



Submission in response to
ACMA Consultation Paper

**Expiring spectrum
licences Stage 4:**

**Updated preliminary views
on pricing**

Public Version

February 2026

EXECUTIVE SUMMARY

The prices that the ACMA set for renewal of expiring spectrum licences (**ESLs**) between 2028 and 2032 will have significant consequential impacts on Australian consumers' continued access to world class mobile capabilities over the next 2 decades. Ensuring that renewal prices are reasonable is essential to sustaining a competitive and innovative mobile market in Australia. Getting pricing right will enable mobile network operators (**MNOs**) to continue investing in faster network speeds, greater capacity, broader and better coverage, innovation and next generation capabilities, supporting the digital needs of consumers across Australia. Getting pricing wrong will mean MNOs will face difficult trade-offs around future investment with corresponding impacts on consumers.

Across the earlier ESL pricing consultation stages, spectrum licensees provided broadly aligned feedback supporting the retention of the Mobile Service Revenue (**MSR**) index, use of spot pricing exchange rates, inclusion of renewal benchmarks, exclusion of outliers and the application of public interest pricing considerations.

The DotEcon methodology deviates significantly from the earlier preliminary approach. These modifications have a substantial influence on the resulting price levels. DotEcon's peer review concluded that the original methodology in Stage 3 was reasonable; however, the updated approach departs from several of its core elements.

This paper responds to the ACMA's issues for comment by setting out Optus' concerns with the changes the ACMA has adopted to the benchmarking methodology in stage 4 of the ESL process, offers suggestions for how these concerns can be addressed, proposes an alternative pricing methodology based on benchmark data for consideration and addresses 'other pricing considerations' as proposed by the ACMA.

Optus has also commissioned an independent assessment of the DotEcon price benchmarking methodology by Coleago Consulting. This is attached as Appendix 1. Key insights from that analysis are referenced or included throughout this submission where appropriate.

The outcomes of price benchmarking are heavily influenced by modelling choices

At its core, price benchmarking is an exercise in applying statistical methods to a set of known existing data points to derive a reasonable estimate of a current price. Inherent in adopting a benchmarking approach is acceptance that the datapoints are relevant and getting the statistical approach right is critical. To this end, there are several key aspects of the stage 4 benchmarking methodology that must be addressed to ensure the approach generates reasonable pricing:

1. Addressing outliers in the data sets

Benchmarking analysis undertaken with a small number and very wide spread of data points is highly sensitive to outliers. Adopting a reasonable outlier removal approach will lead to benchmarking outputs that are more statistically sound and appropriately representative of spectrum valuations in comparable markets. Coleago¹ have outlined a recommended approach to identifying outliers and has calculated the impact of their removal on price per MHz per population (**PMP**) for each band in the table below.

¹ Appendix 1, section 11.3

	Coleago outlier removal method reduction %
Sub 1 GHz Band	4 - 7%
Lower 1 – 3 GHz Band	8%
Upper 1 – 3 GHz Band	11%
3.4 GHz Band	22%

Table 1: Summary of Outlier removal impact on single price per band

2. Accounting for strong evidence of downward trends in spectrum prices

Using a central estimate methodology to set a single price on a data set that shows a clear and long running downward trend in spectrum prices will inherently produce a price that is above current valuations of spectrum. Extrapolating trends provide a reasonable sense check on the outputs of a benchmarking approach. The simplified diagram below illustrates the significant overvaluation that can occur without appropriate trend-based adjustment.

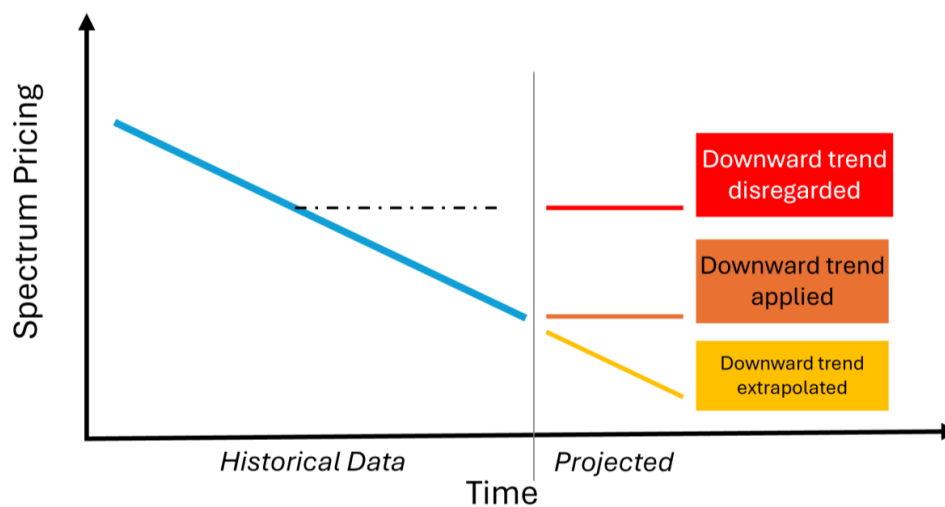


Figure 1: Illustrative impact of trend-based adjustment on spectrum pricing

3. The indexation approach taken to make historical (and future) valuations current

While there is an attractive simplicity in the idea of using Consumer Price Index (**CPI**) data to adjust spectrum valuations over time, CPI is fundamentally disconnected from the realities of spectrum valuation by operators. This is particularly exacerbated by the significant divergence between general consumer inflation and the real reduction in telecommunications prices (and telecommunications sector specific CPI) over the last 10 years. Put simply, using CPI in the benchmarking methodology will lock in an inflationary driver to one of the largest cost components of running a mobile network over the coming decade, leading to higher consumer prices and less capital available for network investment. The ACMA should revert to the far more representative MSR index which reflects the value of spectrum to MNOs relative to their ability to generate revenues.

4. Currency conversion method selection

Using spot exchange rates, appropriately smoothed to reduce short term volatility, is a more representative means of converting international spectrum prices into Australian dollars for the benchmarking process than using Purchasing Power Parity (**PPP**). PPP, as with CPI above, is constructed based on a basket of household goods and services which has limited relevance to the financial considerations (including global equipment sourcing) of running a mobile network.

5. Dataset selection (exclusion of renewal prices)

In contrast with the treatment of outliers by DotEcon (i.e. data points that have the least relevance to Australian spectrum values have not been removed from the dataset), renewal datapoints have been removed. This is particularly concerning as renewal data points best represent the policy considerations that regulators and governments have when considering spectrum renewals, and therefore these data points are likely to be the most relevant in a benchmarking process aimed at setting renewal prices. Optus strongly recommends renewal data points be re-instated to the benchmarking data set.

While assessment of each of these aspects in isolation will naturally involve pros and cons and will elicit different views from stakeholders, it is concerning that for each of these aspects the ACMA has taken the position that results in an inflationary impact on the price outputs of the benchmarking, as illustrated by figure 2 below.

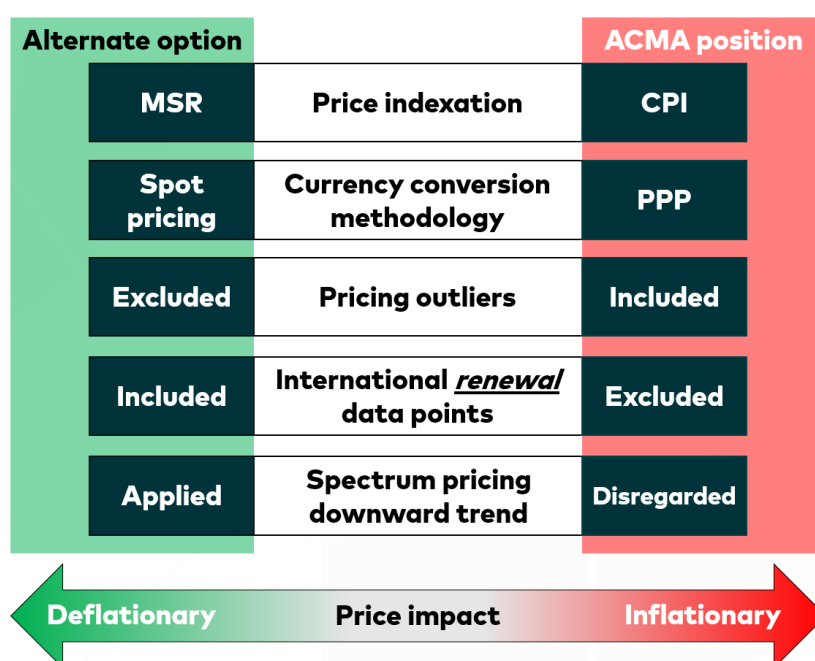


Figure 2: Summary of benchmarking measures and DotEcon/ACMA's position in updated preliminary pricing

Adopting our proposed adjustments to the treatment of outliers and the indexation method (as explained in this paper) alone result in a reduction in the industry spectrum cost to ~\$4.8 billion (down from \$7.3 billion).

Risk based pricing offers a simpler alternative approach to deriving prices from the benchmarking methodology

If the ACMA is not minded to adopt adjustments to the benchmarking approach as outlined in this paper, it is open for the ACMA to consider an alternative approach to deriving prices from the benchmarking dataset. Coleago has proposed a risk-based construct that avoids many of the data set complexities and assumptions inherent in the DotEcon benchmarking methodology. This approach treats the benchmark data points as a range where the highest priced data point represents the highest level of risk, and the lowest data point being the lowest risk. Risk in this context represents the likelihood of one or more MNOs electing not to fully renew their licence. A price is then set at a point in the range that represents the regulator's risk appetite.

Coleago suggest setting prices at a point where 20% of benchmarked data points for the band sit below the proposed price and 80% above, which is in line with the mode (the most likely outcome) of the data set. This would indicate a confidence level of 80% that all licensees would renew their spectrum holdings in the band in full. The ACMA would be reasonable in seeking to

reduce risk of partial non-renewal and the subsequent flow on effects of spectrum /market consolidation and/or spectrum lying fallow and therefore be cautious about increasing the risk profile beyond 20% non-renewal 80% renewal proposed by Coleago.

For completeness, figure 3 below sets out the range of possible price outcomes for industry and Optus driven by each of: the benchmarking approach with indexation and outlier adjustments applied, two variants of the Coleago risk-based pricing approach based on 20% / 80% (including and excluding CPI) and includes the stage 3 envelope and the updated preliminary pricing from stage 4.

	Industry	Optus
ACMA Preliminary Price Range Stage 3	\$5.0 - \$6.2 billion	\$1.19 - \$1.48 billion
ACMA Updated Preliminary Price Stage 4	\$7.3 billion	\$1.92 billion
Coleago DotEcon Adjusted	\$4.8 billion	\$1.16 billion
Coleago 80% Risk based Benchmark Inc CPI	\$3.3 billion	\$0.79 billion
Coleago 80% Risk based Benchmark Exc CPI	\$2.8 billion	\$0.67 billion

Figure 3: impact of methodology changes on spectrum prices

Adjusting the risk level under a risk-based pricing approach would have a corresponding impact on pricing. This is expanded upon in the Coleago paper attached at Appendix 1.

Spectrum licence fee payment should be due 1 month prior to renewal, with the option for instalment payments made available

Finally, and as outlined in our submission in response to the ACMA's application and decision-making process consultation, the ACMA should adjust the proposed processes to require payment for renewed licences to be due 1 month prior to the renewal taking effect and should reconsider the case for supporting instalment-based payment arrangements. This will provide a more efficient, sustainable and equitable approach to ESL renewal fees.

UPDATED PRELIMINARY VIEW OF ESL PRICING

This section sets out Optus' responses to the specific issues posed by the ACMA in the discussion paper.

Revisions to the benchmarking study and updated preliminary pricing

- Issue 1. Revisions to our benchmarking methodology, such as expanding the benchmarking dataset, focusing on purchasing power parity (PPP) exchange rates, amending our indexing methodology, applying time trend adjustments, and our approach to deriving a single preliminary price for each ESL band.
- Issue 2. Our updated preliminary views on pricing for each ESL band with wide-area wireless broadband (WA WBB) or fixed wireless access (FWA) use

The Stage 3 ESL preliminary pricing methodology was developed with advice from Plum Consulting, Ian Martin Advisory and Frontier Economics—organisations well established in the Australian telecommunications regulatory landscape, and with Plum Consulting previously engaged by the Department during the 2009–2010 renewal process. This earlier methodology formed the basis for extensive consultation with stakeholders and was broadly understood, stable, and supported.

In contrast, the updated benchmarking study and accompanying peer review by DotEcon represents a substantial departure from that framework. Many elements of the original methodology have been either removed or materially altered, resulting in two sets of pricing outputs – prepared by respected experts using the same underlying data concept, that nevertheless diverge significantly. This inconsistency underscores an inherent limitation in relying on international benchmarking as the primary tool for determining renewal pricing.

Several of the strengths of the preliminary benchmarking methodology canvassed during the Stage 3 consultation have not been retained in the updated approach. The shift away from previously considered elements – such as the MSR index and spot pricing for currency conversion, combined with the introduction of new adjustments, has resulted in materially higher prices across spectrum bands, well outside the preliminary range previously consulted upon for three of the four data sets.

Benchmarking also faces structural limitations when used for renewal pricing. Changes in technology, spectrum supply, and market conditions mean that the value of licences at the time of reissue may diverge materially from historical auction outcomes. This challenge is compounded by the risk that the benchmarking methodology could be modified before each application period, creating meaningful uncertainty for licensees and increasing pricing risk for operators preparing renewal decisions.

There is no single international market value for spectrum. No global market for spectrum exists and spectrum is not transferable between countries, with each market defined by their own domestic characteristics placing upward or downward pressure on prices.

Spectrum holders do not value spectrum based on global benchmarks as they are irrelevant to the domestic market. This is demonstrated through the significant variability in each of the data sets showing that different markets assign very different values to spectrum.

DotEcon Updated Methodology and Benchmarking Data

While Optus supports the intention to simplify the approach and adopt assumptions that are transparent and consistently applied, the revised methodology now incorporates a number of new assumptions and metrics. Taken together, these changes significantly distort the earlier price range and introduce a high degree of sensitivity to variable selection.

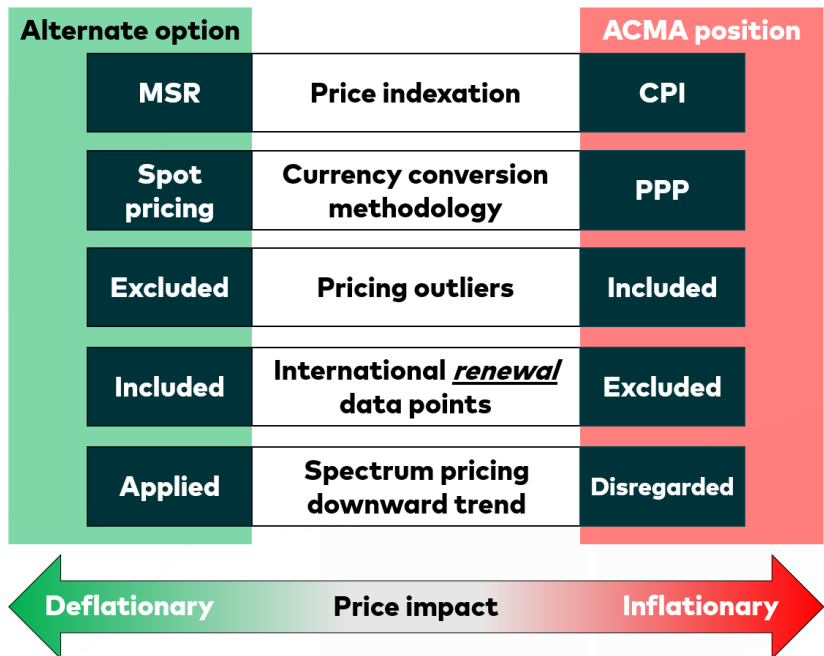


Figure 4: Summary of benchmarking measures and DotEcon/ACMA’s position in updated preliminary pricing

Figure 4 summarises the key metrics used in DotEcon’s spectrum benchmarking report along with the impact on pricing for each option. It is concerning that at every step DotEcon and the ACMA have adopted a combination of adjustment measures which inflates the spectrum prices.

It would be equally concerning if the selection of all measures in a combination simply drove down the price. A balanced approach would identify the bias impact of each decision in combination with other settings, with the collective impact of the chosen settings being used to derive a reasonable spectrum renewal price. It is noted that many of the metrics are interrelated and that positions on individual elements may change depending on views on other individual elements.

The interdependencies among the measures is beyond the scope of this response due to the vast permutations and combinations it may deliver. The following sections therefore set out Optus’ responses to each of the benchmarking measures separately and as independent variables.

Treatment of Outliers in the Benchmarking Dataset

The inclusion of outlier points in the benchmarking dataset materially inflates the preliminary pricing outcomes and overstates the likely market value of spectrum in the Australian context. Optus considers it important to test the validity of the assertion that the median and geometric mean ensure that extreme values do not disproportionately influence the final price.

This section demonstrates how sensitive the single price per band is to the presence of outliers. If a small number of points wield a significant influence on the band single price, then it casts doubt on the applicability of central estimate methodology to that dataset. Graphs for each benchmarking dataset based on the Stage 4 DotEcon Excel files illustrate the outlier points. We

then draw on the analysis of Coleago Consulting to outline the a priori justifications for removing the identified outliers.

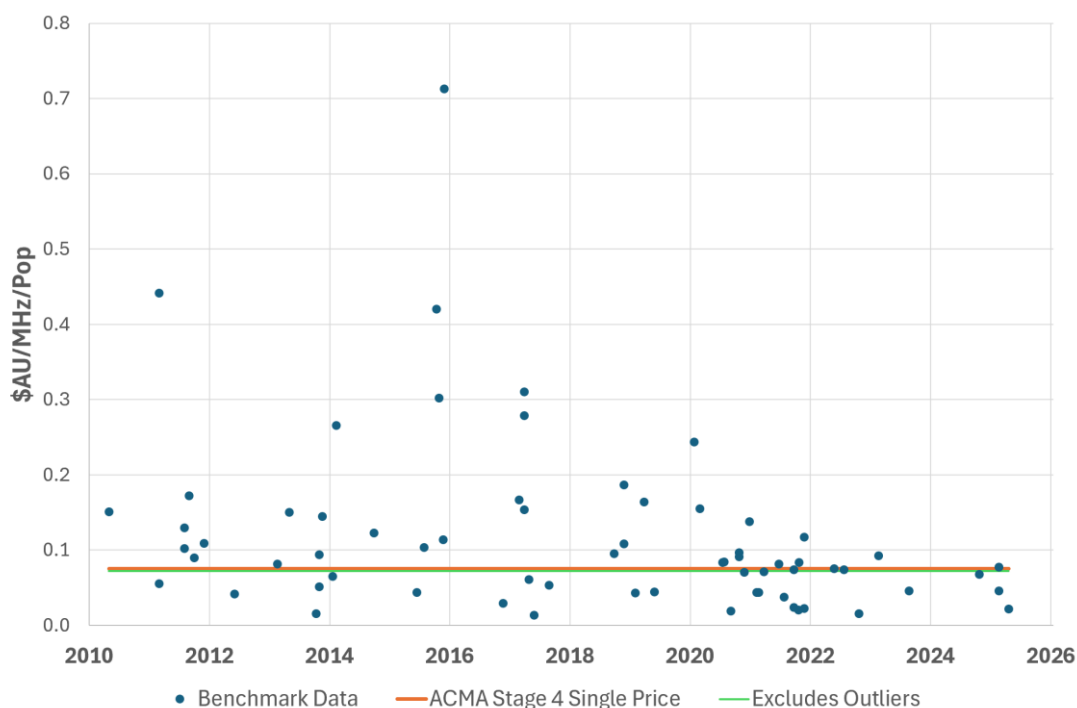


Figure 5: Sub 1GHz benchmark data

Figure 5 charts the benchmarking data used in the DotEcon analysis for the Sub 1 GHz Band. This has been plotted using the \$AU/MHz/Pop/year data and clearly identifies some outliers. Note that this chart uses a linear vertical scale to provide a simpler visual representation of the data (as opposed to the logarithmic scales used in the ACMA consultation papers).

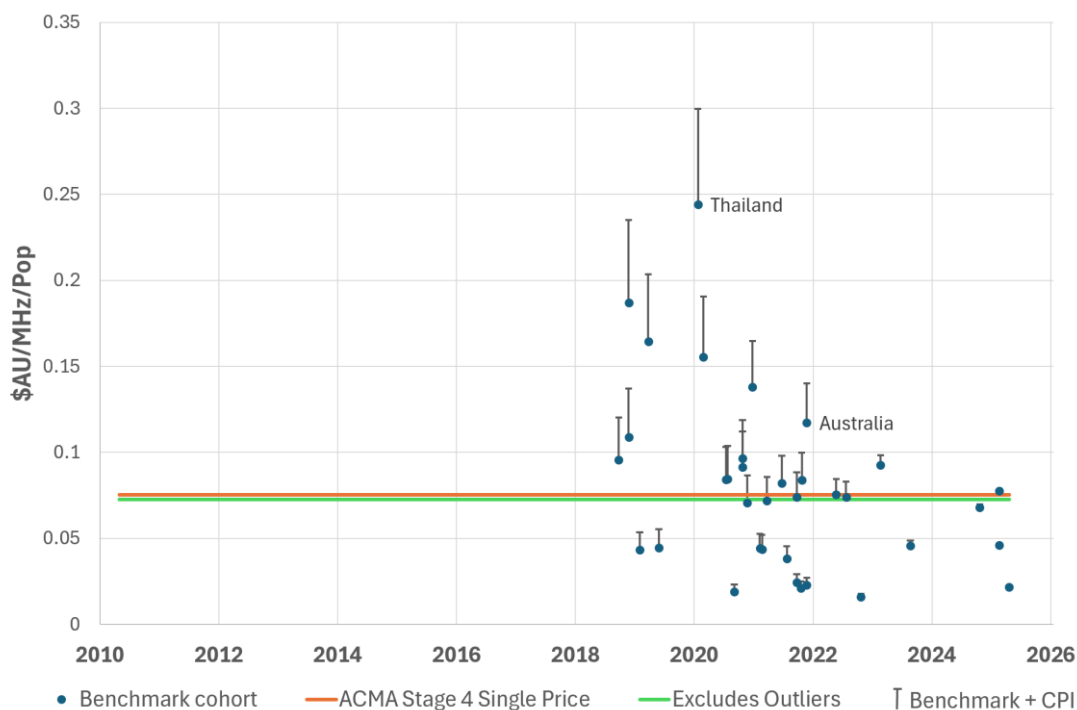


Figure 6: Sub 1 GHz benchmark cohort data and CPI used to determine Stage 4 single price

Figure 6 shows the cohort data which is used for the central estimation of prices for the sub 1 GHz Band. For this band the cohort was restricted to 2018 onwards in which the Thailand data point appears to be an obvious outlier. The chart further illustrates the impact of CPI data on the benchmarks by the bars per point. Whilst it is well understood that application of CPI increases the prices of older data more compared to more recent prices, and that applying a percentage increase to a large figure is greater than to a small figure, the chart clearly illustrates how much CPI further exacerbates the impact of distant outliers to the data set.

	\$AU/MHz/Pop	Reduction %
ACMA Stage 4 Single Price	0.0755	
Removal of Outlier - Thailand	0.0725	4%

Table 2: Sub 1 GHz band single price and outlier impact

Table 2 shows the ACMA Stage 4 Single Price and the re-calculated single price (using the same geometric mean methodology) with the Thailand data point excluded. The removal of this single data point results in a 4% reduction in price. It is a reasonable assessment that when reviewing this metric in isolation from the other steps, this outlier data point should be removed from the calculation.

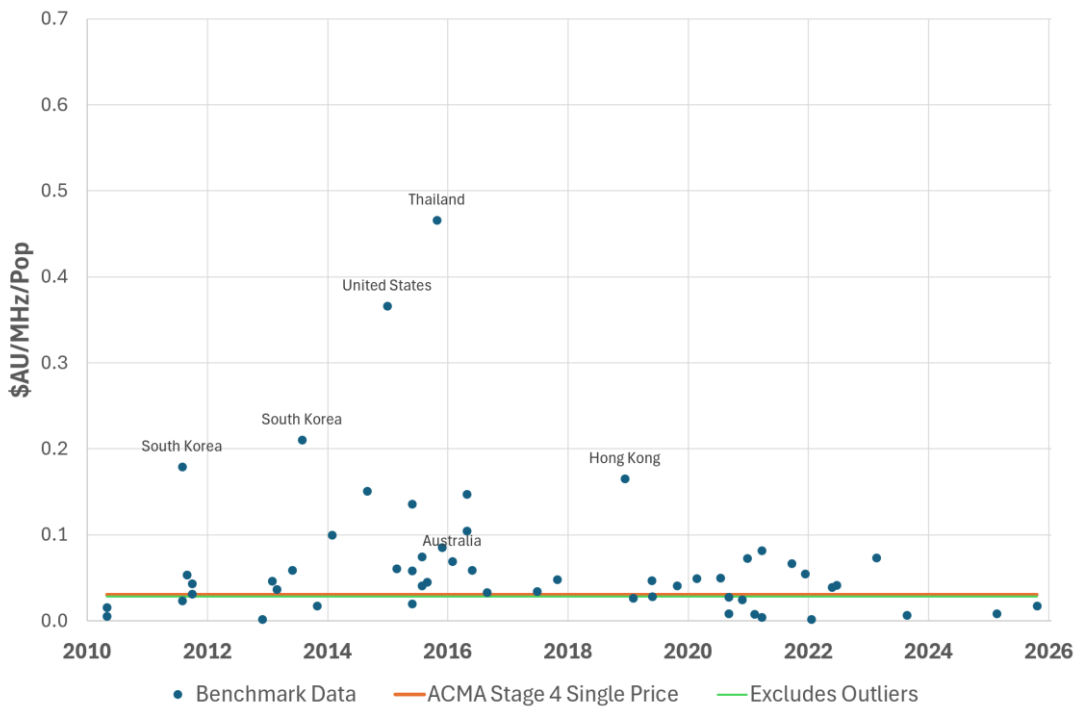


Figure 7: Lower 1-3 GHz benchmark data

Figure 7 charts the benchmarking data used in the DotEcon analysis for the lower 1-3 GHz Band. This has been plotted using the \$AU/MHz/Pop/year data against the date. Note that the chart uses a linear vertical scale to provide a simpler visual representation of the data (as opposed to the logarithmic scales used in the ACMA consultation papers).

