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1 Introduction

Qualcomm International Incorporated (Qualcomm) welcomes the opportunity to provide input to the Australian Communications and Media Authority (ACMA) regarding the draft *Five-year spectrum outlook 2025–30 and 2025–26 annual work program* (the Draft FYSO).

Qualcomm is the world's leading wireless technology innovator and the driving force behind the development, launch, and expansion of 5G. When we connected the phone to the internet, the mobile revolution was born. Today, our foundational technologies enable the mobile ecosystem and are found in every 3G, 4G, and 5G smartphone. We bring the benefits of mobile to new industries, including automotive, the Internet of Things (IoT), and compute, and we are leading the way to a world where everything and everyone communicate and interact seamlessly and reliably.

Qualcomm supports the incorporation of stakeholder feedback into a forward-looking radio spectrum plan such as ACMA's Draft FYSO. Such consultations allow the mobile industry and related stakeholders to provide input on the suitability of the plan, the market readiness of technology, the state of development of product ecosystems, and allow prospective licensees to plan their future spectrum and network investments.

In this response, Qualcomm provides comments for ACMA's consideration regarding specific spectrum bands suitable for International Mobile Telecommunications (IMT) services, both 5G and 6G, Air-to-Everything (A2X) technology, and Satellite Direct-to-Device (D2D) technology.

2 IMT services

The mobile broadband ecosystem continues to evolve rapidly, with growing demand for high-capacity, reliable, and ultra-low-latency networks. When considering spectrum for mobile services, in particular 5G and 6G, Qualcomm urges continued identification of unutilized and underutilized frequencies in low, mid, and high bands so that spectrum is put to its highest-value use. Qualcomm commends ACMA's consideration of mid-band (3.4–4.0 GHz and Upper 6 GHz) and high-band frequencies, particularly 26 GHz, 28 GHz, 40 GHz, and 47 GHz, for licensed mobile operations, as noted in the consultation document.

Ever since its adoption, 5G has been enabling new services, applications, and devices, connecting new industries, and empowering new user experiences. 5G has been supporting heterogeneous services with vastly different requirements – from very low energy sensors, wearables and new form factors – to new mission-critical applications with high reliability and low latency communication needs (e.g., smart city and critical infrastructure, medical and emergency response, sensing and remote control), to very high data rate backhaul and access transmissions using wide channel bandwidths for ultra-high-capacity broadband. The next generation of wireless technology, 6G, will be a smarter, more energy efficient platform that brings more than just a new radio design. It will encompass a broader range of technologies to further drive the expansion of the connected intelligent edge at scale. 6G will take full advantage of the combined potential of communications, artificial intelligence (AI), integrated sensing, system resiliency, and greener networks.

Please find below Qualcomm’s comments on specific spectrum bands.

Mid-band (3.4–4.0 GHz)

Qualcomm supports ACMA’s initiative to optimize arrangements within the 3.4–4.0 GHz range to support new 5G deployments. Given the international harmonization of this band, accelerated planning, licensing, and allocation in regional and metropolitan areas is vital to maximizing ecosystem scale, equipment affordability, and service innovation.

Qualcomm welcomes the next steps outlined for the 3.4–4.0 GHz band, particularly the forthcoming over-the-counter licensing approach for localized WBB applications. Unlocking additional spectrum in this mid-band will support innovative applications and open new opportunities for industry, businesses, and public sector organizations to enable customized connectivity solutions.

Upper 6 GHz Band (6425–7125 MHz)

Qualcomm encourages ACMA to prioritize the licensing of spectrum in the Upper 6 GHz Band for IMT use, recognizing the international momentum for 6G operations in this band in the European Union, Brazil, Mexico, China, India, and elsewhere.

