Australian Government | acma Australian Communications and Media Authority

Future use of the upper 6 GHz band
Outcomes paper

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Executive summary

In response to the growing interest for access to the upper 6 GHz band (6425–7125 MHz) for radio local area network (RLAN) and wide-area wireless broadband (WA WBB) services, we released the *Future use of the upper 6 GHz band*[1] options paper in June 2024.

The paper sought views on planning options to support the introduction of RLAN and/or WA WBB services in the upper 6 GHz band and posed 4 questions for comment. We received 29 responses, mainly supporting the introduction of either RLAN or WA WBB services, supported by use-cases and evidence of the benefit of that use to Australia.

We have undertaken a detailed consideration of the information provided in responses to the options paper and assessed the options against the desired planning outcomes. While the introduction of either RLAN or WA WBB services into the upper 6 GHz band would net significant economic and productivity benefits, there is not sufficient evidence to indicate that either application would require access to the entire band for the vast majority of use-cases that either service would undertake to meet. Geographically, we also found that there is insufficient need for any new WA WBB arrangements to be introduced Australia-wide.

We have also been keeping abreast of international arrangements and deployments, including:

- standardisation
- industry developments
- national regulatory arrangements
- spectrum harmonisation through the International Telecommunication Union (ITU) processes.

There is an established market for RLAN (specifically Wi-Fi) devices, in particular in North America, that operate in the band. We also note that the entire band has been identified in key markets such as Europe and Africa for International Mobile Telecommunications (IMT) in the ITU Radio Regulations – a key market signal on potential WA WBB use of the band in those markets. However, national/regional regulatory arrangements to support WA WBB deployments are less mature and we continue to monitor these developments. Other established WA WBB equipment markets outside these areas do exist, but they do not readily translate to the Australian market.

We have decided that the best use of the band will be achieved by making arrangements for both services on a frequency split basis, consistent with the so-called ‘hybrid’ option presented in our paper. Specifically, we have decided:

- **To include the frequency range 6425–6585 MHz into the Radiocommunications (Low Interference Potential Devices) Class licence 2015 (LIPD class licence), when it is next updated, to support RLAN use.** When aggregated with the existing 500 MHz already in place for RLANs in the lower 6 GHz band (5925–6425 MHz), this means that 2 x 320 MHz, 4 x 160 MHz or various other combinations of 40, 80 160 and/or 320 MHz Wi-Fi channels can be used in a given location. These new arrangements will come into effect when we remake the LIPD class licence before it sunsets in October 2025.

[1] Options paper: Future use of the upper 6 GHz band

- **That the frequency range for 6585[2]–7100 MHz will be reserved for WA WBB in yet to be defined metro areas/regional centres.** We refer to these as 'defined population areas' in this paper.[3] This is subject to us being satisfied that the market for the manufacturing of equipment in this frequency range to support WA WBB will be established. The development of such equipment manufacturing is dependent on international regulatory bodies such as the European Conference of Postal and Telecommunications Administrations (CEPT) and/or the Indian administration indicating they are inclined to allocate spectrum in this range for WA WBB. The earliest date that we may get an understanding of where CEPT is heading is March 2025, when they release their interim coexistence study.[4] We will not commence implementing WA WBB arrangements until this uncertainty surrounding the future establishment of suitable equipment markets has been resolved. If relevant international markets are inclined not to allocate this spectrum range for WA WBB, we will update stakeholders on our position.
- **In the range 6585–7100 MHz (minus a potential guard band) outside defined population areas, we will consult on the introduction of arrangements that support apparatus-licensed WBB services on a coordinated basis with incumbent services.** This would provide access for localised WBB access to the band. This would be suitable for a range of WBB use-cases, including expanding the capacity WBB networks in other bands, as well as for wireless internet service providers or private networks using Wi-Fi technologies (including 'standard power' Wi-Fi on a coordinated basis), or IMT-based technologies when equipment becomes available.

[2] This frequency is likely to be higher to provide for frequency separation between RLAN and WA WBB use. This will be established as part of a future consultation process and informed by compatibility studies.
[3] Consultation to finalise the defined areas will be subject to a separate process.
[4] Further discussion on the ongoing work in Europe is provided in the International context and equipment markets section of this paper.

Introduction

The upper 6 GHz band (6425–7125 MHz) has received significant interest, both domestically and internationally, for the potential introduction of RLAN and WA WBB services. In Australia, this band is used by fixed satellite services, point-to-point fixed links and television outside broadcast services. Current planning arrangements do not support the widespread introduction of RLAN or WA WBB services in the upper 6 GHz without our intervention.

In June 2024, we released the *Future use of the upper 6 GHz band* options paper.[5] It identified domestic and international considerations for the future use of the upper 6 GHz band and presented options for potential planning arrangements to enable RLAN and/or WA WBB use in the band.

The paper also explored the potential use of dynamic spectrum allocations systems, such as automated frequency coordination (AFC), to lessen power restrictions on RLAN use in existing (and potentially future) RLAN frequency bands. We will continue to consider these issues as part of a separate process.

The options paper sought views and posed questions about the 4 planning options and sought detailed information on how the proposed new services would benefit end users, and evidence on the demand for these services. The 4 options were:

- **Option 1:** Maintain existing arrangements, with potential reconsideration at a later date.
- **Option 2:** Introduce arrangements to enable RLAN access to some or all of the upper 6 GHz band, via a variation to the LIPD class licence. There would be no arrangements introduced for WA WBB.
- **Option 3:** Introduce arrangements to enable WA WBB access to some or all of the upper 6 GHz band, under apparatus and/or spectrum licensing. There would be no arrangements introduced for RLANs.
- **Option 4:** Introduce arrangements to enable both RLAN and WA WBB access to different frequency segments within the upper 6 GHz band, using the respective authorisation arrangements in options 2 and 3.

