SPACEX

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RE: IFC 25/2020 - Proposed licensing arrangements in the 26 GHz and 28 GHz bands

Space Exploration Technologies Corp. (SpaceX) appreciates this opportunity to provide input to the Australian Communications and Media Authority (ACMA) in response to the consultation, "Proposed licensing arrangements in the 26 GHz and 28 GHz bands (Consultation 25/2020)".

Summary of Arguments

SpaceX urges the ACMA to take actions that encourage the fast deployment of new technologies and consumer telecommunication services in Australia, especially where there are opportunities to encourage efficient use and sharing of spectrum. Properly designed, the ACMA's proposed Area Wide Licenses have the potential to forward these objectives, and the ACMA should continue to explore regimes that provide consumers with more choices, lower fees, and better service. Such as:

- using power limits to encourage co-existence between services,
- providing regulatory certainty through a defined upper boundary for the 26 GHz band,
- requiring good faith coordination between fixed satellite services and terrestrial networks in urban areas,
- considering radiation pattern envelopes and power limits that are appropriate for a wide variety of satellite antenna systems, and
- pairing tailored spectrum fees that maximize competition with aggressive performance-based policies to reward efficient use of spectrum.

This combination of actions maximizes choices for consumers both between and among different technologies, ultimately driving down prices and propelling the quality of consumer services.

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 only 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. In 2019, 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 713 satellites in orbit as of this submittal. SpaceX is the operator of the most extensive satellite broadband network in the world, with sufficient coverage to provide broadband connectivity within Australia by the end of 2020.

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

In particular, access to the 27.5 – 30.0 GHz band is critical for fixed satellite service constellations such as Starlink in order to bring broadband services to Australians. These bands form the basis for the earth-to-space 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.

Fixed Satellite Service Spectrum

The 28 GHz band (27.5-29.5 GHz) is currently allocated for fixed satellite service earth stations, and reliance on the band is expected to continue for the foreseeable future. In fact, the band is increasingly important as a new generation of satellite services are being developed and deployed. Next-generation satellite constellations, like SpaceX's Starlink, are already deploying systems that use the 27.5-29.1 GHz spectrum band to uplink from gateway earth stations to low-earth orbiting constellations, which are optimized to provide broadband service across remote and rural regions, in Australia and around the world. To ensure that all consumers reap the benefits of this new cutting-edge technology, SpaceX urges the ACMA to safeguard continued access to the 28 GHz band for fixed satellite service use.

Ensuring future use of the 28 GHz band for next-generation satellite systems does not translate into exclusive use. One effective approach that the ACMA could employ while also allowing new terrestrial uses in the band entails establishing power flux density ("PFD") protection limits where fixed satellite service earth station transmissions and emerging terrestrial services could coexist. The ACMA could apply these PFD contours to set a "border" between fixed satellite earth stations and terrestrial 5G 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.

26 GHz Upper Boundary

While Starlink is not seeking to operate in the 26 GHz band, SpaceX urges the ACMA to clearly delineate the upper boundary of the 26 GHz Band at 27.0 GHz in order to avoid interference between terrestrial networks and satellite-based services operating above at 27.5 GHz. Clear rules and enforcement of operations within those limits will be of increasing importance as both satellite and terrestrial operators build out in the Ka-band. The observance of the 500 MHz separation can ensure critical protection of both services and bring efficient use of frequencies for maximum consumer service offerings.

Good Faith Coordination in Urban Areas

As a leader in innovative regulatory approaches, the 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 surpassed the historical presumption that satellite and terrestrial technologies cannot share spectrum. Unfortunately, proposals that segregate terrestrial operations from fixed satellite service in the 27.5-28.1 GHz band inside "specified areas" (largely defined as urban population

centers) using the proposed Area Wide Licenses sets the reverse incentives and will have the effect of unnecessarily limiting choices for consumers.

Properly designed, Area Wide Licenses have the potential to encourage the fast deployment of telecommunication services in urban areas. With proper buildout requirements, the ACMA should expect 5G operators to quickly deploy in urban areas via geographically large Area Wide Licenses, making the services available to more consumers. The expansion of new technologies such as 5G can benefit consumers, and the ACMA should continue employing licensing regimes that encourage new technologies and their fast deployment at the benefit of consumers. But the expansion of 5G technologies does not need to come at the expense of other technology platforms delivering broadband services. With comparatively fewer sites and often less urban deployments, fixed satellite service gateways can be accommodated through spectrum sharing agreements at specific locations where 5G licensees plan operations and, notably, at locations where no such build-out is envisioned.

