Australian Government | acma Australian Communications and Media Authority

Expiring spectrum licences, stage 4
Preferred views on pricing

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Executive summary

Between June 2028 and October 2032, the majority of in-force spectrum licences are due to expire. Since 2023, the ACMA has engaged in consultative process to guide our assessment of options for the use of the spectrum covered by expiring spectrum licences (ESLs) and facilitate applications for renewal by incumbent licensees. The ESL process comprised 4 stages:

- consultation on the process
- information-gathering and stakeholder views on spectrum use
- preliminary views on renewal and pricing arrangements
- preferred views on renewal application and pricing.

This paper represents our preferred views on pricing, presented as single dollar per MHz per head of population ($/MHz/pop) prices for licences in each frequency band that is included in this ESL process.

Our approach to pricing is guided by the long-term public interest

We said in December 2025 that renewing spectrum licences used for wireless broadband, namely mobile phone networks and parts of the NBN, using prices derived from benchmarking, best aligns with our policy objectives.

We have been guided by:

- our public interest criteria for ESLs
- the Ministerial Policy Statement (MPS) for ESLs
- the 2024 Statement of Expectations (SoE) for the ACMA
- the object of the *Radiocommunications Act 1992* (the Act).

The policy objectives in these frameworks include:

- promoting competition
- providing capacity for sustained investment and innovation
- supporting service continuity
- facilitating the efficient allocation and use of spectrum.

Our view that benchmarking is the most appropriate method for setting administrative prices remains unchanged. Benchmarking provides a transparent, economically sound and evidence-based approach to estimating market value, drawing on domestic and international spectrum awards from relevant bands.

Market-value pricing supports efficient use of a public resource and appropriately balances the risks of prices being set too high or too low. Prices set too high may leave spectrum unused and disrupt services, while prices set too low weaken incentives for licensees to reorganise their spectrum holdings. Any benefits, in the form of lower prices or improved service quality, may not flow through to consumers. On balance, we consider market-value pricing derived through benchmarking aligns with and supports our relevant policy objectives.

We have previously shared our views on licensing and pricing arrangements throughout the ESL process

This paper should be read alongside our preferred views on renewal, which we published in December 2025 as part of our 4-stage ESL process. In our preferred views, we outlined our view that use of ESLs for wide-area wireless broadband (WA WBB) and fixed wireless access (FWA) is likely to promote the long-term public interest, and that WA WBB and FWA ESLs should be renewed in most cases. Our preferred view on licence duration ranges between 11–16 years, with expiry occurring in 2044 in line with WA WBB and FWA spectrum licences outside this ESL process. For ESLs used by rail and television outside broadcast (TOB) services, we outlined our preferred view of a transition to apparatus licences while we determine arrangements in these bands that will promote the long-term public interest.

We have previously released our preliminary views on pricing (stage 3) in April 2025 and our updated preliminary views on pricing (stage 4) in December 2025. We have made refinements to our methodology and benchmarking dataset since releasing our updated preliminary views. However, key elements of our approach to pricing contained in both stage 3 and stage 4 of the ESL process have been retained, including the use of direct benchmarking as the primary valuation methodology, expressed in $/MHz/pop terms.

We have developed a robust market-valuation methodology based on expert advice, stakeholder feedback, and independent peer reviews by DotEcon

We have developed a robust market-valuation methodology for ESLs through an iterative, evidence-based process, supported by extensive consultation and 2 independent peer reviews by DotEcon – a UK-based economic consultancy with recognised expertise in spectrum valuation, auction design and regulatory economics. Consultation has been critical throughout the ESL process and played a central role in the development and refinement of the pricing methodology.

As part of this process, we also commissioned Ian Martin Advisory (IMA) to independently assess whether the pricing outcomes produced by our methodology are within the financial capacity of licensees. We have published both the IMA report and DotEcon's second peer review alongside this paper.

During stage 2 of the ESL process, we sought information on appropriate spectrum valuation methodologies, including commissioning a report from Plum Consulting to provide analysis of available approaches. This report examined a range of methodologies, including:

- direct benchmarking
- adjusted benchmarking
- econometrics
- avoided and iterated cost modelling
- enterprise (or business) valuation.

The decision to adopt a benchmarking approach alongside other elements of the methodology outlined in our preliminary views on pricing (released in Q2 2025) were informed by advice from multiple expert consultancies, including Plum Consulting, IMA (with Flat Rock Consulting) and Frontier Economics.

Following the release of our preliminary views, stakeholders broadly supported the use of benchmarking as an appropriate valuation approach. In response to stakeholder feedback

and an independent peer review by DotEcon, we made a number of refinements to the methodology. Given the material nature of these changes, we undertook another round of consultation on our updated preliminary views, to ensure stakeholders had an opportunity to comment on the revised approach. This consultation was open from December 2025 to February 2026. Feedback from this consultation, which closed in February 2026, has directly informed our preferred views. We also engaged DotEcon to conduct a second peer review to confirm their recommendations had been appropriately incorporated and to assist in working through stakeholder feedback.

We have made minor revisions to our methodology based on stakeholder feedback and further peer review

Submissions received in response to ESL stage 4 – *Updated preliminary views on pricing* (available on the ACMA website) generated a substantial volume of feedback, reflecting a wide range of perspectives from industry participants, independent experts, government agencies and other stakeholders.

The feedback covered:

- methodological choices
- alignment with policy objectives
- broader pricing considerations, including payment timing and future dataset updates.

All submissions were carefully considered, and in several instances, informed further refinements to our approach. For example, we have incorporated 21 of the 50 benchmarks proposed in NERA and Aetha Consulting's report provided alongside Telstra's submission. In response to stakeholder feedback, we have also clarified the criteria used to include and exclude awards, as set out in Appendix A.

We have published DotEcon's *Review of the ACMA expiring spectrum licence pricing (Phase Two)* report (the second peer review) alongside this paper. DotEcon largely concluded that its earlier recommendations had been incorporated in a manner consistent with their intent and reasoning, while identifying some areas for further refinement. Based on the review and stakeholder feedback, we have made some minor revisions to our pricing methodology:

- **Selection of the benchmark dataset.** We worked with DotEcon to more clearly define and formalise exclusion criteria applied to the benchmark dataset, ensuring the approach to selecting observations is more transparent and consistently applied.
- **Finding a single price using central estimates.** We have adopted a simplified approach focusing on one central estimate, although we use the geometric mean rather than DotEcon's suggested geometric Hodges-Lehmann (GHL) estimator.
- **Cohort analysis and restriction of the sample.** We have separated the central estimate selection from the cohort analysis step based on DotEcon's recommendation.
- **Adjusting prices with forward-looking inflation.** We have applied a fixed 2.5% inflation rate for forward-looking indexation, in line with the midpoint of the Reserve Bank of Australia's (RBA's) target inflation range. This provides a neutral and predictable basis for forward-looking indexation in an environment of heightened inflation uncertainty, particularly in the context of future updates to benchmarking data.

These revisions to the methodology and some minor updates to our benchmarking dataset have helped form our preferred views on pricing.

We have reached preferred single prices for ESL spectrum under the finalised benchmarking methodology

Table 1 outlines our preferred views on pricing for each ESL band, which are nominal $/MHz/pop prices that have already been adjusted for any indexation.

Table 1: ESL pricing – preferred views on $/MHz/pop pricing for each ESL band

Band grouping	Band	Preliminary views	Updated preliminary views	Preferred views
Sub-1 GHz	700 MHz	0.6055 – 0.7405	0.7405	**0.6618**
	850 MHz	0.6371 – 0.7791	0.7558	**0.6703**
Lower 1–3 GHz	1800 MHz	0.1895 – 0.2356	0.3030	**0.3646**
	2 GHz	0.1583 – 0.1968	0.2757	**0.3389**
Upper 1–3 GHz	2.3 GHz	0.0548 – 0.0670	0.1596	**0.1754**
	2.5 GHz	0.0566 – 0.0692	0.1621	**0.1774**
3.4 GHz	3.4 GHz	0.1568 – 0.1990	0.2052	**0.1732**

For each ESL band, the change to forward-looking indexation results in a minor reduction in our preferred prices. The other differences between our updated preliminary views and our preferred views vary between band groups and are summarised below.

- **Sub-1 GHz:**
  - The benchmarking dataset was updated with additions, adjustments and removal of observations that each had the impact of reducing our preferred price.
- **Lower 1–3 GHz:**
  - The benchmarking dataset was updated with additions, adjustments and the removal of one observation that had the overall impact of increasing our preferred price.
  - Moving from the population density cohort's interquartile range upper bound to the full dataset's geometric mean caused a further increase.
- **Upper 1 –3 GHz:**
  - The benchmarking dataset was updated with some relatively high-value additions across the full time period that resulted in a moderate increase in our preferred price.
- **3.4 GHz:**
  - The benchmarking dataset was updated with the addition of several lower-value observations and some minor downward adjustments, which reduced the price.
  - Switching from the median to the geometric mean resulted in an overall reduction in our preferred price.

We consider the preferred views on pricing represent reasonable estimates of market value for each band group.

We will update the benchmark dataset with new observations for each band grouping until 6 months before each renewal application period begins

We will update benchmarking datasets for ESL bands that expire from 2029 onwards so that renewal prices continue to reflect prevailing market conditions. This approach aligns with our previous proposal and was broadly supported by stakeholders, although concerns were raised regarding pricing volatility and uncertainty. We intend to mitigate these risks by keeping most elements of the methodology fixed so that any movement from indicative prices reflects new benchmark valuations rather how the model uses this data.

Under our approach, a 6-month cut-off would apply for the inclusion of new spectrum awards prior to the commencement of each renewal application period. This keeps benchmarking contemporary, while allowing sufficient time for verification and consultation. It ensures final preferred $/MHz/pop prices to be settled and published before renewal applications open, providing licensees with planning confidence and supporting informed decision-making.

We intend to undertake focused, time-limited consultation on proposed additions to the benchmarking dataset and the resulting price outcomes for each relevant ESL band. This will allow stakeholders to comment on whether new benchmarks are consistent with our inclusion and exclusion criteria recognising that these decisions will be the key drivers of any changes from indicative preferred prices. We will consult in Q4 2026 on the mechanics of the this process. This includes finer details regarding how consultation for each ESL band will function, with the aim of finalising the approach more than 6 months ahead of the next renewal application period.

We will not update benchmarking data for the 850 MHz and 1800 MHz bands, as the renewal application periods for these bands commence on 18 June 2026. The preferred prices for these bands therefore reflect the $/MHz/pop amounts that will apply, while the preferred prices for all other bands for WA WBB and FWA use are indicative and subject to change based on updated benchmarking data.

We are not proposing instalment arrangements for spectrum access charges and will enable payment closer to commencement of renewed licences

We consider full, upfront payment to be the most appropriate payment approach. This is consistent with the previous ESL process and most spectrum auctions. The IMA report also does not support MNO arguments that instalment arrangements are necessary to meet the proposed spectrum fees. We note that instalment arrangements have historically been made available in limited, specific and unique circumstances in response to directions made by the Minister for Communications at the time, with reference to relevant policy considerations.

We acknowledge that requiring payment prior to renewing a licence may act as a barrier to applying early for renewal and undermine providing consumers and industry clarity well in advance of licence expiry. Licensees will now be required to pay for renewal 2 months prior to licence commencement where an application is made in the first 9 months of the application period. It remains our position that licensees who apply after this time will still be required to pay prior to licence issue, although we may consider alternative timing upon request and where practical to do so.

Our preferred views on rail and TOB spectrum pricing remain unchanged and reflect the public interest

Our preferred view is that rail use of the 1800 MHz band should continue to be supported through apparatus licensing, rather than spectrum licensing, while we further consider future

use of the band to best promote the long-term public interest. Under apparatus licensing, our preferred pricing for 1800 MHz rail communications use is $0.005/MHz/pop. This is consistent with our updated preliminary views, the current PMTS Class B licence tax rate for the band, and proposed pricing for rail communications use in the 1.9 GHz band.[1]

While our preferred view for rail communications in the 1800 MHz band is non-renewal, spectrum licensees may still apply for renewal. In the event that spectrum licences were renewed for rail communications use, our preferred view is that pricing should align with the 1800 MHz band price applied to WA WBB and FWA users. This equates to $0.3646/MHz/pop for a 15.58-year licence, based on a single-year valuation on 18 June 2028 of approximately $0.0397/MHz/pop, adjustable for alternative licence terms.[2]

Our preferred view for the 2.5 GHz mid-band gap is that broadcasters should continue to access this spectrum under apparatus licences, as this best serves the long-term public interest. Our updated preliminary view to base 2.5 GHz mid-band gap TOB pricing on current apparatus licensing arrangements for TOB services, applied either through apparatus licence taxes or through equivalent spectrum access charges for spectrum licences if they were to be renewed, remains unchanged.[3] This amount is $29,791 annually for each licensee, based on apparatus licence tax rates as of May 2026.

[1] This refers to the base rate for PMTS Class B licences under item 40 of Schedule 3 of the Radiocommunications (Transmitter Licence Tax) Determination 2025, which is $0.01 per 'paired MHz' per head of population. Each paired MHz represents 2 MHz, so the effective tax rate is $0.005/MHz/pop.

[2] Current 1800 MHz band spectrum licences held by rail operators received a 50% public interest discount compared with spectrum licences held by MNOs due to a ministerial direction. The Minister for Communications has the power to provide for public interest discounts under section 294(2) of the Act.

[3] We note that this would be consistent with pricing for current 2.5 GHz mid-band gap spectrum licences under Radiocommunications (Spectrum Access Charges — 2.5 GHz Mid-band Gap) Determination 2013, where spectrum access charges were calculated with reference to equivalent apparatus licence fees.

Overview

In this paper, we present preferred views on pricing for expiring spectrum licences (ESLs).

Our preferred views on pricing refer to the value of spectrum access charges (SACs) for spectrum licences. Under section 294 of the *Radiocommunications Act 1992* (the Act), we may make determinations fixing SACs payable by licensees for issuing spectrum licences and specifying the times when SACs are payable.[4]

The formulation of our preferred views on pricing follows 2 consultation rounds:

- In April 2025, we released our preliminary views on pricing for ESLs, drawing on advice from Plum Consulting, IMA and Frontier Economics. This paper outlined our initial benchmarking methodology and presented a preliminary price range for each band grouping.
- In December 2025, we released our updated preliminary views on pricing for ESLs. We determined that a further round of consultation on pricing was necessary due to changes to our pricing methodology and the value of our preliminary prices, which were based on incorporating extensive stakeholder feedback and the recommendations of an independent peer review from DotEcon.

Our updated preliminary views on pricing consultation closed on 27 February 2026. To inform our preferred views on pricing for ESLs, we have carefully considered the detailed stakeholder submissions received in that consultation process and have engaged DotEcon for further review of our pricing methodology and stakeholders' views.

This paper works towards our preferred views on pricing by providing:

- an overview of the key themes raised by stakeholders in the consultation on updated preliminary views on pricing, and the ACMA's response to the feedback
- an overview of the findings from the second peer review by DotEcon
- an outline of final adjustments to the benchmarking methodology.

This paper subsequently provides:

- our preferred views on pricing for each spectrum band for wide-area wireless broadband (WA WBB) and fixed wireless access (FWA) use
- our preferred views on pricing for rail communications use in the 1800 MHz band and TOB use in the 2.5 GHz mid-band gap
- our preferred views on updating the benchmark data prior to renewal application periods.

The preferred $/MHz/pop prices presented in this paper are not final pricing decisions. The purpose of the $/MHz/pop prices is to inform the SAC that will be imposed on the issue of a renewed licence.

To calculate the applicable SAC, these prices will be multiplied by the bandwidth and population relevant to the new licence. These calculations rely on the assumption that licensees will apply for their licences in accordance with our preferred views on renewal, including the specified licence durations and an upfront payment structure. A different licence

[4] Our preferred views on pricing do not account for spectrum licence tax.

duration would result in a different $/MHz/pop price, while alternative payment arrangements such as instalments would affect the structure and amount due over time.

For the 850 MHz and 1800 MHz bands, the preferred prices set out in this paper reflect the $/MHz/pop amounts that will be applied, noting that the relevant renewal application periods for these bands commence on 18 June 2026. For the other bands, the preferred prices may be subject to minor adjustments as new data becomes available and is added into the dataset. This approach is further outlined in the Future updates to benchmarking data chapter of this paper.

