Future use of the 28 GHz band

Planning decisions and preliminary views

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Canberra

Red Building   
Benjamin Offices  
Chan Street   
Belconnen ACT

PO Box 78  
Belconnen ACT 2616

T +61 2 6219 5555  
F +61 2 6219 5353

Melbourne

Level 32   
Melbourne Central Tower  
360 Elizabeth Street   
Melbourne VIC

PO Box 13112  
Law Courts   
Melbourne VIC 8010

T +61 3 9963 6800  
F +61 3 9963 6899

Sydney

Level 5   
The Bay Centre  
65 Pirrama Road   
Pyrmont NSW

PO Box Q500  
Queen Victoria Building   
NSW 1230

T +61 2 9334 7700 or 1800 226 667  
F +61 2 9334 7799

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Written enquiries may be sent to:

Manager, Editorial Services  
PO Box 13112  
Law Courts  
Melbourne VIC 8010  
Email: [info@acma.gov.au](mailto:info@acma.gov.au)

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Executive summary

The 28 GHz band (27.5–29.5 GHz) is at the forefront globally for the delivery of new generation satellite services, along with the delivery of millimetre wave (mmWave[[1]](#footnote-2)) fifth generation (5G) wireless broadband services. It is one of a number of mmWave bands the ACMA has identified in its [*Five-year spectrum outlook 2019–23 (FYSO 2019–23*](https://www.acma.gov.au/Industry/Spectrum/Spectrum-projects/5-Year-Spectrum-Outlook/five-year-spectrum-outlook) where there is evidence of competing demands for spectrum access.

Completing the replanning of the 28 GHz band is a significant priority for the Australian Communications and Media Authority (ACMA) and important in providing certainty to stakeholders interested in using this spectrum.

When reviewing arrangements in a band, the ACMA is guided by its [*Principles for Spectrum Management*](https://www.acma.gov.au/Industry/Spectrum/Spectrum-planning/About-spectrum-planning/australian-spectrum-management-principles-spectrum-planning-acma#principles) and the existing legislative framework. This includes having regard to the objects of the *Radiocommunications Act 1992,* such as maximising the overall public benefit derived from using the radiofrequency spectrum.

This planning decision is informed by an extended review and consultation process. This commenced with the release of the [28 GHz spectrum planning discussion paper](https://www.acma.gov.au/theACMA/spectrum-planning-for-the-28-ghz-band)in September 2018 (the 2018 Discussion paper). The 2018 Discussion paper detailed international developments and existing arrangements in the band as well as drivers for change. It also sought information from stakeholders to assist in the formation of possible planning options.

This was followed by the [*Replanning of the 28 GHz band: Options paper*](https://www.acma.gov.au/theACMA/planning-options-for-the-28-ghz-band) (the Options paper) released in April 2019. The Options paper identified a range of planning options, provided the ACMA’s preliminary assessment on the public benefits of each and sought feedback from stakeholders on the most appropriate approach. When developing and assessing planning options, the outcomes of the [26 GHz band review process](https://www.acma.gov.au/theACMA/options-for-wireless-broadband-in-the-26-ghz-band) were also considered, particularly in light of potential use across both bands for terrestrial wireless broadband.

This current paper concludes the ACMA’s review of planning arrangements for the 28 GHz band. It details planning decisions made for the 28 GHz band as well as preliminary views the ACMA has formed on the associated licensing and technical conditions that will subsequently be developed.

Key planning decisions made for the 28 GHz band include:

* An increase in the amount of spectrum available for ubiquitous fixed satellite services (FSS)[[2]](#footnote-3) use, including the availability of at least 1.9 GHz[[3]](#footnote-4) of contiguous uplink spectrum Australia-wide. This expands to 2.5 GHz of spectrum outside of large population centres. The ACMA will also investigate approaches that may allow uncoordinated FSS use in an additional 600 MHz of spectrum within large population centres, potentially with some constraints—this would enable access to a total of 2.5 GHz of spectrum Australia-wide.[[4]](#footnote-5)
* Continuation of apparatus licensed arrangements for FSS earth stations across the entire 28 GHz band Australia-wide, providing access to 2.5 GHz of spectrum on a coordinated, first in-time basis.3
* The introduction of arrangements for fixed wireless access (FWA) services across the entire 28 GHz band. This will be on a co-primary basis with apparatus licensed FSS earth stations in large population centres in the 27.5–28.1 GHz frequency range, and on a secondary (no protection) basis to the FSS in other areas and frequencies. Similar to the 26 GHz band, the ACMA will investigate using the proposed new area-wide apparatus licence type to enable this use.[[5]](#footnote-6)

Removal of arrangements for new fixed point to point (PTP) services in the 28 GHz band and grandfathering existing services for a minimum seven years. It is noted that if area-wide apparatus licence arrangements are implemented in the band, new PTP services could be deployed within individual licence areas. The ACMA will also revise PTP arrangements in the 38 GHz band to provide an alternative option for new wide-channel systems.

The planning decisions made are based on one of the ACMA’s preferred options identified in the Options paper (Option 3), with some modifications based on feedback received. These modifications include:

* Developing arrangements for FWA use across the entire 28 GHz band Australia-wide. Use outside the 27.5–28.1 GHz band in large population centres will be on a secondary basis to the FSS. Given there are no interference concerns from FWA into FSS earth stations, the ACMA is of the view that FWA use can coexist with FSS satellite receivers on a ‘no protection’ basis. This approach increases the flexibility available for FWA deployments. It will require FWA operators to be aware of the possibility of interference from FSS to their operations. However, given the amount of spectrum available and that dedicated primary FWA spectrum is available in both the 26 GHz band and elsewhere in the 28 GHz band, the ACMA sees opportunities for wider spectrum use by adopting this approach to managing coexistence.
* Further investigating approaches that would allow ubiquitous FSS to operate in those areas and parts of the band where FWA operates on a primary basis. This could include constraints on how ubiquitous FSS use the spectrum in these areas to enable coexistence.

Investigating options to support the aggregation of multiple PTP channels in one or more bands below 28 GHz.

The ACMA has formed the view that this combination of measures will best maximise the overall public benefit derived from use of the band. This is on the basis that establishing these arrangements will support new and existing uses of the spectrum under flexible access arrangements. Industry will also have the benefit of increased access to spectrum suitable for current and evolving satellite services such as very high throughput broadband both to the home and to moving platforms.

Similarly, new arrangements will significantly increase opportunities for terrestrial fixed wireless broadband, including 5G. In both cases these opportunities will deliver flow-on benefits to consumers in terms of quality and range of services available.

Importantly, these changes come at little or no detriment to existing users of the spectrum, with explicit support for PTP use being the only arrangements ceasing in the band. However, individual users will continue to be able to operate for an extended period time (up to seven years) reducing the impact of changes on their existing systems.

In coming to its view on the 28 GHz band, the ACMA had regard to planning decisions and intentions already made for the 26 GHz band—specifically regarding spectrum proposed for spectrum licensing optimised for wide-area wireless broadband (that is, the 2.4 GHz within the 26 GHz band proposed by the ACMA for spectrum licensing in populated areas).

Overall, the ACMA’s recent decisions on the 26 GHz and 28 GHz bands have established new planning arrangements for over 5 GHz of mmWave spectrum of great interest for both terrestrial and satellite broadband services. This is in addition to shared access to mmWave spectrum under class licensing arrangements in the 60 GHz band which the ACMA made available in August 2019.

Together with the 26 GHz and 28 GHz bands, these planned arrangements are intended to support a wide range of spectrum interests under a variety of licensing arrangements. These arrangements will enhance competition both between different spectrum uses and provide an opportunity for new entrants in the band. This competition at the use and user levels is expected to offer significant consumer benefits.

Based on planning decisions made in this paper, a summary of the overall proposed configuration of the broader 26 GHz and 28 GHz bands is shown in Figure 1.

### Next steps

To give effect to the decisions and preliminary views detailed in this paper, the ACMA will:

* Review the [Radiocommunications (Communication with Space Object) Class Licence 2015](https://www.legislation.gov.au/Details/F2018C00845) to investigate and implement the changes proposed for ubiquitous FSS in the 28 GHz band. This will also consider possible arrangements for ubiquitous FSS in the associated FSS downlink band (17.7–20.2 GHz).
* Develop and consult on apparatus licence arrangements to support FWA use in the 28 GHz band. This includes investigating the use of the proposed new area-wide apparatus licences. Work on this issue will be combined with the development of spectrum and apparatus licence arrangements in the 26 GHz band.
* Investigate options to support the aggregation of multiple PTP channels in one or more bands below 28 GHz.

1. Summary of planning arrangements for the 26 GHz and 28 GHz bands



# Introduction

In April 2019, the ACMA released [the Options paper](https://www.acma.gov.au/theACMA/-/media/A18AE5C2EE354C94837C87E2D7FDF2A2.ashx). The Options paper identified the different services currently using, as well as parties interested in gaining access to, the 27.5–29.5 GHz (28 GHz) band. It outlined relevant international trends, domestic developments, drivers for change as well as coexistence issues between the identified services. Most critically, it considered a range of planning options for the future use of the band.

The Options paper discussed and assessed the following planning options for the 28 GHz band:

* Option 1—arrangements for wide-area wireless broadband (WWB) suitable for both fixed and mobile 5G, PTP, FWA and FSS (both gateway[[6]](#footnote-7) and ubiquitous).
* Option 2—arrangements for PTP, FWA and FSS (both gateway and ubiquitous).
* Option 3—arrangements for FWA and FSS (both gateway and ubiquitous).

Option 4—arrangements for FSS (both gateway and ubiquitous) only.

Stakeholders were asked a series of questions about the suitability of the proposed options, as well as potential grandfathering arrangements for PTP services. Much of this information has not been reproduced here so this paper should be read in conjunction with the Options paper.

