TELSTRA CORPORATION LIMITED

Planning of the 3700-4200 GHz band

Public submission

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EXECUTIVE SUMMARY

We welcome the opportunity to comment on the ACMA's Discussion Paper *Planning of the 3700-4200 MHz band* (IFC 27/2019). There are a number of existing and possible future use cases for the band and we welcome the ACMA's further consideration of this band as part of the Initial Investigation stage.

Creating an allocation for IMT in the 3700-4200 MHz band

International Mobile Telecommunications (IMT) is a key enabler underpinning economic growth around the world. In Australia, the Deloitte Access Economics report **Mobile Nation 2019: *The 5G Future***[1] projects an additional $65bn GDP will be added to Australia's economy by 2023 through mobile technology and the Bureau of Communications and Arts Research[2] estimates that 5G will add between $1,300 and $2,000 in additional GDP per person by 2030.

Increasing demand for IMT services is driving the need for additional mid-band spectrum. The GSMA recommends 100 MHz of mid-band spectrum per carrier for 5G IMT services, and the 3700-4200 MHz band offers Australia the opportunity to meet this goal. Mid-band spectrum offers a good balance of coverage and capacity, and access to the GSMA recommended quantity will enable Australia to deploy a 5G offering that meets consumer expectations and enables Australia maintain a global leadership position in 5G mobile technology. More spectrum provides for faster download speeds to meet the economic and social demand for access to data and information anytime, anywhere. We also note that globally, several jurisdictions have already allocated, or are moving quickly to allocate, spectrum up as far as 3800 MHz to maximise their implementation of 3GPP band n78.

In view of these local and global drivers, the ACMA's **Scenario c** is our preferred option. Scenario c allows for 3700-3800 MHz to be reallocated to IMT, using spectrum licences for exclusive access, and in the same metropolitan and regional areas defined for the 3.6 GHz band. It also allows for a further allocation of the 3800-4000 MHz frequency range, using spectrum licences for exclusive access in at least four of the six metropolitan areas (Brisbane, Canberra, Melbourne and Adelaide). In the remaining two metropolitan areas (Sydney and Perth) it may not be possible to reallocate all of 3800-4000 MHz to IMT under a spectrum licensing regime due to incumbent satellite services. However, the combination of small-cell technology and the potential for new area-wide (apparatus) licences (AWLs) may support an alternative option where IMT for these two cities is deployed in the lower part of 3800-4000 MHz, while incumbent satellite services in this range are also encouraged to move towards the top of the 3700-4200 MHz band.

The ACMA's Embargo 73 currently only prevents new P2P licences being issued in the frequency range 3710-3790 MHz. This is insufficient to preserve 3700-3800 MHz for reallocation, and we recommend the ACMA expand Embargo 73 to include the full 3700-3800 MHz range and cover other service types such as Point-to-Multipoint (P2MP) and Fixed Satellite Service (FSS) earth stations, while future planning options for the band are considered.

In addition, we recommend the creation of a new embargo while the ACMA conducts the replanning exercise, to minimise deployment of new services in 3800-4000 MHz in all six metropolitan areas

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1 https://www2.deloitte.com/content/dam/Deloitte/au/Documents/Economics/deloitte-au-economics-mobile-nation-2019-080419.pdf

2 Impacts of 5G on Productivity and Economic Growth, April 2018. https://www.communications.gov.au/publications/impacts-5g-productivity-and-economic-growth

defined for the 3.6 GHz band. The new embargo should include Point-to-Point (P2P), P2MP and FSS earth stations.

FSS and P2P use of the band

We are a substantial operator of both FSS and P2P links in the 3700-4200 MHz band. We are the largest FSS earth station operator in this band (83 devices) and the second largest operator of P2P links (83 links). While we plan to continue operating FSS services for the foreseeable future, we do see scope for most or all of the existing services to be retuned to the top of the band to make way for an allocation for IMT.

Similarly, in the case of P2P links, many can be migrated to alternate bands at 6 GHz and above. However, we emphasise there are a number of P2P links used for the delivery of Universal Service Obligation (USO) services which cannot be migrated to higher bands, as these links already operate in conjunction with links in higher frequency bands to form redundant pairs capable of withstanding atmospheric effects that can interfere with links spanning long distances. Other P2P licensees may have similar concerns, and accordingly we recommend all P2P links are grandfathered regardless of operator or use case.

