

May 6, 2024

**The Manager
Spectrum Licensing Policy Section
Australian Communications and Media Authority
PO Box 13112 Law Courts
Melbourne VIC 8010**

Via email to: spectrumworkprogram@acma.gov.au

Dear Sir/Madam,

Re: Respond to ACMA Five-Year Spectrum Outlook 2024-2029 and 2024-2025 Work Program

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 2024–29 and 2024–25 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 computing, and are leading the way to a world where everything and everyone can communicate and interact seamlessly.

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

This response, Qualcomm provides general comments for ACMA's consideration regarding specific spectrum bands suitable for use by International Mobile Telecommunications (IMT) services, particularly 6G services.

2 Preparing for the Next Generation of Wireless Technology 6G

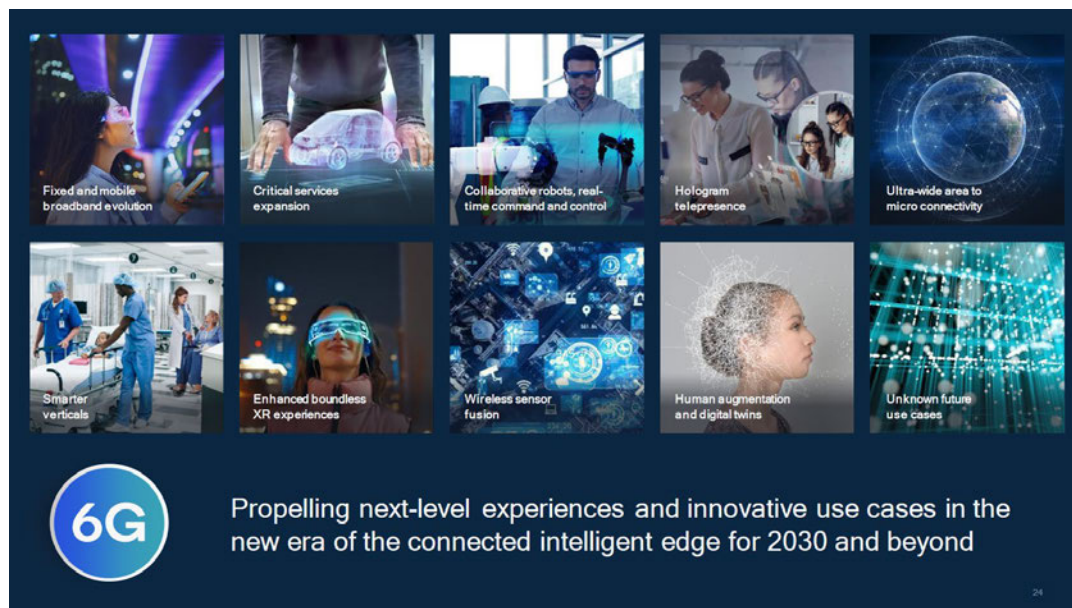
2.1 Context

As wireless technology continues to advance and enable new and expanded use cases, such as those illustrated in Figure 1, additional spectrum resources are required to ensure the reliable provision of

high-quality services. Often, the technological advances that accompany a new wireless generation are made possible due to the availability of wider, contiguous spectrum bandwidths. While 5G leveraged bandwidths of at least 100 MHz, Qualcomm anticipates that 6G will require contiguous channels of at least 400-500 MHz assigned per operator to meet future use cases. 6G can encompass a broad range of technologies and combine the potential of communications, AI, integrated sensing, resilience of systems, and sustainability of networks. The availability of larger and contiguous bandwidth will improve efficiency, support the growing demand for data, and enable the development of new applications.

Access to at least 400-500 MHz of contiguous spectrum will allow each operator to offer ultra-low latency and highly reliable services, while also expanding broadband capacity and speed, resulting in improved communications and enhanced applications. This will allow flexibility for operators and their customers to more rapidly develop a variety of applications that will combine the physical, digital, and virtual worlds. For example, 6G will enable continued development and improved availability of immersive extended reality (XR) – including augmented reality (AR), virtual reality (VR), and mixed reality (MR) – in a wider range of locations. This boundless XR leverages the low latency and high-bandwidth capabilities of 6G in combination with edge cloud processing and on-device processing to offer immersive and video and audio experiences for users. 6G will also enable improved services in smart cities, as well as higher-resolution sensing capabilities that can be employed for uses including environmental monitoring and activity detection.