In this paper, we provide:

- A summary of submissions received in response to the options paper and respond to key issues raised.
- A refinement of the planning options, informed by input in the submissions,
- An assessment of the refined planning options against the desired planning options established in the options paper, including an examination of the quantitative costs and benefits.
- An outline of our planning decisions on the future use of the band, and discussion on next steps towards implementation of those decisions.

[5] Options paper: Future use of the upper 6 GHz band

Summary of submissions

We received 29 submissions in response to our options paper. You can access these on the consultation page. Responses were mainly either pro-RLAN or pro-WA WBB, with each group providing cases for their respective use and evidence of the benefit of that use to Australia. This chapter provides a summary of the key issues and views raised by each sector, and our response.

Some submissions contained views about new arrangements to support higher power RLAN use. As this issue is outside the scope of this paper, it has not been discussed further in the below summary. However, we have noted these views and they will be considered under a separate process.

One submission noted that the passive sea surface temperature measurements are undertaken in the upper 6 GHz band. We acknowledge this use, and it will be considered when considering technical parameters for WB WBB deployments in the band. This will be the subject of a future consultation process.

Sector views

RLAN sector

RLAN proponents cited the value that RLAN use of the upper 6 GHz band would bring to the economy and that access to the upper 6 GHz band was essential to accommodate additional RLAN services. Submissions also noted that RLAN devices that operate in the band are currently available and that providing access to some or all of the upper 6 GHz band for RLAN use would provide 2 key technical benefits:

- Additional 160 and 320 MHz channels, which can support localised, extremely high data rate applications such as virtual and augmented reality.
- An increased number of smaller channel sizes that could be used to limit interference between users in high-density scenarios (such as apartment blocks or educational facilities).

Some submissions indicated that additional spectrum would be needed in high-capacity scenarios such as in universities, industrial settings and sports stadiums.

ACMA response

We acknowledge that the high-density, non-household scenarios described would need additional spectrum to accommodate more RLAN channels to support the data requirements of a high number of end users within a confined area. In these cases, it is likely that fixed-line backhaul capacity would be large enough that the availability of RLAN spectrum would be the limiting factor. This differs from a household scenario where the fixed-line speed would more likely be the limiting factor in many cases. While we do expect that these high-density scenarios will occur, they would be significantly less prolific than the household use of RLANs. It seems likely that in the medium-term, additional spectrum allocated to RLANs to support the highest demand use-cases would be under-utilised outside these isolated scenarios.

There does not appear to be an existing or emerging household need for the additional capacity that enabling access to the whole upper 6 GHz band would provide. Models

presented in submissions were predicated on high use in, for example, apartment blocks, where particular Wi-Fi channel re-use topologies were proposed that minimised potential mutual interference. Wi-Fi is currently used in high-interference environments quite successfully without a need for the kind of low-interference environment that would be provided through the use of more spectrum. The case for multi-gigabit capacity in every home also seems difficult to justify in the short-to-medium term. In-home data capacity is mostly moderated by the connection speed to the home, which is currently typically below 100 Mbps. However, modelling provided in some submissions was based on at least 1 Gbps to every household.

60 GHz band technology such as WiGig is available and may be a viable alternative in some cases. However, it is not a direct substitute for the 6 GHz band, due to its significantly shorter range. So apart from the 6 GHz band, no other spectrum band would be viable to support expansion of RLAN services in the foreseeable future, due to equipment being internationally harmonised and standardised. This means that if the need for additional RLAN spectrum materialises in the future, there may be no other spectrum option until (and if) additional bands are internationally harmonised and standardised equipment become available. The time frames for this may be significant, given that some major international markets have allocated some or all of the upper 6 GHz band for RLAN.

This underscores the importance of the existing 500 MHz made available in the lower 6 GHz band and makes a case for additional spectrum in the upper band. However, it is difficult to justify the full 1200 MHz (the sum of both the lower and upper 6 GHz bands) for all but the most marginal usage scenarios.

WA WBB sector

Submissions in favour of WA WBB use cited the value that the use of the upper 6 GHz band would bring to the economy and that access to the upper 6 GHz band was essential for growth of WA WBB services.

Growth estimates provided by WA WBB proponents indicate that more mid-band spectrum will be needed by their sector and that the upper 6 GHz band is the best candidate to meet this need. This is because, while there is other mid-band spectrum included in 3GPP standards and more bands are being considered for IMT identification under the ITU World Radiocommunication Conference 2027 (WRC-27) study cycle, there are other incumbency issues that may make these other bands less feasible for WA WBB use in Australia.

WA WBB proponents also indicated that their interest is primarily in metro areas and regional population centres but suggested that arrangements should also support ad-hoc WA WBB in regional areas as well.

ACMA response

We acknowledge that WA WBB is a growing sector that will require additional mid-band spectrum to meet growing demand. We note that some major international markets will not have WA WBB use in the upper 6 GHz band (e.g., the United States), so there is the potential that other prospective mid-band options will become harmonised for WB WBB use to meet a spectrum shortfall in those markets in the future. Alternatives to the upper 6 GHz band may therefore emerge, especially post-WRC-27.

