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ONLINE SUBMISSION

12 September 2019

The Manager
Spectrum Planning Section
Spectrum Infrastructure Branch
Australian Communications and Media Authority
PO Box 78
Belconnen ACT 2616

Re: Planning of the 3700-4200 MHz Band (August 2019) (IFC: 27/2019)

Intelsat, the leading provider of fixed-satellite services ("FSS") worldwide,[1] is pleased to submit comments to the discussion paper on Planning of the 3700-4200 MHz band, published by the ACMA in August 2019.[2] Intelsat welcomes the ACMA's interest in investigating options for future uses of the 3700-4200 MHz band, including for the possible deployment of wireless broadband ("WBB") services in Australia. We particularly appreciate the ACMA's comment that "while this paper includes a substantial discussion on possible wireless broadband use of the band, this does not indicate a predisposition on behalf of the ACMA regarding possible changes to the band."[3]

As the ACMA notes in the Discussion Paper, debate on the use of C-band for WBB services has occurred for several years (and WRCs), and at times has been of an intense nature. The debate is unlikely to be less intense in the future, as 5G services deploy in the lower part of the C-band. But regardless of the nature or difficulty of this debate, it is important for the ACMA to acknowledge the fact that satellite services and investments in C-band should not be jeopardized to meet any 5G spectrum requirements that could be met on spectrum already identified for such applications.

[1] For the past 50 years, Intelsat has been delivering information and entertainment for many of the world's leading media and network companies, multinational corporations, Internet Service Providers and governmental agencies, among many users. Intelsat Asia Carrier Services, LLC, a subsidiary of Intelsat US LLC, holds an Australian carrier licence under subsection 56(1) of the Telecommunications Act 1997.

[2] See, Discussion Paper, Planning of the 3700-4200 MHz Band (August 2019) (hereafter "Discussion Paper"), available online at https://www.acma.gov.au/theACMA/planning-of-the-3700-4200-mhz-band.

[3] Discussion Paper, at 4 (emphasis added).

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Issues for Comment

In the Discussion Paper, the ACMA itemised a list of specific questions for comment. We address these issues below.

1. Are there any other international developments in the 3700–4200 MHz band that the ACMA should be aware of?

At WRC-15, the 3700-4200 MHz band was not identified for IMT consideration. Instead, the 3400-3600 MHz band was identified on a pseudo-global basis for terrestrial wireless broadband. However, in Region 3 this identification was done via a footnote. Although this spectrum was intended to represent an important resource to enable and accelerate next generation terrestrial mobile broadband deployments in mid-band frequencies, the fact is that four years after this global identification was made, C-band frequencies in the 3400-3600 MHz band remain largely underutilized for terrestrial mobile broadband services. There is ample capacity in this band to satisfy expected growth in mobile data use in the years to come, without the need to identify additional mid-band spectrum for such uses.

Thus, prior to making any decisions on whether the 3700–4200 MHz band should be made available for deployment of WBB services in Australia, the ACMA should undertake an extensive review and audit of the usage of the 3575–3700 MHz band (*i.e.*, the 3.6 GHz band), which was awarded to terrestrial 5G services in December 2018 at the expense of the satellite industry. This review and audit should be undertaken to determine whether or not there is a need for additional spectrum for such applications and, if so, how much additional spectrum will be needed. The outcome should be made available to the public, and ACMA should conduct another public consultation before any decision is made on the 3700-4200 MHz band.

It is also worth noting that over 33 GHz of spectrum are being considered at the upcoming WRC-19 conference for terrestrial 5G, including 20 GHz in frequency bands where satellite does not operate and which can possibly be made fully available for terrestrial 5G networks. No one disputes that mobile data traffic is increasing, but mobile operators should be encouraged to first improve the network density and efficiency within their existing spectrum and fully utilize spectrum already identified for IMT before asking for additional spectrum already extensively used by other services.

2. What are the future requirements of point-to-point links and FSS earth stations in the 3700–4200 MHz band? Does this differ by geographical area and/or segment of the band?

Due to the ubiquitous nature of satellite services and the fact that the 3700–4200 MHz band is shared among different satellite operators, the future requirements of FSS earth stations in the 3700–4200 MHz band will need to be taken into account by the ACMA. In this regard, Intelsat notes that the satellite industry as a whole continues to make substantial multimillion investments in C-band satellites and ground infrastructure.

