AMTA

Australian Mobile Telecommunications Association

Spectrum Policy Paper

How mobile spectrum is essential to Australia's prosperity

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Spectrum Policy Paper

The Australian Mobile Telecommunications Association (AMTA) is the peak industry body of Australia's mobile telecommunications industry.

Our purpose is to be the trusted voice of industry, promoting the adoption, monetisation and sustainability of mobile telecommunications technology for the benefit of all Australians.

AMTA members include the mobile network service providers, handset manufacturers, network equipment suppliers, retail outlets and other suppliers to the industry.

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Executive Summary

The essential role of mobile services to Australia's society and economy

Digital connectivity – enabled by mobile networks and services – is essential to Australians' lives and prosperity. Individuals rely on mobile networks, devices, and services to connect and interact with businesses and each other, while businesses depend on mobile networks and services to grow, innovate, and adapt.

In short, digital connectivity and communication is a productivity lever and innovation powerhouse[1].

The increasing importance of mobile communications means effective management of mobile spectrum is more critical than ever to national social welfare, security and economic outcomes.

As such, the quality of spectrum is an important input to Australia's international competitiveness and productivity.

Australia's digital future and competitiveness can only be realised by giving mobile network operators certainty of access to mobile spectrum sufficient to support the long-term investment considerations that underpin operators' extensive network investment programs.

The need for sufficient certainty to promote mobile network investment, and thereby avoid a "digital investment gap" is highlighted by the fact that mobile sector capital expenditure has remained constant at around $5.4 bn each year for the past four years, despite operating profits decreasing by 24% over the same period. This investment program has enabled Australia's major public mobile networks to collectively support approximately 29 million operating services as of 2023[2].

Policy or regulatory decisions that impact public mobile networks will have broad ranging consequences for all Australians.

[1] Refer to GSMA, The Mobile Economy, Asia Pacific 2023.
www.gsma.com/mobileeconomy/wp- content/uploads/2023/07/Mobile-Economy-Report-Asia-Pacific-2023.pdf

[2] JPMorgan Australian Telecommunications Analyst note, 4 Oct 2023

With the right policies and regulations in place, operators can make the investment and deployment decisions needed to enable innovation, digital transformation, and new technologies.

Ultimately, this helps maximise the economic and social benefits of communications, services, and content for Australia.

In 2022, Deloitte Access Economics and AMTA forecast that the cumulative benefit of 5G to the Australian economy over eight years through to 2030 would be $94bn[3]. Similarly, PwC forecast the cumulative impact of 5G for Australia at $110bn over the period 2023-2030[4].

The Australian Government recognises the essential nature of mobile services[5]. As recently as May 2023, the Minister for Industry and Science, the Hon Ed Husic MP, announced the government had updated the list of critical technologies that would help secure Australia's future to include advanced information and communication technologies such as 5G and 6G.

Making new mobile spectrum available is also essential to meet the growing demand from consumers for mobile data services. Mobile network data traffic globally grew 28 percent between Q4 2022 and Q4 2023[6].

Overview of the seven AMTA spectrum policy positions that realise the potential of mobile services.

This paper targets the policy and regulatory agencies of the Commonwealth, State and Territory Governments, and those interested in the broader economic impact of mobile networks and services.

[3] Assuming Australia maintained its third-place position in the global ranking for 5G adoption (or only $67bn if Australia slipped to ninth place, as predicted in GSMA Intelligence forecast): Deloitte Access Economics / AMTA 2022 report in the Mobile Nation series, titled 5G Unleashed: Realising the potential of the next generation of mobile technology. Available at https://amta.org.au/wp-content/uploads/2022/03/5G-Unleashed-Final-Report_combined-21-March-2022.pdf

[4] PwC, The global economic impact of 5G. The cumulative 2023-2030 (8 years) economic benefit is US$76bn (~AUD$110bn). Available at https://www.pwc.com/gx/en/industries/technology/publications/economic- impact-5g.html, and then select for Australia.

[5] List of critical technologies in the national interest, Advanced information and communications technologies. Advanced radiofrequency communications, including 5g and 6G. https://www.industry.gov.au/publications/list-critical-technologies-national-interest/advanced-information-and-communication-technologies

[6] Ericsson Mobility Report November 2023. https://www.ericsson.com/en/reports-and-papers/mobility-report

The spectrum policy positions we detail here are critical for unleashing the full potential of the mobile industry to support Australia's economy and society through 2024 and beyond. These policy positions are:

1. Support mobile networks to maximise their contribution to social and economic outcomes.

Recommendations:

