Future use of the 1.5 GHz and
3.6 GHz bands—

Summary of and response to
3.6 GHz submissions

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# 1. Introduction

The Australian Communications and Media Authority (the ACMA) released the discussion paper [*Future use of the 1.5 GHz and 3.6 GHz bands*](http://www.acma.gov.au/sitecore/content/Home/theACMA/future-use-of-the-1_5-ghz-and-3_6-ghz-bands) on 20 October 2016 (the October 2016 discussion paper). The paper sought industry feedback on the ACMA’s medium- and longer-term planning approaches to address rising demand for mobile broadband (MBB) services. Seventy-two submissions were received to the October 2016 discussion paper as listed in Annex A.

A summary and response to feedback received on issues common to the 1.5 GHz and 3.6 GHz bands, and specifically to the 3.6 GHz band is contained in this paper. The structure of this paper is:

* Section 2 outlines feedback received on both the 1.5 GHz and 3.6 GHz bands, as discussed in the *Introduction* section of the October 2016 discussion paper, and the ACMA’s response
* Section 3 outlines comments received about 3.6 GHz band issues and the ACMA’s response

Section 4 details next steps.

Consistent with the ACMA’s decision to prioritise consideration of the 3.6 GHz band over the 1.5 GHz band (see discussion in Section 2), the ACMA will provide its summary and response to feedback on the 1.5 GHz band when it progresses consideration of this band.

This summary of and response to submissions paper accompanies the release of a package further exploring the options for the future use of the 3.6 GHz band (the Options paper).

# 2. Issues related to both the 1.5 GHz and 3.6 GHz bands

The scope of the October 2016 discussion paper covered the 1.5 GHz and 3.6 GHz bands, including some issues relating to both bands and their relative priority. In this section, a summary of submissions to these issues is outlined, as well as the ACMA’s response.

## Purpose of the October 2016 discussion paper

At the time of release of the October 2016 discussion paper, the 1.5 GHz and 3.6 GHz bands were in the *initial investigation* stage of the process for consideration of additional spectrum for MBB services.

In the October 2016 discussion paper, the following questions were asked about this issue:

1. **Should the 1.5 GHz band and/or the 3.6 GHz band be progressed from *the initial investigation* stage to the *preliminary re-planning* stage in the ACMA’s process for consideration of additional spectrum for MBB services? Why/Why not?**
2. **Comment is sought on the ACMA’s proposal to progress the 1.5 GHz band to the *preliminary re-planning* stage of its process for consideration of additional spectrum for MBB services, as detailed in the ACMA’s** [**MBB strategy**](http://www.acma.gov.au/~/media/Spectrum%20Transformation%20and%20Government/Issue%20for%20comment/IFC%2022%202015/MBB%20strategyThe%20ACMAs%20spectrum%20management%20strategy%20to%20address%20the%20growth%20in%20mobile%20broadband%20capacity%20docx.docx).
3. **Comment is sought on the ACMA’s proposal to progress the 3.6 GHz band to the *preliminary re-planning* stage of its process for consideration of additional spectrum for MBB services, as detailed in the ACMA’s** [**MBB strategy**](http://www.acma.gov.au/~/media/Spectrum%20Transformation%20and%20Government/Issue%20for%20comment/IFC%2022%202015/MBB%20strategyThe%20ACMAs%20spectrum%20management%20strategy%20to%20address%20the%20growth%20in%20mobile%20broadband%20capacity%20docx.docx)**.**

### Summary of submissions

A range of responses were provided. Some respondents, typically incumbent users, did not support the progression of either the 1.5 GHz or 3.6 GHz bands to the preliminary re-planning stage, stating that current arrangements were satisfactory.

Some respondents, namely incumbent 3.6 GHz satellite operators and point-to-multipoint users in the 3.6 GHz band, supported the progression of the 1.5 GHz band to the preliminary re-planning stage but opposed the progression of the 3.6 GHz band. These respondents argued that the incumbent use of the 1.5 GHz band is less complicated than those in the 3.6 GHz band, and therefore any change in arrangements would be more easily achievable in the 1.5 GHz band. Further, point-to-multipoint users argued that progressing with re-farming of the 3.6 GHz band would favour larger carriers over smaller operators, and therefore should not be pursued. They suggested that because the 3.6 GHz band was already being used for MBB in regional and remote areas, re-farming appears to be a case of simply moving from an apparatus licensing to a spectrum licensing regime. It was argued that small operators cannot compete with larger operators in an auction scenario.

Some existing point-to-multipoint users suggested that only part of the 3.6 GHz band be progressed through the ACMA’s process for consideration of additional spectrum for MBB services. One suggested that only spectrum below 3.6 GHz should be progressed. Others suggested the band should only be considered in certain areas where there was no incumbent use.

A number of respondents, mainly from the mobile manufacturers and network providers, supported the progression of both the 1.5 GHz and 3.6 GHz bands to the preliminary re-planning stage. These respondents supported the analysis made regarding international spectrum harmonisation and technology standardisation drivers provided in the October 2016 discussion paper and supported progression of both bands.