The ACMA can encourage this type of spectrum sharing by requiring good faith coordination between 5G licensees and co-primary satellite licensees in the 27.5-28.1 GHz band. 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 it proposed 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.

Area Wide License Radiation Pattern Limit

SpaceX cautions the ACMA that the proposed Area Wide License satellite earth station radiation pattern envelope in ITU-R S.1855, listed in the new Radiocommunications Assignment and Licensing Instructions (RALI) on page 17, requires further consideration, as this pattern is appropriate for large GSO antenna but may not be appropriate for smaller NGSO antenna. More generally, the need for a specific radiation pattern envelope appears redundant given that the ACMA has already defined an off-axis EIRP limit toward the horizon of -60 dBW/Hz and a PFD limit at the Area Wide License boundary, which already provides protection for other services.

A Cost Recovery Model for Taxes

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, but proposals to tailor the tax model to keep pace with the technology available at any particular moment is similarly futile, as innovators drive to develop new and exciting ways to match evolving consumer demand.

In fact, advanced wireless technologies that are either already on the market or on the cusp of introduction are making current tax structures and policies even less productive. For instance, the ACMA's current methodology results in fixed satellite earth station taxes that are prohibitively high and may inadvertently deter new entrants from serving the Australian market altogether, even though the earth stations would cause little interference to surrounding services. For example, under the current ACMA Apparatus License Fee Schedule, a fixed satellite earth station operating with 1GHz bandwidth in the 28GHz band would have a yearly license fee of up to AUD 197K, depending on the ACMA spectrum density classification of the location.

The new tax structure proposed by the ACMA for Area Wide Licenses fails to capture the actual spectrum use or the efficiency of such satellite constellations, where the license tax amount is a function of population in the Area Wide Licensed geographic area. In effect, the proposal would assess higher license tax based on the population

surrounding a specific licensed gateway earth station site, even though the earth station site location supports a wide national network. For example, under the proposed ACMA Area Wide License fee schedule, a fixed satellite earth station operating with 1GHz bandwidth in the 28GHz band in high-density area could similarly see yearly license fees greater than AUD 200K per year. The proposed tax structure would have the perverse effect of penalizing cutting-edge antenna technology for beam forming and steering, along with advanced filtering techniques, that make it possible for different users and different services to work more precisely and closer together without adding significant interference. In the end, these proposed taxes set the wrong incentive structure for spectrum sharing innovation and add unnecessary costs to service, potentially chilling the benefits of new competition for Australian consumers.

SpaceX therefore urges the 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. The ACMA's spectrum efficiency goals would be better served with a price-recovery model, tied with other policy incentives for efficiency. As one example, the United States employs a fixed application fee for spectrum use along with annual fees for upkeep, 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 or network expansion.

Spectrum Efficiency

The ACMA has long recognized an interest in increasing spectrum access for all users, and has an opportunity here to set 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 greater spectrum availability to reward efficient users and the stick of higher costs for inefficiency.

With respect to spectrum sharing among NGSO satellite operators, SpaceX proposes approaches to encourage development of spectrally efficient technologies. SpaceX supports 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.

With that goal in mind, SpaceX proposes a default rule under which—absent successful private coordination—two NGSO operators split the spectrum during the specific in-line events that occur between their two systems. To encourage all operators to develop systems better able to share spectrum, the NGSO operator that uses spectrum more efficiently should be awarded first choice of bands to select in the splitting of spectrum during in-line events. SpaceX notes that the current rule in the United States actually sets the wrong incentives by granting this right of first spectrum choice to the operator that is first to launch a satellite and operate in the frequencies in question, because it encourages operators to launch quickly a small number of satellites without consideration of actual service provision or spectral efficiency, leaving the potential for an inefficient system that hinders anyone who follows. Instead, a rule that assigns first choice of spectrum to the more efficient NGSO system creates a race-to-the-top in which operators compete to develop the most spectrally efficient technology. And ultimately, satellite

operators that can share with each other are also better able to share with other technologies, such as terrestrial wireless services.

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 a well-earned reputation for innovation and finding efficiencies where others cannot. As you know, we created the Falcon 9, which is the only orbital-class vehicle that can deliver a payload to space and return safely to Earth to be used again and again. We have designed a satellite system that is equally innovative and efficient. We would like to see others do the same. We would 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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