



**Submission to the
Australian Communications and Media Authority**

Future approach to the 3.6 GHz band

11 August 2017



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Executive Summary

We welcome the opportunity to respond to the ACMA's consultation paper *Future approach to the 3.6 GHz band* (the Options paper). The ACMA's proposal to move this band to the *re-farming* stage is important for enabling Australian consumers and businesses to continue having early access to the latest and best mobile services, noting that 3.6 GHz is a global pioneer band for the launch of the fifth generation of mobile technology (5G). So we are pleased to see the 3.6 GHz band being given the highest priority by the ACMA, and we strongly support moving this band to the *re-farming* stage.

We support Option 3c

We agree with the ACMA's preference for Option 3c, which is to re-allocate the 3.6 GHz band for spectrum licensing in metropolitan and regional areas of Australia (defined as Area 3 in the Options paper). This approach creates the certainty that will be required for mobile operators to invest in 5G mobile services, for the benefit of customers across metropolitan and regional Australia.

While agreeing with the ACMA's proposal to adopt Option 3c, we do recommend some amendments to this approach, as summarised below, to maximise the potential utility of this spectrum.

We recommend a shorter re-allocation period for services in Area 1

In the case of satellite earth station services in major metropolitan areas (Area 1), we recommend the ACMA consider a re-allocation period shorter than seven years, and possibly as short as two years, considering that:

- initial demand for the deployment of 5G services will be in Area 1;
- there are only a few incumbent satellite earth station services impacted (15 licences in Area 1) in this spectrum; and
- as explained below, we now think there is opportunity for many of these services to be re-tuned relatively quickly and economically to alternative frequencies.

In our original 26 May open letter to the ACMA¹, we suggested a fifteen year protection period would be appropriate for satellite earth station services, given the size of the existing investments in earth station infrastructure and the substantial costs and time that would be incurred to physically relocate such infrastructure to more remote locations. However, after undertaking a further investigation into the available options, we have now determined that it would be possible to retune our satellite earth station services (nine licences in total) at Oxford Falls (Sydney) and Landsdale (Perth) relatively quickly to alternative frequencies in the C-Band (above 3700 MHz), without having to incur the cost and time of physically relocating these services to new locations. We appreciate that other licensees may require a longer period, but we would be comfortable with a re-allocation period as short as two years for our satellite earth station services in Area 1.

Area 3 should be treated as a single area to avoid "dead zones"

Assuming the 3.6 GHz band will be re-allocated and auctioned for spectrum licensing under Option 3c, we recommend Area 3 be treated as a single area lot with no divisions between the three Areas defined in the Options paper. The challenges of coordinating time division duplex (TDD) systems across geographic boundaries and the potential to create "dead zones" are well described in the ACMA's paper. In order to

¹ Telstra Open Letter "Expediting the reallocation of 3.6 GHz and 26 GHz spectrum for 5G". 26 May, 2017.

<http://www.acma.gov.au/~media/Spectrum%20Transformation%20and%20Government/Issue%20for%20comment/IFC%2025%202016/Telstra%20supplementary%20submission%20pdf.pdf>



minimise the risk of “dead zones” and enable this band to be utilised most efficiently, we believe there should be no geographic boundaries within Area 3, and the ACMA should look to re-farm the band as a single geographic region. We recognise additional spectrum licences may be required to accommodate a shorter re-allocation period in Area 1 but this should still allow auction lots to be defined that cover all of Area 3 as a single area.

Sharing is best achieved by agreement between parties in the re-allocation period

We do not see value in importing the sharing models from other countries. Models such as the three tiered model in the United States, or the Licensed Shared Arrangement (LSA) currently contemplated for some countries in Europe, have been designed to address specific issues that are unique to those regions and do not apply in Australia. Further, advances in technology may facilitate closer proximity between 5G mobile services and other services in the future, so it is important that flexibility is retained to leverage this opportunity. For these reasons, in Australia, we consider sharing is best achieved through incumbents and new licensees working together during the re-allocation period to explore and agree on commercial arrangements for sharing. Sharing can be implemented through licensees creating third party authorisations on their licences. While we cannot speak for other mobile operators, if Telstra is successful in acquiring spectrum licences, it would welcome discussions with incumbent licensees about the possibility of entering into commercial arrangements to expand or extend sharing arrangements in areas where Telstra has no immediate plans to deploy services.

Alternative bands for the relocation of incumbents

- We note that the 3700-3800 MHz segment, in line with international trends and the co-primary allocation of this segment to mobile services under Article 5 of the ITU Radio Regulations, has potential to also be considered for mobile broadband deployment in the future. So it would be desirable to limit the number of new licences that are assigned in the 3700-3800 MHz range and thus minimise the disruption to existing services that would result from a future re-allocation of this segment to mobile use. To support this outcome, we recommend that RALI FX 3 be amended so that channels above 3800 MHz are prioritised for the relocation of 3.6 GHz point-to-point links to the 3.8 GHz fixed link band.
- We support the identification of 5610-5650 MHz as an alternative band for fixed wireless access (FWA) services, noting that all of these services are in regional areas where Wi-Fi density is lower. However, we also recognise the need for the 5600-5650 MHz band to be opened up in Australia for indoor and outdoor class-licensed Wi-Fi devices based on FCC report FCC-14-30A3. We think the risk of interference between Wi-Fi and regional FWA services in the 5610-5650 MHz range would be small considering that the Wi-Fi services are low power, often located indoors, are likely to be more dispersed in regional areas, and (in accordance with FCC-14-30A3) are required to employ techniques such as dynamic frequency selection to avoid interfering with channels used by incumbent services.
- In addition to 5610-5650 MHz, we recommend that other bands such as 4800-5000 MHz and 3300-3400 MHz should also be given consideration as alternative options for incumbent regional FWA services.
- Rather than requiring satellite earth station services to be physically relocated (although an earth station operator may choose to do so), we believe that, in many cases, it is likely to be more cost effective to retune these services to the 3700-4200 MHz C-Band range.