### ACMA response to submissions

The results of the ACMA’s preliminary assessments of the highest-value use of both the 1.5 GHz and 3.6 GHz bands indicate that the highest-value use has changed, or may be changing, in some areas. The level of interest in the 1.5 GHz and 3.6 GHz bands, both nationally and internationally, also supports further investigation and analysis of arrangements in these bands. In particular, technology standardisation developments and international spectrum harmonisation considerations indicate that there is potential value in further investigating the arrangements for the use of these bands for MBB services in some or all areas of Australia. The ACMA further notes that existing regulatory arrangements are unlikely to be conducive to the deployment of wide area broadband networks (fixed or mobile), and hence facilitating the highest value use of the spectrum is likely to require changes to the exiting regulatory framework. **Therefore, the ACMA has decided to progress both the 1.5 GHz and 3.6 GHz bands to the *preliminary replanning* stage of the ACMA’s process for consideration of additional spectrum for MBB services.**

As noted in the ACMA’s MBB strategy, while the domestic replanning process is influenced by international developments, it is not entirely dependent on these developments. Therefore, work can continue domestically while issues including harmonised channel arrangements are debated internationally. The results of these international deliberations can be taken into account later in the replanning process, if and when the decision is made to re-farm a particular band.

## Timing and prioritisation of work

As noted in the October 2016 discussion paper, should the 1.5 GHz and 3.6 GHz bands progress to the *preliminary re-planning* stage, it is likely that they will be advanced through the remaining stages at different rates. This is partly to enable resources to be focused on facilitating the timely release of spectrum, but timing is also likely to be affected by factors unique to each band, as described in the October 2016 discussion paper.

In the October 2016 discussion paper, the following questions were asked in relation to this issue:

1. **Should either of the 1.5 GHz and 3.6 GHz bands be prioritised through the ACMA’s process for consideration of additional spectrum for MBB services? If so, which band? Why?**
2. **Are there specific issues, other than those mentioned, that may affect the timeframe in which the 1.5 GHz or 3.6 GHz bands could be made available for MBB?**
3. **If the 1.5 GHz and 3.6 GHz bands are re-farmed for MBB, would there be benefit in allocating the bands simultaneously?**

### Summary of submissions

There were various opinions expressed regarding the urgency or otherwise to progress the 1.5 GHz and 3.6 GHz bands through the ACMA’s process for consideration of additional spectrum for MBB services. It was noted by mobile manufacturers and telecommunications industry respondents that work was still ongoing within 3GPP and ITU-R on frequency arrangements for these bands. Incumbent users, including those from the satellite industry and wireless internet service providers, also highlighted this, and argued that neither band should be progressed within Australia until these arrangements were finalised.

Some respondents, particularly those from the satellite industry and incumbent users of the 3.6 GHz band, argued that the 1.5 GHz band should be prioritised over the 3.6 GHz band as it would reduce impact on incumbent services. It was noted that typically, there is not alternative spectrum available for services currently provided in the 3.6 GHz band, and therefore the consequences of any changes may be more significant.

As the major incumbent user of the 1.5 GHz band, Telstra argued that the 3.6 GHz band should be prioritised due to incumbency issues within the 1.5 GHz band, pending the report and response to the inquiry into the future direction of a universal service obligation (USO) in the telecommunications market. Prioritisation of the 3.6 GHz band was also supported by mobile manufacturers, who noted that the 1.5 GHz band, compared to other future proposed spectrum above 1 GHz, offers less potential spectrum bandwidth, has lower projected roadmap support in vendor roadmaps and has considerably less ability to support key new technologies. Unlike the 3.6 GHz band, the 1.5 GHz band has not been explicitly nominated as an early 5G band by various countries around the world.

Some respondents noted that there would be equipment available for the 3.6 GHz band in calendar year 2017, which makes the 3.6 GHz band better suited for earlier deployment, and therefore prioritisation over the 1.5 GHz band.

One respondent noted that regardless of which band is prioritised, it is critical that there is certainty around the future availability of spectrum resources, as well as the timing of spectrum allocations, to enable investment decision making to proceed in a timely manner.

Many respondents expressed the view that the timeframe for replanning either band should support incumbent licence holders’ ongoing operation for a number of years in order to achieve a return on their investment in these bands.

Regarding simultaneous allocation of the 1.5 GHz and 3.6 GHz bands, most respondents did not see a justification for considering the two bands together as they are subject to different factors and timeframes. One respondent argued that the bands are not substitutable and would not normally be considered complementary, and therefore do not need to be allocated simultaneously.

### ACMA response to submissions

**Given international developments and strong domestic interest, the ACMA has decided that consideration of the 3.6 GHz band will be prioritised over the 1.5 GHz band**. A more timely resolution of what, if any, replanning would occur in the 3.6 GHz band will also provide certainty to incumbent services regarding long-term arrangements in the band and any alternative options available to them (if applicable).

It is noted that strong views for urgent re-allocation, particularly of the 3.6 GHz band, are held by a number of respondents to the October 2016 discussion paper. However, equally noted is the opposition and challenges associated with re-farming of both the 1.5 GHz and 3.6 GHz bands. Therefore, while every effort will be made to progress the reviews of these bands in a timely manner, sufficient time is required for due process that allows for the collection of information and evidence to inform ACMA decisions, and for all interested and affected parties to consider their options.

Relative timing of any future consideration of the 1.5 GHz band with respect to the 3.6 GHz band (or other bands included in the ACMA MBB work program) will not be considered further at this time. However, feedback relating to the benefits, or otherwise, of allocating the bands simultaneously is noted.