- The Australian Government should promote the use of 5G within business and Government to deliver a further $27B above the baseline $67B to realise a total of $94B in productivity gains to the economy in the eight years through to 2030, as identified in the AMTA-commissioned Deloitte Access Economics report, *5G Unleashed*.
- Government and regulatory decisions affecting mobile services should always reflect the vast social and economic benefits these services deliver to Australia.
- Spectrum must be priced to support investment and facilitate a competitive, high-performance telecommunications industry. This can deliver long-term benefits to consumers and businesses, enhance international competitiveness and ongoing economic development.
- Where expiring spectrum licences productively support good economic outcomes, the licence renewal process should ensure the continuity of those outcomes.
- In determining the price for renewing spectrum licences, the amortised value of all allocated spectrum as a proportion of an MNO's revenue, or earnings, should be considered, as the ability of MNOs to pay diminishes over time. This is because demand for data continues to grow, ARPUs remain relatively flat, and more spectrum is acquired to meet data demand.

2. Develop long-term planning horizons to ensure a pipeline of future mobile spectrum is available.

Anticipating future demands and technologies such as 6G, ensures Australia will have sufficient spectrum for the next generation technologies, maintaining our position as a global leader in mobile-enabled innovation.

Recommendations:

- The Australian Communications and Media Authority (the ACMA) and the Department of Communications consider whether MNOs' current spectrum holdings are sufficient to meet demand in the long term.
- The Australian Government allocate Upper 6 GHz to IMT.

- The Australian Government pursue the identification of spectrum above 7GHz for IMT through the ITU and WRC processes to meet future 6G needs.

3. Government must ensure certainty and predictability of spectrum access to network investment.

Mobile network investments are inherently long term and dependent on realizing a sufficient return on investment. Regulatory decision frameworks must be predictable so that mobile operators can make prudent investment decisions with confidence.

Recommendations:

- The ACMA be more transparent in its approach to spectrum management decisions, including assessment criteria and processes that impact spectrum licence rights.
- The ACMA provide a decision-making framework that includes detailed policy, qualitative and quantitative factors.
- When contemplating changes to the spectrum licence technical framework after deployment, the ACMA takes into consideration the financial implications for network operators.

4. Expedite Expiring Spectrum Licence (ESL) processes to give licensees certainty over investment planning.

It is essential the ACMA expedites the Expiring Spectrum Licence (ESL) process to provide licensees with early visibility of its intended direction, so planning and investment decisions in the second half of this decade can be made with certainty.

Recommendations:

- The ACMA apply sound project management principles to the ESL process including establishing key deliverables and milestones with target delivery dates.
- The ACMA advise MNOs of its renewal intentions for existing spectrum licences no later than mid-2025.
- The ACMA engage with AMTA regularly throughout the ESL process to ensure decision making is transparent, considered, and well informed.

5. Protect spectrum licensees' rights.

Maintaining spectrum licensees' rights provides a stable investment environment to foster innovation and sustain industry competition.

Regulatory decisions should be based on open processes and extensive engagement to ensure fairness, inclusivity, and accuracy.

Recommendations:

- The ACMA ensures that spectrum remains of sufficient quality and utility to enable MNOs to continue to provide essential services.
- The ACMA acknowledges the Australian mobile market is too small to specify customised infrastructure solutions at affordable prices.
- The ACMA, when setting technical spectrum conditions for mobile spectrum, does so within 3GPP standards.
- The ACMA recognises that the use of Active Antenna Systems in 5G networks means simple add-on filtering solutions are no longer viable if out of band emissions are more stringent than 3GPP standards.

6. Allocate 8 GHz of spectrum to IMT by 2030 to meet Australia's demand for data.

In aggregate, 8 GHz of spectrum is required across low, mid and high-band frequencies by the end of the decade to meet user demand.

Recommendations:

- 700 MHz of upper 6 GHz spectrum be allocated by 2030 to meet forecast demand for 5G services[7].
- 80 MHz of low band 600 MHz spectrum be reallocated to mobile by creating a second digital dividend to meet regional and rural mobile data demand.
- 900 MHz of upper mid-band spectrum be allocated by 2033 to support 6G technology so Australia remains competitive on the global stage.

7. Allocate broad, contiguous spectrum blocks across large areas to optimise utility.

Assigning these spectrum blocks across large geographic areas reduces fragmentation and optimises spectrum utility for public mobile networks.

This in turn provides better coverage, capacity, and quality of services, especially in rural and remote regions.

[7] Coleago Consulting Ltd, IMT spectrum demand, Estimating the mid-band spectrum needs in the 2025-2030 time frame in Australia, https://amta.org.au/wp-content/uploads/2021/12/Coleago-Report-Demand-for-mid-bands-spectrum-in-Australia.pdf

Recommendations:

- The ACMA facilitate defragmentation of spectrum bands to promote the more efficient use of spectrum, e.g., 3.4 – 3.8 GHz.
- The ACMA, when making new spectrum available for mobile, create larger spectrum lots to lessen the need for spectrum defragmentation.

