

Nokia response to ACMA's Spectrum Management Work Program

“Five-Year spectrum outlook 2021-2026”



About Nokia

We create the technology to connect the world. We develop and deliver the industry's only end-to-end portfolio of network equipment, software, services and licensing that is available globally. Our customers include communications service providers whose combined networks support 6.1 billion subscriptions, as well as enterprises in the private and public sector that use our network portfolio to increase productivity and enrich lives.

With an end-to-end portfolio that is unique in the industry, Nokia can work in partnership with operators to deliver "real 5G". Nokia's in house 5G mmWave Small Cells and AirScale BTS provide in-building and outdoor coverage, while our Microwave Anyhaul, Cloud native RAN, antennas, and 5G cloud-native core are part of approximately half of our agreements to date. Beyond our mobile networks portfolio, Nokia has excellent FP4 network processor-based IP routers and PSE- 3 chipset powered optical networking - our customers can use the Nokia Network Services Platform to make this into full-5G-strength software defined connectivity 'smart network fabric' secured by Nokia Security Orchestration, Analytics and Response (Nokia SOAR) to ensure resilient 5G.

Nokia is a global leader in 5G standardization and technology innovation with a strategy specifically designed to support the Australian market. Nokia is proud to be a strong partner in the current roll-out of 5G in Australia, continuing our 120-year presence here.

Nokia has been selected by both Optus and TPG Telecom as a key supplier for the network deployments of 5G, including the required radio modules, as well as a major supplier to nbn for fixed network technology solutions. Nokia is also a supplier to various enterprises which have deployed private wireless networks deployed using apparatus licenses, including for example 27 mines with 10 customers in Australia. Globally Nokia has been selected by more than 150 operators to supply 5G networks.

Through our research teams, including the world-renowned Nokia Bell Labs, we are leading the world to adopt end-to-end 5G networks that are faster, more secure and capable of revolutionizing lives, economies and societies. Nokia adheres to the highest ethical business standards as we create technology with social purpose, quality and integrity.

For more information: <https://www.nokia.com/networks/5g/>

Disclaimer: This response is based on Nokia's current understanding of the market dynamics and various standards bodies; these dynamics are changing and hence our views may update with these changes

Summary

Nokia welcomes the opportunity to respond to Australian Communications and Media Authority Consultation Draft, “Five-Year spectrum outlook 2021-2026”. As a leading player in the global communications sector, and contributor to the Australian market over many decades, Nokia is well placed to provide insight on market and technology trends, including industry structure and regulatory practice.

ACMA’s “Five-Year spectrum outlook 2021-2026” is a clear signal that all stakeholders should work together to meet the expected demand for spectrum for mobile broadband (public or private) and ensuring the speedy development of 5G. ACMA has identified several spectrum bands to address future needs to make 5G a reality for Australia. Nokia welcomes the effort of ACMA on the regional and international discussions and its clear and transparent process in the planning of spectrum.

In the promotion of 5G, ACMA has an important role especially related to the 5G innovation initiative as stated in this draft FYSO. Through discussions with various 5G innovation initiative applicants and stakeholders, Nokia are seeing a strong demand from Enterprise customers wishing to deploy 5G private wireless solutions either standalone or through a carrier depending on their use case and buying preference. We recommend that ACMA increase the information available to potential participants through on-line sessions or via a helpdesk in order to understand the spectrum process and administrative requirements. Beyond the 5G innovation funds, we encourage ACMA to promote different licensing regimes and the suitable spectrum that might be available ‘over the counter’ for localized use.

Overall Nokia would like to congratulate ACMA for the allocation of mmWave bands (26GHz/28GHz) the updated technical review frameworks for 2.3GHz and the future allocation of 850/900 MHz

Nevertheless, Nokia is also encouraging ACMA to:

- Start the initial investigation work for 600 MHz with Industry and explore the whole UHF band
- Further work to optimize the extended C-Band 3.3-4.2GHz
- Start study on potential use of 4.5GHz/4.8GHz for 5G for additional capacity or for specific localised used cases
- Ensure an optimal use of the 6GHz
- Dedicate monitoring of spectrum range between 37-43.5 GHz.
- Study the implementation of the FRMCS

Further comments:

UHF spectrum

Availability of additional UHF spectrum (in the 470-694/698 MHz range) can bring great benefits to achieve improved coverage, capacity and performance in sparsely populated areas and some suburban areas as well as in hard-to-reach locations (e.g., deep indoors). Beside enhanced mobile broadband services, it is necessary to address a growing range of applications¹ requiring good propagation characteristics in an economically efficient manner.

