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Via email: spectrumworkprogram@acma.gov.au

Re: *Response to Proposed changes to apparatus licence pricing structures*

To whom it may concern:

Starlink Australia Pty Ltd ("SpaceX") appreciates the opportunity to respond to the Australian Communications and Media Authority's ("ACMA") Proposed changes to apparatus licence pricing structures (the "Consultation").[1] Below is a general overview of SpaceX and its Starlink product, along with specific responses to the Consultation.

I. Background

SpaceX is a private company founded in 2002 to revolutionize space technologies, with the ultimate goal of enabling humanity to become a multi-planetary species. SpaceX has achieved a series of historic milestones and is proud to have become the first private company in history to send astronauts to orbit and safely return them to Earth. To date, SpaceX has successfully launched more than 150 missions to space.

SpaceX is leveraging its accumulated expertise in space system manufacturing, design, and operations, to develop Starlink, which is served by a constellation of satellites designed to provide high-speed, low-latency, competitively priced broadband service to locations in Australia and anywhere around the globe. SpaceX's first-generation constellation consists of over 4,400 non-geostationary orbit ("NGSO") fixed-satellite service ("FSS") satellites and extensive ground infrastructure employing advanced communications and space operations technology. SpaceX has invested billions of dollars in this system and is currently launching 120 satellites per month on average, along with building gateway and end-user terminal antennas. Starlink is designed to make efficient use of radio spectrum resources by optimizing its ability to flexibly share spectrum with other licenced satellite and terrestrial users, including through advanced beam-forming and digital processing technologies. SpaceX currently links satellites to the customer user terminals in the Ku-band for both uplink and downlink frequencies, with gateway links in the Ka-band.

[1] *See* ACMA, "Proposed changes to apparatus licence pricing structures," Consultation Paper (March 2023).

The events of the past two years have reminded us all of the importance of being able to connect people and businesses through high-speed Internet service, whether to complete school lessons, connect with distant family and friends, conduct business, or even to run a government. Powerful next-generation satellite systems supported by robust backhaul connectivity will enable all consumers across Australia to use the bandwidth-intensive, real-time applications that have become essential to accessing remote work, school, and public services.

To meet these evolving consumer needs, whether in the suburbs of Sydney or the most remote parts of Western Australia, SpaceX is currently building and deploying its next iteration of its Starlink commercial satellite service. This next-generation technology includes upgraded end-user terminals, new satellite technology, and improved gateway ground stations that will provide customers with even higher speeds. For example, SpaceX has developed satellites capable of utilizing the 71-76 GHz and 81-86 GHz band (the "E-band"). In doing so, SpaceX can leverage the high-gain, narrow beam characteristics of E-band links to expand backhaul link capacity to meet ever-increasing consumer demand. SpaceX has also designed its gateway earth stations to utilize these spectral features to efficiently co-exist with terrestrial services using minimal separation and common frequency coordination techniques.

These innovations extend beyond FSS operations, where SpaceX has sought authorization to make better and more efficient use of mobile satellite service ("MSS") frequencies, particularly the 1-2 GHz ("L-band") and 2-4 GHz ("S-band") frequencies. These frequencies present an untapped opportunity for new entrants and can enable expanded mobile services for consumers, particularly those in traditionally unserved or underserved portions of Australia. SpaceX's state-of-the-art satellites will utilize advanced phased array beam-forming and digital signal processing techniques to efficiently utilize spectrum resources and promote co-existence with other space-based and terrestrial-licenced users within these bands. Moreover, SpaceX can support these frequencies without increasing the number of satellites in orbit, without altering any orbital characteristics on its satellites, and without requiring any additional physical coordination.

SpaceX began its beta Starlink service in Australia in April 2021. Today, Starlink is capable of serving large parts of the country. Starlink customers in Australia typically experience speeds exceeding 100 Mbps, with reliability nearing 100 percent. SpaceX is excited to serve even more Australians, with a particular desire to reach those who are currently unserved or underserved by broadband.