Dynamic spectrum sharing mechanisms

We welcome the ACMA's investigation of new methods to increase spectrum utilisation in locations and frequency bands where at times it is underutilised. As the ACMA has identified, a number of jurisdictions globally (including the USA and UK) have been working to develop sharing mechanisms to improve utilisation of spectrum, generally in more remote locations where it is underutilised and/or where there are services that create the potential for time-sharing in a complementary manner. We are not opposed to the consideration of such mechanisms in Australia, but note that such mechanisms would not be appropriate in locations and frequencies allocated under exclusive spectrum licensing.

The ACMA's Scenario c

The ACMA's Discussion Paper outlines a number of scenarios, and we propose the ACMA proceed with **Scenario c** by commencing work on reallocating 3700-3800 MHz to IMT on an exclusive basis in the geographic regions defined for the 3.6 GHz band, along with 3800-4000 MHz in at least four of the six metropolitan areas.

We are of the view that, while the 3700-4200 MHz band is important to progress, at this time there are other higher priorities, i.e. the reallocation of 26 GHz, the investigation of the 28 GHz band and the 800/900 MHz band reallocation. Reallocation of spectrum in the 3700-4200 MHz band should have a lower priority than these other activities.

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01 Introduction

We welcome the opportunity to comment on the ACMA's Discussion Paper *Planning of the 3700-4200 MHz band* (IFC 27/2019). The broader C-Band (3300-4200 MHz) plays an important role in many services today including Point-to-Point links (P2P), Fixed Satellite Service (FSS) earth stations, Fixed Wireless Access (FWA) and most recently, 5G International Mobile Telecommunications (IMT). As Australia seeks to meet the demand for mid-band spectrum for 5G, it is important to ensure adequate provision is made for other service types, noting that re-farming of spectrum will be required in some areas to achieve optimal utility.

Our submission is structured as follows:

- Section 2 makes the case for an allocation for IMT in 3700-4200 MHz;
- Section 3 outlines our support for Scenario c to maximise HVU;
- Section 4 outlines our view on the priority of this work relative to other ACMA spectrum activities;
- Section 5 concludes the body of our submission; and
- Appendix 1 contains our specific responses to the questions posed in the Discussion Paper.

02 The case for an allocation to IMT in 3700-4200 MHz

The GSMA's Public Policy Position on spectrum[3] recommends 80-100 MHz of contiguous mid-band spectrum per operator. There are two important points in this policy position; the quantum of spectrum and its contiguous nature. In Australia, the presence of three mobile network operators means that in aggregate, between 240-300 MHz is required to achieve this recommendation and the C-Band (3300-4200 MHz) is globally recognised as the band from which it will be fulfilled.

However, the fragmented nature of 3400-3700 MHz in Australia, coupled with nbn holding up to 175 MHz (e.g. 3400-3575 MHz in the outer metropolitan areas of Sydney and Melbourne under a combination of apparatus and spectrum licences) makes it impossible to achieve the GSMA's recommendation of 100 MHz of mid-band spectrum per carrier without a substantial further allocation of spectrum for IMT. Even after the completion of the work the ACMA is currently leading to defragment the 3400-3575 MHz band, it will not be possible to achieve the GSMA's recommendation without a substantial further allocation to IMT. Mid-band spectrum offers a good balance of coverage and capacity, and meeting the GSMA recommended quantity will enable Australia to deploy a 5G offering that enables Australia maintain a global leadership position in 5G mobile technology.

This section of our submission makes the case for 100 MHz (3700-3800 MHz) to be allocated exclusively for IMT in the same fourteen geographic areas defined for the 3.6 GHz band (six metropolitan and eight regional areas), and for a further 200 MHz (3800-4000 MHz) to be allocated exclusively for IMT in at least four of the six metropolitan areas and at the same time as the 3700-3800 MHz segment is allocated.

[3] 5G Spectrum: GSMA Public Policy Position. July 2019. p.2. https://www.gsma.com/spectrum/wp-content/uploads/2019/07/5G-Spectrum-Positions.pdf

2.1. Mobile technology boosts the economy by improving productivity

The Deloitte Access Economics report **Mobile Nation 2019: *The 5G Future***[4] projects that an additional $65bn GDP will be added to Australia's economy by 2023 through mobile technology; the equivalent of $2,500 per person. 5G alone is estimated to be worth between $1,300 and $2,000 in additional GDP per person by 2030 according to the Bureau of Communications and Arts Research[5].

Mobile technology achieves this uplift in GDP by boosting labour productivity. Today, every sector of our economy (office-based, construction, hospitality, health, agriculture, etc) operate and rely on data and information, and none of these sectors are able to function fully or efficiently without access to it. Mobile technology allows workers to realise genuine productive gains through real-time access to this information no matter where they are. Health workers are able to access patient information while caring for a patient in their own home, construction workers are able to obtain updated plans on site, agricultural workers are able to obtain up to date weather information and professional office-based workers are able to access information at a client's premises allowing them to spend more time with their customers. This is in addition to benefits such as teleworking and being able to work while commuting.