Policy 1. Support mobile networks to maximise their contribution to social and economic outcomes

Mobile services are a cornerstone of the digital economy, enabling e-commerce and online services, access to data and information, and consumption of digital content. They are also integral to Australia's social fabric.

As mobile connectivity and services become more important to Australia's consumers and businesses, adequate and sustainably priced spectrum also increases in criticality.

In 2022, Deloitte Access Economics estimated 5G would contribute $67 billion in 2022 dollars to Australia's Gross Domestic Product (GDP) by 2030. Further, if Australia adopted some modest policy initiatives and maintained its leadership in technology adoption, an additional $27 billion in GDP by 2030 could be realised[8].

The ACMA has principal responsibility for spectrum management and is tasked with managing the spectrum in a manner that promotes the long-term public interest.

Public interest objectives may depend on prevailing circumstances, involve balancing potentially competing interests and reflect broader government policy objectives. However, decision makers' overarching objective should be to ensure efficient spectrum use from a technical and economic perspective.

In this context, spectrum management decisions affecting mobile services should always reflect the vast social and economic benefits delivered to Australia.

Public benefit must be considered when allocating new spectrum and renewing existing spectrum licences.

Underestimating, or failing to properly account for the public benefit delivered by mobile services, risks decisions that do not promote the public interest.

[8] Deloitte Access Economics, 5G Unleashed: Realising the potential of the next generation of mobile technology. Available at https://amta.org.au/wp-content/uploads/2022/03/5G-Unleashed-Final- Report_combined-21-March-2022.pdf.

They may increase costs to mobile carriers, either directly through spectrum access charges, or indirectly through changes to the technical arrangements of the band (eroding the rights of licensees) that generate incremental cost to mitigate interference.

Australia is vast and sparsely populated outside the main capital cities. Network investment decisions are informed by return-on-investment considerations. As highlighted in a recent Venture Insights report[9], telecommunications industry ARPUs are flat and spectrum costs are growing. This impacts the financial sustainability of the industry to consumers' detriment in terms of quality of service, coverage and price. It also creates a potential digital investment gap.

Higher prices for spectrum mean less capital to invest in crucial mobile networks and services. Spectrum must be priced to promote investment and facilitate a competitive and high-performance telecommunications industry for the long-term benefit of consumers and businesses, enhanced international competitiveness and economic development.

As mobile spectrum comes up for renewal, the criticality of spectrum to the long-term sustainability of the mobile industry should be considered. Such considerations must feature in decisions relating to the preferred approach to expiring spectrum licences.

Where spectrum has already been allocated, and is productively supporting good economic outcomes, administrative processes should ensure the continuity of that economic contribution.

Disrupting that economic contribution by using other allocation means may result in increased cost to consumers or result in less capital for network operators to use in deploying new infrastructure.

As the amount of spectrum and corresponding data needed to sustain an efficient digital economy grows, the ability for mobile operators to meet historical expectations of spectrum price declines.

In determining the price for renewing spectrum licences, the amortised value of all allocated spectrum as a proportion of an MNO's revenue, or earnings, should be considered as the ability of MNOs to pay diminishes over time. This is because demand for data continues to grow, ARPUs remain relatively flat, and more spectrum is acquired to meet this growing demand.

[9] Venture Insights. Report: State of the Australian Telecommunications Industry. 13 June, 2023. Available at: https://www.ventureinsights.com.au/product/report-state-of-the-australian-telecommunications-industry/

Recommendations:

- The Australian Government should promote the use of 5G within business and Government to deliver a further $27B above the baseline $67B to realise a total of $94B in productivity gains to the economy in the eight years through to 2030, as identified in the AMTA-commissioned Deloitte Access Economics report, *5G Unleashed*.
- Government and regulatory decisions affecting mobile services should always reflect the vast social and economic benefits these services deliver to Australia.
- Spectrum must be priced to support investment and facilitate a competitive, high-performance telecommunications industry. This can deliver long-term benefits to consumers and businesses, enhance international competitiveness and ongoing economic development.
- Where expiring spectrum licences productively support good economic outcomes, the licence renewal process should ensure the continuity of those outcomes.
- In determining the price for renewing spectrum licences, the amortised value of all allocated spectrum as a proportion of an MNO's revenue, or earnings, should be considered, as the ability of MNOs to pay diminishes over time. This is because demand for data continues to grow, ARPUs remain relatively flat, and more spectrum is acquired to meet data demand.

Policy 2. Develop long-term planning horizons to ensure a pipeline of future mobile spectrum

Mobile services have delivered vast social and economic benefits to Australia over the last 30 years. However, while demand for data has grown substantially, the ability of MNOs to monetise this trend has declined.