We note that we received substantial feedback on payment timing in the context of the consultation on the ESL renewal application and decision-making process. In response, we have refined our approach to better align payment obligations with licence commencement while continuing to encourage early applications from licence holders. Under our preferred approach, payment of SACs will be required 2 months prior to licence commencement where applications are made within the first 9 months of the renewal application period. Further information is available in the Payment timing chapter of this paper. In addition, further guidance material will be released to support licensees applying for renewal prior to the first renewal application period commencing on 18 June 2026.

Summary of submissions

This chapter provides a summary of the feedback received in the ESL stage 4 – updated preliminary views on pricing consultation, and our responses to that feedback.

Concern about price increases and impact on policy objectives

What stakeholders said

Stakeholders expressed concern that the updated preliminary prices are materially higher than those in stage 3 of the ESL process, warning that this may undermine the ACMA's ability to meet the investment and innovation (including regional connectivity) as well as the efficiency and competition objectives set out in the Act, the ESL Ministerial Policy Statement (ESL MPS) and the public interest criteria (PIC) for ESLs.[5]

Many submitters argued that current market conditions are materially weaker than when the licences were originally issued, citing flat or declining average revenue per user (ARPU), rising capital and operating costs, and declining industry returns. GSMA further noted that while unit spectrum prices have declined, this has not offset the overall increase in spectrum costs driven by rapidly growing mobile data demand and emerging use cases.

A consistent theme across stakeholder submissions was that the risks of overpricing outweigh those associated with conservative pricing. MNOs and AMTA argued that higher spectrum costs would constrain their ability to fund infrastructure maintenance, deploy future technologies (such as 6G) and reduce investment in regional and remote areas. NBN Co submitted that its fixed wireless network provides essential connectivity where no alternative services are available, is subject to mandated service obligations, and is structurally loss-making. It argued that applying full market rates would impose unrecoverable costs and undermine long-term investment planning for regional infrastructure.

In contrast, ACCAN challenged the assumption that lower spectrum prices would lead to improved investment and regional outcomes. ACCAN argued that lower spectrum prices do not guarantee that cost savings will be invested, citing evidence suggesting that MNO appetite for investment outside metropolitan areas is limited. On this basis, ACCAN recommended coverage obligations as a practical solution to compel operators to invest in their networks and deliver services in regional, rural and remote areas.

Pivotel submitted that the methodology does not adequately distinguish between the value of spectrum in metropolitan areas and its value in regional and remote areas. It argued that the population density cohort fails to reflect the gap between population measures and actual network coverage, resulting in regional spectrum being valued despite not being deployed by MNOs across large parts of Australia's landmass. Pivotel noted that the high upfront spectrum costs may crowd out investment in regional network expansion, which would be contrary to the MPS objective of promoting regional and remote connectivity. It further submitted that this overvaluation reinforces the case for mandatory sharing mechanisms to ensure the public benefit of unused spectrum is realised rather than foregone.

Some submissions warned higher spectrum prices could prevent the ACMA from meeting efficiency objectives, which are part of the object of the Act and an ESL public interest

[5] Public interest criteria for ESLs include the following: facilitates efficiency, promotes investment and innovation, enhances competition, balances public benefits and impacts and supports relevant policy objectives and priorities.

criterion. Optus and Telstra indicated that at current pricing levels, there is a risk that licensees may not seek full renewal. Partial renewal would likely result in spectrum underutilisation in the short term, representing an inefficient allocation of spectrum and a failure to meet policy objectives.

Submitters warned higher spectrum prices will further entrench market dynamics, potentially preventing the ACMA from meeting the competition objectives outlined in the ESL PIC and ESL MPS. It was noted that this could arise from partial renewal applications or due to uneven financial impacts of full renewal across operators. TPG and Optus argued that ESL prices would place greater strain on their financial positions than on Telstra's, potentially exacerbating competitive imbalances and leading to reduced consumer choice, higher prices, and diminished service quality.

ACMA response

We consider establishing a market price for each ESL band, derived through benchmarking, is the most effective means of promoting public interest outcomes consistent with the ESL PIC, the Act and the ESL MPS. Prices derived from benchmarking incorporate information about future demand expectations, anticipated technological developments and capital investment requirements.

We recognise stakeholder concern about the impacts of setting prices too high, which includes the potential for partial or non-renewal of licences. However, this risk must be balanced against the risks associated with undervaluation, such as inefficient investment signals, spectrum under-utilisation and a potential reduction in service quality. We consider that our pricing methodology is fit for purpose, appropriately balancing the risks of over and under-pricing. Market-based prices support disciplined investment decisions and reduce the risk of spectrum under-utilisation. These outcomes are expected to flow to consumers in the form of improved service quality, innovation, and competitive market dynamics.

Submissions raised concerns of affordability of ESLs, which may inhibit an operator's capacity to meet public interest outcomes. We engaged IMA to assess the financial capacity of the MNOs and NBN Co to renew ESLs at our updated preliminary views prices. The assessment indicates that all operators have the capacity to renew their ESLs while maintaining their current operating activities, without significantly affecting their long-term financial outlook and investment decisions. To support transparency, the IMA report has been published alongside this paper on the ACMA website.

We acknowledge concerns that higher prices may have different financial impacts across operators, potentially affecting competitive dynamics. We consider, however, that market-based pricing remains competitively neutral, as it is applied consistently across licensees and reflects the underlying economic value of the spectrum. Competitive outcomes are influenced by a range of factors (scale, business models and access to capital) that spectrum pricing is not well-suited to address.

While some submissions advocated for lower spectrum prices on the basis that this would free up capital for network investment, we note that lower prices do not guarantee that cost savings will be reinvested in infrastructure or innovation. Investment and innovation decisions are driven by expectations of future demand, revenue and competitive positioning, rather than input costs alone. Market prices therefore support sustainable investment outcomes without distorting incentives or encouraging inefficient spectrum use.

We note that regional connectivity is an important objective reflected in the MPS and ESL PIC. We consider that prices reflecting global market benchmarks remain appropriate, including for regional spectrum. We do not support differentiated pricing for spectrum held in regional areas, particularly as $/MHz/pop pricing means spectrum in regional areas with lower population density already provides for lower prices. As spectrum prices are not a primary driver of network investment decisions, geographic price differentiation is unlikely to materially improve regional connectivity outcomes.

Some submitters suggest coverage obligations or sharing arrangements are best placed to facilitate better outcomes for regional connectivity. In 2025, we published our views on alternative licensing conditions, which outlined the potential role of place-based secondary licensing frameworks in improving access to spectrum in regional, rural and remote areas.

Benchmarking dataset

What stakeholders said

Stakeholders provided a range of views on the construction of the dataset, which was previously expanded from 123 to 205 allocations between our stage 3 preliminary views and stage 4 updated preliminary views pricing consultations. Submissions from MNOs, NBN Co and AMTA focused on the selection of benchmark countries and awards, the treatment of outliers, and the type of allocations included.

Some stakeholders questioned the comparability of countries to Australia, including but not limited to the United States, Canada, Hong Kong, Singapore and South Korea. They argued that differences in market structure, competition levels, and ARPUs in these countries mean spectrum prices are not representative of Australian market conditions. Submissions also sought greater transparency regarding the criteria used to include or exclude awards. NERA and Aetha Consulting (on behalf of Telstra) suggested a list of 50 benchmarks for inclusion and identified 7 awards where our data differed from their own records.

NERA and Aetha raised concerns about the treatment of US benchmarks. Their report argued that valuing US spectrum licences based on their initial licence term materially misrepresents how such licences are valued in practice, as spectrum licences in the US are widely understood to be de facto perpetual assets. Modelling them on a 10–15-year term would materially overstate US benchmark prices. NERA and Aetha consequently requested that US benchmarks be modelled using licence terms of at least 40 years. Their report also noted that some population figures used for US auctions relied on the 2010 US Census and recommended updating these to World Bank data for the relevant award years.

Several stakeholders submitted that the dataset contains outlying price observations that skew valuations upward, reflecting auction-specific circumstances such as artificial scarcity rather than underlying value. Analysys Mason (on behalf of TPG) and Coleago Consulting (on behalf of Optus) identified material outliers and suggested that removing them would lead to more statistically sound outputs. Optus further recommended including renewal award data, as they reflect regulatory decisions in similar contexts to our ESL process, and would improve the representativeness of central estimates, reduce the upward bias introduced by auction-only datasets, and promote alignment with public interest objectives. AMTA expressed similar views, arguing that the benchmark dataset should only comprise of prices established through renewal processes.

ACMA response

We have undertaken further validation and refinement of the benchmark dataset based on stakeholder feedback and our peer review processes.

- We have incorporated 21 of the additional 50 benchmarks proposed in NERA and Aetha Consulting's report provided alongside Telstra's stage 4 submission, where the underlying data could be verified and aligned with our exclusion criteria.
- We performed the same validation exercise on additional awards suggested by stakeholders in response to stage 3 of the ESL process, incorporating 33 benchmark additions proposed by NERA and Aetha on behalf of Telstra (4 of which were also proposed by Plum Consulting on behalf of NBN Co), 40 proposed by Analysys Mason (on behalf of TPG), and 12 proposed by DotEcon.
- We identified cases where included benchmarks met our formalised exclusion criteria, so those benchmarks were subsequently removed from the dataset. Further information regarding our exclusion criteria and the net effect on sample size can be found in the Pricing methodology revisions chapter of this paper.
- We made adjustments for data discrepancies identified through this process, including those relating to population figures, deferred payments, or annual fee structures.

On the treatment of US benchmarks, we agree with NERA and Aetha's suggestion that contemporaneous population figures should be used and have updated the benchmarking dataset accordingly, as using 2010 population figures overstates spectrum valuations in $/MHz/pop terms. In terms of licence durations, however, we have retained the initial licence terms (typically between 10 and 15 years), consistent with DotEcon's recommendation. While extending the assumed licence duration for the US could better reflect expectations of renewal, doing so would still require making implicit assumptions about the value placed on spectrum benefits far into the future. These assumptions are inherently uncertain and risk introducing a degree of subjectivity into our analysis, particularly where there is no clear, objective basis for selecting an alternative duration.

With respect to outliers, the pricing methodology already limits their impact through our central estimate use. The geometric mean is robust to the impact of high-priced outliers as it is effectively the average of observations that have undergone a log transformation, which brings down higher values. Potential alternative measures of central tendency, such as the GHL or median, are also robust to extreme outliers. Furthermore, analysis by DotEcon indicates that excluding individual high-priced observations has little effect on final price outcomes, with results driven by the broader distribution of benchmark prices rather than a small number of extreme values.

Regarding concerns that the dataset comprises only market-based award prices, we consider such prices to best reflect the economic value of spectrum as they are determined through competitive processes that reveal bidders' willingness to pay. We have not included renewal prices in our benchmarking dataset, as these prices do not represent competitive market-based processes and may reflect considerations other than market value. This does not align with our position to set market-value prices for each ESL band.

Updating benchmarking data in the future

What stakeholders said

Stakeholders generally acknowledged that updating the benchmark dataset in the future maintains contemporaneity. Telstra emphasised the importance of maintaining a consistent

methodology, including the use of a full benchmark dataset. However, some stakeholders raised concerns about transparency, price volatility, and investment certainty.

NBN Co submitted that incorporating new data could improve robustness, provided the ACMA excludes outliers and non-comparable countries with a clear and transparent rationale, allows sufficient time to source and verify data, consults licensees, and avoids material price changes that could undermine long-term investment. Coleago Consulting (on behalf of Optus) warned that regularly revising ESL prices will create major uncertainty for licence holders, forcing MNOs to make decisions on renewing their licences (those falling due earliest) without knowing the price of other ESLs that are major substitutes.

The Australasian Railway Association (ARA) similarly emphasised that while updates support contemporaneity, they introduce pricing volatility and forward budget risk for long-term infrastructure operators and recommended that any future updating framework includes price stability mechanisms such as caps, smoothing, or fixed reference dates.

ACMA response

We acknowledge stakeholder feedback on the benefits and potential risks of updating the benchmark dataset after the release of our preferred views on pricing. We agree that incorporating the most recent competitive international award prices can improve the robustness of the benchmarking analysis and help ensure prices reflect contemporary market valuations.

DotEcon noted that there are diminishing returns to updating benchmarks closer to licence expiry, as the number of potential new awards reduces and any incremental impact on the results is likely to be small. To balance contemporaneity with investment certainty, a clear and transparent cutoff point is required. Consistent with this approach, we have proposed a cutoff of 6 months prior to the opening of the renewal application period for a given ESL band, which means the cutoff is 2.5 years before the commencement of renewed licences.

We note Coleago's concerns about pricing uncertainty for substitute spectrum when making renewal applications. We considered this risk but concluded that, on balance, the benefits of contemporaneous valuation outweigh the uncertainty created by staggered renewal timings. This is particularly relevant where renewal dates are materially separated, such as between the 1800 MHz band (expiry 17 June 2028) and 2 GHz band (expiry 11 October 2032), as the valuation for the 2 GHz band could become outdated by over 4 years. To mitigate the risk of material or unexpected price movements, we have designed the benchmark update process so that the methodology and its application remain as stable as possible relative to the approach used to derive our preferred views in this paper. Further information on the approach is in the Future updates to benchmarking data chapter.

Time trends

What stakeholders said

Some stakeholders have argued that global spectrum prices are showing a sustained downward trend over the past decade, reflecting structural factors such as increased spectrum supply, efficiency improvements and maturing mobile markets.

Telstra (supported by NERA and Aetha Consulting) provided detailed feedback on the specific treatment of time trends in our pricing methodology, arguing that the Mann-Whitney U test is not the most appropriate approach. Instead, the Mann-Kendall test and Sen Slope

estimator were recommended, as they are robust nonparametric methods designed to detect and measure monotonic trends in time-ordered data.

Telstra, the Pentland report (on behalf of AMTA) and Analysys Mason (on behalf of TPG) also raised concerns that the choice to limit the sample to 2018-onwards awards (where a statistically significant time trend is observed) is arbitrary and it obscures the full extent of the downward trend in prices. Optus argued DotEcon's analysis indicated a downward trajectory in spectrum values across all bands, even when pre-2018 data is excluded.

ACMA response

We have considered stakeholder views that spectrum prices have exhibited a historic downward trend, particularly in the last decade. However, guided by DotEcon's advice, we do not consider these movements, which are not consistent across all ESL bands, represent a sustained trend suitable for extrapolation. Instead, we intend to continue relying on a more neutral statistical test (the Mann-Whitney U test) to determine whether to limit the sample to more recent awards. This approach is underpinned by first principles regarding the drivers of spectrum value, and by the need to apply methods that are robust and transparent for the purpose of benchmarking.

Some alternative statistical techniques, such as the Mann-Kendall test and the Sen slope estimator, are designed to detect monotonic trends – that is, trends where prices are assumed to move consistently in a single direction (upwards or downwards) over time. These methods also typically assume an absence of serial correlation, meaning that outcomes at different times are not systematically related to each other. In practical terms, this would imply that the price outcome in one auction does not influence the price outcome in later auctions. This assumption does not necessarily hold in the context of spectrum pricing.

Observed prices are influenced by prevailing economic and market conditions at the time of award, which creates a degree of interconnectedness between outcomes across periods, reflecting the complex interaction of supply-side and demand-side factors. We do not consider the assumptions underlying these statistical methods to be well suited. When applied to the data, these alternative methods produce broadly similar qualitative results to our analysis, indicating that prices for some lower-frequency bands are lower in more recent periods. However, this pattern is uneven, episodic, and does not constitute a stable, sustainable long-run trend that could be reliably extrapolated for pricing purposes.

We consider that restricting benchmark samples to recent observations where statistically significant differences are identified provides a more defensible, neutral and economically grounded means of reflecting current market conditions than extrapolating historic trends. This approach avoids overstating the persistence of past price movements and supports our objective of estimating market-based spectrum values that are representative of contemporary conditions. We consider that 2018 remains an appropriate cut-off point, being approximately the midpoint of our dataset and aligning with international harmonisation of the 3.4 GHz band for 5G being finalised.