Intelsat does not agree with the ACMA's implied suggestion that FSS use is decreasing in the 3700-4200 MHz band simply because fewer FSS earth station apparatus licenses have been issued.

[INFORMATION REDACTED]

The ACMA is well aware that the 3700–4200 MHz band is heavily used for satellite communications in the Asia Pacific region, including Australia, for critical services such as air navigation, maritime communications, and meteorology services. These services complement other economically important ones like TV broadcasting, VSAT networks, internet broadband services, banking networks, and mobile backhaul used to extend terrestrial networks. The services take advantage of the unique physical characteristics of C-band, which makes satellite communications more suitable than other frequency bands given the region's geography and climate. We do not believe it is feasible to relocate FSS earth stations to particular geographic regions or exclusion zones due to the destructive disruption this would create not to mention the added cost

The C-band frequencies (3400–4200 MHz for the downlink, and 5825–6725 MHz for the uplink) and in particular the 3700–4200 band, are the core frequency bands for the provision of satellite services in the Asia Pacific region and are considered as a "red flag" band for the satellite industry since they provide wider coverage with high availability and superior propagation characteristics to overcome high rain attenuation. Figure 2, below, depicts how a C-band satellite can use its capabilities to deliver services over Australia and the Asia-Pacific region.

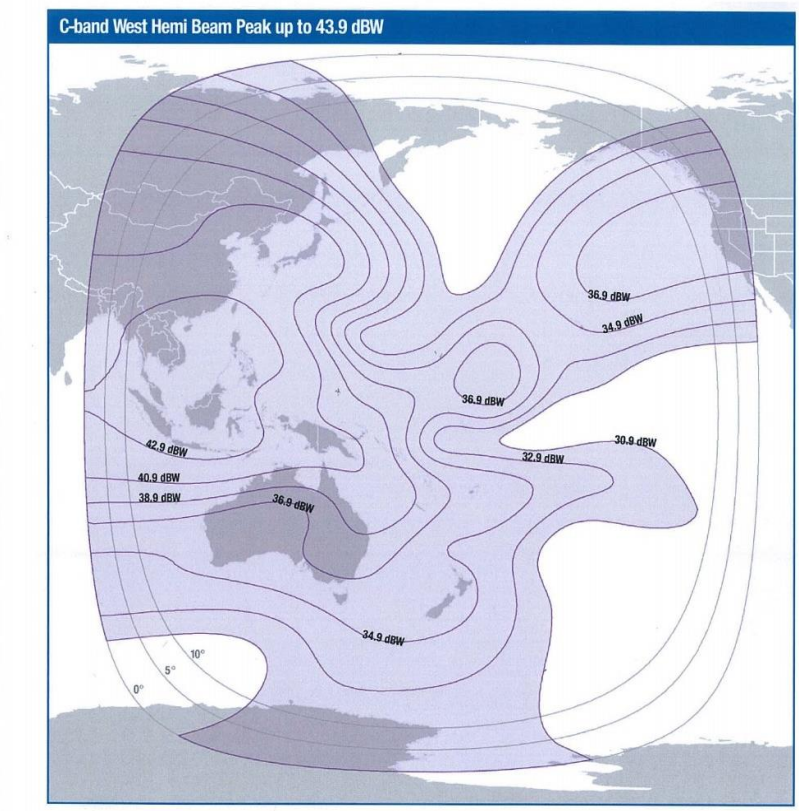


Figure 2: Example of C-Band Coverage over Australia and the Asia-Pacific Region

C-band earth stations have been, and continue to be, extensively used in the Asia-Pacific region, delivering AUD$ billions in value through multiple sectors of the communications industry and greatly contributing to the socio-economic growth of the region. A large number of administrations and satellite operators in the Asia-Pacific region utilize C-band satellite services in support of a great diversity of services. Many C-band stations are seen today on the rooftops of commercial, educational, government, and residential buildings, supporting critical applications for private and government users alike. Every city, town, and village across Australia and the region has C-band stations whose performance would be greatly impacted if frequencies used by satellite services are forced to share with terrestrial mobile broadband services. Using C-band frequencies for terrestrial 5G in the Asia-Pacific region threatens the millions of television reception stations and a wide range of critical and safety related applications including vital emergency communications.

