



TELSTRA CORPORATION LIMITED

Five year spectrum outlook 2022-2027

Public submission

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CONTENTS

EXECUTIVE SUMMARY	3
01 Drivers of spectrum demand	5
02 Proposed 2021-22 annual spectrum management work program	6
2.1. Our views on specific spectrum bands	6
2.2. Forward allocation work plan	8
2.3. Other matters	10



EXECUTIVE SUMMARY

We welcome the opportunity to provide our comments to the Australian Communications and Media Authority (ACMA) in response to its draft *Five-year spectrum outlook 2022-27 (FYSO) and 2022-23 work program* consultation.

There has been a step change in demand for telecommunication services since the start of the pandemic, as many organisations and individuals realise the benefits of being able to do business remotely. As we emerge from the pandemic, it is more crucial than ever that spectrum resources are effectively allocated and managed so we have the flexibility and certainty required to address the ongoing increase in demand and provide services that are reliable, cost effective and can leverage the latest technologies.

The release of additional mid band spectrum for IMT is important as we look to maximise the opportunity for 5G over the period covered by the FYSO. Therefore, we are pleased to see the ACMA progressing the re-allocation of the 3400-3575 MHz (3.4 GHz) and the 3700-3800 MHz (3.7 GHz) bands. The re-allocation of these bands creates a unique window of opportunity to significantly improve the overall efficiency and utility of the spectrum across the 3400-3800 MHz frequency range – through reallocating this spectrum to its highest value use and preparing the way for a potential future defragmentation of this spectrum that will further improve its utilisation. We support the auction being held no later than Q3 2023.

After the planning allocations for the 3.4 GHz and 3.7 GHz bands we believe it is important to complete the technical liaison group (TLG) work for the 700 MHz and the 2.5 GHz bands in order to make these bands ready for 5G.

Prioritisation of the ACMA's forward allocation work plan

Following the re-allocation of the 3.4 GHz and 3.7 GHz spectrum licences, we recommend the prioritisation set out in the table below for the of the spectrum work program. While these activities have been sequentially ranked, this does not imply the activities should be conducted sequentially. Rather, in a resource constrained environment, we present this ranking to the ACMA to assist with planning activities in a pragmatic way to ensure activities that deliver the highest value to Australia are given the highest resource allocation.

Activity	Priority	Comment
Allocation of 3.4 GHz (3400-3575 MHz) & 3.7 GHz (3700 -3800 MHz)	1	Re-allocation of spectrum in the 3.4 and 3.7 GHz band is important for making additional mid-band spectrum available for mobile broadband coverage and should remain the ACMA's highest priority in the immediate term. We support the ACMA's decision to auction this band in 2023.



Adjusting spectrum licence technical frameworks for 5G - 700 MHz and 2.5 GHz TLGs	2	<p>The second highest priority on the ACMA's spectrum management work program should be completing the residual TLG work on the 3.4/3.7 GHz bands, followed closely by the 700 MHz band TLG (including alignment of the 850 MHz band) and then the 2.5 GHz band. It is important to progress this work expeditiously, to optimise these bands for 5G.</p> <p>The 2 GHz TLG should also be completed as soon as practicable, however, it is not an urgent 5G requirement.</p>
Renewal of 800 MHz and 1800 MHz spectrum licences	3	<p>We support the ACMA beginning consideration of licence renewals 5 years from expiry, with a final outcome reached no later than 2 years from expiry, noting these spectrum licences are due to expire on 11 June 2028. We support inclusion of this item on the forward allocation work plan.</p>
Allocation of 1800 MHz (1710–1785 MHz and 1805–1880 MHz) in remote areas	4	<p>1800 MHz is a key band for 4G/5G services and we support the ACMA's plan to release a discussion paper in Q3/Q4 2022, which may consider reallocating this band in remote areas, potentially completing national spectrum licensing of this band. There are, however, significant incumbency issues to consider in this process.</p>
Allocation of 600 MHz (617-694 MHz)	5	<p>The high value of low-band spectrum for mobile communications (due to its propagation and building penetration characteristics) means this band is an area the ACMA should focus on, and we consider further low-band spectrum should take priority over adding additional mm-wave bands, given the recent completion of the reallocation of the 26 GHz mm-wave band.</p> <p>We support the media reform work program including the ACMA's technical research work. We also recognise any potential reallocation of this band has a range of technical, commercial and political hurdles to overcome and that working through these issues will take considerable time.</p>
Allocation of 40 GHz (37-43.5 GHz)	6	<p>Given the recent completion of the 26 GHz band spectrum licence auction, the lowest priority on the spectrum workplan for 5G and wide-area MBB should be additional mmWave bands such as the 40, 46 and 47 GHz bands. We note that the 40 GHz band is further along the maturity curve than other mm-wave bands and therefore should be progressed to the initial investigation stage ahead of others.</p>