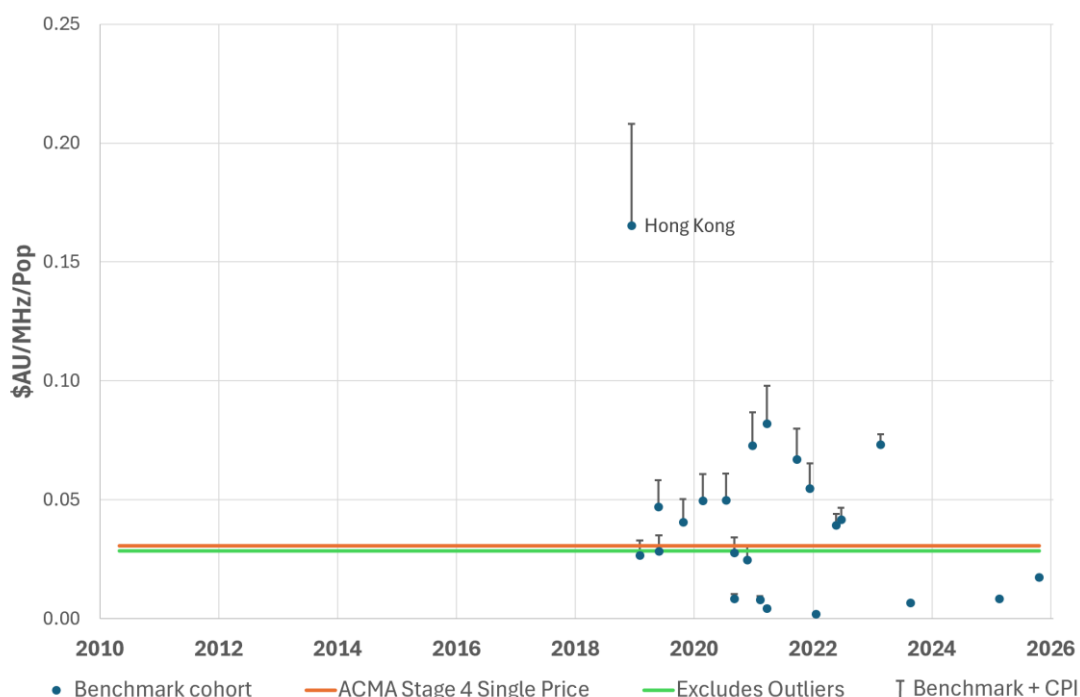


Figure 8: Lower 1-3 GHz Benchmark Cohort Data and CPI used to determine Stage 4 single price

Figure 8 shows the cohort data which is used for the central price estimate for the lower 1-3 GHz Band. The vertical scale has been reduced from the full benchmark data to show greater granularity of the data points. For the lower 1-3 GHz Band the cohort was restricted to Dec 2018 onwards. The chart illustrates the impact of CPI data on the benchmarks by the bars per point. Similarly to the sub 1 GHz Band, the chart illustrates how much CPI further exacerbates the impact on obvious outliers to the data set.

For the lower 1-3 GHz band, the upper bound of the population density cohort IQR is the final step in the calculation of the single price point. However, as it is an adjustment to the geometric mean, it does not influence the outlier impact.

	\$AU/MHz/Pop	Reduction %
ACMA Stage 4 Single Price	0.0310	
Removal of Outlier – Hong Kong	0.0285	8%

Table 3: Lower 1-3 GHz band single price and outlier impact

Table 3 shows the ACMA Stage 4 Single Price and the re-calculated single price (using the same geometric mean methodology) with the Hong Kong data point excluded. This results in an 8% reduction in price. Optus considers the inclusion of the Hong Kong point in this cohort dataset to be in error. It is the first point to be included and the decision to restrict the data based on time is not uniform between the sub 1 GHz and the lower 1- 3 GHz bands.

The removal of a single point in the lower 1-3 GHz band results in an 8% reduction in the benchmark price. The Hong Kong data point should not be included in the calculation.

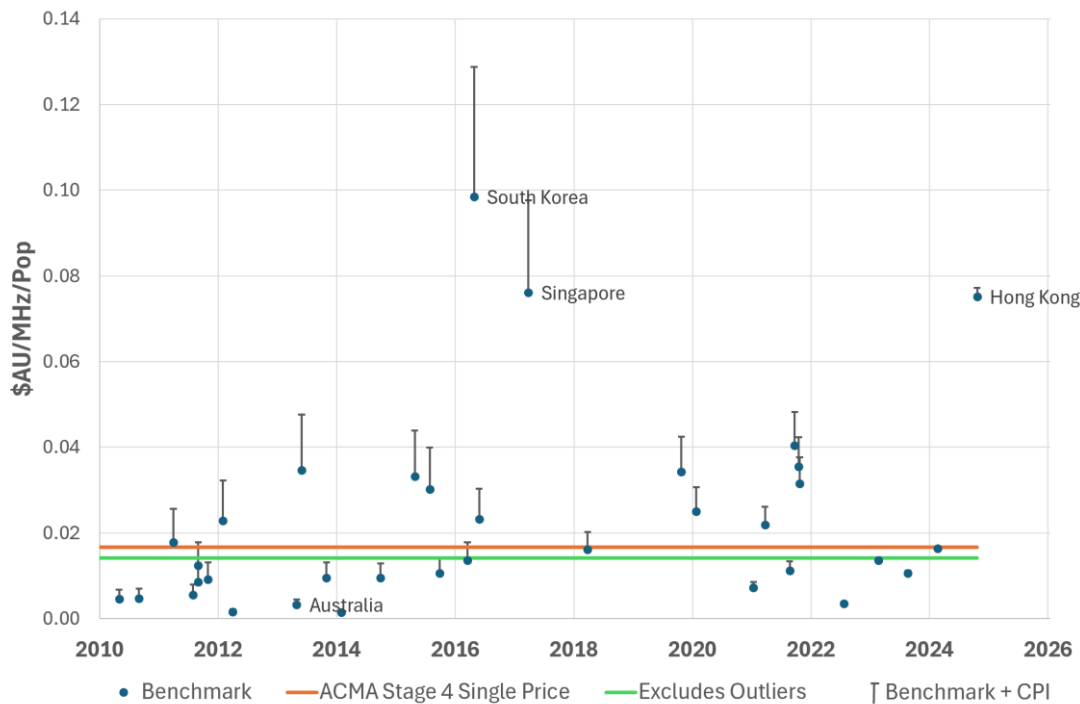


Figure 9: Upper 1-3 GHz Benchmark Data and CPI used to determine Stage 4 single price

Figure 9 charts the benchmarking data used in the DotEcon analysis for the upper 1-3 GHz Band. This has been plotted using the \$AU/MHz/Pop/year data against the date. Note that this chart uses a linear vertical scale to provide a simpler visual representation of the data (as opposed to the logarithmic scales used in the ACMA consultation papers).

For this band the full dataset from 2010 is used as the cohort data. The chart indicates the impact of CPI data on the benchmarks by the bars per point. Similarly to the sub 1 GHz and lower 1 – 3 GHz Bands, the chart illustrates how much CPI further exacerbates the impact on large outliers to the data set.

	\$AU/MHz/Pop	Reduction %
ACMA Stage 4 Single Price	0.0167	
Removal of Outliers – South Korea, Singapore	0.0149	11%
Removal of Outlier – South Korea, Singapore, Hong Kong	0.0142	15%

Table 4: Upper 1-3 GHz Band Single Price and Outlier Impact

Table 4 shows the ACMA Stage 4 Single Price and the re-calculated single price (using the same geometric mean methodology) with the outlier points removed. This has been calculated for 2 scenarios, one being South Korea and Singapore removed and the other with South Korea, Singapore and Hong Kong removed. The results are a 11% reduction in price for the South Korea and Singapore removal and a 15% reduction in price for the South Korea, Singapore and Hong Kong removal.

Optus considers that these outliers should be removed from the benchmark as they have a material impact on the single price.

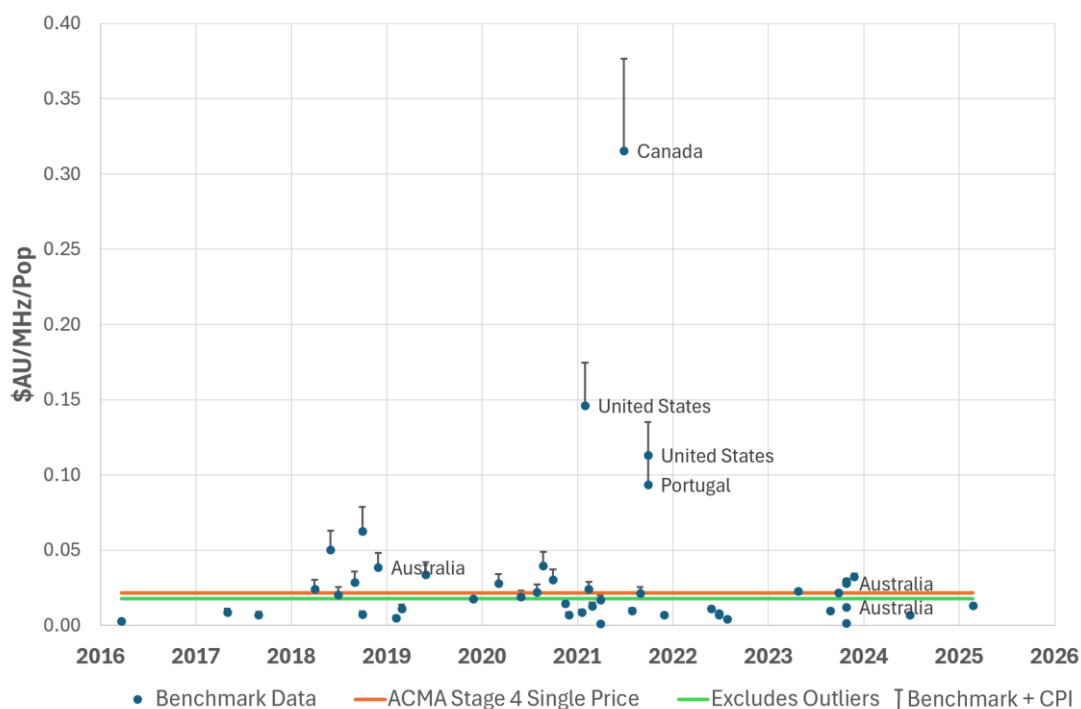


Figure 10: 3.4 GHz Benchmark Data and CPI used to determine Stage 4 single price

Figure 10 charts the benchmarking data used in the DotEcon analysis for the 3.4 GHz Band. This has been plotted using the \$AU/MHz/Pop/year data against the date. Note that this chart uses a linear vertical scale to provide a simpler visual representation of the data (as opposed to the logarithmic scales used in the ACMA consultation papers).

For this band the full dataset is used as the cohort data, noting the time series starts in 2016 rather than 2010 as per previous bands. The chart indicates the impact of CPI data on the benchmarks by the bars per point. Similarly to the sub 1 GHz, lower 1 – 3 GHz and upper 1 - 3 GHz Bands, the chart illustrates how much CPI further exacerbates the impact on large outliers to the data set.

	\$AU/MHz/Pop	Reduction %
ACMA Stage 4 Single Price	0.0217	
Removal of Outliers – Canada	0.0208	4%
Removal of Outliers – Canada, United States	0.0189	13%
Removal of Outliers – Canada, United States, Portugal	0.0178	18%

Table 5: 3.4 GHz Band Single Price and Outlier Impact

Table 5 shows the ACMA Stage 4 Single Price and the re-calculated single price (using the same median methodology) with the outlier points removed. This has been calculated for 3 scenarios, one being Canada removed, the second with Canada and 2 x United States points removed and the third with Canada, 2 x United States and Portugal removed. The results are a 4% reduction in price for the Canada removal, a 13% reduction in price for the Canada and 2 x United States removal and a 18% reduction for the Canada, 2 x United States and Portugal removal.

Optus considers that these outliers should be removed from the benchmark as they have a material impact on the single price.

Benchmarking Methodology and Outlier removal – Coleago

As described by Coleago, the updated benchmarking methodology departs significantly from established statistical practice regarding the treatment of outliers. In particular, DotEcon’s position that outliers should not be removed unless there are explicit a priori reasons is inconsistent with its own long-standing approaches in regulatory work for Ofcom and ComReg (2013–2021). In those studies, DotEcon applied systematic outlier-removal criteria, most notably, excluding data points that lie more than three times the inter-quartile range above the 75th percentile, on the basis that extreme observations distort market value estimates and compromise the reliability of central estimates.

DotEcon’s decision not to remove outliers in the Australian ESL benchmarking dataset represents a significant and unjustified departure from these earlier methodologies. The decision appears driven more by a desire to retain maximum sample size (and consequently increase calculated prices) rather than by adherence to sound statistical reasoning.

Optus supports the view, consistent with Coleago Consulting’s analysis, that outliers must be removed from the data set used to derive a single price. This is particularly true in cases where extreme values arise due to structural differences between Australia and the countries sampled – such as very high population densities, artificially induced spectrum scarcity, or non-comparable auction environments. These characteristics constitute clear a priori reasons for exclusion.

Coleago Exhibit 35: Extreme outliers identified by applying DotEcon’s criteria

Su- 1 GHz	Lower 1-3 GHz	Upper 1-3 GHz	3.4 GHz
Thailand (2020)	Hong Kong (2018)	Singapore (2017)	Canada (2021)
		South Korea (2016)	Portugal (2021)
			US (2021)
			US (2021)
			Italy

Source: Coleago

Coleago’s analysis (exhibit 35) identifies nine extreme outliers across the four band groups. These outliers are overwhelmingly associated with markets such as Singapore, Hong Kong and South Korea – jurisdictions with population densities that are 176 – 2,747 times higher than Australia. These market characteristics fundamentally alter the economics of spectrum deployment and valuation, making these data points highly unsuitable for direct comparison and inappropriate as inputs for Australian renewal pricing.

Coleago have provided additional insight as to why the specific outliers should be removed from the dataset in sections 3 and 11.3 of their paper.

DotEcon’s claim that the removal of outliers would have only a “minimal impact” on pricing is inconsistent with the quantitative evidence presented by Coleago. Coleago’s Exhibit 40 shows that removing extreme outliers materially lowers the geometric mean in every band category:

Coleago Exhibit 40: % decrease in geometric mean by removing outliers

	Sub 1GHz	Lower 1-3 GHz	Upper 1-3 GHz	3.4 GHz
Extreme outliers	-4%	-8%	-11%	-22%
All outliers (including extreme)	-7%	-8%	-11%	-22%

Source: Coleago

These are substantial impacts, particularly given that the geometric mean is used as the basis for deriving the single renewal price per band. The continued inclusion of these extreme observations materially inflates the preliminary pricing outcomes and overstates the dataset benchmark values and the likely market value of spectrum in the Australian context.

In summary,

- DotEcon’s deviation from its own historic outlier-removal methodology lacks justification and inflates ESL prices.
- Extreme outliers arise from markets with economic and demographic characteristics that are fundamentally incomparable to Australia.
- Coleago analysis shows that removing these outliers materially reduces calculated prices (up to 22% in the 3.4GHz band).
- Extreme outlier inclusion compounds other methodological issues (CPI indexing, MSR removal, small sample sizes), producing renewal prices that cannot reasonably be interpreted as reflecting Australian market value.

For these reasons, the ACMA should reinstate outlier-removal procedures consistent with international best practice.

Recognition of Downward Pricing Trends in Spectrum Markets

A consistent and well-documented downward trend in global spectrum prices over the past decade has been acknowledged by regulators, industry bodies and independent consultants, including the ACMA’s own advisers in Stage 3 of the ESL process. The trend reflects structural market dynamics such as increased spectrum supply, improvements in spectral efficiency, maturing mobile markets, and the diminishing marginal value of additional bandwidth for established operators.

Multiple international studies, including those by the GSMA, confirm that spectrum prices have fallen materially over the last 10 – 15 years, even before adjusting for underlying revenue and profitability trends in the mobile sector. This decline is further illustrated in the long-term MSR index used in the ACMA’s preliminary benchmarking methodology, which demonstrated substantial real-term reductions across all major band categories. In effect, operators are generating lower revenue per MHz than in previous cycles, while the volume of available spectrum continues to rise. This places strong downward pressure on the sustainable market value of spectrum.

Given this backdrop, benchmarking methodologies must properly recognise the long-term direction of spectrum prices rather than relying on nominal, unadjusted auction results. Benchmarking models that fail to incorporate declining price trends risk producing distorted price estimates that are neither representative of global market conditions nor aligned with the economic realities of the Australian mobile sector. This risk is particularly acute where methodologies introduce inflationary components – such as CPI uplift, or exclude mechanisms

like the MSR index, which was explicitly designed to adjust for downward revenue and price trajectories.

A robust and credible benchmarking framework must therefore apply trend adjustments that reflect the well-established decline in global spectrum prices and ensure that benchmarked prices reflect the economic value of spectrum in a mature, substitutable, highly competitive mobile market.

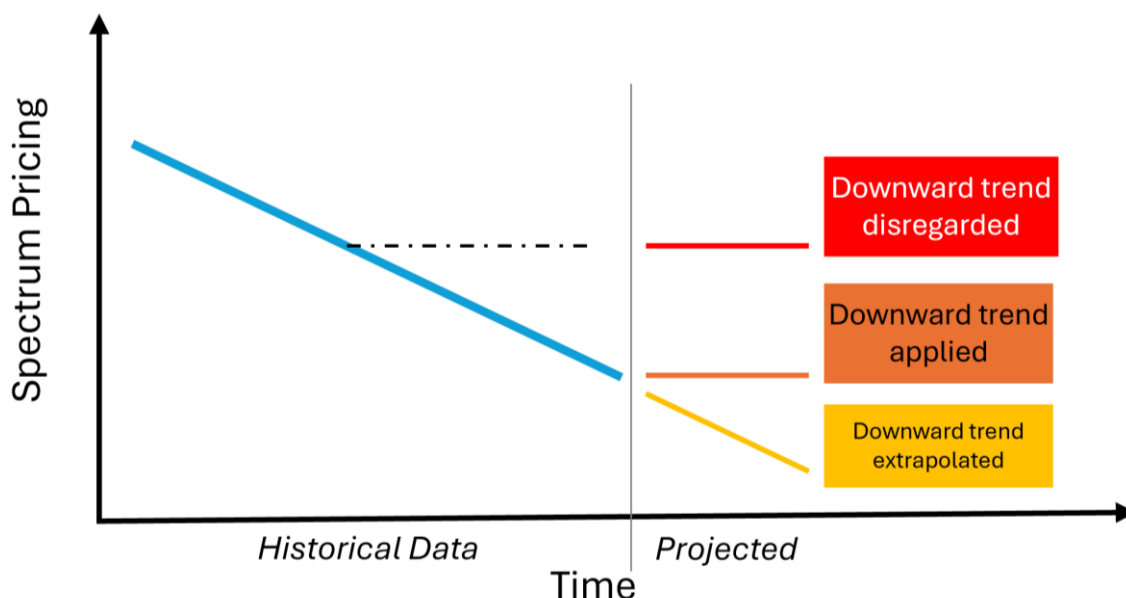


Figure 11: Illustrative impact of trend-based adjustment on spectrum pricing

Figure 11 is a representation of the historical downward trend in international spectrum prices. When using a central estimates methodology to determine a single price, if the trend is disregarded, the result would be the average of the datapoints, i.e. midway between the highest and lowest points. This scenario is illustrated in the chart as the red line in the projected trend time. This is the methodology used in the DotEcon analysis, and this delivers the highest value. If the downward trend is considered, then the lowest point would be the basis of the projected line. Using this and assuming that there is no further downward trend would result in the orange line. If the downward trend is expected to continue then the yellow line represents an extrapolation of the trend, and this would then be used to determine a variable price over the projected timeframe.

Recognising the downward pricing trend is not optional – it is essential to ensure that ESL renewal prices are evidence-based, economically grounded, and aligned with the long-term public interest objectives of investment, innovation, and sustainable competition in the Australian mobile sector.

There remain inherent challenges with the use of benchmarks to set future pricing. The GSMA has also expressed concern regarding use of historic benchmarks particularly due to falling prices, *“Regulators should not anchor administratively set prices to historical prices either those observed in other markets, or the market in question. Given the falling price of spectrum over the past decade, they are unlikely to reflect the current reality of the domestic market.”*²

² GSMA – Spectrum prices May 2025

This issue is compounded by benchmark selection focused on perceived market value and based on global spectrum auction prices to set renewal prices. Optus does not support this approach, particularly the exclusion of spectrum renewal prices observed in other jurisdictions.

DotEcon's analysis of long-term price trends (section 4.3, Figure 2) indicates a downward trajectory in spectrum auction values across all bands, even where pre-2018 data is excluded.

Discontinuing CPI Adjustments and Restoring the MSR Index

Optus recommends that the ACMA reject the use of CPI indexation in the benchmarking methodology and reinstate the MSR index, which was a core element of the preliminary pricing model and remains the only economically relevant inflator/deflator for spectrum valuation.

CPI Is Not Relevant to Spectrum Valuation

The application of Australian CPI to historic auction prices is inappropriate and introduces significant upward distortions into renewal pricing. CPI reflects changes in pricing of consumer goods and services, most of which bear no relationship to the cost drivers or valuation methodologies applied to mobile networks. Spectrum is a production input, not a consumer good, and is valued by operators based on long-term traffic forecasts, technology efficiency, site deployment costs and discount rates, and how all of these factors contribute to an ability to generate profitable revenue.

Further, the telecommunications sector has experienced substantial real-term price declines over the last decade in comparison to all other sectors in the CPI. As illustrated in figure 12 below, the Australian telecommunications sector has experienced sustained deflation since 2015, with telecommunications prices falling by more than 20%. This makes it the weakest-performing sector within the Australian CPI index.

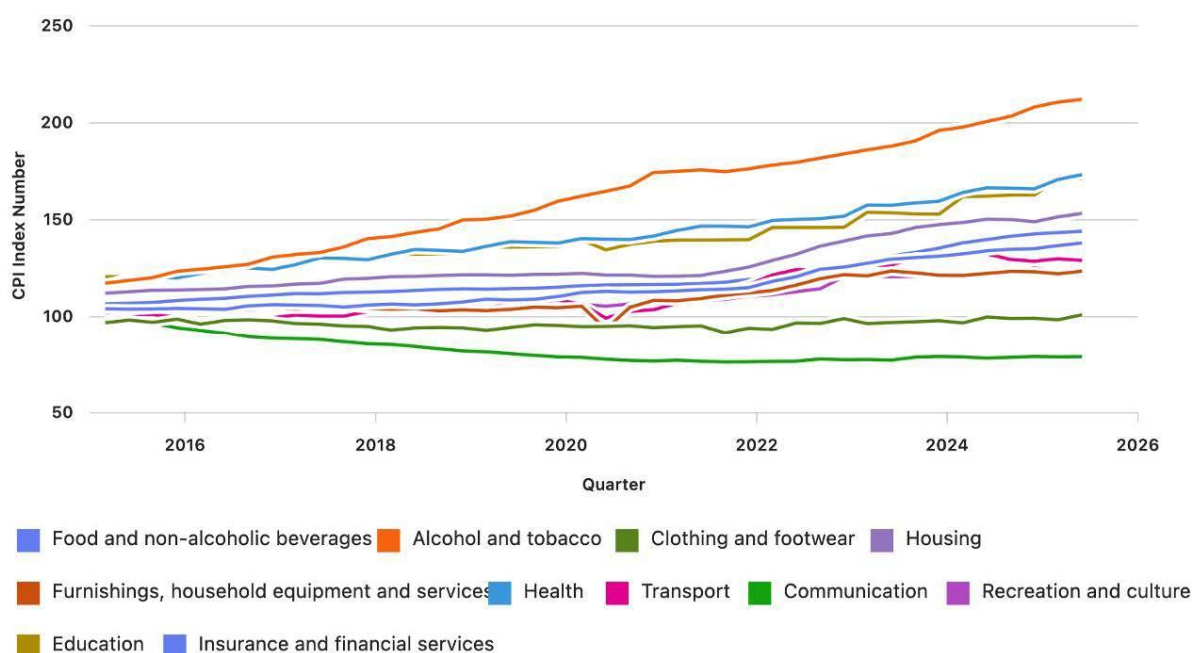


Figure 12: ABS CPI data indexed to 2015, chart from ATA³

³ Australian Telecommunications Alliance Submission to Treasury Re 2025-26 Pre-Budget submission

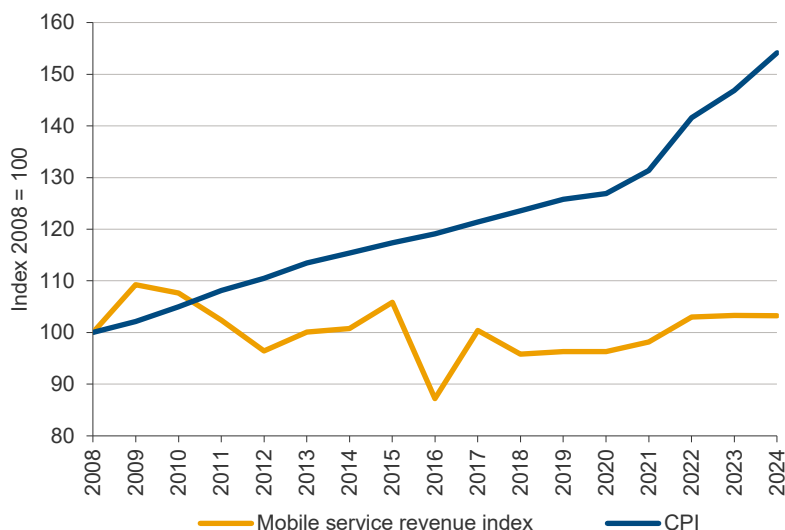
Notwithstanding the inappropriateness of using CPI over the MSR index, if CPI was to be used it would be more appropriate to use the telecommunications sector specific CPI rather than the headline, whole of Australian economy CPI. Using the sector metric would result in an ESL price reduction, which is appropriate for an industry that has experienced sustained declines in revenue and profitability.

Mobile retail prices have fallen significantly while CPI has risen, demonstrating that sector-specific cost and price dynamics diverge substantially from broad CPI trends. Applying headline CPI therefore artificially inflates spectrum values and contradicts both industry economics and historical price behaviour.

The use of CPI is also inconsistent with the ACMA's own past conclusions. In the previous ESL renewal process, the ACMA's consultants explicitly rejected CPI adjustments, noting that inflating auction receipts using CPI would overstate value and fail to account for increased spectrum supply and technological change. Those same conditions apply today, only more acutely given the substantial planned release of additional low, mid and upper band spectrum over the coming years.

Coleago's exhibit 31 clearly shows that there is no relationship between Australian headline CPI and the MSR index. CPI is not an appropriate measure of indexation for spectrum pricing.

Coleago Exhibit 31: CPI vs Mobile Service Revenue Index



Source: Coleago

As demonstrated by the Coleago analysis using DotEcon's own dataset, spectrum prices exhibit a significant downward trend across all benchmark samples.

Coleago Exhibit 45: Price declines since 2013

	Sub 1GHz	Lower 1-3GHz	Upper 1-3GHz	3.4GHz
Annual price declines	-6.6%	-11.1%	-7.6%	-1.5%
Real price decline from 2013-2025	-48%	-67%	-53%	-12%

Source: DotEcon

This decline is even more pronounced when CPI adjustments are applied to express prices in real terms. In this context, the suggestion that there is “no proof” the observed downward trend will continue sits uneasily alongside the ACMA’s decision to rely on global benchmark data to inform Australian ESL pricing. If international benchmarks are considered sufficiently robust to guide renewal pricing, it follows that the long-term trend evident in those benchmarks should also be recognised and incorporated into the pricing.

