

## RADIO SPECTRUM POLICY GROUP

### RSPG Opinion on Spectrum Sharing – Pioneer initiatives and bands

## Nokia's response to the Draft RSPG Opinion

Nokia would like to thank the RSPG for the opportunity to provide comments on the draft opinion on Spectrum Sharing – Pioneer initiatives and bands. This response is complementary to those provided via the industry association of which Nokia is member, namely GSA and DIGITALEUROPE. It should also be considered in conjunction with the responses to the Opinions on Additional Spectrum Needs and on the Radio Spectrum Policy Programme (RSPP).

As digitalization of society and industries will continue to grow in relevance in the actual decade, the scarce radio spectrum resource plays an even more central role in supporting this trend. The demand for mobile broadband services will continue to grow requiring access to additional spectrum resources for wireless connectivity.

Exclusive individually licensed and dedicated spectrum continues to be a preferred approach to unlocking spectrum for use with 3GPP technology because of the predictability and quality of service that comes with it and the certainty it brings when investing in the (public) mobile networks. However, where clearing the spectrum from incumbent users is not possible in the short term (if clearing is very expensive and lengthy process, or spectrum cannot be vacated by existing users), co-existence and sharing of the spectrum resources should be considered.

Nokia notes that the Report RSPG21-016 explores different options and approaches of spectrum sharing and uses the term “dynamic” to refer to different mechanisms that include or not an opportunistic access to spectrum (e.g., CBRS vs. club licensing).

#### 1. Options for promoting Spectrum sharing

Any spectrum or network sharing agreements among MNO/CSPs should be market-led and subject to regulatory approval.

However, the RSPG and the Member States should consider encouraging the refarming process of the legacy 2G/3G networks and the migration from 4G towards 5G. Solutions similar to the frequency domain re-farming can also be used in the transition from LTE to 5G. In addition, as LTE and 5G frame structures are similar, an alternative method to migration is the 3GPP standardised Dynamic Spectrum Sharing (DSS) in the time and frequency domain, which allows full bandwidth for both LTE and for 5G where the data channel resources are shared. Although

the DSS term has been adopted in 3GPP only for the 4G-5G spectrum sharing, it should be noted that the 3GPP toolbox could evolve to apply to other spectrum sharing scenarios.

Network slicing in mobile (4G, 5G) networks is a means to serve different service requirements through sharing of network and spectrum resources, efficiently addressing multiple use cases via customisation of public and non-public networks.

Spectrum sharing in IMT networks should remain a complement to the individually licensed spectrum which continues to be the preferred option for the main spectrum bands that assure the predictability of long-term investments in infrastructure and services and offer coverage and capacity for public and private networks.

Where clearance of spectrum is not a viable option, spectrum sharing frameworks between licensed MFCNs and existing services (e.g., FSS, FS, DTT etc.) allow mobile services to access additional new spectrum without creating harmful interference to incumbents. Efficient spectrum sharing frameworks have been developed in the recent years by the mobile industry at a global level to allow more extensive use of the scarce spectrum resource. Transparent spectrum sharing conditions should be available prior to assignment of such bands.

Technical conditions for sharing solution should be defined on a case-by-case basis. Existing sharing frameworks should be evaluated for their potential to provide more harmonised solutions leading to economies of scope and scale.

Solutions including those relying on databases can improve coordination between services, minimizing the required separation and risk for interference, reducing restriction zones, and optimizing thus the use of the spectrum. To this end, solutions like LSA/eLSA or CBRS or Automated Frequency Coordination (AFC) exist and allow access to spectrum on a shared basis.

Nokia sees interest in RSPG's initiative to evaluate future spectrum management techniques aimed at increasing the efficient usage of the radio spectrum by assessing the potential for new services / usages to flourish while ensuring that coexistence with adjacent services is possible. Any sharing solution developed at a national level in Europe or elsewhere should be evaluated within the specific context that led to it, taking into account the potential addressable market and the level of local customisation.

Nokia agrees spectrum sharing should not be a goal in itself and sharing solutions should take into account the targeted scenarios, compatibility of usages and coexistence of solutions, as well as potential impact on the operations of all parties and on the long-term investments needed for rollouts. Clear scenarios for sharing should bring benefits to users of spectrum to build trust and confidence in use.