Meeting the increasing capacity needs of WA WBB networks can be achieved in a number of ways, including provisioning more spectrum. It can also be increased by deploying more

base stations in lieu of additional spectrum, i.e., through network densification. The potential for additional capacity through densification, rather than additional spectrum, was acknowledged in submissions. However, it was suggested that network densification can be more complex to implement and any increased costs may be passed on to consumers.

WRC-23 identified the upper 6 GHz band for IMT (WA WBB) in Region 1 and various countries in other regions. Currently, the only major market to commit to IMT use in the upper 6 GHz band is China. Europe is still considering hybrid sharing arrangements in the band and India has reserved its decision on the entire (upper and lower) band. However, if both decide against a WA WBB allocation, there is risk that device availability may be limited/costly. The United States, Canada, South Korea and a number of South American countries have already allocated the entire band for RLAN use, so Australia might not benefit from economies of scale for equipment that can be used in the band.

If dedicated WA WBB use were to be supported in the upper 6 GHz band, there is a case for it to be limited to metro areas and regional centres only. We note that submissions indicated that there is less of a need for WA WBB use of the band in regional/remote areas and that WA WBB access in those areas could be facilitated on a shared basis with existing uses. We agree with this premise.

Satellite sector

The satellite sector expressed the broad view that, if it were to support either of the additional uses put forward, it strongly preferred RLAN use. In its view, RLAN devices would be able to coexist with satellite services better than WA WBB services would. Satellite users also stated that WA WBB use would interfere with satellite receivers.

ACMA response

We note that coexistence arrangements included in the ITU-R Radio Regulations (as an outcome of WRC-23) are considered adequate to mitigate the risk of aggregate interference from widespread WBB deployments to satellite uplinks. These arrangements could be mandated in technical frameworks, which would be subject to further discussion via a Technical Liaison Group (TLG) when considering technical parameters for WA WBB deployments in the band.

We agree that RLAN use can coexist with earth stations transmitters with minimal regulatory intervention, and this sharing scenario is already present in the lower 6 GHz band. Coexistence between RLAN and earth station receivers operating above 6700 MHz would require a different regulatory solution if class licensed RLANs were permitted above 6700 MHz.

We also agree that coexistence between WA WBB services and earth stations may require a higher level of regulatory intervention, which would partly depend on the chosen licensing solution. This could range from implementing coordination requirements around existing earth stations and/or requiring earth stations to cease operation in the same area as a potential WA WBB allocation. We agree that the introduction of WA WBB arrangements would likely have a greater impact on fixed satellite service operations than that of introducing RLAN arrangements. However, while the impact on incumbents is an important consideration in any band planning activity, a decision to replan a band for a new service or application will always be based on the arrangements that provide the greatest net benefit from the use of the band. Some analysis on the benefits and impact from the planning options is provided in the Assessment of options chapter in this paper.

Television outside broadcast (TOB) sector

The TOB sector uses spectrum above 7100 MHz to deliver television content of live events (i.e., the upper 25 MHz of the upper 6 GHz band). The sector has argued that changes in spectrum availability over the years has provided an environment of uncertainty and has led to high costs related to equipment turnover, and that some certainty about use of this spectrum is needed.

ACMA response

We note the importance of the upper 25 MHz of the upper 6 GHz band for TOB operations and that the TOB sector has been impacted by several band replanning projects. Consideration of the benefit for ongoing use of this spectrum for TOB operations must be weighed against the benefit that could be provided by introduction RLAN and WA WBB arrangements.

Fixed point-to-point link sector

Representatives of this sector described their reliance on the band and suggested that coordinating with WA WBB to minimise interference would be challenging.

ACMA response

We note the extensive use of the band by fixed point-to-point links and will consider the potential impact of planning outcomes on this service. Similar to our response to the satellite sector, the level of impact would depend on the chosen planning solution, with introduction of RLANs likely to have less of an impact comparted to WA WBB. Some analysis of this impact is provided in the Assessment of options chapter.

Planning considerations

International context and equipment markets

A key input to our decision process is international factors – in particular, the maturity of device equipment markets. Equipment standardisation, industry developments, national regulatory arrangements, and spectrum harmonisation through the ITU all contribute to the availability and scale of devices.

There is an established market for RLAN devices operating in the 6 GHz band, with Wi-Fi 6 and 6E (both part of the IEEE 802.11ax standard) already in the market in many countries, and Wi-Fi 7 (802.11be) devices in the early stages of release. Both technologies use the 2.4 GHz, 5 GHz and 6 GHz bands, depending on national frequency arrangements. The lower 6 GHz band (5925–6425 MHz) has been made available for RLANs throughout much of the world. This includes the Americas, Europe, Russia, Japan and Australia, while the upper 6 GHz band has also been made available in the United States, Canada South Korea and a handful of other countries.[6] This includes standard power Wi-Fi-based equipment, which although not currently authorised under the LIPD class licence, could potentially be operated on a coordinated basis under an apparatus licence. We note that consideration of arrangements that support standard-power RLAN use will be subject to a future, separate consultation process. We are therefore confident that RLAN equipment that operates in the band is readily available.

The scenario for WA WBB equipment is not yet as clear. The upper 6 GHz band has been included in 3GPP standards as part of Release 17 (referred to as band n104). While this is a key milestone, the manufacture of devices that can operate in this band at scale will depend on national regulatory and licensing arrangements being put in place in key markets.