3. If licensed point-to-point links and FSS earth stations are affected by re-planning activities in the 3700–4200 MHz band, what alternative deployment options could be considered?

As shown in Figure 3, below, the LS Telcom study[4] indicates there is 50 MHz of spectrum identified for IMT in Region 3 that have not yet being licensed and utilized in Australia. Should there be a need to identify more spectrum for WBB services and based on the ACMA conducting an extensive review and audit as discussed above, this 50 MHz of spectrum that have not yet being licensed and utilized should be the primary candidate band for the deployment of such services. Meanwhile, we note that the 5G NR technology supports bandwidths 10, 15, 20, 30, 40, 50, 60, 70, 80, 90, and 100 MHz, and carrier aggregation can be used for combining spectrum in different frequency bands. Thus, we believe there is no imminent need for wide contiguous spectrum blocks of additional spectrum for 5G.

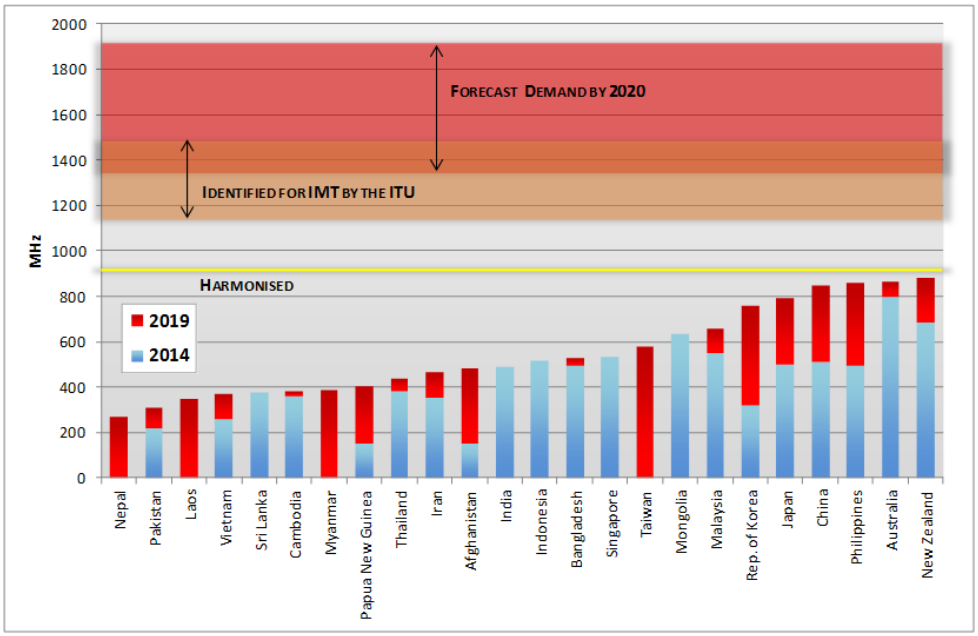


Figure 3: Spectrum Licensed for IMT Services in Region 3

As an additional reference, the ACMA should also consider the information in Table 1, below, which shows the harmonized spectrum for terrestrial mobile services that is available in Region 3. A total of approximately 915 MHz could be used for the deployment of WBB services in Australia in a harmonized manner. The ACMA could review and identify which harmonized IMT spectrum has not yet been licensed and utilized and could be made available for the deployment of WBB services.

[4] See https://www.lstelcom.com/fileadmin/content/marketing/news/2019_Study_LicensingUseofMobileSpectrum.pdf.