Mobile coordination with satellite services should be based on interference thresholds

Setting fixed geographic exclusion zones around existing satellite earth station installations would not be an efficient approach to achieving coordination with mobile services and maximising the utilisation of the 3.6 GHz



spectrum. We strongly recommend that coordination be achieved through setting interference thresholds, and requiring the design of adjacent mobile services to respect these thresholds. Forthcoming technologies, such as 5G beam-forming antennas, hold great potential for being able to reduce the distances for coexistence between satellite earth stations and future 5G mobile network sites, so it would be inappropriate to set minimum exclusion distances which would preclude such benefits being realised.

Certainty is required by mid-2018

Commercial 5G network equipment and devices for the 3.6 GHz band are expected to become available during 2018 so it is important that the spectrum in this band is released urgently, to give industry the certainty it needs to invest in 5G services and allow Australia to be a leader in realising the benefits of this next revolution in mobile technology. This consultation is a welcome step towards achieving that outcome but it is critical that urgency continues to be applied to the remaining steps, including moving quickly to the re-farming stage and conducting an auction as soon as possible in the first half of 2018.

We also recommend that provision be made for early access apparatus licences to be issued during the re-allocation period, so that new licensees can deploy 5G services without delay.



1 Introduction

We welcome the opportunity to make this submission in response to the ACMA's consultation on the *Future approach to the 3.6 GHz band*, IFC 9/2017. The ACMA's Options paper culminates in a series of options, and we support the ACMA's preferred option: 'Option 3c – **Spectrum Licence metropolitan areas and regional areas**'. We believe that re-allocating the 3.6 GHz band to spectrum licences in metropolitan and regional areas, with a seven year re-allocation period for services in regional and remote areas, and a shorter re-allocation period (possibly as short as two years) for services in major metropolitan areas (Area 1 in the Options paper), provides the best outcome for all Australians. It enables the early introduction of 5G mobile services while also balancing the needs of incumbent licensees of the band and recognising the benefits they deliver to Australia.

Our submission is structured as follows:

- Section 2 – **Pioneer 5G bands are the ACMA's highest priority**, re-emphasises the case for the 3.6 GHz and 26 GHz bands to be the highest priority on the ACMA's work program;
- Section 3 – **Discussion of issues**, sets out our response to the five discussion issues raised in chapter 4 of ACMA's option paper;
- Section 4 – **Replanning options**, conveys our support for the ACMA's preferred option (Option 3c) for the licensing of the 3.6 GHz band;
- Section 5 – **Highest value use (HVV) assessment**, contains our endorsement of the ACMA's framework for assessing the HVU;
- Appendix 1 contains specific answers to the 23 questions posed in the Options paper; and
- Appendix 2 contains answers to the 13 questions posed in the highest value use paper.

2 Pioneer 5G bands are the ACMA's highest priority

In previous submissions^{2, 3} we have stated the case for the 3.6 GHz and 26 GHz bands to be given the ACMA's highest priority for re-allocation work. We maintain that these bands should continue to be the top priority for the ACMA, due to their impending use in many countries for 5G mobile services and the substantial social and economic value predicted to be delivered by these services.

Today, mobile technology makes a significant contribution to the Australian economy (\$42.9bn in 2015⁴), and using a smartphone is a way of life for most Australians: 80% of Australians have one, and 60% of owners have more than one device⁵. Demand for mobile broadband is ever increasing with over 120,000 terabytes⁶ of

² Telstra submission to ACMA consultation on "Future use of the 1.5 GHz & 3.6 GHz bands", 9 December, 2016, section 5, Pg 7
<http://www.acma.gov.au/~media/Spectrum%20Transformation%20and%20Government/Issue%20for%20comment/IFC%2025%202016/Telstra%20-%20submission%20pdf.pdf>

³ Telstra submission to "FYSO 2016-2020", 20 January, 2017, Exec Summary Pg 3.

<http://www.acma.gov.au/~media/Spectrum%20Licensing%20Policy/Issue%20for%20comment/IFC%2023%202016/Telstra%20submission.pdf>

⁴ Mobile nation: Driving workforce participation and productivity. Deloitte Access Economics. 17 March 2016.

⁵ Mobile Consumer Survey 2015 – The Australian Cut. Deloitte Access Economics. 29 October 2015. 2000 respondents, aged 18-75

⁶ ABS report 8153.0 - Internet Activity, Australia, June 2016. Australian Bureau of Statistics. 5 October 2016.



data downloaded to mobile devices across all three mobile networks in the three months to June 2016. Use of Telstra's LTE network is continuing to grow rapidly and already supports around 9.5 million LTE devices.

We are committed to providing our customers with the latest and best communications tools and services so that Australian consumers can benefit from these developments, and businesses can be increasingly competitive and productive on both domestic and international stages. The early adoption of 5G and other new technologies is important for delivering this commitment.

Spectrum is a critical ingredient for delivering all mobile services. Since existing mobile spectrum is already heavily used for 3G and 4G services, new spectrum is required to launch 5G services. There is an urgent need to release new spectrum in the 3.6 GHz and 26 GHz bands for this purpose. Internationally, standards are already largely developed and aligned on these bands being used for the initial deployment of International Mobile Telecommunications (IMT).

To this end, we strongly support the 3.6 GHz band progressing from the *preliminary replanning* stage to the *re-farming* stage.

It is important that mobile operators should be able to acquire spectrum in large contiguous blocks (up to 100 MHz) to realise the maximum benefits of 5G. 3GPP standards⁷ are currently being finalised for 20 MHz, 50 MHz, 80 MHz and 100 MHz channel bandwidths for 5G mobile services operating below 6 GHz. There is no guarantee that any other channel bandwidths will be supported by 5G equipment and devices. We strongly recommend that the ACMA plans be aligned with these channel bandwidths so carriers can acquire bandwidths of up to 100 MHz in the 3.6 GHz band to enable them to properly leverage the capability of the new technology to deliver the best possible 5G experience. Inappropriately sized spectrum lots could result in parts of the 3.6 GHz spectrum band remaining fallow, which would be contrary to the principle of efficiently allocating spectrum.

We also note that recently the ACMA released a consultation for the "*Multiband residual lots auction*"⁸. While the tidying up of these residual lots should increase the utility of these bands (assuming the lots are sold), this increase in utility will be minor compared to the utility arising from the re-allocation of the 3.6 GHz band. It is important that this multiband auction does not divert resources or attention away from the task of bringing forward the re-allocation and auction of the 3.6 GHz band.