We consider that the provisions in the EECC create the right premises for a more fluid secondary market and this should be strengthened at Member States level. To this end, NRAs may play a more active role in promoting and facilitating efficient secondary markets, encourage voluntary sharing, and investigate the benefits of greater levels of automation in spectrum administration and management as basis for efficient local licensing and secondary markets.

IMT technologies are designed to deliver predictable and managed quality of service at the network level. Individual licensing is preferred for IMT to deliver the challenging technical requirements as set out by the ITU-R; access to spectrum on shared basis should be to complementary to exclusive licensed spectrum. Conditions for sharing should be known well in

advance and communicated in a transparent manner prior to assignment process to preserve confidence for all users.

Nokia sees value in the development of harmonised standards and regulatory deliverables through ETSI and CEPT respectively and encourages the Member States to evaluate and implement standardised sharing solution when required. Equally, prior to introduction of sharing frameworks, Member States should consider the adequate mechanisms and market surveillance capabilities required.

## 2. Identification of key pioneer initiatives and bands

Sharing solutions should be considered on a case-by-case basis, accounting for the nature of the new and existing users, the risks of harmful interference, and an analysis of the costs and benefits of spectrum sharing.

We note that while this Opinion does not consider specific pioneer initiatives or bands, the RSPG suggests in the RSPG Opinion on Additional Spectrum Needs the possible use of the mmWave bands and/or 3.8-4.2 GHz for local licenses where wide-area networks cannot be implemented. Nokia is of opinion that:

- Any spectrum for local licences should be available to all interested parties, and should not compromise the availability of nationwide licensed spectrum for national IMT networks;
- mmWaves provide good opportunities to respond to localised spectrum needs
- Local licenses in mmWave bands are more easily conceivable, given the physical characteristics of the spectrum, and coexistence and interference can be managed more efficiently than in lower frequencies.

Within the 2020-2030 timeframe and with a look towards future IMT developments towards 6G, access to higher frequency bands in the sub-terahertz spectrum will imply sharing with existing (passive) services and more advanced solutions that will take advantage of machine learning and AI techniques to optimise the access to spectrum. In terms of innovation and development of new technologies, access to suitable spectrum for research purposes is of paramount importance. Facilitating access to such spectrum under affordable conditions and pricing should be considered.

Nokia sees greater level of automation of the licensing processes at Member State level as a goal in itself to improve the licensing administrative processes; however, such improvements are linked to local IT systems and platforms that should not be mixed with the introduction of spectrum sharing solutions.

## 3. Roadmap for increased Spectrum Sharing

### 3.1. Investigation of spectrum sharing options

IMT technologies require a more predictable spectrum sharing environment than the licence-exempt ones which are most appropriate for dynamic/opportunistic sharing in licence-exempt bands. Where clearance of spectrum is not a viable solution, frameworks that allow the co-

channel sharing of spectrum between IMT networks and existing users can help open up additional spectrum for mobile services. Adherence to worst-case interference modelling assumptions has been an issue in the past in developing least restrictive technical conditions, hindering the possibility to effective sharing in some cases. Improved modelling of radio propagation, more realistic scenarios, and increased use of terrain maps could to some extent assist in better coordination and more efficient spectrum sharing.

Market-led mechanisms such as leasing of unused spectrum can facilitate sharing in licensed bands and the national regulatory frameworks should enhance these options, in line with the recommendations of the EEC.

Nokia, as telecom equipment vendor is greatly involved in the development of global standards in 3GPP, ETSI, IEEE, WInnForum, etc. We are supporting the technology neutral approach to spectrum, encouraging that the newest and most spectral efficient technologies are deployed in order to improve the spectrum use.

Where certain parties are contented with deploying communications networks with dynamic/opportunistic access to spectrum, the use of spectrum bands subject to general authorisation is recommended. Such opportunistic access is, for example, offered by 5G NR-U (New Radio – Unlicensed) which is defined in 3GPP to be used in licence-exempt spectrum. Moreover, spectrum in mid-bands such as 2.4 GHz, 5 GHz and the lower 6 GHz already offers more than 1300 MHz that can respond to dynamic/opportunistic access needs, with additional resources in high bands at 60 GHz.

