SPACEX

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RE: Response to implementation of the Spectrum Pricing Review - consultation 39/2020

Space Exploration Technologies Corp. (SpaceX) appreciates this opportunity to provide input to the Australian Communications and Media Authority (ACMA) in response to the consultation, "Response to implementation of the Spectrum Pricing Review - consultation 39/2020".

Summary of Arguments

SpaceX applauds the ACMA's recognition that technology has evolved past the current tax structure. Two proposals from the paper will be particularly beneficial to the Australian consumer:

1. The "systems" approach to licensing satellite ground stations with multiple operationally synchronous antenna is critical to remove unnecessary cost overhead in the Non-Geostationary Satellite industry.
2. The reduction in the spectrum pricing geographic weights for frequencies above 5 GHz used in their respective license tax formulas is a necessary change to reduce barriers to entry and expansion of technology beneficial to Australian consumers. However, ACMA should consider following international best practice and removing these fees altogether for the best impact.

SpaceX urges ACMA to consider policies and tax formulas that specifically provide incentives to use advanced wireless technology that improves spectrum efficiency and enables sharing both within and across platforms. Instead of the Opportunity Cost regulatory method used by ACMA, SpaceX encourages a stronger focus on a Cost Recovery method paired with policies that reward efficient spectrum use. Together, these approaches combine to ensure that Australian consumers benefit from cross-platform competition among a multitude of cutting-edge technologies.

Background

SpaceX is rapidly deploying a Non-Geostationary Satellite (NGSO) system to provide fixed satellite service. The system will provide direct to consumer broadband for millions of users in Australia and around the world. In March 2018, the United States Federal Communications Commission (FCC) authorized SpaceX to construct, launch, and operate a constellation of 4,425 NGSO satellites operating close to the Earth. Since then, SpaceX has accelerated its efforts to design, develop, and deploy an innovative and spectrum-efficient satellite system to deliver broadband service directly to consumers around the world. Just one year later, SpaceX launched the first 60 satellites in its broadband constellation. Since then, SpaceX has continued an aggressive launch cadence and has 1,143 satellites in orbit as of this submittal. SpaceX is now the operator of the most extensive satellite broadband network in the world, with sufficient coverage to provide broadband connectivity within Australia.

ACMA granted SpaceX's application for inclusion in Australia's Foreign Space Object Determination on 30 January 2020 for operation in the following bands:

- 10.7 – 12.7 GHz downlink

- 14.0 – 14.5 GHz uplink
- 17.8 – 18.55 GHz downlink
- 18.8 – 19.3 GHz downlink
- 27.5 – 29.1 GHz uplink
- 29.5 – 30.0 GHz uplink

Access to these bands is critical for fixed satellite service constellations such as Starlink to bring broadband services to Australians. While SpaceX does not use the lower 250 megahertz of the band so it can protect radio astronomy uses in the adjacent band, the rest of the 10.7 – 14.5 GHz band forms the basis for the transmissions between satellite links and the User Terminal antennae located at individual customer homes and businesses that are required to connect to the internet. The 17.8 – 30.0 GHz band forms the basis for the transmissions needed for the gateway earth stations that complete the satellite links that connect consumers to the Internet backbone via individual fixed satellite earth stations interconnected with terrestrial fiber lines.

Providing service to Australian customers is critically important, especially now that so many people rely on broadband for work, school, healthcare, and so many other essential services. Unfortunately, high spectrum fees, particularly in in AMCA High and Medium population density areas, may have the unintended consequence of actually discouraging service or raising prices for people in these areas. These high fees may be cost prohibitive for some operators or could force others to pass along these additional fees in the form of higher prices for consumers. But the demand for broadband in these areas is real and the need is urgent. For example, in just the few weeks since SpaceX began allowing Australian customers to sign up for its service, over half of the deposits came from ACMA High and Medium population density areas. By charging fees more in line with standards set around the world, ACMA can encourage more deployment in these areas, thereby promoting more choices, lower costs, and better services for Australians.

On the Proposals of the ACMA Paper

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, and in particular, two changes to ACMA regulatory framework proposed in the paper will go far in promoting competition and benefit to the Australian consumer.

Assigning fees per site rather than per antenna is more consistent with actual deployment and will result in more service to Australian consumers

First, the "systems" approach to licensing satellite ground stations with multiple operationally synchronous antennae is critical to remove unnecessary cost overhead in the Non-Geostationary Satellite industry. A Non-Geostationary Satellite ground station site often has multiple antennae working in unison to connect to the respective satellite network, which is comprised of many non-geostationary satellites operating in low earth orbit. Although these antennae are located within meters of each other and are considered a singular unit from functional and technical perspectives, the current ACMA licensing framework requires a separate license fee for each antenna, so a site with ten antennae, for example, will cost many multiples of a single antenna even if it is functionally operating as a single unit.

While a reduction in licensing fees is critical, and welcomed, the proposed "systems" approach to pricing does not reduce the number of individual licenses required to operate an individual ground station site because each antenna still requires its own license. This, on top of the other dimensions of a singular license, means a shocking number of licenses may be required for one site. For example, a single ground station site operating nine antennae

on four frequency bands and two satellite network filings will require hundreds of individual licenses. The ACMA should consider both the administrative and financial burdens in this effort to reform its regulatory framework. Ultimately, licensing structures that are more consistent with the actual use of the earth stations will result in faster deployment and better service for Australian consumers.

Weighting fees based on frequencies will encourage faster deployment

Second, the reduction in the spectrum pricing geographic weights for frequencies above 5 GHz used in their respective license tax formulas is a critical and necessary change to reduce barriers to entry and encourage the expansion of technology beneficial to Australian consumers. Using the current weights for an Australia-Wide license of 2000 MHz between 8.5 – 14.5 GHz, a licensee can expect a yearly fee of approximately AUD 1.6M, which is extremely high and runs the risk of deterring companies from entering the market. For the same license using the proposed weights, a licensee can expect a yearly fee of AUD 800K, a 50% reduction. Although still astoundingly high, any reduction in fees that may increase competition and new technology in the market is welcomed, and, as explained below, ACMA should consider removing these fees altogether to achieve the maximum benefit for the public.

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 license holder. This method is will result in a skewed assessments 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.[1]

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.

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 license holder behavior and instead conceptualizes spectrum license fees more simply as a way of recovering the administrative costs of processing the license 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. ACMA is correct to point out in its paper that the spectrum licensing fees in Australia are significantly higher than 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. As one example, see Table 1 of the comparative price per country for the equivalent of an Australia-Wide license of 2000 MHz between 8.5 – 14.5 GHz. The fees listed below do not include the license application fees, which are nominal. Any yearly licensing fee imposed by ACMA, even the proposed reduced fees in the consultation paper, will be higher than other Western countries.

Table 1. Country Spectrum Fees

Country	Yearly Spectrum License Fee*
Australia	AUD 1.6M
New Zealand	NZD 0

[1] 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.

Canada	CAD 0
United Kingdom	GBP 0
United States	USD 0

***** Unlimited (or Equivalent) Customer End-User Terminal Equipment, Countrywide, for 2000 MHz within the 8.5 - 14.5 GHz Band, as of 01/2021. Does not include license application fees.

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.

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 licensees 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.

SpaceX appreciates the opportunity to provide comments in response to the consultation. Please do not hesitate to contact us with any questions. We look forward to working with the ACMA as we both strive toward a goal of connecting all of Australia's citizens to high-speed Internet services.

Respectfully submitted,

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