The ACMA identified Options 2 and 3 as its preferred planning approach for the 28 GHz band. Both options provide additional spectrum for FWA and ubiquitous FSS use, with the key difference being whether future PTP services are accommodated in the band or can be adequately catered for in alternative bands. To help inform its decision making, the ACMA ran a separate consultation process on the [viability of wide channel PTP arrangements in the 38 GHz band](https://www.acma.gov.au/theACMA/review-of-rali-fx-3-38-ghz-band).

This paper considers issues raised in submissions to the Options paper which have informed planning decisions the ACMA has made for the 28 GHz band. It also details preliminary views the ACMA has formed on the associated licensing and technical conditions that will subsequently be developed.

## Legislative and policy environment

The Options paper identified the relevant considerations in the ACMA’s legislative and policy environment which inform its spectrum planning decisions. This included descriptions of:

* the primary legislation under which the ACMA currently manages spectrum, being the *Radiocommunications Act 1992* (the Act)
* the [*Principles for Spectrum Management*](https://www.acma.gov.au/Industry/Spectrum/Spectrum-planning/About-spectrum-planning/australian-spectrum-management-principles-spectrum-planning-acma#principles), which provide guidance when making decisions on spectrum use
* the three licence types under which spectrum access can be authorised, being apparatus, spectrum and classlicensing
* key ACMA tools which provide transparency to industry and the public on spectrum management and allocation programs, including:
* the [*Mobile broadband (MBB) strategy*](https://www.acma.gov.au/theACMA/mobile-broadband-strategy-and-work-plan), which provides a framework for the consideration and, where deemed appropriate, progression of frequency bands to allocation for provision of mobile (and other wireless) broadband services
* the [*FYSO 2019–23*,](https://www.acma.gov.au/Industry/Spectrum/Spectrum-projects/5-Year-Spectrum-Outlook/five-year-spectrum-outlook) which sets out the ACMA’s forward work program over a five-year period.

# ACMA planning decisions and preliminary views

## Consideration of planning options

When determining whether and how to progress re-planning activities in the 28 GHz band, the ACMA considered a variety of issues. This included current uses of the band, international trends, issues raised in submissions to both the 2018 Discussion paper and the Options paper, the effect each option would have on incumbent services and the relative incremental benefits and costs for each replanning option.

The ACMA also considered the outcomes of the 26 GHz band review process when assessing options and making planning decisions for the 28 GHz band. This has allowed for a more holistic assessment of the spectrum needs of the services and applications seeking access to the bands than would have been the case if they were considered in isolation.

In the Options paper, the ACMA identified Options 2 and 3 as its preferred options for the 28 GHz band. Both of these provide additional spectrum for FWA and FSS use, with the key difference being whether new PTP services continue to be accommodated in the band.

A summary of responses to the Options paper is provided at Appendix A. After considering responses and taking into account the discussion of issues below for each incumbent and prospective new services in the band, the ACMA has determined that adopting Option 3, with some modifications based on feedback received, is considered the most appropriate outcome.

For the purposes of this paper the term ‘large population centres’ is defined in Appendix B. This term is intended to refer to the same areas that the Minister for Communications, Cyber Safety and the Arts (the minister) may decide to re-allocate for the issue of spectrum licences in the 26 GHz band. In June 2019 the ACMA consulted on proposed re-allocation areas as part of a [draft recommendation to the minister](https://www.acma.gov.au/theACMA/draft-spectrum-reallocation-recommendation-for-the-26-ghz-band). Pending final decisions, it is noted that the definition of large population centres may be varied to ensure they match the actual areas that are re-allocated.

### WWB arrangements

The Options paper stated the ACMA’s view that a suitable amount of spectrum for WWB use (including mobile 5G) had already been identified in the 26 GHz band. This included 2.4 GHz of spectrum in large population centres for the issue of spectrum licences (generally preferred for WWB deployments) and 2.8 GHz of spectrum outside these areas for apparatus licensed deployments suitable for WWB and local area FWA. As such, neither sub-Option 1a or 1b were expected to maximise public benefit and therefore these options were not considered to be the most appropriate use of the band.

The ACMA has reviewed its assessment of sub-Option 1a or 1b taking into account responses to the Options paper. While the responses provided arguments for allocating spectrum to WWB, they did not provide any new information which the ACMA had not already considered in forming its original view. Considering all the competing demands for access to the 26 GHz and 28 GHz bands, the ACMA does not propose to develop arrangements for WWB in the 28 GHz band. It makes this decision, noting the 2.4 GHz of spectrum identified for WWB in the 26 GHz band and the fact there are numerous other mmWave bands under active consideration for WWB.

### PTP arrangements

The Options paper indicated the ACMA’s intention to investigate the viability of accommodating the existing 28 GHz band PTP arrangements, including wide channel arrangements, in the 38 GHz band. To help inform its decision, the ACMA conducted a separate consultation process regarding the implementation of [wide channel PTP arrangements in the 37.0–39.5 GHz (38 GHz) band](https://www.acma.gov.au/theACMA/review-of-rali-fx-3-38-ghz-band). After considering submissions to this process, a decision was made to introduce the proposed arrangements.

The ACMA considers that in most circumstances the 38 GHz band would be a suitable alternative for PTP services that would otherwise have used the 28 GHz band. However, it is acknowledged that it may not be suitable in cases where the additional propagation losses in the 38 GHz band cannot be addressed through other link engineering approaches. In this case lower frequency bands are generally preferred. While there are such arrangements for fixed links requiring bandwidths less than or equal to 80 MHz, there are currently no channel arrangements in bands below 28 GHz for bandwidths greater than 80 MHz.

Based on responses to the 28 GHz options paper and the outcome of the 38 GHz consultation process, the ACMA will take the following actions regarding PTP in the 28 GHz band:

* Remove current 28 GHz PTP arrangements. This action will allow other services to access spectrum in the band that may otherwise have been occupied by PTP services.
* Further investigate options to support the aggregation of multiple PTP channels in one or more band below 28 GHz.
* Implement grandfathering arrangements for all existing 28 GHz PTP licences.

In the event an option was adopted that no longer supported new PTP licences in the 28 GHz band, the Options paper sought comment on arrangements to allow incumbent PTP licences to continue operating under the current arrangements for a defined period of time (that is, be ‘grandfathered’). All responses supported such an approach. It was generally felt that the length of any grandfathering period should be long enough for PTP licensees to recoup their investment.

The ACMA will grandfather PTP services for a minimum seven-year period. The grandfathering period has been adopted because the ACMA considers that the continued operation of existing PTP services will have a minor impact on spectrum availability for other services Australia-wide. This is due to the small number of PTP licences, their location in regional areas and highly directional nature. Pending any coexistence issues with new services experienced over this period, the ACMA may choose to allow incumbent PTP licences to continue operating in the band beyond this time on a ‘no interference and no protection’ basis.

The ACMA is also open to considering case-by-case changes to existing PTP licences within the grandfathering period. The primary consideration in such cases will be the potential increase to spectrum efficiency and changes to the interference environment.

It is noted that as part of the arrangements proposed for the 28 GHz band, the ACMA will investigate the use of area-wide apparatus licences. If implemented, it would be possible for new PTP services to be deployed within individual licence areas.

### FSS arrangements

The Options paper highlighted the increasing capacity requirements of new satellite services and the resulting desire by operators for access to more spectrum, particularly in the 28 GHz band. This is reflected by the increasing number of high-throughput satellite (HTS) and very high-throughput satellite (VHTS) systems being deployed. To support such use, all options proposed by the ACMA increased the amount of spectrum available for uncoordinated, ubiquitous FSS earth stations. Options 2, 3 and 4 also maintained existing arrangements for coordinated FSS earth stations at fixed and known locations (referred to in this paper as ‘FSS gateways’) across the entire band Australia-wide. However, Option 1 proposed removing these arrangements in a portion of the band in large population centres to support WWB.

The majority of responses to the consultation acknowledged the need to provide additional spectrum for ubiquitous FSS use and the value of ensuring there are ongoing arrangements for coordinated FSS gateways. The satellite industry also expressed their preference for exclusive access to the entire band Australia-wide especially for the purposes of ubiquitous FSS use.

After reviewing responses, the ACMA is of the view that additional spectrum should be made available for ubiquitous FSS use in the 28 GHz band to meet rising demand.

However, this needs to be balanced with the needs of other services in the band such as FWA (noting the decision to move arrangements for new PTP services to the 38 GHz band). Since the ACMA considers that the current spectrum needs of WWB will be adequately covered by decision made in the 26 GHz band review process, Option 1 will not be adopted. This reasoning supports Option 3 being the most appropriate approach to meet future FSS needs.

Option 3 maintains existing arrangements for FSS gateways across the entire band Australia-wide. It also increases the existing provisions for ubiquitous FSS from 600 MHz to 1.4 GHz Australia-wide, from 28.1–29.5 GHz. In addition, ubiquitous FSS will also gain access to an additional 600 MHz of spectrum outside of large population centres in the 27.5–28.1 GHz frequency range (refer to Figure 2). When this is included with the existing 500 MHz available in the adjacent 29.5–30 GHz frequency range, the ACMA considers there will be a suitable amount of spectrum to support the growing demand for FSS.

As part of Option 3, the ACMA also proposed investigating the possibility of permitting ubiquitous FSS use on a ‘no interference basis’ in areas and frequencies identified for FWA on a primary basis (refer to ‘FWA arrangements’). The Options paper noted that this may require ubiquitous FSS devices to be subject to deployment restrictions to reduce the risk of interference. While the majority of submissions to the Options paper took a position that coexistence between FWA and ubiquitous FSS was untenable, some responses indicated that coexistence could be achieved by imposing deployment restrictions.

After considering responses, the ACMA has decided to further investigate the possibility of arrangements to support ubiquitous FSS use in areas and frequencies identified for FWA on a primary basis. This presents an opportunity to enable greater use of the spectrum provided suitable measures to manage interference can be identified.