Finally, we also recommend that early access apparatus licences should be made available to successful bidders during the re-allocation period in accordance with the provisions in section 153P of the Radiocommunications Act 1992, to ensure that deployment of new 5G mobile networks can proceed without delay.

⁷ 3GPP document R4-1706968_WF. Way Forward on band specific user equipment channel bandwidth. 29 June 2017. Pg 5. http://www.3gpp.org/ftp/Meetings_3GPP_SYNC/RAN4/Inbox/R4-1706968.zip

⁸ ACMA consultation IFC: 16/2017, 2 Aug 2017. <http://www.acma.gov.au/theACMA/multiband-residual-lots-auction>



3 Discussion of issues

In section 4 of the Options paper, the ACMA outlines five issues associated with a decision to re-farm the 3.6 GHz band, including:

- Assessment of the areas with high demand for spectrum;
- Process and effect of re-allocating spectrum for the issue of spectrum licences;
- Geographical boundary issues associated with area-wide licences;
- Options for incumbent services; and
- Sharing arrangements.

We offer our views on each of these items in turn.

3.1. Assessment of the areas with high demand for spectrum

We agree with the ACMA's assessment that the areas of high demand for access to spectrum would be in major metropolitan and major regional population centres, along with key interconnecting population corridors and road/rail links. On this basis, we agree with the ACMA's definition of Area 3 (as defined in Appendix 6 of the Options paper) as being the area with high demand for spectrum.

3.2. Process and effect of re-allocating spectrum for the issue of spectrum licences

We support the position in Option 3c that the most appropriate licensing regime is spectrum licensing for Area 3. Spectrum licensing gives the mobile industry the certainty it needs to invest in 5G services to maximise the business and economic opportunities for Australia.

We recognise the length of the re-allocation period needs to be designed to find the appropriate balance between facilitating the business continuity of existing licensees and enabling early access to the spectrum for 5G services.

Re-allocation period for services outside Area 1

In the case of existing services in the regional spectrum (outside Area 1) we think the proposal for a seven year re-allocation period is a reasonable compromise, considering that:

- the timing for the deployment of 5G services is expected to be later in regional areas than in metropolitan areas;
- there is a large number of incumbent fixed wireless access and other service providers who are impacted; and
- these service providers will require a number of years to achieve a reasonable return on their existing assets and implement alternative longer term arrangements.

We believe the seven year re-allocation period gives future spectrum licensees adequate time to negotiate mutual commercial arrangements with existing service providers to either: move to an alternative solution (for example, re-tune); cease operation; continue operating beyond the re-allocation period; or expand their operations to other geographic areas or frequency ranges within the 3.6 GHz band. From a licensing

perspective, permission for incumbent operators to continue operating beyond the re-allocation period could be achieved by issuing third party authorisations under the 1992 Radiocommunications Act.

Re-allocation period for services in Area 1

We recommend the ACMA consider a re-allocation period shorter than seven years, and possibly as short as two years, for existing services in major metropolitan areas (Area 1), considering that:

- initial demand for the deployment of 5G services will be in Area 1;
- there are only a few incumbent satellite earth station services impacted (15 licences in Area 1) in this spectrum; and
- as explained below, we now think there is opportunity for many of these services to be re-tuned relatively quickly and economically to alternative frequencies.

In our original 26 May open letter to the ACMA, we suggested a fifteen year protection period would be appropriate for satellite earth station services, given the size of the existing investments in earth station infrastructure and the substantial costs and time that would be incurred to physical relocate such infrastructure to more remote locations. However, after undertaking a further investigation into the available options, we have now determined that it would be possible to retune our satellite earth station services (9 licences in total) at Oxford Falls (Sydney) and Landsdale (Perth) relatively quickly to alternative frequencies in the C-Band (above 3700 MHz), without having to incur the cost and time of physically relocating these services to new locations. We appreciate that other licensees may require a longer period, but we would be comfortable with a re-allocation period as short as two years for our satellite earth station services in Area 1.

3.3. Geographical boundary issues associated with area-wide licences

We note and share the ACMA's concerns about geographic spectrum licence boundaries as outlined in detail in pages 30-31 of the consultation paper, and the unintended consequence of creating "dead zones", particularly for TDD based systems where the risk of base station to base station interference can be significant. The ACMA's concern that any spectrum boundaries should be located away from populated areas is a genuine concern and one that needs to be considered very carefully.

Given the evidence presented by the ACMA in the discussion paper regarding existing "dead zones" in the TDD-based 2300 MHz band, we believe spectrum utility is maximised by removing the boundaries between metro and regional areas completely, and hence recommend Area 3 should be treated as a single geographic area. While this area still has a boundary with remote areas of Australia, there are very few population centres that would be affected by any resultant "dead zones"⁹. In contrast, it would be very difficult to draw a boundary around or near the mainland capital cities and completely avoid cutting through or near any inhabited areas, given the constraints of the HCIS system (even at Level 1). Any "dead zones" would potentially result in a number of unserved communities that would not be able to enjoy new 5G services in this band. Clearly this is not a situation that should be allowed to materialise.

Another important consideration is the undesirable potential for delay to the re-allocation and auction of the 3.6 GHz band while the location of the boundaries between metro and regional areas is being explored and

⁹ The largest population centres near the Area 3 Boundary are Morawa WA (pop 500), Koorda WA (300), Coolgardie WA (1000), Lightning Ridge NSW (2500), Mitchell QLD (1300), Capella QLD (900), Moranbah QLD (9000) and Weipa QLD (3300). Most of these towns should be able to be served either with apparatus licences as they are located just outside of Area 3, or are within Area 3 but more than 2km from the boundary.



debated. Australia is already at risk of falling behind other countries in deploying 5G mobile services, and any delay to the availability of spectrum would be unacceptable within the context of minimising “dead zones” (there will always be “dead zones” where there are boundaries, and repositioning of boundaries, while minimising the impact, does not completely resolve the issue).

Hence, we believe the simplest solution to all these issues is to offer Area 3 as a single geographic area, to virtually eliminate the risk of “dead zones” and unserved communities, and maximise spectrum utility.

