



# **PLANNING OF THE 3700–4200 MHZ BAND**

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

Public version

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# 1 Executive summary

Vodafone Hutchison Australia Pty Ltd (**VHA**) is pleased to make this submission to the ACMA's *Planning of the 3700-4200 MHz band* discussion paper (**Paper**).

There are compelling reasons for the ACMA to progress the 3700-4200 MHz band to the preliminary replanning stage. Australia is at risk of falling behind international counterparts as less 5G spectrum has been made available for wireless broadband (**WBB**) in Australia than virtually all its international peers. Wireless data growth continues in Australia at exponential rates, meaning that the smaller amounts of spectrum brought to market to date will be quickly exhausted. The intensification of global interest in using the 3400-3800 MHz and 3800-4200 MHz frequency ranges for WBB makes it a key band in the 5G spectrum landscape. There is already strong demand for access to at least some parts of the spectrum in Australia as the spectrum is compatible with the 3.6 GHz band recently auctioned by the ACMA.

The ACMA should separate its processes for 3700-3800 MHz and 3800-4200 MHz so it can accelerate access to the 3700-3800 MHz range for WBB in metropolitan areas. The 3700-3800 MHz should be immediately replanned for WBB services in the metropolitan areas of Sydney, Melbourne, Brisbane, Perth, Adelaide, and Canberra where demand for 5G services is expected to be highest.<sup>1</sup> The ACMA should also consider immediately replanning a further 200 MHz (3800-4000 MHz) in Melbourne, Brisbane, Adelaide and Canberra due to the limited existing use of this spectrum.

Action is required now on the 3700-3800 MHz range to take advantage of MNOs' major 5G investment cycle (which is already partly underway) and to avoid the deployment of 3.6 GHz equipment that is incompatible with the use of the 3700-3800 MHz frequency range. The economic benefit from reallocating the 3700-3800 MHz frequency range to WBB in major capital cities can be conservatively estimated at \$129 million based on the methodology previously used by the ACMA for the 3.6 GHz band. The benefits are much greater than the incremental costs of moving incumbent fixed links in capital cities out of the segment, with those costs estimated at \$0.9 million to \$1.8 million.<sup>2</sup> These benefits will increase if spectrum from the 3800-4000 MHz range can be added to the allocation.

VHA urges the ACMA to commit to a timeline to allocate the 3700-3800 MHz spectrum in 2021 (with access from H1 2022) and consider including spectrum in the 3800-4000 MHz range in Melbourne, Brisbane, Adelaide and Canberra as part of this allocation. The 3700-3800 MHz allocation should include the metropolitan spectrum. It should also include the regional spectrum license areas immediately surrounding the six metropolitan areas, especially for Brisbane and Sydney, (as these actually encompass metropolitan areas as well) and potentially the remaining regional areas provided that doing so will not delay the timeline for making the

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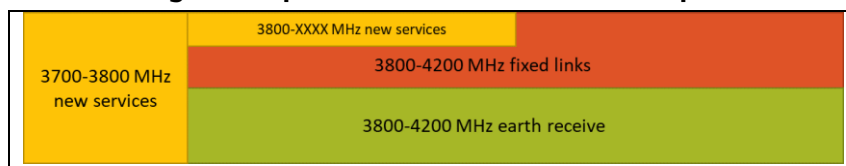
<sup>1</sup> The 3.6 GHz spectrum licence areas of South Queensland and Northern NSW, Western NSW and Regional Victoria should be prioritised as well given they include parts of metropolitan Sydney, Melbourne and Brisbane.

<sup>2</sup> Derived by using the ACMA's highest value use methodology for the 3.6 GHz band.

metropolitan spectrum available. Based on the precedent set by the 3.6 GHz band reallocation process, an auction in 2021 is feasible as much of the assessment (such as highest value use assessment) and the procedural matters leading to an auction will be very similar to those used in the 3.6 GHz allocation process. The ACMA already has sufficient grounds to immediately progress the 3700-3800 MHz segment to a preliminary replanning phase and commence a comprehensive assessment of the spectrum's highest value use. The ACMA should aim to release the results of this assessment and its view on re-farming the 3700-3800 MHz segment by the end of the year.