Solutions including those relying on databases can improve coordination between services, minimizing the required separation and risk for interference, reducing restriction zones, and optimizing thus the use of the spectrum. To this end, we support more recent approaches such as LSA/eLSA in Europe, CBRS and AFC (Automated Frequency Coordination) in the USA, which have the merit of optimizing the access to bands where incumbents are present and need to be protected, in terms of geography and equipment power. For example, the AFC that the FCC is implementing in the USA in the 6 GHz band, can provide the benefit to use the band with higher (standard) power by the unlicensed users. In the case of the 5925-6425 GHz band, Europe should further take into consideration the use cases with power higher than those described in the CEPT Report 75 and the corresponding EC Decision.

Nokia sees interest in RSPG's initiative to encourage national developments of "proof of concept" systems. However, any sharing solution developed at a national level in Europe should be evaluated not only within the context that led to it but taking into account its potential of harmonization and the likely addressable market. A European-scale ecosystem is desirable for a successful deployment of harmonised / standardised sharing solutions, including identification of frequency bands that may support the implementation of specific sharing schemes in a consistent (not necessarily uniform) manner throughout Europe.

Nokia agrees that authorisation of trials and experimental systems is central to the research activities, including towards 6G. New technologies such as AI and machine learning, already deployed for the management of IMT networks, will play even more important roles in the context of future evolutions. As such, availability of temporary trial licenses at Member States level – including access to spectrum and consideration of appropriate licensing schemes – in a timely manner and at affordable prices should be encouraged.

With regards to ICT/database-assisted spectrum sharing solutions, we acknowledge their role to facilitate spectrum sharing mainly between license-exempt devices and existing users of a specific band.

## 3.2. Coordinated actions

A better coordination and cooperation between the European level and the Member States is welcome to effectively exchange; this should not be limited to “sharing best practices” if the goal is to achieve a level of European harmonisation that can ensure a significant scale in Europe.

Moreover, a feedback mechanism on the research results of both national and EU-level projects should be considered for Europe to benefit of these research efforts and their combined outcomes.

We see benefits in supporting research related to spectrum sharing, but we consider of relevance to map such efforts with realistic usages in order to assess applicability and potential of adoption.

As previously mentioned, developments at international level should be monitored and learnings from such deployments considered. Exchanges on such developments with relevant stakeholders can help assessing the potential adoption of similar approaches at European level, to benefit among others of the local experience/expertise and the access to an end-to-end ecosystem. Nokia was an early proponent of LSA/eLSA in Europe and is highly involved in the US in the development of standards and technical specification of spectrum sharing solutions in CBRS and AFC and would be happy to provide additional insights based on our expertise if such solutions are to be evaluated in the European context. Lessons learned from CBRS standardization include:

- Creation of Multi-stakeholder group(s) is key: all interested parties, including the incumbents, discussing in a single forum allows for a more efficient standardization process. One important goal is to understand incumbencies upfront.
- Develop protection criteria for incumbents based on actual impact instead of theoretical impact of potential interference to the incumbents.
- Use realistic propagation model and assumptions to assess potential interference on incumbents.
- Identify key use cases to ensure all the needed requirements are addressed in baseline requirements.
- The higher the number of tiers and the diversity of use cases targeted for the band, the higher the complexity, e.g., for defining the coexistence framework, i.e., the framework to maximize spectral efficiency and minimize interference.
- Consider flexibility in specifications development to develop the ecosystem, enable trials as early as possible, etc.
- Any shared band will require a balance between flexibility of specifications which introduces more testing and certification requirements and future proofing
- Mistakes can be costly: After networks are commercially operating and/or testing and certification is completed for required network elements, it is complex to approve changes which can lead to inefficient operation.

- Introduce requirements and options for sharing protocol extensibility.
- Consider features for transition between Releases (baseline mandated) and other optional releases.
- State diagram to allow for flexibility and optimizations in operation.
- Open-ended features without clear associated requirements may get misused
- Explore testing and certification models which allow for agile / continuous testing of Spectrum/Frequency controllers (e.g., CBRS SAS, 6GHz AFC) functionality.
- Third party certification body vs. Government certification with the goal for quick and thorough testing.