3.4. Options for incumbent services

3.4.1. Point-to-point services

We agree with the ACMA’s proposal to retune point-to-point services into the 3700-4200 MHz (3.8 GHz) fixed services band. This is a suitable alternative band due to its almost identical characteristics (for example, propagation and rain-fade), and availability of equipment.

We note that the 3700-3800 MHz segment, in line with international trends and the co-primary allocation of this segment to mobile services under Article 5 of the ITU Radio Regulations, has potential to also be considered for mobile broadband deployment in the future. So it would be desirable to limit the number of new licences that are assigned in the 3700-3800 MHz range and thus minimise the disruption to existing services that would result from a future re-allocation of this segment to mobile use. Therefore, to support this outcome, we recommend that RALI FX 3 be amended so that channels above 3800 MHz are prioritised for the relocation of 3.6 GHz point-to-point links to the 3.8 GHz fixed link band.

We also emphasise that the licence assignment procedures must continue to protect existing teleports accessing C-band (3700-4200 MHz) spectrum. We believe the current version of RALI FX3 is sufficiently up to date to manage this coordination.

3.4.2. Fixed services – point-to-multipoint

We agree with the ACMA’s proposal that the 5610-5650 MHz band could be an alternative home for fixed point-to-multipoint licences, services currently operating in the 3.6 GHz band. This is because of the ready availability of point-to-multipoint equipment for the band, and the light use of the band for radiolocation (weather radar) services.

As noted in our February 2016 submission on the LIPD Class Licence¹⁰, there is an opportunity to open up 5600-5650 MHz for indoor and outdoor class-licensed Wi-Fi equipment in Australia. We acknowledge that the ACMA has also flagged a review of arrangements for 5 GHz radio local area networks (RLANs), such as Wi-Fi, in the most recent Five-year spectrum outlook¹¹. Opening up this band for Wi-Fi is important because Wi-Fi channels are becoming congested in metropolitan areas, and the current restrictions, which apply to both indoor and outdoor in metro and regional areas, prevent the use of a number of Wi-Fi channels, including an 80 MHz and a 160 MHz channel. FCC report FCC-14-30A3 significantly tightens the dynamic frequency selection (DFS) compliance requirements for Customer Premises Equipment (CPE) and reduces the likelihood

¹⁰ Telstra submission to ACMA consultation on “Proposed variation to the Radiocommunications Class Licence for Low Interference Potential Devices”, 26 February, 2016, Item B, Pg 2.
<http://www.acma.gov.au/~media/Spectrum%20Engineering/Issue%20for%20comment/IFC%2032%202015/4%20Telstra%20Submission%20pdf.pdf>

¹¹ <http://www.acma.gov.au/Industry/Spectrum/Spectrum-projects/Mobile-broadband/five-year-spectrum-outlook-2016-20>



of significant interference to weather radars and to possible future users of the band such as apparatus licensed point-to-multipoint services. We also observe that apparatus licensed point-to-multipoint services would be authorised to operate at higher Equivalent Isotropic Radiated Power (EIRP) than class licensed Wi-Fi equipment, further reducing the risk of Wi-Fi causing interference to potential future point-to-multipoint services, should the restrictions on Wi-Fi be lifted.

The alternate bands suggested in the Options paper for point-to-multipoint services¹² include the 1800 MHz and 2 GHz bands (under an apparatus licence model) and the 2.4 GHz and 5 GHz bands (under a class licensed model). These are likely to be less attractive due to the existing high levels of utilisation, or the inability of class licensed spectrum (which is constrained to 1W EIRP) to provide the required quality of service required, or both. Instead, we suggest that the 4800-5000 MHz and the 3300-3400 MHz bands be further explored as possible alternative homes for point-to-multipoint services, mainly because of the availability of commercial equipment for these bands and the low levels of incumbent use.

3.4.3. FSS earth stations

The ACMA Options paper appears to be strongly of the view that the best and possibly only alternative option for fixed satellite services (FSS) earth stations is relocation to a new geographic location that is well away from population areas and sources of interference. While we acknowledge this approach would resolve interference issues, it is also the most costly solution, and in the light of other interference management alternatives, we are not convinced that that physical relocation is the best option, or perhaps even necessary.

There are significant advances being made in antenna technology for IMT services such as beam-forming. 5G mobile network designers can create virtual exclusion zones around FSS earth station sites to minimise interference. Telstra studies show that FSS earth stations can be afforded sufficient protection from interference from mobile networks through a combination of terrain blocking and access network design. In cases where terrain isolation is not available engineering measures need to be relied on to achieve high levels of isolation.

On page 33 of the Options paper, the ACMA observes that '*Re-tuning to different frequencies is unlikely to be a practical option in most instances*', without offering any supporting evidence for that claim. This is not our understanding. Our recent research suggests there is adequate available transponder capacity covering Australia within the C-Band (3700-4200 MHz) for services operating in 3575-3700 MHz to retune upward into the C-Band.

The ACMA canvasses input on the suitability of Mingenew as a new location for an FSS earth station (on the west coast) for services potentially affected by a re-allocation decision for the 3.6 GHz band. We note that Embargo 49 has been, and is, an effective tool for preventing new frequency assignments for terrestrial radiocommunications equipment for a minimum of 100 km and as far as 300 km from the site in some bands. While the embargo has been effective, we have no plans at this time to use the site as a FSS earth station.

The ACMA also canvasses input on four sites identified as possible locations for an east-coast earth station protection zone, namely, Quirindi, Uralla, Dubbo and Moree. We have not conducted an analysis of the suitability of these locations for possible future FSS earth stations. So we are not currently in a position to offer comments on the suitability (or otherwise) of these sites, and reiterate our earlier comments that in the first instance, we would seek to minimise interference through the use of advanced technology such as beam-forming antennas to permit the greatest coverage for 5G services that also enables FSS earth stations to continue operating at their current location without interference. If that proves to be unachievable, in the

¹² Options paper, Pg 30.



second instance, we would seek to retune the earth stations above 3700 MHz using alternate transponder frequencies in the C-Band. We believe it is unlikely that we would need to resort to physical relocation, as the cost implications of relocation will be greater than alternate transponder frequencies, which we anticipate will be readily available.