# 3. 3.6 GHz band

The October 2016 discussion paper provided an overview of international arrangements and developments in the 3.6 GHz band, an overview of the current planning arrangements and use of the 3.6 GHz band within Australia, a presentation of the ACMA’s initial investigation of the 3.6 GHz band for use by MBB services, and a preliminary assessment of the highest value use of the 3.6 GHz band.

## Current planning arrangements and use

Historically, the 3.6 GHz band has been used by the fixed-satellite service (FSS) and point-to-point links. However, the band was made available in 2009 for point-to-multipoint applications in regional and remote areas. The band remains embargoed in capital cities (excluding Hobart) for point-to-multipoint services, and Australia-wide for all other services.

In the October 2016 discussion paper, the following was asked:

1. **The ACMA seeks comment on expected future use of the 3.6 GHz band by fixed, fixed-satellite, amateur and radiolocation services in Australia.**

### Summary of submissions

Submissions from wireless internet service providers outlined the importance of ongoing access to the band for the delivery of wireless broadband services (via point-to-multipoint licences) in regional and remote areas, and noted the significant investment made by small and medium-sized businesses since this spectrum was made available in 2009. Existing point-to-multipoint licences are used to deliver a broad range of services, including transport management, and provision of mining, oil and gas, electricity and agricultural data. It was put forward that demand for these tailored services is expected to grow and a number of submissions noted that there are no viable alternatives spectrum options available for these services to migrate to.

FSS Earth station operators noted that they require access to the 3.6 GHz band at existing sites into the future, though there were differing views amongst incumbent users as to whether this requirement would grow, remain steady or decline. Submissions from the satellite industry outlined the importance of C-band for satellite operations due to the good connectivity it provides in areas of high rainfall, and global beams for large coverage areas. One mobile manufacturer noted that the use of the 3.6 GHz band is declining globally, while submissions from the satellite industry argued that the embargoes in place across the 3.6 GHz band had artificially supressed demand, with the result that actual demand for satellite capacity in these bands is unknown. It was noted by a number of telecommunications industry and satellite industry respondents that some FSS Earth station facilities are located and positioned in such a way that it would appear to be possible to coordinate with them without a large degree of spectrum denial to other services.

The Department of Defence noted that their requirement for access to the 3.6 GHz band is ongoing.

### ACMA response to submissions

From the responses provided, it appears that the summary of usage outlined in the October 2016 discussion paper provides an accurate account of the current status of the 3.6 GHz band in Australia. The value of the band to incumbent services and the limitation on alternative spectrum options are also noted.

## Potential spectrum options

In the October 2016 discussion paper, the ACMA postulated that the options for the 3575–3700 MHz frequency range, should it be re-farmed for MBB services, are limited to time division duplex (TDD) arrangements. It was noted that a possible advantage of TDD arrangements is the flexibility they provide in the ACMA’s ability to identify all or part of the 3.6 GHz band for MBB in different areas. The following questions were asked in relation to this issue:

1. **If the 3.6 GHz band is re-farmed for MBB services:**
2. **Do you agree that a time division duplex (TDD) arrangement should be adopted? Why/Why not?**
3. **Should all or only part of the band be considered for re-farming?**
4. **Should different amounts of spectrum be re-farmed in different areas?**

### Summary of submissions

The vast majority of respondents agreed that a TDD arrangement should be adopted in the 3.6 GHz band, should it be re-farmed for MBB services. Wireless internet service providers noted that fixed point-to-multipoint services currently using the band in regional and remote areas employ TDD technology, and this use could be expanded into metropolitan areas. Respondents from the telecommunications industry, wireless internet service providers and mobile manufacturers noted that TDD provides greater flexibility in licensing and use, as it does not require paired spectrum, and also provides the opportunity for harmonisation with global technology standards.

One US-based wireless organisation advocating a flexible allocation approach argued that the greatest spectrum efficiencies come from maximising spectrum regulatory flexibility, and thus neither frequency division duplex (FDD) nor TDD should be expressly mandated.

Responses to the questions about the amount of spectrum that should be considered for re-farming ranged from no spectrum to the full band. Incumbent point-to-multipoint users argued that at least part of the band should be set aside for continued access for their services. A number of these responses suggested 25 MHz be set aside for point-to-multipoint use and that this arrangement be extended into metropolitan areas.

However, respondents from the telecommunications industry noted that the amount of spectrum made available needs to be maximised to meet the requirement for wide bands of contiguous spectrum for 5G services.

Most respondents acknowledged the differing need for MBB spectrum across different areas and that traditionally less spectrum is required outside metropolitan areas. Those who supported re-farming, typically from the telecommunications industry, noted that metropolitan and metropolitan fringe areas were the areas of greatest demand for MBB services. It was suggested by some that more spectrum could be re-farmed in these areas and less in regional and remote areas where it could continue being used for existing services. It was also suggested by both existing FSS users and aspirational future users that existing FSS sites should be excised from any future re-farming activity. However, respondents particularly from the telecommunications industry, noted the importance of not fragmenting spectrum arrangements.