Standard forecasting practice relies on historical data supplemented by additional evidence, such as upcoming spectrum allocations and sustained declines in real mobile revenues—both of which create downward pressure on spectrum values. No contrary evidence has been presented to indicate that the historically observed price trajectory is no longer relevant.

The ACMA has itself acknowledged this trend, noting publicly that “over the last 10 to 15 years, spectrum prices internationally have fallen significantly”⁴. However, this acknowledged decline does not appear to be reflected in the updated ESL pricing methodology, particularly following the removal of the MSR index, which previously captured reductions in mobile service revenues relative to spectrum supply.

MSR reflects actual spectrum price trends

The MSR index directly captures the long-term decline in spectrum prices relative to mobile service revenues, adjusted for population and MHz availability. It reflects the economic reality that:

- a) Mobile service revenue has been flat or declining in real terms for over a decade.
- b) Total available spectrum has increased materially and will continue to rise.
- c) Spectrum efficiency improves with each generation of technology, reducing the cost per GB.
- d) Operators’ willingness to pay for spectrum is constrained by declining returns on capital.

MSR therefore provides a transparent, empirically supported, and industry-aligned measure of spectrum value trends. It adjusts prices in a manner consistent with how operators evaluate renewal spectrum—through changes in demand, efficiency, and long-term cost avoidance—not through consumer inflation.

MSR was previously supported by all stakeholders

The use of MSR was strongly supported by all MNOs, by Coleago, by other industry consultants and by the ACMA itself in Stage 3. The ACMA previously noted that MSR was the most appropriate proxy for long-run value trends, particularly where profit-based indices are volatile and difficult to construct. The sudden removal of the MSR index in the updated preliminary pricing, without adequate explanation, represents a significant departure from the earlier methodology and has produced inflated results.

CPI creates upward bias to single price calculations; MSR produces evidence-based prices

The combination of CPI uplift, inclusion of outliers, and removal of the MSR index is the primary cause of the dramatic escalation in updated preliminary ESL prices. CPI alone increases nominal auction prices by up to 52% in some bands, with no economic basis for doing so. In contrast, the MSR index reflects the well-documented downward trend in global spectrum prices

⁴ ACMA Chair Nerida O’Loughlin, 10 February 2026, Senate Environment and Communications Legislation Committee.

and ensures that renewal pricing aligns with operators' capacity to pay and long-term industry sustainability.

Reinstating the MSR index would:

- a) Correctly reflect the downward trajectory of spectrum values;
- b) Ensure benchmarking aligns with real-world operator economics;
- c) Remove inflationary distortions introduced through CPI;
- d) Improve comparability of historic auction results;
- e) Support public interest objectives of investment, innovation and sustainable competition.

Given the clear deficiencies and inflationary effects of CPI indexation, and the strong empirical, economic and policy arguments for the MSR index, Optus recommends that the ACMA remove CPI from all components of the benchmarking methodology, including both historic price adjustments and carry-forward calculations, and reinstate the MSR index as the primary mechanism for trending prices to renewal dates and through the licence period.

Spot Exchange Rates as the Preferred Conversion Method

Optus does not support the use of Purchasing Power Parity (PPP) for converting international auction prices into Australian dollars and continues to recommend the use of spot exchange rates.

Spot rates provide a transparent, market-based, and economically grounded method of currency conversion that directly reflects the actual cost of acquiring spectrum, at the time, in international markets. Unlike PPP, which is constructed from consumer price baskets and therefore unrelated to the capital-intensive nature of telecommunications networks, spot rates accurately capture the financial conditions faced by operators when assessing spectrum acquisition costs.

Spot exchange rates better reflect the economic reality of the mobile sector for several reasons:

- a) **Relevance to spectrum valuation:** Spectrum valuation and network deployment decisions are heavily influenced by global equipment markets, international vendor pricing, and cross-border capital flows. These costs are not affected by relative domestic purchasing power, making PPP an unsuitable basis for translating spectrum prices across currencies. Spot rates, by contrast, align with the actual financial exposures borne by operators in global supply chains.
- b) **Transparency and replicability:** Spot rates are observable, objective, and easily verifiable; they do not rely on assumptions about consumer goods, inflation differentials, or theoretical economic parity. This makes spot conversion more transparent and consistent with best-practice benchmarking methodologies.
- c) **Managing exchange rate volatility:** Concerns regarding short-term volatility in spot exchange rates can be effectively addressed by applying smoothing techniques such as multi-year or multi-quarter averaging, or by using forward rate adjustments. These approaches retain the economic validity of spot pricing while mitigating temporary market fluctuations, without resorting to PPP, which introduces structural distortions unrelated to spectrum markets.
- d) **Avoiding Inflationary Bias:** PPP is inherently inflation-based, reflecting GDP levels that often have no relationship to the drivers of spectrum value. Applying PPP conversion artificially inflates benchmark prices for countries with lower GDP levels and higher PPP adjustments, which bears no connection to spectrum demand, network cost structures,

or competitive dynamics. This introduces an upward bias into the benchmarking model, overstating the implied value of spectrum in the Australian context.

Given these issues, the continued application of PPP produces results that are neither economically justified nor consistent with sound regulatory practice. Spot exchange rates, appropriately averaged to address short-term volatility, provide the most accurate and policy-aligned method for currency conversion in the benchmarking process.

Optus therefore strongly recommends that PPP be removed from the updated methodology and replaced with a spot-rate-based approach to ensure accuracy, reliability, and alignment with internationally accepted valuation principles.

Incorporating Renewal Outcomes into the Benchmark Dataset

Optus strongly supports the inclusion of renewal award data within the benchmarking dataset, as renewal outcomes provide the most relevant and reliable reference points for setting renewal prices in Australia.

Renewal awards reflect regulatory decisions in circumstances more directly comparable to the Australian ESL process and incorporate policy considerations, market maturity, and operator economics that are not captured in auction data for new spectrum allocations.

Renewal data is fundamentally different from auction outcomes for newly released spectrum. Auctions often reflect unique, time-specific market dynamics, such as scarcity events, new entrant bidding behaviour, or the valuation of entirely new use-cases, that do not apply to the renewal of long-held, fully substitutable spectrum.

In contrast, renewal pricing reflects the public policy objectives that overseas regulators apply when assigning ongoing access to essential mobile spectrum. These decisions typically consider investment incentives, competition, capacity to pay, and continuity of service, all elements central to the Australian regulatory framework. Benchmarking that excludes renewal awards therefore omits the most relevant international comparators.

There are key differences between the methodologies employed in valuing spectrum for auctions and renewals. Common to both scenarios of renewals and auctions is cost avoidance. Incremental revenue is generally only considered for auctions and has the effect of increasing the attributable value of spectrum at auction compared to the same spectrum when available for renewal. This means the results of spectrum auctions when applied to renewal prices will result in an inflated outcome.

The omission of renewal data has additional methodological consequences. By excluding renewal outcomes which tend to be priced lower than auction awards due to the absence of scarcity premiums, the dataset results in an inflated view of price levels. This undermines the representativeness of the central estimate and increases the risk that renewal pricing will be set above the weakest operator's value. This may elevate the risks of non or partial-renewal resulting in spectrum lying fallow and subsequent market consolidation. Incorporating renewal awards improves the statistical validity of the dataset, expands the sample size, and ensures the central estimate reflects the full range of relevant global practice rather than only high-variance auction results.

Renewal pricing decisions by regulators in other jurisdictions also provide important insight into policy alignment. Many international agencies including Ofcom, ComReg, and regulators across Europe and Asia apply renewal frameworks that explicitly moderate prices to support long-term investment, sustainable competition, consumer welfare, and service continuity. These outcomes are not captured in global auction data, which instead reflect competitive tension and market conditions at a single moment in time. Including renewal awards ensures that Australian ESL

pricing remains consistent with broader global regulatory practice rather than being anchored to auction results that have limited relevance to renewal valuations.

For these reasons, Optus strongly recommends that renewal award data be reinstated and treated as a core component of the benchmarking dataset. Renewal outcomes provide the most appropriate reference points for determining Australian ESL renewal prices because they:

- a) Reflect regulatory decisions in contexts directly comparable to Australia;
- b) Align with cost-avoidance valuation methodology used by existing operators;
- c) Improve the representativeness and stability of central estimates;
- d) Reduce upward bias introduced by auction-only datasets; and
- e) Promote alignment with public interest objectives, including competition, investment, and service continuity.

A benchmarking methodology that excludes renewal data cannot produce reliable, policy-aligned or economically grounded renewal pricing for Australia. Incorporating renewal outcomes is therefore essential to ensuring a reasonable, evidence-based and sustainable ESL pricing framework.

Further benchmarking recommendations from Coleago Consulting

Coleago Consulting's assessment includes a review of the DotEcon methodology, the statistical validity of the data and analysis, and provides an alternative risk minimisation method to develop a single price for each spectrum band, which Optus considers to be a more reasonable approach.

Coleago have recommended the following refinements to the DotEcon methodology to support a robust, transparent, and repeatable benchmarking framework:

- a) **Exclude Outliers:** Excluding anomalous datapoints will improve the representativeness of the sample and reduce the influence of atypical market conditions.
- b) **Remove CPI-Based Inflaters:** CPI does not reflect telecommunications sector dynamics, which are characterised by declining retail prices and technology-driven cost efficiencies.
- c) **Reinstate the MSR Index:** The MSR index was strongly supported across stakeholders and was previously justified by the ACMA as an appropriate mechanism for reflecting revenue trends where profit data is volatile. It provides a consistent and transparent link between sector revenues and spectrum valuation.
- d) **Refine the Central Estimate Method:** Improving sample consistency and reducing variability will enhance reliability and repeatability of benchmark-derived estimates. The choice of central estimate metric should reflect the characteristics of the dataset.
- e) **Adopt a Risk-Based Pricing Approach:** Using the distribution of benchmark results above or below a particular renewal price as an indicator of renewal likelihood provides an objective, evidence-based method for assessing pricing risk.

Preliminary modelling undertaken by Coleago in Exhibit 48 indicates that implementing three adjustments of exclusion of outliers, removal of CPI and the reinstatement of the MSR index, would reduce the estimated total industry ESL cost by approximately 35%, from \$7.3 billion to \$4.8 billion. This represents a more sustainable and proportionate outcome consistent with long-term market trends and public interest objectives.

	Prices adjusted for outliers and CPI (AUD, full licence)		Total Industry bill (AUD million)		
	ACMA	Adjusted	ACMA	Adjusted	Change
700	0.7405	0.5462	1,945.9	1,435.3	26%
850	0.7558	0.5575	858.9	633.6	26%
1800	0.3030	0.2182	1,295.5	933.1	28%
2100	0.2757	0.1986	801.5	577.3	28%
2300	0.1596	0.0697	322.9	141.0	56%
2600	0.1621	0.0708	661.6	289.0	56%
3400	0.2052	0.1073	1,502.5	785.4	48%
Total			7,388.8	4,794.7	35%

Coleago assessed that the central estimate methodology used to derive a single renewal price per band does not produce results that are representative of the underlying benchmark samples. Several interrelated issues limit the reliability of the central estimate as presently constructed.

Coleago's analysis (Exhibits 2–10 in Appendix 1) demonstrates that datapoints across all four spectrum band categories are heavily clustered at the lower end of the observed ranges. In each band:

- Datapoints are not clustered around a central value
- Distributions are not normal
- Samples exhibit substantial positive skew
- Extreme outliers are present
- Internal variability is high

Under these conditions, the choice of a central estimate—particularly where DotEcon use the mean or median—does not reflect the underlying distribution of values and is highly sensitive to small changes in the dataset.

A methodology that produces renewal prices materially above the most commonly occurring values in the benchmark sample does not appear representative of the data set as a proxy for typical market outcomes.

Risk-based methodology

Coleago recommends adopting a risk-based methodology for determining renewal prices. Under this approach, the pricing point would be informed by the proportion of the benchmark distribution lying above or below each value, providing a proxy for the probability of renewal by incumbents.

Coleago proposes a 20% threshold, reflecting the mode of benchmark datapoints, and the objective of ensuring at least 80% confidence that incumbents will renew all licences in full. These figures are not absolute, should the ACMA have a higher tolerance for risk then a 30% threshold could be used, although would represent a higher risk that some spectrum may not be renewed in full.

This approach would support continuity of service provision and reduce risks to competition in mobile markets. A risk-based method also offers a transparent mechanism for setting prices that align with both market evidence and public interest objectives.

Coleago Exhibit 50: Recommended ESL prices based on risk

365-day price / MHz / pop AUD 2025	Sub 1 GHz	Lower 1-3 GHz	Upper 1-3 GHz	3.4 GHz
20% benchmark price limit (real values)	0.0455	0.0083	0.0070	0.0087
20% benchmark price limit (nominal values)	0.0381	0.0083	0.0055	0.0071
ACMA updated preliminary price	0.0755	0.0307	0.0167	0.0217
% reduction (real values)	40%	73%	58%	60%
% reduction (nominal values)	49%	73%	67%	67%

Risk based price - AUD / MHz/ pop full licence				Industry bill - AUD millions and % change vs. ACMA		
	ACMA	CPI excluded	CPI included	ACMA	CPI excluded	CPI included
700	0.7405	0.3743	0.4465	1,945.9	984 (-49%)	1,173 (-40%)
850	0.7558	0.3820	0.4558	858.9	434 (-49%)	518 (-40%)
1800	0.3030	0.0819	0.0820	1,295.5	350 (-73%)	350 (-73%)
2100	0.2757	0.0745	0.0746	801.5	217 (-73%)	217 (-73%)
2300	0.1596	0.0529	0.0668	322.9	107 (-67%)	135 (-58%)
2600	0.1621	0.0537	0.0679	661.6	219 (-67%)	277 (-58%)
3400	0.2052	0.0669	0.0823	1,502.5	490 (-67%)	603 (-60%)
Total				7,388.8	2,801 (-62%)	3,274 (-56%)

Source: Coleago and ACMA

This approach offers several benefits including:

- Improved representativeness, by recognising actual clustering of datapoints
- Greater methodological stability, as results are less influenced by outliers
- Better alignment with market behaviour, through probability-based assessment
- Enhanced confidence, by ensuring a high likelihood that incumbents will renew

As referenced earlier, Coleago proposes an 80% confidence level (with a 20% threshold reflecting the mode) as an appropriate benchmark for assessing renewal probability, resulting in ESL prices of \$2.8 billion (CPI excluded) to \$3.3 billion (CPI included). This would align renewal pricing with observed data distributions while supporting continuity of service and competitive outcomes in the Australian mobile market.

ESL General Comments

Historically, the ACMA acknowledged that, in renewal settings, the risk of setting prices too high—with potential for non-renewal, market consolidation and/or spectrum lying fallow—exceeds the risk of setting prices too low, and indicated a conservative approach would better promote continuity, competition, and investment. The updated preliminary total of ~\$7.3 billion – a 18 – 46% increase over the earlier \$5.0 - \$6.2 billion range appears inconsistent with that earlier stance and heightens over-pricing risk at renewal.

The Stage 4 updated benchmarking methodology introduces elements that systematically push the single price points upward, exacerbating the risk that renewal prices exceed operators'

economic value and capacity-to-pay. This direction stands in contrast to a conservative calibration that would prioritise operator capacity to pay, and renewal certainty.

Spectrum costs are not sunk costs but inextricably linked to the amount of network investment and development of mobile services. There is also growing global understanding by regulators that high spectrum prices negatively impact consumers and efforts to maximise revenues from spectrum auctions can damage the wider economy.

High upfront spectrum costs can impact on business decisions in several ways:

- Cost recovery – high spectrum costs will weigh on the business decisions made throughout the duration of the licence term, as well as affect the operator's approach to future spectrum awards.
- Consumer welfare trade-offs – high upfront spectrum will impact on network investments, which may lead to long-term downsides for consumers (eg. cost burden may be passed onto customers through higher prices or lower quality of service, or indirectly through delayed network investments).
- Licensees may be forced to make difficult trade-offs around partial or non-renewal, including weighing increasing site numbers to overcome reduced spectrum holdings for the purposes of capacity and customer experience.

Importantly the price of spectrum should not be confused with its value to operators – acquiring spectrum rights may allow an operator to extend its coverage, increase network capacity, improve the quality of an existing service, or offer new services. Operators must still be able to make positive commercial returns, i.e., achieve a ROIC at or above the WACC.

An effective ESL renewal price should factor industry sustainability and competition, to ensure both increased investment and increased innovation, while continuing to meet consumer outcomes and influence downward pressure on retail pricing.

Public interest

Optus reiterates that public interest pricing for spectrum licence renewals is warranted based on the essential nature of telecommunications.

The essential nature of mobile services has been repeatedly stated by the ACMA and the government in public statements. This view was supported by all the MNOs and their respective consultants.

The ACMA has emphasised that ESL pricing should align with public interest criteria and broader policy objectives such as investment, innovation, sustainable competition, service continuity, and consumer outcomes, and indicated that a Step 6C “policy check” could adjust prices where required. However, the ACMA stated that it “has not needed to use this step” in forming updated preliminary prices, leaving unaddressed whether the materially higher prices advance or hinder the public interest criteria/ Ministerial Policy Statement objectives in practice.

Optus refers to Coleago's paper on public interest (see Appendix 1, section 9).

Cost avoidance has been used previously

The ACMA previously used a cost avoidance methodology to determine the spectrum renewal pricing across the 850 MHz, 1800MHz, 2100MHz spectrum bands (2012). Benchmarking was only used for 2300 MHz and 3.4 GHz as there were no existing mobile services in those bands and the cost avoidance values could not be calculated. During the previous ESL process, Plum Consulting valued the spectrum using cost avoidance/reduction to ensure the spectrum offered

value for money and was affordable for all incumbent operators to reduce the risk of non-renewal.

The cost avoidance method compares the cost of deploying incremental sites (green fields, upgrades sites) using their existing spectrum versus deployment of additional spectrum (either acquired or renewed) to determine the least cost option.

The rationale for using the cost avoidance of the lowest market share Australian MNO (not global) was that it was used as a proxy for determining the market price of spectrum under a competitive auction scenario. The principle being, the bidder with the lowest bid limit/and or value, scales back bidding by quantity first which sets the final auction price, to ensure the spectrum renewal offered value to all the operators at or below the value of the spectrum for all existing operators.

DotEcon similarly recognises that “the large majority of spectrum value typically comes from the avoided cost of additional network equipment that would be required to meet expected data traffic projections in the counterfactual in which that spectrum was not won.”⁵

The ACMA has not conducted any form of cost avoidance valuation for the spectrum being renewed or any form of valuation for an operator.

Cost avoidance is also likely to be a primary test considered by operators as part of the corporate governance process used to assess individual licensee’s decision to renew. Without undertaking a similar assessment, the ACMA risks the renewal price being higher than the value to the operator and some of the spectrum not being renewed.

[CiC]

Capacity to Pay

Optus supports the application of a capacity to pay test on the pricing to determine if all operators can afford to renew, to reduce the risk of spectrum consolidation, market consolidation and/or spectrum lying fallow. Such a test could provide insight into whether the ESL renewal prices encourage renewal based on capacity to pay and which operators are likely to apply to renew fully, partially or not renew across each of the bands and licence areas.

Capacity to pay remains an acute issue in this market, with only Telstra achieving a ROIC at or above the weighted average cost of capital WACC. This severely limits Optus and TPG being sustainably competitive with Telstra. It also impacts Optus and TPG’s ability to renew all their spectrum. We are pleased that the ACMA have stated they have sought advice on capacity to pay, which Optus requests be made available in the interests of transparency.

Overall spectrum price impacts

The industry level and Optus ESL licences pricing has been summarised below along with the Coleago scenarios:

⁵ DotEcon, 2025, Review of the ACMA expiring spectrum licence pricing, Prepared for the ACMA, September, p18

	Industry	Optus
ACMA Preliminary Price Range Stage 3	\$5.0 - \$6.2 billion	\$1.19 - \$1.48 billion
ACMA Updated Preliminary Price Stage 4	\$7.3 billion	\$1.92 billion
Coleago DotEcon Adjusted	\$4.8 billion	\$1.16 billion
Coleago 80% Risk based Benchmark Incl CPI	\$3.3 billion	\$0.79 billion
Coleago 80% Risk based Benchmark Excl CPI	\$2.8 billion	\$0.67 billion

Figure 13: impact of methodology changes on spectrum prices

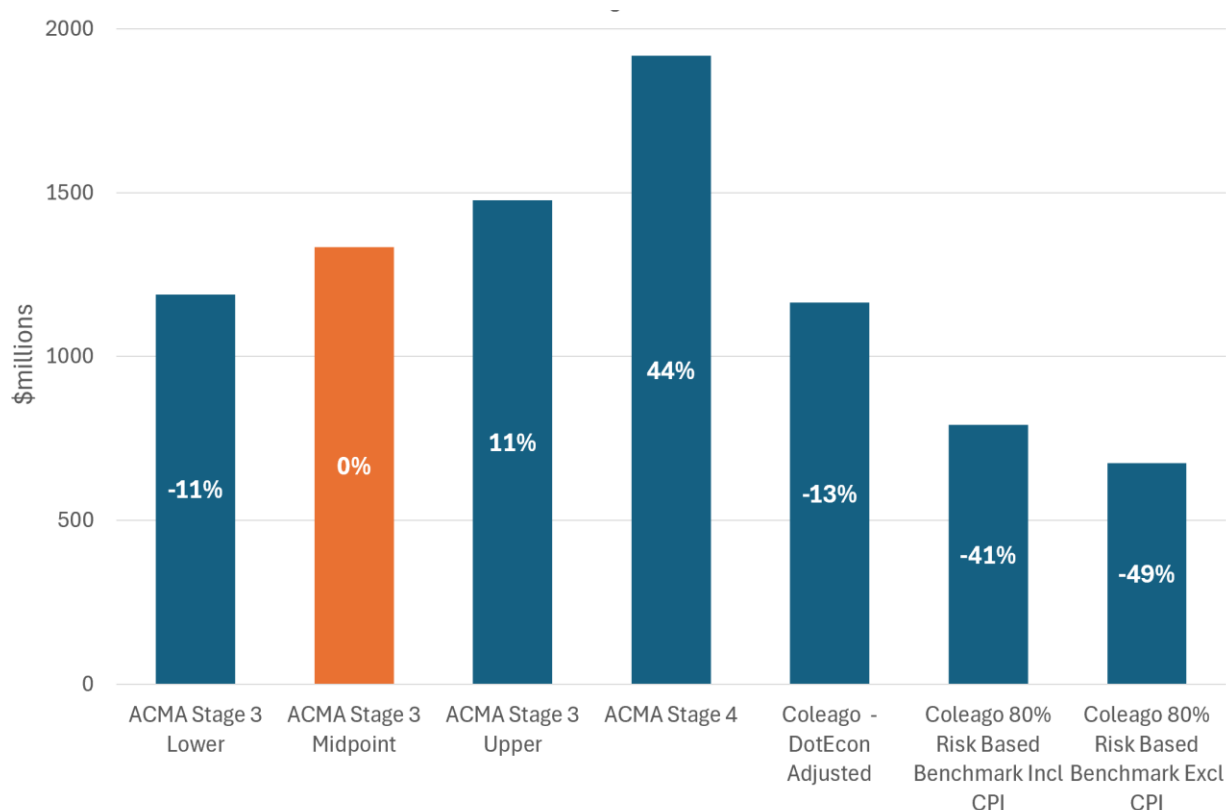


Figure 14: Optus ESL Pricing and percentage change from ACMA Stage 3 Midpoint

Figure 14 shows the Optus ESL pricing per ACMA Stage and the Coleago scenarios. The percentage change in price referenced to the ACMA Stage 3 Midpoint is included on the bars. This represents the impact of the various scenarios to the preliminary pricing midpoint from Stage 3.

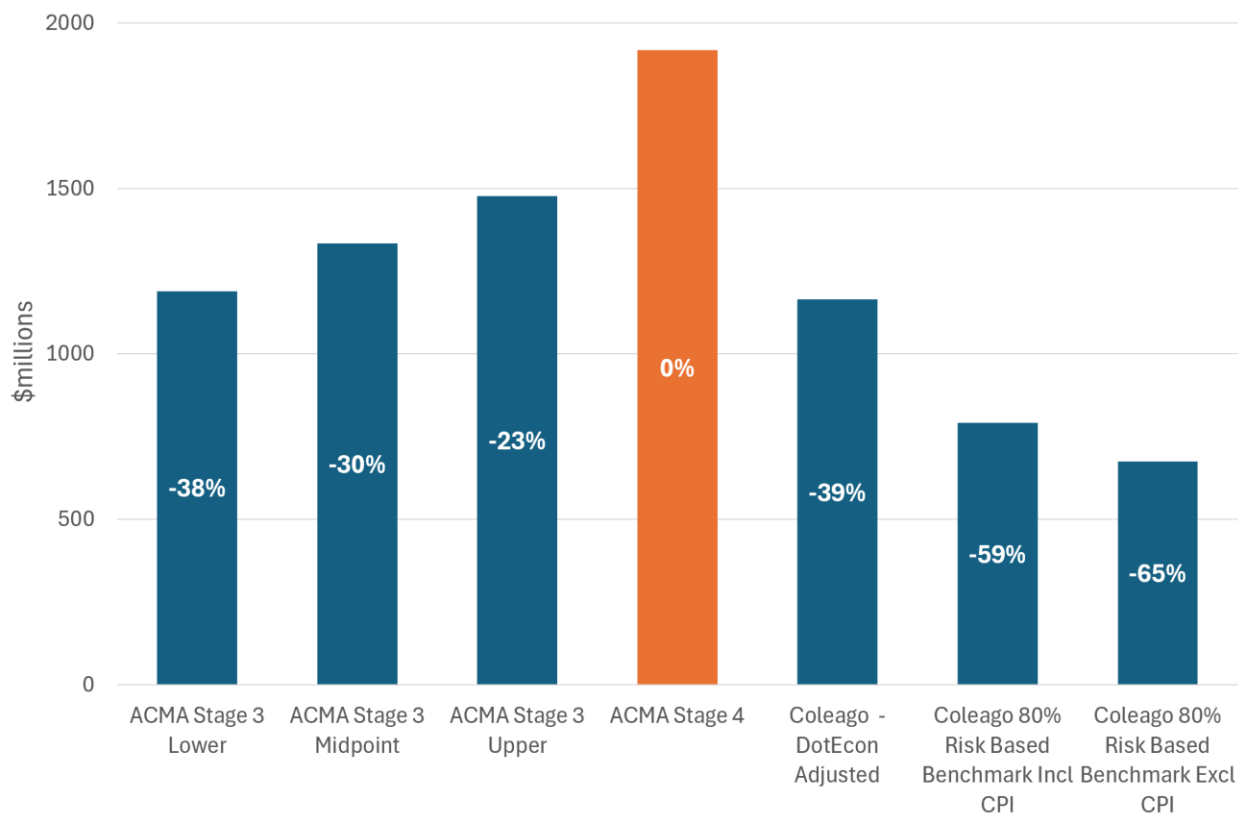


Figure 15: Optus ESL Pricing and percentage change from ACMA Stage 4 updated preliminary pricing

Figure 15 shows Coleago's re-baselining of the DotEcon methodology (\$4.8 billion industry ESL) which is comparable to ACMA Stage 3 lower pricing (\$5.0 billion industry ESL).

