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SATELLITE SERVICES WORKING GROUP (SSWG)

SUBMISSION

to the

Australian Communications and Media Authority's (ACMA)

Implementation of the Spectrum Pricing Review - Proposed guidelines and focus areas for change

30 June 2020

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EXECUTIVE SUMMARY

The Communications Alliance Satellite Services Working Group (SSWG) welcomes the opportunity to provide comments to the ACMA consultation on the *Implementation of the Spectrum Pricing Review - Proposed guidelines and focus areas for change* (the *Consultation Paper*).

This consultation on spectrum pricing offers the opportunity to revisit ACMA's approach to satellite regulatory fees, especially in light of Australia's renewed focus on growing its domestic space industry.[1] Affordable access to spectrum for the space sector is essential for Australia to build a 'globally competitive space industry.'[2] Unfortunately, it is clear that space and earth station spectrum prices in Australia are much higher than in most other major space nations by an order of magnitude or more. Such high prices prevent Australia from fully leveraging its natural advantages to grow its space industry.

Satellite services, FSS, MSS and BSS, are major contributors to Australia's prosperity. While terrestrial mobile services mostly cover only the areas where population density makes terrestrial networks commercially viable, satellite covers the whole country and territories. Given much of Australia's wealth is derived from agriculture, resources and services (tourism)[3], the ability to provide communications and broadband access to all parts of the country is a vital consideration. In the health industry, during the COVID pandemic, satellite was the only method of communicating for many Australians who live in the outback and this kept Australia's regional economy moving, even while people were forced to remain in one place.

A fundamental rethinking of Australia's spectrum pricing for space services is necessary and most welcome. Indeed, when the ability of space services to re-use spectrum and other factors are taken into account, there is good justification to substantially reduce Australia's high spectrum prices for all space services, to be more in line with the prices charged by international peers.

Taking these considerations into account, the SSWG proposes:

- a new baseline of spectrum pricing for Australia-wide Apparatus licensing, mapping through to the already familiar and accepted geographic discounts for high, medium and remote density areas. The SSWG favours this approach of area discounting to continue. This could be regarded as a static update to the changes made by the ACMA in 2016.
- applying appropriate discounts for space services on account of the reusability of spectrum among GSO and NGSO satellites, and other appropriate factors.
- introduction of the concepts of spectrum denial caused by earth stations and the practical consequences of evaluating opportunity cost pricing for individual stations and where a number of stations are co-located in the same band.

Here sharing is taken to mean coexistence under no constraints of spectrum denial. Taxation should still be broken down into area discounts. Some examples in this submission are provided as an illustration.

[1] *See* Australian Space Agency, *Advancing Space: Australian Civil Space Strategy 2019-2028*.
[2] *Ibid.*
[3] https://www.dfat.gov.au/trade/resources/trade-statistics/Pages/trade-statistics

With the wider concept of service links and with evaluation of multiple beam arrays for both GSO and NSGO systems, a more realistic assessment of pricing is necessary for footprints served, again apportioned for spectrum denial. This denial has two further considerations – being for ubiquitous terminals in the two cases which may or may not require protection and no-interference. Once again, sharing potential is also important for the actual population covered in the case of Australia Wide licences.

An update of international comparisons shows the fees charged to operate satellite services in Australia to be far in excess of those in other countries. This is damaging to Australia's position and attractiveness for industry investment and its social/economic future.

About Communications Alliance

Communications Alliance is the primary telecommunications industry body in Australia. Its membership is drawn from a wide cross-section of the communications industry, including carriers, carriage and internet service providers, content providers, equipment vendors, IT companies, consultants and business groups.

Its vision is to provide a unified voice for the telecommunications industry and to lead it into the next generation of converging networks, technologies and services. The prime mission of Communications Alliance is to promote the growth of the Australian communications industry and the protection of consumer interests by fostering the highest standards of business ethics and behaviour through industry self-governance. For more details about Communications Alliance, see http://www.commsalliance.com.au.

1. Evolution of satellite networks – an overview

Modern satellite services have grown beyond the traditional C-band, Ku-band FSS and L-band MSS systems in geostationary orbit. Over the past two decades, a growing and vibrant satellite industry has launched (and is continuing to launch) High Throughput Satellites (HTS) in the C, Ku and Ka-bands, in both geostationary and non-geostationary orbits, to provide advanced broadband communications everywhere. In the coming years, HTS systems will also incorporate the Q and V-bands.

Indeed, many of these systems serve Australia today with, for example, Sky Muster providing broadband to even the most remote parts of Australia and O3b enabling 4G in places such as Norfolk and Christmas Islands. Recently, new space entrants have launched (and are continuing to launch) constellations of satellites in non-geostationary orbit to provide space-based earth observation, Internet-of-Things and broadband applications in multiple frequency bands. Satellite earth station terminals in both the FSS and MSS can now operate in fixed locations or while in motion, leading to expansion in connectivity global aero and maritime connectivity markets. Combinations of these systems enable Australians to enjoy narrowband and broadband connectivity wherever they are, even when they are on aircraft or ships in Australian airspace and waters.

All of these new and emerging satellite services require affordable access to spectrum to truly flourish. As the Australian Government has recognised, Australia enjoys some natural advantages when it comes to the space industry. While Australia has managed to attract some of the new satellite systems to establish gateway earth stations in Australia, there can be no doubt that Australia would be an even more attractive location and market for new satellite services if its spectrum prices for space services were not so high. Modern HTS systems need access to unprecedented amounts of spectrum (4 GHz or more) to make full use of their capabilities and deliver the best broadband experience to customers. A reasonable Australia-wide tax is therefore an imperative for a viable business case.

Australia's high pricing is unsustainable in a globally competitive environment, especially in light of the large bandwidth requirements of modern HTS systems. Australia's high spectrum prices have already deterred entry by at least some satellite operators, thus reducing the variety of services available to all Australians. The SSWG is also aware that some operators have chosen other countries in the region in which to establish their gateways, in part because of high licensing fees. If the Australian Government truly wants its space sector to grow, and attract new constellations and services to Australia, then lowering its high spectrum prices would be an excellent first step.

Fortunately, as explained below, there are compelling reasons for reducing Australia's spectrum prices for space service, especially when the satellite's ability to re-use spectrum is taken into account. The absence of spectrum denial, combined with findings of a lack of congestion, justify substantial reductions that will bring Australian spectrum prices more in line with its international peers.

2. The Case for Lower Apparatus Licence Fees for Space Services

The case for lower apparatus licence fees for space services rests on the following considerations, and the SSWG would urge the ACMA to reduce its fees as matter of priority as it implements the Spectrum Pricing Review.

2.1. International competitiveness

As noted above, companies in the new 'space race' are building their new satellite networks and systems, and planning their ground facilities right now. While Australia enjoys some

natural advantages as a location for such space infrastructure, the ACMA's very high apparatus licence fees relative to its international peers remain a significant deterrent for both the deployment of gateways and for user terminals in Australia. As Australia aims for a 'globally competitive' space sector, we believe it will have to consider substantial reductions in fees for space services.

Comparing licensing fees for space services across countries can be notoriously difficult, due to differences in licensing regimes. In 2016, the Canadian government relied on an international comparison of FSS and BSS space station licensing fees that it had commissioned (with some normalising assumptions) in order to set its own fees of C$120/MHz in all frequency bands. This fee, while still very high by international standards, is still significantly lower than the Australian one in the most common FSS frequency bands (i.e. C, Ku and Ka). Further to this, the Canadian fee applies only to domestic (i.e. Canadian) space stations, but provides helpful information.