The ACMA contemplated four planning scenarios in its Paper. Of these scenarios, VHA supports scenario c which enables exclusive use in one band segment by new services (i.e., WBB), shared use in another segment by new services and incumbent services, and incumbent-only use in the rest of the band. A stylised representation of the ACMA's spectrum scenario is shown in **Figure 1**.

**Figure 1: Spectrum scenario from the Paper**



VHA supports extending the shared use segment to cover the entire 3800-4200 MHz segment; in the alternative, the shared use segment should span at least 3800-4000 MHz.

While not within the scope of the Paper, the potential for the deployment of network equipment in the 3.6 GHz band that is incompatible with the 3700-3800 MHz range ought to be of significant concern to the ACMA. The existing arrangements for 3400-3700 MHz do not optimise 5G performance and the problems worsen when the entire 3400-3800 MHz range is considered.

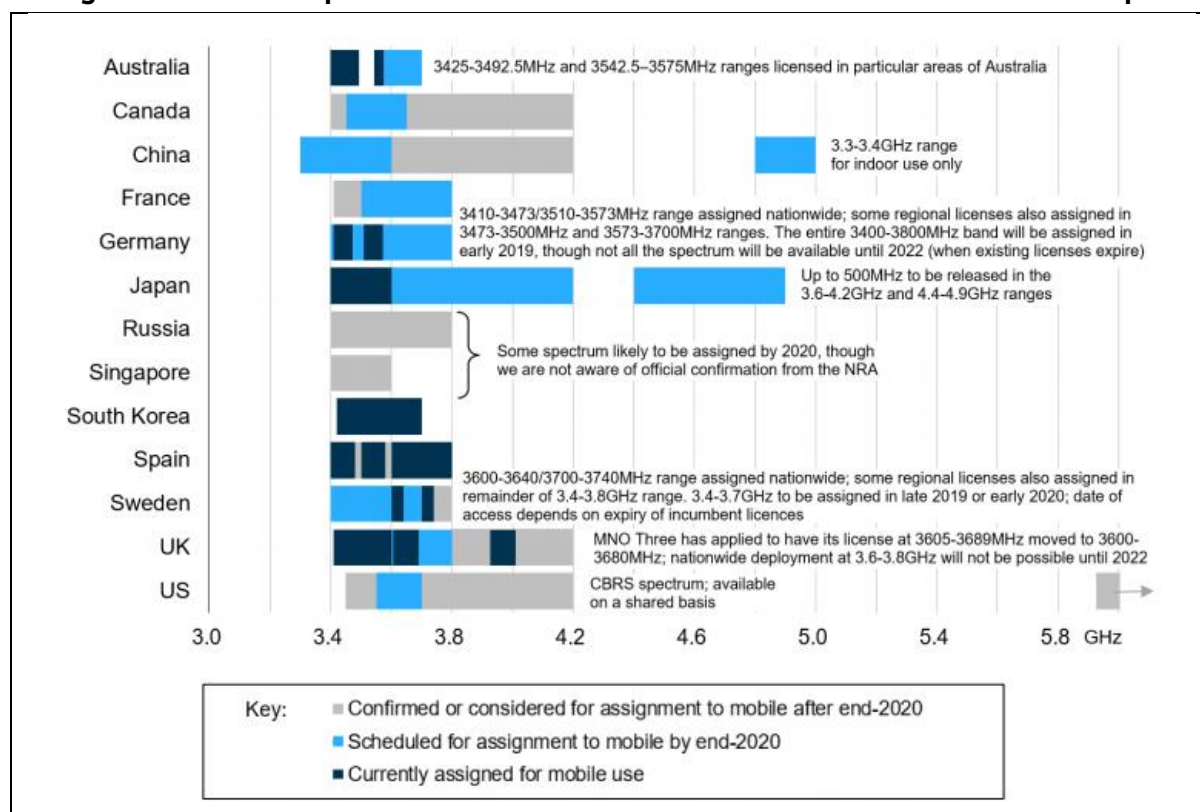
For example, the emission mask imposed on licences in the 3.6 GHz band will have significant and persistent ramifications for the future use of the 3700-4200 MHz frequency range for WBB. Equipment vendors are required to make Australian variants of their global 5G equipment to satisfy the emission limits imposed by domestic conditions on spectrum licences in the 3.6 GHz band. The costs and delays of requiring bespoke equipment in a standard band but configured only for the Australian market should not be underestimated.