On the regulatory front, the full band has been identified in key markets such as Europe and Africa for International Mobile Telecommunications (IMT) in the ITU Radio Regulations. This is a key market signal on potential WA WBB use of the band in those markets. However, national/regional regulatory arrangements to support WA WBB are in their infancy and may be implemented gradually. We are aware that China has made the entire 6 GHz band available for WA WBB deployments and that some other Asian countries are considering following suit. From an equipment market perspective, this importantly includes India, which is yet to make a decision on the use of the entire (upper and lower) 6 GHz band for RLAN and/or WA WBB use.

The United Arab Emirates also announced in November 2024 their intentions to make the upper 6 GHz band available for WA WBB. We will continue to monitor developments in other (particularly larger) markets. The other major market we are watching closely is Europe, where CEPT's Electronic Communications Committee (ECC) has been studying potential sharing models under which both RLANs and WA WBB would be able to access the upper 6 GHz band. These studies are likely to be considered as part of the broader work in Europe to harmonise technical arrangements in the upper 6 GHz band, where a draft European Commission (EC) Mandate to CEPT, which is being prepared in parallel to the ECC study, requests CEPT to:

[6] Including Brazil, although we understand there has been further consideration of potentially repurposing the upper 6 GHz band for WBB.

> Study feasibility of and develop least restrictive harmonised technical conditions for the potential shared use of the 6425–7125 MHz frequency band for the provision of wireless broadband by terrestrial systems capable of providing wireless broadband electronic communications services and by wireless access systems, including radio local area networks.

Three tasks are set out in the draft EC mandate:

- study coexistence of prospective RLAN and WA WBB services with incumbent services
- study the feasibility and scenarios for shared RLAN/WA WBB use
- develop harmonised technical conditions for access to the band.

The current ECC study appears to align with the second of those tasks.

Assuming the EC adopts the draft mandate, an interim report on the coexistence study is expected in March 2025. However, harmonised conditions are not scheduled for finalisation until July 2027, with various reporting milestones against the 3 tasks scheduled. While 2027 is some time off, favourable coexistence studies, later reinforced by feasibility studies, would be a strong indication that the eventual harmonised arrangements would contain provisions for both WA WBB and RLAN access on a shared basis.

March 2025 might be the first key waypoint in gaining an indication of where Europe might be heading. More clarity will emerge as interim, draft and final reports on each of the 3 tasks are delivered to the EC, and we will watch these developments with interest. How and when EC member administrations choose to adopt/implement harmonised arrangements will also be a key factor, but it can be reasonably assumed that those harmonised arrangements will be a useful indicator of future equipment markets overall. At the latest, it seems that a clear picture of equipment markets in both India and Europe will be available in 2027. However, there could be sufficient evidence to make informed projections ahead of that.

Another factor when considering the implications of international standards and markets is the impact that unique Australian arrangements might have on the provision of equipment to the Australian market. Our technical frameworks that govern access to spectrum are intended to manage coexistence with other licensed services in our domestic environment – international standards are a key input to frameworks but there are other considerations that go into developing domestic licence conditions.

We seek to adopt international standards to the most feasible extent – principally, so our industry can benefit from market scale and limit deployment costs. However, unique domestic factors often mean that frameworks are a variation on standards rather than a direct adoption. For example, such variations might include additional filtering to, say, protect frequency-adjacent or near-frequency services.

In the context of the upper 6 GHz band in Australia, Option 4 provides for frequency-separated access by both RLAN and WA WBB services. This would mean that only a subset of the frequency range that n104-band radios operate across would be used for WA WBB, and some (for example) non-standard filtering might be necessitated. Again, while we seek to make regulations that minimise deployment costs, this is not uncommon in the Australian domestic spectrum environment. We do so knowing that the broader benefit of the planning decisions made will outweigh any additional costs to prospective licensees.

Refinement of planning options

The options paper sought views on 4 planning options (replicated in the Introduction chapter in this paper). Based on feedback we received to the paper, and noting the discussion in the previous section on equipment markets, we have refined the options as below:

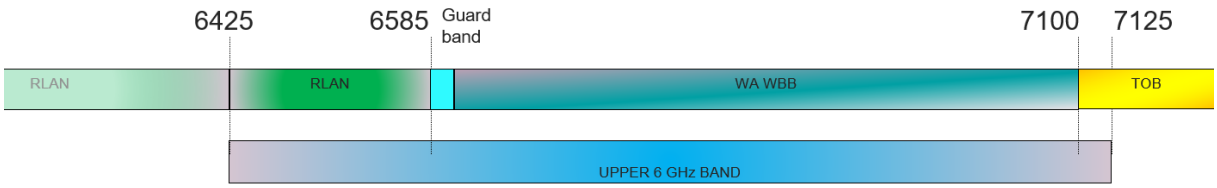
- **Options 1 and 2:** we have not proposed any change to these planning options.
- **Option 3:**
  - Based on feedback about the areas where WA WBB access to the upper 6 GHz band is primarily needed, under this option we would only introduce WA WBB arrangements in defined population areas (a preliminary view on these defined areas is provided later in this chapter). Outside these defined areas, arrangements would be introduced for apparatus-licensed WBB use (not limited to wide-area applications of WBB), on a coordinated basis with existing users.
  - Our disposition is that the range 7100–7125 MHz should remain available for TOB use, due in part to the expected increase in TOB use of this spectrum as a result of planning changes to TOB use in the 2 GHz band.[7] This means that under this option, the upper bound of a WA WBB allocation in defined areas (and WBB allocation outside of defined population areas) would be limited to 7100 MHz. This would negate the need for TOB services to cease operating in 7100–7125 MHz.
- **Option 4:** changes include the 2 revisions discussed for Option 3, as well defining the proposed frequency boundary between – and therefore amount of spectrum for each service resulting from – spectrum allocations for RLAN and WA WBB (see Figure 1). This option is also split into 2 sub-options (4A and 4B), with Option 4B being a temporal variation on 4A:
  - **Option 4A:**

    RLAN arrangements: access to the lower 160 MHz of the upper 6 GHz band (being 6425–6585 MHz) would be provided for RLAN use through an update to the LIPD class licence. This provision, combined with the existing RLAN arrangements in the lower 6 GHz band, would provide for 2 x 320 MHz channels (or various other combinations of 40, 80, 160 and 320 MHz channels) for RLAN use.