The space station fee in Australia does, however, also cover the operation of user terminals under a class license in various frequency bands. Nevertheless, the resulting fee is disproportionately high with respect to other countries which also adopt a 'blanket license' approach. For instance, in relation to ESIM in Europe, the implementation of the relevant decision is that in the vast majority of countries for the 'blanket' authorisation of user terminals operation no additional fees are incurred. A US blanket licence is less than A$500, while user terminal operation under a General User Radio Licence (GURL) in New Zealand does not attract any fee.

For earth stations, Plum Consulting conducted an international comparison of licensing fees for the ACMA in 2016. Figure 1 compares Plum's findings with the 2020 Australia earth licence fees by population density area and in three common FSS frequency bands. The difference is even more enhanced by the fact that some of the fees have further reduced since 2016 (e.g. UAE, Singapore) and in several cases they are a flat fee, independent on the amount of spectrum used (e.g. US, UAE). Canadian fees will also be revised, as currently they are based on an old 'equivalent telephone channel' methodology.

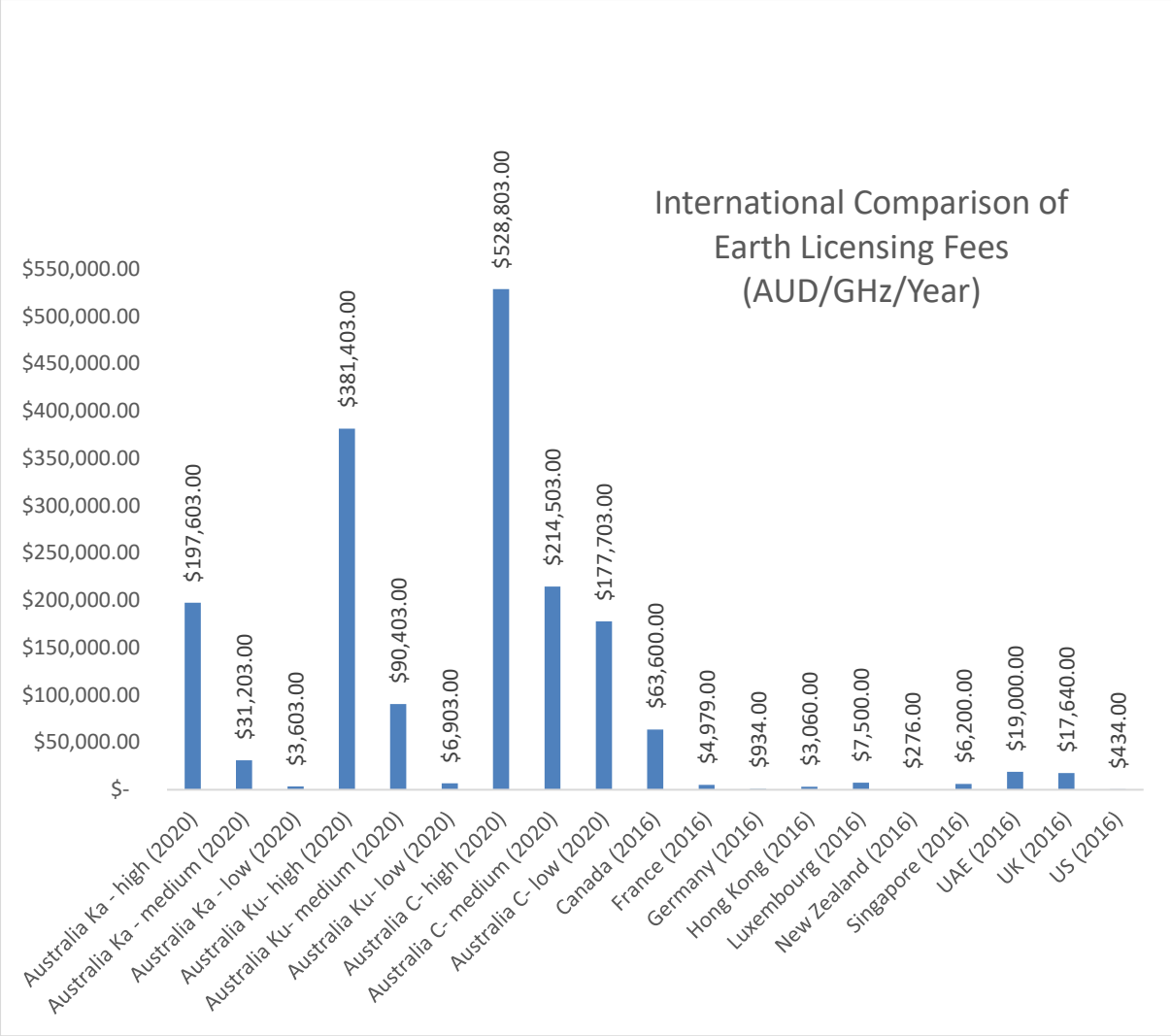


Figure 1
International comparison of earth licensing fees [4]

The contrast between the space station and earth station licensing fees in Australia and the fees in other countries is striking. The divergence suggests that the apparatus licensing fees for space services no longer reflects real-world values and must be reduced.

It should be noted that Plum recommended a 50% reduction in the Australia-wide and high-density fees for the Ka-band due to the lack of foreseeable spectrum congestion. The ACMA decided to only implement a 30% reduction due to uncertainty about future demand for Ka-band spectrum from 5G services. Even with a 30% reduction, Australian Ka-band fees remained significantly higher than other major space nations. The ACMA has since resolved any uncertainty over 5G demand for Ka-band FSS spectrum. In the 28 GHz decision, it found 5G millimetre wave requirements can be met in the 26 GHz band and higher mm-Wave bands above 31 GHz, and decided to allocate the 28 GHz band predominantly for FSS use. This confirms a lack of spectrum congestion in the 28 GHz band, and suggests that the base

[4] *See* Attachment E to ACMA, IFC 19-2016, Review of Taxation Arrangements for Satellite Services: Consultation Paper (Aug. 2016).

price of Ka-band spectrum for space services should be further reduced – at least to the 50% level suggested by Plum, i.e. to a base price of **$0.50/kHz**, as a starting point for the Ka-band spectrum (with further sharing discounts below).

The international comparisons by Canada and Plum also suggest that reductions in the base price of spectrum in other satellite bands are definitely warranted. Australia's fees in the Ku and C-band are even higher than in the Ka-band, while many of other countries do not distinguish between different FSS or BSS bands when setting fees, i.e. the same fee applies equally in the C-band, Ku-band and Ka-bands. As a result, Australia's C-band and Ku-band fees look even higher in comparison. The SSWG would suggest that base prices for Australia-wide and high-density area licenses in these other bands should also be reduced by at least the 50% suggested by Plum.

2.2. Non-preclusive Use of Spectrum and other factors leading to further reductions

a) Space stations

In addition to an across-the-board reduction in base prices for space services in light of international benchmarks, a further discount is warranted on account of the 'non-preclusivity' of satellite spectrum use. Unlike many terrestrial services, which often involve exclusive licences, apparatus licences for many space services, e.g. in the FSS, MSS and BSS, are generally not preclusive.

For example, a grant of space licence for a space station at one geostationary orbital location does not preclude the grant of a second licence for the same spectrum to another space station at an adjacent orbital location. Co-frequency, co-coverage geostationary satellites can operate as close as (on average) two degrees apart, and with 120 degrees of geostationary arc visible from Australia, as many as 60 such space stations could conceivably be licensed to serve Australia before there is spectrum congestion. The grant of a geostationary space licence in the FSS also does not typically preclude the grant of a non-geostationary space licence (or vice versa) in the same frequencies. Instead, compatibility is typically achievable via a combination of Equivalent Power Flux Density (EPFD) limits, angular separation and/or frequency coordination.

This suggests that the base price for space apparatus licence fees should be significantly discounted further on account of this 'reusability' of satellite spectrum. No single space or earth licensee should pay as if it was licensing spectrum for its sole use, to the exclusion of all other space or earth licensees.