Then, as those Australian variants cannot operate above 3700 MHz, once that equipment is deployed, those Australian variants would need to be replaced with global variants if the carrier intends to use spectrum above 3700 MHz. This would be an extremely costly requirement to fulfil, essentially forcing either delays or a replacement of significant components already installed. Urgent action is required by the ACMA to remedy this situation through either regulatory forbearance or voluntary arrangements to vary spectrum licences to change the emission masks.

## 2 International regulatory developments

As acknowledged in the Paper, many countries have already allocated or are in the process of allocating the whole of, or a part of, the spectrum in the 3700-4200 MHz range for 5G services. See for example the following research in **Figure 2** by Analysys Mason:<sup>3</sup>

**Figure 2: Mid-band spectrum for mobile use in benchmark countries from the Paper**



Consistent with developments by the 3GPP for 5G (bands n77 and n78) and 4G (band 43), there is a trend globally towards allocating the spectrum ranges 3400-3800 MHz and 3800-4200 MHz for WBB on either an exclusive or a shared basis. Several countries have begun to use 3400-3800 MHz for mobile services, with the adjacent 3800-4200 MHz the next practical spectrum range to be released. Japan is the most progressed in this regard, having recently allocated bands between 3400-4200 MHz to its four mobile operators. In comparison, Australia appears out of step with an allocation of mid-band 5G spectrum of 3400-3700 MHz with no existing plans to designate any spectrum in the 3700-4200 MHz range for WBB use.

<sup>3</sup> Analysys Mason white paper – Mid-band spectrum global update, November 2018

### 3 Our preferred spectrum scenario

Of the four spectrum scenarios the ACMA canvased, VHA supports scenario c which has the following characteristics:

- exclusive use in the 3700-3800 MHz segment for WBB services;
- shared use from 3800 up to at least 4000 MHz for WBB and incumbent services; and
- incumbent use in the remainder segment of the band.

Under scenario c, the ACMA ought to consider shared use across the entire 3800-4200 MHz segment as there is global support for the use of WBB up to 4200 MHz (NR band n77).

In the interests of an accelerated planning and allocation process, VHA advocates:

- a staggered approach where the 3700-3800 MHz segment is prioritised (at least in metropolitan areas) and reallocated;
- that the ACMA also consider a further 200 MHz (3800-4000 MHz) in Melbourne, Brisbane, Adelaide and Canberra for allocation within the same process;
- the arrangements for the remainder of the band (including any spectrum in the 3700-4200 MHz range not allocated through the aforementioned steps) being progressed as a lower priority; and
- the geographic licence boundaries used for the 3.6 GHz spectrum licences should be adopted for the 3700-3800 MHz segment, with the metropolitan areas (correcting a significant flaw with the 3.6 GHz licences and including the surrounding “regional” licenses) prioritised for allocation.

The sharing framework should encompass geographical exclusion zones around incumbent satellite services. WBB users could then comply with these zones by ensuring compatible antenna radiation configurations, in addition to restrictions regarding transmitting devices (e.g., lower powered devices closer to incumbent equipment). In international markets such as the UK, WBB and satellite have shared access to key bands. VHA is confident such mechanisms can be implemented successfully in the domestic context.

VHA acknowledges ACMA’s recent consultation on dynamic spectrum access (**DSA**) and agrees that it may be a future solution for general spectrum sharing, but currently the ecosystem is not sufficiently mature for its widespread implementation.

## 4 Allocate 3700-3800 MHz in 2021

The ACMA should accelerate its replanning of the 3700-3800 MHz frequency range. Using the 3.6 GHz allocation process as a guide,<sup>4</sup> an auction of the 3700-3800 MHz in 2021 is achievable if the ACMA accelerates its work program. Specifically, the ACMA should release its planning decision for the 3700-3800 MHz segment by the end of 2019 by leveraging the work it undertook during the 3.6 GHz initial investigation phase (e.g., the highest value use assessment for WBB will be similar to the assessment previously undertaken by the ACMA). This will likely require decoupling its work program for the 3700-3800 MHz segment from its assessment of the 3800-4200 MHz frequency range.