The Optus total price of \$1.92 billion is a marked increase from the Stage 3 values of \$1.19 - \$1.48 billion. This represents a \$585 million or 44% increase from the ACMA Stage 3 Midpoint and indicates the large impact of the changes in methodology in the Stage 4 paper. We note that the industry wide increase is 30% (from \$5.6 to \$7.3 billion).

Optus requests that the proposed modifications to the DotEcon benchmarking methodology be adopted. In addition, an alternative price setting approach that the ACMA can consider for a simpler single price exercise is a risk-based methodology as it includes an increased focus on the likelihood of renewal of some or all of the spectrum, as outlined in detail in the Coleago paper.

Updated preliminary views on pricing for rail and TOB

Issue 3. Our updated preliminary views on pricing for rail communications use in the 1800MHz band and television outside broadcasting (TOB) use in the 2.5GHz mid band

No further comment from our previous submissions.

Other pricing considerations

Issue 4. The proposals on the other pricing considerations chapter including updating benchmark data beyond the release of our preferred views on pricing, and adjusting spectrum access charge amounts for different payment timing

Optus reiterates its position that ESL renewal pricing should be set upfront for all bands prior to commencement of the first application period for the first tranche of ESL bands due to expire.

Noting that there is overlap between the application and process consultation and the updated preliminary price consultation, Optus repeats the same commentary on instalment payments and payment timing below:

Our submissions through the ESL process have advocated for instalment payments on the basis that they offer significant financial, operational, and policy advantages for both regulators and licensees. The key benefits can be summarised as:

a) Improved Cashflow Management for Licensees

Paying spectrum fees over time aligns costs with the period in which benefits are realised. It reduces large, immediate outflows that can strain financial resources and allows operators to better manage capital for ongoing investment in network rollout, upgrades, and customer service.

b) Alignment with the timing of economic benefit

Spectrum licences generate value gradually over the life of the licence, not all at the moment they are granted, and instalments mirror the way operators amortise spectrum on their balance sheets. Instalment payments more accurately track cost-avoidance and revenue benefits as they accrue over time.

c) Supports sustainable industry investment

Large upfront payments can divert funds from investment in infrastructure (5G/6G rollout, fibre backhaul, regional expansion) and innovation.

d) Reduces risk of market distortion or consolidation

Upfront lump-sum payments favour large incumbents with deep pockets. Instalment payments have the ability to reduce barriers for smaller operators or those with weaker balance sheets. This lowers the risk of market consolidation driven by cashflow constraints and higher funding costs and assists in maintaining and growing the competitive intensity in the market currently.

e) Increases certainty and predictability

Instalments provide a clear, predictable cost schedule which allows operators to plan budgets and financing requirements across many years, and regulators to benefit from more stable and recurring revenue streams. In addition, instalment payments reduce exposure to short-term interest rate or macroeconomic shocks at a single payment point.

f) Reduces real economic burden for industry

When lump-sum payments are required, operators often need to raise debt or reallocate capital rapidly. Operators face a higher cost of capital than government, which increases the overall real economic burden. Instalments smooth borrowing needs over time,

reduce the likelihood of borrowing at unfavourable interest rates and lowers the overall cost of capital.

g) Reduced risk of non or partial renewal

For renewals in particular, instalments avoid forcing licensees into premature renew, exit or consolidate decisions driven by cashflow rather than value and reduces the risk that viable operators fail to renew spectrum simply because early, large payments are required.

Optus seeks further clarification on ACMA's ability to support instalment payments.

Recommendation 6 of the Spectrum Pricing Review 2018 has been referenced by the ACMA as a justification for requiring upfront payments for renewals.

Recommendation 6

For spectrum access charges determined by auction, the ACMA should generally require upfront lump-sum payments. There may be circumstances where instalment payments are warranted shortly after the beginning of a licence term. In considering use of instalments, the ACMA should assess the risks to the state of default and the potential impact on competition. The ACMA should generally receive upfront payments before the licence period begins because it protects against the risk of payment default. It reduces the complexity and increases the certainty of spectrum auction outcomes. Upfront payments also help to reduce speculative bidding. However, the Government recognises that long term licences require a large amount of capital. Therefore, there may be circumstances where Government or the ACMA approves short term deferrals. In considering these circumstances, the Government or the ACMA should take into account the risks to competition of payment deferrals (including the role the competition limits are playing), the number and type of bidders at an auction, and the risk to the Government of unpaid licence payments. In these circumstances, requirements such as a bank guarantee over a portion of outstanding funds are appropriate to reduce risk to Government.⁶

It appears that this recommendation does not prevent the ACMA (or the Government) from providing an option for instalment payments for spectrum licence renewals, noting that the recommendation applies to spectrum charges determined by auction and makes no specific reference to renewals. This recommendation does provide the ACMA the ability to approve instalment payments after assessing risks for default and impact on competition. It also focuses on payments applicable to a single auction at a single point in time rather than a series of renewals due in relatively short succession. If the ACMA is able to consider instalment payments having regard to a single auction, it is reasonable to expect a similar assessment could be conducted for renewals, with specific recognition given to the short-term capital squeeze multiple renewals within a short time period creates. Whilst not the subject of this paper, it should be noted that when all the renewed ESLs are next up for renewal they will all fall within 1 year.

The ACMA has also noted that past instalment arrangements were enabled through Ministerial Direction, as occurred in the 700 MHz (2017) and 26 GHz (2021) auctions. Aside from relying on historical practice, the ACMA has not provided any substantive policy, economic, or legal rationale for requiring upfront payment of renewal fees.

⁶ https://www.infrastructure.gov.au/sites/default/files/spectrum-pricing-review_0.pdf page 9

Furthermore, international practice indicates that instalment arrangements are frequently offered by regulators in spectrum assignments, particularly where licence terms are long and amounts are substantial. This is reflected in DotEcon's treatment of benchmarking data, which includes adjustments to normalise for the presence of instalment payment structures—implicitly acknowledging their prevalence across jurisdictions. Recognising this global context, making instalment options available for ESL renewals would align the Australian framework with established regulatory practice and provide a balanced mechanism to manage cashflow without compromising policy objectives.

For these reasons, we again request that the ACMA give full and careful consideration to offering instalment payment options for ESL renewals. Instalments aligned with the amortisation schedules of each band would provide a more balanced, sustainable, and appropriate approach to renewal payments, while supporting continued investment and maintaining the financial health of the sector.

Practical issues with up-front payments within the ACMA's proposed timeframes

As the ACMA's proposed payment of licence renewal fees is determined by the completion of the application process, this introduces significant issues for operators as there is no certainty in payment dates. If renewal application is made early in the process this could result in payments being due up to 19 months prior to renewal.

Since licensees may submit renewal applications at any point during the application window, it follows that those who apply early, as encouraged by the ACMA, would face earlier decision dates and therefore earlier payment triggers. The ACMA has not committed to issuing renewal decisions on a fixed schedule and there is a potential for further delay should additional information requests be required. Therefore, the resulting processing times and consequently payment dates may vary significantly by licence, thereby further increasing uncertainty for operators.

Further, the proposed process is misaligned with established practice. Historically, both auctioned licences and renewals require payment close to licence commencement, usually around one month beforehand. Requiring payment up to 19 months early represents a significant and unjustified departure from long-standing regulatory practice.

Requiring spectrum renewal payments at an uncertain time, and potentially up to 19 months before the renewed licence takes effect, creates a range of significant financial and operational challenges for licensees: These challenges extend well beyond standard cashflow considerations and have material implications for business planning, investment cycles, governance processes, and competitive neutrality.

a) Cashflow Volatility and Budgeting Uncertainty

Spectrum renewals involve large, multi-million-dollar payments. Without certainty on when these payments will fall due, operators cannot accurately forecast cash needs or allocate capital. This level of uncertainty is inconsistent with prudent financial management in a capital-intensive industry.

The ACMA has made it abundantly clear that early submission of licence renewal applications is preferred. If licensees follow this direction and apply at the start of the application window for the 850/1800 MHz bands (18th June 2026), then payment would fall within this current calendar year. This outcome is entirely unexpected for operators and has not been incorporated into approved budgets. Noting that Optus use April to March financial year, this would bring forward our 1800 MHz licence payment by two financial years. To align with our current financial spectrum cost forecasting, Optus would need to apply no earlier than October 2027 assuming payment 5 months later, for payment in financial year 2029 as previously forecasted.

b) Impact on Debt, Financing, and Capital Structure

The scale of the current renewal obligation represents a step-change relative to the previous ESL cycle. For Optus, the prior ESL bill was approximately \$700 million, whereas the current renewal liability is in the order of ~\$2 billion (if fully renewed). This material increase significantly amplifies the cashflow, financing, and opportunity-cost implications of a lump-sum payment model.

When the timing of large regulatory payments is uncertain, operators are forced to maintain higher cash reserves, reducing capital available for investment. Early payments of months or years ahead of licence commencement, mean operators must carry the debt or cost of capital for that period without receiving any benefit from the renewed licence.

c) Pressure on Corporate Governance and Board Approval Processes

Spectrum renewals require extensive internal governance, involving board approval, risk assessments, financing plans, investment trade-off analysis and shareholder reporting (for listed entities). These processes cannot be performed efficiently unless the operator knows the payment amount, and when payment is due. If Ministerial Policy Statements are released only shortly before the application window opens, and payment may be required immediately after ACMA approval, the governance cycle becomes compressed and rushed, increasing legal, financial, and operational risk.

d) Misalignment of Costs and Benefits

Requiring payment up to 19 months prior to licence commencement forces operators to incur the full cost of renewal long before receiving the legal right to the spectrum, the operational benefit, or the revenue/cost-avoidance value the spectrum provides. This creates a major negative working capital impact, inconsistent with how spectrum value is realised (which occurs gradually throughout the licence term).

e) Distortion of Long-Term Investment Priorities

Large, early payments divert capital from network deployment and upgrades, resilience improvements, rural and regional coverage investments, and technology upgrades (such as 5G to 6G). Uncertain payment timing forces operators to delay or cancel planned network programs to preserve liquidity until a renewal payment date becomes clear.

f) Disproportionate Impact on Smaller Operators

Early payment timing advantages operators with larger balance sheets, deeper capital reserves, or easier access to debt markets. Smaller operators are disproportionately affected by early, uncertain payments, increasing the risk of competitive disadvantage, weakened financial performance, or reduced ability to renew all spectrum bands. This is particularly problematic in a renewal process, where spectrum is already fully integrated into networks and critical for competition.

g) Administrative and Operational Disruption

Operational processes tied to renewal including network planning, vendor contracting, capacity forecasting, and workforce allocation, depend on knowing when renewal will occur and the certainty that the licence can be renewed. Uncertainty in payment timing cascades through to delays in procurement and deployment, misalignment of rollout schedules, and complexity in managing multi-year investment programs. This creates

unnecessary operational inefficiency for both the operator and the broader ecosystem (vendors, contractors, equipment suppliers).

h) Sovereign Risk and Financial Reporting Issues

Uncertain payment timing, particularly when disconnected from licence commencement, creates challenges in financial reporting and provisioning, potential impacts on credit ratings, and increased perceptions of sovereign/regulatory risk among investors and lenders. These factors can directly influence the cost of capital and long-term investment appetite in the Australian telecommunications sector.

We do not support the proposed Spectrum Access Charge (**SAC**) adjustments and consider that a fixed payment date is the most appropriate way forward. The SAC adjustments will introduce unnecessary complexity and have consequences beyond the renewal process, as discussed below.

- a) CPI is an insufficient motivator for an operator to pay early, as it does not represent the cost of capital. Instead of CPI, the relevant metric for timing a payment decision used by operators as well as government, is the weighted average cost of borrowing / capital (**WACC**). The ACMA is currently using the long-term, post-tax nominal WACC recommendation provided by Frontier Economics of 8.49%⁷, which is more than double CPI (3.8% October 2025). As the spectrum renewal charges are large, and the WACC is significantly greater than CPI, this will result in considerable incentives for operators to pay and therefore apply as late as possible in the window.
- b) The SAC adjustment may adversely impact secondary market trading as licensees have paid different amounts based on the timing. This can result in different views on paid prices between different licences which could complicate any secondary market negotiations.

Operators are afforded certainty of renewal via an ACMA renewal offer and subsequent renewal notification, as both are legally binding commitments by the ACMA. These instruments give operators assurance that their licences will be renewed, without requiring payment many months in advance. Optus disagrees with the premise that certainty only arises once payment is made. A legally binding renewal offer by the ACMA provides all necessary certainty to MNOs. Additionally, there is no precedent for the ACMA rescinding such an offer. Doing so would represent a significant sovereign-risk event with likely legal implications.

Conversely, the risk to the ACMA of a licensee defaulting on a renewal payment is extremely low. No Australian mobile operator has ever defaulted on a mobile spectrum auction or spectrum renewal payment. The risk is even lower in renewal scenarios compared with auctions, because the expiring spectrum is already fully deployed in networks and underpinned by billions of dollars in infrastructure investment, meaning operators have strong commercial incentives to complete payment. For these reasons, requiring payment up to 19 months before licence commencement is neither justified nor proportionate, and provides no additional certainty beyond what is already delivered by the ACMA's own legally binding renewal offer and notification.

The ACMA should issue a renewal offer and, upon acceptance of the offer, provide a renewal notification to the licensee with payment due 1 month prior to renewal.

⁷ <https://www.acma.gov.au/sites/default/files/2025-05/Preliminary%20views%20paper%204%20-%20Pricing%20for%20ESLs.pdf> p46

APPENDIX 1: COLEAGO CONSULTING REPORT ON ESL STAGE 4 – UPDATED PRELIMINARY VIEWS ON PRICING

ESL Stage 4 – Updated preliminary views on pricing

prepared for

Optus

26 February 2026

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Benchmarking spectrum prices is challenging because they are influenced by a wide range of factors

Careful interpretation is critical – the ACMA's has been too narrow

Analysis shows the data vary widely and are clustered at the lower end of the ranges. Using the geometric mean or median is unlikely to be representative of Australia.

1. Executive summary

This document sets out Coleago's views on the ACMA's Stage 4 Consultation¹ on updated ESL preliminary prices and on the Peer Review² of the ESL pricing methodology carried out for the ACMA by DotEcon.

Benchmarking spectrum prices lies at the heart of the ACMA's approach to ESL pricing and underpins its Stage 4 consultation. In our response to Stage 3, we stated that both renewal and auction prices should be included for benchmarking to be truly representative to ESLs. Since the ACMA has not included renewal prices in its latest approach, we begin by reiterating our view that the ACMA's prices are likely to be overstated. In any case, benchmarking is inherently challenging due to the wide range of factors that influence spectrum prices, such as auction design, scarcity of supply, market structure, and geography. Careful interpretation of the data is therefore critical. While these are technical issues, it is important to highlight several fundamental points.

The ACMA has erred by adopting a flawed interpretation of the data that is not appropriate given the level of noise in the dataset. In particular, it focuses on the average, or "central estimate," without considering wider issues such as:

- Is the central estimate (in this case, geometric mean or median) representative?
- What do the range, variability and possible trends in the data imply for its use?
- Should we trust all the data in the set, thus maximising the data available, or are some datapoints too extreme to be included, i.e. they are true outliers?

Wide range and variability of benchmark values

Exhibit 1 below shows the number of benchmark spectrum market values (datapoints) used in the analysis and provides a high-level assessment of their range. It is evident that the range is very wide and that there are relatively few datapoints. For example, in the upper 1 - 3 GHz category, the maximum value is 144 times higher than the minimum, based on only 36 datapoints. The fewer the datapoints and the wider the range, the greater the uncertainty that any central estimate can provide a meaningful indication of the value of spectrum in Australia.

Exhibit 1: Number of benchmark values and their range (365day price / MHz / pop AUD 2025)

	Sub 1 GHz	Lower 1-3 GHz	Upper 1-3 GHz	3.4 GHz
Number of benchmark values	35	23	36	47
Minimum (365 day price)	0.0178	0.0021	0.0009	0.0015
Maximum (365 day price)	0.2996	0.2081	0.1288	0.3764
Maximum as a multiple of minimum	16.8	97.6	144.2	247.7

Source: Coleago based on ACMA Excel files

Simple statistical tests also support this conclusion. The variability of the data can be measured using the "coefficient of variation," which is equal to the standard deviation

¹ Expiring spectrum licences (stage 4) – updated preliminary views on pricing
<https://www.acma.gov.au/consultations/2025-12/expiring-spectrum-licences-stage-4-updated-preliminary-views-pricing>

² Review of the ACMA expiring spectrum licence pricing,
https://www.acma.gov.au/sites/default/files/2025-12/dotecon_review_of_acma_expiring_spectrum_licence_pricing.pdf

divided by the mean. As a rule of thumb used by statistical authorities³, if this ratio exceeds 50%, the average is a poor representation of the data.

The variability across all four band groups is well above 50%. This provides clear evidence that central estimates such as the geometric mean and median proposed by ACMA are neither robust nor representative of the dataset, and it is therefore inappropriate to draw conclusions from them.

Exhibit 2: Coefficient of variation in the benchmark dataset

	Sub 1 GHz	Lower 1-3 GHz	Upper 1-3 GHz	3.4 GHz
Standard deviation	0.0638	0.0448	0.0274	0.0609
Mean	0.0942	0.0491	0.0270	0.0369
Standard deviation / mean	68%	91%	101%	165%

Source: Coleago based on ACMA Excel files

Given the wide range of observed market values, the ACMA should have considered where within this range the market value of spectrum in Australia is likely to lie, rather than insisting that the geometric mean and median are reasonable and representative. Further analysis shows that the data is clustered at the lower end of the range across all four spectrum categories, with these most typical values (the modal values) lying below the central value proposed by the ACMA.

Risk of ACMA price being too low or too high

The risk is high, 35%-49%, that the proposed ESL prices exceed the value for at least some operators, if the benchmark data is indicative of the probability

Since the benchmarks vary widely, particularly between countries, and are not clustered around the mean, no one value in the dataset is more likely to reflect the value of spectrum in Australia than another, before considering actual market conditions in Australia.

It is therefore essential to consider the probability of whether the value of spectrum in Australia is in fact the geometric mean used by the ACMA, and the probability that the true value is lower (or higher) than this geometric mean: all the more so because the ACMA appears not to have commissioned its own licence valuation exercise to directly measure the value of spectrum to the Australian operators.

A simple indication of this is provided by the proportion of benchmark data points that lie below the geometric mean. Depending on the spectrum band group, the risk that the ACMA's updated preliminary price would exceed the value of spectrum for all or some operators ranges from 35% to 49%.

Setting renewal prices too low

The socioeconomic risks if ESL prices are set too low are limited

If the ACMA sets renewal prices below market value, this would not result in socio-economic harm. The likely consequences are:

- All three operators would renew their spectrum licences.
- With three competing operators each seeking to earn their cost of capital, consumers are likely to be the winners. It is far more likely that operators would either invest more in network build-out, minimise potential price rises or increase service quality, than accrue windfall gains. This is supported by evidence from the ACCC Communications Market Reports, which show that while mobile services retail prices in Australia declined by 79% in real terms between 2014 and 2022, operators' returns on invested capital did not increase. Indeed, Optus' ROIC of 2% is well below its cost of capital. There is no evidence that low spectrum prices increase enterprise value.

³ See UK Office for National Statistics <https://www.ons.gov.uk/methodology/methodologytopicsandstatisticalconcepts/uncertaintyandhowwemeasureit>

The socioeconomic risk if ESL prices are set too high are substantial

The weakest operators may not renew all of their spectrum; investment and competition could decline

Setting renewal prices too high

If the ACMA sets renewal prices above market value, the likely consequences are:

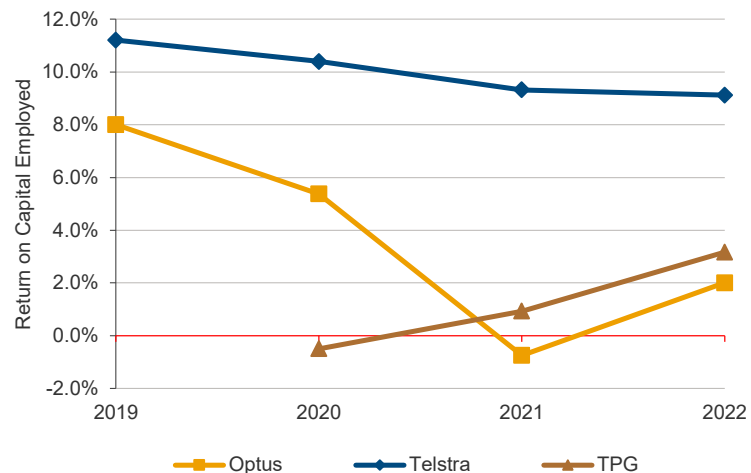
- The operator(s) with the lowest market share, and therefore the least financial flexibility, may choose not to renew all of their spectrum; potentially, two operators could decide not to renew some of their ESL.
- Spectrum would either remain unused for the foreseeable future, as mobile services are generally accepted to be the highest-value use, or the operator with the highest market share could acquire the unused spectrum, potentially further reducing competition.

Since mobile networks are dominated by fixed costs, an operator with a larger market share benefits from significantly stronger economies of scale than an operator with a smaller market share. As spectrum licence fees are themselves a fixed cost, high fees exacerbate this fixed cost problem.

Australia is a relatively small market with a very large land mass, which makes it particularly challenging for operators with lower market share to earn their cost of capital. As a result, competition is especially vulnerable to the fixed-cost nature of the industry. In 2009, following the merger of Vodafone and Hutchison (VHA), their combined market share was 27%. Despite subsequent consolidation to form TPG, TPG's market share challenge has worsened and now stands at just 15%.

Furthermore, the gap in financial performance between Telstra and its competitors is also significant, as illustrated in the ROCE chart below. Both Optus and TPG are in a difficult position relative to Telstra, with limited prospects for catching up and returns that remain well below the ROCE expected by shareholders and financial markets.

Exhibit 3: Return on capital employed



Source: Operator financial statements, Coleago

Telstra is able to earn a return above its WACC because its dominant market share provides economies of scale that are not available to operators with smaller market shares. High spectrum renewal licence fees would further entrench the disadvantages faced by Optus and TPG. Fundamentally, a business that does not earn its WACC does not represent a sustainable investment opportunity. The inability of either Optus or TPG to earn their WACC illustrates that there is a real threat to investment and competition.

The risks from the ACMA's pricing approach are unacceptable and ESL prices must be set conservatively

We recommend a 20% threshold which also corresponds to how the data is clustered

ESL prices must be set conservatively because of these asymmetric risks

A 35%, or even 49%, risk that TPG or Optus would not renew some or all of their ESLs (based on the analysis above) is not acceptable, given the essential nature of mobile services and the key public interest criteria of efficiency, competition and investment.

In our Stage 3 submission, we strongly recommended that ACMA should set ESL prices conservatively because of such risks and the fact that TPG's and Optus's returns on capital have been substantially below their WACC. The ACMA also stated in its Stage 3 Consultation that its preliminary prices were "*relatively conservative*". So, the ACMA's updated preliminary prices are a departure from this position. Setting ESL renewal prices at a level where 20% of benchmark prices are lower and 80% are higher may represent an acceptable level of risk. Under this approach, the ACMA could be 80% confident that incumbents would renew all of their spectrum licences and that competition in mobile services would not be weakened.

The 20% threshold is not arbitrary. Exhibit 4 below shows the resulting ESL prices when this risk-based approach is applied. These prices fall within the modal 5th-percentile bucket around which the benchmark values are clustered, indicating a high probability that an appropriate value has been selected based on the dataset. These risk based prices represent Coleago's recommendation for an ESL renewal price level which will deliver all stated policy objectives.

Exhibit 4: Recommended ESL prices based on risk and total Industry bill by band

	Risk based price - AUD / MHz/ pop full licence			Total Industry bill - AUD millions and % change vs. ACMA		
	ACMA	CPI excluded	CPI included	ACMA	CPI excluded	CPI included
700	0.7405	0.3743	0.4465	1,945.9	984 (-49%)	1,173 (-40%)
850	0.7558	0.3820	0.4558	858.9	434 (-49%)	518 (-40%)
1800	0.3030	0.0819	0.0820	1,295.5	350 (-73%)	350 (-73%)
2100	0.2757	0.0745	0.0746	801.5	217 (-73%)	217 (-73%)
2300	0.1596	0.0529	0.0668	322.9	107 (-67%)	135 (-58%)
2600	0.1621	0.0537	0.0679	661.6	219 (-67%)	277 (-58%)
3400	0.2052	0.0669	0.0823	1,502.5	490 (-67%)	603 (-60%)
Total				7,388.8	2,801 (-62%)	3,274 (-56%)

Source: Coleago and ACMA

The total industry bill would fall by 62% compared to the ACMA's updated preliminary prices under our recommended estimate. We removed the ACMA's CPI adjustment from our main estimates (though values with CPI are included for completeness) and we explain below why it is not appropriate to adjust benchmark prices using the CPI.

If risk based pricing is not adopted, the ACMA must address issues in its proposed methodology

If the ACMA does not accept our recommended risk based approach, and decides to continue with its proposed approach of setting ESL prices based on central estimates, it must address several concerns in its methodology as set out in the next section.

Issues to be addressed in the benchmarking if risk based pricing is rejected

We have identified a number of detailed issues in the benchmarking which the ACMA should address

Although ACMA has commissioned well regarded industry experts for the benchmarking, the materially different results of the two ACMA-commissioned benchmark studies underscore the inherent challenges of using benchmarks to set future prices – our key concerns are as follows:

- There are a priori reasons to remove some benchmark outliers from the data set
- Declining trends in spectrum prices must be fully captured in the approach
 - Using CPI on its own is not appropriate

- The ACMA's Mobile Spectrum Revenue index in Stage 3 better captured the downward trend in spectrum prices and the ACMA considered it a reasonable proxy for profit and hence cash flows relating to spectrum
- DotEcon's report did not properly assess the impact of future spectrum releases and its impact on spectrum prices
- ESL prices must be consistent with all public interest criteria and the claim that the updated preliminary prices support ACMA's policy objectives is not substantiated – a public interest discount would be one way to reflect wider public benefits.

Outliers should be excluded from the analysis as is standard practice

It is standard practice to identify and exclude outliers – i.e. data that are not representative – not excluding them overstates ESL prices by an average of 11%

The benchmark analysis by DotEcon for the ACMA did not investigate or remove extreme historical spectrum prices, which disproportionately affect the median/geometric mean leading to a significant upward bias. Robust analysis should identify outliers and assess their impact, if only to detect potential data errors. Indeed, the ACMA notes in Stage 4 that *Stakeholders [including Optus] recognised the cohort analysis as a tool to exclude outliers and improve the robustness of valuation results*".