Ka-band (17.3-31.3GHz)

A further discount factor of (say)10 is appropriate to reflect the number of co-frequency satellites that might realistically serve Australia at a given time and other factors such as the unprecedented amount of spectrum required by novel systems operating in this band and the limited use of the 27.5-28.1 GHz portion of the band.

Applying this discount, in addition to other factors, on top of the internationally driven reductions in base prices results, for example, in an Australia-wide Ka-band licence fee of **$0.05/kHz** ($0.74 reduced to $0.50 due to international comparisons, and then further discounted by a factor of 10 to $0.05).

Similar considerations could also apply to other bands, for example, Ku and C-band.

b) Earth Stations

The licensing of an earth station is also largely non-preclusive of the licensing of other earth stations and services in the vicinity. The Consultation itself recognises that 'antenna farms' consisting of multiple earth stations communicating with multiple satellite systems, all in the same frequency band, may be subject to licence fees today that are out of all proportion to the amount of 'spectrum denial' that they cause.[5] In fact, the non-preclusive nature of earth station siting has prompted the ACMA to enact policies that encourage co-location, including a 30% discount for co-located earth stations, no matter the number.

The SSWG supports a discount for co-located earth stations but would urge the ACMA to: (1) consider a larger discount if a co-located earth station does not cause any additional 'spectrum denial' than a prior licensed earth station, and (2) provide more flexibility in how close together antennas must be in order to qualify for a discount.

Given that, for logistical/operational reasons, deployment in urban areas is required (e.g. proximity to fibre), the SSWG suggests a reduction of at least a factor of five or three, for earth stations in high and medium density areas respectively, to bring the fee to acceptable levels. This is also reasonable in terms of international comparisons. Other considerations will be taken into account later in this submission.

2.3. Restrictions on use due to sharing requirements

Bands shared by different types of services typically attract lower fees for any of the services in the band due to the constraints imposed by sharing. This should be taken into account by an appropriate discount factor in the apparatus licensing fees in shared bands. The exact discount factor may vary, depending on the sharing regime.

The discount factor could be a fixed number for all services in the band, to reflect the mutual constraints imposed by sharing, e.g. in bands where earth stations and fixed services are licensed and coordinated on a first-come-first served basis. But that is not the only sharing regime in the ACMA's rules. For example, class licensed earth stations receiving in the 10.7 to 11.7 GHz band enjoy no protection from the fixed service in the same band. This would suggest a very large discount is appropriate for space licences (but not the fixed service) in this band since such earth stations create no spectrum denial for the fixed service.

In other bands, the sharing scheme is population-based. In the 27.5 to 28.1 GHz band, for example, apparatus-licensed FSS earth stations will be co-primary with area-wide licensed (AWL) FWA systems in defined populated areas. While the licensing framework in this band is still being developed, it can be expected that prior issued FWA AWLs in such an area would preclude some types of earth stations from being licensed in the same area. However, under the ACMA's current regime, the space licensee seeking an Australia-wide license would still pay full coverage price even though, in reality, it can longer serve the populations covered by FWA AWLs. In such situations, a discount on the Australia-wide licence fee is warranted based on the Australian population that can longer be served by the licensee.

2.4. Other inequities

The SSWG also urges the ACMA to look out for hidden inequities in apparatus licensing fees as it implements the Spectrum Pricing review. One example identified by the SSWG is the higher prices charged for space services than for more preclusive terrestrial services in the 2 GHz band.

[5] Pages 19 and 20 of the Consultation Draft.

In the 1980 to 2010 MHz and 2170 to 2200 MHz MSS bands, the MSS must pay $2.848/kHz for an Australia-wide licence while TV Outdoor Broadcasting services pay $1.4610 and P-MP pays $1.2444. These fee differentials are 'hidden' in that they appear in different fee tables. However, MSS can generally share more easily with other systems whereas P-MP and TOB generally cannot and require a greater degree of exclusivity. In other words, P-MP and TOB create more 'spectrum denial' for themselves and for other services than the MSS. To address this inequity, the SSWG suggests a single base fee of $1.20 be adopted for all services in this band, and that the MSS fee be discounted by a factor of three based on the ability of MSS systems to share between themselves and the requirement on them to share with other more-preclusive terrestrial services. On this basis, the MSS fee would be reduced to **$0.40/kHz**.

3. Issues for comment

The following responses are to the questions posed by the ACMA in the *Consultation Paper*.

Question 1

Do stakeholders have any views about the status of the ACMA's role in implementing the recommendations of the Spectrum Pricing Review?

The ACMA (and its predecessors) has always been a well-regarded spectrum regulator, implementing world-leading spectrum plans and allocation methods. With a large portion of the spectrum now being allocated using market methods, combined with a massive demand for spectrum access and the use of frequency bands not envisaged in the days of the Spectrum Management Agency, it is timely for a review of apparatus licence fees and the ACMA is the only body with the experience and combined understanding of engineering and economic drivers in spectrum management. Thus it is appropriate that the ACMA conduct this review.

In undertaking the review, the ACMA should combine its engineering, economic and pricing experience and factor in things such as spectrum reusability grounded on sound engineering principles involving RF propagation, antenna performance, protection margins and band segmentation. Only by understanding and taking into account all of these factors will a new pricing formula reflect the reasoned value and engineering utility of the spectrum to users and the community.

The ACMA clearly has a leading role in the implementation of the recommendations of the Spectrum Pricing Review. Recommendations 1, 7 and 8 are the focus of this *Consultation Paper* and the SSWG agrees that carriage of these Recommendations should rest with the ACMA. However, the role of the ACMA should also extend to informing stakeholders over intersecting treatment of other proposals and how these are specifically intentioned together with its interactions with other bodies. Transparency and accountability are important and the ACMA has a clear role in this interworking and needs to advise (in addition to consulting) industry on how it is progressing or intends to progress. Whilst the ACMA suggests how it is doing this in accordance with the other Recommendations, this is presented in a rather piecemeal and abbreviated fashion.

Question 2

Do stakeholders have any views on the legislative and policy environment that may be relevant to the pricing issues outlined in this paper?

The SSWG response is focussed on the ACMA Apparatus Licence Fee Schedule[6], noting that it has had a tortuous history and now, with this consultation, an opportunity has been provided for a major review of the fee model and to address the inconsistencies that have been known as far back as 2004.

The outcomes of the review of the Apparatus Licence Fee Schedule in 2004 were unanimous, in addressing the spectrum location bands and congestion weightings at the time, recognised as being inappropriate and no longer reflecting usage patterns.

The same can now be said for the current Apparatus Licence Fee Schedule which is in need of significant amendment in the case of space services for the reasons set out in Section 2.

The object of the *Australian Communications and Media Authority Act 2005* is to provide for management of the radiofrequency spectrum in order to achieve a number of goals, five of which are listed Page 11 of the *Consultation Paper* as being relevant to spectrum pricing. Each of the listed goals is addressed individually below:

- ***maximise, by ensuring the efficient allocation and use of the spectrum, the overall public benefit derived from using the radiofrequency spectrum***

  The current pricing policy is based on an old model. The maximum public benefit from the use of the spectrum can only come from the delivery of the services to the public, which should not be deterred by unreasonably high spectrum prices.

- ***provide a responsive and flexible approach to meeting the needs of users of the spectrum***

  The current fees are inflexible and not particularly responsive. A system is charged in terms of bandwidth and geographic area with some recognition of frequency and vis-à-vis throughput capability. The fees do not take into account, for example, spectrum denial or indeed sharing. A truly responsive fee structure would recognise systems with very small spectrum denial, such as FSS gateways, and also recognise the 'non-preclusive' nature of some satellite systems. A responsive fee would also take into account when space services cannot make full use of a spectrum band due to a requirement to share with other services.