Indexation methodology

What stakeholders said

In stage 3 of the ESL process, we used a mobile service revenue (MSR) index (MSR/MHz/pop) to carry forward past valuations to the present and subsequently carry forward valuations to future renewal timings. Following the peer review of our preliminary views conducted by DotEcon, the indexation approach was revised for stage 4, with the

Consumer Price Index (CPI) adopted as the basis for carrying forward valuations. Several stakeholders expressed concerns about the appropriateness of using CPI for this purpose.

Stakeholders argued that CPI does not reflect the sector-specific drivers of spectrum value that are not correlated with CPI, such as revenue trends, spectrum supply, population, ARPU and profitability. Submissions highlighted that prices in the telecommunications sector have generally declined over the past decade, while CPI has increased, meaning CPI-based indexation risks overstating forward values and introducing upward pressure on prices inconsistent with observed market trends.

Submitters supported reinstating the MSR index on the basis that it is more robust, transparent and objective. Optus and NBN Co noted that the MSR index was supported by industry and consultants in stage 3 and considered it to be more consistent with the ACMA's broader valuation framework. Some stakeholders suggested that if inflation is to be used, it would be more appropriate to use a sector-specific measure, such as the Australian Bureau of Statistics' (ABS) telecommunication equipment and services expenditure class for CPI.

Telstra (with support from NERA and Aetha Consulting) submitted that it accepts CPI being used to carry forward values to 2025 in step 4 of the benchmarking methodology, provided time trends are accounted for more strongly in step 5 of the methodology. However, Telstra is not supportive of using CPI in step 7, where CPI forecasts are applied to project prices to the renewed licence commencement date for each band. Telstra recommends making no forward-looking inflationary adjustments (flat nominal pricing) and suggests that the ACMA should be more cautious when estimating market value.

ACMA response

Our view on the use of CPI for pricing remains unchanged. Although the MSR index was applied in stage 3 of the ESL process, DotEcon's peer review and stakeholder feedback highlighted the complexity and limitations of using MSR to carry forward valuations.

Expressing prices in real terms using CPI is standard economic practice and supports transparent and consistent comparison of awards across different years. CPI is a widely accepted broad-based measure of inflation and is commonly used by regulators, including Ofcom and ISED, for benchmarking and forward projections. It also enables analysis of valuation time trends using real prices, allowing for tailored, evidence-based adjustments to band groups, rather than relying on alternative forms of indexation that apply uniform adjustments and may distort time trend analysis.

We examined telecommunications-specific measures for the purpose of indexation, but we found their relationship to spectrum value to be ambiguous and unlikely to be stable over time. The telecommunication equipment and services CPI expenditure class measures changes in the prices of a range of telecommunications-related retail goods and services, rather than changes in the underlying value of spectrum itself.[6] The expenditure class also incorporates unit value measurement and quality adjustments, meaning price movements may reflect retail pricing and competitive dynamics rather than underlying economic value.[7]

[6] Item examples for this expenditure class are on the ABS website (see Table 8.9).

[7] The ABS website (see 8.100) indicates that higher data allowances are reflected in quality adjustments: "For example, if the level of service increases by the way of an increased data allowance, and the price does not change, this will be reflected in the unit value decreasing, and a price fall being recorded".

For example, mobile data allowance increases at a given price can result in a measured price decline, even where the additional data has limited value to consumers.[8]

Given the limitations involved in relating the telecommunication equipment and services CPI expenditure class to spectrum value, we consider headline CPI to be the more appropriate measure of inflation. While neither index directly measures spectrum value, headline CPI is a transparent and widely accepted indicator of general inflation. It supports consistent assessment of real prices over time and avoids distortions associated with technological change in the telecommunications sector. As noted by DotEcon in its first peer review report, spectrum prices can reasonably be expected to track general inflation in the long run. Adjusting for headline CPI therefore enables changes in real spectrum prices, relative to other goods and services, to be identified in a way that is not feasible using the telecommunications equipment and services CPI expenditure class or the MSR index.

Currency conversion

What stakeholders said

In our stage 4 updated preliminary views on pricing paper, we implemented DotEcon's peer review recommendation to adopt purchasing power parity (PPP) exchange rates as the sole currency conversion method in our pricing methodology, which meant removing use of spot exchange rates. Stakeholders provided a range of views on the most appropriate approach for currency conversion.

Telstra indicated a preference for spot exchange rates but accepts the use of PPP exchange rates. Optus and TPG strongly favoured spot exchange rates on the basis that they better reflect the commercial reality of mobile networks. Some submissions noted that PPP exchange rates can introduce distortions unrelated to spectrum markets, overcorrect for domestic price differences and inflate benchmark prices.

NBN Co considered both PPP exchange rates and spot exchange rates to be relevant. It argued that using these rates in combination, as applied in stage 3, provides a more balanced representation of the cost structures that influence spectrum pricing. Submissions highlighted the need for transparency regarding the rationale for the chosen method and the implications of relying solely on PPP rates in the updated methodology.

ACMA response

DotEcon's advice supports the continued use of PPP exchange rates rather than spot exchange rates for benchmarking purposes. PPP exchange rates are explicitly designed to equalise the purchasing power of currencies across countries, based on a broad basket of goods and services, and therefore adjust for persistent cross-country differences in price levels. While PPP rates may not reflect short-run exchange rate movements, they provide a more stable and basis for benchmarking long-lived assets such as spectrum licences.

By contrast, spot exchange rates reflect financial market conditions and can be highly volatile over the short term and long term. While commonly used in trade, spot rates do not adjust for underlying structural differences in domestic price levels and can distort comparisons of economic values across countries. While stakeholders argued that spot exchange rates better reflect imported network equipment costs, DotEcon's advice notes that exchange rate risks for large, multi-year capital investments are typically managed through hedging and

[8] In the ACCC communications market report 2024-25 (page 10), it was noted that price increases are often accompanied by higher data allowances, but "it is unclear the extent to which consumers value the higher data allowances which have been offered in return for higher plan prices in many cases".

contractual arrangements. As a result, long-run exchange rate anchors such as PPP rates are more relevant than spot rates for benchmarking purposes.

Band groupings

What stakeholders said

Submissions presented differing views on whether the Upper 1–3 GHz band grouping (2.3 GHz and 2.5 GHz bands) should be split or combined with the 3.4 GHz band. NBN Co argued for separating the Upper 1–3 GHz band grouping, on the basis that the 2.3 GHz and 2.5 GHz are not substitutable. It cited the high costs involved in establishing a viable ecosystem and the unique synchronisation requirements for time division duplex (TDD) operation in the 2.3 GHz band. NBN Co further argued that, given the limited number of awards in the 2.3 GHz and 2.5 GHz bands, there is insufficient statistical evidence to support combining the bands with a reasonable degree of confidence.

In contrast, TPG (supported by Analysys Mason) argued that the 2.3 GHz and 2.5 GHz should remain together and be combined with the 3.4 GHz band, citing similarities in bandwidth availability and propagation characteristics. Analysys Mason contended that there is greater variance within the sub-1 GHz band grouping than between Upper 1–3 GHz and 3.4 GHz. It also commented that the variance between Upper 1–3 GHz and 3.4 GHz has only narrowed since the introduction of the updated methodology.

ACMA response

The current band groupings were established in stage 3 of the ESL process and were supported by the initial independent peer review undertaken by DotEcon.

We acknowledge NBN Co's submission that 2.3 GHz and 2.5 GHz are not readily substitutable. We note that grouped bands may not be perfect substitutes, but rather are bands with sufficiently similar technical characteristics and observed award prices. DotEcon notes limited award data mean it is not possible to apply formal statistical tests (such as a Mann–Whitney U test) to assess whether prices for the 2.3 GHz and 2.5 GHz bands are significantly different, with the available evidence not indicating a clear basis for separating them. The data shows that the median 2.3 GHz price is above the median 2.5 GHz price, and that 2.3 GHz prices fall within the range of prices observed for 2.5 GHz awards. If the grouping is split, this would materially reduce sample sizes, weaken statistical efficiency and diminish the robustness of the analysis and the resulting price estimates.

While TPG supports 2.3 GHz and 2.5 GHz remaining together and joining with 3.4 GHz, DotEcon concluded that treating 3.4 GHz as a separate group remains appropriate. The 3.4 GHz band has distinct characteristics, including its role as the primary 5G band in Australia, the presence of large contiguous spectrum blocks, and a different balance of capacity and propagation relative to bands in the Upper 1–3 GHz range. There is also sufficient benchmark data available to assess the 3.4 GHz band separately, without needing to pool it with the Upper 1–3 GHz group. We note that the price of each band group in our preferred views is nearly identical, with Upper 1–3 GHz being slightly above 3.4 GHz now, reflecting similarities between band groups. However, we will continue to treat the band groups separately due to their sufficient sample sizes and unique technical characteristics.

Finding a single price

What stakeholders said

In our stage 4 updated preliminary views paper, we proposed a method for deriving a single price based on central estimates to reflect the market value of the spectrum. We checked against relevant policy considerations to ensure the single price reached aligns with our public interest criteria for ESLs.

Optus (supported by Coleago Consulting) submitted that the process of finding a single price point is unnecessarily complex and does not account for the impact of population density on final prices. They argued that median and geometric mean are not always representative of a dataset, and given the wide range of observed market values, the mode is likely to be a more appropriate estimate. Coleago recommends adopting a risk-based methodology for determining renewal prices, where the pricing point is informed by the proportion of the benchmark distribution lying above or below each value. They propose setting renewal prices at a level where 20% of benchmark prices are lower and 80% are higher.

Telstra recommended setting the renewal price at the midpoint between the central estimate and the lower IQR bound, as this will account for the asymmetric risk involved in setting prices too high.

ACMA response

We acknowledge stakeholder concerns surrounding the complexity in deriving a single price from the dataset. We commissioned further expert advice from DotEcon to review our approach to our selection of a central estimator and on ways to improve the clarity of our approach. The review found that the framework could be simplified by focusing on our choice of central estimator first, then conduct cohort analysis separately. This provides a clearer conceptual separation between how a central estimate of market value is derived and whether there is a subset of data more appropriate for Australia.

Stakeholders strongly argued renewal prices should be set below central estimates to reflect asymmetric risk. DotEcon noted that our use of central estimators, including the median and the geometric mean, are already considerably lower than the arithmetic mean and suppress the influence of high-priced observations. These central estimators are therefore already conservative by construction and, given this, we do not consider that additional subjective adjustments to further reduce prices are necessary. While we recognise that prices set too high or too low can give rise to different risks, we consider that anchoring renewal prices to robust estimates of market value is the most appropriate approach, as this reflects relevant policy and economic considerations.

Further detail on the choice and performance of central estimators, including robustness and efficiency considerations and the role of alternative estimators reviewed by DotEcon, is set out provided in the Pricing methodology and peer review chapter of this paper.

WACC adjustments

What stakeholders said

In our pricing methodology, there are 2 steps in which we use a flat annuity approach with an estimated weighted average cost of capital (WACC) to convert spectrum valuations for different licence durations. In step 2, we convert all benchmark valuations to consistent single-year valuations so they are comparable with one another; in step 8, we convert the single-year price for an ESL band to the preferred licence duration for the band.

Professor Richard Holden (on behalf of ACCAN) argued that our use of a nominal vanilla WACC of 8.49% may materially undervalue the spectrum. Instead, Professor Holden supported the use of a pre-tax WACC of 7.34%, as reflected in advice from Cambridge Economic Policy Associates (CEPA) to the Australian Competition and Consumer Commission (ACCC) regarding the NBN special access undertaking (SAU). Professor Holden contended that a pre-tax WACC provides for a more consistent comparison of returns across companies operating under different tax arrangements within the same country. Professor Holden also recommended using tilted annuity on the basis that it is more realistic to assume growing cashflows rather than neutral cashflow growth over time.

ACMA response

Our choice to adopt a long-term, nominal vanilla WACC of 8.49% and a flat annuity approach was informed by expert consultant advice, as set out in *Preliminary views paper 4: Pricing for ESLs* in our stage 3 consultation.[9]

A post-tax WACC is well-suited to international benchmarking, as it aligns the discount rate with the after-tax cashflows reflected in spectrum valuations and avoids the need for additional assumptions to adjust for different tax regimes. Given the long duration of spectrum licences, we also consider it appropriate to use a WACC that reflects long-term investment expectations. While a tilted annuity approach was considered, we determined that there was not compelling evidence to assume constant growth in cashflows, particularly in the ESL context where spectrum is already heavily used.

Payment timing

What stakeholders said

As part of our consultation on the application and decision-making process, we proposed that, where we are inclined to renew a licence, SAC payment in full would be required prior to renewal. This would be a time approximately 5 months after a renewal application is made.

MNOs, NBN Co and AMTA expressed concerns about being required to pay well in advance of licence commencement (that is, when the licence begins to authorise use of the spectrum) and that this approach would likely see licensees delaying making applications to put off when payment was due. These stakeholders advocated for payment timing to be aligned much closer to the commencement of renewed licences, while still receiving the certainty provided by decisions on applications well in advance of expiry.

MNOs, NBN Co, the ARA, NSW Government, and AMTA supported payment by instalments, arguing that spreading spectrum costs over time would reduce the burden of large upfront costs and support ongoing investment in infrastructure. Pivotel noted that the materially higher upfront costs relative to the preliminary views warrant consideration of a conditional instalment mechanism, but considered any such mechanism should be explicitly tied to verifiable investment in expanding regional coverage.

ACMA response

We note the stakeholder feedback regarding both payment timing and instalment arrangements. In response, we intend to require payment of the SAC 2 months prior to commencement, where a licence is renewed in response to an application made in the first 9

[9] Appendix B (page 46-47) of *Preliminary views paper 4: Pricing for ESLs*, which is available at Expiring Spectrum Licences (stage 3) – preliminary views, sets out our detailed considerations for our choice of WACC and annuity approach. All expert consultant reports informing these considerations have been published on the same webpage. These include reports from Plum Consulting, IMA (with Flat Rock Consulting) and Frontier Economics.

months of the application period. Licences renewed in response to applications received outside of this timeframe will still be required to pay prior to renewal, however we may consider alternative timing on a case-by-case basis.

This approach to payment timing is discussed further below, and more detail about this payment timing in the context of the decision-making process will be provided in guidance material to support licensees applying for renewal ahead of the 850 MHz and 1800 MHz application periods.

We have not changed our view on instalment arrangements. We consider full, upfront payment to be the most appropriate payment approach, noting that the IMA report demonstrates that instalment arrangements are not necessary to meet the proposed spectrum fees. We consider they remain a whole-of-government matter, consistent with the limited circumstances in which instalment arrangements have previously been made available for SACs, where the Minister for Communications at the time directed the ACMA under section 294(2) of the Act to provide for payment by instalments.

Rail pricing

What stakeholders said

The ARA and the Victorian Government argued that rail spectrum pricing should reflect the unique nature of rail communications, which are not demand-driven, competitive services. The ARA emphasised that pricing approaches anchored to benchmarks reflecting value derived from mobile broadband use are inappropriate for rail operation, which deliver essential public safety and transport functions. The Victorian Government supported a cost-recovery approach to rail spectrum pricing, arguing that rail spectrum is non-commercial in nature and that fees should be limited to administrative and regulatory costs to ensure efficiency, value for money, and the continuation of essential public services.

The NSW Government welcomed the move to lower pricing for the 1800 MHz spectrum if provided via apparatus licences. The Victorian Government submitted that although the apparatus licence price is nominally lower than the previous price paid, this does not provide sufficient incentive to transition to apparatus licencing or reflect the public benefit derived from rail communications without the requirement for further public interest discounts. Both stakeholders argued for these licences to continue to be provided at a public interest pricing level to maximise value for essential public services.

ACMA response

We acknowledge stakeholder views that rail communications differ from commercial mobile broadband services and deliver significant public benefits, including public safety outcomes and the efficient operation of essential transport infrastructure. We agree that it is in the long-term public interest for rail operators to maintain access to spectrum to support these functions, although our preferred view is for access to the 1800 MHz band to be provided under apparatus licensing with a long-term view to transitioning to 1900 MHz band use.