GPP Band		Uplink (MHz)	Downlink (MHz)	Region 3
FDD Bands				
31	450 MHz	452.5 - 457.5	462.5 - 467.5	10
28	700 MHz	703 - 748	758 - 803	90
5	850 MHz	824 - 849	869 - 894	Up to 130
8	900 MHz	880 - 925	935 - 960	
3	1800 MHz	1710 - 1785	1805 - 1880	150
1	2100 MHz	1920 - 1980	2110 - 2170	120
7	2600 MHz	2500 - 2570	2620 - 2690	140
Sub-Total				640
TDD Bands				
75/76	1400 MHz	1427 - 1517		90
33	1900 MHz	1900 - 1920		20
34	2000 MHz	2010 - 2025		15
40	2300 MHz	2300 -2400		100
38	2600 MHz	2570 - 2620		50
Sub-Total				275
TOTAL				915

Table 1: List of Harmonized IMT Spectrum in Region 3

In addition, as noted above, the ITU-R is exploring possible additional IMT identifications on more than 33 GHz of spectrum as a part of WRC-19. Therefore, there seems to be little merit to the consideration at this time of other frequency bands for 5G, in particular those frequency bands that are critical to other radiocommunication sectors. Intelsat is fully supportive of some of the frequency bands being studied under Agenda Item 1.13 being made available for IMT at WRC-19. An adequate and generous allowance of spectrum for IMT is available without having to resort to other frequency bands, in particular C-band.

Among the more than 33 GHz of spectrum under Agenda Item 1.13 at WRC-19, there are at least a total of 3250 MHz of spectrum within the 26 GHz band (*i.e.*, 24.25–27.5 GHz) that can be identified for IMT. The 26 GHz band should be carefully considered by the ACMA for the deployment of WBB services in Australia. Agenda Item 1.13 at WRC-19 identifies this band as one of the candidate bands for IMT, and the 26 GHz band is considered as one of the core spectrum resources for terrestrial 5G by several administrations in several regions around the world. Should there be a need for additional spectrum for the deployment of WBB services in Australia, the ACMA should wait for the outcome of WRC-19 and consider first the bands with high probability for global harmonization.

Another approach for the ACMA to consider when considering the deployment of WBB services in Australia should be the refarming of those frequency bands that have been used for 2G, 3G and 4G networks. This kind of approach has been used, for example, in China. In December 2018, China Mobile was authorized to conduct 5G trials in the 2515-2675 MHz band. In the future, according to the needs of MNO operators, this frequency band could be refarmed for 5G, including WBB.

4. In the event arrangements are made for new services in the 3700–4200 MHz band, do stakeholders have any comments on the ACMA's proposal to maintain the existing arrangements for Radiodetermination and LIPD devices, and the existing policy around TVRO systems?

Intelsat believe that the satellite sector will likely experienced lack of necessary spectrum if traditional methods of spectrum allocation and long-term assignments are to prevail. Today, satellite networks in the form of NGSOs and low earth orbit systems are approaching the technical performance and pricing of terrestrial networks. Moreover, these NGSO networks are likely to interwork with GSO networks in the future (including C-band) to combine the advantages of both architectures and bring to the market substantial capabilities beyond the ability of terrestrial networks. It is therefore important to preserve the breathing room for these development in satellite services.

The discrepancy between lifetimes of an apparatus and a spectrum license has been shown to be a mismatch of poor proportioning. Satellites with a long lifetime have been apparatus licensed, whilst terrestrial mobile networks have a long license which isolates them from pressure to perform efficiently when using spectrum. At the same time those terrestrial networks are crowding out other services. This highlights the need for considerable attention to relevant coordination and sharing within C-band, starting in an incremental way.

5. What are the future requirements for WBB services in the 3700–4200 MHz band and what arrangements should be considered? Does this differ by geographical area and/or segment of the band?

Intelsat believe the current satellite technology has been able to deliver internet broadband services to the end users wherever they are.

6. What WBB deployment scenarios should be considered for the 3700–4200 MHz band? Should use be limited to one scenario or should more flexible arrangements be implemented?

Satellites will play a vital role in the future 5G ecosystem and their role needs to be taken into account by the ACMA as indicated by both the ECC report on the role of satellite in 5G[5]. Multiple technology demonstrations have been successfully held around the world that show satellites can support the software-defined network (SDN), network virtualization ("slicing") and mobile edge computing (MEC) functionality expected in 5G networks. Reducing the ability of satellite operators and services to access and use spectrum will impact the role satellite will play in the future 5G ecosystem.

[5] https://www.ecodocdb.dk/download/e1f5f839-ba17/ECCRep280.pdf

7. What is the current and planned availability of fixed and mobile WBB equipment in the 3700–4200 MHz band?

No comment.