### ACMA response to submissions

Submissions largely supported the proposal to adopt TDD arrangements should the 3.6 GHz band be re-farmed. Therefore, the ACMA will continue to assess replanning options based on the use of TDD in the band. The opportunity for different arrangements across different geographic areas and for setting aside spectrum for existing services should the band be re-farmed will be further investigated as the ACMA’s process for the consideration of additional spectrum for MBB services in the 3.6 GHz band progresses.

## Potential geographic options

The ACMA identified four geographical area options that could be considered for re-farming the 3.6 GHz band in the October 2016 discussion paper. These are Area 1 (major metropolitan areas), Area 2 (Area 1 plus outer-metro and fringe areas described in [Annex D of RALI MS39](http://www.acma.gov.au/~/media/Spectrum%20Engineering/Information/Word%20Document/RALI%20MS39%20final%20docx.docx)), Area 3 (encompasses Area 2 and relates to those metro and regional areas subject to spectrum licensing in the 3.4 GHz band and described in Schedule 2 of the [Radiocommunications (Spectrum Re-allocation) Declaration 2000](http://auction.acma.gov.au/auction_results/3.4ghz_results_page/34_pdf/aip_pdf/re-allocation.pdf)), and a fourth option covering all of Australia. A detailed description of these geographical areas is available in Appendix 6 to the Options paper.

In the October 2016 discussion paper, the following question related to this issue:

1. **If the 3.6 GHz band is re-farmed for MBB services, what geographical areas should be considered?**

### Summary of submissions

A number of respondents, mainly incumbent point-to-multipoint users, expressed a preference to limit re-farming to metropolitan areas currently identified in Embargo 42 (Area 1) in order to limit any disruption to existing services. A number of wireless internet service providers and supporters suggested the expansion of arrangements currently in place in regional and remote areas into metropolitan areas.

Satellite industry respondents suggested that any re-farming should ensure protection of existing 3.6 GHz band FSS operations in Sydney and Perth, as well as adjacent band FSS services in the 3.7–4.2 GHz band. It was noted that several studies, including those conducted by the ITU-R, have shown that sharing between MBB and FSS services in the 3.6 GHz band is not feasible in the same geographic area. One satellite industry respondent noted geographic separation of several kilometres, and up to tens of kilometres will be required to protect C-band Earth receive stations in the adjacent band.

Re-farming of Areas 2 and 3 was supported by a number of respondents, including some from the telecommunications industry. Some of these submissions suggested that a staged approach be developed, where Area 1 was made available as a priority with suitable coordination mechanisms put in place to support longer transition timeframes of incumbent services in Area 2 and Area 3.

A number of respondents noted a preference for the implementation of uniform arrangements Australia-wide, either from the outset or as part of a staged approach, but differed in opinion as to what arrangements should apply across the country. Some respondents from the telecommunications industry argued for uniform area-wide licensing arrangements, as this would ensure a broadly available and scalable MBB service, especially given the 3.6 GHz band is touted as the ‘coverage’ band for 5G; whereas incumbent point-to-multipoint operators argued that current point-to-multipoint arrangements should be expanded Australia-wide.

Defining large enough geographical areas was noted in a number of submissions as being very important for the meaningful deployment of area-wide TDD MBB services. Some argued that greater spectrum efficiencies result from not introducing artificial boundaries and therefore larger areas should be considered. A number of respondents referenced the US Citizen Band Radio Service (CBRS) model as a model that should be implemented in Australia. These arrangements define a three-tiered spectrum authorisation framework to support shared access to the 3550–3700 MHz frequency range by a variety of services, including radiolocation, FSS and wireless broadband systems.[[1]](#footnote-2)

### ACMA response to submissions

Submissions highlighted the complexity of the different geographic re-farming options in the 3.6 GHz band. These issues are further discussed and expanded as part of the consideration of options for the future use of the 3.6 GHz band in the Options paper.

## Coexistence and sharing with incumbent services

It was recognised in the October 2016 discussion paper that there will likely be demand for numerous incumbent services to continue operating in the 3.6 GHz band in the future. A number of different sharing options were canvassed in the October 2016 discussion paper:

1. **If the 3.6 GHz band is re-farmed for MBB services, should existing users (some or all) be allowed to continue operation within the band either temporarily or on an ongoing basis? Should/could sharing arrangements be developed? Should sharing only be considered for some services or specific licences? If yes, what kind of arrangements would be suitable to support the ongoing operation of incumbent services or specific licences? If no, why?**
2. **If the 3.6 GHz band is re-farmed for MBB services, and migration of incumbent services is required, are there alternative spectrum or delivery options?**

### Summary of submissions

Incumbent users of the band expressed a requirement to continue operation within the 3.6 GHz band on an ongoing basis. Point-to-multipoint users noted that arrangements for access to spectrum had only been in place since 2009 and highlighted a lack of alternative spectrum options. FSS Earth receive licensees outlined the significant investment in current Earth station facilities and significant expense associated with the geographic relocation of this services.

Most respondents agreed that sharing arrangements should be developed. However, opinions varied over whether the arrangements should be long term or short term. It was noted that sharing studies using characteristics of 5G systems would need to be conducted to determine the technical parameters for sharing with incumbent services. The US CBRS model was touted as a potential solution to allow ongoing access of the band by incumbent services, particularly point-to-multipoint licences. Some respondents, particularly wireless internet service providers, advocated a ‘use it or share it’ arrangement. Some MBB operators suggested the 3.6 GHz band could be sold via auction, with incumbent operators in place and commercial arrangements made to facilitate clearance.