The ACMA should also consider accelerating its replanning for a further 200 MHz (3800-4000 MHz) in Melbourne, Brisbane, Adelaide and Canberra due to the limited use of this spectrum by incumbents and a well-established use case for WBB. If the inclusion of the additional 200 MHz of spectrum in the four capital cities will significantly delay the allocation process, then VHA prefers it be excluded from the process for allocating the 3700-3800 MHz range.

### 4.1 Incumbent use

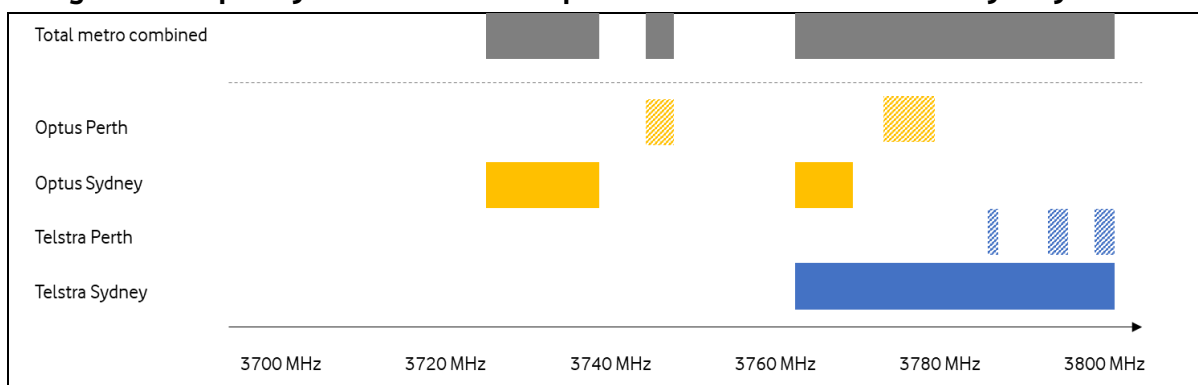
VHA recognises that there are incumbent interests in the 3700-4200 MHz band. As outlined above, VHA supports an acceleration of the ACMA's consideration of the 3700-3800 MHz segment and a further 200 MHz (3800-4000 MHz) in Melbourne, Brisbane, Adelaide and Canberra. Replanning for the remaining parts of the band should progress as a lower priority. A key reason for a staggered process is to minimise the disruption to incumbent users while transitioning spectrum to its expected highest value use (i.e., WBB).

There are limited incumbent interests in the 3700-4000 MHz range in Adelaide, Brisbane, Canberra and Melbourne (see Appendix 2 of the Paper). However, there are incumbent interests in Sydney and Perth with both Telstra and Optus operating satellite earth receiver stations (see **Figure 3**).

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<sup>4</sup> The ACMA proposed to progress the 3.6 GHz band to preliminary replanning in October 2016 and published its notice advertising the auction in August 2018.

**Figure 3: Frequency use for Telstra & Optus earth receiver stations in Sydney & Perth**



The existence of the earth receive stations in Sydney and Perth should not prevent the ACMA from progressing the 3700-3800 MHz segment to auction in these geographic areas. In the short-term, those services can be protected by licence conditions that require prospective licensees to avoid causing interference to the earth stations. The longer-term solution must progressively clear those services out of the band, potentially relocating the services to a different frequency range or to a different geographic region that is outside the major metropolitan areas.

The fixed point-to-point links operating in the 3700-3800 MHz segment should be phased out of the 3700-3800 MHz segment in areas that would be spectrum licensed. Clearance of incumbent point-to-point use should be prioritised in Sydney and Brisbane as these are areas of high demand for WBB.

## 4.2 WBB provides the highest value use

WBB is demonstrably the highest value use of the 3700-3800 MHz spectrum. Based on the methodology used by the ACMA for its 3.6 GHz highest value use assessment spectrum in the five major capital cities plus Canberra delivers at least \$129 million in economic benefits.<sup>5</sup> We regard this estimate as extremely conservative - the downstream benefits from making more 5G spectrum available are expected to be substantial. The Bureau of Communications Research suggested that the productivity impacts of 5G alone could be worth between \$1,300 and \$2,000 in additional GDP per person by 2030.<sup>6</sup>