01 Drivers of spectrum demand

We broadly agree with the assessment of demand drivers for new spectrum as provided in the FYSO. In particular, we agree with the ACMA's observation that as we emerge from the global pandemic the shift to digital work and business practices that evolved during the pandemic will continue¹ as well as a trend of significant numbers of people moving from capital cities to regional areas. We note that as part of our efforts to grow and extend our network and boost mobile coverage across the country, in particular in regional and remote parts of Australia, in March 2022 we announced the signing of a Memorandum of Understanding (MoU) with OneWeb, to explore new low earth orbit (LEO) satellite communications solutions for improved digital connectivity across Australia and the Asia Pacific region². This partnership reinforces Telstra's ongoing commitment to providing world class communications for regional Australia at a time when investment in expanding digital infrastructure remains a top priority for the country's economic recovery and development post-pandemic.

The pandemic has also triggered an explosion in online and digital services such as telehealth and telemedicine, remote working and learning, online government services and more. We're currently riding a wave of digitisation unlike any other, that industry observers expected to take over a decade to develop. As noted by the ACMA, 2021 saw data traffic at an all-time high and the ever-increasing popularity of wireless services has resulted in, "almost all Australians aged 18 or over now owning some form of mobile device."³ In the short and medium term, we expect the upward trend in data growth to continue, driving increased investment in 5G networks and complementary technologies spurring spectrum demand. We are pleased the ACMA acknowledges this demand for spectrum to support the ever-increasing growth in mobile and fixed WBB applications and associated data in the short to medium term⁴.

The consultation paper notes the increasing interest in using spectrum above 100 GHz, including the terahertz frequency range, and seeks industry views on whether it is necessary for the ACMA to explore, in the near term, the development of an ongoing regulatory framework for this spectrum. More specifically, it asks the following two questions⁵:

- Is the global technology and spectrum market mature enough for Australia to follow the UK and the US in establishing dedicated spectrum management arrangements? Or is it prudent to wait until the technology and business landscape becomes clearer?
- What relative priority would this work have compared to other spectrum management activities?

Currently, we see no clear evidence yet of an ecosystem developing for terahertz technology and hence an associated spectrum market. While there have been some recent developments in the USA and UK, as pointed out by the ACMA, technology and commercial use-cases for terahertz spectrum are still in their infancy. In our view it is best to take a wait and see approach for now, noting that in Australia the scientific licensing regime provides a flexible mechanism to support trials and technology developments for interested parties. Compared to other spectrum management activities, we believe this work should be ranked lower than other priorities (as shown in Table 1) that are crucial in the short to medium term

¹ Consultation paper, p.10

² <https://www.telstra.com.au/aboutus/media/media-releases/telstra-oneweb-mou-february-2022>

³ Ibid

⁴ Ibid, p.12

⁵ Ibid



for the progress of 5G networks and which address the ever-increasing demand for WBB services such as those that need to be undertaken by the various TLG workstreams.

The rest of this submission addresses the ACMA's spectrum work program, and the forward allocation work plan.

02 Proposed 2021-22 annual spectrum management work program

Mid-bands typically offer a good mixture of coverage and capacity benefits. Reallocating the spectrum in the 3.4 and 3.7 GHz bands is important for making adequate mid-band spectrum available for 5G mobile broadband coverage and to complement the existing 3.6 GHz holdings. To this end, we are pleased the ACMA is planning a simultaneous auction of these two bands in 2023. Beyond this, we consider the next highest priority on the ACMA's spectrum management work program should be completing the residual TLG work on the 3.4/3.7 GHz bands, followed closely by the 700 MHz band TLG. It is important to progress this work expeditiously, to ready the bands for 5G. The 2 GHz TLG should also be completed as soon as practicable given it is already partly completed, however, it is not an urgent 5G requirement. In addition, we consider the ACMA should progress the proposed reallocation of 1800 MHz remote spectrum and kickstart the renewal process for the 800 and 1800 MHz licences which are due to expire in 2028.