DotEcon's rationale for not attempting to identify and exclude possible outliers from the dataset was that *"Trying to find more refined principles for excluding awards quickly becomes nebulous and difficult to apply on a consistent basis"*. However, this argument is weak, given that DotEcon has previously applied consistent tests for outliers in its historic reports for Ofcom and ComReg (2013-2021) and removed extremes using inter quartile range (IQR) or standard deviation-based tests. Moreover, the ACMA in Stage 3 Paper 4 seemed to approve the removal of outliers commenting that *"... our approach leads to relatively conservative renewal prices, as the valuation methodology controls for outlier prices and assumes declining spectrum values over time"*.

Using the same tests as DotEcon's previous studies, we found several clear outliers in the dataset which significantly inflate the ACMA's updated preliminary price by 11% on average. This contradicts the ACMA's claims that using the geometric mean and median *"... ensures that extreme values do not disproportionately influence the final price"* (Stage 4, p. 24).

Using CPI to adjust auction benchmarks without adjusting for changes in mobile spectrum value is not sufficient

Adjusting benchmarks by the Consumer Price Index is not appropriate because spectrum is a producer cost and values are largely driven by cost avoidance

In a major change from the previous benchmarking analysis the ACMA inflated the benchmark prices to 2025 equivalent values using the Consumer Price Index to *"reflect changes in general price levels"*. It also proposes to project forward its 2025 prices to the commencement date of renewed ESLs using the CPI. However, using the CPI solely to adjust benchmark prices and also future single prices is fundamentally flawed:

- Mobile communications prices fell by 79% in real terms from 2014-2022 (based on ACCC data) whilst the CPI increased by 20% in the same period.
- Between 2008 and 2024, Australia's CPI increased by 54% whereas Australia's mobile service revenue increased by a mere 3%. In other words, mobile service revenue is essentially flat whereas consumer prices have increased by 2.58% per year and continue to increase.
- Analysing the benchmark data without the CPI adjustment shows that historically spectrum prices have not increased over time.
- MNO spectrum valuations are largely driven by the relevant avoidable costs of their networks and by their cost of capital, so are even more unlikely to be correlated with general consumer prices.
- The CPI is the "Consumer Price Index", but ESL spectrum is a cost to the producer, i.e. MNO, and adjusting spectrum values for price changes over time should reflect changes in the relevant prices the MNO faces.

Expert research shows that mobile spectrum prices have been declining and future spectrum release plans imply this will continue in Australia

A mechanism such as the Mobile Spectrum Revenue index discussed in Stage 3 should be applied

Declining spectrum price trends must be fully incorporated into the benchmark analysis

The ACMA must fully incorporate acknowledged declining trends in mobile spectrum prices into the benchmarking both to historical and expected future prices. The Peer Review acknowledged historical evidence of this declining price trend and evidence previously submitted by experts such as NERA confirms the trend. The recent EU Digital Networks Act also recognises this and recommends that in setting fees “revenues per connection, as well as the overall burden ... should also be taken into account, to avoid that very high prices paid in past auctions continue to overburden holders of rights and prevent them from investing in networks”.

DotEcon's approach of limiting the benchmark data to 2018 onwards, only partially accounts for falling spectrum values and does capture falling price trends post 2018. Moreover, changing the cut-off date changes the results suggesting the 2018 cut-off is not robust. While the previously proposed Mobile Spectrum Revenue (MSR) index (which was rejected in the Peer Review) has some limitations, it may still be better than other alternatives for this purpose. The ACMA should either use the MSR index or develop a better one to make this important adjustment. It is both fair to take into account mobile spectrum price trends and it provides a check on affordability.

Equally as important, the ACMA must also adjust future spectrum prices because there is credible evidence that mobile spectrum prices will continue to decline.

A substantial amount of spectrum of spectrum below 7.1 GHz has been identified for potential release by ACMA. Within the next 10 years, the amount of spectrum below 7.1 GHz used by mobile operators may increase by 96%. With such a large amount of close substitutes to existing mobile spectrum becoming available in this period, it is highly unlikely that mobile spectrum prices will not continue to decline.

Exhibit 5: Likely future mobile spectrum releases in Australia

	Existing	New	Future Total	Increase %
Sub 1-GHz	200	80	280	40%
Lower 1-3 GHz	240	90	330	38%
Upper 1-3 GHz	238	0	238	0%
3.4 GHz	225	0	225	0%
4.4-4.8 GHz	0	200	200	n/a
6585-7100	0	500	500	n/a
Total	903	870	1773	96%

Source: Coleago based on ACMA Spectrum Outlook 2025

Updating the benchmarking periodically with new auction data could undermine efficiency and investment

Finally, the ACMA's proposal to rerun the benchmarking with new auction prices between now and renewal will not capture the full decline in spectrum prices and will have serious unintended consequences. MNOs will be forced to decide on the earliest ESLs without knowing the price of other ESLs that are substitutes. This undermines MNO choices, risks inefficiency and, in extreme cases, will chill investment.

Consistency of revised prices with public interest criteria

ESL pricing should promote the long-term public interest, but the ACMA has not provided evidence to support this and seems to focus only on one component – economic efficiency

While formally checking against public interest criteria is mentioned in the Consultation, the ACMA simply states that “We have not needed to use this step in forming our updating preliminary views on pricing.” The ACMA does not provide or consider any wider information / analysis on the industry and future development of the market, and only offers a weak argument in support of their assertion.

In fact, the ACMA only seems to focus on one objective that of promoting efficiency and also argues that “higher spectrum prices may be beneficial in facilitating efficiency by reducing incentives to hoard spectrum” although there is no reason to believe this is a significant concern and there has been no evidence of hoarding in the past.

However, the ACMA has not shown how its updated preliminary prices promote: investment and innovation; enhanced competition; service continuity for end users; and connectivity and inclusion in regional and remote areas. In fact, higher prices are doing the exact opposite, as we argued in previous responses. The notion that if more money is taken out of the mobile industry in form of spectrum licence fees, this would leave more cash for investment is not plausible given the financial position of the industry.

Public interest discount

The essential service that mobile provides should be recognised in pricing through applying a public interest discount

Mobile networks provide an essential service to the public and their importance is reflected in the policy considerations relating to ESLs. It is therefore undeniable that there is a public interest in maintaining a competitive mobile market in which operators continue to invest to deliver 5G-Advanced, 5G-Stand-Alone, and future 6G services especially given the difficult financial position of the industry, as mentioned above.

To meet all the appropriate public policy objectives, it is important to apply a public interest discount to MNO ESL. The ACMA did not provide any plausible arguments why the public interest discount applied to MNO ESLs should be zero. A public interest discount would help all operators to invest and reduce the risks to competition.

As previously, we believe that, given the public interest discount of 50% applied in the past to rail and TOB, it is appropriate to apply a similar discount to mobile spectrum.

Impact of addressing the key concerns on ESL prices and the total bill

Fixing our three most important concerns would lead to a total Industry bill of AUD 4.8bn, 35% lower than the updated preliminary prices

We have estimated the impact of addressing the most important methodological issues in the ACMA's benchmarking. Removing the outliers we identify and removing the CPI effect and reflecting price declines through MSR index would give the following prices and a total industry bill of AUD 4.8bn (35% less than the updated preliminary prices). The impact of the other concerns, which would depend on how they were addressed, is also likely to be significant.

Exhibit 6: Prices after adjustment for outliers, CPI and MSR, and total Industry bill

	Prices adjusted for outliers and CPI (AUD, full licence)		Total Industry bill (AUD million)		
	ACMA	Adjusted	ACMA	Adjusted	Ch0061nge
700	0.7405	0.5462	1,945.9	1,435.3	26%
850	0.7558	0.5575	858.9	633.6	26%
1800	0.3030	0.2182	1,295.5	933.1	28%
2100	0.2757	0.1986	801.5	577.3	28%
2300	0.1596	0.0697	322.9	141.0	56%
2600	0.1621	0.0708	661.6	289.0	56%
3400	0.2052	0.1073	1,502.5	785.4	48%
Total			7,388.8	4,794.7	35%

Source: Coleago

Conclusion and recommendations

The ACMA should adopt a risk based pricing approach and not inflate benchmark prices.

However, if the ACMA continues to use central values to set ESL prices, it must address the flaws identified

The ACMA should adopt risk based pricing in view of the complexities identified in the benchmarking, the need for a conservative approach, the asymmetric risk of setting ESL prices too high and the need to promote all the components of the long term public interest. This would reduce prices by 49%-73% compared to the ACMA's updated preliminary prices.

However, if the ACMA maintains its proposed approach based on the geometric mean and median, benchmarking issues must be fixed, it must still set ESL prices conservatively, and the resulting prices must address all public interest issues. In particular, it should:

- Exclude outliers that meet standard tests and are backed up by a priori evidence;
- Adjust benchmarks by trends in mobile spectrum prices and remove the CPI adjustment;
- Apply a public interest discount given mobile is an essential service bring substantial public benefit.

2. Introduction

The guiding principle for setting ESL prices is the long-term public interest

The benchmarking is fundamental to the ACMA's ESL pricing approach, hence our response focuses on this and the impact on the wider public interest

This document sets out Coleago's views on the ACMA's Stage 4 Consultation⁴ on updated ESL preliminary prices and the Peer Review⁵ of the ESL pricing methodology carried out for the ACMA by DotEcon.

The framework for both the approach to ESL renewal and ESL pricing was established during the previous three stages of the ESL process. Stage 3⁶ in particular set out the key criteria the ACMA would use to assess renewal and pricing in accordance with the long-term public interest, as specified in Section 77C(5) of the Radiocommunications Act 1992.

The core of the preliminary ESL price ranges (both preliminary and updated preliminary) proposed by the ACMA is an international benchmarking analysis of historical spectrum auction prices. Following the recommendations of the peer review, the ACMA has made significant changes to both the benchmarking approach and the dataset.

Accordingly, Section 3 of this document begins with an assessment of the most substantive aspects of the benchmarking analysis and how it should be used to set ESL prices.

Subsequent sections are as follows:

- Section 4 sets out the asymmetric impacts of setting ESL prices too high or too low.
- Section 5 discusses the risks to public interest objectives of identifying a single price point based on statistical measures such as the geometric mean or median, rather than a range, given the variability in auction price datasets and their limited representativeness for Australia.
- Section 6 sets out our view that, as a result, the ACMA should adopt a conservative approach to ESL pricing.
- Section 7 discusses spectrum price trends and explains why we consider it inappropriate to adjust spectrum values using the consumer price index.
- Section 8 explains why we believe it is preferable to explicitly adjust for declining spectrum price trends, for both historic and future prices.
- Section 9 discusses the lack of evidence that the ACMA has considered public interest criteria beyond efficiency, including the trade-off between spectrum fees and other aspects of the public interest.
- Section 10 restates our view on the case for public interest discounts.
- Section 11 sets out our detailed analysis of the benchmarking approach and recommendations for how it can be improved.

Finally, although the focus of this paper is ESL pricing, we would like to make one broader comment on the ACMA's proposal to reissue ESLs to MNOs where they can demonstrate a continuing or future need, rather than re-auctioning them. The European Commission recently adopted the Digital Networks Act⁷. This aims to restore the EU's industrial competitiveness and innovation in mobile networks. A key element is spectrum, and the Act proposes that rights to MNO spectrum should be "*mainly unlimited licence duration by default, with possibility for review clauses and revocation of rights of use*" (p12). It argues that "*the insufficiently long duration of licences, a lack*

4 Expiring spectrum licences (stage 4) – updated preliminary views on pricing
<https://www.acma.gov.au/consultations/2025-12/expiring-spectrum-licences-stage-4-updated-preliminary-views-pricing>

5 Review of the ACMA expiring spectrum licence pricing,
https://www.acma.gov.au/sites/default/files/2025-12/dotecon_review_of_acma_expiring_spectrum_licence_pricing.pdf

6 <https://www.acma.gov.au/consultations/2025-04/expiring-spectrum-licences-stage-3-preliminary-views>

7 <https://digital-strategy.ec.europa.eu/en/policies/digital-networks-act>

of flexibility and incentives to share spectrum and use it more efficiently, have increased the cost of spectrum which, combined with limited mobile revenues and lack of demand, has negatively affected deployment” (p9). Furthermore, it says “Investment predictability can hence be better achieved by the provision of rights with indefinite duration ... subject to periodic reviews, with credible revocation options” (p46).

This landmark change in approach supports the views we have expressed on renewal in previous submissions and aligns with several of the themes on ESL pricing discussed later in this document.

3. Flawed use of benchmarking to set renewal prices

Correctly analysing and interpreting the benchmark data is critical to the resulting ESL prices given the inherent complexities of spectrum auction benchmarking

The peer review of the ACMA’s pricing methodology, which is based on benchmarking spectrum market prices, lies at the core of the ACMA’s Stage 4 consultation.

We have previously acknowledged that such benchmarking is inherently challenging due to the wide range of factors that influence spectrum auction prices, including auction design, scarcity of supply, market structure, geography, and broader economic conditions. Interpreting the data is therefore critical to the usefulness and validity of the results. Accordingly, this section analyses the key methodological issues involved in interpreting the data.

As the ACMA and their advisors know, when analysing a dataset with the view to draw conclusions there are several aspects to examine:

1. What is the range?
2. Is there a representative central value such as the mean, median or mode?
3. What is the standard deviation?
4. What is the central value?
5. Are there outliers?
6. Is there a trend?
7. Is there a correlation?

The ACMA, following DotEcon’s advice, did not consider, or explicitly excluded, items 1, 2, 3, and 5 from its analysis. Instead, it assumed that it was appropriate to calculate a central value, specifically the median and the geometric mean, and, in Step 6A of its methodology, used these central estimates to determine a single market value for spectrum in Australia.

The use of central values (mean, median) as recommended in the Peer Review is not necessarily representative of a dataset

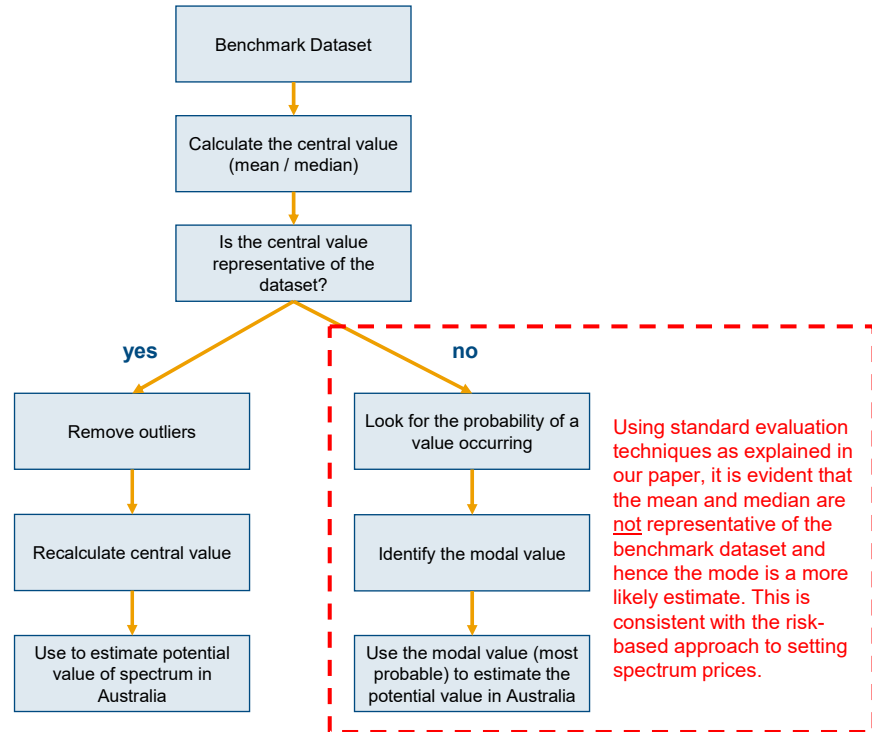
A geometric mean, median, or arithmetic mean can be calculated for any dataset. However, this does not imply that the resulting average or central value is representative of the dataset. To illustrate this point, consider an extreme example. In a dataset with 100 observations, 50 observations have a value of 1 and the remaining 50 have a value of 9. This represents a starkly bimodal distribution, with two distinct peaks.

In this example, the median and mean are both 5, while the geometric mean is 3. However, concluding that a “typical” or representative value is 5 or 3 would be incorrect. Based on the 100 observations, the probability that the next observed value would be 3 or 5 is zero. Examining statistical measures of dispersion for this dataset would provide important context on the extremity of the distribution and the lack of representativeness of the averages.

If benchmark data is used for statistical analysis to estimate the market value of spectrum in Australia, the analysis should be undertaken in an exhaustive manner, taking account of all relevant information contained in the dataset.

Below, Coleago provides a detailed analysis of the benchmark spectrum value datasets, demonstrating that neither the geometric mean nor the median is representative of the data and recommends that the mode is more likely to be an appropriate estimate for spectrum values in Australia.

Exhibit 7: Identifying the representative value in the benchmark dataset



Source: Coleago

Wide range of benchmark values

In fact, the benchmarking datapoints vary widely and are not clustered around a central value

Exhibit 8 below shows the number of benchmark spectrum market values (datapoints), the range of benchmark values across the four band categories, and the maximum value expressed as a multiple of the minimum. It is apparent that the range is very wide and that there are relatively few datapoints. For example, in the upper 1 - 3 GHz category, the maximum value is 144 times higher than the minimum, based on only 36 datapoints (benchmark observations). The fewer the datapoints and the wider the range, the greater the uncertainty that any central estimate provides a meaningful insight into the value of spectrum in Australia.

Exhibit 8: Number of benchmark values and their range (365day price / MHz / pop AUD 2025)

	Sub-1 GHz	Lower 1-3 GHz	Upper 1-3 GHz	3.4 GHz
Number of benchmark values	35	23	36	47
Minimum	0.0178	0.0021	0.0009	0.0015
Maximum	0.2996	0.2081	0.1288	0.3764
Maximum as a multiple of minimum	16.8	97.6	144.2	247.7

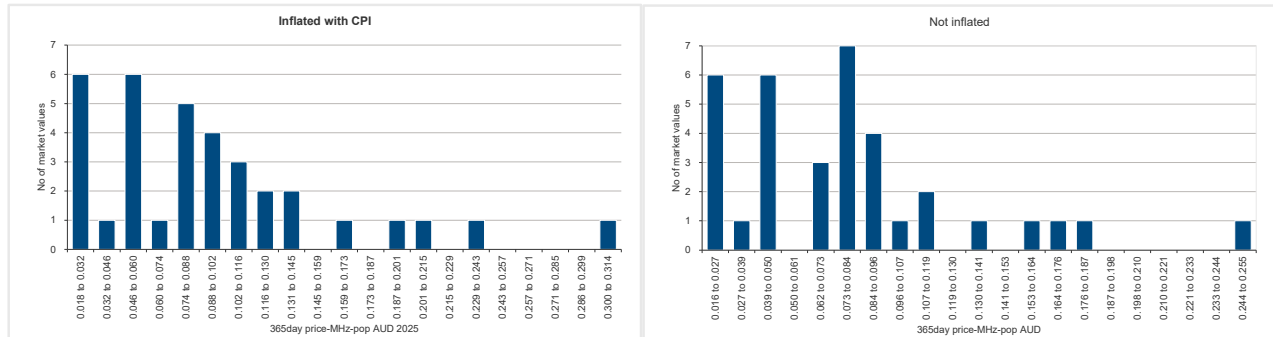
Source: Coleago based on ACMA Excel files

Given the wide range of observed market values, the ACMA should have considered where within this range the market value of spectrum in Australia is likely to lie, rather than simply calculating the geometric mean and median and insisting that these constitute a reasonable and representative central estimate.

Calculated geometric mean and median are not representative of the dataset

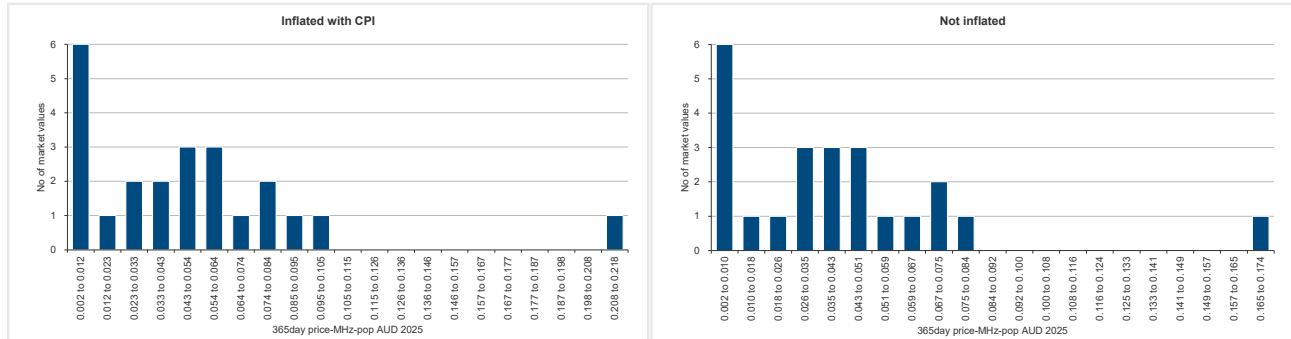
The exhibits below show the benchmark values for the four band categories, grouped into 5 percentile buckets. The charts clearly show that spectrum market values irrespective of whether they inflated by the CPI or not are not clustered around a central value.

Exhibit 9: Number of sub-1 GHz benchmark values in 5 percentile buckets



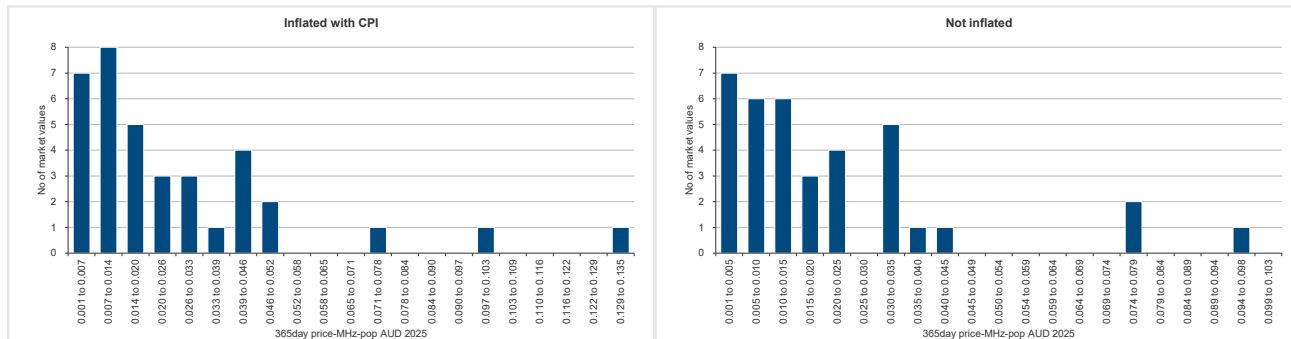
Source: Coleago based on ACMA Excel files

Exhibit 10: Number of lower 1-3 GHz benchmark values in 5 percentile buckets



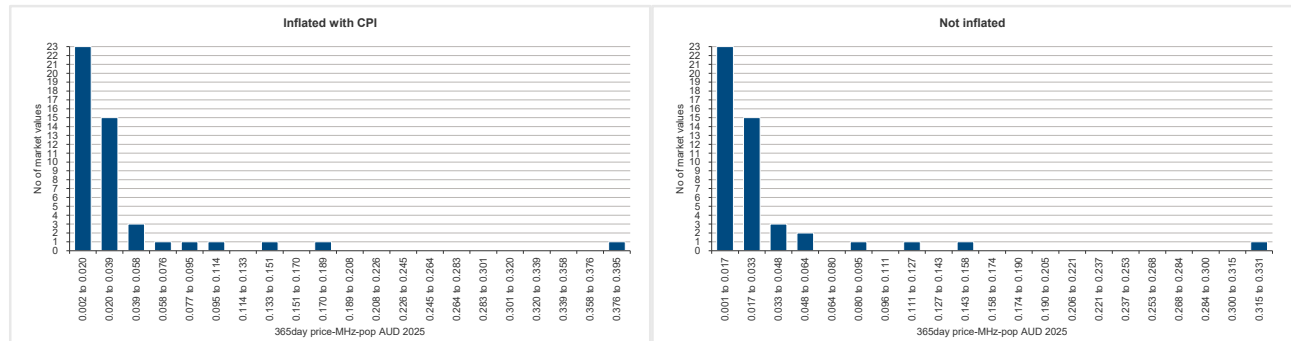
Source: Coleago based on ACMA Excel files

Exhibit 11: Number of upper 1-3 GHz benchmark values in 5 percentile buckets



Source: Coleago based on ACMA Excel files

Exhibit 12: Number of 3.4 GHz benchmark values in 5 percentile buckets

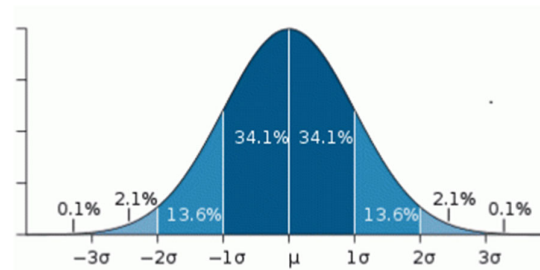


Source: Coleago based on ACMA Excel files

Statistical metrics indicate that the central values used by the ACMA are only weakly representative

For illustrative purposes, Exhibit 13 below shows a standard normal distribution, in which values are clustered around the mean. This implies that, based on the observations in a sample, there is a high probability that an additional observation will fall within a range close to the central value. It is immediately apparent that the observations used for spectrum value benchmarking are not normally distributed; rather, they are widely spread, skewed, and include extreme outliers.

Exhibit 13: Standard normal distribution



Source: Australian Bureau of Statistics

We examined the four benchmark datasets to assess whether calculating an average value in the form of the mean or median provides a price that is representative of the benchmark market prices observed in other countries.

First, we calculated the ratio of the standard deviation to the mean, i.e. the coefficient of variation (CV). When variability is large relative to the mean, this indicates that:

- Individual observations are widely spread.
- Many data points are far from the mean.
- The mean does not describe a “typical” observation very well.

Exhibit 14: Interpretation of coefficient of variation

Coefficient of Variation	Interpretation	Mean representativeness
< 10%	Very low variability	Mean is highly representative
10–20%	Low variability	Mean is representative
20–30%	Moderate variability	Mean is reasonably representative
30–50%	High variability	Mean is weakly representative
> 50%	Very high variability	Mean is poorly representative

Exhibit 15 and Exhibit 16 below show the coefficient of variation (CV) for each of the four spectrum value benchmark datasets. The CV for all four datasets is well above 50%. This provides clear evidence that the mean is poorly representative of the datasets and that it is therefore inappropriate to draw conclusions from it.