    WA WBB arrangements: access to 6585–7100 MHz would be provided for WA WBB use in defined population areas (and WBB access via apparatus licensing in other areas), noting that there would need to be some form of guard band above 6585 MHz to help manage interference between RLAN and WA WBB services (further consideration on the need for a guard band would be considered at a later time when developing the applicable technical frameworks).
  - **Option 4B**: is a variation on 4A, where the proposed arrangements are the same, except we would delay implementing arrangements for WA WBB in defined population areas until international arrangements mature. RLAN arrangements would be implemented as per Option 4A with no delay. This approach would mitigate the risk of implementing WA WBB arrangements before there is certainty of equipment availability in the necessary scale. We would continue to monitor international developments and commence the implementation process once international harmonisation becomes more advanced. Under this sub-option, we anticipate that this delay would not adversely impact RLAN use in 6425–6585 MHz or WBB deployments above 6585 MHz outside defined areas any more than they are already constrained by international factors.

[7] See our 2021 Review of the 2 GHz Television Outside Broadcast Frequency Band Plan.

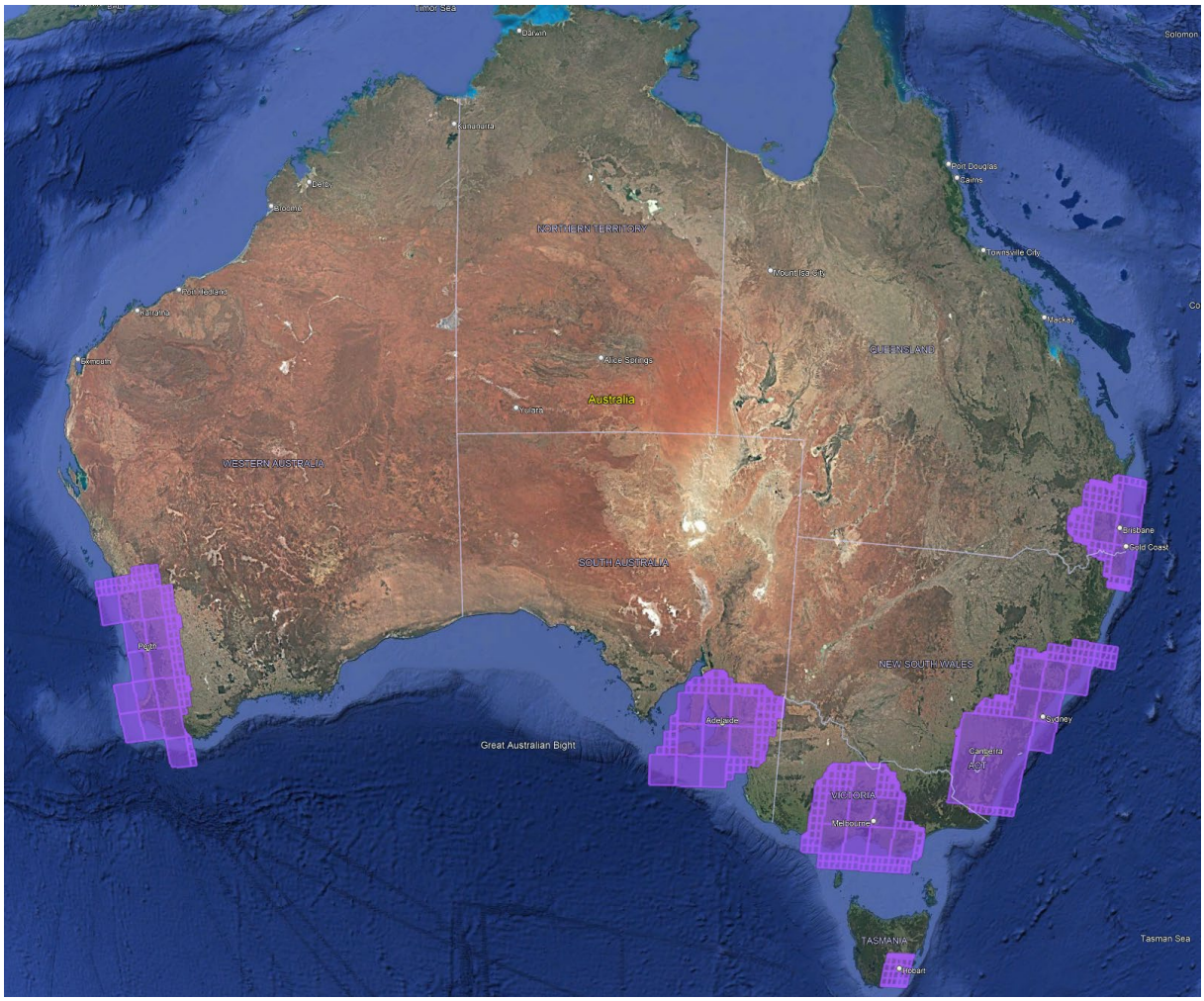
Figure 1: Band configuration under Option 4, guard band size will be determined as part of a future process



Preliminary view on defined population areas

The above refined options refer to WB WBB arrangements being limited to defined population areas. While these areas will be defined later, as a starting point the geographic areas that are subject to spectrum licensing in the 3750–3800 MHz frequency range provide a good indication of what defined areas in the upper 6 GHz band might look like. These areas are set out in the Radiocommunications (Spectrum Re-allocation – 3.4 GHz and 3.7 GHz Bands) Declaration 2022 and are shown in Figure 2. While these areas provide a useful basis for analysing planning options discussed in this paper, they will be subject to further consultation with industry before they are finalised.