In the mid-term, we consider further low-band spectrum in the 600 MHz band should continue to be progressed by ACMA, subject to the outcomes of the media reform work program, followed by further mm-wave spectrum in the 40, 47 and 46 GHz bands as a lower priority.

2.1. Our views on specific spectrum bands

Monitoring

600 MHz band (617-698 MHz)

The potential reallocation of the 600 MHz band has a long lead time given the incumbent use by broadcasters, the social and political aspects associated with technology and business model changes in the broadcast media and associated industries, and because the government is still only at the early stage of consulting on the many issues through the Media Reforms Green Paper. Nevertheless, the high value of low-band spectrum for mobile coverage due to its propagation and building penetration characteristics, especially in regional areas, means this band is one the ACMA needs to keep actively monitoring and guiding. We consider this additional low-band spectrum should take priority over adding additional mmWave bands, given the recent allocation of the 26 GHz mmWave band.

Future mm-wave (40, 46 and 47 GHz bands)

We recommend the 40 GHz band be progressed to initial investigation stage ahead of the other mm-wave bands i.e. 46 and 47 GHz bands. Considering the developments overseas and the emerging device ecosystem for this band, we believe this band is further along the maturity curve than other mm-wave bands. For example, 39 GHz (band n260, covering 37-40 GHz) has already been allocated in the USA and is supported by the US version of the iPhone 12. However, we note, there is no urgent demand for more mmWave spectrum band in the short term given the recent allocation of the 26 GHz mmWave band.



13 GHz (12.75–13.25 GHz)

In Australia, the 13 GHz band is currently used to support fixed point-to-point (PTP) services and television outside broadcast (TOB) services. As the consultation paper acknowledges, there are over 2200 PTP links licensed in the band (261 links belonging to Telstra) and 4 Australia-wide licences for TOB, as well as a single licence covering Western Australia⁶.

Since spectrum for fixed microwave links is being lost elsewhere (e.g. 3.7 GHz reallocation and the 1.5 GHz and 6 GHz bands are under review), we are expecting to make greater use of the 13 GHz band for fixed links and therefore strongly suggest that the current arrangements in the 13 GHz band should continue.

4.8 GHz (4800–4990 MHz)

The consultation paper notes (p.29):

Separately, the 4940–4990 MHz band is included in IEEE standard 802.11y Public Safety Wireless Local Area Network (WLAN) and has also been included in 5G standards (3GPP band n79), which may enable public safety agencies in Australia to deploy their own 5G capabilities under the PSER class licence.

We also note the FCC is conducting a review of this band after halting a previous US Government plan to open up the 4.9 GHz band which is currently dedicated to public safety⁷.

We recommend the ACMA continues to monitor this band, including the FCC review, and retain optionality for it to be used for future public safety and/or other mobile broadband uses.

Initial investigation

1.5 GHz (1427-1518 MHz)

This band has challenging incumbency issues, including fixed links for universal service obligation (USO) services to regional and remote communities. As per our submission to the 2019-23 FYSO and the 2020-24 FYSO, we consider that reviewing this band should not be viewed as a priority in the short-medium term. In the longer term, planning for the release of the 1.5 GHz band could be progressed in metro areas but regional and remote areas should be deferred for as long as fixed links carrying USO services are required to remain in place.

The FYSO indicates there is interest in using the 1.5 GHz band for private LTE solutions. In response to this, we would like to note that there are a number of other possible bands and access arrangements at various stages of maturity that may provide options for private LTE such as the proposed allocations in the 3.4 and 3.7 GHz bands and the recently released Area Wide Licences (AWLs) in the 26 and 28 GHz bands.