- ***encourage the use of efficient radiocommunication technologies so that a wide range of services of an adequate quality can be provided***

  The current fees do not achieve this objective. Linked to the objective above there is nothing in the fees that provides economic incentive or compulsion to share spectrum.

- ***provide an efficient, equitable and transparent system of charging for the use of spectrum, taking account of the value of both commercial and non-commercial use of spectrum***

  The current fee structure does not accurately reflect current non-preclusive spectrum use by some satellite systems and provides unjustified discounts for other systems that simply cannot share. The ability of multiple satellite systems to use the same band with little or no impact on others means there is little or no scarcity in these bands and thus no justification for high prices. This is taken up in the proposed revision of apparatus licence fee schedules later.

[6] ACMA Fees for apparatus licences https://www.acma.gov.au/fees-apparatus-licences

While it could be argued that government use is important, it has also been shown that without true pricing and pro-active spectrum management, large agencies with no real budget incentives, for example Defence, may simply hoard spectrum.

- ***support the communications policy objectives of the Commonwealth Government***

  Given the current *Radiocommunications Act* was made in 1992, it is difficult to discern the current policy objectives of the Government.

The ACMA's principles for spectrum management, as listed on Page 11 of the *Consultation Paper*, are:

1. Allocate spectrum to the highest value use (HVU) or uses.
2. Enable and encourage spectrum to move to its HVU.
3. Use the least cost and least restrictive approach to achieving policy objectives.
4. To the extent possible, promote both certainty and flexibility.
5. Balance the cost of interference and the benefits of greater spectrum utilisation.

The principles for spectrum management were well made but are now dated. We find there is, for example, often more focus on the highest value use rather than the highest value combination of uses. Examples are spectrum allocated by auction primarily for various mobile services that have no real method or incentive to share.

Locking in single use allocations for fifteen or twenty years through spectrum licences has a high risk and the potential to be inefficient if the anticipated market does not develop as anticipated, e.g., as was the prior case with Local Multipoint Distribution Services (LMDS).

The current focus on single use is evident in Principle 2. Moving to the HVU seems to essentially mean 'put the band to auction and clear everyone else'. Invariably this ends up with a small number of spectrum holders, generally those with the deepest pockets and a single service focus. This is not economically efficient as it places no value on the burden of clearing to other important sectors of the economy, or the opportunity costs of denying spectrum to other services.

In its current state, the legislative environment makes adequate prescription of taxation responsibilities. The evaluation of the level of those taxes and discretion in assessing service applications is left to the ACMA and the narrowly focussed policy decisions made by the ACMA. In this, the ACMA relies heavily on the concept of highest value use, which is an extremely vexed and intangible quality, unless the dollar value of spectrum is relied on exclusively and based on market responses. It is tempting and convenient to respond to a more affluent industry, e.g. the mobile industry, in directing the future use of spectrum, and leaving the balance of spectrum remaining to other industries, consumer and non-profit activities, and scientific needs. Grappling successfully with the HVU should comprise a balance of economic and society values plus encouragement for exploration and innovation. This is a complex task for a regulator and has yet to be achieved successfully in Australia.

Also challenging the implementation of legislation is a fundamental realisation of assumptions around spectrum denial. Without spectrum denial there is no case for spectrum charging, except for an overhead administrative cost recovery to the regulator. For ubiquitous satellite services there are several types of terminal application which call for different solutions:

- Individual Earth stations or Earth station farms which provide feeder links e.g. providing gateways to the satellite network(s) for these services. The Earth station farms are candidates for the Area Wide (Apparatus) Licence (AWL) which the ACMA is

proposing in a separate context. The SSWG believes that the concept of AWLs is not relevant to the FSS, especially where terrestrial networks become involved. The expectation is that licensing should not distinguish between a single Earth Station or an Earth Station farm and both should be licensed on a site basis. This may seem to simplify the licensing process, coordination and the operational and economic challenges. However, in a practical business sense this is a situation which involves difficulties for industry. Taking the case of a 'Satellite Park' as an example, the first licensee in the band would pay a fee based on a revised fee schedule. Once a second operator enters, the fee for both would be 50% and so on as the park filled up in that band. This is based on the fact that there is no appreciable difference in 'spectral denial' from the presence of one or a number of FSS terminals in any given area.

- The ACMA would need to introduce regulatory pricing arrangements which would need to be updated and maintained on a regular basis.

Putting geographic constraints into licensing practice and interpreting the Table of Apparatus Licensing in a world where multiple beam GSO networks/systems, or Non-Geostationary Orbit (NGSO) networks/systems and constellations, operate are circumstances which were not imagined when these Tables were conceived. As a consequence, more thought is required. This is dealt with under Focus Area 4 in this submission. With some minor common-sense amendments, the applicability of the Taxation Formula and the charging Table can be resolved to a more acceptable state.

The factors associated with the tax formula for apparatus licences are listed in the document on Page 14 of the *Consultation Paper*. One factor missing is from the demand side arising from potentially competing services which are provided for within the Australian Frequency Band Plan.

Question 3

Do stakeholders have comments on the ACMA's draft spectrum pricing guidelines including the relevant spectrum pricing decisions, guiding principles and process for changing prices?

The SSWG addresses these concepts under ACMA's draft guiding principles that are proposed to be applied when considering various administrative pricing options, as listed on Page 16 of the *Consultation Paper*:

> ***Efficient allocation and use of the radiofrequency spectrum (efficiency)***
>
> *The primary economic objective for managing public resources is to maximise the benefit that resource provides to society. This occurs when spectrum is allocated and used efficiently. This is achieved where spectrum is allocated to the highest value use or uses; that is, the use or uses that maximise the value derived from the spectrum by licensees, consumers and the wider community. This is most likely to occur when prices are set in a way that reflect the opportunity cost associated with spectrum denial.*

These are 'economics' concepts and are not always reflected in the real world. Fees and taxes, regardless of how they are determined, often act as inhibitors to activity and thus supress the very economic activity that they seek to 'make efficient'. Highly complex or inequitable fees and taxes could severely harm an industry and result in less services.

For instance, use of the FSS Ka-band is, in terms of the satellite industry, relatively new and growing rapidly. In the 18/28 GHz bands satellites in orbit can be coordinated as close as 2° or even 0.5° apart. So between 60 and 240 individual systems can theoretically use the

same spectrum providing services on land and to ships and aeroplanes. These are high-value services to end users. There is a number of inequities that emerged in the supply of Space Systems Licences:

- Annual licence tax for an Australia wide licence is currently set for Space Systems at $0.7409 per kHz in the 17.3 to 31.3 GHz band. In the same band the equivalent tax for Television Outside Broadcast (TOB) is set at $0.5430 per kHz, noting the TOB assignment is historical. On the other hand, the FSS can deliver services using the same spectrum without band segmentation unless that is needed for a very close coordination. Thus arbitrary service-based fee discounts for preclusive systems are inequitable and do not lead to spectral efficiency.
- As an example, the current licence tax for the 27.5 to 30 GHz band, Australia-wide, would result in annual payment of $1,852,250 (to which the downlink portion still needs to be added). This is an extremely high fee, disproportionate also in terms of an international comparison, and which would result in an artificial barrier to entry.
- Emerging satellite systems operating in Ka-band will typically need access to unprecedented amounts of spectrum (4 GHz or more) to make full use of their capabilities and deliver the best broadband experience to customers. Some systems can also use spectrum in a very flexible manner, depending on demand. All considered, the availability of a reasonable Australia-wide tax is an imperative for a viable business case.
- As an additional consideration, use of the 27.5 to 28.1 GHz band in Australia will be constrained by FWA deployment in populated areas. As such, a significant percentage of the Australian population may be denied to some ubiquitous FSS applications and the Australia Wide fee should be adjusted accordingly.
- Finally and as already mentioned, an extremely important outcome of the generally 'non-preclusive' nature of satellite services vis a vis other satellite services in the same band is that licensing fees should be discounted by at least a factor of ten from the base price in a band.