Some users and customers of point-to-multipoint services described a lack of alternative delivery options if the 3.6 GHz band is re-farmed. They advised that only satellite rather than terrestrial broadband services are available as an alternative in many areas, which they contend is insufficient for their requirements.

While some alternative spectrum options were suggested for point-to-multipoint services, it was noted that these options were largely complementary, rather than alternatives to the 3.6 GHz band. Point-to-multipoint equipment providers and operators noted that most equipment operates in the frequency range 3.55 GHz to 3.8 GHz or even 3.3 GHz to 3.9 GHz for newer equipment. Therefore, migration to spectrum above 3.7 GHz or below 3.4 GHz could be an option in some cases. The 2.7–2.9 GHz and 2.9–3.1 GHz bands were also suggested as alternative bands for point-to-multipoint services. However, the non-availability of equipment in other frequencies was highlighted as a challenge for migration. The 5.8 GHz class-licensed band was also noted as an alternative spectrum option with some equipment availability, however incumbent 3.6 GHz band point-to-multipoint respondents highlighted the need for apparatus-licensed spectrum to guarantee a high grade of service.

Limited options for alternative delivery platforms were identified for satellite services in the 3.6 GHz band. It was noted that fibre distribution offers only point-to-point delivery, whereas satellite offers point-to-multipoint, making it a lower cost option.

FSS operators and users advised that given the long-lead times in satellite planning, and the fact that C-band satellite services provide large whole-of-region coverage areas, the frequency agility of these services and ability to migrate to different frequencies even within C-band is limited. One satellite industry respondent highlighted that the adjacent 3.7–4.2 GHz band is already at capacity for the provision of satellite services. Overall, they argued that C-band (3.4–7.25 GHz) frequencies are required as they are ideal for certain types of satellite services, including in areas of high rainfall, and it is usually not possible to transition these services to higher frequency satellite bands.

Some respondents from the telecommunications industry and some mobile manufacturers suggested that satellite services could be relocated to rural areas to prevent spectrum denial to terrestrial services in highly populated centres. However, satellite industry respondents identified a number of challenges with this approach, including the high capital costs required for relocation.

### ACMA response to submissions

A number of options for sharing the 3.6 GHz band between potential new MBB services and incumbent services were identified.

The ACMA acknowledges the challenges associated with migration of incumbent services to alternative spectrum, geographic locations or delivery platforms. The various options, including estimated costs of these options, are further explored in the Options paper.

## Compatibility issues with adjacent band services

The October 2016 discussion paper described the services currently operating below 3575 MHz and above 3700 MHz. This includes spectrum licensed services below 3575 MHz, and FSS and fixed point-to-point services above 3700 MHz. The October 2016 discussion paper asked the following questions:

1. **In determining whether to re-farm the 3.6 GHz band for MBB, are there any adjacent band issues that should be considered? This includes:**
2. **the effect such use may have on adjacent band services**
3. **the effect adjacent band services may have on the utility of the 3.6 GHz band for MBB services.**

### Summary of submissions

Most respondents agreed that with appropriate coordination arrangements, including updates to existing arrangements, compatibility with adjacent band services would not be a significant issue if the 3.6 GHz band was re-farmed for MBB. A number of respondents noted that if the 3.6 GHz band is re-farmed for MBB and planned for TDD services, that adjacent band issues at the lower end of the band would be minimised and that the relevant 3GPP specifications could be adopted. However, one respondent expressed concern regarding adjacent band compatibility of TDD services operated by different licensees and the requirement to implement a guard band, which can potentially impact adjacent licensees. Some submissions from wireless internet service providers suggested that expanding consideration of the 3.6 GHz band to the entire 3.4–3.7 GHz band, or even the 3.3–3.8 GHz band, would further minimise adjacent band issues in the long-term.

Respondents noted that emission limits for the upper end of the band would need to be implemented in order to protect the FSS and fixed point-to-point services operating in the adjacent 3.7–4.2 GHz band. Satellite operators suggested that consideration should be given to interference caused by both out-of-band emissions and low noise amplifier (LNA) overload. However, current point-to-multipoint users identified difficulties with current coordination arrangements with FSS services, arguing that they are too conservative and also noting that FSS Earth receive stations are not fitted with receive filters, making them more susceptible to interference.

### ACMA response to submissions

If the decision is made to re-farm the 3.6 GHz band, consideration of compatibility with adjacent services will be required. It is noted that the core conditions of existing 3.4 GHz band spectrum licences cannot be modified prior to expiry without the agreement of licensees.