We also acknowledge the interest from the satellite industry in progressing consideration of the adjacent extended MSS L-band (1518-1525 MHz and 1668-1675 MHz bands), noting the common frequency

⁶ Consultation paper, p.30

⁷ [https://www.fiercewireless.com/regulatory/fcc-says-not-so-fast-plan-to-share-4-9-ghz-third-parties#:~:text=The%20FCC%20issued%20an%20order,4940%2D4990%20MHz\)%20band](https://www.fiercewireless.com/regulatory/fcc-says-not-so-fast-plan-to-share-4-9-ghz-third-parties#:~:text=The%20FCC%20issued%20an%20order,4940%2D4990%20MHz)%20band)



boundary at 1518 MHz between the 1.5 GHz Band and the Extended MSS L-band. The ACMA has proposed that since a decision in one band affects the other, a simultaneous review of the extended MSS L-band and the 1.5 GHz bands would be appropriate⁸. While we agree with the concept of increased efficiency through developing 1.5 GHz and extended MSS L-band together, and we are open to participating in a TLG (or similar working group) to resolve adjacent-band compatibility issues above 1518 MHz, we are not aware of any increased demand for extended MSS L-band which would warrant prioritising this band ahead of other bands that we have identified in this submission.

We will provide further detail about our views in response to the review of the 1.5 GHz band consultation paper that was released on 5 May 2022.

Implementation

3400-3575 and 3700-3800 MHz

The reallocation of the 3.4 and 3.7 GHz bands is important for provision of additional mid-band spectrum for 5G and should remain the ACMA's highest priority. We support the auction being held no later than Q3 2023.

1800 MHz (1710–1785 MHz and 1805–1880 MHz) in remote areas

1800 MHz is a key band for 4G/5G services, and we support the ACMA's plan to release a discussion paper in Q3/4 2022, which may consider reallocating this band in remote areas, potentially completing national spectrum licensing of this band.

There are a significant number of incumbent users of this band in remote areas which will be an important consideration in how and when this band could be reallocated. Adequate protection of incumbent services, and/or the timeframes in which incumbent services would be required to exit the band are significant considerations that we expect would be addressed as part of the consultation process.

2.2. Forward allocation work plan

Our views on the prioritisation of the spectrum work program for 5G, and mobile broadband (MBB) more generally, are shown in the following table. We generally support the ACMA's proposed forward allocation work plan and potential timing of allocations (table 2 of the FYSO p.47).

Please note that itemising the work plan activities in a "priority order" does not imply the activities should be conducted sequentially, as all the bands listed in this table are high priority for delivering 5G in Australia. Rather, in a resource constrained environment, we present this prioritisation to the ACMA to assist in planning activities in a pragmatic way to ensure activities that deliver the highest value to Australians and the Australian economy are given the highest resourcing priority.

⁸ Consultation paper, p.34



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Allocation of 3.4 GHz (3400-3575 MHz) & 3.7 GHz (3700 -3800 MHz)	1	Re-allocation of spectrum in the 3.4 and 3.7 GHz band is important for making additional mid-band spectrum available for mobile broadband coverage and should remain the ACMA's highest priority in the immediate term. We support the ACMA's decision to auction this band in 2023.
Adjusting spectrum licence technical frameworks for 5G - 700 MHz and 2.5 GHz TLGs	2	<p>The second highest priority on the ACMA's spectrum management work program should be completing the residual TLG work on the 3.4/3.7 GHz bands, followed closely by the 700 MHz band TLG (including alignment of the 850 MHz band) and then the 2.5 GHz band. It is important to progress this work expeditiously, to optimise these bands for 5G.</p> <p>The 2 GHz TLG should also be completed as soon as practicable, however, it is not an urgent 5G requirement.</p>
Renewal of 800 MHz and 1800 MHz spectrum licences	3	We support the ACMA beginning consideration of licence renewals 5 years from expiry, with a final outcome reached no later than 2 years from expiry, noting these spectrum licences are due to expire on 11 June 2028. We support inclusion of this item on the forward allocation work plan.
Allocation of 1800 MHz (1710–1785 MHz and 1805–1880 MHz) in remote areas	4	1800 MHz is a key band for 4G/5G services, and we support the ACMA's plan to release a discussion paper in Q3/Q4 2022, which may consider reallocating this band in remote areas, potentially completing national spectrum licensing of this band. There are, however, significant incumbency issues to consider in this process.
Allocation of 600 MHz (617-694 MHz)	5	<p>The high value of low-band spectrum for mobile communications (due to its propagation and building penetration characteristics) means this band is an area the ACMA should focus on, and we consider further low-band spectrum should take priority over adding additional mm-wave bands, given the recent completion of the reallocation of the 26 GHz mm-wave band.</p> <p>We support the media reform work program including the ACMA's technical research work. We also recognise any potential reallocation of this band has a range of technical, commercial and political hurdles to overcome and that working through these issues will take considerable time.</p>
Allocation of 40 GHz (37-43.5 GHz)	6	Given the recent completion of the 26 GHz band spectrum licence auction, the lowest priority on the spectrum workplan for 5G and wide-area MBB should be additional mmWave bands such as the 40, 46 and 47 GHz bands. We note that the 40 GHz band is further along the maturity curve than other mm-wave bands and therefore should be progressed to the initial investigation stage ahead of others.