As a leading provider of both IMT and RLAN technologies, Qualcomm has a unique viewpoint on the 6 GHz band. Qualcomm was the driving force behind 3G, 4G, and 5G, and is now leading the development of 6G to be deployed throughout the world later this decade. At the same time, Qualcomm is at the forefront of Wi-Fi innovation and is the world’s leading provider of Wi-Fi chipsets for Access Points and devices.¹

In addition, Qualcomm has been active in the development of spectrum sharing frameworks and technologies aimed at enabling improved spectrum utilization across diverse frequency bands. In March 2024, Qualcomm was awarded by the United Kingdom’s Department for Science, Innovation and

¹ Qualcomm’s Wi-Fi chipsets operate in the 2.4 GHz band, the 5 GHz U-NII bands and in 6 GHz bands (in the lower 500 MHz from 5.925-6.425 GHz and in the full 1200 MHz from 5.925-7.125 GHz)

Technology (DSIT) a funded project to study co-channel spectrum sharing between Wi-Fi and IMT in the Upper 6 GHz band in the UK. That effort determined that dynamic co-channel spectrum sharing between the two technologies is technically possible but requires substantial collaborative work to be successful in the field. To enable successful co-channel spectrum sharing between IMT and RLANs in Upper 6 GHz, stakeholders from the RLAN community and the IMT community worldwide must work collaboratively and in good faith to develop and put in place a stable implementation framework.

Specifically, before any RLAN or IMT equipment is deployed in the Upper 6 GHz Band, all stakeholders would need to define in standards a viable sharing mechanism and work with regulatory bodies to implement enabling rules and a compliance testing framework with which all equipment must comply. This would require substantial resources from the commercial sector and from regulators and would take more than a few years. While Qualcomm has invested substantial resources into this effort, it does not appear that many other stakeholders are interested in investing the resources and time in enabling co-channel sharing. Given that we are less than five years away from initial 6G deployments and there is not a consensus view on co-channel sharing in the Upper 6 GHz band, Qualcomm believes it is critically important that countries to prioritize the need for spectrum for 6G IMT operations and identify the upper 6 GHz band for IMT, especially since Wi-Fi 7 has considerable spectrum allocations in the lower 6 GHz band and 5 GHz bands.

Having a spectrum home for 6G deployments later this decade is critically important to Australia's economic success. Before ACMA expands RLAN operations into the Upper 6 GHz band, e.g., within 6425-6585 MHz, it should ensure those operations do not cause harmful interference to future adjacent IMT operations in the Upper 6 GHz band. ACMA should implement adequate protective measures (e.g., out-of-band emissions limits) and ensure RLAN equipment complies with those measures before RLAN operations are allowed in any portion of the Upper 6 GHz band. ACMA also should carefully consider and monitor the efforts to open the Upper 6 GHz band for IMT operations underway in the European Union, Brazil, Mexico, India, and China, as the Upper 6 GHz band will play an instrumental role in 6G deployments later this decade in most of the world.

Wireless connectivity has become the backbone of global digital transformation. The relentless demand for wireless data will continue to reshape the connectivity landscape as we march toward 2030 and the dawn of 6G deployments. The proliferation of smartphones, Internet of Things (IoT) devices and connected vehicles—each supported by wireless broadband—has driven a massive surge in data consumption. It is expected that by 2030, global mobile data traffic will quadruple, reaching a staggering 465 exabytes per month, with a compound annual growth rate (CAGR) of 23%² from 2023. 6G deployments will be essential to meeting this surge in demand that will be driven by enhanced mobile video streaming quality, the rise of extended reality (XR), cloud gaming, and the increasing prevalence of AI-fueled applications and services. AI is reshaping data flows, with global wide-area network (WAN) traffic projected to grow five to nine times from 2023 to 2033. By then, AI is estimated to account for 33% of all WAN traffic.³

² GSMA. (2024). The Mobile Economy 2024, available at: <https://www.gsma.com/solutions-and-impact/connectivity-for-good/mobile-economy/>.

³ Nokia. (2024). Global network traffic report, available at: <https://onestore.nokia.com/asset/213660>.

The Upper 6 GHz is the most promising spectrum opportunity to launch 6G in Australia later this decade. The availability of Upper 6 GHz band for reliable mobile services is vital for the successful introduction of 6G, and making the band available for mobile services is a key prerequisite to ensuring Australia's economic competitiveness and ambitions to keep pace with other leading world markets. ACMA should ensure that 6G operations can be reliably deployed throughout the country in this spectrum band in the 2029-30 timeframe, and Australia will have at least 200 MHz per channel bandwidth per operator for initial 6G deployments later this decade.