Figure 2: Defined population areas for WA WBB arrangements – to be a subject of further consultation



Assessment of options

This chapter contains our assessment of the refined planning options against the desirable planning outcomes for the upper 6 GHz band. This is informed by a quantitative cost-benefit assessment.

Assessment against the desirable planning outcomes

As detailed in the options paper, the desirable planning outcomes for the upper 6 GHz band are:

1. Optimise the efficiency and utility of the upper 6 GHz band by introducing arrangements for RLAN and/or WA WBB services.
2. Maintain regulatory arrangements to the extent possible for existing services within the upper 6 GHz band when optimising its utility.
3. Ensure coexistence with other services in the upper 6 GHz band.
4. Maintain coexistence with adjacent band services.

We have assessed each of the refined planning options against the desirable planning outcomes in working towards our planning decisions. The following sections contain a summary of that assessment:

Desirable planning outcome 1: Optimise the efficiency and utility of the upper 6 GHz band by introducing arrangements for RLAN and/or WA WBB services.

Option 1 provides no arrangement to introduce RLAN or WA WBB services in the upper 6 GHz band. As such, it is rated low for desirable planning outcome 1.

Options 2–4 all provide RLAN and/or WA WBB arrangement to varying degrees. As detailed in the Summary of submissions chapter, we have not seen sufficient evidence that supports the need for the entire upper 6 GHz band to be allocated for either RLAN or WA WBB use. Options 2 and 3 would therefore not, in our view, optimise the utility of the upper 6 GHz band, especially when compared to Option 4, which would allow both RLAN and WA WBB use of the band.

We again acknowledge that there may be some limited scenarios where the entire band, if provided to one service or the other (through implementation of either Option 2 or 3), might be efficiently used by that service in small areas and/or timeframes. However, this would be at the expense of no use at all by the other candidate service. We are of the view that Option 4 would optimise the efficient use by both services concurrently for more of the time and/or at more locations overall. It would provide sufficient bandwidth to support most use-cases to be served by both prospective services.

Spectrum requirements can also differ geographically. It was evident in submissions that dedicated spectrum allocations for WA WBB are only desired in populated areas, and that outside these areas apparatus-licensed access that is coordinated with other services would be more appropriate. We agree with this suggestion, so implementation of prospective options that make this geographic distinction would help meet desirable planning outcome 1.

Our view is that Option 4, with arrangements for dedicated WA WBB access limited to defined geographic areas, would rate the highest against the desirable planning outcome 1. Access to the band by both RLAN and WA WBB services would help enable proliferation of the next generation of technologies, providing consumers with more advanced devices and capabilities, as well as encouraging more intensive use of existing devices (e.g., smartphones, laptops, tablets, and smart appliances). This will be driven by applications such as high-definition and ultra high-definition content, video calls and new use-cases such as smart glasses, real-time cloud gaming, 360 video and virtual/augmented reality devices. It would also enable a significant increase in machine-to-machine (M2M) and IoT devices and applications, such as for smart home, manufacturing, and vehicles.

Desirable planning outcome 2: Maintain regulatory arrangements to the extent possible for existing services within the upper 6 GHz band when optimising its utility.

Option 1 would rate high against the first part of this desirable outcome, as the existing arrangements would be maintained. However, as detailed above, this option would not optimise the utility of the band, given that RLAN and/or WA WBB services would not be able to be deployed. Option 1 would therefore not be rated highly against this desirable planning outcome.

We believe the introduction of RLAN arrangements would have minimal impact on incumbent services. WA WBB arrangements would require incumbent services in the same area to be coordinated against (which is difficult) or potentially cease operation. Similar views were expressed in submissions to the options paper. Options 2 and (to a lesser extent) 4 would therefore rate highly against this desirable outcome compared to Option 3.

The impact on existing services from the potential introduction of WA WBB services can be reduced by limiting the frequency range and geographical area of WA WBB arrangements. Variations of Options 3 and 4 that limit WA WBB arrangements to defined areas will mean the existing services outside these areas will not be affected. Likewise, options that have a smaller frequency range for WA WBB use, balanced with ensuring the WA WBB allocation is still of sufficient bandwidth to ensure its utility, will rate higher against the desirable outcomes.

Overall, a variation on Options 3 and 4, which limits a WA WBB allocation to defined population areas, and doesn't overlap with TOB services above 7100 MHz, would rate highest against this desirable outcome.

Desirable planning outcomes 3 and 4: Ensure coexistence with other services in the upper 6 GHz band and maintain coexistence with adjacent band services.

It is expected that RLAN arrangements would be able to coexist with other services with minimal regulatory conditions, and without the need for incumbent users to cease operation. While for WA WBB, incumbents would need to be coordinated against (which is difficult) or potentially cease operation in the same frequencies and areas where WA WBB will be used. We expect that the technical framework that would be developed for WA WBB would contain provisions for WA WBB to coexist with other services in adjacent areas or frequencies.