8. Is there interest in the use of other new service types in the 3700–4200 MHz band?

No comment.

9. What services/applications should be accommodated in the 3700–4200 MHz band?

No comment, other than incumbent services in the 3700-4200 MHz band need to be protected from harmful interference from new services.

10. Which frequencies ranges should be made available for these services/applications?

Additional spectrum for WBB services in Australia could be identified in other frequency bands outside the 3700-4200 MHz as discussed in detailed on our answers to question 3 above.

11. Which geographic areas should be made available for these services/applications?

We do not believe it is feasible to relocate FSS earth stations to particular geographic regions or exclusion zones because, as noted previously in the response to question 2, the 3700–4200 MHz band is heavily used for satellite communications in the Asia Pacific region, including Australia, for critical services such as air navigation, maritime communications, and meteorology services. These services complement other economically important ones like TV broadcasting, VSAT networks, internet broadband services, banking networks, and mobile backhaul used to extend terrestrial networks. These services take advantage of the unique physical characteristics of C-band, which make satellite communications more suitable than other frequency bands given the region's geography and climate.

Additionally, as noted in response to question 14, below, co-frequency sharing between FSS and terrestrial 5G/IMT is not feasible and interference into FSS will occur when terrestrial 5G/IMT and FSS operate, even in adjacent bands.

12. On what basis should access be provided? Should access be granted on an exclusive or shared basis, on a coordinated or uncoordinated basis, et cetera?

The ACMA should give its considerations first to answers on question 1 and question 3 prior to giving any access to the new services in the 3700-4200 MHz bands. Furthermore, we do not see any considerations from ACMA on the compatibility challenges between FSS and terrestrial 5G/IMT.

13. What licensing mechanisms are appropriate (spectrum, apparatus or class licensing)?

No comment.

14. If arrangements for WBB specifically are implemented in the 3700–4200 MHz band, are the proposed interference management techniques with services in the 3.6 GHz band suitable? Are any other techniques proposed? Are there any other compatibility issues with the 3.6 GHz band the ACMA should consider?

Intelsat firmly believes that there is no justification for introducing WBB services into any part of the 3700-4200 MHz band, for the reasons already stated. An additional compelling reason is that no suitable interference management techniques have been demonstrated. The ACMA would first need to conduct additional technical studies and field trials to properly identify the regulatory measures (e.g., indoor use restrictions, guard bands, OOBE conditions, separation distances and filter specifications, etc.) that are required to prevent harmful interference to incumbent services in C-band. In addition, the practicability and logistics of migrating existing satellites services in Australia out of a determined range of the C-band (e.g., above 3800 MHz) or to any other frequency band will also require further assessments, including the impact to deliver satellite services with the availability and coverage it requires.

The interference management techniques in the 3.6 GHz will not be suitable for WBB services if these new services are implemented in the 3700–4200 MHz band when considering that FSS usage in the 3700–4200 MHz bands is more extensive than in the 3400–3700 MHz band.

Given that WBB services are an IMT application, spectrum sharing considerations need to be taken into account due to the high power and ubiquity of IMT and their impact on FSS stations, as confirmed by several ITU-R studies.

The studies conducted by the ITU-R, as well as several studies performed by both the mobile and the satellite industries, clearly show that co-frequency sharing is neither feasible nor practical between these two services. FSS earth station receivers are designed to receive signals from satellites located 36,000 kilometres above the Earth, which makes these signals orders of magnitude weaker than terrestrial signals. These earth stations require large exclusion zones in order to be protected from interference from terrestrial mobile networks. Even when IMT and FSS operate in adjacent frequency bands, interference into the FSS will occur, unless carefully managed as can be seen in Figure 4, below.

Spectrum sharing with (much) more powerful IMT-2020/5G becomes even more difficult and definitely imposes geographical separation between spectrum users and exclusion zones for IMT. This is because, as outlined above, FSS stations are very sensitive to interference from terrestrial IMT signals, which can interfere with receive earth stations in two ways:

1. IMT saturates the LNB of the FSS earth station, even if the mobile 5G signal is adjacent to the satellite signal; and

2. out-of-band-emissions ("OOBE") of the mobile 5G signal can cause in-band interference to FSS signals.