Appendix 4 assumes protection of the entire satellite geostationary arc is required. This does not appear to align with the current state of affairs where issuing of new licences in the band is embargoed to avoid constraining the options for the future use of the band. Protecting the full arc would also be inconsistent with existing domestic planning processes by reserving spectrum for future uses that have not been identified and may not eventuate. To provide certainty for future mobile deployment, we believe it is important that only the reception of services from existing orbital locations be protected.

Finally, we do not believe it will be necessary to create fixed-radius exclusion zones for existing satellite earth station locations within Area 3, including Landsdale/Lockridge, Oxford Falls/Belrose and Uralla, as fixed-radius exclusion zones are typically rather conservative and would leave larger-than-necessary surrounding areas devoid of 5G services. Such exclusion zones would be an inefficient use of this scarce spectrum resource and unnecessarily deprive communities in these areas of the benefits of 5G services. Instead, we propose that coordination between future 5G mobile services and FSS earth stations be based on maximum permissible interference levels (incident power-flux density). Consideration of fixed exclusion zones for any entirely new satellite locations on the east coast (within Area 3) is a matter that would require further analysis and investigation, and we have not yet formed a position on this matter. As an aside, we are happy to support the continuation of Embargo 49 near Mingenew, Western Australia, which maintains fixed radius exclusion zones (different radii at different frequency ranges), as Mingenew sits outside Area 3.

3.4.4. Amateur, radiolocation, class-licensed services and TVRO

We agree with the options the ACMA has outlined for amateur services, radiolocation services, class-licensed services and TVRO systems operating in the 3.6 GHz band. They are offered no protection and must not cause interference to other licensed users of the band under the conditions of their licences.

3.5. Sharing arrangements

Sharing is inherent in the extended seven year re-allocation period proposed by the ACMA, which we are recommending only be applied to services outside Area 1 (we are recommending a shorter period be applied in Area 1). The extended re-allocation period allows for incumbent users and new spectrum licensees to effectively share the band without the need for rigid and complex tiered sharing arrangements such as the CBRs model in the US or the LSA model proposed for Europe. We believe it provides incumbent and new licensees with sufficient time to consider their future options and hold discussions with each other about reaching commercial arrangements, to either clear the spectrum more quickly, extend the existing arrangements beyond seven years, or modify them to cover different geographic areas or frequency ranges.

3.5.1. Commercial negotiation to manage sharing

As indicated above, we believe commercial negotiation should be the basis for managing sharing during and beyond the re-allocation period. If Telstra is successful in acquiring spectrum licences, it would be happy to have discussions with interested incumbent licensees about the possibility of entering into commercial arrangements to expand or extend the sharing arrangements in areas where there are no immediate plans to deploy mobile services.

For example, if a spectrum licensee wishes to make use of spectrum at a location where incumbent apparatus licensed services are still in operation, the parties could come to a commercial agreement to migrate the

service to an alternative band. The apparatus licence would then be cancelled and the spectrum licensee would have freedom to deploy services under early access apparatus licensing arrangements until its spectrum licence commences.

In other cases agreement may be reached for apparatus licensed services to continue operating beyond the expiry of the re-allocation period, or for the services to be expanded to new locations or frequency ranges. In these cases we recommend that ongoing provision for (former) apparatus licences be managed as a third party authorisation under section 68 of the existing Radiocommunications Act. As we noted in our response to section 3.2, the Department of Communications and the Arts is currently conducting a review of the radiocommunications legislation. In our latest (28 July 2017) submission¹³ to the review, we have made a suggestion that the 'Delegation of Management Rights' (as proposed in Part 17 of the exposure draft of the new Bill) could be an effective mechanism to enable sublicensing of third parties in the new regime.

3.5.2. Other sharing models are not required

We note the ACMA's consideration of the "multi-tiered" approach to sharing in the FCC model for the CBRs¹⁴ and the LSA model being considered by the European Commission¹⁵.

We consider the CBRs model to be an impractical option, primarily because lower-tier licensees could be displaced in populated areas sooner than expected, and would be unable to assure their customers about the duration or quality of their service offering. Therefore, we believe this option is unlikely to be workable in practice. We also observe that telecommunications operators in the US are raising concerns¹⁶ about the model and requesting the FCC change the way it plans to allocate CBRs licences, citing that the model does not provide sufficient certainty.

As the ACMA notes¹⁷, both the CBRs and LSA models have been designed to support the ongoing use of the 3.6 GHz spectrum by incumbents, along with accommodating factors that are specific to those regions and not applicable to the situation in Australia. For example, under both models, consideration has had to be given to the extensive existing use of the spectrum by government users. There is no government use that needs to be taken account of in Australia.

For these reasons, and considering that the extended seven year re-allocation period is expected to be a more effective mechanism for facilitating sharing in Australia, we are of the view that neither the FCC or European LSA models are worthy of further consideration.

4 Replanning options

The ACMA lays out a series of options ranging from status quo through to a hybrid blend of apparatus and spectrum licences in section 5 of the Options paper. We strongly support the ACMA's preferred option, Option 3c - ***Spectrum licence metropolitan areas and regional areas***.

¹³ Telstra submission to DoCA consultation on new Spectrum Legislation. 28 July, 2018. s2.6, Pg 8.
<https://www.communications.gov.au/sites/g/files/net301/f/submissions/2017-07-28-miller-brian-telstra-submission-spectrum-review-exposure-draft-2017-07-28.pdf>

¹⁴ Options paper, Pg 35.

¹⁵ Options paper, Pg 36.

¹⁶ For example, <http://www.rcrwireless.com/20170702/opinion/analyst-angle-longer-licenses-for-3-5-ghz-spectrum-will-be-good-for-5g-tag10>

¹⁷ Options paper, Pg 37.



We believe that re-allocating the 3.6 GHz band to spectrum licences in Area 3, with a seven year re-allocation period for services outside Area 1 and a shorter re-allocation period (possibly as short as two years) for services within Area 1, provides the best outcome for all Australians by giving new licensees the certainty they need to invest in 5G mobile services, while balancing the needs (for example, certainty of tenure and quality-of-service) of incumbent users in regional and rural areas to continue offering their services.