The ACMA notes that this paper is limited to considering options and arrangements for the FSS uplink in the 27.5–29.5 GHz band. Options for the associated FSS downlink segment (17.7–20.2 GHz band) are not included. The ACMA expects to undertake further work on the associated downlink segment, based on the scope of changes required for the uplink segment identified in this paper.

In summary, the ACMA will take the following actions regarding the FSS in the 28 GHz band:

* maintain existing apparatus licence arrangements for coordinated FSS earth stations (that is, gateways) across the band Australia-wide
* work with industry to identify possible arrangements to support ubiquitous FSS use in areas and frequencies identified for FWA on a primary basis (that is, inside the 27.5–28.1 GHz frequency range in large population centres—refer to Figure 2
* extend existing arrangements for uncoordinated ubiquitous FSS use to cover all areas and frequencies not identified for FWA use on a primary basis
* undertake further assessment on options for the extension of existing ubiquitous FSS use in the associated downlink segment in the 17.7–20.2 GHz band.

### FWA arrangements

As outlined in the Options paper, one of the outcomes from the [Future use of the 3.6 GHz band](https://www.acma.gov.au/theACMA/future-approach-to-the-3_6-ghz-band) process was that the ACMA committed to investigating the possibility of apparatus licensed arrangements in part of the 28 GHz band for localised FWA services. The intention was to provide additional spectrum options for wireless internet service providers (WISPs), local councils, mining companies and other industry verticals.

The ACMA identified two preferred options for additional FWA spectrum in the 28 GHz band, one if PTP arrangements in the band were retained and one if they were not.

Many submissions supported identifying more spectrum for FWA. However, a number of responses from the satellite industry indicated a preference for exclusive FSS use of the 28 GHz band Australia-wide. This was due to a coexistence issue between ubiquitous FSS and other services and a preference to not have different arrangements for the FSS in different geographic areas. There were also some concerns raised about potential aggregate interference from FWA deployments into satellite receivers.

After reviewing responses, the ACMA still considers that additional spectrum should be made available for FWA use in the 28 GHz band. Since arrangements for WWB will not be implemented in the band, and arrangements for new PTP services will not be retained, this points to Option 3 being the most appropriate way forward. It is further considered that 600 MHz of spectrum (from 27.5–28.1 GHz) should be made available on a primary basis (that is, provided protection from other services) in large population centres in the 28 GHz band. When combined with arrangements in the 26 GHz band, this provides a total of 1000 MHz for FWA use on primary basis in large population centres. The ACMA considers this a suitable amount of spectrum to support multiple FWA operators in an area and allow each to provide a competitive service.

In the remaining areas and parts of the 28 GHz band the ACMA will develop apparatus licence arrangements for FWA use on a ‘no protection’ basis from the FSS (that is, on a secondary basis to the FSS), this approach:

* Provides interference management between FWA operators.
* Acknowledges that the 28 GHz band is a satellite uplink band (that is, an earth station transmit band) and there is no risk of interference to FSS earth stations.
* Allows unconstrained FSS use in the relevant frequencies and areas.

Allows FWA operators to opportunistically use more of the 28 GHz band, thereby maximising utility of the spectrum. This could be used by operators to complement (or instead of) other primary FWA allocations across the 26 GHz and 28 GHz bands. Theses primary allocations also provide operators with options to fall back on in the event interference is experienced.

This outcome provides a total of 1.4 GHz of spectrum in large population centres and 2 GHz of spectrum outside large population centres for FWA use on a secondary basis (refer to Figure 2).

As detailed in the Options paper and the [*Future use of the 26 GHz band: Planning decisions and preliminary views*](https://www.acma.gov.au/theACMA/options-for-wireless-broadband-in-the-26-ghz-band)paper, the ACMA is of the view that FWA can coexist with FSS satellite receivers. To safeguard against any potential interference issues and, in line with the outcomes of the 26 GHz band review, the ACMA will work with industry to identify and implement appropriate licence conditions for FWA use of the 28 GHz band. These additional conditions will be developed within a broader technical liaison group (TLG) that will be formed to develop spectrum and apparatus licensing arrangements for access to the 26 and 28 GHz bands.

The allocation for FWA is primarily to support the provision of localised wireless broadband services by WISPs, utility companies, the mining industry and other industry verticals. Noting that, in the 28 GHz band, such use is expected to primarily be for fixed applications, and that there is a significant amount of spectrum already identified for fixed and/or mobile use in the 26 GHz band, the ACMA considers it appropriate that 28 GHz arrangements be limited to fixed wireless only.

Similar to the 26 GHz band, the ACMA will also investigate the use of the new area wide apparatus licence approach for FWA in 28 GHz band. This new approach to apparatus licensing was recently [consulted on by the ACMA](https://www.acma.gov.au/theACMA/proposed-area-wide-apparatus-licence). It is intended that the relevant arrangements be developed simultaneously with those created for the 26 GHz band.

In summary, the ACMA will take the following actions regarding FWA in the 28 GHz band:

* Create apparatus licence arrangements for FWA in large population centres on a primary basis in the 27.5–28.1 GHz frequency range. Create apparatus licence arrangements for FWA on a secondary basis to the FSS in other areas and frequencies across the band.
* Limit use to fixed user terminals only.
* Investigate the use of area-wide licensing in the band.

### Class licence arrangements for body scanners

The [Radiocommunications (Body Scanning – Aviation Security) Class Licence 2018](https://www.legislation.gov.au/Details/F2018L01583) supports arrangements for the use of body scanners across the 24.25–30 GHz frequency range. Such use is limited to Australian airports for security screening purposes. In the Options paper the ACMA stated it did not intend to change these arrangements. The ACMA will consider services operating under this class licence when formalising the licensing arrangements for the band. However, the ACMA does not foresee the need to amend the class licence based on the outcome of this consultation.

### High altitude platform systems (HAPS) arrangements

While HAPS have been identified as a possible application in 28 GHz band, the Options paper stated that the ACMA was not contemplating use of the band by HAPS at this time. The ACMA acknowledges that internationally there is evolving interest for HAPS use of the 28 GHz. However, this is yet to evolve into the deployment of fully-fledged commercial systems and there is currently limited interest domestically in using the band for HAPS. Furthermore, WRC-19 agenda item 1.14 is still investigating additional identifications for HAPS in a variety of bands. The ACMA will continue to monitor international and domestic developments for HAPS, including the outcomes of WRC-19, in the 28 GHz and other bands. Consideration of possible arrangements for HAPS will be progressed under a separate consultation process as demand and spectrum options become more certain.

## Coexistence of planned services and applications

The Options paper provided a preliminary examination of the ability for proposed and incumbent services and applications to coexist in the 28 GHz band. Following analysis of submissions to the Options paper and subsequent identification of a planning approach for the band, the ACMA has further assessed what conditions and/or further work is required to ensure arrangement implemented effectively manage interference and facilitate coexistence between different services. This section summarises the outcomes of this work.

### FWA and FSS earth stations at fixed and known locations

International and domestic analysis indicates that FWA and FSS earth stations operating at fixed and known locations (referred to in this paper as FSS gateways) are able to coexist in the 28 GHz band—provided appropriate coordination procedures and protection criteria are defined. Such use could be supported by the requirement to take out apparatus licences for both FWA and FSS gateways. This means that, before a licence is issued, prospective licensees would be required to satisfy defined coordination procedures and protection criteria in order to manage interference between the two services.

The ACMA will work with industry to develop the relevant apparatus licence arrangements to support sharing between FWA and FSS Gateways. This will take into account:

* the fact that the 28 GHz band is a satellite uplink band (that is, an earth station transmit band) and there is no risk of interference to FSS earth stations
* areas and frequencies where FWA use will be on a co-primary and secondary basis to the FSS

options to improve sharing by taking advantage of terrain, local clutter and other measures to improve site shielding.

It is noted that the use of deployment restrictions may also be considered to help maximise frequency re-use and manage potential interference. Such criteria may include, maximum in-band radiated power limits, unwanted emission limits, restrictions on antenna tilt angles and power flux density limits.

### FWA and uncoordinated, ubiquitous FSS

Fixed terminals

While fixed and uncoordinated ubiquitous FSS terminals may be deployed anywhere, once deployed these stations do not move. This could allow for a more controlled interference environment when sharing spectrum with other services. It would also make it easier to identify the source should interference occur.

The ACMA’s preliminary view is that there is a possibility for FWA and fixed ubiquitous FSS terminals to coexist under certain conditions without the need to coordinate. These conditions include different combinations of geographical separation/isolation, taking a more detailed account of environmental factors (for example, terrain and clutter) and/or defining deployment restrictions on ubiquitous FSS use (for example, limiting minimum elevation angle, of-axis radiated power limits, site shielding). Following the release of this paper, the ACMA will further investigate the possibility of sharing between these services with industry members. This will be done as part of the review of the [Radiocommunications (Communication with Space Object) Class Licence 2015](https://www.legislation.gov.au/Details/F2018C00845) to expand existing arrangements for ubiquitous FSS use in the 28 GHz band.

Earth stations in motion (ESIM)

The mobile/nomadic nature of ESIM makes it difficult for them to share spectrum with other services in the same geographical area. This presents a coexistence issue in parts of the 28 GHz band were ESIM would be required to not cause interference to FWA services. However, the ACMA considers there may be options to support ESIM use in such scenarios provided appropriate deployment restrictions on their use are applied. The most practical means to currently do this is by ensuring a minimum separation between ESIM and other services.

For land ESIM, the ACMA considers the only practical way to ensure a minimum separation distance with other services is by defining areas where devices can and cannot be used. Given FWA use of the 27.5–28.1 GHz frequency range will be on a primary basis in large population centres, to manage interference, the ACMA does not propose developing arrangements for land ESIM use in these frequencies and areas.