Figure 1. 6G use cases



Source: Qualcomm

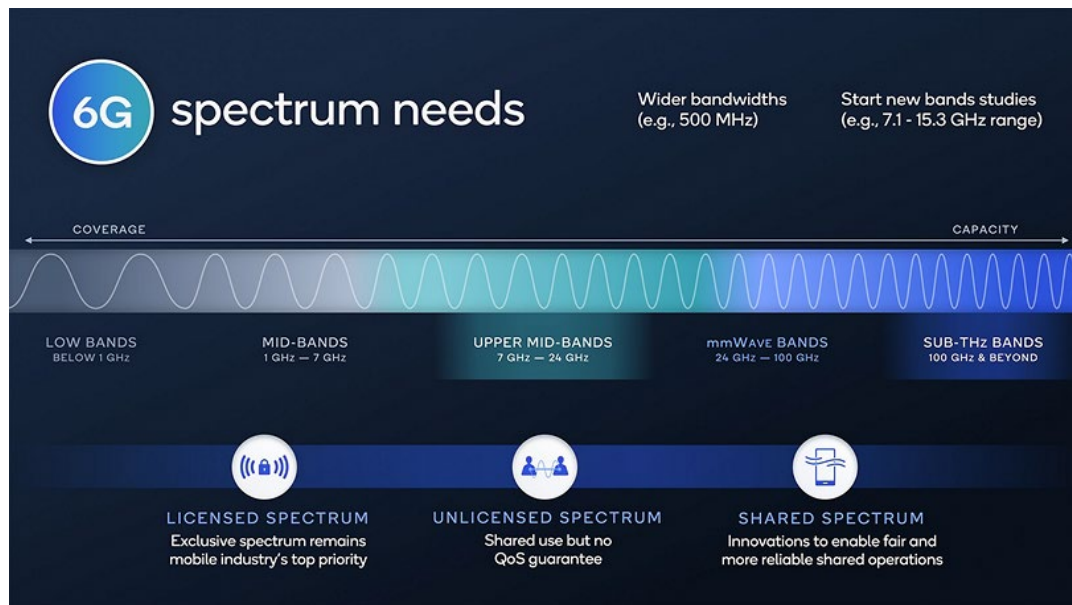
In addition, as noted by the GSMA, the assignment of larger contiguous spectrum blocks reduces the need for operators to employ carrier aggregation across different channels and also reduces the amount of spectrum set aside for guard bands.¹ This, in turn, allows for a smaller number of base stations to provide capacity and coverage and reduced energy consumption. The availability of a contiguous 400-

¹ GSMA, Spectrum: The Climate Connection – Spectrum policy and carbon emissions, May 2023, https://www.gsma.com/connectivity-for-good/spectrum/wp-content/uploads/2023/05/Spectrum_Climate_Connection.pdf.

500 MHz assignment for each operator will not only allow a faster development and deployment of 6G technologies but will also allow systems to be designed in accordance with environmental sustainability objectives, including Australia's net zero goals.

As illustrated in Figure 1, 6G will require spectrum across a range of bands from below 1 GHz to above 100 GHz. The various spectrum bands and assignment approaches will collectively enable coverage and capacity for next-generation networks.