As more data and information is generated, and as more workers require access to this information while away from a traditional office environment, the demand for mobile data increases. To enable Australia to remain competitive internationally, and to meet the forecast economic predictions, it is vital that Australia makes the spectrum allocations necessary for the GSMA recommendation of 80-100 MHz contiguous mid-band spectrum per operator to be realised.

2.2. Other jurisdictions have or are allocating spectrum above 3800 MHz to IMT

We thank the ACMA for the detailed section in the Discussion Paper on International Developments. The ACMA's list of international developments is a comprehensive report on current status and we are not aware of any additional developments beyond those listed in the Discussion Paper. However, as explained below, we are concerned that Australia is lagging behind some other global leaders in making plans to open up spectrum in this band for IMT.

To date, Australia's allocation of mid-band spectrum for IMT has occurred in the range 3400-3700 MHz, and as the ACMA observes, work is either complete or progressing in many jurisdictions[6] to also allocate 3700-3800 MHz to IMT. In this respect, Australia is lagging other jurisdictions internationally.

Importantly though, some jurisdictions have either allocated, or are in the process of allocating spectrum above 3800 MHz. Japan's award[7, 8] of 100 MHz to each of the three incumbent MNOs as well as to a fourth new entrant in April 2019 sets an important benchmark given half of the awarded spectrum is above 3800 MHz. In the Americas, the GSA's 5G Spectrum Report[9] shows both the USA and Canada are also currently consulting on 3700-4200 MHz.

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[4] https://www2.deloitte.com/content/dam/Deloitte/au/Documents/Economics/deloitte-au-economics-mobile-nation-2019-080419.pdf

[5] Impacts of 5G on Productivity and Economic Growth, April 2018. https://www.communications.gov.au/publications/impacts-5g-productivity-and-economic-growth

[6] For example, the GSA's August 2019 update to their periodic 5G Spectrum Report shows in Figure 3 that in Europe, eight countries have already licensed spectrum in 3700-3800 MHz for IMT, with a further 11 currently in the auction/licence planning stage. https://gsacom.com/paper/5g-global-spectrum-report-august-2019/

[7] https://5gobservatory.eu/japan-assigns-5g-spectrum-to-four-operators/

[8] https://www.telegeography.com/products/commsupdate/articles/2019/04/11/mic-approves-allocation-of-5g-spectrum-to-japanese-operators-with-conditions/

[9] Figure 1, p.7, https://gsacom.com/paper/5g-global-spectrum-report-august-2019/

This shows that a large number of jurisdictions globally have allocated or are in the process of allocating at least 3700-3800 MHz, and work is also underway in some early-mover jurisdictions to allocate spectrum above 3800 MHz to IMT. In order for Australia to keep pace with global progress in this band, we consider it important that at least 3700-3800 MHz is allocated to IMT, along with the allocation of additional spectrum in the 3800-4000 MHz range.

2.3. An ecosystem of network equipment and devices is emerging

The ACMA's Discussion Paper[10] references the June 2019 edition of the GSA's periodic report **5G Device Ecosystem**, at which time there were 39 vendors who had announced 90 available or forthcoming devices. In the ensuing two months, the August 2019 edition[11] has been released, and that number is now at 41 vendors and the number of devices available or announced has now passed 100, 26 of which are phones and nine of them being commercially available.

Today, Telstra sells four 5G handset devices (Samsung S10 5G phone, Samsung Galaxy Note 10+ 5G, LG V50 ThinQ 5G phone and the Oppo Reno 5G phone), all of which operate on 3GPP band n78 (3300-3800 MHz). While it is duly noted that n78 devices only operate up to 3800 MHz, two important points can be made regarding the rapidly emerging ecosystem of devices. Firstly, devices are available now that operate up to 3800 MHz, justifying the re-allocation of 3700-3800 MHz to IMT, and secondly, the speed with which these devices have emerged gives confidence that an ecosystem of devices and network equipment will be developed quickly for band n77 (up to 4200 MHz) once other markets globally open up more of this band for IMT.