While the 1800 MHz band supports rail operators' provision essential public services, its continued use involves an opportunity cost, as the spectrum could alternatively be deployed for WA WBB services. For spectrum licensing, that opportunity cost is reflected in our proposal to set ESL prices in the 1800 MHz band for rail communications users that are aligned with prices proposed for WA WBB use. For apparatus licensing, there is already an

established apparatus licence tax rate intended to represent the opportunity cost of spectrum use, which is $0.005/MHz/pop annually.[10]

While access rights to spectrum under apparatus licences are no different in substance to those provided under spectrum licences, in these circumstances we consider it appropriate that rail licensees are subject to the existing tax rate despite it reflecting lower opportunity cost (see Preferred views on pricing (rail and TOB) for further discussion). This approach also supports a smoother transition to the 1900 MHz band, where we have proposed to apply the $0.005/MHz/pop tax rate for PMTS Class B licences. In addition, we consider that these apparatus licence tax arrangements provide reasonable incentives for efficient spectrum use.

Submissions also noted that rail licensees have previously received a 50% public interest discount for 2 x 10 MHz of spectrum. The discounts were provided under direction from the Minister for Communications at the time. We consider that the imposition of any public interest discounts in this instance is a whole-of-government matter. As such, if the Minister for Communications were minded to provide for public interest discounts under section 294(2) of the Act, our preferred views on pricing could act as a reference point.

Comparison with international jurisdictions

What stakeholders said

Several stakeholders provided case studies from international spectrum renewal frameworks for the ACMA to consider. They identified several countries where jurisdictions have adopted pricing models that consider a downward trend in spectrum prices. The frameworks are designed to reduce financial pressure on operators while supporting continued investment in connectivity and coverage.

On behalf of Telstra, NERA and Aetha Consulting compared our updated preliminary prices with those recently set by Ofcom in the United Kingdom and ISED in Canada, both of which used international benchmarks to inform renewal pricing. NERA and Aetha contend that we have materially overestimated our updated preliminary prices for the sub-1 GHz and lower 1–3 GHz band groups as they exceed those set by Ofcom and ISED. Telstra noted that cross-checking renewal prices against outcomes in other jurisdictions is an appropriate tool to sense-check our pricing and assess whether proposed values are reasonable.

NBN Co cited Ofcom's 2025 decision to reduce annual fees for 900 MHz and 1800 MHz by 26%, and Germany extending spectrum rights in certain bands by 5 years while only charging administrative fees. GSMA and Stephen Pentland (on behalf of AMTA) also recommended case studies for the ACMA to consider, including cases in the UK, France, Germany, Portugal, Spain and Czechia. These cases include cost-free renewals, licence extensions, lower annual fees, and investment commitments in place of upfront renewal fees.

ACMA response

We recognise that international comparisons can be a useful sense-check. However, many of the cited examples, such as reduced fees, licence extensions, or renewals priced at administrative costs, reflect administrative pricing frameworks or broader policy objectives rather than attempts to estimate market value. Differences between international outcomes

[10] This refers to the base rate for PMTS Class B licences under item 40 of Schedule 3 of the Radiocommunications (Transmitter Licence Tax) Determination 2025, which is $0.01 per 'paired MHz' per head of population. Each paired MHz represents 2 MHz, so the effective tax rate is $0.005/MHz/pop.

and our updated preliminary prices therefore reflect methodological and policy differences, rather than evidence that the methodology has materially overstated spectrum values.

Ofcom's methodology for setting renewal prices for the 900 MHz, 1800 MHz and 2100 MHz bands was based on UK auction prices, with international benchmarks only used to determine relative prices between bands. If we were to adopt a similar approach, it could lead to higher prices that are strongly linked to recent domestic auctions with unique policy settings that are not relevant in the ESL context.

ISED's renewal methodology differed from Ofcom's, as it took an average of renewal fees charged across jurisdictions with similar policy objectives. ISED did not use international auction benchmarks on the grounds that auction outcomes can be significantly influenced by external factors. This contrasts with our approach, under which we estimate market value by benchmarking international auction outcomes. We consider this approach robust, as sufficiently large samples and formal exclusion criteria mitigate the influence of external factors on benchmarks, and prices established through competitive processes are most likely to provide reliable indicators of market value, consistent with our policy objectives.

Pricing methodology revisions

We have now finalised our pricing methodology. This chapter provides a summary of our preferred approach and sets out the refinements made in response to DotEcon's second peer review (published alongside this paper) and stakeholder feedback. These updates strengthen the robustness, transparency, and economic basis of the methodology, while ensuring it remains aligned with our policy objectives. The full, finalised methodology is set out in Appendix A**.**

Summary of preferred views methodology

We commence the methodology by collecting all relevant spectrum valuation for a specific band grouping.

- **Step 1:** compile benchmark valuation data, including domestic and international market-based spectrum valuations in 'per MHz per pop' terms.
  - *Update:* we have included additional spectrum awards suggested by stakeholders that do not fall within our refined exclusion criteria, and amended data inconsistencies.
  - *Note:* the awards sample can be found in the modelling spreadsheets released alongside this paper.

We then proceed to convert all benchmark valuations to a consistent licence duration, currency and payment timing:

- **Step 2 (licence duration conversion):** convert different licence durations to a single-year valuation using a flat annuity approach with an estimated weighted average cost of capital (WACC).
- **Step 3 (currency conversion):** convert award prices to Australian dollars.
- **Step 4: (timing conversion):** convert auctions that occurred in different years to the same timing (current year).

We then determine if time trends are present within the sample of real prices, and if required, exclude older, less representative benchmarks to control for this effect.

- **Step 5: (controlling for time trends):** conduct statistical testing to determine whether time trends in spectrum valuations exist for the band grouping and restrict the sample to a more recent subset of awards to control for this effect.
- **Step 6:** determine a single price point for each spectrum band grouping.
  - *Update*: we have moved from using 2 central estimates selected through cohort-based rules to a single central estimate, the geometric mean.
  - *Update*: the cohort analysis has been separated from central estimate selection and now involves restricting the sample to observations within a cohort if there is statistically significant evidence.

Finally, we convert the valuation for spectrum band groups for each individual ESL band, reflecting likely payment timing and licence duration:

- **Step 7:** carry forward the band group's valuation to the relevant renewal date.
  - *Update:* we have moved to a fixed inflation rate of 2.5% beyond the end of 2025, which is the mid-range of the RBA's target inflation range. This replaces the combination of

RBA forecasts followed by 2% fixed inflation that we used in our updated preliminary views on pricing.

- **Step 8:** convert the valuation from single-year valuations to our preferred option for licence duration for the applicable ESL band.

Explanation of updates

This section provides additional detail and explanation behind the methodology steps that have updates applied.

Step 1 – compiling benchmark data

We have applied a broad disposition toward including spectrum awards unless there are compelling reasons to exclude them. This approach is consistent with DotEcon's second peer review and with standard statistical practice. As such, we have framed our approach in terms of explicit exclusion criteria. Although each spectrum award reflects a distinct political, regulatory, market, and technological context, the majority provide a reasonably representative indication of market valuation. The exclusion criteria set out in Table 2 are designed to identify and omit spectrum awards where outcomes are likely to deviate materially from a fair market valuation.

Table 2: Exclusion criteria

Category	Criterion	Description
Uncompetitive award	Uncompetitive format	Spectrum awards that were administrative and do not provide genuine market information (e.g. 'beauty contests', direct allocations, licence renewals, etc.).
	Limited participation	Spectrum awards where it was infeasible to increase above reserve given the number of bidders participating and/or binding caps.
	Material amounts of spectrum unsold	Spectrum awards where significant amounts of the spectrum offered went unsold. It is not necessary to exclude all awards with unsold spectrum (e.g. if spectrum only went unsold in unattractive regions or encumbered lot categories).
Licences not comparable	Special obligations	Prices of awards that incorporate onerous rollout obligations or investment commitments that do not reflect full market valuation. Awards will only be excluded under this criterion if the obligations are explicitly interventionist (not use-it-or-lose-it conditions).
	Use case restricted	The licences on offer are not comparable as they *could not* be held by the operators holding existing licences in Australia due to being restricted to or configured for a different use case.

Category	Criterion	Description
	Residual awards	Awards of lots that were undesirable in the main award, typically involving materially limited bandwidths or short-term licences.
Measurement issues	Incorrect information	Spectrum awards where there is a clear reason to expect prices or other information are incorrect and a correction is not possible.
	Lack of information	Sufficient information to calculate award prices is unavailable (e.g. prices, bandwidths, durations or population numbers are not public, per band prices cannot be calculated, there is insufficient information on annual fees).

As noted in DotEcon's second peer review, the application of consistent exclusion criteria may give rise to a small number of borderline cases where it could reasonably be argued that an award should either be included in or excluded from the analysis. DotEcon conducted sensitivity analysis on the impact of including additional awards and found that such cases do not materially affect price outcomes.

The sample size of the benchmark dataset underpinning our preferred views has increased by 19 observations relative to the updated preliminary views. This change reflects the:

- inclusion of awards recommended by stakeholders where they met our criteria
- exclusion of awards following further analysis demonstrating that they fall within one or multiple categories set out in Table 2
- consolidation or separation of multiple bands from the same spectrum award.[11]

Between our updated preliminary views and our preferred views, we have removed 8 awards. The sample sizes of each band group are outlined in Table 3.

Table 3: Benchmarking data – sample sizes for each band group

Band Group	Preliminary views	Updated preliminary views	Preferred views
Sub-1 GHz	29	67	70
Lower 1–3 GHz	37	55	61
Upper 1–3 GHz	28	36	43
3.4 GHz	29	47	50
Total	**123**	**205**	**224**

[11] Spectrum bands that are configured for supplementary downlink (SDL) are not combined with other bands in the same award.

Step 2 – licence duration conversion

The process of scaling valuation from full licence durations to a 365-day basis remains unchanged from our updated preliminary views methodology. This is carried out using the flat annuity formula with an 8.49% nominal vanilla WACC.

Step 3 – currency conversion

The process of converting award prices to Australian dollars remains unchanged from our updated preliminary views methodology. This is carried out using PPP exchange rates.

Step 4 – timing conversion

The process of converting valuations that occurred in different years to the same timing (current year) remains unchanged from our updated preliminary views methodology. This is carried out using CPI to bring award prices forward so that benchmark prices reflect changes in general price levels.

For future updates to benchmarking data, this step will be slightly adjusted so that indexation from the end of 2025 onwards aligns with how we have applied forward indexation in Step 7 in this paper. This is intended to reduce future pricing uncertainty. Further detail is in the Future updates to benchmarking data chapter of this paper.

Step 5 – time trends

The approach to controlling for time trends in spectrum valuations remains unchanged from our updated preliminary views methodology. Benchmark prices are compared across awards occurring prior to 2018 and from 2018 onwards, and where a statistically significant difference is identified, the benchmark sample is restricted to post-2018 awards to ensure our sample reflects contemporary market conditions.

As part of our preferred views, time-trend-based cut-offs will be fixed and applied consistently on an ongoing basis. The statistical testing used to assess the presence of time trends in the benchmarking dataset will not be rerun as new awards are added, and the 2018 cut-off used in this testing will not be updated. Further detail on this is available in the Future updates to benchmarking data chapter of this paper.

Step 6 – deriving a single price point

Under the revised approach, the derivation of a single price for each band is undertaken in 2 distinct steps. The first step is the calculation of a revised central estimate from each band group's benchmark samples. The second step is cohort analysis, which assesses the relevance of different subsets of the benchmark data and is considered separately in the following section.

Central estimates

We previously calculated 2 central estimates, the median and the geometric mean, and then used cohort-based rules to determine which estimate should be used. While both measures reduce the influence of extreme values, neither is fully immune to outliers. The median can see substantial shifts when values near the centre of the distribution are dispersed, while the geometric mean can be pulled down by atypically low values. In addition, the sequential decision rules we relied on to pick between central estimates could make outcomes sensitive to small changes in the benchmark dataset.

DotEcon has suggested deriving a single price point using one central estimate, the GHL estimator. Using a single estimator reduces subjectivity and supports more stable price

outcomes by anchoring prices to a consistent statistical measure, so that changes in results better reflect movements in benchmark evidence rather than features of the methodology. DotEcon notes the GHL estimator retains robustness to extreme values, limiting the influence of unusually high or low benchmark prices like the median, while retaining efficiency by making fuller use of the information contained in the benchmark dataset, like the geometric mean.

We agree with DotEcon that there are meaningful benefits in moving to a single central estimator, particularly in the context of future updates to benchmarking data. However, our testing of movements from updated preliminary views to preferred views on pricing indicates that the GHL estimator delivers only marginal improvements in robustness relative to the geometric mean. In our view, it is not clear that these incremental gains justify the added complexity of the GHL estimator. We also place weight on maintaining continuity with our updated preliminary views, where the geometric mean was used. Taken together, these considerations support using the geometric mean as the single central estimator.

Cohort analysis – variables

The purpose of the cohort analysis is to ensure that our pricing methodology uses benchmarks that are relevant to the Australian context. We identify observations to be within cohorts using supplementary data for multiple cohort variables to assess a country's comparability to Australia.

In our updated preliminary views, we used population density and real GDP per capita as our cohort variables, with priority given to population density. DotEcon has suggested replacing population density with urbanisation as a cohort variable for our preferred views in its second peer review report. DotEcon noted that Australia has very low headline population density due to large areas of uninhabited land, which can make population density less relevant as a basis for comparison in the context of mobile network deployment and spectrum demand.

While we agree that population density has limitations in this regard, we consider it remains informative in capturing Australia's unique geographic characteristics, and we have kept the similarity threshold deliberately low (10%) to help mitigate distortions arising from uninhabited land. We also note that urbanisation has alternative limitations, as countries that are similar to Australia on this measure – such as large European economies – may not be representative in terms of geographic scale or demographic dispersion. On balance, we retain population density as the formal cohort variable for our preferred views, but we will test the sensitivity of results using urbanisation with a 70% similarity threshold as an alternative measure.

Cohort analysis – process

The purpose of cohort analysis and the cohort variables used have not changed, but the process has been updated.

Previously, single price points were determined through a multi-step process that used the median, geometric mean, and interquartile ranges (IQRs) for both the full benchmark dataset and cohorts based on population density or real GDP per capita. A single central estimate was ultimately chosen and adjusted based on the central estimates and IQRs of the cohort samples. While this approach has merit, it is limited by small sample sizes in some cohorts reducing confidence in IQRs, and that multiple conditional steps and cohort checks could make outcomes highly sensitive to small changes in the data.

Under the revised approach, we have made the following changes to mitigate limitations:

- We have introduced an explicit step to test whether a cohort is relevant for each band group before it is used. We use Mann-Whitney U tests to identify statistically significant differences between cohort and non-cohort observations for this purpose.
- If there are differences at the 1% significance level, we restrict the sample to within-cohort observations and use the geometric mean for those observations to determine the single price for the band group. This differs from the previous approach relying on cohort IQRs.
- We apply a structured decision tree format to incorporate multiple cohorts into this approach – it is possible to restrict the sample to observations that must be in more than one cohort.

This process is more statistically rigorous than our previous approach. By relying on formal statistical tests, it ensures that a subset of data is only used to override the full cohort's results when there is clear evidence to do so. This reduces the risk that a small group of unusual results could be mistaken for a meaningful difference between cohorts.

For a more detailed explanation and diagrammatic representation of the new process, see Appendix A.

Step 7 – carry forward valuations to various future dates

We have adjusted the methodology used to carry forward licence values from 2025 to licence commencement dates by applying a constant annual CPI assumption of 2.5% from the end of 2025 onwards. We are using the midpoint of the RBA's inflation target range because it reflects the most neutral approach to estimating market value and is consistent with regulatory best practice in Australia. This differs from the previous approach, where we used published RBA inflation forecasts to carry forward valuations where available, then used the lower bound of the RBA's inflation target range (2%) beyond the forecast horizon.

In the current economic environment with heightened inflation uncertainty, forecasts are more prone to change and diverge from actual outcomes. This increases the risk that preferred prices based on these forecasts deviate greatly from those using realised inflation. In the context of future updates to benchmarking data, where we would theoretically revise prices based on observed inflation and updated forecasts, this could cause material pricing uncertainty for licensees.