Policy and regulatory settings must reflect market realities to maximise the potential of mobile networks and services to support Australia's long term socio-economic prosperity.

Mobile network operators' need for spectrum, in the short to medium term, is relatively easy to predict based on an analysis of data consumption trends. Indeed, on AMTA's calculation, MNOs will require access to 8GHz of spectrum between now and 2030.

MNOs welcome the transparency provided by the ACMA's annually updated Five Year Spectrum Outlook (FYSO), which provides a spectrum planning tool and plan for the short to medium term.

However, the longer-term requires influencing global decisions on spectrum allocations to ensure that a pipeline of spectrum is available to be considered within the ACMA's medium-term five-year planning cycle.

The processes that lead to agreement on bands that should be made available are complex and must be globally and regionally defined. Australian demand for both infrastructure and devices must align closely to global spectrum allocations and conditions of use, to guarantee supply at affordable prices and leverage global economies of scale.

From a mobile industry perspective, this requires allocating spectrum in a manner that is globally recognised for IMT, via the International Telecommunications Union (ITU). Advocacy for the reallocation of spectrum through the ITU is led by the Australian Government.

International policy and rulemaking processes inform domestic policy and regulatory decisions, all of which influence investment decisions along the mobile supply chain, from devices and equipment to networks and services delivered to end-users.

Spectrum global harmonisation processes are lengthy, with study cycles of four years to decide whether a band should be reassigned within the ITU. The implementation period of then making the band available can take several more years depending on the current occupancy of those bands.

The spectrum policy development framework means that the mobile telecommunications industry and regulators must consider and plan for spectrum requirements at least a decade out from when it is likely to be needed.

AMTA encourages the Australian Government to prioritise the long-term economic benefits derived from mobile networks and services when formulating its position on preferred use cases for spectrum.

Recommendations:

- The Australian Communications and Media Authority (the ACMA) and the Department of Communications consider whether MNOs' current spectrum holdings are sufficient to meet demand in the long term.
- The Australian Government allocate Upper 6 GHz to IMT.
- The Australian Government pursue the identification of spectrum above 7GHz for IMT through the ITU and WRC processes to meet future 6G needs.

Policy 3. Government must ensure certainty and predictability of spectrum access to underpin network investment

MNOs make a considerable financial investment in deploying mobile networks. Mobile sector capital expenditure has remained constant at around $5.4 bn each year for the past four years, despite operating profits decreasing by 24% over the same period[10].

Given the scale of mobile networks, changes to the spectrum licence technical framework after deployment can have significant financial implications for network operators, especially where those changes require the operator to retrofit equipment.

Mobile network deployment and planning requires sufficient certainty that the spectrum regulatory framework in which they make their network planning and deployment decisions will not fundamentally change over the licence term or at renewal.

To commit the capital investment required to deploy networks, MNOs must be confident that the terms of access to that spectrum will remain certain or sufficiently predictable to justify long-term investment.

Existing and prospective spectrum access seekers must be able to understand and have visibility of the ACMA's decision making in detail, to properly assess the value of spectrum and ensure the ACMA's decision-making is credible.

The ACMA must exercise its spectrum management functions in a manner that promotes the "long-term public interest" derived from the spectrum as set out under section 3 of the Radiocommunications Act 1992.

[10] Deloitte Access Economics,
5G Unleashed: Realising the potential of the next generation of mobile technology, March 2022

The ACMA has indicated its assessment of the public interest will necessarily vary with specific circumstances, but aligns significantly with the assessment of the long-term interest of an end-user's test under the Competition and Consumer Act 2010.4[11].

To promote predictability in decision-making that supports network investment, the ACMA must provide a detailed decision-making framework covering policy, qualitative and quantitative factors.

At a minimum, AMTA expects to see quantitative assessments in major spectrum decisions take a more prominent position than current practice, with transparent reasoning.

AMTA also prefers that the ACMA weigh up the economic costs and benefits in a quantitative and objective manner.

For any competing claims for spectrum access, the ACMA should clearly demonstrate how its decision promotes the long term public interest derived from the use of spectrum.

MNOs also seek greater transparency and clarity on the ACMA's approach to spectrum management decisions, including assessment criteria and processes that impact spectrum licence rights.

On a forward-looking basis, AMTA is particularly focused on:

- the upper 6GHz band, and
- the ESL process.

Both major spectrum projects are highly consequential to the future health of the mobile industry and its ability to support Australia's digital transformation.

Transparent decision making against a defined decision framework is needed in dealing with these two critical spectrum activities.

Recommendations:

- The ACMA be more transparent in its approach to spectrum management decisions, including assessment criteria and processes that impact spectrum licence rights.
- The ACMA provide a decision-making framework that includes detailed policy, qualitative and quantitative factors.