2.4. Incumbency is low, leaving space for restacking

Table 3 in the Discussion Paper observes that P2P links have declined by over 90% in less than two decades, from 1090 licences with 4008 devices in June 2000 down to 103 licensed with only 384 devices in May 2019. For FSS, Table 4 of the Discussion Paper demonstrates that while the number of licences and devices has increased over the last two decades, the licensed bandwidth in May 2019 is less than half (0.92 GHz) what it was in June 2000 (2.15 GHz). While the historic trends are undeniable, it is important to note that history is not necessarily a predictor of the future. We consider that the current quantity and aggregate bandwidth of FSS services and P2P links operated by Telstra is relatively stable now, and is unlikely to decline further.

The lower levels of incumbency today across all service operators now makes it possible to restack the band for an allocation for IMT. Many if not all incumbent FSS services can be accommodated higher up in the band, and in the case of P2P links, many incumbent links could be accommodated in alternate P2P bands above 6 GHz.

That said, the one service type that cannot be migrated to a different part of the band or to another band, is the fixed P2P service used to supply Universal Service Obligation (USO) services to remote communities. We discuss this in further detail in response to question 2 in Appendix 1 of our submission.

[10] Top of page 17.
[11] https://gsacom.com/paper/5g-devices-ecosystem-august-update/

03 Scenario c will achieve highest utility for the band

This section of our submission outlines our views in support of the ACMA's Scenario c to provide the largest possible allocation for IMT services while still accommodating incumbent services through re-farming them to the upper end of the band. We also identify a number of other planning issues such as coexistence, licence area boundaries and embargos, for the ACMA to consider in its investigation of possible future uses of this band.

3.1. Scenario c delivers highest utility

In the section of the Discussion Paper titled Band Planning Considerations, the ACMA outlines a number of considerations taken into account for the design of the scenarios, including current and possible future incumbent use of the band, and possible new entrants in the band.

We propose that Scenario c (Figure 8) delivers the highest utility, as it allows for the greatest number of uses and users to utilise the band efficiently and without causing interference to each other. The arrangement we propose for Scenario c has two components which should be executed simultaneously as follows:

1. 3700-3800 MHz to be reallocated for exclusive use by IMT using spectrum licences in the fourteen geographic regions (six metropolitan capital cities, eight regional areas) defined for the 3.6 GHz band.

2. 3800-4000 MHz to be reallocated for exclusive use by IMT using spectrum licences in at least four of the six metropolitan capital cities defined for the 3.6 GHz band (Brisbane, Canberra, Melbourne and Adelaide) and further investigation should be conducted to determine whether all or only part of 3800-4000 MHz can be reallocated in Sydney and Perth.

Both components should occur simultaneously to avoid delay to gaining access to underutilised spectrum in four of the six metropolitan areas, for two key reasons. Firstly, auctions are time consuming and expensive exercises to conduct, both from the perspective of the ACMA and the participants. Secondly, a single auction of a larger amount of spectrum will result in less fragmentation as bidders will seek to obtain contiguous spectrum in the assignment round, resulting in more efficient use of the spectrum. The single price allocation (auction) should occur immediately following existing priorities including the reallocation of 26 GHz, the investigation of the 28 GHz band and the 800/900 MHz band reallocation. We expect this means the reallocation can be completed over the next few years.

In order to achieve these reallocations, it will be necessary for some FSS earth stations to retune to frequencies higher in the band, and for P2P links in regional areas to tune above 3800 MHz or migrate to a different band, and for P2P links in metropolitan areas to migrate to other bands altogether. This approach maximises the spectrum that can be allocated to IMT for delivering mobile services and the associated benefits to all Australians.

3.2. Coexistence between WBB and FSS

The Discussion Paper references[12] the study contained in Appendix 4 of the "*Future approach to the 3.6 GHz band*". This study investigated the compatibility of FSS earth stations with macro and small cell WBB deployments, both fixed and mobile, in Sydney and Perth and concludes that mobile IMT macro cell deployments will be unable to share the same spectrum with licensed FSS earth stations within a large population centre. The ACMA considers that the results of this study also apply to the 3700–4200 MHz band, and we support the conclusion of the ACMA's original study along with the premise that the results will readily extend into the adjacent 3700-4000 MHz band.

Telstra has conducted coexistence studies for areas adjacent to existing FSS earth stations and confirms that sharing with IMT macro deployment is in general quite difficult. The exception to the rule is in CBD areas where buildings and other man-made structures offer a degree of protection to the FSS installation due to high clutter losses.

The Discussion Paper goes on to contemplate whether small cell deployments may be an alternate approach to achieve IMT coverage in closer proximity to FSS deployments, potentially allowing the two services to coexist in the same or nearby geography.