For aeronautical ESIM, the ACMA is aware of draft ITU-R studies that have identified altitude limits or power flux density limits on the ground as methods to manage interference with other services. For maritime ESIM, the same studies have indicated a nominal separation distance from other terrestrial based service as methods to manage interference. It is noted these studies have not yet been finalised and different methods and results could apply for an Australian specific FWA scenario. The ACMA has also identified restricting the deployment of FWA services (or make them secondary) in and around airports and major maritime ports as another technique to manage interference.

Following the release of this paper, the ACMA will further investigate options to support aeronautical and maritime ESIM use in areas where FWA is allocated on a primary basis. The work will be conducted as part of the review of the [Radiocommunications (Communication with Space Object) Class Licence 2015](https://www.legislation.gov.au/Details/F2018C00845) to expand existing arrangements for ubiquitous FSS use in the 28 GHz band.

It is noted that where FWA use is on a ‘no protection’ basis to ubiquitous FSS, the ACMA does not intend to apply restrictions on ESIM use. Instead it would be up to the FWA operator to assess the risk of interference to their business model.

### Protection of FSS satellite receivers operating in the 27.5–29.5 GHz band

As detailed in the Options paper and the [*Future use of the 26 GHz band: Planning decisions and preliminary views*](https://www.acma.gov.au/theACMA/options-for-wireless-broadband-in-the-26-ghz-band)paper, the ACMA is satisfied that FWA systems can coexist with FSS satellite receivers. To safeguard against any potential interference issues, the ACMA will adopt the same restrictions on fixed transmitters as implemented in the 26 GHz band. The ACMA will work with industry to identify and implement appropriate licence conditions for FWA use of the 28 GHz band. These additional conditions will be developed within the TLG formed to develop arrangements for apparatus licensed FWA use of the 28 GHz band.

In line with the outcomes of the 26 GHz band review, the ACMA’s preliminary view is that the following licence conditions should apply to all FWA services operating in the 27.5–29.5 GHz frequency range:

* outdoor base stations must have mechanical down tilt equal to or greater than 0 degrees
* outdoor base stations must not direct antenna beams (via electrical steering) to elevation angles greater than 5 degrees above the horizon for more than 5 per cent of time

outdoor fixed UEs must not direct their antenna beam (via electrical steering) to within 1.5 degrees of the geostationary orbit (GSO) arc

reduced base station total radiated power (TRP) limit of 25 dBm/200 MHz.

The aim of these additional conditions is to ensure that FWA networks are designed and optimised to serve user equipment below the base station. This way they will act as a safeguard to ensure that FSS satellite receivers are protected from FWA operations. Unlike the 26 GHz band, it is intended these conditions be applied to FWA use Australia-wide. This ensures all potential new FSS in the 28 GHz band will be provided with this additional interference safeguard.

### Coexistence with body scanners

The [Radiocommunications (Body Scanning – Aviation Security) Class Licence 2018](https://www.legislation.gov.au/Details/F2018L01583) supports arrangements for the use of body scanners across the 24.25–30 GHz frequency range. These services are subject to restriction on radiated power and operation within airports for security screening purposes. This confines their use to security screening areas which are typically within controlled premises with significant shielding to the external environment.

The ACMA considers this to be a low risk interference environment that can efficiently be site-managed at airports. To avoid the need for changes in operation to body scanners, in the event there is interference it will be the responsibility of FWA licensees to make change to resolve the issue.

### Coexistence with services in the 26 GHz band

As part of the outcomes detailed in the [*Future use of the 26 GHz band: Planning decisions and preliminary views*](https://www.acma.gov.au/theACMA/options-for-wireless-broadband-in-the-26-ghz-band) paper, the ACMA announced its intentions to recommend that the minister reallocate the 25.1–27.5 GHz frequency range for the issue of spectrum licences in large population areas. In May 2019 the ACMA consulted on the [draft recommendation to the minister](https://www.acma.gov.au/theACMA/draft-spectrum-reallocation-recommendation-for-the-26-ghz-band). If the Minister accepts the ACMA’s recommendation and makes a re-allocation determination, the ACMA will progress work to develop arrangements for apparatus and spectrum licensed use of the 26 GHz band by wireless broadband services. This work will initially be undertaken by a TLG and later publicly consulted on. As part of this work, the boundary conditions between services operating in the 26 GHz and 28 GHz will need to be considered. This will include consideration of criteria such as unwanted emission limits and a potential synchronisation requirement. The ACMA will commence the TLG process in Q4 2019.

## Planning decisions and preliminary views

This section summarises planning decisions made for the 28 GHz band; these are illustrated in Figure 2. It also details preliminary views the ACMA has formed on the associated licensing and technical conditions that will subsequently be developed.

The full suite of licensing provisions and conditions that will apply are not included in this paper, these will be developed with any additional consultation processes on relevant licensing frameworks and instructions as required, in accordance with normal practice. However, preliminary views on which licence conditions might be appropriate—particularly those conditions which are fundamental for coexistence with existing services—are included. Indicative timeframes for the subsequent work required to implement planning decisions are defined under ‘Next steps’ of this paper.

This paper is limited to considering options and arrangements for the FSS uplink in the 27.5–29.5 GHz band. Options for the associated FSS downlink segment (17.7–20.2 GHz band) will be considered as part of further work on the associated downlink segment, based on the scope of changes required for the uplink segment identified in this paper. This work will be conducted as part of the update to arrangements in the [Radiocommunications (Communication with Space Object) Class Licence 2015](https://www.legislation.gov.au/Details/F2018C00845) work item arising from the decisions made in this paper.

1. Proposed allocation for the 28 GHz band

Proposed allocation for the 28 GHz band

\* The possibility of this, including any restrictions on use, will be further investigated

### Planning decisions

The ACMA has decided to:

* Remove arrangements for new PTP licences in the paired frequency range 28.1085–28.4445 GHz and 29.1165–29.45 GHz.

Implement grandfathering arrangements for existing PTP licences. The period for the grandfathering arrangements will be set at a minimum period of seven years. Grandfathered fixed PTP services will be allowed to amend their services during the grandfathering period. However, the ACMA will consider these requests on a case by case basis, with the primary consideration being that any amendment should either maintain or enhance the overall spectrum utility for all services.

Implement apparatus licensing arrangements for FWA services, limited to communications with fixed terminals only, across the entire 28 GHz band Australia-wide as follows:

* FWA services will operate on a no protection basis from FSS services (both apparatus licensed FSS earth stations and ubiquitous FSS) Australia-wide except within the frequency range 27.5–28.1 GHz inside large population centres
* In the frequency range 27.5–28.1 GHz and inside large population centres, FWA services will operate on a co-primary basis with apparatus licensed FSS earth stations and will be afforded protection from ubiquitous FSS
* FWA services will operate on a first-in-time coordinated basis with respect to other FWA stations in all areas and frequencies.

Extend existing arrangements in the [Radiocommunications (Communication with Space Object) Class Licence 2015](https://www.legislation.gov.au/Details/F2018C00845) for ubiquitous FSS in the 28 GHz band as follows:

* Extend existing arrangements to cover all areas and frequencies not identified for FWA use on a primary basis (that is, outside the frequency range 27.5–28.1 GHz and large population centres).
* Work with industry to identify possible arrangements to support ubiquitous FSS use in areas and frequencies identified for FWA on a primary basis (that is, inside the 27.5–28.1 GHz frequency range and in large population centres).
* All ubiquitous FSS use will be on a ‘no interference’ basis to primary FWA services.

Maintain current apparatus licensing arrangements for fixed satellite services in the frequency range 27.5–29.5 GHz. Develop and consult on frequency assignment procedures for first-in-time coordination of FSS earth stations with FWA operating in the 27.5–28.1 GHz frequency range in large population centres

Maintain existing arrangements for body scanners in the [Radiocommunications (Body Scanning – Aviation Security) Class Licence 2018](https://www.legislation.gov.au/Details/F2018L01583).

### Preliminary views

To implement the planning decision detailed in this paper, the ACMA will need to develop a range of licensing and technical conditions. These would be applied to new and updated class and apparatus licence arrangements in the 28 GHz band. All conditions developed will be subject to the standard consultative processes before being finalised. Refer to ‘Next steps’ for indicative timing on these processes.

The ACMA has formed preliminary views on a number of the key licensing and technical conditions that are required. These are detailed below. As formal consultation processes have not yet been conducted, they may still be subject to variation.

Conditions on ubiquitous FSS use—preliminary views

Arrangements for ubiquitous FSS will be developed and consulted on as part of a revision to the [Radiocommunications (Communication with Space Object) Class Licence 2015](https://www.legislation.gov.au/Details/F2018C00845). The ACMA’s preliminary views on some of the key conditions that could apply to ubiquitous FSS use of the 28 GHz band follow:

* All ubiquitous use to be on a no interference basis to other licensed services with the exception of secondary FWA services. This is not expected to constrain ubiquitous FSS use as in most frequencies and areas there are will be no other in-band services to manage interference with.
* Possible conditions for ESIM use in the 27.5–28.1 GHz frequency range inside large population centres:
* Limit aeronautical operation to being above a define altitude. While other methods are possible and could be considered during the formal development of criteria, this is the currently preferred approach.
* Limit maritime use to a minimum distance from the coastal low water mark.
* Prohibit all land-based use.
* Possible conditions for fixed terminal ubiquitous FSS use in the 27.5–28.1 GHz frequency range inside large population centres:
* Restricting use below a defined minimum elevation angle.
* Defining off-axis EIRP or power flux-density (PFD) limits.
* Requiring the use of man-made or natural site shielding to limit the potential for interference to other services.
* Possible conditions on ubiquitous FSS use in the 28.1–29.5 GHz frequency range to manage adjacent band interference to FWA use of the 27.5–28.1 GHz frequency range in large population centres:
* Extending restrictions on ubiquitous FSS use in the 27.5–28.1 GHz frequency range inside population centres to encompass a suitable portion of the adjacent band.
* Possible conditions on ubiquitous FSS use in the 27.5–28.1 GHz frequency range outside large population centres to manage co-channel interference to FWA use of the 27.5–28.1 GHz frequency range in large population centres:
* Extending restrictions on ubiquitous FSS use in the 27.5–28.1 GHz frequency range inside population centres to encompass a suitable portion of the adjacent area.