[11] The ACMA – Our approach to radiocommunications licensing and allocation, Page 33 https://www.acma.gov.au/sites/default/files/2021-06/Our_approach_to_radcomms_licensing_and_allocation_information_paper.pdf

- When contemplating changes to the spectrum licence technical framework after deployment, the ACMA takes into consideration the financial implications for network operators.

Policy 4. Expedite ESL processes to give licensees certainty over investment planning

Between June 2028 and December 2032, spectrum licences across several bands are due to expire. This spectrum is currently used for 3G (until the 3G networks are shut down), 4G and 5G services, and represents around 80% of the total low- and mid-band spectrum allocated to IMT.

The ACMA has commenced the process for examining arrangements governing the use of spectrum under these Expiring Spectrum Licences (ESL). The outcome of the ACMA's ESL process has profound implications for the mobile sector and the supply of mobile services.

Spectrum is used today by MNOs to deliver essential services to Australians. While the timeframe for the expiry of these spectrum licences may seem to be some time away (2028- 2032) network planning and investment decisions are inherently medium to long term.

It is therefore in the public interest for MNOs to be provided with certainty, sufficiently early, that any of the expiring spectrum licences currently held by MNOs will be renewed if an MNO applies for renewal.

The mobile industry makes long-term decisions on network infrastructure predicated on assumptions that spectrum licences will continue. The earlier that renewal decision is known, the more able the mobile industry is to make better informed investment decisions and reduce the risk of stranded capital investment.

AMTA recommends the ACMA apply sound project management principles to its approach to the ESL process. This should help reduce uncertainty for existing licence holders by delivering renewal decisions at the earliest possible time.

To support transparency and predictability in the ESL process, we recommend the ACMA strengthen its proposed process by setting key deliverables/milestones along with target delivery dates.

Recommendations:

- The ACMA apply sound project management principles to the ESL process including establishing key deliverables and milestones with target delivery dates.
- The ACMA advise MNOs of their renewal intentions for existing spectrum licences no later than mid-2025.
- The ACMA engages with AMTA regularly throughout the ESL process to ensure decision making is transparent and well informed.

Policy 5. Protect spectrum licensees' rights

The mobile sector has invested billions of dollars purchasing and renewing spectrum licences and deploying network infrastructure. Further investment will be required to meet the forecast demand for high-capacity and high-quality connectivity services, along with the evolution from 3G to 5G as 3G networks are shut down.

Mobile network operators require confidence that spectrum-licensed services can be deployed without undue spectrum denial, so they can commit the significant expenditure required for network deployments.

Spectrum licences have, to date, provided the certainty and exclusivity required for long-term investment in network infrastructure. Accordingly, they have attracted a high price from operators.

While the ACMA must balance competing demands for finite spectrum in a way that promotes the long-term public interest, new protection and coordination requirements on spectrum licence holders erodes the regulatory predictability required for the deployment of national mobile networks.

While individual changes to the spectrum licence technical framework[12] may not be significantly detrimental in-and-of themselves, the cumulative effect is an increased risk of interference to spectrum licensed services, coverage planning, and ultimately to consumers of mobile services.

Licensees must dedicate more operational and administrative resources to manage their spectrum and ensure quality of mobile services to end-users.

Such impacts have downstream effects, as consumers and businesses potentially bear the brunt of delays and potentially higher prices for lower quality mobile services.

In this context, measures that erode the licence rights of spectrum licence holders must first be demonstrated to be in the public interest.

AMTA recognises that class and apparatus licensed services may be authorised to co-exist with spectrum licensed services. Indeed, no licensee is entitled to operate in

[12] For example, changes to out-of-band emissions, procedures for coordination with other service types in adjacent bands, or power limits applied to only part of a band.

a completely interference-free environment. However, the ACMA also recognises that telecommunications services are essential services[13].

Erosion of an MNO's capacity to use existing spectrum holdings appears inconsistent with the ACMA and the Government's expectations regarding a mobile telecommunications network operator's role as a supplier of essential services.

Australia is a relatively small market and when faced with market specific spectrum emission limits that are more stringent than those specified by the 3GPP, an MNO wanting to comply would most likely lower the power transmitted for the band, impacting coverage. Global suppliers are unlikely to build equipment to meet the specific needs of our small market when outside the 3GPP specifications.

The use of Active Antenna Systems (AAS) in 5G networks means that simple add-on filtering solutions are no longer viable to meet emission requirements that are stricter than stipulated within 3GPP standards.

The ACMA must set terms and conditions of use of spectrum that align with international standards, so Australia can leverage global economies of scale in sourcing infrastructure and devices.

The ACMA should consider solutions for adjacent spectrum users other than implementing a technical requirement for mobile networks that may impact the use of spectrum at thousands of sites or require market specific customisation of infrastructure at a high cost.