5 Highest value use (HVV) assessment

5.1. The HVV framework is appropriate for assessing the potential benefits of re-farming

Telstra welcomes the ACMA's highest value use assessment (HVV), undertaken for the purposes of informing the preliminary replanning of the 3.6 GHz band. Under this approach the potential benefits of re-farming the 3.6 GHz spectrum are compared to the incremental costs of displacing incumbent users to determine if overall economic welfare gains exist.

We recognise this comparison requires — like all modelling exercises — the use of assumptions. The benefit estimation step, for example, uses a range of input values (based on possible spectrum prices in terms of \$/MHz/pop), while the incremental cost estimation similarly provides for different relocation costs between incumbent licensees and both the continuation (constant output) or discontinuation (variable output) of each incumbent use. Geographical parameters, reflecting different options for the future licensing (and thus extent of re-farming) of 3.6 GHz spectrum, are also factored into the analysis.

We consider that the assumptions which have been used by the ACMA in the current context are appropriate. While there could be some debate of the cost estimations, we note there could also be debate of the benefit estimations. On this latter point for example, the deployment of 5G technologies is expected to have a positive and substantial economic impact on numerous vertical sectors such as agriculture and transport — especially via channels such as the internet of things — but these wider economic benefits are not captured in the analytical framework. Similarly the ability for parties to assemble contiguous blocks of spectrum can positively impact the value of spectrum resources. We accept, however, that the exclusion of such considerations result from the design of the HVV framework and provided the framework is applied in a consistent way, its results are useful for the purposes of informing a re-allocation decision.

5.2. Results indicate scope for significant increases in overall economic welfare

The results of the HVV analysis are clear, and consistent across all scenarios, in showing that there are significant increases in overall economic welfare which can be realised from the re-farming of the 3.6 GHz spectrum for use in the provision of MBB services. Given these results, we consider that the ACMA can confidently proceed towards re-allocation of the 3.6 GHz band, while also taking measures to mitigate the impacts of re-allocation on the incumbent licensees.



Appendix 1: Options paper questions – specific responses

Section	Question	Comments
1	Should the 3.6 GHz band be progressed from the <i>preliminary replanning</i> stage to the <i>re-farming</i> stage in the ACMA's process for considering additional spectrum for MBB services? Why/Why not?	Yes. Telstra supports the 3.6 GHz band progressing from the <i>preliminary replanning</i> stage to the <i>re-farming</i> stage. This is an important and urgent step to facilitate the deployment of 5G mobile services in Australia.
2	Do the areas identified in this analysis cover the likely areas of high demand for access to the 3.6 GHz band? Would smaller or larger areas be more appropriate? Why?	We agree that Area 3 (as defined in Appendix 6 of the Options paper) represents the likely areas of high demand. We also recommend that Area 3 should be treated as a single geographic area to minimise the creation of “dead zones” in or near population centres.
3	If any part of the 3.6 GHz band is re-allocated for the issue of spectrum licences is seven years a suitable re-allocation period? If not, what period of time would be appropriate?	We support the ACMA's proposal of a seven year re-allocation period in non-metro areas (outside Area 1 in the ACMA's Options paper) on the basis that this should provide sufficient time for future spectrum licensees to negotiate mutual commercial arrangements with incumbent (apparatus licensed) operators to either cease operation prior to the end of the seven year re-allocation period, to continue operating beyond the re-allocation period, or make alternative arrangements to migrate to an alternative band. However, we recommend a shorter re-allocation period (possibly as short as two years) be adopted for services in metro areas, where there are far fewer incumbents (see Q4).
4	Should different re-allocation periods be considered for different areas? For example, should a longer period be considered for services outside Area 1?	We recommend there should be a shorter re-allocation period, and possibly as short as two years, for metropolitan areas (Area 1 in the ACMA's Options paper). We agree with the ACMA's proposal for a seven year re-allocation period for the remainder of Area 2 and Area 3. This may require separate (spectrum) licences for metropolitan and regional areas, and if so, it is critical that the two ‘virtual lots’ are sold as a single lot at auction, to avoid the creation of “dead zones” at the boundary between Area 1 and Area 2.
5	Are these guidelines appropriate? Why?	We support Area 3 being offered as a single geographic area, with no metro/regional split. This completely aligns with the ACMA's guidelines that: <ul style="list-style-type: none">the boundaries should be defined in areas of low demand (i.e., Remote areas)



Section	Question	Comments
		<ul style="list-style-type: none"> the geographic area is large to avoid co-channel conflict, and enables rollout across the entire area, even if in practice the rollout of services commences in some areas earlier than others.
6	Are there any other issues that affect the usability of an area-wide licence that should be taken into account when defining the licence area?	We are not aware of any other issues that would affect the usability of an area-wide licence. We note that any potential future restack of the entire band is not necessarily inhibited by boundary locations, as evidenced by the 2015 restack of the 3.4 GHz band.
7	If point-to-point licences are affected by replanning activities in the 3.6 GHz band, are the options identified for point-to-point licences suitable? Are there any alternative options that should be considered?	We recommend that RALI FX 3 be amended so that channels above 3800 MHz are prioritised for the relocation of 3.6 GHz point-to-point links to the 3.8 GHz fixed link band, noting that, in line with international trends and the co-primary allocation in Article 5 of the ITU Radio Regulations, the 3700-3800 MHz segment might also be considered for mobile broadband deployment in the future.
8	Is the 5.6 GHz band a viable option for wireless broadband systems?	We believe the 5610-5650 MHz band is a viable alternative for point-to-multipoint services currently operating in the 3.6 GHz band because of the ready availability of point-to-multipoint equipment for the band, and the light use of the band for radiolocation (weather radar) services. In section 3.4.2 we have also explained the need to remove the restriction preventing the use of Wi-Fi equipment in this band.
9	Under what circumstances should apparatus- and class-licensed arrangements be considered for the 5.6 GHz band?	No comment
10	If apparatus licensing arrangements are developed for wireless broadband systems in the 5.6 GHz band, are the notional arrangements proposed in Appendix 3 suitable?	<p>If apparatus licensing arrangements are developed for point-to-multipoint services in the 5.6 GHz band, we believe the notional arrangements in Appendix 3 are suitable. Specifically, we:</p> <ul style="list-style-type: none"> agree with only making the top 40 MHz of the band available to minimise disruption to Wi-Fi services (consistent with the defined Wi-Fi channelisation for the band); agree with the use of site-based apparatus licensing, and note that the ACMA would not be able to grant apparatus licences inside spectrum licensed areas;