Conditions on apparatus licensed FSS earth station use—preliminary views

Any updates required to the existing arrangements for apparatus licensed FSS earth stations will be developed and consulted on as part of a TLG process. The TLG will be charged with developing arrangements for spectrum[[7]](#footnote-8) and apparatus licenced use of the 26 GHz and 28 GHz bands by wireless broadband services—including coexistence with other services. The ACMA’s preliminary views on some of the key conditions that could apply to apparatus licensed FSS earth station use of the 28 GHz band follow:

* arrangements only apply to fixed satellite earth stations (that is, gateways) operating at a known location
* access permitted on a primary basis to the entire band Australia-wide
* new apparatus licensed FSS earth stations must be coordinated on a first-in-time basis with:
* FWA services operating in the 27.5–28.1 GHz band inside large population centres
* grandfathered PTP services in the 28 GHz band
* apparatus licensed wireless broadband services operating in the 26 GHz band
* registered devices operating under a spectrum licences in the 26 GHz band.

Conditions on FWA use—preliminary views

Arrangements for FWA will be developed and consulted on as part of a revision to a TLG process. The TLG will be charged with developing arrangements for spectrum and apparatus licenced use of the 26 GHz and 28 GHz bands by wireless broadband services. The ACMA’s preliminary views on some of the key conditions that could apply to FWA use of the 28 GHz band follow:

* Use will be limited to fixed terminal deployments only (that is, base station with fixed subscriber terminals).
* Proposed FWA services in the 27.5–28.1 GHz frequency range inside large population centres will need to be coordinated with existing in-band and adjacent band apparatus licenced FSS earth stations and FWA services on a first-in-time basis.
* Proposed FWA services outside the 27.5–28.1 GHz frequency range and large population centres will need to be coordinated with existing in-band and adjacent band apparatus licenced FWA services on a first-in-time basis. They will not be afforded protection from existing or future apparatus licensed FSS earth stations or ubiquitous FSS.
* All FWA use will need to coordinate with grandfathered PTP services.
* To avoid the need for changes in operation to body scanners all FWA use will be on a ‘no interference and no protection’ basis to body scanners operating in accordance with the [Radiocommunications (Body Scanning – Aviation Security) Class Licence 2018](https://www.legislation.gov.au/Details/F2018L01583). This ensures it is the responsibility of FWA licensees to resolve any interference issues.
* The same conditions and access arrangements developed for fixed wireless broadband services in the 26 GHz will be applied to FWA use of the 28 GHz band:
* Authorise use under a potential new area-wide apparatus licence type. The ACMA is currently [exploring the design for this potential new licence type](https://www.acma.gov.au/theACMA/proposed-area-wide-apparatus-licence) and associated conditions. It could include conditions limiting the PFD at area boundaries to ensure coexistence between adjacent service areas.
* Conditions to ensure the protection of FSS satellite receivers may include:
* outdoor base stations must have mechanical down tilt equal to or greater than 0 degrees
* outdoor base stations must not direct antenna beams (via electrical steering) to elevation angles greater than 5° above the horizon for more than 5 per cent of time

outdoor fixed UEs must not direct their antenna beam (via electrical steering) to within 1.5 degrees of the GSO arc

reduced base station TRP limit of 25 dBm/200 MHz.

* Conditions to manage adjacent band interference between wireless broadband services in the 26 GHz and 28 GHz bands may include:

limits on unwanted emissions

a requirement to synchronise services in the event there is interference and agreement cannot be reached on how to manage it.

## Next steps

To give effect to the planning decisions and preliminary views outlined in this paper, the ACMA intends to proceed in accordance with the timetable set out in Table 1. Due to the similarity of apparatus licence services and associated interference issues that need to be considered between the 26 GHz and 28 GHz band, the ACMA intends to progress the development of arrangements in both bands together.

1. Indicative timetable for development and implementation of 26 GHz and 28 GHz band arrangements

| Action | Date |
| --- | --- |
| Commence development of allocation arrangements for wireless broadband apparatus licensed spectrum (24.7–25.1 GHz Australia-wide, 25.1–27.5 GHz outside of large population centres and 27.5–29.5 GHz band Australia-wide).  Commence development of technical arrangements for 26 GHz spectrum licences\* and 26/28 GHz wireless broadband apparatus licences. This will be done via a TLG process.  Commence work to consult on an update to the [Radiocommunications (Communication with Space Object) Class Licence 2015](https://www.legislation.gov.au/Details/F2018C00845) and expand arrangements for ubiquitous FSS to encompass the entire 28 GHz band. This will also consider possible arrangements for ubiquitous FSS in the associated FSS downlink band (17.7–20.2 GHz).  Commence work investigating options to support the aggregation of multiple PTP channels in one or more bands below 28 GHz. | Q4 2019 |
| Consult on any arrangements identified to support aggregation of multiple PTP channels | Q1 2020 |
| Finalise any arrangements identified to support aggregation of multiple PTP channels  Publicly consult on technical arrangement for 26/28 GHz wireless broadband apparatus licences.  Finalise updates to the [Radiocommunications (Communication with Space Object) Class Licence 2015](https://www.legislation.gov.au/Details/F2018C00845). | Q2 2020 |
| Finalise technical arrangements for 26 GHz spectrum licences\* and 26/28 GHz wireless broadband apparatus licences. | Q3 2020 |
| Allocation of wireless broadband apparatus licences. Release spectrum (24.7–25.1 GHz Australia-wide, 25.1–27.5 GHz outside of large population centres and 27.5–29.5 GHz band Australia-wide). | TBD |

\* Please note, this step is subject to the minister making a reallocation declaration for 26 GHz band spectrum.

# Appendix A: Responses to the options paper

The Options paper invited comment on the following:

1. Do stakeholders have comments or further views on the services and planning issues discussed for the 28 GHz band?
2. What is the minimum appropriate length of time for PTP grandfathering arrangements to apply?
3. Are there any other conditions that should be considered for PTP grandfathering?
4. Are there any other technical issues the ACMA should consider regarding the ability for WWB, FWA, PTP and FSS to share or coexist in the 28 GHz band?
5. Do stakeholders have comments on any of the options proposed in this section or other options to propose?
6. Is the definition of ‘large population centres’ (as described in Appendix B), suitable for application in Options 1a, 1b, 2 and 3?
7. Do stakeholders have any comments on the assessment of each option against the Spectrum Management Principles?
8. Is there any relevant evidence that provides an indication of the value the WWB sector places on additional spectrum in the 28GHz band?
9. Is there any relevant evidence that provides an indication of the value the FWA sector places on additional spectrum in this band?
10. What value do PTP operators place on having access to 112 MHz channels? If similar arrangements could be implemented in the 38 GHz band, would they be a suitable replacement for the 28 GHz band?
11. Is there any evidence that provides an indication of the value the PTP sector places on maintaining access to this band?
12. Is there any evidence that provides an indication of the value the FSS sector places on access to this band?
13. The ACMA invites comment on its currently preferred options. Should other options be considered?

## Summary of submissions

Consultation on the 28 GHz options paper closed on 14 May 2019. Twenty-five submissions[[8]](#footnote-9) were received. Responses by proponents of a prospective service have been grouped together to allow for easier comparison. The ACMA acknowledges that some responses address multiple services. In such cases the comments from these responses were only included within the proponent’s prospective section.

### Wireless broadband industry

Responses were received from the Australian Mobile Telecommunications Association (AMTA), Ericsson, Global Mobile Suppliers Association (GSA), Huawei, Qualcomm, Samsung and Telstra. It is noted that Optus also expressed interest in using the 28 GHz band for wide-area wireless broadband services. Key points arising from these respondents on each of the issues for comment are summarised below:

1. Submitters wanted to preserve the option for a 600 MHz allocation at the bottom of the 28 GHz band for WWB. Four responses cited the desire to obtain 3 GHz of spectrum for WWB use across the 26/28 GHz bands—enabling three Mobile Network Operators (MNOs) to obtain access to 1 GHz of spectrum each. 1 GHz of spectrum per operator was considered ideal for initial 5G deployments to reach their full potential. Two responses proposed the consideration of further allocations across the band for WWB.
2. Only one respondent commented on possible grandfathering arrangements for incumbent PTP licences. They noted the potential usefulness of the 28 GHz band arrangements for short distance high capacity PTP links, and that they may be of interest to them in the future.
3. No comments were received.
4. The four responses to this question supported the ability for WWB to coexist with other services as indicated in international studies. One submission suggested restricting ESIM to above 28.1 GHz to help mitigate any potential interference issues with proposed WWB use of the 27.5-28.1 GHz band. It was also noted that coexistence with body scanners which are already licensed in the band will need to be considered.
5. The three responses to this question proposed ACMA consider identifying more spectrum for WWB use in addition to the allocation proposed in Option 1.
6. The two responses to this question supported the proposed geographic definition. One response stated the need to align the geographic areas with any areas identified for spectrum licensing in the 26 GHz band.
7. The two responses to this question generally supported the assessment of the options against the spectrum management principles. However, one disagreed with the ACMA’s assessment of principle 1 against Option 1. The response indicated that they believe there is a correlation between an incremental increase in spectrum allocation and an increase in Gross Domestic Product (GDP).
8. All responses provided reasoning for identifying more spectrum for WWB in the 28 GHz band, this included:

* identification of the band for WWB use in other countries, including the US, Korea, Hong Kong and Japan
* the existence of established 3GPP standards
* the desire for each operator to gain access to 1 GHz of spectrum across the 26/28 GHz bands
* economic and social benefits that could be realised for Australia.