Applying a fixed CPI assumption from the end of 2025 mitigates these risks by providing a stable and predictable basis for forward indexation. It improves long-term pricing certainty for licensees, which is important in supporting the policy objectives of the ESL process under our ESL PIC and the ESL MPS. Clear and predictable pricing settings are likely to enable licensees to plan and commit to long-term network investment with greater confidence, which promotes investment and innovation and supports efficient spectrum use.

We note that a fixed CPI assumption may not align exactly with future inflation outcomes and considered alternatives like capping or smoothing CPI forecasts. However, there is inherent uncertainty in alignment with future inflation outcomes under all approaches given we are setting prices at least 2 years prior to licence commencement. More complex options such as capping and smoothing also have significant practical limitations, particularly in the context of future benchmarking updates. On balance, we consider that a constant 2.5% CPI rate represents a simple, neutral approach that is consistent with best practice and will best meet our policy objectives.

Step 8 – expand valuation to desired licence duration

The process of scaling valuations from a 365-day basis to the full licence duration remains unchanged from our former methodology. This is carried out using the flat annuity formula with an 8.49% nominal vanilla WACC, which adjusts the single-year value to reflect the preferred licence duration for spectrum licences in each band.

Preferred views on pricing (WA WBB and FWA)

The below sections discuss how we reached our preferred views on pricing for each ESL band following minor changes to our benchmarking dataset and methodology. Further detail regarding the process used to calculate our preferred prices is available in the benchmarking modelling spreadsheets released alongside this paper.

The $/MHz/pop prices outlined in this chapter are intended to inform how we calculate SACs payable by licensees for issuing spectrum licences, as fixed in written determinations under section 294 of the Act. SACs are expected to be calculated by multiplying the $/MHz/pop price by bandwidth (MHz) and population (projected to the licence commencement date) for each part of a renewed spectrum licence.

We note that the preferred $/MHz/pop price for each ESL band is based on our broader preferred views for licences in each band, including our preferred views on licence duration, and assumes upfront payment based on the time of licence commencement. If these parameters were to change, then the basis for either $/MHz/pop prices or the method to calculate SACs from $/MHz/pop prices may be subject to change.

This section will settle our preferred views on pricing for the 850 MHz band and 1800 MHz band, both of which have renewal application periods commencing 18 June 2026. For other bands, our preferred views are indicative and may be subject to minor changes due to updated benchmarking data being available in the future. Further detail on our approach is available in the Future updates to benchmarking data chapter of this paper.

In setting these renewal prices, we have been guided by the long-term public interest with respect to promoting efficient, competitive and sustainable use of spectrum. Market-based pricing plays an important role in supporting policy objectives by encouraging efficient spectrum use while providing signals that support continued investment in networks. In this context, we consider the preferred prices for each band grouping provide an appropriate proxy for market value, helping to encourage efficient spectrum use while facilitating sustainable investment, particularly in coverage-oriented bands.

Sub-1 GHz: preferred views on pricing

The single-year price in 2025 A$ that we have calculated is $0.0677/MHz/pop, which compares with our updated preliminary single-year price of $0.0755/MHz/pop. When the single-year price is carried forward to the relevant licence commencement dates and expanded to our preferred views on licence duration, we reach the preferred price for each band in Table 4 below.

Table 4: Sub-1 GHz: preferred views prices

Band	Licence duration (years)	Updated preliminary price ($/MHz/pop)	Preferred price ($/MHz/pop)
700 MHz	14.50	0.7405	0.6618
850 MHz	16.03	0.7558	0.6703

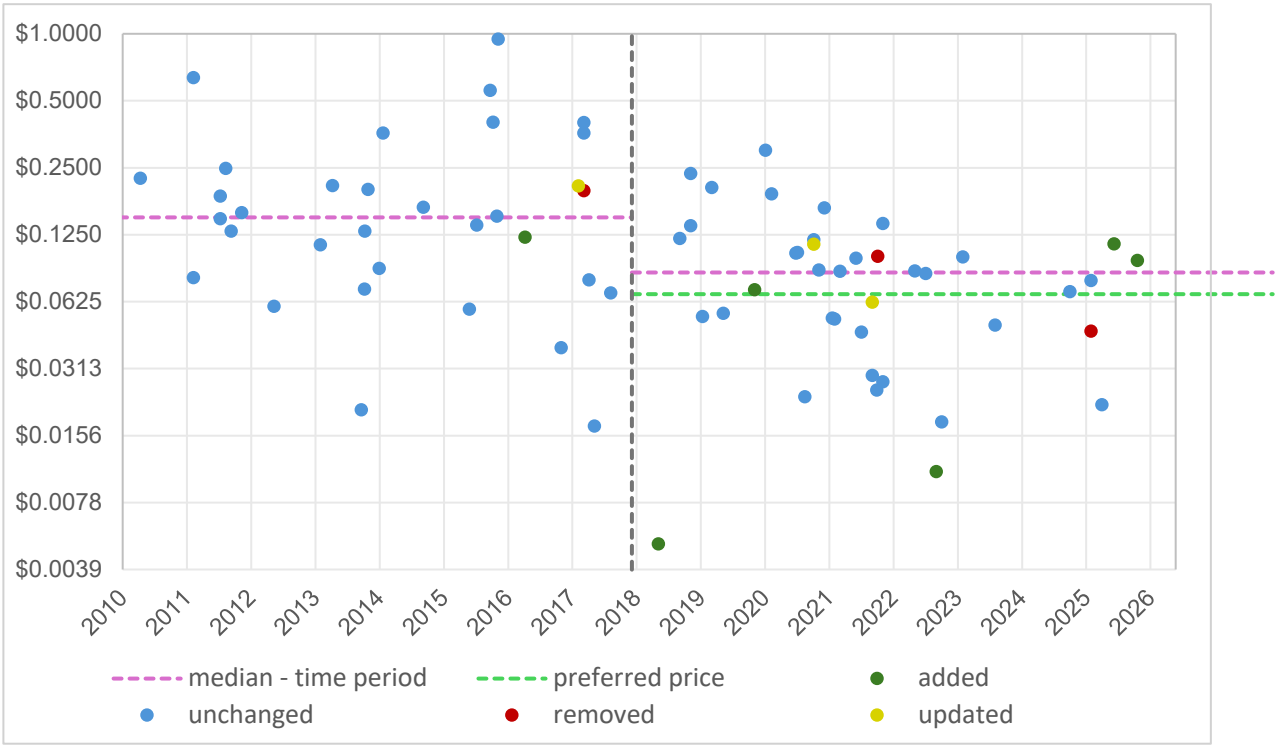
The refinements to the pricing methodology have resulted in lower prices for sub-1 GHz bands than in our updated preliminary views. The key changes that caused the differences in price for our preferred views are the following:

- **Benchmarking dataset updates.**
  - We added 6 observations (including 5 from 2018 onwards) suggested by stakeholders.
  - We removed 3 observations (including 2 from 2018 onwards) in accordance with our exclusion criteria.
  - We updated values for 3 observations (2 of which were from 2018 onwards), with 2 being reduced and one being increased.
  - The net effect of these dataset updates was to reduce the single-year price.
- **Deriving a single price update.** We previously used the geometric mean to determine the single $/MHz/pop price for the sub-1 GHz band grouping, so the central estimator update has caused no change to the price.
- **Forward-looking indexation.** The change to a fixed inflation rate of 2.5% for forward indexation from the end of 2025 onwards led to a minor reduction in price compared with using a combination of RBA forecasts (from May 2026) and a fixed 2% inflation rate.

Benchmarking dataset and time trend analysis

The benchmarking dataset is visualised in Figure 1 below, with the start of 2018 represented by the grey dotted vertical line. Benchmark observations are coloured differently depending on their status compared with our dataset for our updated preliminary views on pricing, while the respective median values for pre-2018 and 2018-onwards benchmarks are represented by the pink dotted lines. The green dotted line for our preferred single-year price is displayed from 2018 onwards as we have restricted the dataset to these observations.

Figure 1: Scatterplot of sub-1 GHz benchmark prices (converted to 2025 365-day A$/MHz/pop prices, log scale)



Note: The different colours of the benchmarks relate to how they compare with our updated preliminary views. The 'removed' benchmarks do not contribute to our preferred prices but are included to provide context for dataset changes.

The Mann-Whitney U test identified statistically significant differences between the distribution of pre-2018 and 2018-onwards benchmarks, which is evident in the large gap between medians for the discrete time periods. However, we do not consider that there is compelling evidence of a sustained, monotonic trend in benchmarking valuations over time, as has been suggested in some stakeholder submissions. This is due to the small number of observations from 2023 onwards and the high potential for confounding variables like country-specific factors. We have therefore determined our preferred price, represented by the green dotted line in the diagram, based on the benchmarking dataset from 2018 onwards without any further time trend adjustments.

Central estimate and cohort analysis

The geometric mean calculated for the 2018-onwards sample was $0.0677/MHz/pop, which was considerably below the GHL estimator and median.

We performed Mann-Whitney U tests for our real GDP per capita and population density cohorts to assess whether there was evidence of differences in prices based on similarity to Australia in these metrics. We found no statistically significant evidence for either cohort, as well as for an urbanisation cohort.

We therefore retain the geometric mean for the full 2018-onwards sample.

Converting to full $/MHz/pop prices

The single-year price of $0.0677/MHz/pop is based on 2025 A$. When carrying it forward to licence commencement dates and expanding the valuation for preferred licence durations, it converts to $0.6618/MHz/pop for the 700 MHz band (preferred 14.50-year licence duration, commencing 1 January 2030) and $0.6703/MHz/pop for 850 MHz band (preferred 16.03-year licence duration, commencing 18 June 2028).

Public interest criteria and policy objectives

The preferred prices are considerably lower than prices paid for similar spectrum in domestic auctions. For example, in the 850/900 MHz auction in 2021, the average $/MHz/pop price paid for 20-year licences was $1.21/MHz/pop, which included competitively allocated lots covering regional areas selling for an average price of $2.11/MHz/pop.[12]

By reflecting longer-term market conditions, under which valuations have generally been lower in the 2018-onwards period, we consider the preferred prices better align with the long-term public interest than short-term auction outcomes. In particular, the preferred prices promote the efficient use of low-band spectrum, support improved service quality and encourage investment in coverage.

Lower 1–3 GHz: preferred views on pricing

The single-year price in 2025 A$ that we have calculated is $0.0373/MHz/pop, which compares with our updated preliminary single-year price of $0.0307/MHz/pop. When the single-year price is carried forward to the relevant licence commencement dates and expanded to our preferred views on licence duration, we reach the preferred price for each band in Table 5 below.

[12] Further detail on the 850/900 MHz band auction can be found on the ACMA website. The spectrum was available nationally, separated into a ‘major population’ area (population: 22,764,063) and a broad ‘regional’ area (population: 2,011,962). The average $/MHz/pop price paid includes the set-aside lots allocated pre-auction to Optus nationally for $1.44/MHz/pop, while the ‘competitively allocated’ regional lots price calculation excludes the regional set-aside lot.

Table 5: Lower 1–3 GHz: preferred views prices

Band	Licence duration (years)	Updated preliminary price ($/MHz/pop)	Preferred price ($/MHz/pop)
1800 MHz	15.58	0.3030	0.3646
2 GHz	11.27	0.2757	0.3389

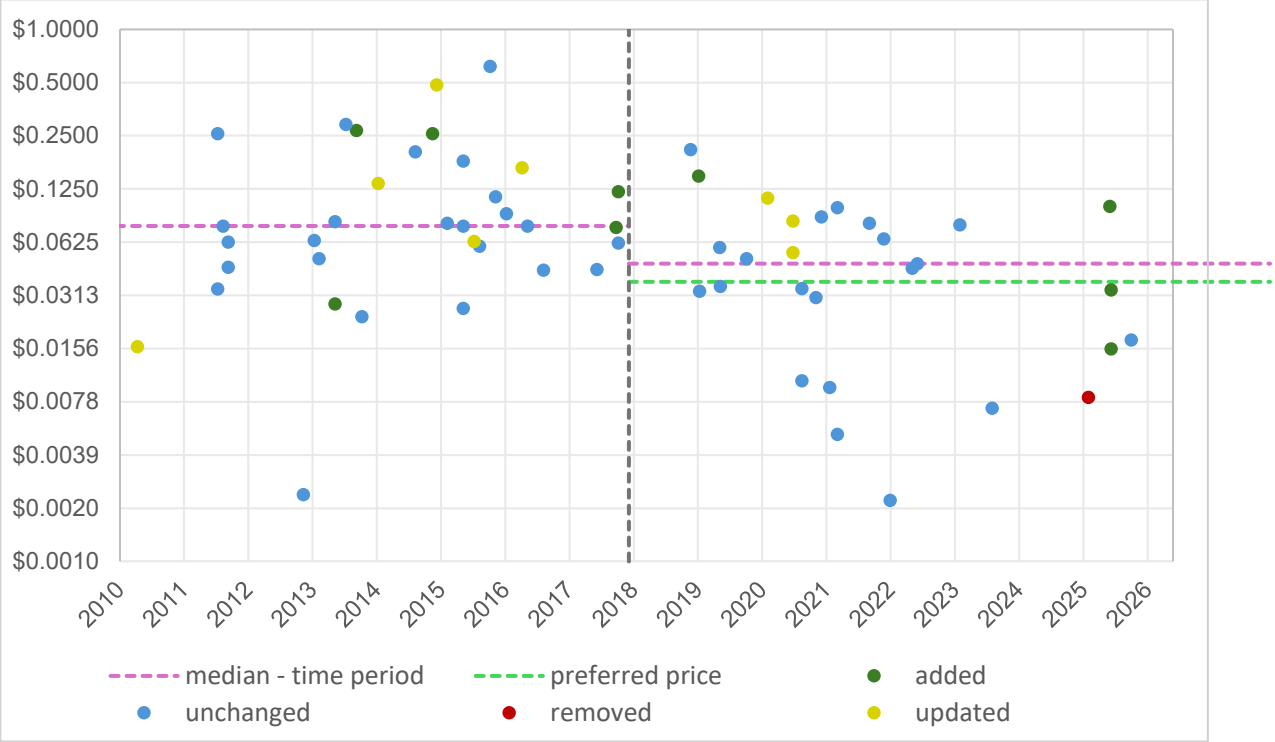
The refinements to the pricing methodology have resulted in higher prices for lower 1–3 GHz bands than in our updated preliminary views. The key changes that caused the slight differences in price for our preferred views are the following:

- **Benchmark dataset updates.**
  - We added 9 observations (including 4 from 2018 onwards) suggested by stakeholders.
  - We removed one observation (from 2018 onwards) in accordance with our exclusion criteria.
  - We updated values for 3 observations, including reducing $/MHz/pop valuations for 2 observations (from before 2018) and increasing the $/MHz/pop valuation for one observation (from 2018 onwards).
  - We updated a further 4 observations based on consolidating or separating multiple bands from the same spectrum award.
  - The net effect of these dataset updates was an increase in the single-year price.
- **Deriving a single price update.** We previously used the upper bound of the population density cohort's interquartile range to adjust the price down from $0.0310/MHz/pop (the previous geometric mean) to $0.0307/MHz/pop in our updated preliminary views. We did not find evidence (to the 1% significance level) of differences between observations within and outside the population density cohort, so we are now using the geometric mean for the full dataset, which has caused the price to increase.
- **Forward-looking indexation.** The change to a fixed inflation rate of 2.5% for forward indexation from the end of 2025 onwards led to a minor reduction in price for the 1800 MHz band and a minor increase in price for the 2 GHz band compared with using a combination of RBA forecasts (from May 2026) and a fixed 2% inflation rate.

Benchmarking dataset and time trend analysis

The benchmarking dataset is visualised in Figure 2 below, with the start of 2018 represented by the grey dotted vertical line. Benchmark observations are coloured differently depending on their status compared with our dataset for our updated preliminary views on pricing, while the respective median values for pre-2018 and 2018-onwards benchmarks are represented by the pink dotted lines. The green dotted line for our preferred single-year price is displayed from 2018 onwards as we have restricted the dataset to these observations.