The 600 MHz band is rising in importance in countries in the Americas and in some countries in Asia-Pacific for IoT use in remote areas and for indoor penetration in urban areas. In the United States, following the Voluntary Incentive Auction of the 600 MHz band, T-Mobile and Nokia completed the world's first 5G data transmission over "low-band" 600MHz radio spectrum back in November 2018. T-Mobile is looking for a broad and potentially fast rollout of 5G services across the United States on this band.

Regarding the expected availability of the next wave of 5G spectrum, Nokia welcomes ACMA decision to move 600 MHz under initial investigation. Nevertheless, ACMA should also considered the feasibility study and potential migration of existing services especially for the whole UHF spectrum.

1880–1920 MHz band

Nokia welcomes the opening of a discussion related to 1880-1920 MHz and the possible use that include the modernization of train communication system. FRMCS is set to become the global standard for railway communications. This mobile broadband-ready technology will enable you to improve safety and operational efficiency, support innovative passenger services and accelerate your digital transformation. FRMCS also minimizes network latency and uses cloud technology, which will help you automate train operation and support broadband M2M communication.

2 GHz

As indicated in our answer to previous ACMA paper, some countries (such as Korea) have started to investigate a potential use of this band for mobile services and Nokia is closely monitoring the

¹ A study of spectrum needs of C-V2X network-based (V2N) communications (cellular vehicle to everything) indicated that additional service-agnostic sub-1 GHz spectrum would provide connectivity for advanced automotive V2N services in rural environments with affordable deployment costs. The study concludes that: "... c) At least 50 MHz of additional service-agnostic low-band (< 1 GHz) spectrum would be required for mobile operators to provide advanced automotive V2N services in rural environments with affordable deployment costs. d) At least 500 MHz of additional service-agnostic mid-band (1 to 7 GHz) spectrum would be required for mobile operators to provide high capacity city wide advanced automotive V2N services." See: <https://5gaa.org/news/the-new-c-v2x-roadmap-for-automotive-connectivity/>.

evolution of the demand of this spectrum. We support ACMA in further assessing the potential for new services such as mobile services while ensure that co-existence with adjacent services is possible.

A2G is internationally deployed in the 1980-1995/2170-2185 MHz (UL/DL) portion of the band and has the benefits of a complete off-the-shelf ecosystem. As such, at least the lower 2x15 MHz of this band can be assigned to A2G. Assigning the same band by ACMA for A2G services will benefit from the existing ecosystem and the international status: de-facto-standard, roaming, airworthiness-certified equipment.

Based on our expertise, Nokia recommends that ACMA reconsider allocating all or part of the 2GHz spectrum to Direct air-to-ground (DA2G) services or allowing flexibility to deploy A2G.

The (extended) C-Band (3300-4200 MHz)

Global 5G harmonization is happening now, and the 3.3-3.8 GHz spectrum range is at the epicenter of this, being the spectrum for near-term deployment of robust 5G services. Spectrum harmonisation helps to achieve economies of scale, enables global roaming and reduces equipment design complexity. 3GPP has developed two bands supporting the 3.5GHz ecosystem: band n78 covering 3.3-3.8 GHz and band n77 covering 3.3-4.2 GHz.

The 3300-4200 MHz band offers the unique opportunity for largest amount of spectrum below 6 GHz. The amount of contiguous spectrum that can be made available in the 3300-4200 MHz range offers an interesting opportunity for the exploitation of the innovative capabilities of the latest IMT technologies, with particular reference to the 5G New Radio air interface which will deliver increased capacity and connectivity.

In previous consultation, Nokia has also recommended to ACMA to further investigate the potential future use of 3800-4200 MHz for private wireless networks. In line with our position on 3700 MHz-3800 MHz, we welcomed ACMA outcomes paper to explore various potential approaches. 5G New Radio (NR) Band n77 has been defined for 3.3-4.2 GHz covering the proposed range of 3.8-4.2 GHz. With demand also from other regions such as USA and Japan, Nokia expect a quickly evolving ecosystem for Band n77.

We would also like to draw attention of later initiatives like in the Saudi Arabia where the regulator CITC is investigating how to split the 3.8-4.2 GHz portion of the band between mobile service providers and vertical users. The option CITC is investigating the migration of the FSS stations from the 3.8-4.0 GHz part of the band and release it to MNOs, while proposing a light licensing regime under shared use of the 4.0-4.2 GHz portion for verticals. Other countries like China and Korea are also investigating ways to use the upper part of this spectrum range.