1. The two responses to this question highlighted that FWA services can use 5G technology to deploy a network as has been done in the US.
2. The one response to this question supported consideration of alternative bands for larger bandwidth channel arrangements for PTP.
3. No comments were received.
4. Two responses commented onto the value the FSS sector places on access to the 28 GHz band. One response indicated the need to support existing and future satellite service operations in the band. The other response highlighted international studies that demonstrate the ability of WWB to share with FSS in the band.
5. Respondents position on the four options identified in the Options paper are summarised below:

* Option 1: Preferred by all (two specifically supported Option 1b)
* Option 2: One supported
* Option 3: One supported, one did not support
* Option 4: One did not support.

### Satellite industry

Responses were received from the Boeing, Communications Alliance, Global VSAT Forum, iPStar, Lockheed Martin, NBN Co, Oneweb, Optus, Qantas, SES, Telesat, Viasat. It is noted that Telstra also expressed interest in using the 28 GHz band for future satellite services. Key points arising from these respondents on each of the issues for comment are summarised below:

1. All responses expressed a desire to have contiguous spectrum Australia-wide for the deployment of FSS with a preference for access to the entire band. One response acknowledged the eventual planning option is dependent on the outcomes of the 38 GHz consultation process.
2. The three responses to this question agreed that incumbent PTP services should be grandfathered for an appropriate period that enables licensees to recoup their investments. Two of these responses suggested a minimum period of two to three years.
3. No comments were received.
4. Ten responses were received on this question. The following issues were raised:

* There was concern regarding the potential interference between FSS and other services, and the inherent potential for this to restrict the use of the spectrum by FSS.
* Any coordination procedures involving the FSS must consider the requirements of earth stations operating at Lockheed-Martin’s Uralla facility including lower antenna pointing angle requirements.
* PTP and FWA are fundamentally different meaning sharing scenarios should be considered separately.
* Planning decisions for the 28 GHz band should be finalised before progressing too far with the development of the technical framework for the 26 GHz band.
* Earth Station Protection Zones (ESPZ) should be considered in any coordination procedures developed.
* If Option 3 is adopted, FWA should be made as a secondary service to the FSS (that is, operating on a no protection basis from FSS use).

1. Respondents provided two variations to Option 3 for the ACMA to consider:

* Variation 1: Make ubiquitous FSS co-primary with FWA in major population centres within 27.5 GHz–28.1 GHz, with access on a first-in-time basis. Detail on how this would work in practice and whether there would be support for some form of registration of areas or devices for ubiquitous FSS use was not provided.
* Variation 2: FSS (gateway and ubiquitous use) primary across whole band Australia- wide and FWA secondary across whole band Australia-wide.

One response proposed to discard any distinction between gateways and ubiquitous FSS and suggested they both be class licensed. Another submission raised concern over the international consideration of the frequency range of 37–43.5 GHz for future 5G allocations and the potential for conflict in establishing new PTP arrangements in this band.

1. The five responses to this question raised concerns regarding sharing between the FSS and FWA. There was concern that a secondary service allocation to the FSS in large population centres would diminish their ability to provide a service.
2. Five responses were received to this question. One was satisfied with the ACMA’s assessment. One indicated that the assessment should be undertaken across the both 26 GHz and 28 GHz bands. The remaining three responses disagreed with the assessment and indicated that the highest value use would be to allocate the entire band to the FSS.
3. The three responses to this question disputed the option of allocating spectrum to WWB. They stated there was no evidence to support the claim that WWB requires additional spectrum and believed the spectrum provided in 26 GHz was sufficient.
4. The one response to this question suggested that FWA would be more efficiently accommodated in other bands such as 38 GHz band.
5. The one response to this question indicated that the 38 GHz band is a suitable alternative and supported the creation of alternative bands for high bandwidth PTP channels.
6. The one response to this question stated that due to the low number of PTP assignments in the 28 GHz band, there is low value in this spectrum for PTP.
7. Respondents provided the following justification for the value the FSS sector places on access the 28 GHz band:

* The FSS industry have spent over $3 billion globally on creating infrastructure to support networks in this band
* FSS can provide a cheaper more efficient broadband service than WWB
* FSS can provide nationwide coverage with the ability to provide a high quality of service
* Experience in the North America indicates there is high demand for satellite services.

1. Respondents position on the four options identified in the Options paper are summarised below:

* Option 1: None supported
* Option 2: Three supported, two did not support
* Option 3: Five supported (one with variation), one did not support
* Option 4: Preferred by all.

### Fixed wireless and point to point interests

Responses were received from the Australian Small Business and Family Enterprise Ombudsman, DB Telecommunications, Intracom Telecom and the Wireless Internet Service Providers Association of Australia (WISPAU). It is noted that NBN Co also expressed interest in using the 28 GHz band for fixed wireless broadband. Key points arising from these respondents on each of the issues for comment are summarised below:

1. All respondents highlighted the importance of both FWA and PTP within Australia. While all supported making spectrum available for FWA, there was a range of differing views regarding the proposed planning options involving other services in the band. One submission did not support the inclusion of WWB in the band, while another submission fully supported its inclusion. Two submissions proposed maintaining the PTP allocation within the 28 GHz band, on the basis that PTP has already been displaced in numerous other bands to make way for wireless broadband use and co-existence with other services is possible. One submission supported removing arrangements for PTP if alternative options were made available in other bands with similar or better propagation characteristic and large channel bandwidths.
2. There were four responses to this question. One did not foresee the need to remove current arrangements for PTP. The other three responses all indicated a minimum of five to seven years would be preferable for grandfathering arrangements.
3. The two responses to this question proposed the following conditions to be considered as part of any grandfathering arrangements developed:

* reduction in licensing fees for PTP licences in other bands to help incentivise faster migration
* allowing channel amalgamation in other bands, for example to allow two 55 MHz channels to be used for a single 110 MHz carrier
* allow incumbent PTP licensees in the 28 GHz band to make limited changes to their existing PTP within the grandfathering period.

1. The three responses to this question made the following suggestions:

* PTP and FWA can coexist with FSS if appropriate coordination methodologies are implemented
* arrangements for PTP and FWA should be developed to facilitate use of both TDD and FDD technologies
* additional licence conditions may need to be applied for WWB or FWA deployments within satellite footprint areas
* a dynamic spectrum licensing management (DSLM) system should be implemented to control tiered access to spectrum in areas were multiple users wish to coexist.

1. There were two responses to this question. One recommended that any arrangement that shifts spectrum allocations needs to consider the effect on regional and rural small business WISP. Another suggested an increase to the spectrum allocation for FWA to 27.5 GHz–28.35 GHz to align with arrangements in the US. The third response suggested that implementing a DSLM system would facilitate the most efficient allocation of the spectrum.
2. There were three responses to this question. Two responses supported the proposed definition of ‘large population centres’ (as described in Appendix B). One of the supporting responses also proposed to include Kalgoorlie. The third response stated that the proposal resembled a ‘land grab’ for MNOs compared to the well-established apparatus licence density areas used in past policies.
3. There were two responses to this question. One stated that they supported the view that the highest value use of spectrum should not simply relate to the use which delivers the highest contribution to Treasury. The other reiterated concerns that the proposed concept of ‘large population centres’ resembled a ‘land grab’ for MNOs compared to the well-established apparatus licence density areas used in past policies.
4. One response commented that the needs of WWB sector can probably be adequately catered for by the proposed arrangements in the 26 GHz band.
5. Three responses indicated demand for access to the 28 GHz band for the delivery of FWA services, especially after the decision to re-allocate the 3.6 GHz band. The 28 GHz band provides an option for the provision of high capacity FWA services and suitable equipment is being developed by numerous vendors. Arrangements in the US were cited as an example of current FWA use. However, it was noted that due to the propagation characteristics of the 28 GHz band it could never truly be a replacement for the 3.6 GHz band.
6. The two responses to this question highlighted the value of the 28 GHz band by PTP operators for the provision of short distance high capacity links. The availability of 112 MHz channel sizes was of particular interest as they are not available in other bands. One of the respondents believed the 38 GHz band was not a suitable alternative due to its inferior propagation characteristics. They instead preferred migration to lower frequency bands and a change to existing policies to allow the aggregation of multiple channels on a single carrier frequency. The other respondent indicated that the 38 GHz band would be a viable option for many of the existing PTP services that operate over short distance (1–2km).
7. The two responses to this question indicated that the availability of 112 MHz channel sizes was of value to PTP operators as they are not available in other bands. One respondent indicated that current use, including investment by operators, is evidence of the value some operators place on PTP services in the band. The other respondent suggested the current low uptake of PTP licences was likely due to the time it takes for a viable equipment ecosystem to develop and the current review process is holding back the demand for further licences being taken out.
8. Current use is evidence of the high demand for the band.
9. No comments were received
10. Respondents position on the four options identified in the Options paper are summarised below:

* Option 1: One preferred (specifically Option 1a), one supported
* Option 2: Two supported
* Option 3: One preferred, one supported
* Option 4: One did not support.

### Department of Defence

A response was received from the Department of Defence (DoD). The DoD indicated that a number of future capabilities may require the use of FSS, including for ESIM, in the 28 GHz band. Given the nature of their deployments, the DoD indicated that this would likely involve Australia-wide operation and cannot necessarily be excluded from population centres. As such, the DoD encouraged the ACMA to consider the potential undesirable impacts of any Australia-unique frequency arrangements on satellite-system design and operation. The DoD indicated their preference for the ACMA to adopt Option 4.

### HAPS interests

A response was received from Facebook that supported the consideration of HAPS in the 28 GHz band. While it acknowledged that there are no current provisions for such use in Australia, it proposed the ACMA consider future planning options for HAPS in the 27.9–29.2 GHz frequency range. Facebook also noted work being conducted under World Radiocommunications Conference 2019 (WRC-19) agenda item 1.14 which includes a proposal to make a global identification for HAPS in the 27.9–28.2 GHz frequency range.