Upper mid-band (7125-8400 MHz) and high-band (26 GHz, 28 GHz, 40 GHz, and 47 GHz)

Qualcomm commends ACMA's ongoing consideration of upper mid-band and high-band spectrum for mobile operations. We particularly emphasize the importance of enabling IMT deployment in the 7125-8400 MHz range, as this range is the natural extension of the Upper 6 GHz band – which should be allocated for IMT as soon as possible. The Upper 6 GHz band and 7/8 GHz band will be critical to support 6G mobile broadband, improve connectivity for smart cities, and support advanced applications.

As noted in the Draft FYSO, WRC-27 agenda item 1.7 will consider studies on sharing and compatibility and develop technical conditions for the possible use of IMT in certain bands, including 7125-8400 MHz. This will be an important band for 6G services, in conjunction with the Upper 6 GHz spectrum range. Upper mid-band spectrum such as 7125-8400 MHz has been widely identified for 6G consideration and can support wide-area coverage as well as high capacity, enabled by Qualcomm's innovations that will underpin 6G technology.

As published by the ITU in Recommendation ITU-R M.2160 on the framework for IMT-2030 (or 6G), the next generation of IMT is expected to support enriched and potential immersive experience, enhanced ubiquitous coverage, and enable new forms of collaboration. In addition, IMT-2030 is envisaged to support expanded and new usage scenarios compared to those of IMT-2020, while providing enhanced and new capabilities.

In alignment with the ITU conclusions, the upper mid-band range combines the wide-area coverage of bands below 5 GHz with the greater throughputs of millimeter wave (mmWave) bands. Potential use cases will be more capacity for wide-area broadband, expanded use of extended reality (XR), and support for high-resolution radio frequency (RF) sensing. These use cases will provide additional benefits to smartphone users in the mass market, enhance smart cities and automotive connectivity, and improve support of industry verticals.

Qualcomm encourages ACMA's continued participation in international fora, including activities in ITU-R study groups leading up to and including WRC-27, to ensure early alignment and harmonization of future 6G bands, including the 7125–8400 MHz band.

As Australia considers its plans for enabling the successful deployment of 6G services, consideration of international and regional developments and domestic use will be important inputs into the planning process. Qualcomm would be pleased to continue engaging with ACMA to provide compatibility study updates, as appropriate, and relevant technical information to assist with the Australian WRC-27 preparation process.

At the same time, ACMA should recognize the important role the 26 GHz, 28 GHz, 40 GHz (37–43.5 GHz) and 47 GHz (47.2–48.2 GHz) bands will continue to play in the 5G and 6G mobile ecosystems. Today, these high mmW bands underpin ultra-high capacity 5G deployments in urban cores, transportation depots, stadiums, entertainment venues, and shopping malls, where large numbers of users congregate. These high mmW bands also are important for smart factories and other emerging industrial use cases. Qualcomm has had chipset support for these bands for many years.

1.5 GHz (1427–1535 MHz)⁴

Qualcomm encourages ACMA to consider allocating 1.5 GHz band for IMT WBB. Some countries in the region are currently considering auctioning the portion of 1.5 GHz while ensuring protection of the satellite services in the bands adjacent to it.

According to the Global mobile Suppliers Association (GSA), 14 countries, primarily in Europe, have assigned all or part of the L-band (1427-1518 MHz) for mobile use.⁵ Further 13 countries are reportedly planning to assign the band or are considering their future assignment plans with respect to this band. Currently, there is a growing interest in Region 3 countries such as Indonesia, India and others to assign spectrum in 1.5 GHz band for TDD based 5G deployments. This is expected to help in overcoming the challenges of indoor coverage of 5G services since mobile operators while deploying 5G can configure (UL/DL ratio) the band according to their needs. Australia can allocate the band to help the coverage of WBB using IMT technology.

3 Satellite Direct-to-Device (D2D) Technology

Qualcomm supports ACMA's activities to clarify the regulatory framework related to Low Earth Orbit (LEO) satellite-based direct-to-device (D2D) services. Satellite D2D technologies represent an essential complement to terrestrial networks, providing broad mobile coverage and emergency communications in remote areas. Qualcomm supports ACMA's proactive regulatory guidance clarifying existing licensing frameworks for satellite D2D mobile operations. We further support the Australian Government's Universal Outdoor Mobile Obligation (UOMO), leveraging emerging D2D services to ensure nationwide outdoor voice and SMS coverage.