II. Response to the Pricing Consultation

SpaceX applauds the ACMA's recognition of the ongoing explosion in demand for both satellite and terrestrial wireless services that are driving technological development and demand for spectrum. A successful spectrum policy will encourage operators, terrestrial and satellite, to design and deploy systems that increase efficiency and better share limited spectral resources. ACMA's consultation paper rightly observes that technology has evolved past the current tax structure.

A. ACMA's Opportunity Cost Method

Although SpaceX appreciates the steps ACMA is already proposing, the Opportunity Cost method that forms the basis of the proposals will not result in the greatest benefit for Australian consumers. At the core of the Opportunity Cost method is the idea that a regulatory body should evaluate the cost of assigning one use of spectrum over any other use, then attribute those costs to the spectrum licence holder. This method is will result in a skewed assessment for three reasons: 1) it does not account for spectrum sharing among different services, 2) it discourages coordination among users, and 3) it unrealistically relies on the regulator having information perfect information about different services. Instead, a Cost Recovery method through which ACMA charges only to recover its own costs, coupled with policies to encourage spectrum efficiency, will lead to faster deployment, more competition, and ultimately better and more choices for Australian consumers.

First, the Opportunity Cost method does not account for the fact that spectrum can, in many cases, be shared between multiple users of the same spectrum band. If two companies operate in the same spectrum band and develop a method to avoid interfering with each other, then there is little point for a licensing fee imposed on both companies that assumes there was an opportunity cost of choosing one over the other. Both companies now need to pay the same licensing fee for efficiently using the same spectrum. These are costs that inevitably get passed on to consumers in the form of higher prices or overall worse service where the money associated with the fee could have been used to improve the product. Rather than discourage sharing, a better approach would provide incentives for different users to develop more efficient technologies, resulting in more intensive use of the band.

Second, the Opportunity Cost licensing fee does not incentivize companies to coordinate on creating new methods for sharing the spectrum; the fee only reduces the incentive for each company to use the spectrum in the first place. Once the companies have paid the fee to use the spectrum, the only method to ensure the spectrum is used efficiently is through the good faith coordination of the parties and the continued development of the implemented technology. The licensing fee is a sunk cost that is passed on to the consumer and fails at its intended goal of promoting efficient spectrum use.

Third, if we assume the spectrum band cannot be shared between different operators, then the Opportunity Cost method could potentially achieve its objective, but only if the regulator has a complete understanding of the marginal cost/benefit of any one assignment of spectrum over another, a task that is nearly impossible and easy to get wrong. As explained by the OECD, the economic valuation of any particular use of spectrum is difficult because:

> Firstly, it necessarily requires a multiyear evaluation – ten or more years – in a sector characterized by technological breakthroughs and discontinuities. Few envisaged, for example, the high rate of smartphone uptake around the world. Secondly, country-specific and market conditions influence any valuation. Thirdly, even among similar players and uses, the value for each player could be significantly different depending on specific circumstances. Assigning the spectrum to a player that values it the most does not necessarily maximize the value to the economy. This is part of the rationale behind

> spectrum caps, which try to protect competition by preempting possible spectrum hoarding, which increases barriers to entry. Fourthly, the valuation might require a comparison of distinctly different things, as was the case for broadcasting and broadband. In such scenarios, certain aspects are very hard – if not impossible – to measure. In countries where most households predominantly access free-to-air (FTA) television broadcasting, either because of income restrictions or because pay television infrastructure is not ubiquitous, the social value of the service is high and challenging to quantify.[2]

A regulatory method based on economic valuations that are likely incorrect will therefore likely have outcomes that are at best unintended and at worst harmful for consumers. ACMA should instead adopt a method that drives the market to more efficient use of the spectrum, rather than leaving the regulator with the impossible task of predicting the value of different services into the future.

B. Cost Recovery Method and Spectrum Efficiency

SpaceX urges ACMA to consider policies and tax formulas that specifically reward the use of advanced wireless technology that improves spectrum efficiency and enables sharing both within and across platforms. Therefore, SpaceX believes ACMA's spectrum efficiency goals would be better served with a Cost Recovery method, tied with other policy incentives for efficiency. The Cost Recovery method avoids the problems of the Opportunity Cost method by rejecting the idea of spectrum licensing fees as a primary lever for influencing licence holder behavior and instead conceptualizes spectrum licence fees more simply as a way of recovering the administrative costs of processing the licence itself. As one example, the United States employs a fixed application fee for spectrum use, where the licensing fees for a fixed satellite earth station would range in the hundreds of dollars, instead of hundreds of thousands of dollars. This pricing structure allows the government to recover expenses for processing applications but does not discourage new entrants, new technologies, or network expansion.