Based on the aforementioned studies, Telstra agrees that low-power, street level "small cells" may be able to coexist in closer proximity FSS compared to a macro site. By their nature small cells are employed as an 'infill' coverage solution which normally relies on an overlay macro network to ensure consistent customer experience. Nevertheless, we believe this is an area worthy of further investigation, although ultimately the deployment model used by a licensee should be the decision of that licensee. If a licensee can comply with the technical requirements of their licences through deploying macro sites, the licensee should not be restricted from doing so.

Another development, currently being investigated by the ACMA, is the concept of Area-Wide Licences (AWLs). The proposed AWLs are an apparatus licence, which makes them a peer of an FSS earth station apparatus licence. In the two metropolitan areas where FSS earth station incumbency is high (Perth and Sydney) it might not be possible to completely clear 3800-4000 MHz, as would be required under the s153 reallocation procedures for spectrum licensing. Instead, a combination of small cell technology and AWL licensing could maximise IMT deployment in a portion of 3800-4000 MHz that cannot be completely cleared for reallocation. But ultimately it should be up to the licensee to determine the appropriate deployment solution comprising macro or small-cell form factors.

3.3. P2P coexistence with other service types

P2P links and IMT cannot coexist co-channel without causing interference to each other if they are located within the same radio environment. Some P2P links are used to supply Universal Service Obligation (USO) services to remote communities, and for this reason, we recommend existing P2P links are grandfathered. We discuss the reasons supporting this recommendation in response to question 2 in Appendix 1 of our submission.

[12] Bottom of page 23.

3.4. Geographic boundaries should align with the 3.6 GHz boundaries

The challenges of coordinating time division duplex (TDD) systems across geographic boundaries and the potential to create "dead zones" are well understood. In order to minimise the risk of "dead zones" and enable the lower part of the 3700-4200 MHz band to be utilised most efficiently, we propose the boundaries for any spectrum licences for IMT be aligned with the boundaries established for the 3.6 GHz band.

3.5. Embargos

Embargo 73 commenced on 11 December 2017 to prohibit new P2P links in 3710-3790 MHz in the entire geographic area defined for the 3.6 GHz IMT band. This is insufficient to reserve the full 3700-3800 MHz for a possible future allocation to IMT. We also note that the embargo only prevents new licences for P2P services, allowing other possible service types to apply for licences. As such, we recommend Embargo 73 is expanded to cover the full 3700-3800 MHz, acknowledging that this will prevent the use of P2P channel 6, and to include other service types such as Point-to-Multipoint (P2MP) and FSS earth stations.

In addition to expanding Embargo 73, we propose a new embargo should be created for 3800-4000 MHz in the six metropolitan areas (capital cities) defined for the 3.6 GHz band. This embargo should include P2P, P2MP and FSS. We recognise that such an embargo will prevent the creation of any new P2P links in the 3.8 GHz band, however, we believe that in metropolitan areas, demand for new P2P links can adequately be serviced using other P2P bands above 6 GHz.

Modifying Embargo 73 and the creation of a new embargo will limit the potential for spectrum denial caused by other services in critical areas while the ACMA works through the replanning process.

3.6. Dynamic sharing models may be appropriate outside spectrum licensed space

The Discussion Paper[13] and the ACMA's August 2019 tune-up session explored a range of ideas around spectrum sharing, including the FCC's CBRS[14] scheme. We welcome the ACMA's investigation of new methods to increase spectrum utilisation in locations and frequency bands where at times it is underutilised. We note that the Radiocommunications Act already contains provision under s68(1) for third party authorisation under a spectrum licence. We maintain that third party authorisation is the most appropriate sharing mechanism, and that dynamic sharing under a scheme such as the CBRS is not appropriate in conjunction with a spectrum licence.

Outside spectrum licensed space, we consider the CBRS model has limitations where end customers have an expectation of continuity of service, which is the case for IMT and FWA services. This is because lower-tier licensees could be displaced with little or no notice, meaning service providers would be unable to assure their customers about the duration or quality of the service offering. However, if there are services that can be developed, such as the opportunistic use of spectrum to augment a base service using exclusively licensed spectrum, then the CBRS scheme may be a way to increase overall

[13] Page 30.
[14] https://www.fcc.gov/wireless/bureau-divisions/mobility-division/35-ghz-band/35-ghz-band-overview.

spectrum ultilisation. It would be prudent to wait until after CBRS has been introduced in the USA over the coming year before reaching conclusions about how a CBRS approach might be useful in Australia.

04 Prioritisation

In our submission to the ACMA's Draft FYSO 2019-23, we proposed that the relative priority of the 3700-4200 MHz band should be in fifth place behind the 26 GHz reallocation, 3.4 GHz defragmentation, 28 GHz reallocation and the 800 MHz/900 MHz reallocation. Our view has not changed so we still consider that the 3700-4200 MHz band should be the fifth priority in this list.