## Optimising use of the 3400–3700 MHz band

It was identified in the October 2016 discussion paper that a broader review of the entire 3400–3700 MHz band, taking into account the rights of existing spectrum licence holders, may yield larger contiguous segments for licensees and therefore increase the overall utility of the band. In the October 2016 discussion paper, the following questions were asked in relation to this issue:

1. **If the 3.6 GHz band is re-farmed for MBB services, should the ACMA review arrangements in the broader 3400–3700 MHz band? Why/Why not?**
2. **Would such a review be facilitated through the alignment of geographical boundaries in the 3.6 GHz band with existing boundaries defined for spectrum and apparatus licensing in the 3400–3575 MHz band (that is, to facilitate trading)?**
3. **Is there anything else that could be considered as part of the 3.6 GHz band process that may facilitate a future review of the broader 3400–3700 MHz frequency range?**

### Summary of submissions

It was acknowledged by a number of respondents that greater spectrum efficiencies may result from a reorganisation of the broader 3400–3700 MHz frequency range. It was noted that such a review would be of benefit for site-based point-to-multipoint use of this spectrum, as well as area-wide MBB use. Some submissions from wireless internet service providers proposed that such a review be expanded to consider the 3300–3800 MHz frequency range. However, support for broadening the scope of the review was caveated by some respondents on the basis that it should not lead to a significant delay in consideration of the 3.6 GHz band.

Respondents from the satellite industry and other incumbent 3.6 GHz users argued that optimisation of the 3400–3575 MHz band should occur ahead of any consideration of the 3.6 GHz band. Conversely, a number of respondents, particularly mobile manufacturers and some telecommunication industry respondents, suggested that such a review could be conducted after the completion the 3.6 GHz band review, once the final outcomes were known.

Respondents highlighted the complexities that will need to be considered when designing geographic boundaries if the 3.6 GHz band is re-farmed. It was noted in submissions that a misalignment of geographical boundaries already exists in the 3400–3575 MHz band, between that portion of the band allocated via spectrum licence and that potion allocated when implementing the [October 2014 Ministerial Direction](https://www.legislation.gov.au/Details/F2014L01399) for the 3.5 GHz band. It was argued that spectrum trading and spectrum markets could assist in rectifying this misalignment if licence holders were allowed to sub-divide their licence areas (it should be noted that is option is already available to licensees). Some submissions from wireless internet service providers suggested that apparatus licence use of the entire band would allow natural boundaries to appear over time, whereas alignment of the current artificial geographic boundaries would only benefit spectrum licence holders.

### ACMA response to submissions

The ACMA sees the value in optimising arrangements across the 3400–3700 MHz band and has made several attempts in recent years to progress the issue in the 3400–3575 MHz sub-portion. In particular, options and issues associated with this were discussed in the paper [*Making the most of the 3.5 GHz band in future*](http://www.acma.gov.au/theACMA/making-the-most-of-the-3dot5-ghz-band-in-future). However, to facilitate timely consideration of the 3.6 GHz band, any process for optimisation of the broader 3400–3700 MHz frequency range will be postponed until the outcomes of this process are known. It should also be noted that any optimisation process would need to respect the rights of existing licence holders under the *Radiocommunications Act 1992*, and the fact that spectrum licences are designed to allow reconfiguration via aggregation or splitting.

Consideration of the options for geographical boundaries of the 3.6 GHz band should the band be re-farmed for MBB services, and the consequences of alignment or otherwise with existing 3.4 GHz spectrum licence areas, is outlined in the Options paper.

## Preliminary assessment of the 3.6 GHz band for use by MBB services

A preliminary assessment of the highest value use of the 3.6 GHz band was outlined in the October 2016 discussion paper. The results indicated that the highest-value use of the bands has changed, or may be changing in some areas. In the October 2016 discussion paper, the following questions were asked related to this issue:

1. **To assist the ACMA in conducting a comprehensive assessment of the highest-value use for the 3.6 GHz band, responses to the following questions are requested:**
2. **Do you see increasing demand for fixed broadband/MBB services in the 3.6 GHz band? What benefits do you envision from using the band for fixed broadband/MBB services?**
3. **Which regions of Australia will be in demand for fixed broadband/MBB services in the 3.6 GHz band?**
4. **Is demand the same or similar across regions, or are some regions/areas more likely to be in demand for MBB providers?**
5. **Do incumbent 3.6 GHz band licensees require ongoing access to the band, or are there plans to cease operation at some future point?**
6. **Do other options exist for the delivery of fixed, fixed-satellite and amateur incumbent services, how practical are they? What are the costs involved? Will there be a diminution of the service delivered if MBB services are introduced in the band?**
7. **Should further consideration be given to the migration of incumbent 3.6 GHz band FSS Earth stations to low density population areas?**

### Summary of submissions

Most respondents agreed that there was increasing demand for fixed broadband/MBB services in the 3.6 GHz band, with a number of responses outlining evidence that the band is well suited for utilising a small cell/dense coverage approach. A number of respondents highlighted that demand would be proportional to population density, and therefore highest demand for these services will be in metropolitan areas. However, existing point-to-multipoint users noted increasing demand for wireless broadband services in rural and regional areas, and that in these areas, there are limited alternative delivery options available. Further, increasing demand for niche data services, including from the mining, transport and agriculture sectors was highlighted, which expand into the metro and metro fringe areas.

Point-to-multipoint users argued that the potential use of the band for MBB services, in particular 5G services, is speculative at this stage as standards are yet to be finalised, whereas current fixed broadband use was proven and in demand. Telecommunications industry and mobile manufacturer respondents argued that use of the band for fixed broadband/MBB using LTE is well established, with the number of networks in operation in this band internationally and the number of available devices increasing rapidly. They also highlighted that the band is earmarked as an early implementation band for 5G and was therefore important for the timely roll-out of 5G services in Australia.