Exhibit 15: Coefficient of variation in the CPI inflated benchmark dataset

	Sub-1 GHz	Lower 1-3 GHz	Upper 1-3 GHz	3.4 GHz
Standard deviation	0.0638	0.0448	0.0274	0.0609
Mean	0.0942	0.0491	0.0270	0.0369
Standard deviation / mean	68%	91%	101%	165%

Source: Coleago based on ACMA Excel files

Exhibit 16: Coefficient of variation in the non-inflated benchmark dataset

	Sub-1 GHz	Lower 1-3 GHz	Upper 1-3 GHz	3.4 GHz
Standard deviation	0.0510	0.0362	0.0221	0.0509
Mean	0.0791	0.0411	0.0215	0.0310
Standard deviation / mean	64%	88%	103%	164%

Source: Coleago based on ACMA Excel files

As a secondary check on the appropriateness of calculating an average value to estimate the central estimate of spectrum values, we also examined the ratio of the interquartile range (IQR) to the median. This ratio provides a measure of how concentrated the datapoints are around the central value. As a general rule, an IQR-to-median ratio below 25% indicates that the median is highly representative of the dataset; a ratio between 25% and 50% suggests the median is reasonably representative; and a ratio above 50% indicates that the median is weakly representative.

Exhibit 17 and Exhibit 18 below show that, for all four spectrum categories, the IQR-to-median ratio is well above 50%. This indicates that the calculated central datapoint, in this case the median, is not representative of the values in the dataset.

Exhibit 17: Standard deviation to median (CPI inflated data)

	Sub 1 GHz	Lower 1-3 GHz	Upper 1-3 GHz	3.4 GHz
Inter Quartile Range	0.0650	0.0493	0.0277	0.0244
Median	0.0856	0.0439	0.0173	0.0217
Inter Quartile Range / Median	76%	112%	160%	113%

Source: Coleago calculation based on ACMA benchmark data

Exhibit 18: Standard deviation to median (non-inflated data)

	Sub 1 GHz	Lower 1-3 GHz	Upper 1-3 GHz	3.4 GHz
Inter Quartile Range	0.0502	0.0393	0.0223	0.0206
Median	0.0741	0.0392	0.0136	0.0175
Inter Quartile Range / Median	68%	100%	164%	118%

Source: Coleago calculation based on ACMA benchmark data

We conclude that, in all 4 spectrum groups, it is questionable that the central value is a reasonable estimate of spectrum value in any one country

The analysis shows that, for all four spectrum categories, the central estimates calculated by the ACMA are not representative of the benchmark value datasets. It is therefore highly questionable to conclude that the central estimate provides a reasonable estimate of the market value of spectrum in Australia (or any one country for that matter).

Skewed distribution and modal value

We also find that the central values are significantly above the “modal value” which indicates where the data is most clustered

Examining the benchmark data in 5 percentiles as shown in the charts above, reveals that the data is clustered at the lower end of the range. For all four spectrum categories, the modal 5-percentile (the most frequently occurring range) lies below the single value proposed by the ACMA.

Exhibit 19: Modal value vs. ACMA updated preliminary price

365day price / MHz / pop AUD 2025	Sub 1 GHz	Lower 1-3 GHz	Upper 1-3 GHz	3.4 GHz
Modal 5-percentile	0.018 to 0.032 and 0.046 to 0.060 (bimodal)	0.002 to 0.012	0.007 to 0.014	0.002 to 0.020
ACMA proposed single price	0.0755	0.0307	0.0167	0.0217

Source: ACMA and Coleago analysis

The Australian Bureau of Statistics states: “In a set of data, the mode is the most frequently observed value. A set of data can have more than one mode or no modes. In many datasets, the most frequently observed value will occur around the mean and median values, but this is not necessarily the case, particularly where the distribution of the dataset is uneven.”⁸ As we can see from the 5-percentile analysis of the benchmark data, the benchmark values are very uneven and hence it would be appropriate to focus on the modal value.

⁸ 1500.0 - A guide for using statistics for evidence-based policy, 2010

4. Assessing the risk of ACMA price being too low or too high

Because spectrum auction prices can be very specific, to market conditions, rules etc., benchmarking is not straightforward

If we accept that prices paid for spectrum in an auction - i.e. a market-based allocation mechanism - represent the market value of spectrum in the market where the auction was held, it is clear that different markets assign very different values to spectrum. There is no single international market value for spectrum, as each country is a distinct market. A mobile operator cannot purchase spectrum in country X and deploy it in country Y.

In the Stage 4 consultation paper, the ACMA states “*Benchmarking, based on outcomes from domestic and international spectrum awards, allows us to derive prices that reflect the market value of the spectrum in a transparent and evidence-based manner.*” and writes “*We consider the updated preliminary views represent reasonable market valuations for each band group.*”

The essence of the ACMA’s approach to benchmarking spectrum prices is:

- That prices paid at auction are market values.
- That averaging those prices paid in other markets tells us what the market value of spectrum in Australia is likely to be.

As shown in the analysis above, the wide range of values and their skewed distribution indicate that it is inappropriate to draw conclusions based on the median, mean, or geometric mean.

- The high variability in the benchmarks indicates the mean or geometric mean describes the centre but not a typical value.
- The benchmarks are not clustered around the mean or geometric mean which is further evidence that the mean and geometric mean are not representative of the dataset.

For example, let us consider the sub-1 GHz spectrum:

- All 35 benchmarks are market values and are deemed by DotEcon and the ACMA as relevant to estimate what the value of spectrum might be in Australia.
- The benchmarks are widely dispersed and are not clustered around the mean.
- There is a great variation in the benchmark market values and, without knowing the cause of these variations, particularly between countries, there is a reasonable probability that any particular market value in the dataset is the value of spectrum in Australia.

The risk is high, 35%-49%, that the proposed ESL prices exceed the value for at least some operators, if the benchmark data is indicative of the probability

The mean or geometric mean of all values is no more likely to represent the market value of spectrum in Australia than any other of the 35 market values in the benchmark dataset. Hypothetically, for an auction outcome included in the benchmarking dataset with a price below the mean, if the reserve price had been set at the mean value the spectrum would have remained unsold.

It is therefore essential to ask what the probability is that the value of spectrum in Australia is in fact the geometric mean (a single price) used by the ACMA, and what the probability is that the true value is higher or lower than this geometric mean.

If the price is set at the lowest benchmark value, one can be reasonably confident that the value of spectrum to Australian operators is not lower. Setting the price above the lowest value progressively increases the risk that the price exceeds the market value of spectrum in Australia.

Exhibit 20 below shows, for each of the four spectrum categories, the percentage of benchmark spectrum market values that are below the single price proposed by the ACMA. Depending on the category, the risk that the updated preliminary price would exceed the value of spectrum for all, or some, operators ranges from 35% to 49%.

Below, we examine these probabilities in more detail and focus on the implications of the price being set too high, as well as the implications of it being set too low.

Exhibit 20: Benchmark market values below ACMA updated preliminary price

% of benchmark values	Sub-1 GHz	Lower 1-3 GHz	Upper 1-3 GHz	3.4 GHz
Below ACMA single price	40%	35%	47%	49%

Source: Coleago analysis using ACMA Excel files

4.1 Implications of the single value being lower than the market value in Australia

The socioeconomic risks if ESL prices are set too low are limited

First, we examine the risk of the ACMA proposed single value being lower than the market value in Australia and what would be the consequence.

- All three operators would renew their spectrum licences.
- The question then is whether the difference between the market value and the renewal price accrues to shareholders in the form of a windfall gain, or whether paying less than operators would have been prepared to pay has a positive impact on society. Since there are three competing operators (who are seeking to earn their cost of capital), paying less than spectrum might have been worth to an operator is likely to translate into enabling operators to spend more on network build, reduce prices, or a mixture of both. Either way, the winner is the consumer.

Further, there is little evidence that low spectrum prices lead to inefficient use or hoarding; in fact, the benefits typically flow to consumers

We have previously provided evidence that consumers have benefited significantly from mobile operators' investment in spectrum and networks, while shareholders have not. The value of spectrum accrues to society rather than to investors in mobile operators. In a competitive market, prices fall to a level at which operators earn only their cost of capital. There is no evidence that low spectrum prices increase enterprise value.

Data from the ACCC Communications Market Reports show that, between 2014 and 2022, mobile services retail prices in Australia declined by 79% in real terms. Over the same period, operators' returns on invested capital did not increase. Indeed, Optus' ROIC of 2% is well below its cost of capital. This demonstrates that the value of additional spectrum accrues to consumers rather than to investors.

Setting ESL prices below the value to operators is therefore unlikely to result in a misallocation of spectrum, provided that prices remain above the opportunity cost of alternative uses of the spectrum. This condition should be met, given that renewal decisions are predicated on the ACMA finding continuing and ongoing demand for ESL spectrum from existing licensees, and the absence of credible competing demand from alternative users.

In conclusion, the arguments set out above indicate that, even if the ACMA's focus is limited to the public interest criterion of efficiency, setting renewal prices below operators' value does not result in socio-economic harm.

Furthermore, we reiterate our view that it is not necessary to set ESL prices at market value in order to promote efficiency, given that the secondary market for mobile spectrum is functioning well and already provides strong incentives for efficient spectrum use.

4.2 Risk and implications of the single value being higher than the market value in Australia

The socioeconomic risk if ESL prices are set too high are substantial

The weakest operators may not renew all of their spectrum; investment and competition could decline

Secondly, we examine the risk of the ACMA updated preliminary price being above the market value in Australia and what the consequence would be.

- The operator(s) with the lowest market share and hence financial leverage may not renew all of their ESL i.e. possibly two operators might not renew all of their ESL.
- Spectrum would either remain unused for the foreseeable future, since mobile is generally accepted to be the highest value use. Alternatively, the operator with highest market share might acquire unused spectrum, thus increasing the concentration of spectrum holdings.

An outcome in which one or two operators do not renew even some of their spectrum would be highly negative when assessed against the policy objectives underpinning the ESL process, notably “enhancing competition” and “promoting competition.”

In Australia, there is a significant risk that the prices proposed by the ACMA will exceed the value of spectrum to Optus, TPG, or both. Australia already faces a highly concentrated mobile market, in which the dominant operator, Telstra, holds a market share of around 50%, giving it economies of scale that are not available to Optus or TPG. Some regional areas are already served only by Telstra, meaning there is no competition at the network level.

There are real risks to competition too if ESL prices are set too high especially given market conditions in Australia

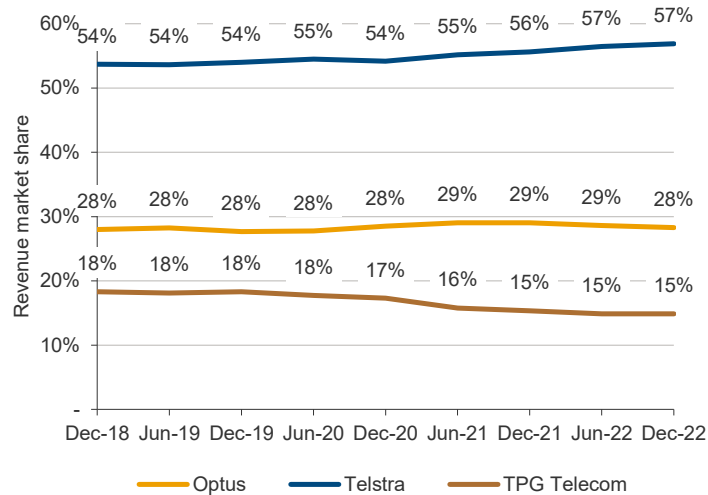
Mobile networks are dominated by fixed costs. For a typical mobile operator, the ratio of fixed to variable costs is approximately 70:30⁹. An operator with a larger market share therefore benefits from substantially greater economies of scale than an operator with a smaller market share. Spectrum licence fees are a fixed cost and therefore exacerbate the fixed cost problem in mobile markets. Australia, with a population of 26.3 million and a very large land mass, is a relatively small and geographically challenging market, making it particularly difficult for operators with lower market shares to earn their cost of capital.

As a result, Australia is especially vulnerable to threats to competition arising from the fixed-cost nature of the industry. In 2009, following the merger of Vodafone and Hutchison (VHA), their combined market share was 27%¹⁰. Subsequent consolidation to form TPG did not resolve the market share and associated economies of scale challenges. Exhibit 21 below shows that TPG’s market share position has continued to deteriorate and now stands at just 15%.

⁹ Coleago Consulting Ltd research. Fixed costs are cost which do not vary with revenue (at least in the short to medium term); variable costs scale in proportion to revenue.

¹⁰ Global Wireless Matrix 1Q14, Bank of America Merrill Lynch, 21 April 2014

Exhibit 21: Mobile network operator market shares by revenue



Source: Optus

To illustrate differences in economies of scale, the table below presents two indicators for the three Australian operators: the number of subscribers per MHz and the number of subscribers per site (shown as an index for ease of comparison). Each metric serves as a proxy for the unit cost of serving customers; higher values for subscribers per MHz or per site typically indicate lower unit costs and greater economies of scale.

The table therefore provides evidence supporting the view that the revised, higher spectrum prices proposed by the ACMA pose significant risks to competition, given that Telstra's economies of scale are substantially greater than those of Optus and TPG.

Exhibit 22: Economy of scale measures

	TPG	Optus	Telstra
Index: subscribers / MHz	100	117	258
Index: subscribers / site	100	109	142
Spectrum excluding mmWave (metro areas)	225	380	280
Sites	5,207	9,391	11,767
Mobile subscribers	5,514,000	10,861,000	17,710,000

Source: Coleago, Optus, ACCC Mobile infrastructure Report 2025, GSMA

Differences in the financial position of the MNOs further increase the sensitivity of competition to ESL prices

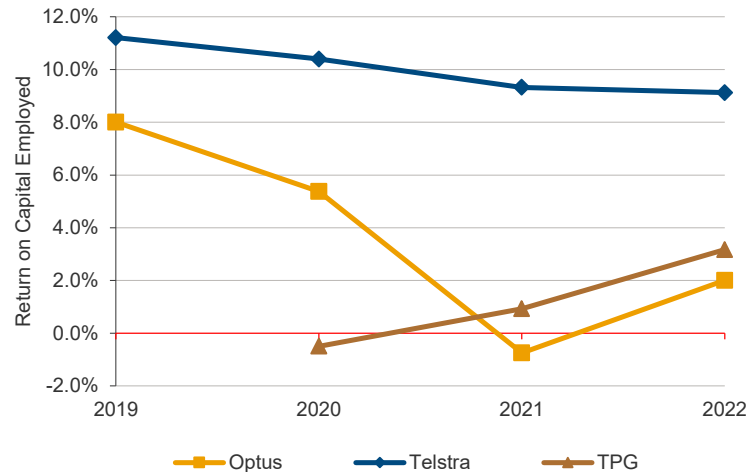
The current returns on capital employed (ROCE) for Optus and TPG are unsustainable. As shown in the ROCE chart below, the gap between the financial performance of Telstra and its competitors is significant. Both Optus and TPG are in a difficult position relative to Telstra, with limited prospects of catching up and returns that are well below the ROCE expected by shareholders and financial markets.

Telstra is able to earn returns above its weighted average cost of capital (WACC) because its dominant market share provides economies of scale that are not available to operators with smaller market shares. High spectrum renewal license fees would further exacerbate the fixed cost disadvantages faced by Optus and TPG.

Fundamentally, a business that does not earn its WACC does not represent a sustainable investment opportunity. Telstra's competitive advantage, driven by its superior financial position and ability to charge a price premium, is therefore

entrenched. The inability of either Optus or TPG to earn their WACC illustrates a real risk of declining investment and poses a clear threat to the current three-player market structure.

Exhibit 23: Return on capital employed



Source: Operator financial statements, Coleago

Notes: Optus financial year runs to end March, Telstra to end June and TPG to end December. TPG results are given from 2020 as that was the year in which TPG merged with VHA to form the current company.

TPG is the operator with the lowest market share and most challenging financial position of the three. The risk that the prices proposed by the ACMA are above TPG's value is high, as evidenced by TPG's share price performance. Exhibit 24 below shows the share price performance of Telstra and TPG against the ASX 200 index from 2020 to 2023. While Telstra's share price has broadly tracked the market, TPG has performed considerably worse by comparison. TPG's share price underperformance indicates that, at prevailing prices, investors do not expect to earn a return equivalent to alternative investments. In other words, investor sentiment regarding TPG's business case is negative.

To the extent that share prices reflect each company's ability to raise funds for future investment in financial markets, this further highlights the disparity in the financial positions of Telstra and at least one of its rivals. It also supports our argument that, for TPG in particular, the business case for investment is challenging and likely to be sensitive to the level of spectrum renewal fees.

Exhibit 24: Telstra and TPG share prices compared to the ASX 200 index

Chart generated on 10/5/2023 at 1:44 pm



Source: ASX

Even if Optus and TPG were to renew all their spectrum licences, higher renewal fees would increase Telstra's dominance due to its greater ability to absorb fixed costs and its deeper financial resources. This would give Telstra greater scope than its competitors to invest, innovate, and expand services, particularly in regional and rural areas, creating a vicious circle from a social welfare perspective by further strengthening Telstra's financial performance and exacerbating competitive imbalances.

5. Setting prices based on risk

The risks from the ACMA's pricing approach are unacceptably high and ESL prices must be set conservatively

As explained in Section 4, the impacts of setting ESL prices above market value are much worse than setting them below, and this affects the risks the ACMA faces in ESL pricing. The percentage of benchmark prices that are lower than the single price proposed by the ACMA gives an indication of the risk that spectrum values may be below the ACMA's proposals and is repeated for ease of reference in the table below.

Exhibit 25: Benchmark market values below ACMA updated preliminary price

% of benchmark values	Sub-1 GHz	Lower 1-3 GHz	Upper 1-3 GHz	3.4 GHz
Below ACMA single price	40%	35%	47%	49%

Source: Coleago analysis using ACMA Excel files

A 35% or even 49% risk that TPG or Optus would not renew some or all of their ESLs is not acceptable, given the essential nature of mobile services and the policy goal of promoting competition and investment in mobile services. If prices are maintained at the levels proposed by the ACMA, the ACMA would be gambling with the future of a competitive mobile market in Australia. Moreover, the ACMA is incorrect in stating in its Stage 4 consultation that a focus on market-value-based pricing avoids concerns about the risk of overpricing, given the issues inherent in its methodology (p. 26).

We recommend a 20% threshold which also corresponds to how the data is clustered

Coleago has previously argued for the adoption of a conservative approach to setting renewal prices. Setting ESL renewal prices at a level where 20% of benchmark prices are lower and 80% are higher may represent an acceptable level of risk. Based on the benchmark data for spectrum market values, the ACMA could be 80% confident that

incumbents would renew all of their spectrum licences and that competition in mobile services would not be weakened.

The 20% threshold is not arbitrary. Exhibit 26 below shows the ESL prices that result when this risk-based approach is applied. These prices fall within the modal 5th-percentile bucket, indicating a high probability that an appropriate value has been selected based on the benchmark dataset used by DotEcon and the ACMA.

Exhibit 26: Recommended ESL prices based on risk by spectrum group

365day price / MHz / pop AUD	Sub-1 GHz	Lower 1-3 GHz	Upper 1-3 GHz	3.4 GHz
Modal 5-percentile range	0.073 to 0.084	0.002 to 0.010	0.001 to 0.005	0.001 to 0.017
20% benchmark price limit – non-inflated	0.0381	0.0083	0.0055	0.0071
ACMA updated preliminary price	0.0755	0.0307	0.0167	0.0217

Source: Coleago and ACMA

This translates into the prices per ESL band, for full licence length, shown in Exhibit 27 below. The total industry bill would fall 62% compared to the ACMA's updated preliminary prices – for the main estimate which excludes CPI. For completeness, the table also shows that the total bill would fall by 56% if CPI were included (though we do not consider it appropriate to inflate benchmark prices with the CPI).

Exhibit 27: Recommended ESL prices based on risk and industry bill by Exhibit 4band

	Risk based price - AUD / MHz/ pop full licence			Industry bill - AUD millions and % reduction vs. ACMA		
	ACMA	CPI excluded	CPI included	ACMA	CPI excluded	CPI included
700	0.7405	0.3743	0.4465	1,945.9	984 (-49%)	1,173 (-40%)
850	0.7558	0.3820	0.4558	858.9	434 (-49%)	518 (-40%)
1800	0.3030	0.0819	0.0820	1,295.5	350 (-73%)	350 (-73%)
2100	0.2757	0.0745	0.0746	801.5	217 (-73%)	217 (-73%)
2300	0.1596	0.0529	0.0668	322.9	107 (-67%)	135 (-58%)
2600	0.1621	0.0537	0.0679	661.6	219 (-67%)	277 (-58%)
3400	0.2052	0.0669	0.0823	1,502.5	490 (-67%)	603 (-60%)
Total				7,388.8	2,801 (-62%)	3,274 (-56%)

Source: Coleago and ACMA

For completeness too, we include the table below showing the 365 day price data for the four spectrum groups, based on the CPI inflated benchmarks.

Exhibit 28: CPI inflated ESL prices based on risk by spectrum group

365day price / MHz / pop AUD	Sub-1 GHz	Lower 1-3 GHz	Upper 1-3 GHz	3.4 GHz
Modal 5-percentile range	0.018 to 0.032 and 0.046 to 0.060 (bimodal)	0.002 to 0.012	0.007 to 0.014	0.002 to 0.020
20% benchmark price limit – CPI-inflated	0.0455	0.0083	0.0070	0.0087
ACMA updated preliminary price	0.0755	0.0307	0.0167	0.0217

Source: Coleago and ACMA

6. ACMA must set prices conservatively given the uncertainty in the benchmark data

ESL prices must be set conservatively, given market conditions, the benchmark data issues and to maximise the long-term public interest

In our Stage 3 submission, we strongly recommended that the ACMA should set ESL prices conservatively.

- One reason for this was the need for ESL prices to remain affordable, given the challenging financial position of the MNOs. As reiterated in Section 4.2 above, TPG and Optus are earning returns on capital substantially below their WACC, while only Telstra is earning above its WACC. Moreover, the investment requirements associated with completing the rollout of advanced 5G networks and the future rollout of 6G are significant. This is not unique to Australia - the EU Digital Networks Act states that high spectrum costs would “*reduce the attractiveness of mobile operators and mobile deployment projects for financial markets and further weaken operators’ capacity to fund high-quality 5G and future 6G deployment*” (p58)
- Secondly, the risks to the industry, investment, competition, service quality, and coverage (i.e. the public interest) are asymmetric depending on whether the ACMA’s ESL price determination is above or below MNOs’ spectrum value.

As discussed in Section 4, the downside risks of setting prices too low are that the government receives less direct revenue from licence fees. Spectrum hoarding is also cited by the ACMA as a potential risk; however, no concerns regarding spectrum hoarding by MNOs have been raised in the past. By contrast, the impact on the mobile market and the wider economy of setting prices too high is potentially far greater and would persist for the entire duration of the licences.

- Thirdly, the benchmarking process itself leaves considerable uncertainty as to how the data should be interpreted and made most relevant to ESL renewal in Australia.
 - Coleago expressed reservations in Stages 2 and 3 of the ESL process regarding the conceptual challenges of using benchmarking to set renewal prices, and the extent to which subjective assumptions were required.
 - While DotEcon’s peer review recommendations reduce the number of assumptions required in some areas, such as by using fewer cohorts, standardising the interquartile range, and seeking to minimise the number of excluded observations, significant uncertainty nevertheless remains.
 - Moreover, the benchmark datapoints are widely dispersed around the chosen averages across all band groups, particularly in the upper 1 - 3 GHz band, with large interquartile ranges. This is not surprising, given that variations in auction design and market dynamics can significantly affect spectrum values, and that it is not possible to correct for all such factors.

Taken together, these issues make a compelling case for a conservative approach to interpreting the benchmark data. In stage 3, the ACMA also supported this principle stating that its preliminary prices were “relatively conservative” though in our view they did not go far enough. Relying on the median or geometric mean could easily overestimate ESL values, with serious consequences for MNOs and spectrum users alike - the high variability of the benchmark data further increases this risk. A conservative approach should therefore apply both to key methodological choices and to the derivation of final prices from the statistical measures of the benchmark data.

This approach should also be applied to the treatment of declining trends in mobile spectrum prices within the benchmarking analysis, as discussed in Section 8, and when considering the case for public interest discounts, as discussed in Section 10.

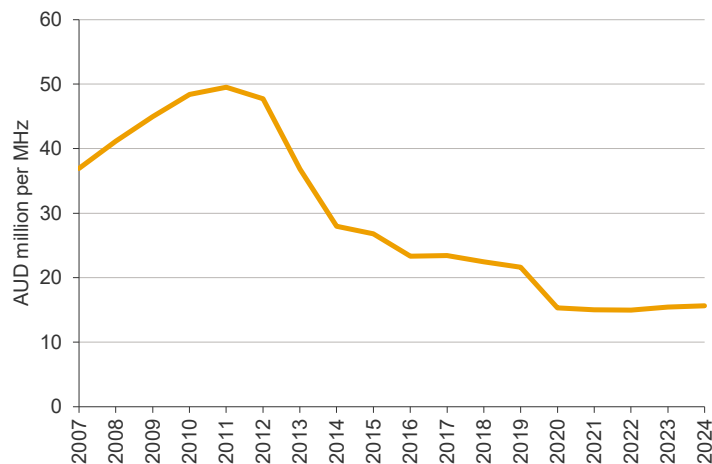
7. Using the CPI on its own to adjust benchmark prices is not appropriate

Adjusting benchmarks solely by the Consumer Price Index is not sufficient to reflect changes in spectrum values over time

The ACMA inflated prices in the benchmarking sample to bring prices forward to a uniform date (2025) using the Consumer Price Index “so that benchmark prices reflect changes in general price levels.” This is a major change from the previous benchmarking analysis.

While it has not been possible to isolate the impact of using CPI on ESL prices using the information released by the ACMA, it is clear that the impact is significant. Simply comparing the 25% change in the CPI from 2018 to 2025 compared to the 28% fall in the MSR index over the same period shows that the combined effect is considerable, as DotEcon recognise in their Peer Review (p5).