Figure 2. 6G spectrum needs



Source: Qualcomm

2.2 Use of IMT in 7125-8400 MHz and 14.8-15.35 GHz

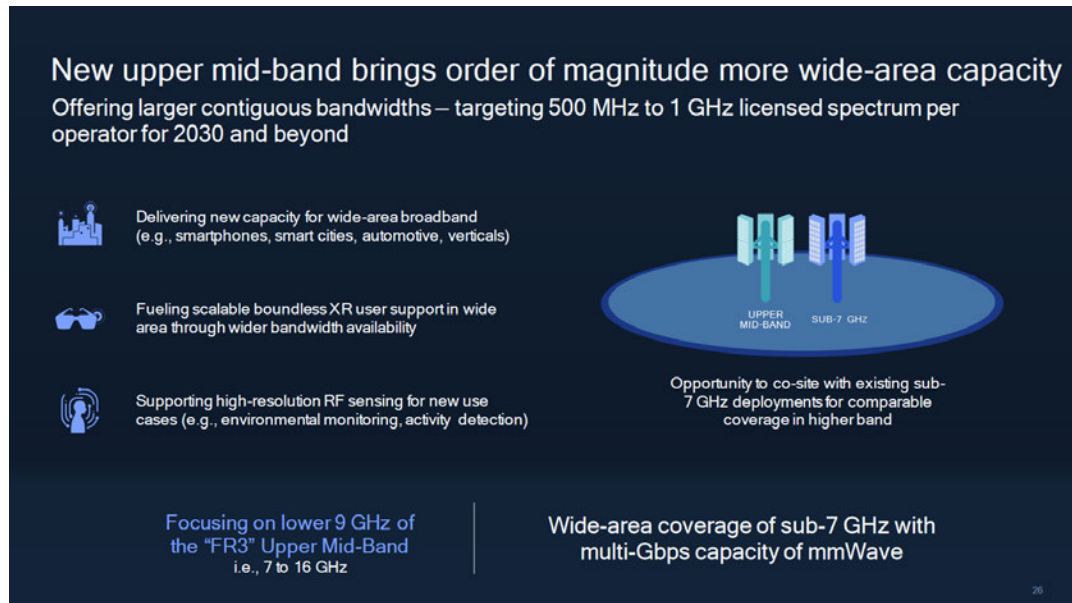
As noted in the Draft FYSO, WRC-27 agenda item 1.7 will consider studies on sharing and compatibility and develop technical conditions for the possible use of IMT in certain bands, including 7125-8400 MHz and 14.8-15.35 GHz. These bands will be particularly important for the development of 6G services, which will require larger contiguous bandwidths. The 7-16 GHz range (upper mid-band) has been widely identified for 6G consideration. This range can support wide-area coverage as well as high capacity, especially in concert with 6G technology.

For example, Qualcomm is developing advanced end-to-end system innovations called Giga-MIMO, which utilize a large array of antennas on both the base station and the device to support wide-area communications in these bands and provide coverage comparable to that achieved currently with 5G massive MIMO in the lower mid-band frequency bands. Furthermore, as published in Recommendation ITU-R M.2160, on the framework for IMT-2030 (or 6G), IMT-2030 is expected to support enriched and potential immersive experience, enhanced ubiquitous coverage, and enable new forms of collaboration. In addition, IMT-2030 is envisioned to support expanded and new usage scenarios compared to those of IMT-2020, while providing enhanced and new capabilities.

The upper mid-band range brings an order of magnitude more wide-area capacity, combining the wide-area coverage of bands below 7 GHz with the wider capacities of millimeter wave (mmWave) bands.

Potential use cases will be an expansion of the 5G use cases including substantially 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, smart city and automotive connectivity, and industry verticals, as illustrated in Figure 2.

Figure 3. Upper-mid band capacity benefits



Source: Qualcomm

Qualcomm encourages ACMA to participate in international developments about the availability of IMT spectrum for 6G, including the activities in ITU-R Working Party 5D. 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, as well as relevant technical information that could assist with the Australian WRC-27 preparation process.

Conclusion

To realize the full benefits of 6G wireless technologies, Qualcomm encourages ACMA to continue monitoring developments related to key spectrum bands, particularly the range between 7 GHz and 16 GHz. This upper mid-band spectrum will be a key enabler of the range of 6G use cases, providing both coverage and capacity.

We appreciate the opportunity to provide feedback to ACMA on the Draft FYSO and would be happy to provide further information that could assist in the spectrum planning process, particularly with respect to spectrum for 6G services. For any inquiries, please contact Ms. Nies Purwati at [REDACTED].

Sincerely,



Nies Purwati

Sr. Director Government Affairs, South East Asia
Qualcomm International Inc.