Figure 2: Scatterplot of lower 1–3 GHz benchmark prices (converted to 2025 365-day A$/MHz/pop prices, log scale)



Note: The different colours of the benchmarks relate to how they compare with our updated preliminary views. The 'removed' benchmarks do not contribute to our preferred prices but are included to provide context for dataset changes.

The Mann-Whitney U test identified statistically significant differences between the distribution of pre-2018 and 2018-onwards benchmarks, which is evident in the large gap between medians for the discrete time periods. However, we do not consider that there is compelling evidence of a sustained, monotonic trend in benchmarking valuations over time, as has been suggested in some stakeholder submissions. This is due to the small number of observations from 2023 onwards, the high potential for confounding variables like country-specific factors, and specific spectrum characteristics being correlated with awards in particular time periods, such as several low-value SDL awards occurring in 2020–22. We have therefore determined our preferred price, represented by the green dotted line in the diagram, based on the benchmarking dataset from 2018 onwards without any further time trend adjustments.

Central estimate and cohort analysis

The geometric mean calculated for the 2018-onwards sample was $0.0373/MHz/pop, which was considerably below the GHL estimator and median.

We performed Mann-Whitney U tests for our real GDP per capita and population density cohorts to assess whether there was evidence of differences in prices based on similarity to Australia in these metrics. We found no statistically significant evidence for the real GDP per capita cohort. We found evidence of differences at 5% significance but not at 1% significance for the population density cohort. There was no statistically significant evidence for an urbanisation cohort.

The findings for the population density cohort are expected. Benchmark prices in the population density cohort are materially lower than the rest of the sample. This previously resulted in the upper bound of the population density cohort's IQR being used as the single-

year price for the lower 1–3 GHz band group in our updated preliminary views. However, the population density cohort has a very small sample size (6 observations), which reduces confidence that the cohort is representative and applicable to the Australian context.

We therefore retain the geometric mean for the full 2018-onwards sample.

Converting to full $/MHz/pop prices

The single-year price of $0.0373/MHz/pop is based on 2025 A$. When carrying it forward to licence commencement dates and expanding the valuation for preferred licence durations, it converts to $0.3646/MHz/pop for the 1800 MHz band (preferred 15.58-year licence duration, commencing 18 June 2028) and $0.3389/MHz/pop for 2 GHz band (preferred 11.27-year licence duration, commencing 12 October 2032).

Public interest criteria and policy objectives

The preferred prices are generally lower than prices paid for similar spectrum in the domestic context, or at least equivalent in nominal terms, reflecting evidence that valuations have been lower in the 2018-onwards period. For example, in the 1800 MHz regional auction in 2016, the average $/MHz/pop price paid for 11.05-year licences was $0.72/MHz/pop, while previous renewal prices were $0.23/MHz/pop for the 1800 MHz band and $0.625/MHz/pop for the 2 GHz band for 15-year licences. We consider the preferred prices support the long-term public interest by ensuring they are a reflection of trends in long-term market value, thereby promoting efficient use of spectrum, allowing continued investment and improving service quality and coverage.

Upper 1–3 GHz: preferred views on pricing

The single-year price in 2025 A$ that we have calculated is $0.0184/MHz/pop, which compares with our updated preliminary single-year price of $0.0167/MHz/pop. When the single-year price is carried forward to the relevant licence commencement dates and expanded to our preferred views on licence duration, we reach the preferred price for each band in Table 6 below.

Table 6: Upper 1–3 GHz: preferred views prices

Band	Licence duration (years)	Updated preliminary price ($/MHz/pop)	Preferred price ($/MHz/pop)
2.3 GHz	13.48	0.1596	0.1754
2.5 GHz	14.30	0.1621	0.1774

The refinements to the benchmarking methodology have resulted in moderately higher prices for upper 1–3 GHz bands than in our updated preliminary views. The key changes that caused the slight differences in price for our preferred views are the following:

- **Benchmark dataset updates.**
  - We added 9 observations (including 5 from 2018 onwards) suggested by stakeholders or that had results published since we released our updated preliminary views.
  - We removed one observation (from 2018 onwards) in accordance with our exclusion criteria.

- We updated the value of 2 observations (one from 2018 onwards), including slightly increasing the $/MHz/pop valuation for the pre-2018 observation and reducing the $/MHz/pop valuation for the 2018-onwards observation.
- We updated one observation (from before 2018) based on consolidating multiple bands from the same spectrum award.
- The net effect of these dataset updates was an increase in the single-year price.

- **Central estimator update.** We previously used the geometric mean to determine the single $/MHz/pop price for the upper 1–3 GHz band grouping, so the central estimator update has caused no change to the price.
- **Forward-looking indexation.** The change to a fixed inflation rate of 2.5% for forward indexation from the end of 2025 onwards led to a minor reduction in price compared with using a combination of RBA forecasts (from May 2026) and a fixed 2% inflation rate.

Benchmarking dataset and time trend analysis

The benchmarking dataset is visualised in Figure 3 below, with the start of 2018 represented by the grey dotted vertical line. Benchmark observations are coloured differently depending on their status compared with our dataset for our updated preliminary views on pricing, while the respective median values for pre-2018 and 2018-onwards benchmarks are represented by the pink dotted lines. The green dotted line for our preferred single-year price is displayed across the whole dataset as our calculations incorporate all observations.

Figure 3: Scatterplot of upper 1–3 GHz benchmark prices (converted to 2025 365-day A$/MHz/pop prices, log scale)

Note: The different colours of the benchmarks relate to how they compare with our updated preliminary views.

The Mann-Whitney U test did not identify statistically significant differences between the distribution of pre-2018 and 2018-onwards benchmarks. We have determined our preferred price, represented by the green dotted line in the diagram, based on the full benchmarking dataset.

Central estimate and cohort analysis
The geometric mean calculated for the full dataset was $0.0184/MHz/pop, which is below the GHL estimator but above the median.

We performed Mann-Whitney U tests for our real GDP per capita and population density cohorts to assess whether there was evidence of differences in prices based on similarity to Australia in these metrics. For population density, we found evidence at 5% significance but not at 1% significance, while no statistically significant evidence was found for real GDP capita nor urbanisation.

We therefore retain the geometric mean for the full dataset.

Converting to full $/MHz/pop prices
The single-year price of $0.0184/MHz/pop is based on 2025 A$. When carrying it forward to licence commencement dates and expanding the valuation for preferred licence durations, it converts to $0.1754/MHz/pop for the 2.3 GHz band (preferred 13.48-year licence duration, commencing 25 July 2030) and $0.1774/MHz/pop for 2.5 GHz band (preferred 14.30-year licence duration, commencing 1 October 2029).

Public interest criteria and policy objectives
The preferred prices are higher than prices paid for similar spectrum in a domestic context, which has typically been $0.03/MHz/pop. This price was paid in the previous renewal process for the 2.3 GHz band and at auction for the 2.5 GHz band in 2013. The preferred prices reflect the technological evolution of spectrum use in the upper 1–3 GHz spectrum that has resulted in higher valuations globally than when prices were previously set in Australia. We consider that recognising this increase supports the long-term public interest by strengthening incentives for spectrum to be used efficiently and allocated to its highest-value uses, while underpinning continued investment in higher-capacity networks.

3.4 GHz: preferred views on pricing

The single-year price in 2025 A$ that we have calculated is $0.0183/MHz/pop, which compares with our updated preliminary single-year price of $0.0217/MHz/pop. When the single-year price is carried forward to the relevant licence commencement dates and expanded to our preferred views on licence duration, we reach the preferred price for each band in Table 7 below.

Table 7: 3.4 GHz: preferred views prices

Band	Licence duration (years)	Updated preliminary price ($/MHz/pop)	Preferred price ($/MHz/pop)
3.4 GHz	13.09	0.2052	0.1732

The refinements to the benchmarking methodology have resulted in moderately lower prices for the 3.4 GHz band than in our updated preliminary views. The key changes that caused the slight differences in price for our preferred views are the following:

- **Benchmark dataset updates.**
  - We added 6 observations (all from 2018 onwards) suggested by stakeholders.
  - We removed 3 observations (all from 2018 onwards) in accordance with our exclusion criteria.

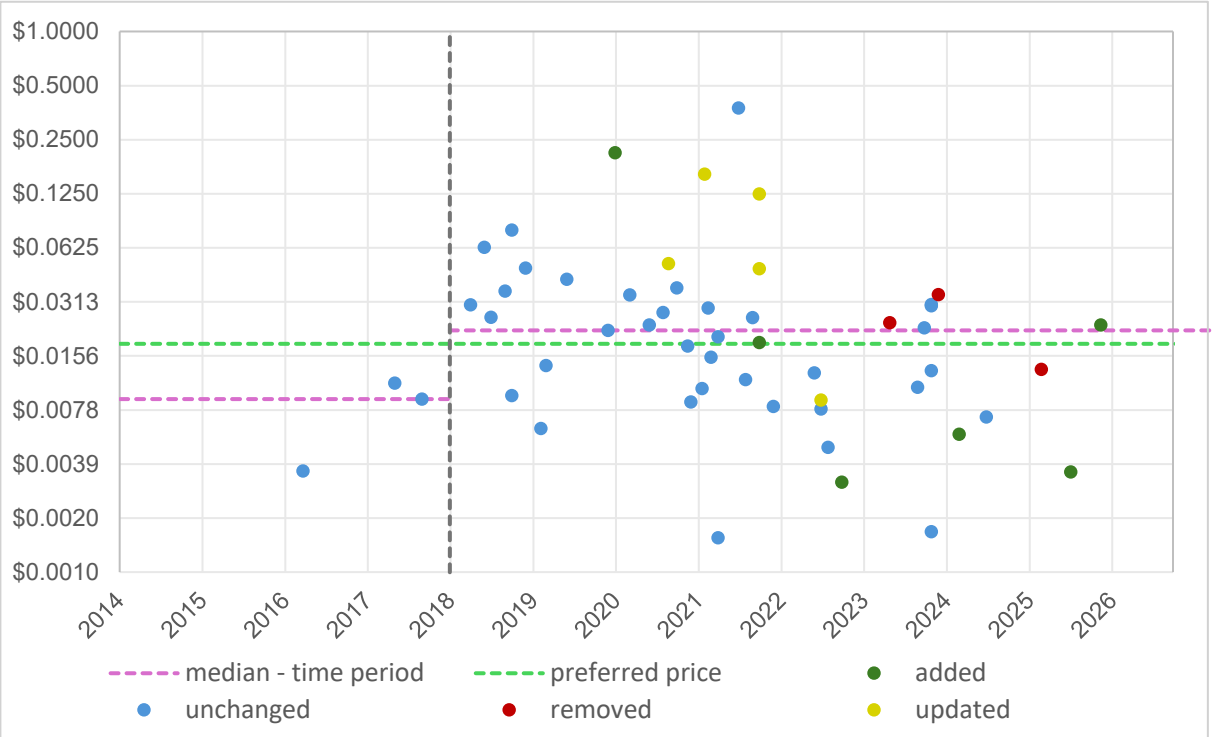
- We updated 5 observations (all from 2018 onwards), including reducing $/MHz/pop valuations for 3 observations and increasing the $/MHz/pop valuations for 2 observations.
- The net effect of these dataset updates was a decrease in the single-year price.

- **Central estimator update.** We previously used the median to determine the single $/MHz/pop price for the 3.4 GHz band, based on its greater comparability than the geometric mean to central estimates for the population density and real GDP per capita cohorts. The switch to the geometric mean reduces the single-year price.
- **Forward-looking indexation.** The change to a fixed inflation rate of 2.5% for forward indexation from the end of 2025 onwards led to a minor reduction in price compared with using a combination of RBA forecasts and a fixed 2% inflation rate.

Benchmarking dataset and time trend analysis

The benchmarking dataset is visualised in Figure 4 below, with the start of 2018 represented by the grey dotted vertical line. Benchmark observations are coloured differently depending on their status compared with our dataset for our updated preliminary views on pricing, while the respective median values for pre-2018 and 2018-onwards benchmarks are represented by the pink dotted lines. The green dotted line for our preferred single-year price is displayed across the whole dataset as our calculations incorporate all observations.

Figure 4: Scatterplot of 3.4 GHz benchmark prices (converted to 2025 365-day A$/MHz/pop prices, log scale)



Note: The different colours of the benchmarks relate to how they compare with our updated preliminary views. The 'removed' benchmarks do not contribute to our preferred prices but are included to provide context for dataset changes.

The Mann-Whitney U test did not identify statistically significant differences between the distribution of pre-2018 and 2018-onwards benchmarks, which is expected given the small pre-2018 sample size. We have therefore determined our preferred price, represented by the green dotted line in the diagram, based on the full benchmarking dataset.

Central estimate and cohort analysis
The geometric mean calculated for the full dataset was $0.0183/MHz/pop, falling above the GHL estimator but considerably below the median.

We performed Mann-Whitney U tests for our real GDP per capita and population density cohorts to assess whether there was evidence of differences in prices based on similarity to Australia in these metrics. We found no statistically significant evidence for either cohort.

We note that we found evidence at 5% significance but not at 1% significance for an urbanisation cohort using a 70% similarity threshold.

We therefore retain the geometric mean for the full dataset.

Converting to full $/MHz/pop prices
The single-year price of $0.0183/MHz/pop is based on 2025 A$. When carrying it forward to licence commencement dates and expanding the valuation for preferred licence durations, it converts to $0.1732/MHz/pop for the 3.4 GHz band (preferred 13.09-year licence duration, commencing 14 December 2030).

Public interest criteria and policy objectives
The preferred price is relatively similar to market-based prices paid for the same spectrum at auction when adjusting for licence duration, such as the 3.6 GHz band auction in 2018 and the 3.4/3.7 GHz bands allocation process in 2023.

The approach to align pricing with prevailing market conditions is consistent with the Ministerial Policy Statement for the 3.4–4.0 GHz band, which requires the ACMA to promote the long-term public interest through supporting the deployment of new and innovative technology (including 5G), support a range of use cases and users in the band, support digital connectivity and investment in regional Australia, and promote competitive markets. These objectives are achieved by setting prices that reflect the underlying market value of the spectrum, which in turn promotes efficient use, supports investment, and promotes competitive outcomes.

The preferred price is materially higher than the previous renewal price of $0.03/MHz/pop for this spectrum, reflecting the international harmonisation of the 3.4 GHz band as a pioneer 5G band. By maintaining alignment with prevailing market conditions, we consider the preferred price supports the long-term public interest by balancing allocative efficiency with broader public policy objectives, including service quality and coverage.

Preferred views on pricing (rail and TOB)

1800 MHz rail communications: preferred views on pricing

Our preferred view is that existing rail use of the 1800 MHz band should continue to be supported under apparatus licensing, rather than spectrum licensing, while we further consider the use of the band likely to best promote the long-term public interest.

We therefore provide preferred views on pricing for apparatus and spectrum licensing arrangements.

Apparatus licensing

Our preferred view on pricing for 1800 MHz band apparatus licences for rail communications use is that the prices should be $0.01 per paired MHz per head of population, which is equivalent to $0.005/MHz/pop.

This is consistent with our updated preliminary views on pricing. It aligns with the current PMTS Class B licence tax rate for the 1800 MHz band and is equivalent to what we have proposed for rail communications use of PMTS Class B licences in the 1900 MHz band.

This proposed price is considerably lower than the single-year equivalent of the prices paid by rail communications users for up to 2 x 10 MHz of their current spectrum licences after public interest discounts applied, which was approximately $0.0125/MHz/pop.[13]

Spectrum licensing

While we have outlined a preferred view of non-renewal for 1800 MHz band spectrum licences for rail communications use, we note all licensees may apply for renewal and their licences may still be renewed.

Our preferred view, if spectrum licences were renewed for rail communications users, is that prices should be based on our 1800 MHz band price for WA WBB and FWA users. This is consistent with our updated preliminary view for this scenario. Our preferred view on the 1800 MHz band price is $0.3646/MHz/pop for a 15.58-year licence, which is based on a single-year valuation at 18 June 2028 (the commencement date for renewed spectrum licences in the 1800 MHz band) of $0.0397/MHz/pop.[14] This single-year valuation can be converted for alternative licence durations.

Spectrum licences held by rail communications licensees have received public interest discounts previously through direction from the Minister for Communications under section 294(2) of the Act. In the absence of such a ministerial direction, we would not apply a public interest discount in this scenario.