Taking into account also this aspect, the SSWG proposes a fee of 0.05 $/KHz, for the 17.3 to 31.3 GHz range.

Thus, as an example, the tax for an Australia Wide Licence in 27.5 to 30 GHz becomes $125,000 per annum. This fee would seem equitable in a shared band where multiple services or systems of the same service can use the same spectrum and where a significant part of the population is un-serviced in a part of the band.

The same inequities due to sharing capability apply in other bands, for example in the MSS frequency bands (1980 to 2010 MHz and the 2170 to 2200 MHz) used for the Mobile Satellite Service (MSS). MSS must pay $2.848/kHz for an Australia-wide licence while TOB pays $1.4610 and P-MP pays $1.2444, yet MSS may be able to share with other systems whereas P-MP and TOB cannot. The SSWG suggests a single fee of $1.20 be adopted (P-MP) and that this be discounted for MSS by a factor of three based on the ability of these systems to share between themselves and with other terrestrial services. Thus the per kHz fee for MSS would be $0.40.

These inequities are widespread throughout the apparatus licence fee schedules and need to be urgently reviewed to ensure efficient allocation and equitable fees and taxes, not just for satellite services.

Consistency and simplicity

A simplified framework should enable licensees to understand and navigate their regulatory requirements, thereby minimising regulatory burden. It should use the least restrictive approach to reduce regulatory burdens, allowing licensees to focus on optimising their use of spectrum.

As outlined above, the current fee structure is inconsistent and gives 'discounts' based on unexplained criteria, which are deemed justifiable in relation to the efficient use of the spectrum.

There is also certainly a need for simplicity. The inconsistencies themselves make for a complex interpretation of a formula which can cause confusion.

Flexibility and adaptability to technology change

The highest value use of spectrum will change over time as technology develops, consumer and social preferences evolve, and as the circumstances of licensees change. These changes will also result in a change in the value of spectrum. The spectrum pricing regime should be flexible enough to reflect these changes to enable licensees to adapt spectrum usage to both market requirements and technological advances.

As with other services, space services require certainty in continued access to spectrum, in order to commit the massive investments required to develop and deploy innovative new satellites, constellations, and ground infrastructure. In turn this provides for equitable access to all Australians no matter where they live or work.

Transparency in process

A principle of good governance is transparency. Stakeholders should be able to understand the basis for the pricing arrangements associated with their use of spectrum. This in turn ensures that the ACMA is accountable for the decisions being made about spectrum pricing.

Transparency, except with broadcasting bands, does not seem to be an issue with the ACMA articulating changes well, providing that explanations are forthcoming in areas previously identified.

Recovery of the costs of spectrum management

The ACMA incurs costs for spectrum regulatory activities such as planning, interference management and coordination, and these costs should be recovered from those using spectrum. The Radiocommunications (Charges) Determination 2017 sets out the fee for services that can be directly attributed to a licensee, such as the consideration and issue of an apparatus licence. Indirect costs are those that cannot be attributed to a licensee. A notional component of the $231 million apparatus licence taxes contributes to the collection of the indirect costs of spectrum management. Spectrum licence taxes also enable the recovery of the indirect costs of spectrum management from spectrum licensees. The recovery of costs should be consistent with the Australian Government Charging Framework.

The costs of spectrum management seem disproportionate to the work required to develop and support spectrum licences. The recent 26 and 26/28 GHz ACMA Technical Liaison Groups (TLGs), examining the potential of spectrum licensing, placed a heavy burden on the ACMA and industry alike. Yet industry receives no credit for its efforts.

There should be a buyer's premium – referred to previously – in addition to spectrum maintenance fees levied on spectrum licences to fully cover the cost of developing new spectrum licences and to recognise the burden these processes place on other operators who do not benefit from market based allocation.

An example of a proposed new pricing formula

This example looks at the MSS, within what are known as the '2 GHz MSS bands' (1980 to 2010 MHz paired with 2170 to 2200 MHz). There are other frequency bands (such as 2483.5 to 2500 MHz and 1610 to 1636.5 MHz bands) where 'one off' discounts have been applied based on modulation.

Currently, the 2 GHz bands temporarily support TOB services in population centres, but can also support mobile satellite, fixed and mobile services. The bands are subject to review by the ACMA. We will assume the current assignment, although if terrestrial mobile services were permitted in the bands, the outcome would be similar. The ideal outcome from an SSWG perspective would be allocation to the MSS.

MSS networks can, to a defined extent, re-use the same spectrum with other MSS networks using different orbital arrangements, timing, and polarisation.

For the 2 x 30 MHz, to date the MSS would be charged $168,186 as an annual tax component for an Australia Wide space transmit/receive pair (assuming the terrestrial component were class licensed). TOB pays only $32,070 for a similar Australia Wide licence, noting also it is in practice for the high population areas.

The SSWG believes a single per kHz figure might be possible for all licence types. However, this figure would be discounted to recognise the benefits and burdens of sharing spectrum where sharing does in fact take place.

Whilst some MSS systems have exclusive channel allocation to different operators, most MSS systems can also share to a certain extent using orbital parameters, antenna discrimination, and modulation schemes. The MSS may also sometimes share with terrestrial systems. When this happens a discount proportional to the number of systems operating in a particular band should be offered. For example if two systems operate in a particular band then the MSS operator should pay only 50% of the full annual fee for the licence.

Finally, all elements of the terrestrial MSS network should be included in the Communicating with Space Objects Class Licence. Applying individual licensing to handsets and IoT terminals is an extreme dis-incentive and is inequitable. A historical decision to remove the 2 x 30 MHz spectrum from the Class Licence in the 2 GHz bands should be reversed.

Example of equitable sharing in FSS bands above 10.7 GHz

There are a number of issues in the FSS bands above 10.7 GHz affecting the Ku-band, and particularly, as already mentioned above, in the Ka-band. This is not taken into account in the current licence fee calculation.

Because multiple satellite systems make use of the same spectrum without limiting the operation of others, there is in fact no scarcity within that band between satellite networks and systems.

The SSWG suggests the following changes:

- A 'discount' should therefore be applied to take into account the fact that multiple satellite networks and systems can operate simultaneously in the same band.
- A discount be applied in bands where constraints are placed on FSS due to a requirement to share with other services. As discussed in Section 2 above, a number of different sharing regimes have been developed by the ACMA in different bands, and the discount factor would vary accordingly. In the 10.7 to 11.7 GHz band where class-licensed FSS earth stations are secondary to primary FS in the band, then the Australia-wide space fees should be heavily discounted on account of the lack of denial. On the other hand, in the 27.5 to 28.1 GHz band, ubiquitous FSS terminals may be precluded from urban areas (a population of about 15 million is denied ubiquitous FSS service), and as such, suitable discounts should be factored in the Australia-wide fee for the Ka-band.
- As per the current ACMA arrangements, minimal fees should be chargeable for secondary Space Transmit services (i.e. Ka-band Earth receive stations in the 18 GHz band and the 12 GHz band in Ku-band).

It should also be noted that the affected terrestrial area of modern Ka-band transmitting antennas, in terms of spectral denial is extremely low. Where FWA is co-primary, a 1.8m Ka-band transmitting Earth station antenna would deny less than 0.2 km^2 to the other service. Thus, whilst the FSS has defined primary status, the FSS is able to conceivably share with very little spectral denial. Through the judicious use of clutter, antenna discrimination and link budgets, the terrestrial service may be installed to avoid interference. Again, there is an argument for this to be factored into the satellite apparatus licence pricing fees.