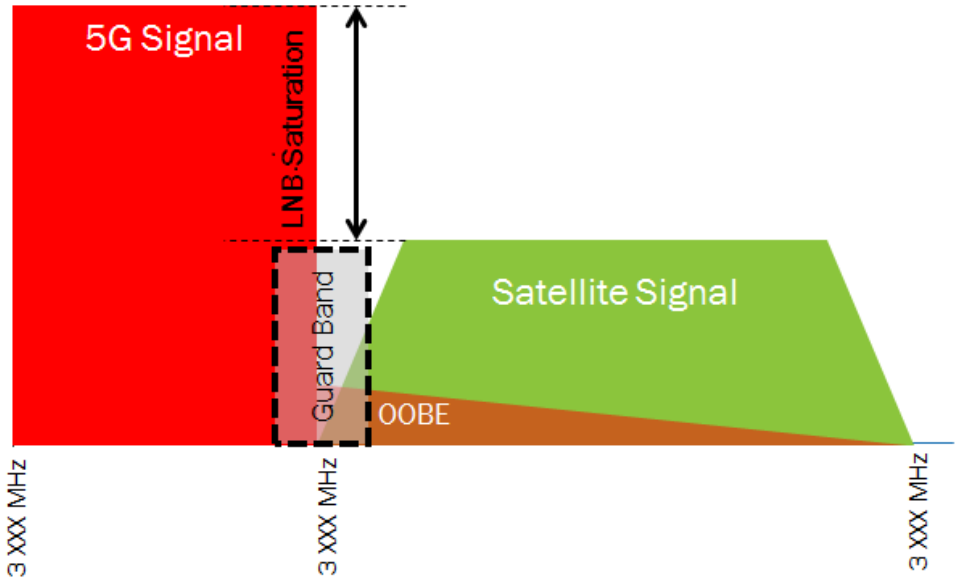


Figure 4: 5G Signals Must be Carefully Managed

Imposing a spectrum sharing framework between FSS and IMT can pave the way to dismissing existing FSS services, which are very much needed in Australia. Current OOBE levels specified in 3GPP standards do not protect FSS signals in adjacent frequency bands. Therefore, the combination of protection measures such as using a guard band, imposing separation distances, and/or imposing strict OOBE conditions on terrestrial 5G, are required to ensure the protection of FSS earth stations. The measures applied on terrestrial 5G would have to be complemented with additional mitigation measures on the FSS side (*e.g.*, retrofitting an appropriate band pass filter) to protect FSS operations from terrestrial 5G deployments.

15. Should the ACMA consider extending existing apparatus and spectrum licence arrangements in the 3.6 GHz band into the 3700–3800 MHz band or another segment of the 3700–4200 MHz band?

No comment, other than Intelsat disagrees with extending the existing apparatus and spectrum licence arrangements in the 3.6 GHz band into the 3700–3800 MHz band. Further, any consideration of additional spectrum for WBB services should first be identified in the alternative bands stated in our answers to question 3 above.

16. Is there any additional information available that would assist the ACMA in assessing compatibly of potential new WBB services in the 3700–4200 MHz band with WAIC and radio altimeter systems in the 4200–4400 MHz band?

No comment.

Other Considerations for the ACMA to Take into Account

Despite the decision on the 3.6 GHz band and WRC-15 decisions on mid-band spectrum, the terrestrial mobile industry continues to make demands for additional spectrum identification for 5G, even though much of the spectrum already identified for terrestrial mobile services remains unused to this date. Figure 5, below, shows the amount of spectrum that has been identified for IMT in every World Radio Conference. The outcome of discussions on Agenda Item 1.13 at the upcoming WRC-19 would also need to be taken into account by the ACMA, as this conference is expected to identify plenty of additional spectrum for IMT among the more than 33 GHz of spectrum under consideration.