[13] The previous price paid for up to 2 x 10 MHz of spectrum licences with a duration of 13 years 45 days was $0.1053/MHz/pop, incorporating a 50% public interest discount compared with other 1800 MHz band spectrum licences, consistent with the Radiocommunications (Spectrum Access Charges) Direction 2013.

[14] This takes the single-year A$ 2025 price of $0.0373/MHz/pop for the lower 1–3 GHz band group and uses fixed 2.5% annual inflation to index it forward to 18 June 2028.

Difference between preferred pricing for apparatus licences and spectrum licences

We note that there is a discrepancy between our preferred prices for rail communications use under spectrum licences versus apparatus licences. We consider the discrepancy in preferred pricing appropriate in these circumstances.

We intend to retain consistency with spectrum licence pricing in the previous renewal process, where pricing was aligned with what MNOs were charged in $/MHz/pop terms, less a public interest discount. However, there is no precedent for apparatus licence pricing in this specific context. We consider that rather than setting a new apparatus licence tax rate aligned with the ESL preferred price for WA WBB and FWA use, it would be more appropriate to use the established apparatus licence tax rate for PMTS Class B licences. We note that this lower price would support rail operators in transitioning to apparatus licensing, and in future to the 1900 MHz band, where we have proposed the same PMTS Class B licence tax rate for rail communications use.

2.5 GHz mid-band gap TOB: preferred views on pricing

Our preferred view on licence renewal for spectrum licences in the 2.5 GHz mid-band gap for TOB services is that the long-term public interest would likely best be served by continued access to the spectrum under apparatus licences rather than spectrum licences. Industry submissions during earlier ESL consultation processes indicated support for apparatus licensing arrangements for TOB use.

Apparatus licensing

Under our preferred approach, 2.5 GHz mid-band gap licensees would pay apparatus licence fees in line with the current calculation method used for the 2 GHz, 7.2 GHz, 8.3 GHz and 13 GHz bands to build up the Australia-wide TOB network (TOBN) licence tax rate of $223,901.27 (see Table 17 of the *Apparatus licence fee schedule*). Based on apparatus licence tax rates as of May 2026, this calculation method (detailed below) equates to annual apparatus licence tax of $29,791 for each licence in the 2.5 GHz mid-band gap.

The calculation method for the TOBN licence tax rate was outlined in the *Proposed changes to apparatus licence pricing structures* consultation paper we released in March 2023. The calculation method as applied to the 2.5 GHz mid-band gap, using apparatus licence tax rates as of May 2026, is outlined below.

Step 1: Calculate the tax per band:

*Total kHz (**40,000**) x Location weighting (**9.985**) x Normalisation factor (**0.29835390482468**)*
*= Tax per band (**119,162**)*

Step 2: Adjust for proportion of exclusive use by commercial broadcasters:

*Tax per band (**119,162**) x (No. of commercial channels (**3**) / Total no. of channels (**4**))*
*= Commercial tax per band (**89,372**)*

Step 3: Allocate tax across commercial broadcasters:

*Commercial tax per band (**89,372**) / **3***
*= TOBN tax per band (**29,791**)*

This amount is subject to annual adjustments in line with Australia-wide population growth, consistent with the ACMA's approach to updating apparatus licence tax rates.

Spectrum licensing

While we are outlining a preferred view of non-renewal for 2.5 GHz mid-band gap spectrum licences for TOB use, we note all licensees may apply for renewal and their licences may still be renewed.

Our preferred view, if spectrum licences were renewed for TOB users, is that prices should be equivalent to those proposed for apparatus licences. We note that in the administrative pricing process for current 2.5 GHz mid-band gap spectrum licences, the SAC for each licence was calculated with reference to the apparatus licence tax that would apply under the calculation method outlined above. We consider there is benefit in maintaining consistency with that approach, such that any SAC for TOB is equivalent to an annual amount of $29,791, with adjustments made for indexation or licence duration.

Future updates to benchmarking data

In our stage 4 consultation paper on updated preliminary views on pricing, we proposed continuing to update the benchmarking dataset used to inform ESL renewal prices beyond the release of our preferred views on pricing. For ESL bands with renewal application periods commencing between 1 October 2027 (2.5 GHz band) and 12 October 2030 (2 GHz band), this would involve updating the benchmarking datasets used to inform ESL prices with more recent spectrum awards. This may result in changes to the preferred $/MHz/pop renewal prices for these bands compared with the indicative prices set out in this paper.

The objective of this approach is to ensure that renewal prices reflect contemporary market conditions, particularly for ESL bands with later expiry dates. We recognise that spectrum valuations can change over time due to shifts in data demand, spectrum supply and technology efficiency. At the same time, pricing outcomes should provide licensees with sufficient certainty and advance notice ahead of making renewal applications. Stakeholder feedback reflected an interest in maintaining this balance, as outlined in the Summary of submissions chapter of this paper.

Approach to updating benchmarks

Having considered stakeholder feedback, we will proceed with updating benchmarking data prior to renewal application periods.

Pricing methodology

We intend to keep the methodology as stable as possible so that any price movements predominantly reflect new data being added to the dataset.

Exclusion criteria will be retained

Spectrum awards that occur following the release of our preferred views on pricing will only be added to our benchmarking datasets if they satisfy our exclusion criteria, as outlined in the Pricing methodology and peer review chapter of this paper.

Time trend analysis and derivation of single price will be retained

Where we have identified a statistically significant time trend for a band grouping in this paper, we will continue to apply the same data restrictions. For example, for the 700 MHz band, the sub-1 GHz band grouping would continue to be restricted to spectrum awards that occurred from 2018 onwards. In contrast, for the 2.3 GHz band, the upper 1–3 GHz band grouping would continue to use the whole dataset, including pre-2018 awards.

The geometric mean will continue to be used as the method for deriving single prices from each benchmark sample. Using a single, robust estimator reduces the likelihood that the inclusion of new awards results in sudden or disproportionate changes in derived prices, such as those that arise from switching between alternative central estimates under decision rules. As a result, movements in single price points more closely reflect changes in underlying market evidence.

Indexation certainty

In our pricing methodology:

- Step 4 uses CPI data to carry forward historic benchmark values to present value (currently up to 2025).

- Step 7 will carry forward the single-year price for each band group by applying a constant annual CPI assumption of 2.5% from the end of 2025 to the commencement date of a renewed licence.

When updating benchmarking data in the future, the timing of 'present value' in step 4 will occur at the benchmarking data cut-off dates outlined in Table 8 below, which will be later than our current use of 2025 for present value. To provide indexation certainty, when undertaking step 4 of the pricing methodology with updated benchmarking datasets, we will apply CPI growth of 2.5% annually between December 2025 and future benchmarking data cut-off dates, for both existing and new benchmarks. This means existing benchmarks from 2025 and earlier will be increased by 2.5% annually from the end of 2025, while new benchmarks from 2026 onwards will be carried forward from their respective award dates to benchmarking cut-off dates using 2.5% annual CPI growth.

Fixing inflation assumptions mitigates the risk that changes to preferred prices are primarily driven by deviations between forecast and real inflation rather than new market evidence, which would be inconsistent with the intent of future updates to benchmarking data. This will provide greater stability between our indicative preferred prices and adjusted prices based on future updates to benchmarking data, which in turn helps us meet our ESL policy objectives, including supporting investment and innovation by enabling licensees to make decisions with greater confidence regarding renewal prices.

Process for updating benchmarks

Benchmarking data cut-off 6 months before renewal application period
We consider that adopting a cut-off for new spectrum awards 6 months prior to the commencement of each renewal application period is appropriate. This means that only spectrum awards that have concluded and had results published prior to the 6-month cut-off date may be included in an updated benchmarking dataset.

This allows sufficient time to source and verify relevant award data, update benchmarking analysis, calculate revised $/MHz/pop prices, and undertake consultation on any changes relative to the indicative prices set out in this paper. It also ensures that updated preferred renewal prices are available before renewal application periods commence, supporting informed decision-making and planning certainty.

Table 8 shows how this would apply to each ESL band. For the 850 MHz and 1800 MHz bands, which have renewal application periods commencing on 18 June 2026, renewal prices will be determined based on this paper and will not be subject to further benchmarking updates. For all other bands, the proposed benchmarking dataset cut-off dates reflect the 6-month framework described above.

Table 8: Future updates to benchmarking data – cut-off dates

Band	Benchmarking dataset cut-off	Beginning of renewal application period	Licence expiry
850 MHz	N/A	18 June 2026	17 June 2028
1800 MHz	N/A	18 June 2026	17 June 2028
2.5 GHz	1 April 2027	1 October 2027	30 September 2029
700 MHz	1 July 2027	1 January 2028	31 December 2029
2.3 GHz	25 January 2028	25 July 2028	24 July 2030
3.4 GHz	14 June 2028	14 December 2028	13 December 2030
2 GHz	12 April 2030	12 October 2030	11 October 2032

Stakeholder consultation

We will undertake focused, time-limited consultation on proposed additions to the benchmarking dataset and the resulting $/MHz/pop price outcomes for each relevant ESL band. This consultation will provide stakeholders with an opportunity to comment on:

- the suitability of any proposed additions to the benchmark dataset, including comparability and alignment with our established criteria
- the extent and drivers of any changes to renewal prices relative to those outlined as indicative preferred prices in this paper.

As noted below in the 'Next steps' section, we intend to undertake consultation on the detail of how this process would work.

Next steps

We intend to release a public consultation paper in early Q4 2026 on the process for updating benchmarking data for each ESL band, with a particular focus on how band-by-band consultation should occur. This timing allows stakeholder feedback to be considered before the first benchmarking dataset cutoff of 1 April 2027, which is 6 months prior to the renewal application period for the 2.5 GHz band commencing on 1 October 2027.

Payment timing

It is our position that, where a licence is renewed in response to an application received within the first 9 months of the application period, the licensee will be required to pay the SAC 2 months before the new licence is due to commence. That is, payment will be required 2 months prior to when the ESL it is replacing is due to expire and the new licence begins to authorise use of the spectrum.

This position has been informed by extensive stakeholder feedback received through the consultation on the ESL renewal application and decision-making process. Stakeholders emphasised that requiring payment well in advance of licence commencement would likely create incentives for licensees to delay renewal applications in order to defer payment.

Our approach to payment timing addresses barriers identified in submissions that may prevent licensees from applying for renewal as early as possible and undermine providing consumers and industry certainty over the outcomes of the ESL process, well in advance of licence expiry.

We cannot guarantee at this time that it will be possible to provide this payment timing for applications that are received after the first 9 months. This is because there is uncertainty about how long decision-making for each application will take, noting that decision-making may be extended up to 12 months from when an application is received where requests for further information are made under section 77B of the Act.

Where a licence is to be renewed in response to an application received after this initial 9-month period, it is our position that the licensee will be required to pay the SAC prior to renewal, consistent with our original proposal. However, upon request, we may consider requiring payment 2 months prior to commencement, or other alternative timings, on a case-by-case basis and where feasible.

While submissions indicated a preference to pay one month prior to licence commencement similar to other processes, we think requiring payment 2 months prior to commencement is more appropriate, providing additional time to consider potential issues arising in the event of non-payment.

In other processes, like most spectrum licence auctions and the previous ESL process, new licences are only issued after the licensee pays the SAC.

To facilitate payment after commencement and decision-making occurring well in advance of renewal as part of this ESL process, payment will be required after licence issue. Non-payment after a licence has been issued therefore raises a different set of considerations, including whether to suspend or cancel the licence, which will require time to work through.[15]

Further information about payment timing and the decision-making process will be provided when we publish guidance material to support licensees making applications for renewal ahead of 18 June.

[15] Section 67 of the Act requires that all spectrum licences must include a condition requiring the licensee to meet all obligations to pay the spectrum access charge, among other charges and spectrum licence tax.

Appendix A: Pricing methodology

Step 1: compile benchmark dataset

The benchmarking dataset used in this methodology is compiled from publicly available sources on market-based spectrum allocations and is designed to capture a diverse range of observed market outcomes. Any benchmarking exercise requires a sufficiently large and relevant sample, therefore our dataset includes a substantial number of domestic and international spectrum awards to ensure broad coverage and representativeness.

The dataset has been constructed based on a default position of including spectrum awards, unless there is a clear and compelling reason to exclude them. While all spectrum awards occur within specific political, regulatory, market and technological contexts, the majority are considered to provide a reasonable indication of market value when assessed as part of a large international sample.

The benchmark data have been compiled from a range of sources such as the ACMA's internal awards database, market research services and official publications released by national regulators. The dataset has also been supplemented with spectrum award information provided by industry stakeholders and consultants involved in the ESL process, where this information could be independently verified.

The outcome of this step is the creation of a benchmarking dataset that is sufficiently broad to support robust analysis, while excluding awards that are unlikely to provide reliable information about market value or where there is insufficient information available to calculate consistent $/MHz/pop prices. This dataset forms the basis for subsequent standardisation steps.

Information collected for each spectrum award

For each spectrum award considered for inclusion, the following information is collected. This information is required to calculate benchmark prices and to apply the standardisation steps set out later in this appendix.

Table 9: Information required for benchmark prices

Item	Description
Price	Total price of the allocation in local currency. This includes upfront payments and ongoing fees where relevant.
Bandwidth	The amount of spectrum awarded, expressed in MHz.
Population	Population covered by the award. This is typically national population but may be a subset of the population where the allocation does not cover the entire country.
$/MHz/pop	The price divided by the bandwidth divided by the population. This is the actual benchmark price to be used to inform our methodology. It may be a weighted average if the bandwidth sold is not the same across the whole population being considered.

Item	Description
Licence dates and duration	Licence commencement and expiry dates, from which the licence duration is derived and used to standardise awards to a consistent duration.
Exchange rate information	Purchasing power parity (PPP) exchange rates applicable at the time of allocation, used to convert benchmark prices to Australian dollars.
Award format and conditions	Information on the award mechanism and any material licence conditions relevant to comparability.

Only awards for which this information is publicly available or can be reliably derived are included in the benchmarking dataset.

Exclusion criteria

While the methodology generally favours inclusion, spectrum awards are excluded where there is strong evidence that observed prices do not reliably reflect market value or are not suitable for benchmarking. Exclusions are intended to remove awards that likely deviate significantly from market-based valuations, rather than to exclude awards simply because prices appear unusually high or low.

The exclusion criteria are grouped into three broad categories and are summarised in Table 10. These categories and criteria were developed in line with advice received through both peer reviews of the pricing methodology.

Table 10: Exclusion criteria for benchmark awards

Category	Criterion	Description
Uncompetitive award	Uncompetitive format	Spectrum awards that were administrative and do not provide genuine market information (e.g. ‘beauty contests’, direct allocations, licence renewals, etc.).
	Limited participation	Spectrum awards where it was infeasible to increase above reserve given the number of bidders participating and/or binding caps.
	Material amounts of spectrum unsold	Spectrum awards where significant amounts of the spectrum offered went unsold. It is not necessary to exclude all awards with unsold spectrum (e.g. if spectrum only went unsold in unattractive regions or encumbered lot categories).
Licences not comparable	Special obligations	Prices of awards that incorporate onerous rollout obligations or investment commitments that do not reflect full market valuation. Awards will only be excluded under this criterion if the obligations are explicitly interventionist (not use-it-or-lose-it conditions).

Category	Criterion	Description
	Use case restricted	The licences on offer are not comparable as they *could not* be held by the operators holding existing licences in Australia due to being restricted to or configured for a different use case.
	Residual awards	Awards of lots that were undesirable in the main award, typically involving materially limited bandwidths or short-term licences.
Measurement issues	Incorrect information	Spectrum awards where there is a clear reason to expect prices or other information are incorrect and a correction is not possible.
	Lack of information	Sufficient information to calculate award prices is unavailable (e.g. prices, bandwidths, durations or population numbers are not public, per band prices cannot be calculated, there is insufficient information on annual fees).

Dataset maintenance

The benchmarking dataset is regularly reviewed and updated as new spectrum awards are issued and additional information becomes available. Awards suggested by stakeholders are evaluated against the same inclusion and exclusion criteria applied to all other awards. If previously included awards are later found to meet the exclusion criteria, they are removed from the dataset to maintain consistency.