Section	Question	Comments
		<ul style="list-style-type: none"> • support a power of 4 Watts as reasonable for point-to-multipoint deployments, noting that antenna gain would lead to higher EIRP; • agree that RALI FX-19 would be appropriate for point-to-multipoint coordination with radars, which may involve the use of exclusion zones around radars; • agree that the pricing for apparatus licences can be “over the counter” using the Apparatus Licence Fee Schedule; and • would support a “priority access” period, whereby apparatus licences in the 5.6 GHz band are only available to services displaced from the 3.6 GHz band, before the band is opened up to requests for new licences.
11	If point-to-multipoint licences are affected by replanning activities in the 3.6 GHz band, are the alternative options identified suitable? Are there any alternative options that should be considered?	We support the 5610-5650 MHz band as the preferred alternative for the relocation of point-to-multipoint services currently operating in the 3.6 GHz band. In addition, we propose that the ACMA also review the feasibility of other possible alternatives such as the 4800-5000 MHz and the 3300-3400 MHz bands for this purpose.
12	The ACMA seeks comment on the suitability of the current west coast earth station protection zone located near Mingenew, WA, for long-term satellite service use. Are the current regulatory arrangements effective?	Telstra does not operate any satellite services in the earth station protection zone near Mingenew. As such, we are not in a position to respond to this question.
13	<p>In the event FSS earth stations are affected by replanning activities in the 3.6 GHz band, the ACMA seeks comment on:</p> <ol style="list-style-type: none"> Any issues surrounding the development and establishment of an east coast earth station protection zone; particularly on what factors would be necessary to make it an attractive option for earth station operations. Whether there are any views on potential candidate locations to consider. Whether there should be more than one earth station protection zone on the east and west coasts of Australia. If the identification of a central Australia earth station zone should be considered. 	Telstra has not conducted analysis on the suitability of these locations for possible future FSS earth stations. As such, we are not currently in a position to offer comments on the suitability (or otherwise) of these sites, and reiterate our earlier comments that in the first instance, we would seek to minimise possible interference from future 5G mobile networks into FSS earth stations through the use of advanced technology such as beam-forming antennas to permit the greatest coverage for 5G services that permits FSS earth stations to continue operating at their current location without interference.



Section	Question	Comments
14	Are the approaches for amateurs, radiolocation services, class licensed devices and TVRO systems suitable?	Yes, the approaches for amateurs, radiolocation services, class licensed devices and TVRO systems are suitable. We note they are offered no protection and must not cause interference to other licensed users of the band under the conditions of their licences.
15	Are there any other options for incumbent services, not identified in this paper, which should be considered?	We have not identified other options beyond the refinements we have already recommended in our answers to previous questions, including: <ul style="list-style-type: none">• prioritising channels above 3800 MHz for the relocation of 3.6 GHz point-to-point links to the 3.8 GHz fixed link band, to limit the use of channels that include the 3700-3800 MHz range;• the use of apparatus (not class) licensing for point-to-multipoint services in the 5.6 GHz band;• lifting the restriction preventing the use of Wi-Fi equipment in the 5.6 GHz band; and• our strong preference for re-tuning FSS services operating in the 3.6 GHz band to C-Band frequencies above 3700 MHz, rather than the physical relocation of earth station facilities.
16	Should any of the sharing arrangements discussed in this section be considered for implementation in the 3.6 GHz band? Why or why not?	No. As the ACMA has identified, these sharing arrangements have been designed to accommodate requirements to protect incumbents that are unique to the US and European markets. Those requirements do not apply to the Australian market. As the ACMA also identifies, introduction of these sharing arrangements in Australia would undermine certainty of spectrum utility resulting in a chilling effect on investment in both mobile broadband and other services such as FSS and point-to-multipoint services.
17	Are there any other sharing arrangements that should be considered?	No. There are no other sharing arrangements that the ACMA should consider.
18	Are there any other replanning options that should be considered?	No. We support Option 3c, which provides for spectrum licensing for Area 3.
19	Which replanning option should be implemented in the band? Why?	We support spectrum licensing in Area 3 (Option 3c) for the reason we have outlined in the body of our submission.



Section	Question	Comments
20	In the event an area-wide licensing option is implemented, in which of the defined areas (that is, Area 1, 2, 3 and Australia-wide as defined in Appendix 6) should these arrangements be implemented? Are the current area definitions appropriate? If not, what area should be defined?	We recommend that area-wide licensing is implemented for Area 3, as defined in Appendix 6 of the Options paper. We reemphasise that Area 3 should be treated as a single area, with no subdivisions for metropolitan or major regional areas.
21	If Option 4a is implemented, what frequencies and areas should be re-allocated for the issue of spectrum licences? How much spectrum should remain subject to site-based apparatus licensing arrangements? Should different amounts be considered in different areas?	We do not support Option 4a. Reserving part of the band (e.g., 25 MHz in metropolitan areas and up to 100 MHz in lower population regional areas) to site-based apparatus licensing arrangements is not consistent with the outcome of the HVU assessment, which has concluded that the band should be re-allocated for spectrum licences.
22	If Option 4b is implemented, what frequencies and areas (that is, incumbent apparatus licence services) should remain subject to site-based apparatus licensing arrangements?	We do not support Option 4b, which proposes to identify specific frequencies and geographic areas around incumbent apparatus-licensed services that would not be re-allocated for spectrum licensing. We believe this would be an unworkable situation for spectrum licensees, given the number of point-to-multipoint services and their spread across the entire 3575-3700 MHz range.
23	Comment is sought on the ACMA's preferred option (Option 3c) for the 3.6 GHz band.	We support and recommend Option 3c in alignment with the ACMA's preference.