Qualcomm applauds ACMA's ongoing work in preparing the 2 GHz MSS band for licensing in early 2026. Expedited and transparent licensing processes for MSS will foster certainty and encourage investment in innovative satellite D2D infrastructure, as outlined in the consultation document.

Given the strategic importance of satellite D2D technology in Australia, we encourage ACMA to continue active coordination with industry stakeholders and international counterparts to maintain globally harmonized spectrum access for these services.

⁴ RR Footnote No. 5.341C, 5.346A

⁵ GSA, GSA Snapshot: Spectrum Positions Used for Mobile Services, June 2024, <https://gsacom.com/paper/spectrum-allocations-june-2024/>.

4 Air-to-Everything (A2X) Technology

We acknowledge ACMA's recognition of emerging Air-to-Everything (A2X) technologies as detailed in the consultation document.

We note that the International Civil Aviation Organization (ICAO) forecasts a surge in unmanned aircraft systems (UAS), from two million units in 2021 to an estimated 6.5 million by 2030.⁶ To ensure the safe and scalable operation of UAS in Australia, we strongly urge ACMA to consider licensing arrangements that allow access to the 5030-5091 MHz band (the "5030 MHz band") for direct Aircraft-to-Everything (A2X) communications between aircraft. This critical technology is essential for UAV collision avoidance.

As a globally recognized standard under 3GPP, A2X provides vital aircraft-to-aircraft communication links for safety-critical Detect and Avoid (DAA) operations. This technology enables unmanned and manned aircraft to detect and avoid collisions, significantly enhancing flight safety and augmenting strategic deconfliction provided by UAS traffic management systems. A2X will not only support the growth of cutting-edge UAS and Advanced Air Mobility applications but also ensure the safety and security of all airspace users.

In some countries (e.g. the United States), significant progress is being made in researching and standardizing A2X. The Federal Aviation Administration (FAA) has developed a concept of operations, requirements documents, and conducted a waveform analysis for A2X. The Federal Communications Commission (FCC) is currently considering various proposals, including one from Qualcomm to allocate a 20 MHz channel in the 5030 MHz band for UAV DAA communications.⁷ Additionally, countries like China are evaluating A2X as a tactical solution for safe and efficient scaled UAS operations.

We commend ACMA's initiative in studying the 5030 MHz band for aviation and unmanned aerial vehicle (UAV) communications. Given this global momentum, we encourage ACMA to collaborate with the Civil Aviation Safety Authority and Airservices Australia to license spectrum in the 5030 MHz band for A2X. By doing so, Australia can ensure the safe integration of scaled UAS operations into its airspace, while fostering innovation and maintaining the highest standards of flight safety.

5 Conclusion

As wireless technologies rapidly evolve from advanced 5G deployments and early 6G research towards full scale 6G deployments later this decade, spectrum management decisions made today will determine Australia's future in global digital connectivity. To ensure that Australian consumers and businesses can fully capitalize on advanced connectivity, Qualcomm encourages ACMA to maximize the spectrum available for IMT services and release additional spectrum suitable for IMT services, particularly the Upper 6 GHz and 7125-8400 MHz ranges, as detailed herein. We encourage ACMA to continue monitoring

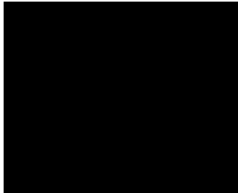
⁶ Increased Use of Unmanned Aircraft Systems (UAS), ICAO (2021) (last accessed 4/1/25): <https://www.icao.int/annual-report-2021/Pages/emerging-and-cross-cutting-aviation-issues-increased-use-of-unmanned-aircraft-systems-uas.aspx>.

⁷ Qualcomm Comments (March 9, 2023): <https://www.fcc.gov/ecfs/search/search-filings/filing/10309809528237>.

developments related to key spectrum bands, ensuring spectrum availability aligns with international best practice and facilitates early and widespread adoption of emerging wireless technologies.

We appreciate the opportunity to provide feedback to ACMA on the Draft FYSO and would be happy to provide further information to assist in ACMA's spectrum planning process, particularly for spectrum for 6G services.

Sincerely,



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