The 3.6 GHz highest value use assessment indicated the cost of replacing a fixed link at \$85,000-\$100,000. The ACMA also considered that it may be feasible to re-tune rather than replace fixed

<sup>5</sup> The ACMA assessed the economic benefit of 125 MHz of 3.6 GHz spectrum in Area 1 (i.e., Sydney, Melbourne, Brisbane, Adelaide, Perth and Canberra) using an assumed benefit price of \$0.10/MHz/pop to be worth \$201 million. To determine a conservative estimate, we have pro-rated that result using 100 MHz of spectrum and the reserve price from the 3.6 GHz auction (i.e., \$0.08/MHz/pop) – that is, \$201m x (100/125) x (0.08/0.10) = \$129m.

<sup>6</sup> Bureau of Communications and Arts Research. (2018). Impacts of 5G on productivity and economic growth. Australian Government, Department of Communications and the Arts.



links. It estimated re-tuning costs were under \$1,000 and it might be possible to re-tune rather than replace these fixed links. There are 18 of these links operating in the 3700-3800 MHz across Sydney and Brisbane (and none in Melbourne, Adelaide, Perth or Canberra), using the same methodology as the ACMA used for the 3.6 GHz highest value use assessment the incremental cost of a reallocation decision for fixed links is estimated to be between \$909,000 to \$1.8 million.<sup>7</sup>

The magnitude of economic benefits from reallocating the 3700-3800 MHz frequency range to WBB relative to the incremental costs of moving incumbent fixed links provides a compelling rationale for the ACMA to take immediate action to accelerate access to this segment. These benefits will increase if spectrum from the 3800-4000 MHz range is added to the allocation.

## 5 Optimise arrangements in the 3.6 GHz band

The equipment ecosystem, both for network equipment and device chipsets, for 3400-3800 MHz is rich due to the global popularity of this band for 5G deployment. However, due to the emission mask requirements imposed by the ACMA in the 3.6 GHz band, VHA and other Australian carriers are unable to take advantage of the global scale. Moreover, this problem is likely to have enduring ramifications for the planning of the 3700-4200 MHz band if it is not remedied.

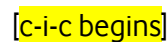
The emission mask for 3.6 GHz spectrum licences at the 3700 MHz edge of the 3.6 GHz band is a mechanism designed to address potential out-of-band emission issues. Unfortunately, the existing mask has significant ramifications for the future use of spectrum above 3700 MHz. VHA has confirmed with prospective vendors that none of their C-Band active antennas intended for use with 5G globally can be used in Australia, yet several of these products are otherwise capable of operating all the way up to 3800 MHz while still meeting the out-of-band emission requirements specified by 3GPP when their operation is limited to the current Australian upper allocation limit of 3700 MHz.

A consequence of the ACMA emission mask is that vendors have been forced to make a unique Australian market variant that cannot be used with any future spectrum above 3700 MHz. This means the opportunity for Australian carriers to use spectrum above 3700 MHz is likely to be unreasonably costly once the equipment for 3.6 GHz spectrum is deployed, as the initial antenna systems deployed to comply with the emission mask need to be replaced after only a short period in service. The duplication of C-Band radios to address this issue may often be infeasible due to sites already having reached their structural limits once the first C-Band active antenna system is deployed.

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<sup>7</sup> Under the ACMA methodology, replacement costs were \$100,000 per licence and re-tuning costs were \$737 per licence. In this analysis, the re-tuning costs have been rounded up to \$1000 per licence. The minimum cost estimate assumes that 50 per cent of licences require equipment replacement and 50 per cent require re-tuning; the maximum cost for each area assumes 100 per cent of licences require equipment replacement.

**Figure 4: Australian band n78 emission mask depiction for AAS devices (example showing a licence at the top of the band covering 3640-3700 MHz).**



[c-i-c continues]

c-i-c ends]

Regardless of the progress of the 3700-4200 MHz consultation, the ACMA should relax the emission mask requirements at the 3700 MHz edge of the 3.6 GHz band. If there are lingering interference concerns the ACMA ought to consider an alternative approach, for example regulatory forbearance on 3.6 GHz licensees provided they do not cause interference to the services of incumbents above 3700 MHz. Such an approach is consistent with the object set out in section 3(c) of the *Radiocommunications Act 1992* (**Radcomms Act**) to “provide a responsive and flexible approach to meeting the needs of users of the spectrum”. Alternatively, the ACMA ought to consider using section 72 of the Radcomms Act to vary 3.6 GHz licence conditions for managing out-of-band emissions to ensure the economic benefits of near-term 5G deployments are maximised.