Overall, Options 1 and 2 would rate highly against these desirable planning outcomes, whereas Options 3 and 4 would rate lower. While coexistence with other adjacent band/area services would be achievable, services in the same band/area as WA WBB would need to cease operation.

Quantitative cost-benefit analysis

Where evidence is available, a quantitative analysis in a cost/benefit evaluation is also undertaken to help inform the planning decisions. While potentially providing some useful insights – especially in comparing options – we acknowledge that there are limitations to a quantitative cost-benefit analysis. Firstly, all inputs are estimates, often with large margins between point estimates. Precise data is either impossible to acquire (e.g., future benefit to the economy) or unavailable to obtain in practice (exact knowledge of equipment related costs and user business decisions, etc).

Quantification of benefits

Quantitative benefits to the economy attributed to RLAN and WA WBB use were provided in submissions to the Options Paper.

A submission from the Wi-Fi Alliance suggested that, based on a study published in 2021, that the total economic value to Australia for the allocation of the 6 GHz spectrum band for Wi-Fi and the deployment of Wi-Fi 6 and Wi-Fi 6E devices would reach $5.4 billion in 2025. This value is expected to increase in future years in line with a greater uptake of 6 GHz band compatible equipment (the study assumed that by 2025 only 40% of Wi-Fi traffic would rely on 6 GHz channels, demonstrating that there is scope for future growth). Our understanding is that the quoted economic benefit values is based on the entirety of the 6 GHz band (both the upper and lower bands) being made available for RLAN use, so the benefit attributed to providing RLAN access to the upper 6 GHz band alone would be less.

AMTA's submission quoted a study from 2022 which suggests that there may be a 0.15–0.35% (roughly $4.5 to $10.5 billion based on current projections) increase to the Australian GDP in 2035 if the entire upper 6 GHz band were to be made available for WA WBB use.

While these economic projections are, by nature, difficult to produce with a high degree of accuracy, the material provided by industry gives a useful indication of the general magnitude of the economic benefits that RLAN and/or WA WBB use of the upper 6 GHz band might contribute to Australia. Our view is that these economic benefits would outweigh the cost of relocating existing users out of the band (discussed further below) by a considerable margin.

Quantification of costs

The key quantifiable costs of a planning decision in the band are those associated with requiring incumbent services to cease operation. As the planning options have been refined to limit WA WBB operation to below 7100 MHz and within defined geographic areas, the impacted services that would incur costs from a planning decision are fixed point-to point links and earth stations (operating under an earth or earth receive licence).

The quantification of costs in this section is based on the following assumptions:

- Impacted incumbent fixed point-to-point link operators would either:
  - Retune to the lower 6 GHz band (5925–6425 MHz), if there is capacity in the lower 6 GHz band to accommodate the link and if the equipment/infrastructure allows retuning with minimal cost.
  - Upgrade equipment/infrastructure to enable operation in a frequency band other than the lower 6 GHz band, at a higher cost.

- Affected satellite earth station operators would need to physically relocate their station outside of a defined area. While a possible option would be to retune operations to below 6585 MHz, this would be dependent on factors such as the flexibility of equipment/infrastructure to retune and successful coordination with fixed links and domestic and foreign satellite operators. We have taken the conservative approach and assumed that all affected earth stations would need to be physically relocated. However fixed-satellite uplink stations, for example, could be subject to exclusion zones for WA WBB deployments instead of needing to relocate. This reinforces that these are indeed worst-case compliance costs.
- Fixed link and earth station compliance costs are based on the assumptions used in our 3700–4200 MHz planning process, adjusted for inflation.[8]
- The defined areas used in this analysis are the areas subject to spectrum licensing in the 3750–3800 MHz band, for reasons described in the Planning considerations chapter of this paper.

Table 1 contains the number of current fixed links and earth station sites (per operator) in the applicable frequency range and area that would be impacted by either Option 3 or 4, along with the assumed costs per link/site (for either scenario) and the total costs for both options. The assumed percentage of fixed links that would be able to retune (10%) is based on a review of current channel occupancy statistics in the lower 6 GHz band. From Table 1, the estimated compliance costs for Options 3 and 4 are $431,163,442 and $378,337,772 respectively.

Table 1: Estimated relocation costs for incumbent services affected by Options 3 and 4

	Number of links/sites	Replacement cost per link/site	Retune cost per link	% that can retune	Total
Option 3					
Fixed PP	1200 links	$105,651	$883	10%	$114,209,422
Earth and earth receive	6 sites	$52,825,670	-	-	$316,954,020
Total					**$431,163,442**
Option 4					
Fixed PP	1200 links	$105,651	$883	10%	$114,209,422
Earth and earth receive	5 sites	$52,825,670	-	-	$264,128,350
Total					**$378,337,772**

[8] See the paper: Replanning of the 3700-4200 MHz band - Options paper.

A significant number of incumbent licences captured in Table 1 are held by entities that are likely to benefit from a WA WBB allocation. In some cases, they have advocated for incumbents to be removed to support a prospective introduction of WA WBB services. A calculation of the associated costs that are attributed to licences currently held by Optus, Telstra and Vodafone is contained in Table 2.