Table 1: Prioritisation of spectrum work program for 5G and mobile broadband



2.3. Other matters

Low interference potential devices (LIPD) - Wi-Fi

We are pleased with the update to the LIPD class licence to include the 5925–6425 MHz band for RLAN access. As noted in our submission⁹, we consider there is an urgent need to update the rules for the 5150-5250 MHz band to allow higher powered low power indoor (LPI) devices as well as outdoor deployment of standard devices (with appropriate elevation restrictions), up to an EIRP of 30 dBm in accordance with WRC-19 Resolution 229, Resolve 3. We support the next general update of the LIPD class licence (due in Q3 2022) considering the use of RLANs in parts of the 5 GHz band.

800 MHz and 1800 MHz spectrum licence expiry and renewal

We support the ACMA beginning consideration of licence renewals 5 years from expiry, with a final outcome identified no later than 2 years from expiry, noting these spectrum licences are due to expire 11 June 2028. We support inclusion of this item on the forward allocation work plan and for the work to start by early 2023.

It is critical that the renewal mechanism (e.g. a fixed renewal price based on administrative or market rates, or a price-based reallocation) is known well in advance of the licence expiry so that incumbent licensees can plan their investment decisions accordingly.

Review of spectrum licence technical frameworks – 3.4/3.7 GHz, 700 MHz and 2.5 GHz TLGs

We are pleased to see the ACMA has a review of the technical frameworks for both the 700 MHz and the 2.5 GHz bands on its radar, with the 700 MHz spectrum licensed band prioritised as the next band for consideration in Q3 2022 followed by the 2.5 GHz band¹⁰. It is important to progress this work expediently, to optimise the bands for 5G. It is also critical that a review of the technical framework of the 850 MHz spectrum licences is conducted as part of the 700 MHz TLG to ensure consistency between these two low spectrum bands on matters such as the device registration exemption.

We propose the following sequencing / timing for TLGs:

1. Complete the residual TLG work on the 3.4/3.7 GHz bands, which ideally should be completed before the reallocation declaration for the 3.4/3.7 GHz bands is made;
2. 700 MHz band TLG (including alignment of the 850 MHz band) needs to commence quite urgently to ready the bands for 5G and we encourage the ACMA to start this as soon as possible;
3. The 2 GHz TLG should also be completed when possible given it is already partly completed, however, it is not an urgent 5G requirement; and
4. Commence a TLG on the 2.5 GHz band once work on the 2 GHz band is finalised and 700 MHz nears completion, as the ACMA proposes.¹¹ Ideally, that will be in this calendar year (2022).

We also note and support the ACMA's intention in Q4 2022 to review several spectrum licence technical framework instruments which will sunset on 1 April 2023, including the 700 MHz, 1800 MHz, 2.5 GHz and 2.5 GHz mid-band gap frequency bands. We support the ACMA scheduling this work, and while we appreciate it needs to be completed before the instruments sunset, we consider the

⁹ Telstra submission to Proposed updates to LIPD Class Licence for 6 GHz RLANs, December 2021, p.3

¹⁰ Draft FYSO FY22-27, p.58.

¹¹ Draft FYSO FY22-27, Table 3, p.51.



higher priority is the TLG on the 700 MHz band (including 850 MHz band alignment) and the 2.5 GHz band.