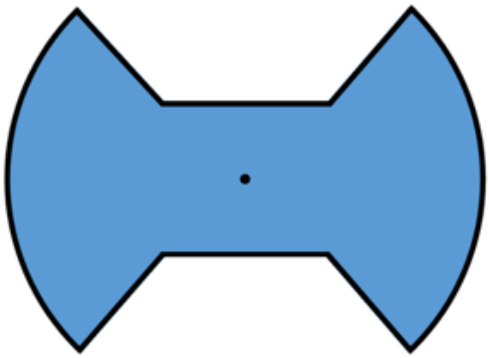
Question 4

Does the tax formula generally provide a solid base for incentivising the efficient use of spectrum?

The SSWG believes it does not. The formula delivers discounts based on service type (e.g. TOB and FWA are cheaper than FSS) rather than a fair assessment of intra- and inter-service spectrum denial. The SSWG suggests that the lower fee should be adopted across the board and then discounted based on the number of users that can realistically operate in the same spectrum in the same area and other applicable factors.

While the ACMA also champions 'opportunity cost', this is not yet evident in the excessive fees charged for many individually licensed systems.

In the case of single FSS Earth stations the licence fees are particularly excessive given the small area of 'spectral denial' they create. For example, a 1 GHz contiguous band of spectrum for an FSS Earth station in a HSDA currently costs $194,200 per annum. However an FSS gateway earth station of 1.8 m in diameter only denies approximately 0.2 km^2 of area, see Figure 2 on the following page.



The diameter of the area is approximately 250 m based on FWA protection requirements.

Figure 2
Stylised FSS transmitter pattern

The area presenting a transmitter pattern in Figure 2 is that which is denied to FWA that has no antenna discrimination on the direction of the FSS transmitter. Through the application of sound engineering methods, the area denied could be reduced significantly. This FSS transmitter potentially denies that spectrum for FWA use to only 86 people (based on a population density of 430 people per square km[7]). The SSWG submits that the current fee for this scenario is grossly excessive and certainly does not represent the actual spectrum denial. This reinforces the already mentioned suggestion that there is ample scope for drastic reductions in individual apparatus licence fees.

Question 5

Do stakeholders have views on:

- ***prioritising the features of the tax formula and other taxes by considering different focus areas***
- ***the criteria for prioritising the focus areas***
- ***other matters or focus areas that should be considered as part of the ACMA's work program.***

The tax formula and the current location weights in Table 1, as shown on Page 25 of the *Consultation Draft*, do not provide a solid basis for incentivising the efficient use of spectrum. As stated, the industry, in previous responses, has pointed out why this is the case.

The ACMA proposes to prioritise its approach to reviewing this tax formula and other taxes through 'Focus Areas' and seeks those areas which require immediate attention. The approach of using Focus Areas is a valid one if it allows the most needy problems to be resolved quickly, especially if they can be remedied in an efficient way.

In this regard, Focus Area 4 should be given immediate attention. It can be resolved in the first instance by agreement on how to interpret the Table 1 in the modern satellite environment. Taking slightly longer within this task would be a demographic audit to bring the density areas up to date.

[7] https://www.cityofsydney.nsw.gov.au/learn/research-and-statistics/the-city-at-a-glance/greater-sydney

Focus Area 1 would be almost an equal starting candidate. These two areas together would bring a great deal of satisfaction and meaningful progress to the satellite industry at an early time.

Focus Area 6, if it independently survives (and the SSWG believes it should not), should naturally be borne in mind as a consequence of Areas 1 and 4, whilst 2 and 3 could logically then follow. Focus Area 5 could progress under current assumptions and the nominated variables would essentially be a nice thing to do.

No other Focus Areas are recommended.

Question 6

What are the relevant price points to undertake an opportunity cost analysis of taxes for services above 5 GHz? Examples of relevant information may include:

- ***how prices for products and services have changed over time***
- ***how prices of radiocommunications equipment have changed over time relative to spectrum prices***
- ***comparisons with international auctions results or administrative spectrum prices.***

Opportunity cost reflects the value of services displaced by allocating the spectrum to a particular use. In the modern era it is effectively the ability to stream data to an end user (person, business or device). It is not related to equipment. Internationally, auctions provide evidence for charging but do not necessarily relate to the Australian market. While a single satellite in the European or US markets may have access to nearly a billion potential customers, one covering Australia is limited to a population of around 25 million. Thus, the cost to cover all Australians equitably exceeds that of other markets and should be factored in.

It is not sufficient to simply allocate the FSS service to the areas terrestrial operators do not want. This is a very outdated argument that ignores the fact that some FSS operators may exit in the Australian market if they are denied a viable business case through inequitable spectrum pricing and allocation.

The points that should be examined to determine pricing involve an holistic look at the ability to provide services to all Australians and Australian systems seamlessly, regardless of where they are, on the ground, at sea or in the air. Terrestrial systems cannot do this and thus satellite spectrum needs to be priced to incentivise this.

Question 7

How can taxes be designed to account for multiple devices? Under what circumstances do stakeholders believe that one tax should relate to many devices and/or there should be 'discounts' for multiple devices authorised under one licence?

FOCUS AREA 1: Large bandwidth and multiple (networked devices) requirements

With regard to the section of the paper on antenna farms (on Page18 of the *Consultation Draft*), the SSWG agrees with the ACMA observation that spectrum denial is not closely correlated with the number of antennas deployed at a site. The ACMA already applies a 30% discount for co-located earth stations. The SSWG would urge the ACMA to also assess whether larger discounts can be applied when a co-located earth station creates no more spectrum denial than previously licensed earth stations nearby. The SSWG expresses no view on whether an area-wide apparatus licence would be appropriate for earth station licensing without knowing more about how such a license would work. Some more flexibility on the applicable distances would also be beneficial.

In the case of co-located systems and those installed in 'Satellite Parks' only one fee, divided among all the users in the park, should be payable. The most equitable way to apply this would be to discount a licence by the number of co-channel operators in that area or in the satellite park. As observed previously, though, this may increase the administrative task for the ACMA

As already mentioned in the text of the consultation, for the specific case of antenna farms comprising identical antennas, operating in the same frequency range within the same NGSO satellite system, while each antenna will be tracking a different satellite at any one time, the overall range of antenna pointing angles and operating frequency range of each stations will be within the same envelope, with negligible additional spectrum denial. Consistently, a single apparatus license fee should be adequate to cover the entire antenna farm. In other words, the reduction for co-located and co-frequency earth/earth receive stations (already contemplated in the current Apparatus tax) should be of 100% for the additional antennas.

The prices for products and services together with radiocommunications equipment have significantly trended down largely due to new and innovative solutions in the satellite industry. Over a short space of time (compared to the age of the Table 1 assumptions) an order of magnitude change in available throughput capacity has come to market, and prices of satellite services and equipment and services have also enjoyed an order of magnitude change to lower levels.

For the use of many service links and terminals and where there is an element of spectrum denial, the relevant tax should take into account the actual usage and business deployment within the footprint of the satellite beam rather than a worst case proxy which has been the case assumed by the ACMA to date. This is particularly true in the case of multiple beam satellite networks for both GSO and NGSO systems. The approach of one satellite space/space receive apparatus licence to cover many terrestrial terminals, though, still remains the best solution and the legislation and instruments supporting that should remain. However, the interpretation of this in practice by the ACMA in the case of multiple beam GSO and NGSO networks is now strained to breaking point, is uneconomic for operators, and discounts need some attention to remain justified in Focus Area 4.

Regarding consistency of pricing across geographic areas and bands, the concept of density-based taxation certainly needs rethinking, as while it makes sense for gateway earth stations, the applicability to moving earth stations such as aeronautical/maritime/ land ESIM is debatable and requires at the minimum a suitable revision of the Australia-wide apparatus taxation.