A number of respondents, particularly incumbent point-to-multipoint users, raised concerns that a re-farming of the 3.6 GHz band via a price-based allocation would favour larger telecommunications companies at the expense of small, locally operated communications companies. The social cost of the disenfranchisement of rural communities was highlighted as a potential issue.

In regard to alternative delivery models, most point-to-multipoint users claimed that the National Broadband Network (NBN) is not specialised enough to offer the type of data transmission requirements for their use, and is not as agile to meet the needs of customers as smaller network providers. Respondents noted the lack of alternative options for the provision of their services. It was noted that the bands these services could operate in are limited by equipment availability, with some level of international harmonisation required before equipment is readily available. It was also noted that alternative spectrum is required to be apparatus licensed rather than class licensed to provide the required quality of service, and that there are currently limited bands available in regional areas that meet this requirement. Submissions highlighted the increasing importance of technology and access to broadband services for all areas.

A number of respondents from the satellite industry expressed their opposition to the relocation of satellite facilities, noting the significant costs in the order of tens of millions of dollars involved in both initial geographic relocation of facilities and ongoing costs including extended backhaul links. It was argued that relocation of satellite facilities would threaten the viability of international programming and other services, reducing Australia’s access to the international community and diverse sources of news, information and entertainment. It was also noted that the 3.6 GHz band is also used for telemetry, tracking and command (TT&C) of satellites, and therefore geographic relocation is not feasible as the location for such Earth stations is carefully selected based on a number of factors and any movement may interrupt satellite operations. Others noted that if relocation was necessary, adequate time would be required to allow the transition of services.

Respondents from the satellite industry highlighted the opportunistic use of direct-to-home satellite television services, and noted that these customers could not be expected to move to areas of low population to continue to receive the services. Conversely, telecommunications industry and mobile manufacturer respondents noted that these services are not licensed in Australia, and therefore should not be taken into account in future planning arrangements. It was suggested that these services could be allowed to continue to operate in the band on a ‘no protection’ basis.

### ACMA response to submissions

As discussed above, the 3.6 GHz band has been progressed to the *preliminary replanning* stage of the ACMA’s process for consideration of additional spectrum for MBB services. The positions and concerns on replanning issues have been noted and will be taken into account in the development of options for the 3.6 GHz band.

As part of the work conducted at the *preliminary replanning* stage, a comprehensive assessment of the highest-value use for the 3.6 GHz band has been conducted. This assessment is outlined in the Options paper and accompanying material, including the *Future use of the 3.6 GHz band—Highest value use assessment* paper. This takes into account the feedback received to the October 2016 discussion paper, which is summarised above, as well as further research and investigations from the ACMA and discussions with stakeholders.

# 4. Further work

Consideration of the 3.6 GHz band will be prioritised over the 1.5 GHz band through the ACMA’s process for consideration of additional spectrum for MBB services. This approach was foreshadowed in the October 2016 discussion paper, where the potential for advancing the two bands through the remaining stages of the process at different rates was discussed.

The decision on work prioritisation is partly to enable limited ACMA resources to be focused on facilitating the timely release of spectrum. However, timing has also been affected, and will continue to be affected, by factors unique to each band, such as:

* incumbency issues, for example, whether services will be required to re-locate from a band (or geographical location), and how much time is required to do this
* international considerations, such as the development of internationally-harmonised band arrangements

the availability of MBB equipment.

There are incumbency issues in both the 1.5 GHz and 3.6 GHz band. However, the disruption to incumbent operators is more evident in the 3.6 GHz band, where the revision of Embargo 42 to include regional areas has been strongly opposed by incumbent point-to-multipoint operators, including a number who are seeking to further expand operations using this spectrum. An arguable advantage of prioritising work on the 3.6 GHz band is that it would provide earlier certainty to incumbent services about long-term arrangements in the band—including, as applicable, either an earlier end than otherwise to the embargo, or clarity about any alternative options available to them for future operation or expansion.

Considerations by international bodies, including the ITU, 3GPP and APT are ongoing for both the 1.5 GHz and 3.6 GHz bands. However, the ACMA believes the domestic review of the bands can progress in parallel, taking account of international considerations as appropriate. This, and the availability of MBB equipment, may influence the timing of any re-farming process, if that is the outcome of the review of these bands.

A feature of submissions is the strength of views in favour of urgent re-allocation of spectrum, most strikingly in the case of the 3.6 GHz band, but also the major challenges for incumbents associated with re-farming both the 1.5 GHz and 3.6 GHz bands. While the ACMA will make every effort to respond in a timely way to changes in the highest value use or user (if established), sufficient time is also needed to work through the legitimate issues raised by all affected parties, in accordance with due process, and for parties to consider options or preliminary views developed by the ACMA.

[Table 1](#Table1) provides an indication of the notional timeline for the progression of the 3.6 GHz band through the remainder of the ACMA’s process for consideration of additional spectrum for MBB services. Under some circumstances and if required, it may be possible for this process to be accelerated by running more steps in parallel, or by compressing steps. However, there are practical limits as to how fast some issues can be progressed, and there may also be a corresponding increase in associated risks.

Importantly, whether the notional timeline is achievable and/or appropriate continues to be contingent on variety of factors, a critical one being the feedback received to ACMA discussion papers that contributes to the ACMA’s evidence-informed decision-making processes.