05 Conclusion

We propose the ACMA proceed with Scenario c as described in Figure 8 of the Discussion Paper, and commence work on reallocating 3700-3800 MHz to IMT on an exclusive basis in the geographic regions defined for the 3.6 GHz band along with 3800-4000 MHz in at least four of the six metropolitan areas. We are of the view that while this is an important opportunity, at this time there is other higher priority work such as the reallocation of the 26 GHz band and the investigation of the 28 GHz band.

We also recommend further work is done to understand how much of 3800-4000 MHz could be allocated to IMT on an exclusive, spectrum licensed basis in Sydney and Perth, along with coexistence studies to confirm the current hypothesis that small cell infrastructure could better coexist with incumbent co-channel FSS earth receive stations.

In order to preserve optionality for a reallocation of spectrum to IMT, Embargo 73 should be expanded up to 3800 MHz and should include P2MP and FSS services, and a new embargo should be created for 3800-4000 MHz in all six metropolitan areas defined for the 3.6 GHz band.

Finally, all existing P2P links should be grandfathered.

Appendix 1: Response to specific questions

This appendix contains our responses to the sixteen specific questions posed in the Discussion Paper.

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

We are not aware of any further international developments beyond those referenced in the consultation paper. Using the information in the International Developments section of the Discussion Paper, we make the observation that many jurisdictions have already allocated, or are well on the way toward allocating 3700-3800 MHz for IMT, and some jurisdictions have even commenced work toward allocating 3800-4000 MHz for IMT. To prevent Australia falling behind internationally, progress needs to be made to re-allocate 3700-3800 MHz in the same geographies as the 3.6 GHz band, along with as much spectrum as possible in the 3800-4000 MHz range. Further details are in the body of our submission.

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?

P2P links. Telstra is the operator of around 48 P2P links in the 3700-4200 MHz band, of which some are used to supply universal service obligation (USO) telephony services to remote communities including locations such as King Island and Flinders Island in Bass Strait. These are essential services that allow people living in these remote locations to be connected to the rest of the world, and we foresee the need to retain these links into the future.

As the ACMA notes in the Discussion Paper[15], the distance to some of these remote locations is in the order of 100 km and may be over water. Alternate bands such as 6 GHz and 11 GHz struggle to span such long distances, especially over water where there is no possibility for a mid-span repeater. For island communities in particular, the 3.8 GHz links often work in conjunction with links in higher bands to form a redundant pair capable of providing a far more reliable service, better able to withstand atmospheric effects that can interfere with links spanning long distances over water. This is critical in cases where a P2P link is the only substantial connectivity a particular location has with the outside world.

Should replanning activities in 3700-4200 MHz affect P2P links (for example, as a result of an exclusive allocation of 3700-3800 MHz to IMT under a spectrum licensing regime in the 3.6 GHz geographic regions), it will prevent use of the lower frequency on channels 4, 5 and 6 for P2P links. We support the reallocation of 3700-3800 MHz to IMT, and acknowledge the consequence that P2P channels 4, 5 and 6 will no longer be usable in these geographies.

It is essential however, that the one remaining FDD channel (Channel 7 on centre frequencies 3850 MHz and 4170 MHz) is maintained. This is in order to allow existing P2P operators to retune to Channel 7 in order to continue operation where long hops are required in order to meet the future requirement to supply USO services to customers in remote communities. We note that in some instances these locations are actually inside the regional geographic areas defined for the 3.6 GHz band (for example, Cape Grim in north-west Tasmania to connect to King Island).

[15] Bottom of p.20.

FSS earth stations. Telstra is also the operator of around 83 FSS earth stations across the 3700-4200 MHz band. Like the P2P links we operate, we also forecast a requirement for these links for the foreseeable future, including at our earth stations in Belrose (Sydney) and Landsdale (Perth). We have determined that while it is possible many of the FSS earth station receivers in Sydney and Perth operating in the range 3700-4000 MHz can be retuned to frequencies above 4000 MHz, it is unlikely that all of the receivers can be retuned. As a consequence, for the immediate term, we are only recommending 3800-4000 MHz be reallocated to IMT in four of the six metropolitan areas, excluding Sydney and Perth, to allow FSS services to continue operation while further study is conducted.

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

P2P links. As we noted in our answer to question 2, we have an ongoing requirement for P2P links to deliver USO services to remote communities, including some island communities. For island communities in particular, the 3.8 GHz links work in conjunction with links in higher bands to form redundant pairs capable of providing a far more reliable service, better able to withstand atmospheric effects that can interfere with links spanning long distances. As such, no alternative deployment options can be considered, and we request all existing 3.8 GHz links are grandfathered. Further relevant detail is provided in our answer to question 2 above.