## Appendix A. Response to ACMA questions

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

VHA generally agrees with the information presented in the ACMA Paper. It is clear there is global interest in allocating mid-band spectrum for 5G technologies, particularly in the 3400-3800 MHz range. Australia's decision to only allocate spectrum up to 3700 MHz for WBB, with no existing plans to make spectrum above 3700 MHz available for WBB, appears out-of-step with international developments.

Given the interest in many other countries, the equipment ecosystem is particularly rich for equipment that operates in the 3400-3600 MHz and 3600-3800 MHz segments. The existing arrangements in the 3.6 GHz band may limit Australian carriers' ability to leverage the economies of scale benefits associated with international harmonisation of spectrum allocations.

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?

N/A.

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?

N/A.

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?

The arrangements in the 3700-4200 MHz should be consistent with the arrangements in the 3.6 GHz band.

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?

There is strong demand for spectrum in the 3700-3800 MHz segment for WBB services in the near term.

VHA supports allocating the 3700-3800 MHz segment for WBB use along the same licence areas as the adjacent 3.6 GHz band as a priority (or at least the metropolitan part of it). The ACMA

should also consider allocating a further 200 MHz (3800-4000 MHz) in Melbourne, Brisbane, Adelaide and Canberra as part of the same process due to its limited incumbent use. Consideration of the segment above 3800 MHz in other regions should progress albeit as a lower priority.

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?

Both mobility and FWA WBB deployments are suitable for the 3700-3800 MHz segment, and spectrum licensing is appropriate for this segment with geographic areas identified that are identical to the licence areas used for the adjacent 3.6 GHz band.

It is premature to consider what arrangements might be suitable for the 3800-4200 MHz range. That said, VHA urges this spectrum to be allocated for its highest value use, that being WBB services.

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

As outlined above, the equipment ecosystem is already well developed for operating in the 3600-3800 MHz range. Although not as well developed, there is equipment capable of operating above 3800 MHz. We anticipate the equipment ecosystem for operating in the 3800-4200 MHz range will develop alongside regulatory arrangements for this band globally.

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

VHA supports allocating the 3700-3800 MHz segment for WBB services in the near term. Planning of the remainder of the band should progress as a lower priority.

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

VHA supports allocating the 3700-3800 MHz segment for WBB services in the near term. Planning of the remainder of the band should progress as a lower priority but the services are expected to be the same as for 3400-3700 MHz.

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

VHA supports allocating the 3700-3800 MHz segment for WBB services in the near term. The ACMA should also consider allocating a further 200 MHz (3800-4000 MHz) in Melbourne, Brisbane, Adelaide and Canberra as part of the same process due to its limited incumbent use. Planning of the remainder of the band should progress as a lower priority.

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

VHA supports adopting the 3.6 GHz geographic licence boundaries for the 3700-3800 MHz segment and for as much of the 3800-4200 MHz range as possible in recognition of some retained incumbent services.

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?

VHA supports adopting the same arrangements as the adjacent 3.6 GHz band for the 3700-3800 MHz segment. Planning of the remainder of the band should progress as a lower priority.

It is reasonable for the ACMA to continue to explore the potential to use shared spectrum schemes above 3800 MHz as it continues its initial investigation.

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

VHA supports adopting spectrum licensing arrangements in the 3700-3800 MHz segment that are similar to the arrangements for the adjacent 3.6 GHz band. Spectrum in the 3800-4000 MHz range in Melbourne, Brisbane, Adelaide and Canberra should also be spectrum licensed.

It is premature to consider what arrangements might be suitable for other parts of the 3800-4200 MHz range.

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?

VHA supports adopting similar arrangements as the adjacent 3.6 GHz band for the 3700-3800 MHz segment, however, VHA urges the ACMA to relax the emission mask requirements at the 3700 MHz edge of the 3.6 GHz band.

In principle, identical arrangements should apply across the 3400-3800 MHz range.

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?

VHA supports making arrangements consistent across the 3400-3800 MHz range.

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

N/A.