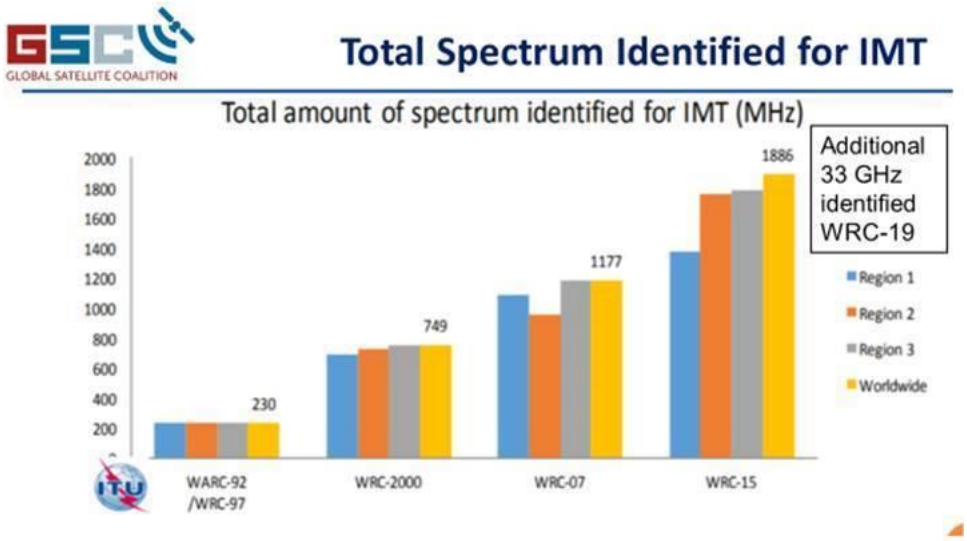


Figure 5: Total Spectrum Identified for IMT at Every WARC/WRC

Intelsat would like to highlight to the ACMA the importance of making sure that spectrum already identified for and made available to terrestrial 5G applications is fully utilized before any additional spectrum is considered for such applications. The latest findings concerning the countries in the Asia-Pacific region not only evidence the progress that has been made in the last few years to this end but also demonstrate that there is even more harmonized spectrum for IMT that could be utilized for terrestrial 5G services.

As shown in Figure 3, above, significant progress has been made in licensing additional spectrum for 5G in the Asia-Pacific region, with many countries now having licensed double the spectrum which they had

five years ago.[6] It is essential, though, that the current harmonized spectrum for IMT be more extensively used by the mobile industry before seeking additional spectrum identifications for 5G.

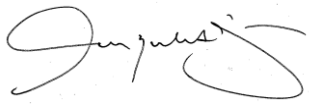
Conclusion

Intelsat would like to thank the ACMA for the opportunity to submit its comments to the Discussion Paper and express its concerns regarding any consideration of the 3700-4200 MHz band for the future deployment of WBB services in Australia. Intelsat encourages the ACMA to first take the prudent steps to ensure the density and efficiency of terrestrial mobile networks improves within existing spectrum already identified and allocated for terrestrial mobile services before seeking to identify additional spectrum for such services, in particular when the spectrum in question is already extensively used by other services (*e.g.*, C-band) and continues to be used for the future.

Intelsat would like to highlight to the ACMA the fact that the satellite industry is counting on continued access to C-band spectrum in the 3700-4200 MHz band for future satellite deployments due to continued demand for satellite services and this would be undermined and impeded upon due to the regulatory uncertainty being created by such proceedings from the ACMA. In addition, Intelsat urges the ACMA to carefully consider the award of the 3575–3700 MHz band for terrestrial IMT that was done less than a year ago, which has caused some pain to the satellite industry. The ACMA should be mindful that if more C-band spectrum is opened for terrestrial IMT/5G, it would be very difficult for satellite operators and service providers to provide effective and efficient services and very costly --if not impossible-- for satellite services to relocate to alternative bands.

Intelsat stands ready to provide additional information on any of the topics discussed in this contribution.

Respectfully submitted,



Gonzalo de Dios
Associate General Counsel

[6] For more information on the analysis of the status of licensing of IMT spectrum which is used for commercial mobile services and the extent to which licensed spectrum has been put into use by terrestrial mobile operators, *see* LS Telcom, "Analysis of the World-Wide Licensing and Usage of IMT Spectrum" (5 April 2019), available online at https://www.lstelcom.com/fileadmin/content/marketing/news/2019_Study_LicensingUseofMobileSpectrum.pdf.