FSS earth stations. While it is our view that many FSS earth stations affected by planning options in 3700-4200 MHz could retune to a frequency above 4000 MHz, it is unlikely all current services can be retuned or accommodated in 4000-4200 MHz, and hence, some will need to remain in the range 3800-4000 MHz.

We note the ACMA's observation that potential exists for earth stations to relocate to Earth Station Protection Zones (ESPZs). However, the relocation costs may make this option unviable, so it is more likely that services would cease than relocate if it is not possible to retune them to a frequency above 4000 MHz.

Further relevant detail is provided in our answer to question 2 above.

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?

Radiodetermination. We support the ACMA's proposal to maintain the status quo for existing radiodetermination services. We note the ACMA also proposes that any new arrangements in the 3700-4200 MHz band as a result of replanning will require existing radiodetermination services to be protected from interference, and that any new arrangements will not be afforded interference protection from existing radiodetermination services. We understand and accept these conditions.

LIPD devices. We have previously noted[16, 17] our concerns related to class licensing of 'ultra-wide band' ground and wall penetrating radar devices. It is our view that such devices should be apparatus licensed, and thus requiring them to be registered on the Australian Radiocommunications Register of Licences (RRL). Then, in the event interference is caused to our network, steps could then be taken to identify the operator and address the source of interference.

TVRO. We support the ACMA's proposal to maintain the status quo for TVRO; namely, they remain unlicensed. Further, we believe that TVRO users should be explicitly denied the ability to apply for receive only licences, and hence be unable to secure any protection rights. TVRO in this band is purely opportunistic and users must fully accept the risk of interference.

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?

The GSMA recommends 80-100 MHz of contiguous mid-band spectrum per network operator for 5G deployment. This is required for network operators to realise the full potential of 5G. Section 2 in the body of our submission provides the evidence for reallocation of 3700-3800 MHz in the geographic areas defined for the 3.6 GHz band, as well as 3800-4000 MHz in at least four of the six metropolitan cities (as defined for the 3.6 GHz band) to IMT.

The ACMA solicits views on the use of area-wide licences (AWLs) in this band. Our submission[18] to the ACMA's AWL consultation noted our broad support for the concept of AWLs, but identified some reservations in relation to coordination of devices between geographically or frequency adjacent licensees. At lower frequencies, such as 3700-4200 MHz, coordination challenges will be more pronounced than, for example, mm-Wave bands given the longer propagation distances. In principle, we support the concept of AWLs in this band for geographic areas outside locations reallocated for spectrum licensing (for example, mining sites or remote communities), and we would welcome the opportunity to work further with the ACMA to define procedures for their use.

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?

In this part of the Discussion Paper, the ACMA contemplates a range of possible physical deployment scenarios for the 3700-4200 MHz band, including macro-cell versus wide-scale use of small cell deployments for both mobile broadband and fixed wireless broadband services.

Small cell form factor equipment is available for 3GPP band n78, for both in-building coverage and localised area deployment such as sports stadiums. However, mobile network operators may be reluctant to use such equipment for wide-area coverage to protect FSS deployments, due to the limited coverage offered by small cells hence the effect on the IMT customer experience. Further work would also need to be undertaken to understand costs and implications to a deployment business case. In metropolitan areas, IMT customers expect seamless coverage, and regardless of whether small cell or macro cell solutions are deployed, the exclusion zone around a co-channel earth station would be in the

[16] Response #1 to ACMA consultation IFC 45/2018: https://www.acma.gov.au/-/media/Spectrum-Engineering/Issue-for-comment/IFC-45-2018/Telstra---IFC-45-2018-pdf.pdf

[17] Response #2 to ACMA consultation IFC 45/2018: https://www.acma.gov.au/-/media/Spectrum-Engineering/Issue-for-comment/IFC-45-2018/Telstra-2--IFC-45-2018-pdf.pdf

[18] Telstra submission to IFC19/2019.

order of a 20 km radius. Such a large exclusion zone would significantly diminish the value of any such spectrum allocation for IMT.

A better solution, as we have proposed in the body of our submission, would be to retune FSS earth stations operating in 3700-4000 MHz to new frequencies above 4000 MHz to clear 3700-4000 MHz of FSS service altogether. We believe this is possible for the current register of earth stations, and will provide a better solution compared to using small-cell style deployment to create exclusion zones around FSS earth stations in metropolitan areas.