Exhibit 29: Mobile service revenue per MHz of spectrum (excl. mmWave)



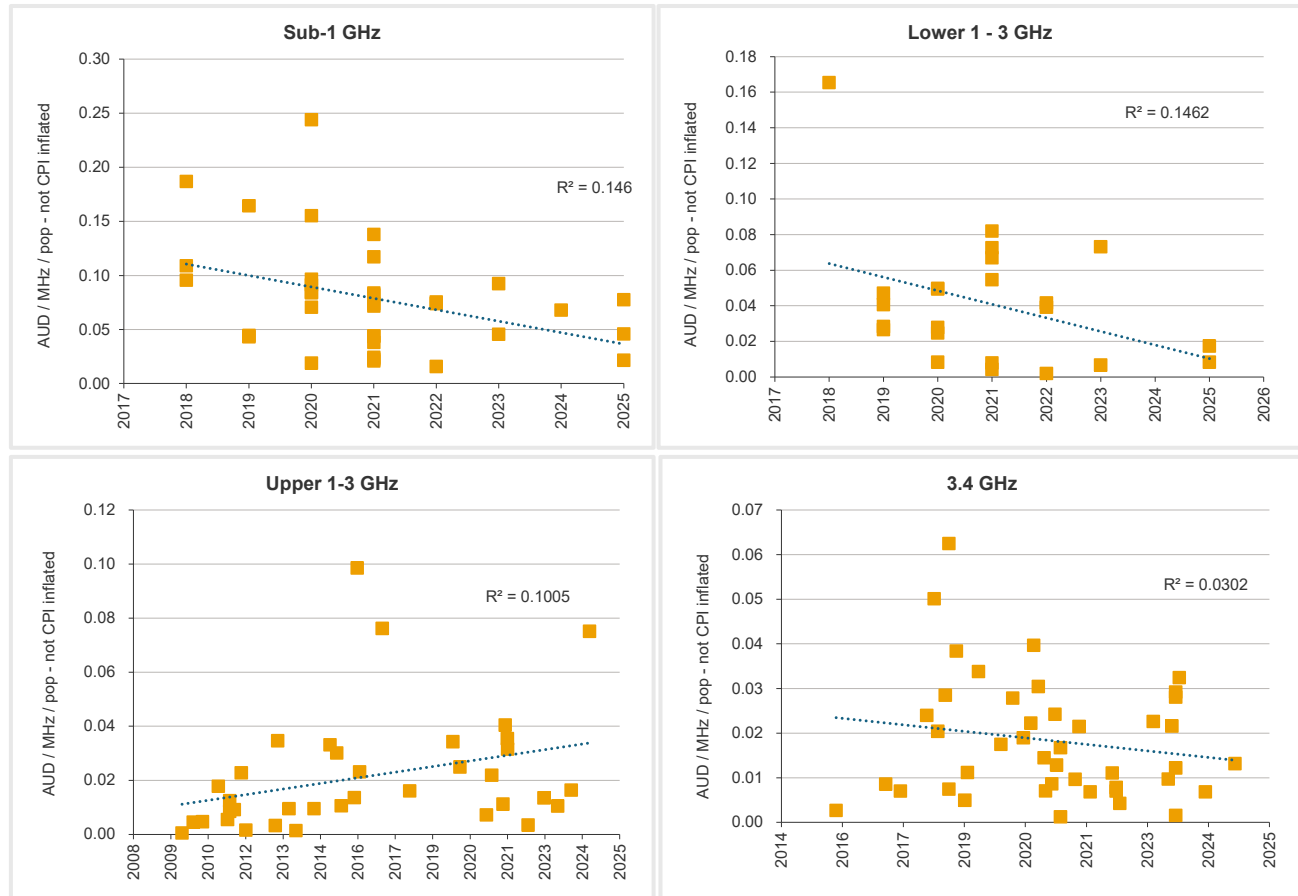
Source: Coleago

Additionally, the ACMA proposes that “The \$/MHz/pop single-year prices derived in the previous step are proposed to be adjusted for inflation (CPI) from 2025 to the relevant commencement date of renewed spectrum licences in each ESL band.”

Below we provide evidence that using the CPI to inflate benchmark prices and to inflate future single prices is fundamentally flawed.

The benchmark data without the CPI adjustment shows that spectrum prices have not increased over time, as shown in Exhibit 30. For three band categories the data shows a slight decline and for one a slight increase. However, the R-squared value is very small, indicating that there is no good correlation between time and prices paid. Another way of looking at this is that despite inflation, prices paid for spectrum have not increased. Therefore, increasing past auction pricing using the CPI is a wilful distortion of benchmark data.

Exhibit 30: Evolution of benchmark prices over time

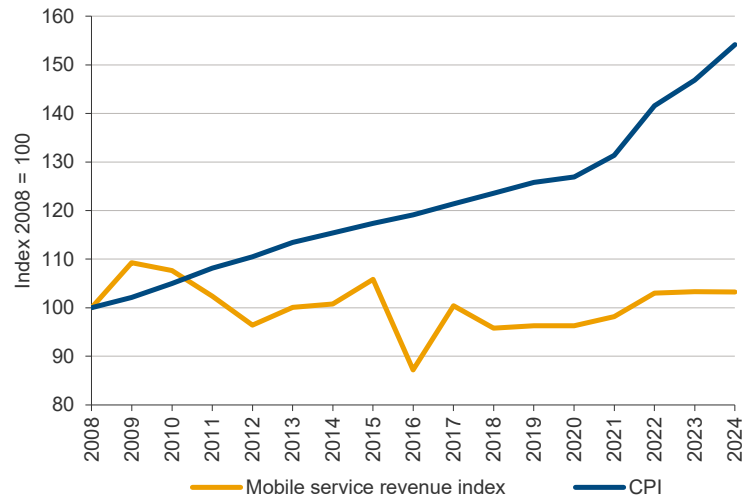


Source: Coleago based on ACMA Excel files

The change in prices for mobile communications is different from general inflation - prices for mobile communications declined over the past decade whereas the CPI shows that prices for other consumer goods have been increasing. When industry sector specific decisions are made, the change in prices in the particular sector should be used to inform decisions. Below we present two pieces of evidence. Firstly, we compare the CPI with the increase in mobile service revenue between 2008 and 2024. Secondly, we show that consumer prices for mobile services have declined sharply whereas the CPI continued to increase.

Between 2008 and 2024, the CPI increased by 54% whereas mobile service revenue increased by a mere 3%, see Exhibit 31. In other words, mobile services revenue is essentially flat whereas the consumer prices have increased by 2.58% per year on average. Essentially mobile service revenue has not increased during past 17 years and there is no indication that mobile service will increase in future. It is not plausible that an input cost, namely the cost of spectrum, shall increase with the CPI whereas mobile service revenue remains flat. Inflating future spectrum prices by inflation ignores this fundamental evidence.

Exhibit 31: CPI vs Mobile Service Revenue Index

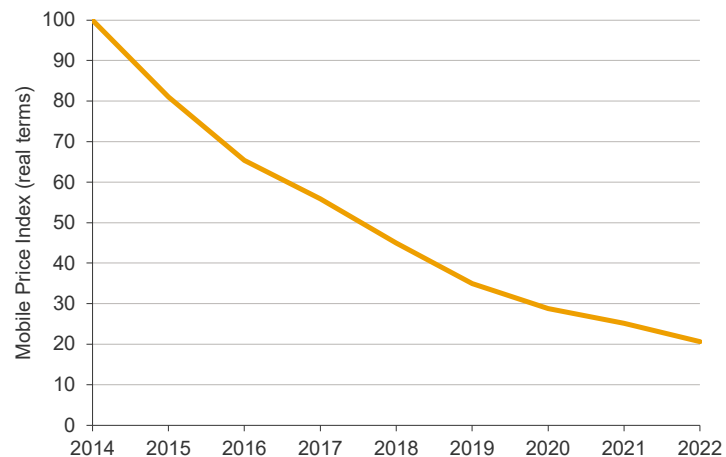


Source: Coleago

Prices for mobile communications declined over the past decade whereas the CPI shows that prices for other consumer goods have been increasing. When industry sector specific decisions are made, the change in prices in the particular sector should be used to inform decisions.

Whereas the CPI increased continuously, prices for mobile communications declined, providing clear evidence the using the CPI to inform ESL pricing amount to a wilful distortion. Exhibit 32 shows the decline in mobile retail prices in Australia between 2014 and 2022. The analysis is based on the price declines¹¹ reported in the ACCC Communications Market reports covering this period. The price declines are reported in nominal terms. The observations cover eight years and hence we have adjusted prices for inflation¹² and calculated an index with 2014 = 100. The data shows that between 2014 and 2022 mobile retail prices declined by 79% in real terms.

Exhibit 32: Mobile retail price decline in Australia



Source: ACCC Communications Market reports and Coleago calculations

¹¹ Feature-adjusted price changes (%) for the hedonic approach

¹² All groups CPI and Trimmed mean, Australia, annual movement (%), Australian Bureau of Statistics

The CPI is the “Consumer Price Index”, whereas spectrum is a cost to a producer. MNO spectrum valuations are largely driven by the relevant avoidable costs of their networks and by their weighted average cost of capital (WACC), hence they are even more unlikely to be correlated with general consumer prices.

In conclusion, we disagree with DotEcon (p. 19) that spectrum prices should, in the long run, necessarily reflect general inflation, and that, absent other changes, spectrum values should remain broadly unchanged relative to consumer prices. As noted above, and as DotEcon itself suggests (p. 18), MNO spectrum values are largely determined on a cost avoidance basis. Over the long term, mobile has experienced considerable technological change which has driven down costs and increased quality. Other factors will also affect mobile network costs, but we do not accept that the underlying trend in spectrum prices should necessarily match general price trends, especially if technological change continues.

Adjusting by CPI alone will lead to ESL prices that are too high, with negative consequences for the public interest, as argued above. Fundamentally, the issue is how to adjust historical (and projected) spectrum values so that they adjust to price movements over time. In our view, it is much more relevant to consider spectrum price trends directly rather than applying the CPI and this is the subject of the next section.

8. Declining spectrum price trends must be fully incorporated in the methodology

Expert research shows that mobile spectrum prices have been declining and future spectrum release plans imply this will continue in Australia

The ACMA's revised methodology fails to fully incorporate the acknowledged declining trends in mobile spectrum prices. This applies both to historical and expected future price trends.

The case that mobile spectrum values have been falling is supported by both the benchmarking data and other evidence (as discussed below), and a growing consensus view that the beginning of the 5G era towards the end of the last decade¹³ marked a change in spectrum values. In addition, we believe that continuing improvements in spectral efficiency, observed slowdowns in data growth, and stagnation in real mobile ARPU add theoretical support for the view of declining spectrum value.

The EU has reached a similar conclusion. Although it recognises that fees should promote optimal use, the Digital Networks Act recommends that “*revenues per connection, as well as the overall burden that holders of rights have from all their radio spectrum holdings, should also be taken into account, to avoid that very high prices paid in past auctions continue to overburden holders of rights and prevent them from investing in networks*” (p47). While the EU has not specified a methodology, the substance of their recommendation is very similar to the MSR index approach which the ACMA has now rejected.

¹³ See also the NERA, Aetha submission for Telstra in response to Stage 2

The approach proposed by DotEcon does not capture the full price declines of recent years. A mechanism such as the Mobile Spectrum Revenue index discussed in Stage 3 should be adopted

8.1 Historical trends in spectrum value

DotEcon itself finds evidence of declining market prices in all band groups, except 3.4 GHz, over the period of analysis 2013-2025 (p14-15). Further, Telstra's response to Stage 2 presented analysis by NERA showing a declining trend for low band and lower mid band spectrum from 2016 onwards¹⁴. Evidence from international benchmarking in the UK for annual licence fees also supports this. While Ofcom proposed cuts of 21% for 900 & 1800 MHz, MNOs strongly pushed back and provided evidence that spectrum values were declining even further¹⁵.

The Stage 3 methodology did attempt to correct historic benchmark data for this declining spectrum price trend using the mobile service revenue / MHz / pop or MSR index. While the MSR index has limitations, e.g. it is only indirectly related to spectrum value, it may still be a better proxy than other alternatives¹⁶ as the ACMA recognised in the Stage 3 Consultation "*MSR provides a reasonable proxy for profit and is more accessible*" (Paper 4 p.55). Moreover, some limitations can be reduced. For example, though the MSR index is sensitive to short term changes in spectrum (ACMA p14), this can be mitigated by taking an appropriate moving average to smooth out variations while still capturing the crucial trends in spectrum values.

DotEcon's approach to correcting for historic spectrum price trends does not capture the full impact of declining spectrum values. Limiting most datasets to 2018 onwards, only partially accounts for falling spectrum values. Although the least relevant awards from the pre-5G era are excluded, the continuing price falls between 2018 and the present day are not accounted for. The sample size is also reduced which has an impact on the statistical reliability of the results.

The ACMA has identified 500 MHz of spectrum below 7.1 GHz for potential release up to 2032 which is strong evidence mobile spectrum prices will continue to decline

8.2 Expected future trends in spectrum values

Equally as important, the ACMA does not appear to have considered the evidence presented that current spectrum price declines are likely to continue in the future and hence does not adjust future spectrum prices accordingly.

As Coleago and other respondents stated in response to Stage 3, 500 MHz of spectrum below 7.1 GHz has already been identified for potential release by the ACMA up to 2032, which strongly supports the case that further declines in spectrum value are likely. Crucially, this includes the upper 6 GHz band which is a good substitute for mid band spectrum including 3.4 GHz.

Looking further ahead, in the next 10 years, 870 MHz of spectrum of spectrum below 7.1 GHz may be released for use by mobile operators, a 96% increase. It is inconceivable that mobile service revenue will increase by 96% in real terms during the next 10 years and hence it is certain that the MSR index will continue to decline.

Exhibit 33: Likely future mobile spectrum releases in Australia

	Existing	New	Future Total	Increase %
Sub 1-GHz	200	80	280	40%
Lower 1-3 GHz	240	90	330	38%
Upper 1-3 GHz	238	0	238	0%
3.4 GHz	225	0	225	0%
4.4-4.8 GHz	0	200	200	n/a
6585-7100	0	500	500	n/a
Total	903	870	1773	96%

Source: Coleago based on ACMA Spectrum Outlook 2025

¹⁴ Round-by-Round: Learnings from the First 35 Years of Spectrum Auctions, NERA, 2024, <https://www.nera.com/insights/publications/2024/round-by-round-.html?lang=en>

¹⁵ <https://totaltele.com/mobile-operators-quibble-with-ofcom-over-spectrum-fees/>

¹⁶ Additionally, some of DotEcon's criticisms can be mitigated – e.g. short term fluctuations could be limited by taking a moving average.

This invalidates DotEcon's argument - based on the assumption that additional mobile spectrum release will primarily be mmWave (p15) - that there is insufficient evidence to assume that current price declines will continue.

Regularly updating the benchmarks with new data risks inefficiency. Renewal decisions would be worse informed since the price of other ESLs would not be guaranteed at renewal

8.3 Updating benchmark data prior to renewal windows runs contrary to the stated aims of the ESL process

The ACMA is proposing to add to the benchmark data set future spectrum awards between now and six months prior to the renewal application period for each ESL. This maximises the data available for the benchmark process.

However, the ACMA's preferred ESL prices would not be fixed but could be revised each year between up to the expiry of each licence type. This potentially creates major uncertainty for ESL holders. It runs directly counter the ACMA's aims in seeking to minimise uncertainty by establishing the terms and conditions of renewal well in advance of licence expiry through its extensive process of analysis and consultation.

If the ACMA adopts this approach, MNOs will be forced to make decisions on renewing some ESLs (those falling due earliest) without knowing the price of other ESLs that are major substitutes. This uncertainty risks undermining MNO choices, inefficient spectrum use and, in extreme cases, chilling investment.

Another disadvantage is that this approach is unlikely to properly represent the declining trend in spectrum values which we believe will continue, particularly due to new spectrum releases in Australia. Although new awards might confirm a continuing downward trend in mobile spectrum values, their impact given the current benchmarking proposals may be limited. Since ESL prices would still be based on the geometric mean or median of the whole benchmarking sample, an extra few data points would only slightly change the results in a sample of thirty or more observations.

ESL pricing should promote the long-term public interest, but the ACMA has not provided evidence to support this and seems to focus only on one component – economic efficiency

9. Lack of evidence that revised prices are consistent with public interest criteria

9.1 Public interest criteria for the renewal of ESLs

With regard to public interest criteria, ACMA stated the following:

Our public interest criteria for ESLs, which we consulted on in 2023, include the following:

- *Facilitates efficiency (which aligns with the object of the Act)*
- *Promotes investment and innovation*
- *Enhances competition*
- *Balances public benefits and impacts*
- *Supports relevant policy objectives and priorities*

The SoE (Statement of Expectations) and the MPS (Ministerial Policy Statement) for ESL cover similar ground. The MPS for ESL specifies 5 Australian Government communications policy objectives that we must consider in the design and consideration of the ESL process:

- *Supporting service continuity for end users, particularly where no alternative service is available.*

- *Facilitating opportunities for new entrants and use cases, including for low earth orbit satellites.*
- *Connectivity and investment in regional and remote areas to deliver improved services to end users.*
- *Promote competition.*
- *Capacity for sustained investment and innovation.*

While formally checking against public interest criteria (step 6C in the process) is mentioned in the consultation document, the ACMA simply states that *“We have not needed to use this step in forming our updating preliminary views on pricing.”* The ACMA does not provide or consider any wider information / analysis on the industry and future development of the market and only offers a weak argument in support of their assertion.

The only argument stated by the ACMA is that *“higher spectrum prices may be beneficial in facilitating efficiency by reducing incentives to hoard spectrum”*. The spectrum in the ESL process has been deployed, i.e. substantial investments were made, and traffic is flowing through the spectrum. As stated in section 6, there has been no evidence of hoarding in the past, and the hypothesis of future hoarding, i.e. that mobile operators would not use the spectrum in future, is not plausible. As other regulatory authorities have argued, such as the EU in the Digital Networks Act, concerns over hoarding can be addressed by *“obligations to provide wholesale access or enable radio spectrum sharing”* (p46). Competition regulation can also be used to reduce the likelihood of hoarding for anti-competitive purposes.

Taking too much money out of the industry in its current state is almost certain to have a knock-on effect on investment and services

The ACMA has not demonstrated how higher prices would support the stated policy objectives of promoting investment and innovation; enhancing competition; supporting service continuity for end users, particularly where no alternative service is available; enhancing connectivity and investment in regional and remote areas to deliver improved services to end users; or promoting capacity for sustained investment and innovation. In fact, higher prices would have the opposite effect, as we have explained in previous submissions:

- The notion that, if more money is taken out of the mobile industry in the form of spectrum licence fees, this would leave more cash for investment is not plausible given the financial position of the industry.
- The social and economic benefits from digital transformation would be at risk from higher spectrum prices given the major ongoing funding requirements for the advanced networks needed to support them.
- With higher prices there is a risk of one or two operators not renewing some ESLs and this would weaken competition and negatively affect service continuity.

The ACMA has assessed the impact on public interest criteria too narrowly, particularly in light of the considerable risk that the single price proposed by the ACMA may exceed the value of the spectrum for one or two operators.

9.2 If ESL prices are set too high there will be serious consequences for wider public interest objectives

Not only has the ACMA failed to demonstrate how its updated preliminary prices meet public interest objectives, but the level of ESL prices proposed would actively undermine them.

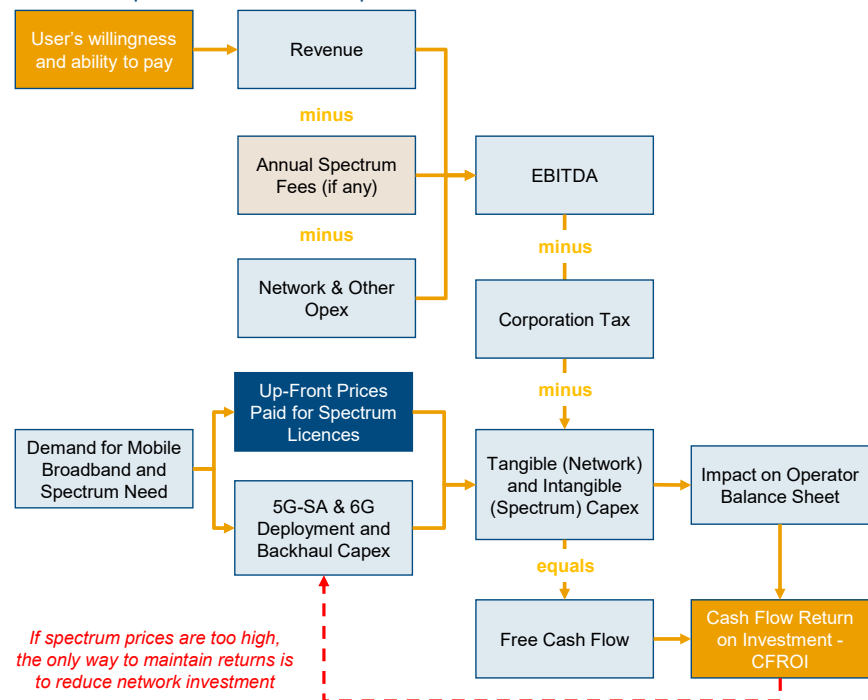
As Coleago has previously stated, imposing substantial fees on MNOs in the form of spectrum prices will inevitably affect investment, service quality, and, indirectly, other objectives such as promoting services in regional and remote areas and supporting broader digital transformation.

Exhibit 34 illustrates the rationale for this. Financial planning in the mobile sector involves carefully balancing cash outflows - operational expenditure and capital

expenditure, including investment in tangible network assets and spectrum licence fees - against cash inflows from revenues. If insufficient cash remains to cover the cost of capital, investments cannot be financed.

Mobile operators must generate sufficient cash to compensate investors in order to finance investment in spectrum and networks. Aside from increasing retail prices - which may have knock-on effects on market share or usage - the only other lever available is to reduce tangible capital expenditure, i.e. invest less in the network, to bring overall capital expenditure to a level that can be financed. In short, high spectrum prices make the business case for mobile network investment less viable.

Exhibit 34: Spectrum licence fee impact on network investment



Source: Coleago

Momentum is building to set spectrum fees according to the wider economic and social good and not just the demands of economic efficiency

Evidence examining investment in mobile networks and the cost of spectrum licence fees is clear. For example, the GSMA's most recent study on the impact of spectrum fees on investment¹⁷ finds that higher spectrum prices are associated with lower network coverage (for both 4G and 5G) and slower download speeds, thereby negatively affecting other policy objectives such as digital inclusion. Specifically, a 10% increase in the ratio of spectrum costs to mobile revenues leads to a 6% reduction in coverage and an 8% decrease in download speeds. The study is based on data from over 250 operators across nearly 100 countries.

Finally, the EU Digital Networks Act represents a sea change in the EU's approach to spectrum licence renewal. Whereas EU countries had historically tended to re-auction expiring spectrum licences, some countries, such as France and Spain, have more recently moved to re-issue licences to existing holders rather than re-auction them. The new Act confirms this shift and recommends that renewal fees not only take into account optimal spectrum use but also the fact that lower fees can spill over into higher investment, quality of services and wider benefits to the economy. In doing so, the Act recognises the importance of appropriate and predictable spectrum prices in promoting wider public policy objectives.

¹⁷ Global Spectrum Pricing, May 2025, <https://www.gsma.com/connectivity-for-good/spectrum/wp-content/uploads/2025/05/Global-Spectrum-Pricing-Summary-v2.pdf>

The essential service that mobile provides should be recognised in pricing through applying a public interest discount

10. Public interest discount

Mobile networks provide an essential service to the public, and their importance is reflected in the policy considerations relating to ESLs. It is therefore undeniable that there is a public interest in maintaining a competitive mobile market in which operators continue to invest to deliver 5G Advanced, 5G Standalone and future 6G services to Australian businesses and consumers.

Given the existence of a clear public interest, it follows that a public interest discount should be considered. The ACMA has not provided any plausible explanation as to why the public interest discount applied to MNO ESLs should be set at zero. A public interest discount would support all operators in continuing to invest and in delivering outcomes that promote the long-term public interest, especially given the difficult financial position of the industry with two operators struggling to earn their WACC.

Of particular concern are the risks of Optus and TPG falling further behind Telstra and of funds being diverted away from network investment. To meet the relevant public policy objectives, it is therefore important that a public interest discount is applied to MNO ESLs.

With regard to rail and TOB, the lower annual apparatus licence tax rate proposed by the ACMA in its updated preliminary views incorporates the previously applied 50% public interest discount and reflects the public benefits derived from rail communications use. Mobile services are an essential service, like rail, and arguably even more so. Given the effective public interest discount of 50% applied to rail and TOB, it is appropriate to apply a similar discount to mobile spectrum.

11. Comments directly related to the benchmarking

11.1 Introduction

In the preceding paragraphs, we set out an alternative risk-based approach to spectrum renewal pricing that would meet policy objectives while mitigating the risk of prices being set excessively high. In this section, we examine the methodology adopted by DotEcon and identify a number of material shortcomings in their approach. These issues would need to be addressed should ACMA choose to adopt this methodology.

In our June 2025 submission, we raised concerns regarding the use of benchmarking to determine spectrum prices, particularly the reliance on historical outcomes as a basis for setting future prices. *“Regulators should not anchor administratively set prices to historical prices either those observed in other markets, or the market in question. Given the falling price of spectrum over the past decade, they are unlikely to reflect the current reality of the domestic market.”*¹⁸

The materially different results of two ACMA-commissioned benchmark studies underscore the inherent challenges of using benchmarks to set future prices.

While both ACMA benchmark studies were prepared by well-respected industry experts, they arrive at materially different results, underscoring the inherent challenges of benchmarking and using them to set spectrum prices, which we highlighted in our June submission.

The new DotEcon benchmarking study seeks to simplify the approach, which is welcome. However, this simplification comes at a cost, and we consider that the DotEcon study does not adequately reflect:

¹⁸ GSMA – Spectrum prices May 2025

- The cohort analysis, which limited the benchmarks used to set prices, has been largely removed. This increases the importance of examining potential outliers.
- The sustained decline in spectrum prices up to 2025, nor the likelihood of further price declines as additional spectrum is introduced to the market.
- The impact of population density on spectrum prices.
- Use of CPI to inflate spectrum benchmarks is not appropriate.

There are a priori reasons for removing some benchmarks from the data set.

DotEcon states that data should only be removed for *a priori* reasons. While it is appropriate to start with such criteria, robust analysis should also include identification and assessment of outliers, at least as a check for potential data errors. Historically other DotEcon studies for Ofcom and ComReg (2013-2021) have removed extreme outliers as they would not be representative of market values. In this report we provide *a priori* reasons to exclude certain benchmarks.

The MSR approach adopted in Stage 3 better captured the downward trend in spectrum prices.

Using benchmarks from 2018 to 2025 does not adequately reflect the price declines observed over that period, as equal weight is given to outcomes in 2018 as those from more recent auctions. The ACMA's MSR approach adopted in Stage 3 better captured the downward trend in spectrum prices. In our view, this approach should have been refined to address the criticisms raised, rather than being replaced with a less robust alternative.

DotEcon's report did not recognise the impact of future spectrum releases and its impact on spectrum prices.

DotEcon argues that future price declines may not continue on the basis that additional spectrum releases will be largely confined to mmWave bands with limited substitutability. This is incorrect; ACMA's Draft 2025 FYSO work program identifies substantial new allocations in the 600 MHz, 1.5 GHz and 6 GHz bands over the next five years, all of which are highly substitutable with the bands under consideration. These releases would increase mobile spectrum supply by approximately 96%, placing continued downward pressure on spectrum prices.