As an additional comment on space-based communication system licensing, novel Low Earth Orbit (LEO) and Medium Earth Orbit (MEO) satellite systems will use bandwidth more efficiently and flexibly, on a per-need basis, in light of variable temporal and spatial capacity demand. Depending on the particular technical capabilities of the LEO or MEO system, beams can be pointed only where and when needed and spectrum, spanning over approximately 4 GHz, can be allocated to each beam flexibly and dynamically, using on-board satellite processing. While this is a new way of operating, licensing frameworks in many countries are still geared towards lower capacity/static coverage systems. The SSWG believes that an adaptation of licensing frameworks may be needed to avoid regulatory fees becoming an economic barrier to entry, and an unrealistic distortion in understanding and characterising these novel technologies.

In the case of Australia, some steps have already been taken in the recent past, with the welcome reduction in taxation for Ka-band systems. However, while the space station apparatus licensing allows for the Australia-wide coverage, the applicable tax over 4 GHz would be very high, given that for an actual use of spectrum as described above, usage

of spectrum is potentially non-uniform and non-continuous (as dependent on demand) over the territory and the frequency band.

Overall, the very large and unprecedented amounts of spectrum needed in higher frequency bands (Ka and above) should also lead to a significant reduction of current fees, to make the introduction of novel systems viable.

Question 8

While the current low power discount provides for a significant reduction in taxes of 90 per cent, the ACMA is interested in considering further incentives to promote the greater sharing of spectrum.

Do the lower potential denial areas of different services provide a case for considering different or additional low power discounts? In responding, please provide:

- ***examples of these services and the denial characteristics of these services***
- ***the information that may be required for the ACMA to be able to apply a discount***
- ***views on whether such approaches can be applied across different licence types and bands.***

FOCUS AREA 2: Sharing and low interference potential devices

As we have demonstrated, FSS terminals are, in effect low interference potential devices. While at first glance a Ka-band 1.8 m FSS terminal appears to deny about 0.2 km^2 of spectrum area to an FWA network, with careful use of antenna pointing, protection management, terrain and clutter this area can be significantly reduced in the cases where FWA is co-primary.

In areas where FWA is secondary the probability of colocation is low, because population densities mean FWA in 28 GHz would not be an application of choice. But just as FSS can coexist with the fixed service in 18 GHz (Ka downlink) on a probabilistic basis FWA may be able to coexist on the same basis with a low probability of failure in areas where it is secondary.

Question 9

Do stakeholders have comments on:

- ***the proposal to monitor bands for potential changes in taxes and the balance and precision required in monitoring and pricing spectrum?***
- ***the use of inflation to keep apparatus licence taxes contemporary and whether there are alternative approaches?***

Focus area 3: Defined approach to considering changes in taxes and opportunity cost pricing

If prices were set according to true opportunity cost, that is (services times people denied), then ongoing monitoring of prices would not be needed. The ACMA would simply need to update a 'table of discounts' as population areas changed and the ability or willingness of systems to share improved.

The use of consumer price index (CPI) appears to be a valid mechanism to adjust prices but may need to be varied in special circumstances (e.g. COVID-19).

Updating taxes on the basis of CPI adjustments, is a commonplace occurrence throughout many parts of the economy and is supported by the SSWG. Alternative approaches might be confusing and do not need to be invented.

Question 10

Do current spectrum locations or frequency ranges remain appropriate? If not, what changes should be made and why?

Spectrum locations and frequency ranges need to be implemented in a way which achieves the objectives of efficient use of spectrum, justifiable pricing, and a responsiveness to newer developments in satellite technology and servicers. Clearly, after so much time, the geographic density areas should be re-assessed, but the immediate application of Table 1 should be refined to account for technologies which were not originally envisaged and have since been applied with difficulty and a lack of transparency in methods and guidelines.

Many High Spectrum Demand Areas (HSDA) areas have no people in them (e.g. the eastern Blue Mountains) and could be considered as remote areas. Pricing using rough boundaries serves to deny valuable services to people living in these areas.

The ACMA should examine the feasibility of developing a finer population density model that could be applied to individual apparatus licensed systems e.g. for Gateway applications. In addition, and also to 'discount' Australia wide licence fees where a significant population mass is denied to that service in that band.

Question 11

What factors should the ACMA consider in determining new spectrum locations or frequency ranges?

Spectrum locations and treatment of spectrum accesses should rely more heavily on consolidated site licensing to avoid an unnecessary explosion in the number of Apparatus Licences. This is especially true for feeder links. The goals should be to reduce the overhead burden of licensing, unnecessary imposts on industry, and efficiency in administration.

True population should be the basis for density charging with a cut-off exemption (zero tax) for areas below, 'say' 1 person/km^2.

Question 12

Do the different tax rates associated with different spectrum locations or frequency ranges influence decisions about deploying radiocommunications equipment?

The different tax rates associated with different spectrum locations or frequency ranges most definitely influence investment decisions and ultimately the availability of new services to commerce and to the public. The basis of ACMA decisions in this area should be to firmly support development and not to raise regulatory barriers that will distort market opportunities and evolution.

Most of the ACMA's approach rests on population distribution. The market and industry have other variables to respond to and would value the ability to express commercial judgement in the licensing process.

In the past, one operator moved an extensive gateway system to New Zealand due to pricing in Australia and FSS. MSS operators may consider not covering Australia if spectrum availability or pricing impact negatively on the business case.

The current inequitable pricing structure acts to both remove the incentive to share spectrum and to exclude certain services by giving preference to others. It is not based on spectrum value and its origins seem to be lost in time, back when today's satellite technology was only a pipedream.

The SSWG has sympathy for the considerations raised by the ACMA on variability amongst density areas and assumes this will be retained in its considerations.

In terms of pricing constructs available for apparatus licences, the SSWG believes that the fundamental reliance on the tax formula and a better interpretation of a taxation table is the preferable course to move forward, accompanied by an audit in the course of time of the geographic distribution of population density areas, and subject to justifiable and realistic discounts. The recognition of new satellite terminal ubiquity, and high capacity operations are initiatives which the SSWG warmly welcomes and supports. The ACMA is to be congratulated in responding in a supportive way to these fundamental shifts in managing spectrum to support satellite services.

Question 13

How does the value of spectrum change across geographic locations?

In terms of the bands of interest within the boundaries of spectrum addressed in the *Consultation Paper*, the satellite industry values the spectrum across all geographic regions. The genesis of business need varies amongst the regions, but it would be a mistake to assume that any particular region would be better served if the satellite industry was not involved.

Spectrum above the HF Bands in populated areas generally has a value commensurate with the population covered. Examples of this are the bands supporting 4G and 5G services. Where population density decreases beyond a certain point it is no longer viable to cover those areas.

Exceptions to this may be individual radio systems such as are used in the aeronautical or maritime services with the ability to cover large distances or where there may only be a few users, there is an advantage.

Question 14

The ACMA also seeks views from stakeholders about:

- ***should density areas be refined for different services/bands?***
- ***rather than having density areas, do models of congestion (like that used in the 400 MHz work) potentially better reflect demand for services and the value of spectrum? If so, what features would such a model have?***
- ***whether different pricing constructs, such as $/MHz/Pop for different licence types should be considered?***
- ***whether there should be parity in pricing arrangements between services like commercial broadcasting taxes and open narrowcasting taxes?***
- ***whether there are other services where the ACMA should be considering providing greater parity in pricing?***

Focus Area 4: Consistency of pricing approach across geographic areas and bands

Dealing with the licensing of multiple beams in modern GSO and NGSO networks and the incompatibility of the footprints of those beams with the ACMA's density maps, has become a considerable challenge, in some cases leading to exaggerated and unreasonable pricing. This incompatibility will be even more exacerbated in relation to newer systems, as clarified further below.