Maintaining clear and ongoing recognition of the exclusivity and certainty of access to spectrum, that has characterised spectrum licences to date, will help cultivate the necessary regulatory environment, foster investment and innovation and help sustain competition in the mobile market for the long-term benefit of Australians.

Recommendations:

- The ACMA ensures spectrum remains of sufficient quality and utility to enable MNOs to continue to provide essential services.
- The ACMA acknowledges the Australian mobile market is too small to specify customised infrastructure solutions at affordable prices.
- The ACMA, when setting technical spectrum conditions for mobile spectrum, does so within 3GPP standards.

[13] The Communications Minister has noted they are "a necessity to support ... access to critical services". The Government's Statement of Expectations for the ACMA confirms that the ACMA "has an important role to support industry and consumers in delivering and accessing essential communications services".

- The ACMA recognises that the use of Active Antenna Systems in 5G networks means simple add-on filtering solutions are no longer viable if out of band emissions are more stringent than 3GPP standards.

Policy 6: Allocate 8 GHz of spectrum to IMT by 2030 to meet Australia's demand for data

Growth in data is accelerating with the rise of AI, IoT and M2M, and rising demand from industry verticals such as health, finance and energy.

A recent study from the research firm Tefficient demonstrated that mobile data usage per SIM has increased more than 40% in Australia over the last year[14]. The ACCC's Internet Activity Report for the year ending December 2022 shows average monthly data consumption on a post-paid plan increased to 14.5GB per user per month[15].

Mobile carriers can apply three approaches to meet the increasing demand for data. They can:

- Upgrade technology to more efficient technologies, achieving more bits/MHz (for example, shutting down the 3G networks and repurposing spectrum for 4G and 5G);
- Build more sites (reduce the footprint of existing cells and add more cells, to reduce the number of users per cell); or
- Add more spectrum, increasing the aggregate data throughput of existing sites.

In practice, mobile carriers use a combination of all three approaches to meet demand. Networks are upgraded, cell density is increased using small cells and lower-powered base stations, and new spectrum is provisioned.

In densely populated urban areas where network deployment is reaching its limits, adding spectrum to meet growing demand is by far the most effective way to increase capacity.

As such, it is essential that mobile carriers obtain new spectrum to meet demand.

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[14] Tefficient industry analysis #2 2023 Mobile data – full year 2022 – excluding M2M/IoT - ARPU Growth almost always slower than inflation; p.7. https://tefficient.com/wp-content/uploads/2023/07/Tefficient-industry-analysis-2-2023- mobile-data-usage-and-revenue-2022-per-country-excl-M2M-14-July-2023.pdf

[15] ACCC Internet Activity Report for year ending Dec 2022. Issued 9 June 2023. Figure 9, p.10. Available at: https://www.accc.gov.au/system/files/Internet%20Activity%20Report%20-%20December%202022.pdf

AMTA's 2021 Policy Position Paper[16] calculated that a total of 8 GHz of spectrum was required for IMT by 2030 to meet the future requirements of 5G. Three years later, the demand forecasts that underpinned that analysis continue to be realised, so AMTA continues to advocate that 8 GHz in total spectrum be allocated for IMT by 2030.

The total spectrum available to MNOs is about 4.25 GHz, with approximately 3.75 GHz of spectrum identified to be made available by 2030. A detailed summary of current spectrum holdings and requirements across low, mid and mmWave band is contained in Appendix A.

At the ITU World Radio Conference at the end of 2023 (WRC-23) further mobile spectrum was identified:

- From 7025 – 7125 MHz (100 MHz) globally.
- For the 6425 - 7025 MHz band (600 MHz) for region 1 (Europe/Africa) and for some countries in region 2 (North and South America) and region 3 (Asia Pacific). This provides an opportunity for Australia to assign this band to mobile.

At WRC-23 progress was also made on the reallocation of 600 MHz broadcast spectrum to IMT which ensures that network and device eco-systems will be supported with a restacking of broadcast and a freeing of 80 MHz for mobile.

WRC-23 also nominated a number of bands for study as candidates for mobile spectrum in the upper mid-band.

Recommendations:

- 700 MHz of upper 6 GHz spectrum be allocated by 2030 to meet forecast demand for 5G services[17].
- 80 MHz of low band 600 MHz spectrum be reallocated to mobile by creating a second digital dividend to meet regional and rural mobile data demand.
- 900 MHz of upper mid-band spectrum be allocated by 2033 to support 6G technology so Australia remains competitive on the global stage.