1. Indicative timeline for the progression of the 3.6 GHz band through the process for consideration of additional spectrum for MBB services

| Stage | Milestone | Date |
| --- | --- | --- |
| **Stage 1—Initial investigation** | Release: Initial investigation of the 1427–1518 MHz and 3575–3700 MHz bands for MBB services discussion paper | October 2016 |
| Submissions to discussion paper due | December 2016 |
| Consideration of submissions and whether to progress consideration of the band to stage 2—*preliminary re-planning* | December 2016 – May 2017 |
| **Stage 2—Preliminary re-planning** | Release: second discussion paper focused on the 3.6 GHz band providing comprehensive highest-value use assessment and planning options | June 2017 |
| Submissions to second discussion paper due | **30 July 2017**  |
| Release: decision paper on whether band will move to stage 3—*re-farming*  | No earlier than late Q3 2017 |
| **Stage 3–Re-farming** | Commencement of *re-farming* stage, if relevant | Q4 2017 |

The 1.5 GHz band will also be progressed to the *preliminary replanning* stage of the process for consideration of additional spectrum for MBB services. This will include the release of further discussion papers, with the next paper likely to be released in 2018.

# Annex A—Submissions received

## All submissions

|  |  |  |
| --- | --- | --- |
| 7upttg | Ericsson Australia | Nicola Pitt |
| Ace Internet Services | Federated Wireless, Inc. | Noni Wells |
| Airservices Australia | Global VSAT Forum | Optus (Public and CIC) |
| Alexandra Earl | Gmbdc\* | Outstanding |
| Alimatchett | Gus McClymont | QEStel |
| AMTA | Huawei Australia | Qualcomm |
| ASTRA | Inmarsat | Richard Clawson  |
| BMS Network Solutions | Intelsat | Robert Jost |
| Bremner Farms | Jacki Bishop | Ruckus Wireless |
| Brian Hanlon | Jason Quinnell | Sam de Beer |
| Cacharelbriards\* | Jennifer Gleeson | Scott Farm\*  |
| Cambium | Jettech Networks | Special Broadcasting Service  |
| Chris Metcalf | JNS\* | Steve Berger |
| CipherTel | Julien\* | TasmaNet |
| Communications Alliance SSWG | Ken Woodward | Telstra |
| Countrytell | Lance\* | Thuraya |
| Craig Bethel | Lee & Geoff Longmire | Troy Strang |
| Darktime IT | Louisek78\* | Tyson Armitage |
| David Melville | Meg Kummerow | Vertical Telecoms |
| DB Telecommunications | Mike Day | VHA |
| Department of Defence | Mitchell Hughes | wake.2.wake**\*** |
| Department of Transport and Main Roads Queensland | mphills05\* | WISPAU |
| Diane White | NBN Co | World Without Wires |
| Emma Ryrie | NSW Telecommunications Authority  |  |
| Epic Energy | Nick\* |  |

\*Online submission with no name provided.

## Submissions by industry

|  |
| --- |
| **1.5 GHz user** |
| Epic Energy |  |  |
| **3.6 GHz point-to-multipoint users** |
| Bremner Farms | Nicola Pitt |  |
| Accredited persons |  |  |
| DB Telecommunications |  |  |
| **Government—Federal** |
| Airservices Australia | Department of Defence |  |
| Department of Transport and Main Roads Queensland | NSW Telecommunications Authority |  |
| **Mobile manufacturers** |
| Ericsson Australia | Huawei Australia | Qualcomm |
| **Rural internet supporters** |
| JNS\* | Louisek78\* | Noni Wells |
| Julien\* | Nick\* | Scott Farm\* |
| Lance\* |  |  |
| **Satellite industry** |
| ASTRA | Inmarsat | Special Broadcasting Service (SBS) |
| Comms Alliance SSWG | Intelsat | Thuraya |
| Global VSAT Forum |  |  |
| **Telecommunications industry** |
| AMTA | Optus | VHA |
| NBN Co | Telstra |  |
| US-based wireless organisations |
| Federated Wireless, Inc. | Ruckus Wireless |  |
| **Wireless internet service providers**  |
| Ace Internet Services | QEStel | World Without Wires |
| CipherTel | TasmaNet | Cambium |
| Countrytell | Vertical Telecoms | BMS Network Solutions |
| Jettech Networks | WISPAU |  |
| **Wireless internet service provider supporters** |
| 7upttg | Emma Ryrie | Mike Day |
| Alexandra Earl | gmbdc\* | Mitchell Hughes |
| Alimatchett | Gus McClymont | mphills05\* |
| Brian Hanlon | Jacki Bishop | Robert Jost |
| Cacharelbriards\* | Jason Quinnell | Sam de Beer |
| Chris Metcalf | Jennifer Gleeson | Steve Berger |
| Craig Bethel | Ken Woodward | Troy Strang |
| Darktime IT | Lee & Geoff Longmire | Tyson Armitage |
| David Melville | Meg Kummerow | wake.2.wake\* |
| Diane White |  |  |

\*Online submission with no name provided.

1. Refer to [Rulemaking 12-354](https://www.fcc.gov/rulemaking/12-354). [↑](#footnote-ref-2)