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

In terms of 3GPP band n78 (3300-3800 MHz), network equipment is already available in a range of form factors including macro cell, small cell and in-building coverage. Similarly, a number of user devices are available, and Telstra currently sells four handsets in this range. The device options in band n78 are expected to only increase in coming years. Further details are available in section 2.3 in the body of our submission.

Regarding 3GPP band n77 (3300-4200 MHz), it is our understanding that both network equipment vendors and device manufacturers are well advanced on developing network equipment to operate above 3800 MHz and we expect this equipment to be available well in advance of the earliest possible time an Australian allocation above 3800 MHz could be made available for IMT deployment.

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

Beyond the use of the band for wide-area, macro-cell deployment of IMT, we have no interest for the deployment of other service types in the band.

9. What services/applications should be accommodated in the 3700–4200 MHz band?
10. Which frequencies ranges should be made available for these services/applications?
11. Which geographic areas should be made available for these services/applications?
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?
13. What licensing mechanisms are appropriate (spectrum, apparatus or class licensing)?

The table below provides our responses to questions 9 to 13.

Service/Application	Frequency	Geographic Area(s)	Basis / Licence
IMT	3700-3800 MHz	Six **metropolitan** (capital cities) areas and eight **regional** areas as defined for the 3.6 GHz band.	Exclusive access / Spectrum licence.
	3800-4000 MHz	At least four of the six **metropolitan** (capital cities) areas as defined for the 3.6 GHz band.	

Service/Application	Frequency	Geographic Area(s)	Basis / Licence
P2P Links	FDD Channel 7: (2 x 40 MHz on centre frequencies 3850 MHz and 4170 MHz).	All existing services grandfathered. New services permitted outside metropolitan and regional areas defined for 3.6 GHz band.	Apparatus licence with renewal on an ongoing basis.
FSS earth receive stations	3700-3800 MHz	Allowed outside the geographic regions defined for the 3.6 GHz band, and in ESPZs.	Apparatus.
	3800-4000 MHz	Allowed outside the geographic regions defined for the 3.6 GHz band. Allowed in Sydney and Perth, and allocated as far as possible towards the top of the frequency range.	
	4000-4200 MHz	Ubiquitous.	
Fixed Wireless Access (FWA)	3700-3800 MHz	Allowed outside the geographic regions defined for the 3.6 GHz band.	Notionally apparatus licensed, however, we envisage AWLs may be an appropriate licence type once available, and we would support Dynamic Sharing Access for FWA services in these locations.
	3800-4000 MHz	Allowed in the eight regional areas defined for the 3.6 GHz band, but not in the six metropolitan areas.	
	4000-4200 MHz	Ubiquitous.	
Radiolocation	Unknown.	Northern Territory.	Defence.
LIPD devices (ground and wall penetrating radar)	3700-4200 MHz	Ubiquitous.	Apparatus licensed. See our answer to Question 4 for further details.

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?

At this early stage of planning (this band is currently in the initial investigation stage), we anticipate the coordination techniques developed for the 3.6 GHz band are likely to be applicable for service types through to 4200 MHz. This should be confirmed as part of the standard Technical Liaison Group (TLG) activities in the re-farming stage of the ACMA's reallocation process prior to a price allocation. We do not foresee the need for any other techniques to be introduced.

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?

We recommend the ACMA extend the spectrum licensing arrangements for the 3.6 GHz band into 3700-3800 MHz and further beyond into 3800-4000 MHz in the metropolitan areas. This would see spectrum licences introduced for 3700-3800 MHz and 3800-4000 MHz using the geographic regions defined for the 3.6 GHz band, along with the consequential clearing of incumbents from 3700-3800 MHz in those geographic regions. Extending the existing licensing regime, including geographic boundaries and coordination procedures will enable maximum use of the band by avoiding dead-zones or large frequency guard bands that may be required if the geographic boundaries are not aligned with the 3.6 GHz band.

We note that existing P2P services should be grandfathered on apparatus licences, and that FSS services should be retuned above 4000 MHz or given the opportunity to physically relocate to one of the ESPZs.

Outside these areas (regional areas for 3700-3800 MHz, and metropolitan areas for 3800-4000 MHz), it would be appropriate for a variety of licensing arrangements to be considered, including traditional apparatus licences and AWLs. Dynamic sharing models may also be contemplated in these locations.

We also restate our objection to class licensed LIPD devices such as wall and ground penetrating radar devices operating in the C-Band (3300-4200 MHz). See our answer to question 4 for further details.

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?

We do not have any additional information to offer the ACMA in relation to this question.