At the heart of this matter is the overlap of ACMA terrestrial density areas by individual satellite beams. The ACMA licences the satellite operations on a per beam basis, each beam (or sub-beam) being regarded as a 'spectrum access'. Some satellite systems have

a fixed beam array which may comprise tens or up to a hundred static beams having footprints on Australia. If the satellite is a 'bent pipe' design, then the distribution of capacity through the beams is constant for the life of the satellite. If re-configuration is available electronically in the satellite, then capacity can be switched around during the lifetime of the satellite and according to changing commercial demography of the customer base and the operator's needs.

Where a beam overlaps more than one geographic charge area, e.g. a high density and a medium density area, then the ACMA charges the highest common factor for the licence, i.e. all at the high charge area cost. This causes an exaggeration of the licensing costs to the operator who in practice has business in both of these areas. As can be seen from Table 1, there are very significant differences between high and medium areas in this example in the Ku-band and Ka-band. A solution to this difficult and oversimplified approach would be to add an extra box in the licence application form requesting the percentage of business spread which the operator anticipates between the two areas and to apply this to an area discount. An even simpler approach on the basis of opportunity cost principles would be to select the next alternative cost level which in this example would be the medium charge area i.e. the lower common denominator in this example. Whilst this would be simpler and more elegant, it would probably result in undercharging in real circumstances.

An extension of this situation comes with the most recent satellite design, such novel NGSO systems, which, thanks also to onboard processing, will use bandwidth in an entirely flexible manner and on a per-need basis, following the temporal and spatial variations in capacity demand. Full flexibility extends to beam pointing and beam shaping, in addition to variable spectrum allocation to each beam. Furthermore, visible area coverage can be achieved by beam hopping at a rate fast enough that all user terminals scattered across the entire field of view can share full access to the satellite.

It is clear that such flexible design is no longer reflected by a fixed patchwork of beam footprints. Also, the current division in density areas, in relation to the fees, is no longer applicable. With reference to Ka-band, these novel systems, need flexible access to around 4 GHz of spectrum over Australia, in order to make full use of their potential. Even if actual spectrum use varies continuously in time, space and bandwidth, an Australia-wide apparatus license would be required. The resulting current fees would however be so high to make, it in practice, unfeasible.

A possible way forward would be to calculate an 'average' temporal and spatial spectrum use at the end of each year. This would however require for the satellite system to be able to store all relevant parameters for such calculation and would also lead to complex negotiation on how to perform the calculation, based on the current density areas.

On the other hand, a simple, transparent and, to the extent possible, future proof solution, compatible with novel dynamic and high throughput satellite system design, is a reasonable Australia-wide tax, along the lines of the one proposed in this submission.

Question 15

Do stakeholders have views on:

- ***the current pricing arrangements for scientific-assigned licences for new technologies?***
- ***the proposal for new short-term scientific-assigned licence trials and alternative pricing proposals?***

Focus Area 5 : New technologies and trials

At a time when new and innovative services and technologies are at a peak in the satellite industry, and when Australia is seeking to make inroads in the global space industry, flexibility and adaptation are essential characteristics of a life support system for nascent developments in the satellite field. Australia cannot countenance a stifling regulatory framework.

The SSWG supports the minimal tax approach for short term 'scientific assigned licences', perhaps with a better title to reflect the broader ambit of the scheme. The SSWG would also support extensions of the scheme beyond twelve months, recognising the long timeframes associated with the industry.

A graduated approach to pricing arrangements would be appropriate, consistent with the time envelope of the application and with a view to covering for over optimistic development schedules influenced by the need to attract investors.

Question 16

Do these proposals promote transparency and ease in calculating taxes?

The ACMA proposals bring out issues of a lack of transparency and complications in dealing with the current framework to achieving a licence. The SSWG has highlighted these issues and the inequities of spectrum fees contained in what is now an outdated and unclear basis for charging,

Focus Area 6 : Transparency and ease of calculating taxes

It is questionable whether this should be the subject of a separate project and whether the ideas and intent should be incorporated into all of the other Focus Areas 1 to 5. There is already a great deal of overlap, and whilst it is appreciated that the ACMA may wish to silo projects for administrative convenience, there is a loss in not having comprehensive consideration at the same time. This in response to Question 16, it is a testament to compartmentalised thinking that a separate Focus Area should be suggested. The SSWG does not support this.

4. Conclusions

To conclude and summarise, the SSWG recommends substantial reductions in apparatus licensing fees for space services. This will increase the range of satellite services available to all Australians and is essential if Australia is to build a globally competitive space industry and bring innovative and affordable satellite solutions to Australian consumers and users.

In general terms, such proposed reductions include:

- a new baseline of spectrum pricing for Australia-wide Apparatus licensing, mapping through to the already familiar and accepted geographic discounts for high, medium and remote density areas. The SSWG favours this approach of area discounting to continue.
- application of appropriate discounts for space services on account of reusability of spectrum among GSO and NGSO satellites and other appropriate factors
- introduction of the concepts of spectrum denial caused by earth stations and the practical consequences of evaluating opportunity cost pricing for individual stations and where a number of stations are collocated in the same band.

In the document, the SSWG has focused most of its assessment and examples on Ka-band, as a new emerging band, but similar principles are also applicable, with adequate consideration, to other frequency bands.

The SSWG's specific recommendations include:

Space station fees

- an Australia-wide fee of 0.05$/kHz in the 17.3 to 31.3 GHz band
- an Australia-wide fee of 0.4$/kHz in the 2 GHz band

Earth Station fees

- a reduction of at least a factor of 3 and 5 for medium and high-density individual apparatus licence fees, respectively.
- avoidance of duplicative fees for co-frequency co-located antennas or antennas in a satellite park that do not create any additional spectrum denial.
- a single apparatus licence fee is suitable for NGSO antenna farms comprising multiple identical earth stations operating with the same spectrum within the same satellite system.

The SSWG is of the opinion that attention to these overdue considerations by the ACMA would re-focus and re-position regulation of satellite spectrum for the better good of Australian consumers and users.

The SSWG looks forward to the outcomes of consideration of submissions by the ACMA and to the influence of submissions on the next edition of the FYSO and, in particular, the ACMA Work Program.

Appendix A Acronyms and abbreviations

AMPS	Advanced Mobile Phone System (First Generation mobile)
AWL	Area Wide Licence
EME	Electromagnetic Energy
ESIM	Earth Stations In Motion
FSS	Fixed Satellite Service
FWA	Fixed Wireless Access
FYSO	Five Year Spectrum Outlook
GSO	Geostationary orbit
HSDA	High spectrum demand areas
HVU	Highest Value Use
IoT	Internet of Things
ISM	Industrial, Scientific and Medical
LEO	Low Earth Orbit
LMDS	Local Multipoint Distribution Service
M2M	Machine to machine
MSS	Mobile Satellite Service
NGSO	Non-Geostationary Orbit
P-MP	Point to Multipoint
RALI	Radiocommunications Assignment and Licensing Instruction
SAN	Satellite Access Network
SCADA	Supervisory Control And Data Acquisition
TOB	Television Outside Broadcast

Communications Alliance Satellite Services Working Group membership

Amazon Web Services
APN
Coutts Communications
EchoStar Global Australia
Foxtel
FreeTV
Inmarsat
Intelsat
Ipstar
Nbn
Omnispace
OneWeb
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ALLIANCE LTD

Level 12
75 Miller Street
North Sydney
NSW 2060 Australia

PO Box 444
Milsons Point
NSW 1565

T 61 2 9959 9111
F 61 2 9954 6136
E info@commsalliance.com.au
www.commsalliance.com.au
ABN 56 078 026 507