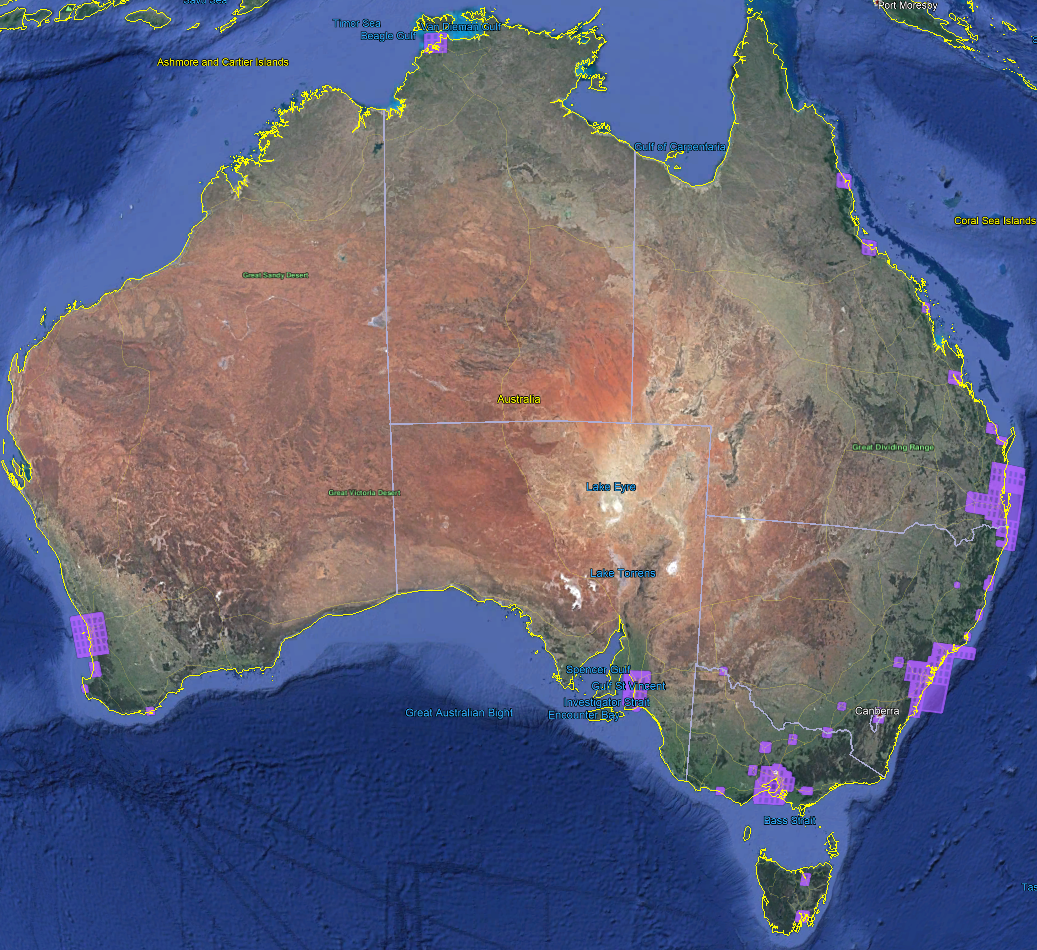
# Appendix B: Geographical area descriptions

Throughout this paper the term ‘large population centres’ is frequently used. For the purposes of this paper the term ‘large population centres’ is defined in this Appendix B. This term is intended to refer to the same areas that the minister may decide to re-allocate for the issue of spectrum licences in the 26 GHz band. In June 2019 the ACMA consulted on proposed re-allocation areas as part of a [draft recommendation to the Minister](https://www.acma.gov.au/theACMA/draft-spectrum-reallocation-recommendation-for-the-26-ghz-band). For convenience these areas are reproduced in Table 2 of this Appendix and illustrated in Figure 3. Pending final decisions, it is noted that the definition of large population centres may be varied to ensure they match the actual areas that are subject to any re-allocation declaration.

The Australian Spectrum Map Grid (ASMG) is used to define geographical areas over which spectrum licences are issued. The Hierarchical Cell Identification Scheme (HCIS) is a naming convention developed by the ACMA that applies unique ‘names’ to each of the cells that make up the ASMG. The ASMG and HCIS are described in detail in the document, [*The Australian spectrum map grid 2012*](http://www.acma.gov.au/Industry/Spectrum/Spectrum-planning/About-spectrum-planning/technical-framework-3_4-ghz).

The HCIS coordinates in Table 2 can be converted into a Placemark file (viewable in Google Earth) through a facility on the [ACMA website](http://www.acma.gov.au/theACMA/convert-hcis-area-description-to-a-placemark).