[16] AMTA 2021 Policy Position Paper Spectrum https://amta.org.au/wp-content/uploads/2021/12/AMTA-Policy-Position-Paper-Spectrum-for-5G-and-Beyond-Nov-2021.pdf
[17] Coleago Consulting Ltd, IMT spectrum demand, Estimating the mid-band spectrum needs in the 2025-2030 time frame in Australia, https://amta.org.au/wp-content/uploads/2021/12/Coleago-Report-Demand-for-mid-bands-spectrum-in-Australia.pdf

Policy 7. Allocate broad, contiguous spectrum blocks across large areas to optimise utility

Current and future generations of mobile technology – 5G and 6G – require the assignment of much larger contiguous spectrum blocks than previous generations. In the initial phase of 5G deployment, the mobile industry globally and in Australia focused on securing 80-100 MHz of mid-band spectrum per MNO.

Now, more than 100 MHz of mid-band spectrum per MNO is the new minimum to meet demand, and more than 200-300 MHz of mid-band spectrum per MNO is needed to provide a compelling 5G and 6G service going forward. Access to spectrum of sufficient quantity and quality is crucial to 5G deployment and ultimately to Australia realising the productivity benefits of 5G.

Larger contiguous spectrum blocks also help achieve high spectrum efficiency and avoid the unnecessary duplication of radio units. Delivering 5G mobile broadband cost-effectively means operators must seek to maximise channel bandwidth and efficiency. Competitive 5G deployments require access to at least 100 MHz contiguous channels, which is supported by current 3GPP technology standards.

Upper mid-band spectrum is a key 5G capacity resource, offering a good combination of propagation and capacity. 3GPP standards currently support 100 MHz wide channels and a maximum bandwidth of 400 MHz in carrier aggregation mode.

By 2030, mobile operators will need at least two 100 MHz blocks of mid band spectrum as well as two 400 MHz blocks of mmWave spectrum. The long-term public benefit will be enhanced where MNOs have access to at least 100 MHz of contiguous spectrum in key spectrum bands, such as mid-band.

Defragmentation of spectrum will help to optimise the use of spectrum fragments and deliver contiguous spectrum blocks. While market-based spectrum trading is the preferred approach to achieve defragmentation, complexity of band fragmentation (e.g. 3.4 GHz to 3.8 GHz) may necessitate an ACMA-led process to help deliver optimal outcomes.

The industry supports closer engagement, with the AMCA, on strategic initiatives that enable defragmentation, and other amendments to spectrum licence technical frameworks, that maximise the efficient use of spectrum among mobile operators.

The need to bring down the cost of network deployment and capacity may drive spectrum reassignment through spectrum trading, or the ESL process.

Recommendations:

- The ACMA facilitate defragmentation of spectrum bands to promote more efficient use of spectrum, e.g., 3.4 – 3.8 GHz.
- The ACMA, when making new spectrum available for mobile, create larger spectrum lots to lessen the need for spectrum defragmentation.

Appendix A: MNO existing spectrum holdings

The diagrams below are designed to convey an 'at a glance' understanding of existing mobile spectrum holdings and, as such, are not definitive. There are different supplies (total MHz) in different bands, not all licensees are shown for all bands and amounts have been rounded to the nearest 5 MHz.

Low-Band Holdings

BAND	TELSTRA	OPTUS	TPG TELECOM
700 MHz			
Metro	40 MHz	20 MHz	30 MHz
Regional	40 MHz	20 MHz	30 MHz
850 MHz			
Metro	40 MHz		20 MHz
Regional	50 MHz		10 MHz
900 MHz			
Metro		50 MHz	
Regional		50 MHz	

Note: The results of the late 2021 auctions for 850 MHz expansion and 900 MHz spectrum are incorporated.

Mid-Band Holdings

BAND	TELSTRA	OPTUS	TPG TELECOM
1800 MHz			
Metro	30 MHz	30 MHz	60 MHz
Regional	80 MHz in various regions	30-40 MHz	20-30 MHz
2.1GHz			
Metro	30 MHz	40 MHz	50 MHz
Regional	40 MHz	30 MHz	30 MHz
2.3GHz			
Metro		100 MHz	
Remote	100 MHz		
2.6 GHz	100 MHz	40 MHz	
3.4-3.8 GHz*			
Metro	135-140 MHz	65-100 MHz	85-120 MHz
Regional	100-160 MHz	30-35 MHz (except 65 MHz in WA)	40 MHz in most areas

*This includes spectrum holdings after the spectrum auction in Nov 2023

mmWave Holdings

BAND	TELSTRA	OPTUS	TPG TELECOM
26 GHz	1000 MHz	800 MHz	600 MHz

Note: The mmWave holdings are in major population areas only and do not include the various AWL holdings.