Optimisation of existing fixed bands

We believe there is an opportunity to optimise some of the existing bands allocated to high-capacity fixed point-to-point links. We currently use the 6 GHz (5925 - 6425 MHz), 8GHz (7725 - 8275 MHz) and 18GHz (17.7 - 19.7 GHz) bands to provide backhaul capacity to support a range of services including USO services in regional and remote areas and mobile and enterprise services in metro areas. We recommend the ACMA consider the introduction of 112MHz channels in these bands. Wider channels will support higher capacity backhaul radio links (up to 4 times the capacity per link i.e. 4 x 28 MHz or 2 x 56 MHz channels) without the need for additional infrastructure and the extra cost. The leading equipment manufacturers have been offering equipment supporting 112 MHz channels in 6 GHz, 8 GHz, 18 GHz, 23 GHz and 38 GHz^{12 13 14} for several years now.

Similarly, we note the 13 GHz band is configured to use 28 MHz channels with channels 1, 2, 3 and 5 used for PTP links, and channel 4, 6, 7 and 8 used for TOB. In order to improve the efficiency of this band, we recommend the ACMA switch channels 5 and 4 so that PTP links are restacked in the bottom half of the band and the TOB in the top half. This would then allow for the introduction of wider channels (i.e. 56 MHz channels) which will support higher capacity backhaul radio links and reduce cost by reducing the need for additional infrastructure.

In addition, we note that channel size limitations in the 7.5 GHz (7425-7725 MHz) band restrict our ability to offer higher bandwidth on our legacy services. Currently the maximum channel size in the 7.5 GHz band is 14 MHz. Upgrading the capacity of these existing legacy links is an expensive exercise, essentially requiring new hardware and external plant to be installed. Providing the flexibility to aggregate 2x14 MHz channels as required (to make a 28 MHz channel) will allow our legacy services to also benefit from higher bandwidths without the need for hardware upgrades.

Sunseting instruments

We note the ACMA has helpfully provided a list of instruments scheduled to sunset this year. We have the following comments:

- **Items 13 and 14.** We understand the right-hand column is to show the groupings of instruments that will be considered together in a single activity. For example, items 2 to 6 on the list are all related to prohibited devices (or exemptions for prohibited devices), so it makes sense to review all these instruments in a single activity. We are curious then, about the grouping of items 13 and 14 which are instruments on Aircraft licences and Trading Rules for Spectrum Licences respectively. These two instruments appear not to have anything in common, so we question why these two instruments have been identified for a single action.
- **Items 15.** The ACMA plans to let the **Radiocommunications Advisory Guidelines (Additional Device Boundary Criteria – 1800 MHz Lower Band) 2012** instrument sunset. This

¹² <https://www.ericsson.com/en/portfolio/networks/ericsson-radio-system/mobile-transport/microwave/split-mount-shorthaul/mini-link-6600>

¹³ <https://www.siaemic.com/index.php/news-events/item/26-eolo-powers-their-ultra-broadband-data-services>

¹⁴ <https://www.siaemic.com/index.php/news-events/item/85-tech-news>



instrument provides additional criteria for coordinating fixed links in the band with IMT. The 1800 MHz Lower band is currently in the implementation stage, and we note the ACMA plans to release a discussion paper later in 2022 to gather feedback on the future of the band.¹⁵ We anticipate this will consider ongoing use of the band for fixed links. Following the consultation, the ACMA expects to implement changes to radiocommunication assignment and licensing instructions (RALIs). Given the timing of the consultation (second half of 2022) and the fact that the instrument does not sunset until 1 April 2023, we suggest the ACMA should delay deciding the future of this instrument until after the consultation, or at least, should preserve a copy of the RAG such that procedures contained within it can be incorporated into RALIs and/or RAGs for the band should the coordination procedures for fixed links still be required after the consultation is complete.

Radcomms

With the easing of COVID-19 restrictions, we encourage the ACMA to restart the Radcomms conference in FY23. Telstra considers Radcomms to be a valuable event on the annual calendar to share information about the latest regulatory and industry developments to facilitate the networking of representatives across all industries that use radio spectrum. We think a physical 'face-to-face' event is best for facilitating these outcomes, but it would also be helpful to make the presenter and panel sessions available through a live-stream for those who are unable to join in person.

¹⁵ Draft FYSO FY22-27, p.41.