In fact, the Cost Recovery method is the primary approach of most advanced Western telecom regulatory bodies, reflected by the stark contrast of spectrum licensing fees between Australia and other countries. SpaceX, as a global system, is currently engaging regulators around the world, and it so far appears that Australian spectrum licensing fees are indeed the highest in the world.

Alongside the Cost Recovery fee method, ACMA would be well served to embrace policies that actively incentivize spectral efficiency for all spectrum users—whether in space or on the ground. Mechanisms that enable and encourage technologies and techniques for spectrum sharing between fixed satellite service and terrestrial users on a more co-equal and technologically neutral basis will allow multiple technology platforms to flourish, as innovation across the communications industry has disproven the historical presumption that satellite and terrestrial technologies cannot share spectrum.

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[2] OECD/IDB (2016), *Broadband Policies for Latin America and the Caribbean: A Digital Economy Toolkit*, OECD Publishing, Paris, https://doi.org/10.1787/9789264251823-en, 71.

ACMA has a long-recognized interest in increasing spectrum access for all users, and has an opportunity here to implement inventive policies that reward those who develop and use efficient technologies by evolving traditional approaches into those that encourage sharing and reward efficient users. Conceptually, policies like these use the carrot of access to more spectrum to reward efficient users. For example:

1. With respect to facilitating sharing spectrum between terrestrial uses and fixed satellite service earth stations, ACMA could establish power flux density ("PFD") protection limits. These PFD limits set a "border" between fixed satellite earth stations and terrestrial operations in a given geographic area. By identifying appropriate well-balanced power protection limits, based on technical inputs from both mobile and satellite users, the ACMA can ensure that both emerging terrestrial broadband networks and fixed satellite earth station operators can operate and augment the broadband services available to rural, unserved, and underserved consumers.

2. ACMA can require good faith coordination between co-primary terrestrial and satellite licencees in areas in areas of heavy shared use, such as in densely populated urban areas. Absent such regulator-based encouragement, the ACMA risks unintentionally and unnecessarily depriving consumers in certain locations of next-generation satellite services. To ensure the most choices for the most Australian consumers, the ACMA should modify its policy to presume that that the co-primary users, both terrestrial and satellite, will drive toward technological solutions to share spectrum through good faith negotiations backed by clear regulatory backstops where the ACMA will resolve differences in the public interest if the parties cannot reach agreement.

3. With respect to spectrum sharing among NGSO satellite operators, ACMA could adopt a band-splitting model for spectrum sharing among NGSO satellite operators that rewards the system that uses spectrum most efficiently. SpaceX agrees with the International Telecommunications Union and other regulators, including the U.S. Federal Communications Commission, that private coordination between operators is the most efficient means for two NGSO satellite operators to manage shared spectrum. Because operators themselves are best positioned to understand the capabilities of their systems and their business objectives, successful coordination ensures the most efficient use of shared spectrum. Towards that end, SpaceX's band-splitting proposals are designed to drive the best results from those negotiations by encouraging operators to employ technologies and techniques that use spectrum efficiently and to come to quick resolution in their coordination discussions. Ideally, any spectrum policies primarily set the terms for successful coordination between operators.

Underlying such proposals is a straightforward principle: aggressive performance metrics set by the regulator incentivize efficient use of the limited resource of radio frequency spectrum. SpaceX has invested in developing technologies that maximize efficiencies and bring superior service to consumers. We have designed a satellite system that is equally innovative and efficient.

We would like to see others do the same. We would also like to see a regulatory environment that rewards efficiency in design.

IV. Conclusion

SpaceX is very grateful for the ACMA's consideration and collaboration and looks forward to continuing to serve Australian customers with even faster speeds as we continue to launch more satellites and deploy more ground infrastructure around the world.

Respectfully submitted,

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