Spectrum Scorecard

	LOW BAND	MID BAND	mmWAVE	TOTAL
Allocate to MNOs (Metro)	200 MHz	840 MHz	2400 MHz	3420 MHz
Adjustments			850 MHz	850 MHz
Total Spectrum (now)				4290 MHz
New Spectrum (by 2030)	80 MHz	700 MHz	3000 MHz	3780 MHz
Total Spectrum (by 2030)				8 GHz
New Spectrum (2030-2033)		900 MHz		900 MHz
Total Spectrum (2033)				9 GHz

Notes:

- The diagram is designed to convey an 'at a glance' understanding of existing mobile spectrum holdings and the gaps identified to achieve the required 8 GHz total by 2030 and 9 GHz by 2033.
- This is an approximation based on highest metro allocations.
- Adjustment made in relation to mmWave band as 24.25 – 27.5 GHz totalling 3250 MHz was identified but 2400 MHz of this is held by MNOs.

Glossary

3G	Third Generation mobile technology first deployed around 2003 in Australia and is due to be turned off from the end of 2023 to end of 2024
3GPP	The 3rd Generation Partnership Project (3GPP) is an umbrella term for a number of standards organisations which develop protocols for mobile telecommunications.
4G	Fourth Generation mobile technology first deployed in 2011 in Australia
5G	Fifth Generation Mobile Technology first deployed in 2019 in Australia
6G	Sixth Generation Mobile Technology which will be available for deployment in 2029 or 2030.
AAS	Active Antenna Systems - used in 5G it consists of multiple input multiple output arrays that facilitate advanced features that provide greater reach and capacity
ACCC	Australian Competition and Consumer Commission is the Australian regulatory body that promotes competition to benefit consumers, businesses and the community. They also regulate national infrastructure services and are responsible for ensuring compliance with competition and consumer protection laws.
ACMA	The Australian Communications and Media Authority is the Australian regulatory body that among other things, manages the allocation of spectrum and the conditions of use.
AI	Artificial Intelligence is a technology that enables computers and machines to simulate human intelligence and problem solving.
ARPU	Average Revenue Per User – it is a financial measure used to indicate the revenue performance at a unit level.
Base Station	This is the equipment that is connected to the mobile network that provides the mobile signal
Cells	This represents an area that a base-station's mobile signal propagates/reaches
Emission Limits	This describes the maximum radio frequency power that can be emitted in a spectrum band
ESL	Expiring Spectrum Licences – approximately 80% of mobile spectrum licences will expire between 2028 and 2032.
FYSO	The ACMA publishes a Five-Year Spectrum Outlook (FYSO), a rolling five-year plan updated yearly, which outlines their plans for spectrum management.

GDP	Stands for Gross Domestic Product which measures the monetary value of final goods and services—that is, those that are bought by the final user—produced in a country in a given period of time
GHz	Gigahertz where 1 GHz is equal to 1 billion Hertz (Hz)
Hz	Hertz a measure for frequency, where one cycle per second equals 1 Hz
IMT	The term International Mobile Telecommunications (IMT) is the generic term used by the ITU community to designate broadband mobile systems.
IoT	Internet of Things refers to a network of physical devices, vehicles, appliances and other objects that are embedded with sensors, software and network connectivity allowing them to collect and share data.
ITU	The International Telecommunications Union is the United Nations specialised agency for information and communications technologies
Low Band	Spectrum in the range 600 to 1000 MHz
MHz	Megahertz where 1 MHz is equal to 1 million Hertz (Hz)
Mid Band	Spectrum in the range of 1000 to 6000 MHz
mmWave Spectrum	Spectrum currently ranging from 26 - 40 GHz (26 GHz has been allocated in Australia)
MNO	Mobile Network Operator is the entity that provides a mobile network and usually sells mobile services in either retail or wholesale form
M2M	Machine to Machine refers to direct communications between devices using a communications channel.
Spectrum Defragmentation	Describes a process where fragmented spectrum holdings are traded or swapped so that within a band all the spectrum holdings with a band are brought together to create a contiguous spectrum block.
Spectrum Denial	Occurs where a change in spectrum planning arrangements results in a lessening of access to spectrum previously acquired by a spectrum licensee, amounting to an erosion of the rights of the spectrum licensee.
Spectrum Fragmentation	Describes a situation where an operators spectrum licences within a band aren't contiguous consisting of two or more licences separated by other licence holders
Spectrum Licences	Mobile Carriers are provided with a licence to provide a mobile signal within a range of frequencies by a regulator, the ACMA in Australia
Upper Mid Band	Spectrum in the range of 6000 to 13000 MHz (yet to be made available to mobile technologies)
WRC	World Radio Conference is convened by ITU every four years to make decisions on changing the use and allocation of spectrum bands to different applications.

Australian Mobile
Telecommunications Association Ltd

PO Box 1507, North Sydney, NSW 2059

Suite 10.01, 50 Berry St, North Sydney NSW 2060

www.amta.org.au