementary (not complementary) aspect of the NTN solutions and propose to modify the text in the first paragraph of page 7:

"The addition of a satellite component to IMT-2020 could extend the coverage of the IMT-2020 service in under and unserved areas where ~~complementing~~ *supplementing* the terrestrial component is most relevant."

Regarding **section 2.4**, while Nokia actively contributed to the CEPT work of harmonizing the 400 MHz of spectrum in 3.8-4.2 GHz band for local networks, we consider that the needs of the vertical industries can be largely satisfied with solutions such as network slicing and/or deployment of private networks using the existing spectrum available for such purposes (in 3.8-4.2 GHz, mmWave, or specific IMT bands unused for MFCN – 2.3

GHz, 2.6 GHz TDD). We see a need to continue the harmonization of specific frequencies, especially in the low range (380-470 MHz) to address the regional- and nation- wide needs for critical infrastructure. However, the policy aspects related to accessing spectrum for enterprises should be harmonised to ease the licensing process, including the pricing of the spectrum and the administrative procedures. Clear, transparent licensing frameworks across Europe would encourage vertical sectors to deploy and use private mobile networks and solutions for digitization of their processes.

Regarding the growing demand of high-speed and reliable connectivity, we acknowledge the role both mobile and fixed networks play to deliver such services. However, we draw attention to the fact that WAS/RLAN relies on the access to the fixed infrastructure and not the vice-versa, as stated in **section 2.5**. While WAS/RLAN will continue to play an important role in providing the last meters of wireless access to the fixed broadband infrastructure, several studies carried on by the mobile industry in CEPT PT1 indicate that WAS/RLAN does not suffer of capacity constraints (see multi-company contribution ECC PT1(24)176r1).

Section 3 on early policy initiatives on 6G, cites the EU Council conclusions on "the importance of a common and strategic European approach to 6G technology as enablers for the technological development and competitiveness of the EU at a global level" and the need "to establish an attractive policy framework for 6G" including "the early recognition of spectrum needs based on the assessment of coverage and capacity requirements for 6G use cases and its environmental impact". We consider that the early identification of new primary and pioneer bands for 6G, as previously done by RSPG for 5G, would cater for a harmonised approach across Europe when launching the 6G initial rollout. Based on previous experience, the RSPG and the Commission could consider ways to improve the coordination of spectrum release for 6G between the Member States.

On the sustainability aspects, as per **section 4.3**, we agree with the view that technology neutrality and least restrictive technical conditions should remain centra to ECS spectrum policies. For positive impact of 6G networks from environmental, social and economic perspective, the harmonised conditions attached to spectrum in the new mid-bands should allow for deployments without undue power restrictions using the existing macrocellular infrastructure grid of the C-band.

We acknowledge the importance that RSPG puts on spectrum sharing solutions in the **section 5** of this document. In 6G, spectrum sharing with incumbent users is one of the areas of active consideration, but we do not see that "an adoption of an EU mandatory regulatory requirement in the ETSI standardisation process" will automatically lead to the emergence of (viable) solutions for inter-service sharing.

Sharing between new services/applications (intra-service sharing) should aim at optimizing the use of the spectrum with technically feasible and commercially viable solutions. Decision towards any such sharing scheme needs to be justified and should consider the demand, the socio-economic and cost-benefit analysis, as well as the complexity of implementation, and finally its potential success.

For successful 6G deployments, any spectrum sharing scheme under investigation should include all potential coexistence scenarios considering the prioritisation of full-power mobile implementations.

In the context of the 6G future, NTN may play a growing role for IoT uses cases for low-power wide area (LPWA) and reduced capability (RedCap) devices. However, initial rollouts of 6G will likely rely almost exclusively on the terrestrial network deployment targeting populated areas and reuse of existing infrastructure. As we previously stated, we see a role for NTN to provide supplemental coverage to terrestrial networks where/when needed. Nevertheless, the development of the ongoing and new D2D initiatives needs to consider safeguarding the protection of terrestrial networks.