Step 2: convert valuations to consistent duration

In step 2 we apply a flat annuity approach to convert benchmark prices with different licence durations into a common 365-day valuation. This conversion is undertaken using a discount rate based on the weighted average cost of capital (WACC).[16]

Consistent with Stage 3, we use the long-term, nominal vanilla (post-tax) WACC of 8.49% recommended by Frontier Economics. This estimate sits within the range of 8.1% to 8.8% recommended by IMA (with Flat Rock Consulting) for 2024, providing confidence in the consistency of expert advice and the robustness of the chosen approach.

A post-tax WACC is used rather than a pre-tax measure, as this facilitates international benchmarking by controlling for differences in corporate tax regimes across countries. A nominal WACC is applied to ensure consistency with the use of nominal cash flows.

Given the long duration of spectrum licences, valuations are appropriately informed by long-term investment considerations rather than short-term market conditions. We apply a WACC that reflects long-run investment expectations and can be applied consistently across allocations undertaken in different years.

[16] The WACC is the cost of debt and the cost of equity combined, which can be used to discount cash flows for predetermined future periods to estimate present value.

While ideally a country- and year-specific WACC would be applied to each benchmark valuation, doing so would be heavily resource intensive for limited benefit. For practical and methodological consistency, a single long-term WACC applicable across a range of contexts is therefore adopted.

Standardising licence lengths is complicated by the presence of licence durations that are not multiples of whole years. To account for this, we amend the standard flat annuity formula to derive 365-day valuations from any licence duration. The standard flat annuity formula to calculate the present value of a series of cashflows is:

$$PV_n = A \times \left\{ \frac{1-(\frac{1}{1+r})^n}{r} \right\} \quad (1)$$

Where:
$PV_n =$ present value of the series of cashflows
$A =$ the nominal value of each cashflow
$r =$ discount rate
$n =$ number of cashflows in the series.

The equation can also be rearranged to calculate the value of A in terms of PV_n:

$$A = PV_n \,/\, \left\{ \frac{1-(\frac{1}{1+r})^n}{r} \right\} \quad (2)$$

We want to calculate the present value of the cashflows for n periods (where $n = 365$) based on the present value of cashflows for a longer number of periods (L periods). To do this, we effectively determine the value of A based on the present value of cashflows for L periods (PV_L), then use the value of A to determine PV_n:

$$PV_n = A \times \left\{ \frac{1-(\frac{1}{1+r})^n}{r} \right\}$$

$$PV_n = \left[PV_L \,/\, \left\{ \frac{1-(\frac{1}{1+r})^L}{r} \right\} \right] \times \left\{ \frac{1-(\frac{1}{1+r})^n}{r} \right\} \quad (3)$$

This formula can be simplified into what we have used in our benchmarking process for licence duration adjustments:

$$PV_n = PV_L \times \left\{ \frac{1-\left\{\frac{1}{1+r}\right\}^n}{1-\left\{\frac{1}{1+r}\right\}^L} \right\} \quad (4)$$

When using the formula in this step, $n = 365$ and $L =$ number of days of the original licence duration. Because we are calculating licence length based on the number of days, r is set to 0.02233%, which is the compounded daily equivalent of the annual WACC of 8.49%

This step results in the ‘per MHz per pop’ prices in local currencies all being converted to have the same single-year valuation in days.

Step 3: convert to Australian dollars using PPP exchange rates

Step 3 will convert all benchmark valuations into Australian dollars. We received advice from DotEcon that recommended to only use purchasing power parity (PPP) exchange rates to perform these conversions.

PPP exchange rates reflect the relative prices for an equivalent basket of items in different countries. PPP exchange rates are less volatile and are likely to better reflect both domestic labour costs and the purchasing power of WBB customers within a country.

We use the 'PPP conversion factor, GDP (LCU per international $)' indicator from World Development Indicators data from the World Bank, and data from the International Monetary Fund for Taiwan's PPP exchange rate.

Where spectrum awards are conducted in a non-local currency, such as US dollars or euros instead of the local currency, we calculate an implied PPP exchange rate. We take the ratio of PPP to spot exchange rates against the Australian dollar, then apply that ratio to the spot exchange rate of the currency that was used for the award.[17]

Step 4: carry forward valuations to 2025

As spectrum licences are awarded in different years, benchmark prices are not directly comparable without an adjustment for the time value of money. Step 4 therefore standardises all benchmark values by carrying them forward to a common valuation year of 2025, using the Consumer Price Index (CPI). This approach is unchanged from the updated preliminary views methodology.

We use ABS Consumer Price Index (CPI) data to account for changes in the general price level over time. For each year, a single CPI value is calculated as the average of the available quarterly indices. The CPI series is then rebased to 2025, which is set equal to one, with all other years expressed relative to this base year. Benchmark prices are carried forward to 2025 by dividing each price by the corresponding rebased CPI index value for the year in which it was observed.[18]

Step 5: conduct time trend testing

It is important that the methodology reflects time trends in spectrum valuations. Changes in underlying market conditions over time, including shifts in spectrum supply and demand, technological developments and evolving use cases, mean that prices observed in earlier awards may not be representative of current market conditions. As a result, older benchmarks need to be treated with caution, and adjustments may be required to ensure that benchmarking outcomes remain relevant to contemporary valuations.

Consistent with DotEcon's peer review recommendations, we undertook statistical testing to assess whether spectrum valuations differ materially over time. For each band group, the benchmark awards were divided into 2 periods – awards before 2018 and awards from 2018 onwards. Mann-Whitney U tests were then applied to assess whether there are statistically

[17] For example, Uruguay auctioned the 700 MHz band in 2017 in US dollars. In 2017, Uruguay's PPP exchange rate was 15.77 Uruguayan pesos to A$1, while its spot exchange rate was 21.98 Uruguayan pesos to A$1, which means the PPP exchange rate was 71.8% of the spot exchange rate. We took the spot exchange rate of US$0.7664 = A$1 and multiplied it by 71.8% to find an implied PPP exchange rate of US$0.5500 for Uruguay.

[18] For example, if there is a benchmark price of $0.50/MHz/pop in 2015 and the index value of inflation is 0.8 for that year, the price would be divided by 0.8 to find a value of $0.625/MHz/pop for 2025. The end result of this step is that we have a 365-day licence valuation in Australian dollars and with a common date.

significant differences between the 2 periods. This approach allows us to identify whether prices observed in more recent awards differ systematically from earlier outcomes, without imposing strong assumptions about the form of any underlying time trend.

Where a statistically significant difference between time periods is identified at the p <= 0.05 level, we limit the benchmark sample to awards from 2018 onwards. This year represents the midpoint of the dataset and aligns with the global commencement of spectrum awards for 5G services. Applying this cutoff helps ensure that the benchmarking analysis is anchored to valuations that reflect contemporary technologies, market structures and demand conditions, rather than historical dynamics that may no longer be representative.

Step 6: deriving a single price point

After we have tested and controlled for time trends within our benchmark prices, single price points are then derived from the resulting sample that reflects the market value of the spectrum. This is done through calculating a robust and efficient measure of central tendency and then conducting cohort analysis to determine if this result is reflective of jurisdictions most similar to Australia. The separation of Step 6A and Step 6B is a moderate change in approach from our updated preliminary views, although price outcomes remain largely similar.

Step 6A: calculating central estimates for each band group sample

We calculate single prices using the geometric mean. This is a change from our previous methodology, where we selected between the geometric mean and the median under decision rules with cohort-based checks.

The geometric mean is calculated by taking the *n*th root of the product of all values in the sample, where *n* is the number of observations.[19] It is effectively the same as averaging the values after they have been converted to logarithms, then converting that average back to a normal number. This makes it well suited to spectrum prices, which usually cluster and spread out in a pattern where differences are best understood in percentage terms. Using the geometric mean helps reduce the impact of unusually high or low prices and gives a more representative central estimate.

Step 6B: cohort analysis

Cohort analysis is used to identify subsets of benchmark observations that are most comparable to Australia, ensuring the final price estimate reflects relevant market evidence. This process involves compiling supplementary data to assess comparability and applying sequential statistical tests to determine which cohort's geometric mean should be used.

Compiling supplementary data and assigning observations to cohorts

In assessing international benchmark prices, we consider their relevance to Australian market conditions. The cohort variables we have used to determine comparability are population density and real GDP per capita, reflecting comparability in geography and income levels.

[19] For example, multiplying 4 values (0.6, 0.4, 0.1 and 1.1) gives 0.0264; taking the 4th root of this value results in an average of 0.4031.

Table 11: Information required for benchmark prices

Item	Description
Population density	Population divided by the land area of a country, measured in persons per kilometre squared. Population density often correlates negatively with spectrum prices.
Real GDP per capita	Real GDP reflects the value of all goods and services produced in an economy and is also a measure of national income. Real GDP per capita correlates positively with spectrum prices.

Note: World Development Indicators data from the World Bank is used for population density and real GDP per capita. For population density, we use the 'Population density (people per sq. km of land area)' indicator, and for real GDP per capita, we use the 'GDP per capita (constant 2015 US$)' indicator.

Note: For Taiwan, data was sourced from the International Monetary Fund and converted into a format consistent with World Bank data, as equivalent World Bank data were not available for this jurisdiction.

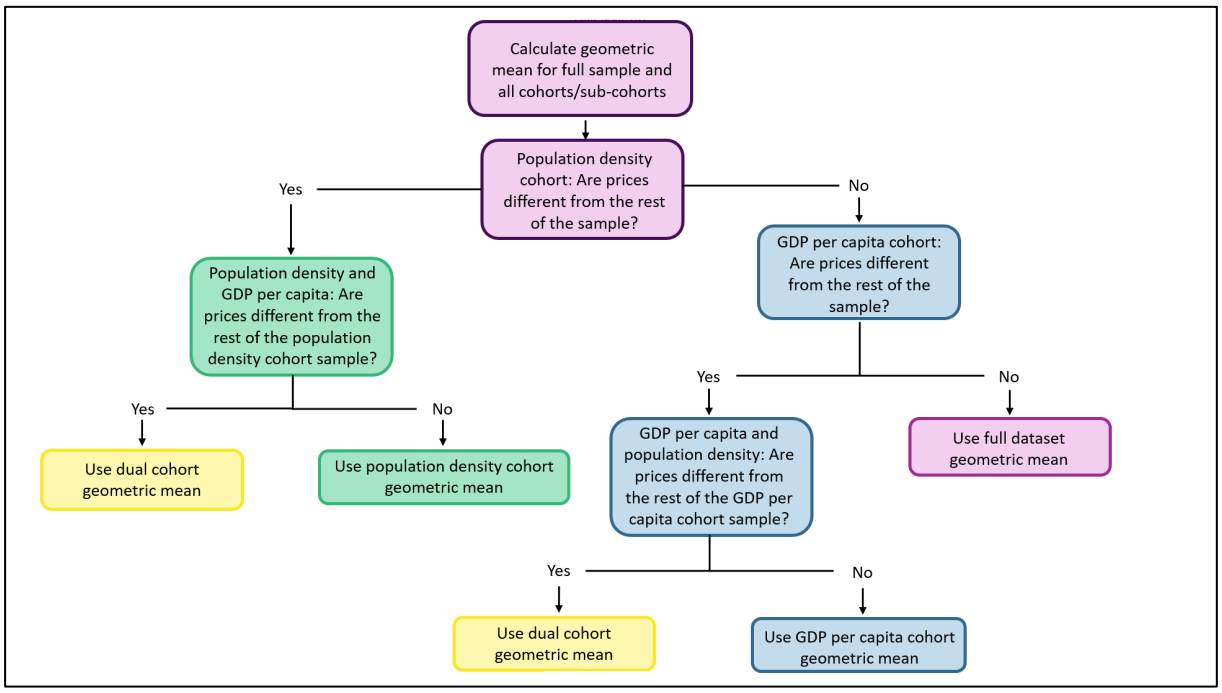
For each benchmark price, we calculate the ratio of the relevant cohort variable for the benchmark country to Australia's corresponding value in the same year. Where a benchmark country's value exceeds Australia's, the ratio is mirrored to ensure that the maximum weight remains one and that proportional deviations in either direction attract the same weight (for example, values that are half or double Australia's both receive a weight of 0.5).

Benchmarks are included in the population density cohort if their ratio is greater than or equal to 0.1, while benchmarks are included in the real GDP per capita cohort if their ratio is greater than or equal to 0.7.

Cohort analysis decision tree

The cohort analysis process uses a sequential decision tree to identify which group of benchmark observations provides the most relevant evidence for Australia. At each step, statistical tests are applied to determine whether the geometric mean should be based on the full sample, a single cohort, or an intersection of cohorts. The diagram below shows how this process works, followed by a step-by-step explanation of each decision point.

Figure 5: Cohort analysis – decision tree diagram



Step 1: Population density cohort test

We first consider observations that fall within the population density cohort and the remainder of the dataset. A Mann-Whitney U test is conducted at the p <= 0.01 significance level to assess whether prices in the population density cohort are statistically different from those in the rest of the sample.

Step 2: Dual cohort subset test (population density and real GDP per capita)

If a statistically significant difference is found, the analysis proceeds to the dual-cohort subset, which includes observations within both cohorts. The Mann–Whitney U test is again conducted for this subset, comparing for statistically significant differences between observations in both cohorts versus observations only in the population density cohort. If evidence of a statistically significant difference is detected, the geometric mean for this group is used. If not, the geometric mean for the population density cohort is used.

Step 3: GDP per capita test

If no evidence is found for the population density cohort, the same process is repeated for the real GDP per capita cohort.

Step 4: Dual cohort subset test (real GDP per capita and population density)

If a statistically significant difference is found, the analysis proceeds to the dual-cohort subset. The Mann–Whitney U test is again conducted for this subset, comparing for statistically significant differences between observations in both cohorts versus observations only in the real GDP per capita cohort. If evidence of a statistically significant difference is detected, the geometric mean for this group is used. If not, the geometric mean for the real GDP per capita cohort is used.

Step 5: Default to full benchmark sample

If neither the population density nor real GDP per capita cohorts show evidence of statistically significant differences, the geometric mean is calculated from the full benchmarking dataset.

Step 7: carry forward valuations to various future dates

Consistent with the approach set out in the updated preliminary views paper, we propose to use inflation (CPI) to carry forward benchmark prices from 2025 to the relevant commencement date of the expiring spectrum licence (ESL).

While CPI remains the basis for this adjustment, the proposed approach has been simplified since our updated preliminary views. We apply a constant annual inflation rate of 2.5% for periods beyond 2025, consistent with the midpoint of the RBA's target inflation range, rather than using a combination of RBA forecasts and inflation assumptions.

To carry forward the estimated present value, we will convert the annual inflation rate (2.5%) into a daily rate and apply it over the number of days between the end of 2025 and the licence commencement date.[20]

Step 8: expand valuations to desired durations

Our final step remains unchanged from our updated preliminary views. We expand the value ranges from 365 days to the desired full licence duration, which can be performed using the flat annuity formula (equation (4)) from step 2. The only difference is that L will equal 365 days, while n will equal the number of days of the desired licence duration.

For example, to convert a valuation from 365 days to 4,784 days (which would be the duration of renewed 3.4 GHz band licences that expire on 18 January 2044), we could use the following flat annuity formula:

$$PV_n = PV_L \times \left\{ \frac{1-\left\{\frac{1}{1+r}\right\}^n}{1-\left\{\frac{1}{1+r}\right\}^L} \right\} \qquad (4)$$

Where:
$PV_n =$ present value of the series of cashflows for the desired licence duration
$PV_L =$ present value of the series of cashflows for the known valuation
$r =$ discount rate – the compounded daily value (0.02233%) of the annual WACC value of 8.49%
$n =$ number of days in the desired licence duration (4,784)
$L =$ number of days for the known valuation (365)

Following the use of this formula, we have estimated a single price that are for the correct year and desired licence duration.

[20] For example, assume the licence commencement date is 1 January 2030, and the present value is currently 31 December 2025. There are 1,462 days between the end 2025 and the licence commencement. An annual inflation rate of 2.5% corresponds to a daily compounded rate of approximately 0.006765%. Applying this rate over 1,462 days results in a CPI index value of 1.103962, calculated as (1 + 0.006765%)^1462.