Table 2: Estimated costs attributed to effected licences held by Optus, Telstra and Vodafone

	Number of links/stations	Replacement cost per link	Retune cost per link	% that can retune	Total
Fixed PP	365	$105,651	$883	10%	$34,738,699
Earth and Earth receive	2	$52,825,670	-	-	$105,651,340
Total					**$140,390,039**

From the totals in Tables 1 and 2, it is evident that approximately 33% and 37% of the estimated costs in Table 1 (respectively for Options 3 and 4) are attributed to entities that are likely to benefit from a WA WBB allocation in the upper 6 GHz band.

The way forward

We have considered:

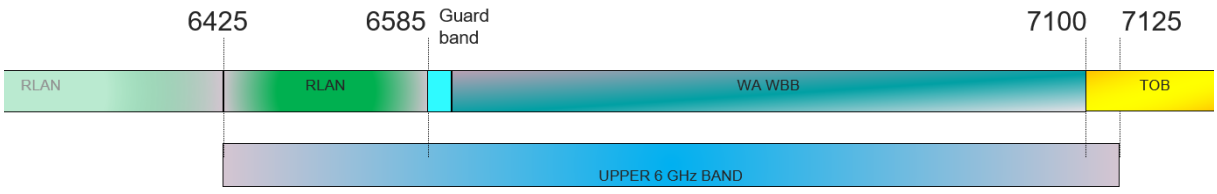
- the responses received to the options paper
- the analysis presented in this paper
- the lack of progress of international developments towards WA WBB arrangements since the options paper was published.

We have decided that the planning arrangements described under Option 4B currently represent the optimal use and public benefit that can be derived from the use of the upper 6 GHz band (configuration shown in Figure 3). While it provides for an expansion in RLAN services to enable more and/or larger Wi-Fi channels, we consider that the best additional use of 6585–7100 MHz to be WA WBB, provided that major relevant international markets ultimately adopt this use in the band.

Putting this decision into effect will entail the following actions for the ACMA:

- Add 6425–6585 MHz to the LIPD class licence to support RLAN use. This work is intended to be implemented as part of our task to remake the instrument prior to its sunsetting in October 2025. We are aiming to consult on updates to the LIPD class licence in early 2025.
- Plan for 6585[9]–7100 MHz in defined population areas for potential WA WBB use, but not commence implementation of these arrangements until certainty around progress towards international equipment markets can be provided. This planning will include determination of defined areas in consultation with stakeholders.
- Once defined areas have been determined, make provision for apparatus licensed access in 6585–7100 MHz outside those areas to enable the deployment of local area WBB services (either IMT or RLAN-based technologies).

Figure 3: RLAN and potential WA WBB in the upper 6 GHz band, guard band size will be determined as part of a future process



We believe this way forward provides for the medium-term requirements of RLAN and positions Australia to take advantage of international developments as they mature. The decision to support RLAN use in part of the upper 6 GHz band acknowledges that there is no alternative spectrum available or contemplated internationally in the short-to-medium term. Preserving existing arrangements above 7100 MHz means that there will be no impact on current TOB services.

[9] This frequency is likely to be higher to provide for separation between RLAN and WA WBB use, and provide protection for WA WBB.

Regarding timeframes for the implementation of WA WBB arrangements in defined population areas, an initial key waypoint might be when the European regulatory body CEPT provides in interim report to the European Commission on sharing studies in the band. Based on the timing in the draft Mandate discussed in the Planning considerations chapter, this would be expected in March 2025 at the earliest. While this wouldn't constitute national planning decisions in Europe, it might at least provide a firm indication of future use at a service level. We also expect that the picture will become incrementally clearer as CEPT continues to work through its planning deliverables over the 2025–27 period.

Introducing WA WBB arrangements in defined population areas only will limit the impact on other existing and future services operating outside of these defined areas. There has been no discussion with stakeholders about what geographical areas should be considered for WA WBB, and this will need to be considered in consultation with relevant stakeholders before we commence implementation of WA WBB arrangements. However, we expect that areas adopted for spectrum licensing in the 3750–3800 MHz range will be a good guide.

As WA WBB would be constrained to defined population areas only, there will be opportunities for apparatus-licensed WBB and/or standard power RLAN services outside of these defined areas in the 6585–7100 MHz band. We will continue to explore these arrangements and will consult with industry as part of a separate process later.

Evaluation of outcomes

Effective regulatory arrangements, including licence conditions and technical frameworks, are essential to ensuring efficient and effective use of the spectrum. While we have decided on what the future arrangements for the upper 6 GHz band will look like, work will continue to shape how these arrangements will be implemented. As detailed above, this will occur through future consultation processes. We will continue to evaluate this future work against the established desirable planning outcomes.

In the longer term, we have an ongoing process to assess the effectiveness of the Australian spectrum management framework, through the annual five-year spectrum outlook (FYSO). Following the implementation of these planning decisions (subject to future consultation processes) we will monitor use of the band and respond to changing uses or demand as part of our continual planning process outlined in the yearly FYSO updates.

For spectrum that is subject to apparatus or spectrum licensing arrangements, the number of licences issued and devices registered is indicative of how the spectrum is being used. The scale of use is one factor we can use in accessing the effectiveness of the licensing arrangements. We will also monitor the effectiveness of the technical conditions for these licences, and may consider if changes to these arrangements are needed to keep pace with changes to technology and use cases.

For operation under class licences, where actual usage is unknown, we can evaluate success by looking at the device market. If devices that align with the arrangements in a class licence (and therefore are authorised to operate in Australia) are readily available, this is an indication that the class licence is operating successfully. We have an ongoing program of work that regularly considers changes to the LIPD class licence to ensure it remains fit-for-purpose.