Section 8 of the 6G Strategic vision document is providing detailed information on topics already covered in the report (e.g., sharing, verticals, NTN). Nokia believes that the success of 6G and its evolution is fueled by collaborations across industries and academia, and we significantly invest in multi-party research projects like HEXA-X-II and 6G-ANNA. While we appreciate the detailed insights from the R&D projects, it can be seen as imbalanced toward the other stakeholders, operators and equipment manufacturers. We suggest RSPG to consider a summary of this section and move the integrality of the existing section text in an annex. This way the vision would provide a more balanced approach between the stakeholders.

In **section 9** the RSPG should take into consideration our comments on section 1.2 and adjust the following:

> "~~Some~~ *All* operators indicate that the spectrum need in upper 6 GHz band would be 200 MHz for each operator *with the right conditions that allow macrocellular deployments without undue power restrictions*."

Nokia supports the RSPG plan to launch the 6G spectrum roadmap in the 2026-2027 working period as indicated in **section 10**, leveraging the experience with the 5G primary and pioneer bands, and identifying the frequency bands to be made available for the mass market launch of 6G. Such identification will give the right signal to the manufacturing industry to develop a common end-to-end ecosystem to support the rapid introduction of the 6G in Europe.

Access to new spectrum bands for launching 6G marks the opportunity of deployments without legacy constraints from existing cellular deployments; it is therefore important for 6G to be designed to utilize those from day one. The recent Nokia White Paper Coverage evaluation of 7–15 GHz bands from existing sites provides an analysis comparing the overall system performance and cell edge coverage at 3.5, 7 and 13 GHz bands from existing urban macro cell sites, confirming that these new mid-bands are promising for the deployment of 6G on existing macro sites. For frequencies from the 7-15 GHz range, the 6G numerology can be derived from the 5G NR numerology with some extensions, enabling wider channel bandwidth up to 400 MHz for substantial capacity enhancements.

4 Conclusions

Nokia is encouraging RSPG to finalize its 6G strategic vision and launch the 6G spectrum roadmap during its 2026-2027 working period. The 6G spectrum roadmap should not disregard the additional spectrum needs that may arise before 2030. As such,

- To support the evolution of 5G and the 6G launch, the 700 MHz of the 6.425-7.125 GHz band (upper 6 GHz) should be assigned for licensed use by WBB ECS and enabling macro-cellular networks deployments without undue power limitations. The upper 6 GHz band will address high capacity and highly demanding use cases, mainly in urban areas covered by mid-bands.
- To address sparsely populated and hard to reach areas, achieve ubiquitous 6G connectivity and digital equality, RSPG should consider the inclusion of the UHF band (470-698 MHz) in the roadmap.
- For the longer-term evolution of the 6G and in the context of the WRC-27 studies, the 7.125-8.4 GHz range should not be disregarded as it can support realizing the full potential of 6G. While recognizing that the study cycle towards WRC-27 just started and considering the various incumbent services in this range, initial performance analysis shows the potential of using spectrum form this range to achieve similar performances as with the C-band thanks to advancements in technology.
- The sunsetting of legacy mobile technologies will continue, allowing the further reuse of the existing harmonised spectrum bands with newer and more efficient spectrum and energy technologies. This evolution will continue as 6G develops, but existing spectrum alone will not respond the spectrum needs of 6G.
- Spectrum in the mmWave bands cannot replace or be considered a substitute for wide-area spectrum, due to smaller coverage reached with these bands, but can serve localised high demands in specific areas. While its use remains restrained for now, an evolution can be envisaged in the 6G era. Spectrum in higher (sub-THz) ranges is still subject to long-term studies and research.

An ambitious 6G spectrum roadmap with clear milestones can put Europe at the forefront of the 6G global landscape. We consider that Europe needs to proactively plan both for the launch of 6G and its development to achieve full potential and support the European stakeholders.

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