Nokia also supports the availability of largest contiguous frequency range within the 3300-4200 MHz. Many countries will need to plan and carry out actions in order to address current fragmentation of existing assignments and ACMA should ensure an optimized use of this critical spectrum

From an equipment vendor perspective, harmonised solutions are preferred for any service to encourage larger scale deployments and economies of scale. Nokia welcomes consideration of the 3.8-4.2 GHz band and proposes to equally consider 6425-7125 MHz as additional upper mid-band resource, both for CSPs and verticals, substantially providing relief on scarcity, and allowing to achieve the mobile industry recommended contiguous bandwidth of minimum 80-100 MHz per communication service provider (CSP network), and to provide additional options for spectrum for vertical use.

Mid bands offer a balance between coverage and capacity and they respond to the future requirements to ensure citywide continuous capacity and coverage for advanced 5G services in the 2025-2030 timeframe. As such, the 3.8-4.2 GHz and 6425-7125 MHz are the two outstanding possibilities to provide additionally required mid band spectrum to CSPs and verticals in the upcoming period while protecting existing applications and services. In our opinion it is important for Australia to consider the use of these bands for IMT in the upcoming future and assure their availability for this scope². The use of the band 3.8-4.2 GHz for IMT services by CSPs or verticals should be decided based on the local demands and circumstances like legacy in the overall 3.4- 4.2 GHz range. However, when evaluating the future use of the band, the need for mid bands spectrum at local, state and federal level should be evaluated simultaneously. Coherent licensing framework and adequate technical conditions should be considered to avoid market fragmentation and assure a robust ecosystem, for both operators and verticals to benefit of economies of scale and prices.

We expect that the digitization of the industries will continue to grow and, as such, their demand for spectrum to increase over time across the different sectors. Their spectrum needs will depend on the use cases in terms of coverage, capacity and performances and will be addressed by a combination of local access and wide national coverage, via private networks and public ones. It is therefore important to consider an efficient mechanism to ensure the best usage of the scarce spectrum resources and encourage cooperation between CSPs and industries.

4.5 GHz/4.8 GHz (n79)

² Coleago report of December 2020 estimates mid-bands spectrum needs in the 2025-2030 timeframe in Europe See <https://www.coleago.com/app/uploads/2021/01/Demand-for-IMT-spectrum-Coleago-14-Dec-2020.pdf>

We are observing an interest from countries in Asia to further investigate the potential use of this band. The 4.5GHz has been allocated in Japan in April 2019 and China is also considering this band for future deployment. Taiwan's government has announced plans to release 100 MHz of spectrum in the 4.8–4.9 GHz band for public and private organisations to test 5G applications.

It is important to note that in all cases 4.8–4.99 GHz spectrum has been allocated primarily as a back-up or supplementary band to 3.5 GHz, or for specific localised use cases. In Hong Kong and Japan, the main use case is localised private network deployments, with additional use in Hong Kong to provide eMBB coverage in specific locations where there is an issue with satellite interference.

As indicated in the ACMA paper, the migration can be challenging, therefore we encourage ACMA to start study on potential use for 5G for additional capacity or for specific localised use cases

6GHz (5925-7125 MHz)

Nokia acknowledges that ACMA is currently carrying a consultation related to LIPD for 5/6GHz. We would like to re-iterate our position with the regards to this band as below:

- We are supportive of technical rules that are harmonized at a greater extent with other markets for this band, to ensure the development of the ecosystem.
- We highlight that the 6425-7125 MHz band is under study for IMT identification, as part of the WRC-23 AI 1.2. Studies are also on-going in 3GPP for the use of the 6 GHz range for LTE and NR, as well as in ITU-R for a potential IMT identification at WRC-23 with the least restrictive conditions for the band usage (e.g. highest possible output power targeting macro cell usage). 3GPP has also started a new study on IMT parameters for 6425-7025 MHz.
- The lower 5925-6425 MHz band is outside of the WRC-23 framework. One option is to consider opening the band and providing a level playing field to both 3GPP (5G NR-U) and IEEE (Wi-Fi) technologies to coexist in this spectrum. We, therefore, recommend the adoption of technology neutral rules for this sub-band. However, when defining the technical rules for usage in the band, ACMA can take into account the different international developments to avoid equipment and market fragmentation.
- We also reiterate the need to consider the protection of the incumbent users for the fixed links, in the entire band 5925-6425/6425-7125 MHz.

We encourage ACMA to support the studies under WRC-23 AI 1.2 towards identification of the upper 6425-7125 MHz for IMT.

40 GHz (37-43.5 GHz)

The 37-43.5 GHz band presents an excellent opportunity for global harmonisation and implementation (also by use of a tuning range). The 37-40 GHz band (39GHz) has already been decided in the United States and Nokia considers that this band will be used for early deployment. In Europe, the 40.5-43.5 GHz frequencies are not extensively used by incumbents and therefore,



could provide large additional 5G capacity in subsequent upgrade steps to 5G networks as more and more services will be put onto 5G networks.