Appendix 2: Highest value use paper questions – specific responses

Section	Question	Comments
1	Are there any general economic impacts that should be included but are not currently included in the method to determine highest value use?	While other economic impacts from re-farming do exist, these are more specific as opposed to general, and including them would risk introducing a new layer of complexity to the analysis without necessarily altering the overall result that re-farming would lead to an increase in overall economic welfare.
2	Are there any other spectrum valuations (for example, domestic or international auction prices or re-issue prices) that should be considered as a guide to the value of the 3.6 GHz band?	We consider the spectrum valuations to be appropriate for the purposes of the HVU analysis.
3	Is the range of \$/MHz/pop values suitable for this analysis, or is there a case to narrow or broaden the range?	The range of spectrum valuations used in the analysis as a proxy for economic welfare benefits from re-farming of 3.6 GHz spectrum is generally appropriate, although a competitive auction is likely to result in the lower bound being greater than \$0.03/MHz/pop.
4	Would there be a change in the quality of services that could be provided by WISPs with the 5.6 GHz band compared with the incumbent 3.6 GHz band services?	We suggest that WISPs are better placed to respond to this question, and we have not performed our own calculations to assess the figure of \$270k per location to retune from the 3.6 GHz band to the 5.6 GHz band for a site with 240 end users (Table 8 of the HVU paper). However, we reiterate that the re-allocation period should be a time where future spectrum licensees and incumbents can arrive at mutual commercial arrangements, which could include recognition of the cost to re-tune to the new band. We observe that the seven year re-allocation period outside of Area 1 should allow for at least some natural asset replacement/upgrade as existing assets reach their end of life, which would include both the base station and the end user equipment in a point-to-multipoint configuration. We also do not support the proposal to set aside spectrum for WISPs (as per option 4a) to lower the retuning costs for WISPs.
5	What alternative internet services could regional consumers access (excluding NBN Sky Muster services) if WISPs are unable to provide their fixed wireless broadband services?	Alternative services — in at least some areas — could include fixed wireless services from nbn co or mobile broadband services from a mobile service provider.

Section	Question	Comments
6	How could the loss of point-to-multipoint licences in the 3.6 GHz band affect regular business operations for non-WISP licensees?	Telstra does not have a view on this question and we suggest that non-WISPs currently using the band are better placed to respond to this question. However, we suggest that for non-WISPs displaced from the 3.6 GHz band, an additional replacement option could include use of 5G mobile services, especially where the non-WISP is a council or government authority (e.g., road authority).
7	Are the applicable costs for equipment replacement and re-tuning for point-to-multipoint licences suitable? If not, what cost ranges should be applied?	In the first instance, we suggest that WISPs and non-WISPs are better placed to respond to this question. We do observe, however, that equipment costs for equipment in the 5.6 GHz band are broadly similar to equipment costs for the 3.6 GHz band, and reiterate that the seven year re-allocation period should allow for at least some natural asset replacement/upgrade as existing assets reach their end of life.
8	Are there any additional costs (applicable under a Total Welfare Standard) that have not been considered in this analysis?	We are not aware of any additional costs (under a Total Welfare Standard) that have not been considered by the ACMA.
9	If the 3.6 GHz band is re-farmed, what is the extent to which a longer re-allocation period would reduce incremental costs under a TWS?	Under a TWS framework a longer re-allocation period: <ul style="list-style-type: none"> • Would not significantly alter costs under constant output cases, as retuning and/or replacement costs would still need to be incurred, along with upgrades to user terminals, (although, this might be better able to occur as part of the natural asset life of the equipment under a longer re-allocation period); • May reduce costs for variable output cases, as the period before disruption occurs would be longer.
10	Is the cost range for the relocation of all C-band licences from an FSS earth station facility suitable for this analysis?	Telstra has not conducted detailed analysis of the likely cost range for relocating C-band services, however, we observe the cost ranges submitted by other satellite operators as quoted in the HVU assessment paper, and these seem reasonable. Based on cost estimates submitted by other satellite operators, the ACMA has arrived at an estimate of \$20m-\$50m for all C-band services at a single FSS earth station facility, which we agree is suitable for the HVU analysis.



Section	Question	Comments
11	Are the applicable costs for equipment replacement and re-tuning for point-to-point licences suitable? If not, what cost ranges should be applied?	At this point in time, Telstra has not conducted detailed analysis on the likely cost range for replacement or re-tuning of point-to-point services, however, we observe that due to the specific circumstances of some of our services, notably, those to King Island, the cost estimates determined by the ACMA for replacement (\$85k-\$100k per link) may underestimate the costs incurred by Telstra, should the equipment need to be replaced rather than retuned.
12	To what extent would 3.6 GHz band spectrum be less valuable if it was restricted to small cell use only?	The value of the 3.6 GHz spectrum would be dramatically diminished if it was restricted to small cell use only, and we do not understand why such an arbitrary constraint would ever be put in place. The planned use for the 3.6 GHz band is broad geographic coverage based on a macro-cell deployment model (possibly with some small-cell infill) with advanced technologies such as Massive or Full Dimension MIMO to improve performance. Restriction of this band to a small-cell only deployment model would force significantly more physical builds/deployments to achieve the same coverage as a macro-cell deployment model, significantly increasing the cost to network operators in negotiating access to new sites, deploying backhaul and ongoing configuration of the network.
13	What kind of differences in value would there be for 3.6 GHz band spectrum in regional or remote areas when compared with metropolitan areas?	A range of factors inform spectrum valuations and it is difficult to be definitive about differences in value between spectrum resources based on their location, noting metropolitan licences have typically had the greatest dollar value (due to underlying population) but on a unit price basis (\$/MHz/pop) metro and regional licence prices may not necessarily be very different. In the 2012-17 process for renewal of spectrum licences in the 1800, 2100, 2300 and 3400 MHz bands, the same unit prices (\$/MHz/pop) were applied to metropolitan and regional licences. In some cases regional and remote licences can have lower valuations due to the higher deployment costs (for given coverage outcomes) in these areas, while the value of these licences may – in in some cases – increase where they have the capacity to complement metropolitan holdings. Other factors such as the quantum of spectrum available and/or the presence of competition limits can also impact valuations.