1. Illustration of the areas encompassed by the term ‘large population centres’



1. HCIS description of ‘large population centre’

| City name | HCIS |
| --- | --- |
| Adelaide | IW3J, IW3K, IW3L, IW3N, IW3O, IW3P, IW6B, IW6C, IW6D, IW6F, IW6G, IW6H, IW3E5, IW3E6, IW3E8, IW3E9, IW3F4, IW3F5, IW3F6, IW3F7, IW3F8, IW3F9, IW3G4, IW3G5, IW3G6, IW3G7, IW3G8, IW3G9, IW3H4, IW3H5, IW3H6, IW3H7, IW3H8, IW3H9, IW3I2, IW3I3, IW3I5, IW3I6, IW3I8, IW3I9, IW3M2, IW3M3, IW3M5, IW3M6, IW3M8, IW3M9, IW6A2, IW6A3, IW6A5, IW6A6, IW6A8, IW6A9, IW6E2, IW6E3, IW6E5, IW6E6, IW6E8, IW6E9, IW6K1, IW6K2, IW6K3, IW6K4, IW6K5, IW6K6, IW6L1, JW1E4, JW1E7, JW1I1, JW1I4, JW1I7, JW1M1, JW1M4 |
| Albany | BW3P7, BW3P8, BW3P9, BW6D1, BW6D2, BW6D3, BW6D4, BW6D5, BW6D6, CW1M7, CW4A1, CW4A4 |
| Albury | LW8D, LW5P7, LW5P8, LW5P9, LW6M7, LW9A1, LW9A4, LW9A7 |
| Armidale | NU7G8, NU7G9, NU7K2, NU7K3 |
| Ballarat | KX2L, KX2G9, KX2H7, KX2H8, KX2H9, KX2K3, KX2K6, KX2K9 |
| Bathurst | MV8G, MV8F3, MV8F6, MV8F9, MV8J3, MV8K1, MV8K2, MV8K3 |
| Bendigo | KW9I5, KW9I6, KW9I8, KW9I9, KW9J4, KW9J5, KW9J6, KW9J7, KW9J8, KW9J9, KW9M2, KW9M3, KW9M5, KW9M6, KW9N1, KW9N2, KW9N3, KW9N4, KW9N5, KW9N6 |
| Brisbane | NT9, NT8C, NT8D, NT8G, NT8H, NT8K, NT8L, NT8O, NT8P, NU3A, NU3B, NU3C, NU3D, NU3F, NU3G, NU3H, NU3K, NU3L, NU3O, NU3P, NT5O4, NT5O5, NT5O6, NT5O7, NT5O8, NT5O9, NT5P4, NT5P5, NT5P6, NT5P7, NT5P8, NT5P9, NT6M4, NT6M5, NT6M6, NT6M7, NT6M8, NT6M9, NT6N4, NT6N5, NT6N6, NT6N7, NT6N8, NT6N9, NT6O4, NT6O5, NT6O6, NT6O7, NT6O8, NT6O9, NT6P4, NT6P5, NT6P6, NT6P7, NT6P8, NT6P9, NU2C1, NU2C2, NU2C3, NU2D1, NU2D2, NU2D3, NU2D5, NU2D6, NU2D8, NU2D9, NU2H2, NU2H3, NU3E1, NU3E2, NU3E3, NU3E5, NU3E6, NU3E8, NU3E9, NU3I2, NU3I3, NU3J1, NU3J2, NU3J3, NU3N3, NU3N6 |
| Bunbury | BV7G, BV7C4, BV7C5, BV7C6, BV7C7, BV7C8, BV7C9, BV7D4, BV7D5, BV7D7, BV7D8, BV7H1, BV7H2, BV7H4, BV7H5, BV7H7, BV7H8, BV7K1, BV7K2, BV7K3, BV7L1, BV7L2 |
| Bundaberg | NS8N, NS8M2, NS8M3, NS8M5, NS8M6, NS8M8, NS8M9, NT2A2, NT2A3, NT2B1, NT2B2, NT2B3 |
| Cairns | LQ1O, LQ1P, LQ1K7, LQ1K8, LQ1K9, LQ1L7, LQ1L8, LQ1L9, LQ4C1, LQ4C2, LQ4C3, LQ4C4, LQ4C5, LQ4C6, LQ4D1, LQ4D2, LQ4D3, LQ4D4, LQ4D5, LQ4D6 |
| Canberra | MW5E, MW4D6, MW4D9, MW4H3, MW4H9, MW4L3, MW5A4, MW5A5, MW5A6, MW5A7, MW5A8, MW5A9, MW5B4, MW5B7, MW5F1, MW5F4, MW5F7, MW5I1, MW5I2, MW5I3, MW5J1 |
| Coffs Harbour | NU9A, NU9E, NU8D9, NU8H3, NU8H6, NU8H9 |
| Darwin | GO7C, GO7D, GO7G, GO7H, GO7K, GO7L, GO8A, GO8E, GO8I |
| Hervey Bay | NT2C8, NT2C9, NT2D7, NT2D8, NT2D9, NT2G2, NT2G3, NT2G5, NT2G6, NT2H1, NT2H2, NT2H3, NT2H4, NT2H5, NT2H6 |
| Hobart | LY9N, LY9I8, LY9I9, LY9J7, LY9J8, LY9J9, LY9K7, LY9K8, LY9M2, LY9M3, LY9M5, LY9M6, LY9M8, LY9M9, LY9O1, LY9O2, LY9O4, LY9O5, LY9O7, LY9O8, LZ3A2, LZ3A3, LZ3B1, LZ3B2, LZ3B3, LZ3C1, LZ3C2 |
| Launceston | LY6E, LY5H3, LY5H6, LY5H9, LY5L3, LY5L6, LY6F1, LY6F4, LY6F7, LY6I1, LY6I2, LY6I3, LY6I4, LY6I5, LY6I6, LY6J1, LY6J4 |
| Lismore | NU3M3, NU3M6, NU3N1, NU3N2, NU3N4, NU3N5 |
| Mackay | MR8A, MR5M7, MR5M8, MR5M9 |
| Margaret River | AV9P6, AV9P9, AW3D3, BV7M4, BV7M5, BV7M7, BV7M8, BW1A1, BW1A2 |
| Melbourne | KX3J, KX3K, KX3L, KX3N, KX3O, KX3P, KX6B, KX6C, KX6D, KX6F, KX6G, KX6H, KX6J, KX6K, KX6L, LX1I, LX1M, LX1N, LX1O, LX4A, LX4B, LX4C, LX4E, LX4I, KX3F7, KX3F8, KX3F9, KX3G7, KX3G8, KX3G9, KX3H4, KX3H5, KX3H6, KX3H7, KX3H8, KX3H9, KX3M6, KX3M8, KX3M9, KX6A2, KX6A3, KX6A5, KX6A6, KX6A8, KX6A9, KX6E2, KX6E3, KX6E5, KX6E6, KX6E8, KX6E9, KX6I2, KX6I3, KX6I5, KX6I6, KX6I8, KX6I9, LX1E4, LX1E7, LX1E8, LX1E9, LX1J1, LX1J4, LX1J5, LX1J6, LX1J7, LX1J8, LX1J9, LX1K4, LX1K7, LX4F1, LX4F2, LX4F4, LX4F5, LX4F7, LX4F8, LX4J1, LX4J2, LX4J4, LX4J5, LX4J7, LX4J8 |
| Mildura | KW1A4, KW1A5, KW1A6, KW1A7, KW1A8, KW1A9, KW1E1, KW1E2, KW1E3 |
| Perth | BV1I, BV1J, BV1K, BV1L, BV1M, BV1N, BV1O, BV1P, BV2I, BV2J, BV2M, BV2N, BV4A, BV4B, BV4C, BV4D, BV4E, BV4F, BV4G, BV4H, BV4I, BV4J, BV4K, BV4L, BV5A, BV5B, BV5E, BV5F, BV5I, BV5J, BV1E7, BV1E8, BV1E9, BV1F7, BV1F8, BV1F9, BV1G7, BV1G8, BV1G9, BV1H7, BV1H8, BV1H9, BV2E7, BV2E8, BV2E9, BV2F7, BV2F8, BV2F9, BV4M1, BV4M2, BV4M3, BV4N1, BV4N2, BV4N3, BV4O1, BV4O2, BV4O3, BV4P1, BV4P2, BV4P3, BV5M1, BV5M2, BV5M3, BV5N1, BV5N2, BV5N3 |
| Port Macquarie | NV2H, NV2L1, NV2L2, NV2L3 |
| Rockhampton | MS6F, MS6G, MS6B7, MS6B8, MS6B9, MS6C7, MS6C8, MS6C9, MS6J1, MS6J2, MS6J3, MS6K1, MS6K2, MS6K3 |
| Shepparton-Mooroopna | LW7F, LW7G1, LW7G4, LW7G7, LW7J1, LW7J2, LW7J3, LW7K1 |
| Sunshine Coast | NT5G, NT5H, NT5K, NT5L, NT6E, NT6F, NT6G, NT6H, NT6I, NT6J, NT6K, NT6L, NT5C4, NT5C5, NT5C6, NT5C7, NT5C8, NT5C9, NT5D4, NT5D5, NT5D6, NT5D7, NT5D8, NT5D9, NT5O1, NT5O2, NT5O3, NT5P1, NT5P2, NT5P3, NT6A4, NT6A5, NT6A6, NT6A7, NT6A8, NT6A9, NT6B4, NT6B5, NT6B6, NT6B7, NT6B8, NT6B9, NT6C4, NT6C5, NT6C6, NT6C7, NT6C8, NT6C9, NT6D4, NT6D5, NT6D6, NT6D7, NT6D8, NT6D9, NT6M1, NT6M2, NT6M3, NT6N1, NT6N2, NT6N3, NT6O1, NT6O2, NT6O3, NT6P1, NT6P2, NT6P3 |
| Sydney | NW1, MV9I, MV9J, MV9K, MV9L, MV9M, MV9N, MV9O, MV9P, MW3C, MW3D, MW3G, MW3H, MW3K, MW3L, MW3O, MW3P, MW6C, MW6D, NV4N, NV4O, NV4P, NV5M, NV5N, NV5O, NV5P, NV7B, NV7C, NV7D, NV7E, NV7F, NV7G, NV7H, NV7I, NV7J, NV7K, NV7L, NV7M, NV7N, NV7O, NV7P, MV9D6, MV9D9, MV9E4, MV9E5, MV9E6, MV9E7, MV9E8, MV9E9, MV9F4, MV9F5, MV9F6, MV9F7, MV9F8, MV9F9, MV9G4, MV9G5, MV9G6, MV9G7, MV9G8, MV9G9, MV9H3, MV9H4, MV9H5, MV9H6, MV9H7, MV9H8, MV9H9, MW3B2, MW3B3, MW3B5, MW3B6, MW3B8, MW3B9, MW3F2, MW3F3, MW3F5, MW3F6, MW3F8, MW3F9, MW3J2, MW3J3, NV4I5, NV4I6, NV4I8, NV4I9, NV4J4, NV4J5, NV4J6, NV4J7, NV4J8, NV4J9, NV4K4, NV4K5, NV4K6, NV4K7, NV4K8, NV4K9, NV4L4, NV4L5, NV4L6, NV4L7, NV4L8, NV4L9, NV4M2, NV4M3, NV4M5, NV4M6, NV4M8, NV4M9, NV5I4, NV5I5, NV5I6, NV5I7, NV5I8, NV5I9, NV5J4, NV5J5, NV5J6, NV5J7, NV5J8, NV5J9, NV5K4, NV5K5, NV5K6, NV5K7, NV5K8, NV5K9, NV5L4, NV5L5, NV5L6, NV5L7, NV5L8, NV5L9, NV7A2, NV7A3, NV7A4, NV7A5, NV7A6, NV7A7, NV7A8, NV7A9 |
| Toowoomba | NT7H, NT7L, NT8E, NT8F, NT8I, NT8J, NT7G2, NT7G3, NT7G5, NT7G6, NT7G8, NT7G9, NT7K2, NT7K3, NT7K5, NT7K6, NT7K8, NT7K9, NT7O2, NT7O3, NT7O5, NT7O6, NT7P1, NT7P2, NT7P3, NT7P4, NT7P5, NT7P6, NT8M1, NT8M2, NT8M3, NT8M4, NT8M5, NT8M6, NT8N1, NT8N2, NT8N3, NT8N4, NT8N5, NT8N6 |
| Townsville | LR2C, LR2D, LR2G, LR2H |
| Traralgon-Morwell | LX5A6, LX5A8, LX5A9, LX5B4, LX5B5, LX5B6, LX5B7, LX5B8, LX5B9, LX5C4, LX5C5, LX5C7, LX5C8, LX5F1, LX5F2, LX5F3, LX5G1, LX5G2 |
| Tuncurry-Forster | NV5B6, NV5B9, NV5C4, NV5C5, NV5C7, NV5C8, NV5F3, NV5G1, NV5G2 |
| Wagga Wagga | LW6B |
| Warrnambool | KX4F2, KX4F3, KX4F5, KX4F6, KX4F8, KX4F9, KX4G1, KX4G2, KX4G4, KX4G5, KX4G7, KX4G8 |

1. mmWaves span 30 to 300 GHz (that is, a wavelength of 1 cm to 1 mm). However, in the current 5G context, mmWave bands are considered to span from 24 GHz up to 86 GHz. [↑](#footnote-ref-2)
2. In the context of this paper the term ‘ubiquitous FSS’ refers to fixed earth stations at unknown locations (typically end user terminals) and earth stations in motion (ESIM). Due to the nature of these devices they are typically not coordinated with other services to manage interference. [↑](#footnote-ref-3)
3. This includes spectrum in the adjacent 29.5–30 GHz frequency range where arrangements for ubiquitous FSS are already in place. This band was outside of the scope of the 28 GHz band review. [↑](#footnote-ref-4)
4. The ACMA notes that the decisions and preliminary views in this paper are focused on arrangements for the FSS uplink segment (27.5–29.5 GHz band). Specific proposals for the associated FSS downlink segment (17.7–20.2 GHz band) are not included. The ACMA recognises that further work on the associated downlink segment, based on the scope of changes required for the uplink segment identified in this paper, will be required. [↑](#footnote-ref-5)
5. See [IFC 19/2019](https://www.acma.gov.au/theACMA/proposed-area-wide-apparatus-licence) Proposed area-wide apparatus licence. [↑](#footnote-ref-6)
6. In this paper FSS gateway is intended to refer to all coordinated apparatus licensed earth station uses. [↑](#footnote-ref-7)
7. The development of arrangements for spectrum licences is subject to the minister issuing a reallocation declaration for 26 GHz band spectrum. [↑](#footnote-ref-8)
8. Submissions can be viewed on the [ACMA website](https://www.acma.gov.au/theACMA/planning-options-for-the-28-ghz-band). [↑](#footnote-ref-9)