The only mechanism proposed to reflect future spectrum prices is the inclusion of additional benchmarks as they become available. However, no detail is provided on how these future benchmarks would be incorporated or how price declines would be treated, for example whether the 2018 cut-off would continue to apply. This newly introduced uncertainty around future pricing undermines the ability of licensees to make rational decisions about which of their spectrum holdings are optimal to be renewed.

The failure to account for the downward trend in spectrum prices is further compounded by the use of CPI to inflate historical values to derive a 2025 equivalent. As set out in the preceding paragraphs, we provide evidence that CPI is an inappropriate metric for determining spectrum prices.

The DotEcon study does not adequately account for population density.

Simplification has also come at the expense of adequately accounting for population density. In the DotEcon study, outcomes from the most densely populated countries, namely Singapore, Hong Kong and South Korea, have a disproportionate influence on the prices derived for Australia, which has the lowest population density in the sample. There is a clear *a priori* basis for excluding Hong Kong, Singapore and South Korea from the benchmarking dataset. These countries have population densities that are orders of magnitude higher than Australia's and are therefore structurally unrepresentative of Australian market conditions. Given the fundamental role population density plays in determining spectrum value, their inclusion as extreme high-population-density outliers disproportionately distorts the prices derived for Australia.

Evidence has not been provided to substantiate the claim that the updated preliminary prices support ACMA's policy objectives.

The study asserts that the proposed updated preliminary prices are consistent with the ACMA's policy objectives; however, no supporting analysis or evidence is provided to substantiate this claim. In particular, no affordability assessment has been undertaken to demonstrate that the updated preliminary price increases are sustainable for Optus and TPG, or that, at these levels both operators would be able to acquire their proportionate share of future spectrum. This leaves it unclear as to how the updated

preliminary prices have been assessed for consistency with the ACMA's competition objectives in an already highly concentrated market.

Removing the impact of outliers and CPI would reduce the prices between 18%-40% and projected total value of \$5.5bn.

There are several instances in the DotEcon study where transparency is limited.

11.2 Lack of transparency and supporting documentation undermines the benchmarking study

Below we highlight several instances where transparency in the DotEcon study is limited:

- The study asserts that the updated preliminary prices support the ACMA's policy objectives; however, no supporting analysis or evidence is provided to substantiate this claim.
- The study claims that the number of mobile network operators does not influence spectrum prices, but this assertion is not supported by empirical evidence or analytical justification.
- The study does not flag the existence of outliers in the box plot analysis, nor do they assess their impact on the results.
- The spectrum price spreadsheets do not include calculation links, which further restricts transparency and independent verification and reconciliation against our own spectrum database, and the calculations have not been provided for the conversion of the single annual price to the preliminary prices.
- No detail is provided on how future benchmarks would be incorporated, or how observed price declines would be treated in the future, for example whether the 2018 cut-off would continue to apply. This lack of transparency creates uncertainty around future pricing outcomes, which in turn complicates licensees' ability to assess the relative value of different spectrum holdings and to undertake robust planning for renewal decisions.

In the Ofcom and ComReg studies DotEcon removed extreme outliers as they would not be representative of market values.

11.3 DotEcon has not considered the impact of outliers or their treatment in the benchmark study

The benchmark analysis by DotEcon for the ACMA did not investigate or remove extreme historical spectrum prices, which distorts the median/geometric mean and risks inflating future spectrum price forecasts. Robust statistical analysis should include the identification of outliers and an assessment of their impact, if only to detect potential data errors. Further, the ACMA in Stage 3 Paper 4 seemed to approve of removing outliers commenting that "... our approach leads to relatively conservative renewal prices, as the valuation methodology controls for outlier prices and assumes declining spectrum values over time".

Although DotEcon may have conducted such analysis, it has not been presented, indicating a lack of transparency. In all DotEcon's previous benchmark studies for Ofcom and ComReg (2013-2021), it has removed extremes using inter quartile range (IQR) or standard deviation-based tests. "Outliers are then removed before producing the summary statistics for the sample".¹⁹

Their previous studies have "adopted a transparent and objective rule to exclude outliers and applied this consistently, rather than dropping data points in an ad hoc manner in the course of the analysis. In particular, we excluded observations that:

- Lie more than three standard deviations away from the sample mean, or
- Lie more than three times the interquartile range above the 75th percentile."²⁰

¹⁹ DotEcon benchmarking ComReg (2021)

²⁰ DotEcon benchmarking ComReg (2015)

The outlier tests traditionally applied by DotEcon are consistent with Tukey's²¹ definition of extreme outliers. Under Tukey's framework, observations lying more than 1.5 times the IQR above the 75th percentile (or below the 25th percentile) are classified as outliers, while those exceeding three times the IQR are classified as extreme outliers. DotEcon's use of a 3×IQR threshold in the Ofcom and ComReg studies, therefore, corresponds to the identification and exclusion of extreme outliers rather than ordinary outliers.

In the Ofcom and ComReg studies DotEcon removed extreme outliers as they would not be representative of market values.

In previous benchmark studies, DotEcon has removed extreme outliers as they "would not be representative of market value of spectrum, and including them in data analysis may skew results and conclusions"²²

Applying the above DotEcon extreme outlier tests to the Australian dataset would result in the benchmarks highlighted in the exhibit below being removed from the dataset.

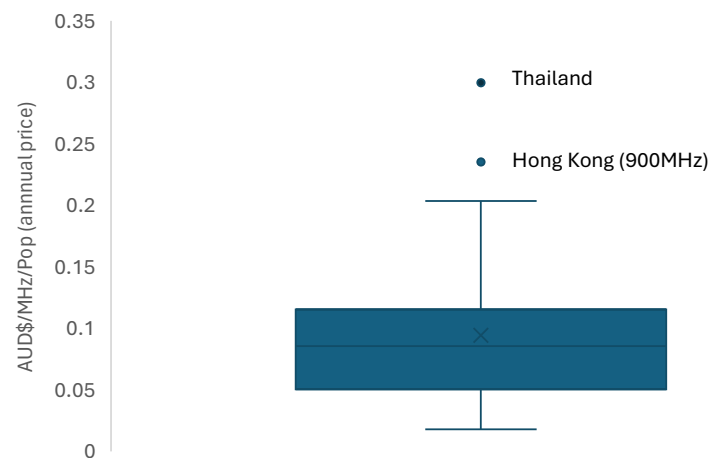
Exhibit 35: Extreme outliers identified by applying DotEcon's criteria

Su- 1 GHz	Lower 1-3 GHz	Upper 1-3 GHz	3.4 GHz
Thailand (2020)	Hong Kong (2018)	Singapore (2017)	Canada (2021)
		South Korea (2016)	Portugal (2021)
			US (2021)
			US (2021)
			Italy

Source: Coleago

Using box plot analysis with a 1.5× IQR threshold, all outliers in the dataset can be identified as either extreme outliers (3× IQR) or non-extreme outliers. Each of these warrants review, as outliers can disproportionately influence benchmark results, distort spectrum price estimates, and may reflect conditions not relevant to the Australian market. Assessing them helps ensure pricing conclusions are robust, representative, and aligned with the ACMA's policy objectives.

Exhibit 36: Sub-1 GHz box plot analysis



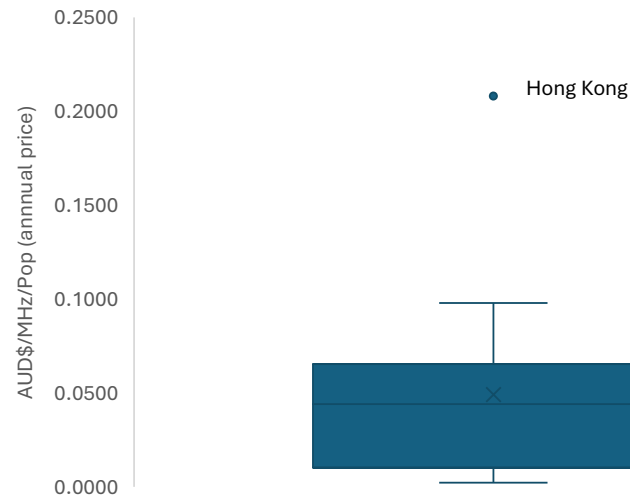
Source: Coleago

²¹ Tukey, J.W. (1977). Exploratory Data Analysis.

²² DotEcon International benchmarking of 900MHz and 1800MHz spectrum (2013)

The box plot analysis for the sub-1 GHz band identifies Hong Kong as an outlier, in addition to Thailand, which was already flagged using DotEcon's criteria for extreme outliers.

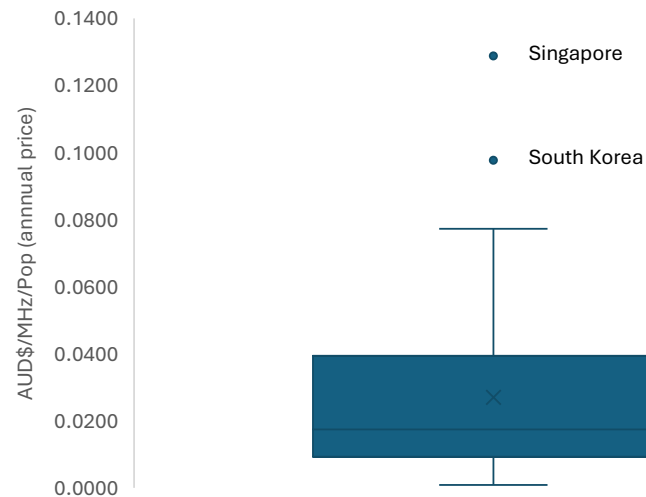
Exhibit 37: Lower 1-3 GHz box analysis



Source: Coleago

Box plot analysis of lower 1 - 3 GHz spectrum identifies no further outliers from those identified using the DotEcon's criteria for extreme outliers.

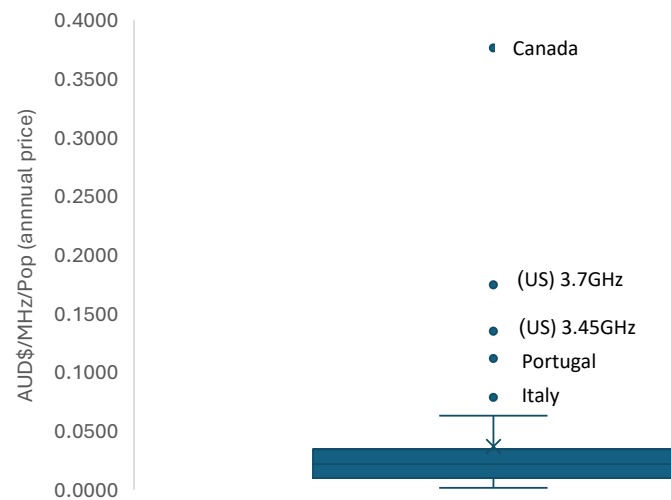
Exhibit 38: Upper 1-3 GHz box analysis



Source: Coleago

Box plot analysis of upper 1 – 3 GHz spectrum identifies no further outliers from those identified using the DotEcon's criteria for extreme outliers.

Exhibit 39: 3.4GHz box analysis



Source: Coleago

Extreme outliers are having a disproportionate impact on the geometric mean and median

In addition to the extreme outliers using DotEcon's criteria (Canada, US, Portugal), Italy is identified as an outlier.

These benchmarks have a disproportionate impact on the geometric mean and median, as shown in the table below. In the lower 1 - 3 GHz band, removing the single benchmark Hong Kong out of a sample of 23 reduces the geometric mean by 8%. The material impact that a single datapoint is having on geometric mean, and hence prices, suggests that the statistical methods used by DotEcon are not robust to outliers or appropriate in the Australian context. If these outliers are included in the benchmark dataset, there is a risk that spectrum prices will be set too high, which would undermine ACMA's spectrum policy objectives.

Exhibit 40: % decrease in geometric mean by removing outliers

	Sub 1GHz	Lower 1-3 GHz	Upper 1-3 GHz	3.4 GHz
Extreme outliers	-4%	-8%	-11%	-22%
All outliers (including extreme)	-7%	-8%	-11%	-22%

Source: Coleago

In the ACMA report, DotEcon has adopted a different approach to the treatment of outliers compared with their benchmarking studies prepared for Ofcom and ComReg, stating that, *"No competitive auctions should be excluded from a benchmarking exercise without good reasons, which are restricted to obvious errors or unavailability of data, or very strong a priori reasons to believe an award is irrelevant."*²³

DotEcon's rationale for not attempting to identify and exclude possible outliers from the dataset is that *"Trying to find more refined principles for excluding awards quickly becomes nebulous and difficult to apply on a consistent basis."*²⁴

There are clear a priori reasons for excluding the outliers identified.

²³ DotEcon - Review of the ACMA expiring spectrum licence pricing (2025)

²⁴ DotEcon - Review of the ACMA expiring spectrum licence pricing (2025)

This argument is weak, given that DotEcon has previously applied consistent interquartile range and standard deviation tests in its historic reports for Ofcom and ComReg (2013–2021). Beyond their disproportionate impact, there are clear *a priori* reasons that should have been considered when determining which outliers should be excluded from the dataset:

- Thailand is not appropriate for inclusion in mobile spectrum benchmarks because the market was originally structured under a concession model. The transition to a spectrum licensing regime meant that spectrum valuations reflected not only network cost-avoidance considerations, but also the additional value associated with avoiding concession fees.
- In some of 3.4 GHz spectrum bands artificial scarcity was created.
 - In Italy (2018): only 200 MHz of the available 400 MHz has been issued with no certainty even seven years after the first auction as to when or if the remaining spectrum will be released as it is currently occupied by FWA players.
 - Canada (2021): this was the first of two auctions. At the time of the auction, there was no certainty regarding the timing of the second auction, what caps might apply, or how much spectrum would be allocated to the “set-aside” for weaker market players. This created short-term scarcity and uncertainty, resulting in prices in the first auction being around 12x higher than in the second auction. The Canadian auction does, however, provide some insight into spectrum valuations/prices for weaker market players through the “set-aside” spectrum outcomes.
 - Using the prices for “set aside” may be more reflective of the market position of Optus and TPG both of whom are struggling in the market. This benchmark could be used as an alternative benchmark for both of the Canadian auctions.
 - Or alternatively a weighted average price across the two auctions would be more appropriate.
- Hong Kong, Singapore and South Korea have population densities that are orders of magnitude higher than Australia’s and are therefore structurally unrepresentative of the Australian market.
- At the time of the US 3.4 GHz auctions, the 2.1 GHz, 2.3 GHz, and 2.6 GHz bands were largely unavailable in the United States, creating artificial scarcity in mid band spectrum - this distorted auction outcomes.
- Valuations for Canada and the US include a terminal value, as licences are offered on an infinite basis. In a developed country, the terminal value typically accounts for approximately one third of the total value. DotEcon recognises the existence of infinite-duration licences but argues that it is preferable not to adjust for the initial licence period, provided the methodology is robust to outliers. The analysis above clearly demonstrates that the methodology currently used is not robust to outliers. Accordingly, these outliers should either be removed, or the licence length should be adjusted to reflect the infinite nature of the licences.

For the *a priori* reasons set out above, we believe that the benchmarks listed in the table below should be removed from the dataset. There are *a priori* grounds for removing all benchmarks identified in our analysis as extreme outliers under the DotEcon criteria, as well as those identified as outliers under the Tukey criteria, with the exception of the Portuguese 3.4 GHz auction (2021).

Exhibit 41: a priori reason for removal of benchmarks from the data set

A priori reason for exclusion	Sub-1 GHz	Lower 1-3 GHz	Upper 1-3 GHz	3.4 GHz
Extreme population density	Singapore, Hong Kong, South Korea (all benchmarks)			
Additional sources of spectrum value – concession model	Thailand (all benchmarks)			
Spectrum scarcity at time of auction	US (all) Canada (2021) Italy (2018)			

Source: Coleago

The Australian Bureau of Statistics (ABS) recognises the need to identify outliers and treat them in a different way.

The Australian Bureau of Statistics (ABS), in its statistical analysis, seeks to identify possible outliers and handle them in a different manner. *“The presence of outliers in the sample, may result in grossly inadequate estimates, unless they are treated in a special way.”*²⁵ The approach adopted for handling outliers has been the use of winsorization techniques. Winsorization is a statistical method that limits the influence of extreme values by replacing them with the nearest values within a defined threshold. This approach reduces distortion from outliers while retaining all observations in the dataset.

11.4 Simplification fails to capture key factors influencing spectrum pricing

DotEcon’s simplified approach does not capture the impact of population density on spectrum prices.

The previous ACMA benchmark study recognised the impact of factors such as the number of MNOs, population density, and GDP on spectrum prices through its weighting methodology. While this did not capture all possible influences, it did acknowledge some of the key drivers of spectrum prices.

Simplification is welcome where it continues to capture the key factors that may influence spectrum prices. However, DotEcon’s simplified approach does not reflect all the impacts recognised in the earlier benchmark analysis.

DotEcon’s benchmark analysis:

- Discounts the impact of MNOs on prices with no evidence provided for this conclusion.
- Recognises the impact of GDP using PPP exchange rates.
- Acknowledges that population density does have an impact on spectrum. However, the Step 6 approach of using population cohorts fails to adequately reflect this as the sample sizes are too small to be statistically valid.

11.5 The updated preliminary prices are unduly Influenced by the three highest-density countries

DotEcon recognises that spectrum prices are influenced by population density: *“Deploying networks over large sparsely populated areas is more costly on a per user basis. The value of spectrum might therefore be expected to be lower in countries with a low population density. Australia has the lowest population density of the countries in the award data.”*²⁶

It argues that population density may not be a good measure, as it will understate the density of areas relevant to the spectrum licence because there are no coverage obligations and the networks do not cover the entire country. Whilst this is true, the

²⁵ Australian Bureau of Statistics - Labour Statistics: Concepts, Sources and Methods, 2013

²⁶ DotEcon - Review of the ACMA expiring spectrum licence pricing (2025)

The disproportionate influence of the three most densely populated countries on Australia's outcomes indicates the approach is not robust to population density effects.

impacts will be small and population density remains an appropriate and comparable metric for cross country spectrum analysis, even where networks are not deployed to 100% of the population. In Australia, around 99.7% of the population is already served. Sparse, unserved areas account for a negligible share of demand and do not materially distort international comparisons.

The Step 6 approach does not account for the impact of population density on spectrum values or prices. Applying the DotEcon outlier tests (as used for Ofcom and ComReg) described earlier identifies the three most densely populated countries in the sample - Singapore, Hong Kong and South Korea - as extreme outliers. These countries exert a disproportionate influence on the price determination for Australia, which is the least densely populated country in the sample. This suggests that the proposed approach to determining spectrum prices is not robust to outliers and is not appropriate in the Australian context.

Exhibit 42: Population density versus Australia

	2023 Population density (Pop/Sq. Km)	Population density multiple versus Australia
Singapore	8,242	2,747X
Hong Kong	7,177	2,392X
South Korea	530	176X
Australia	3	

Source: World Bank

A simple rule could be applied to exclude from the sample any country with a population density more than 150 times that of Australia. Such countries are highly unrepresentative of Australia and should therefore be excluded as data points across all spectrum bands.

DotEcon has expressed concern about removing data without an *a priori* justification. The extreme disproportionality in these countries' population densities provides a clear *a priori* basis for their exclusion from the dataset.

11.6 The approach to deriving a single price point could be simplified

The approach to setting a single price could be simplified.

The approach in Step 6 of the methodology is unnecessarily convoluted and does not adequately account for the impact of population density on final spectrum prices.

The filters used by DotEcon are either redundant or fail to reflect the impact on spectrum prices:

- The GDP filter is redundant, given that the revised benchmarking methodology already uses PPP-adjusted rates.
- The population density filter does not adequately reflect the impact of population density on spectrum prices.

A simpler Step 6 approach would be to base the single price on the geometric mean of the full sample, while explicitly accounting for population density by removing countries with extreme population densities from the sample.

11.7 Differing metrics used to derive single price for each of the bands

Depending on criteria outlined in Step 6, different statistical metrics are being used to determine a single price for each of the bands.

Exhibit 43: Price determiner for each of the bands

	Sub-1 GHz	Lower 1-3 GHz	Upper 1-3 GHz	3.4 GHz
Price determined	Geometric mean of total sample	Upper cohort of population density	Geometric mean of total sample	Median of total sample

Source: DotEcon

As highlighted above, Step 6 of the methodology could be simplified by using a single sample with outliers removed (i.e. eliminating the GDP and population cohorts) to determine a single price. This would then allow the geometric mean to be applied consistently across all spectrum bands using one common sample.

In its previous benchmarking studies, DotEcon has recognised the substantial variation in spectrum prices across markets and concluded that the geometric mean provides a more appropriate measure of central tendency than the arithmetic mean or the median.

Exhibit 44: Spectrum price variation measured by the ratio of the highest to lowest observed values

	Sub-1 GHz	Lower 1-3 GHz	Upper 1-3 GHz	3.4 GHz
Highest/Lowest price multiple	16.8X	97.6X	144.2X	247.7X

Source: Coleago

11.8 The MSR approach better reflects the decline in spectrum prices than the new post 2018 approach

It is widely accepted that spectrum prices have been declining over time and DotEcon recognise this with the exception of 3.4GHz spectrum. To reflect price declines DotEcon take a simplified approach to focus only on benchmarks since 2018 for the Sub 1GHz and the Lower 1-3GHz band. "By excluding older observations, we avoid using valuations based on conditions that no longer apply."²⁷ The only rationale for using 2018 cut off is that it leaves approximately half the data set.

The basic approach of using 2018 benchmarks is applied only to the sub-1GHz and lower 1–3GHz bands, as DotEcon's statistical test does not consider the observed price declines to be material. This is despite the upper 1–3GHz spectrum showing a higher annual rate of decline than sub-1GHz and an overall real-terms price reduction of 53% since 2013.

Exhibit 45: Price declines since 2013

	Sub 1GHz	Lower 1-3GHz	Upper 1-3GHz	3.4GHz
Annual price declines	-6.6%	-11.1%	-7.6%	-1.5%
Real price decline from 2013-2025	-48%	-67%	-53%	-12%

Source: DotEcon

²⁷ DotEcon - Review of the ACMA expiring spectrum licence pricing (2025)

Significant reductions in the geometric mean with changes in the cut-off date indicates limited robustness in the DotEcon approach to reflect 2018–2025 price declines.

This approach does not reflect differential price declines that have been observed after 2018 for Sub 1GHz and Lower 1-3GHz and gives an equal weight to a benchmark in 2018 as to a more recent one in 2025. The use of 2018 cutoff is arbitrary, changing this date to 2019 or 2020 results in significant reductions in the geometric mean suggesting that this approach is not robust to statistical analysis.

For Upper 1-3GHz where benchmarks from 2013 are used, the study gives no consideration of the observed price declines.

Exhibit 46: Impact of changing the cutoff from 2018 to 2020 for Lower 1-3GHz

	2018 (Absolute geometric mean)	2019 (% change geometric mean)	2020 (% change in geometric mean)
Geometric mean	0.0310	-8%	-16%
Sample size	23	22	18

Source: Coleago

The MSR approach advocated in the previous ACMA benchmark study was more robust for accounting for declines in spectrum prices.

The MSR approach adopted in the Stage 3 benchmark study better captured the downward trend in spectrum prices. In our view, this approach should have been refined to address the criticisms raised, rather than being replaced with a less robust alternative.

Removing the impact of outliers and reinstating MSR would reduce the prices between 14%-44% and projected total value of AUD 5.6 bn (23% reduction compared to the ACMA updated preliminary estimate of AUD 7.4 bn).

Exhibit 47: Impact of adjusting for outliers and using MSR to reflect price declines

	Prices adjusted for outliers and MSR (AUD, full licence)		Total Industry bill (AUD million)		
	ACMA	Adjusted	ACMA	Adjusted	Change
700	0.7405	0.6395	1,945.9	1,680.6	14%
850	0.7558	0.6527	858.9	741.8	14%
1800	0.3030	0.2546	1,295.5	1,088.6	16%
2100	0.2757	0.2317	801.5	673.6	16%
2300	0.1596	0.0899	322.9	181.8	44%
2600	0.1621	0.0913	661.6	372.5	44%
3400	0.2052	0.1261	1,502.5	923.2	39%
Total			7,388.8	5,662.0	23%

Source: Coleago

DotEcon themselves recognise there may be better approaches than using a 2018 cutoff “At least in principle, it may be possible to capture trends over longer periods through a systematic econometric model. However, we have not attempted this as it would require significant investigation of the appropriateness of the fit of such a model to the data. Simply taking more recent benchmarks provides a simpler approach”.²⁸

In summary, the simplistic approach of using 2018 as a cutoff for two of the bands fails to reflect the observed price declines after 2018. Where no cutoff is applied, the absence of any adjustment for price declines similarly leads to a material overstatement of spectrum prices. The band most affected is Upper 1–3 GHz, where all benchmarks date back to 2013, despite evidence of a real price decline of 53% over that period. Given the risks associated with setting prices too high, a more robust approach to accounting for observed price declines needs to be adopted.

²⁸ DotEcon - Review of the ACMA expiring spectrum licence pricing (2025)

“Regulators should not anchor administratively set prices to historical prices either those observed in other markets, or the market in question. Given the falling price of spectrum over the past decade, they are unlikely to reflect the current reality of the domestic market.”²⁹

11.9 Use of CPI is inappropriate without a robust approach for addressing spectrum price declines

The failure to account for the downward trend in spectrum prices is further compounded by the use of CPI to inflate historical values to derive a 2025 equivalent. As set out in the preceding paragraphs, we provide evidence that CPI is an inappropriate metric for determining spectrum prices.

Removing the impact of outliers and CPI and reflecting price declines by using MSR index would reduce the prices between 26%-56% and projected total value of AUD 4.8bn (35% reduction compared to the ACMA updated preliminary estimate of AUD 7.4 bn).

Exhibit 48: Prices after adjustment for outliers, CPI and MSR, and total Industry bill

	Prices adjusted for outliers, CPI and MSR (AUD, full licence)		Total Industry bill (AUD million)		
	ACMA	Adjusted	ACMA	Adjusted	Change
700	0.7405	0.5462	1,945.9	1,435.3	26%
850	0.7558	0.5575	858.9	633.6	26%
1800	0.3030	0.2182	1,295.5	933.1	28%
2100	0.2757	0.1986	801.5	577.3	28%
2300	0.1596	0.0697	322.9	141.0	56%
2600	0.1621	0.0708	661.6	289.0	56%
3400	0.2052	0.1073	1,502.5	785.4	48%
Total			7,388.8	4,794.7	35%

Source: Coleago

11.10 Future spectrum prices will likely fall with the release of new spectrum

The DotEcon study did not account for future releases of substitutable spectrum.

DotEcon argues that price declines have resulted mainly from increased spectrum being made available and believe that this effect may not continue, as additional spectrum releases are likely to be largely limited to mmWave bands, which have limited substitutability for the mobile spectrum bands considered in this analysis.

“Whilst there is evidence of trends over the sample period, we cannot assume that a similar downward trend will continue. During the sample period there was both re-award of previous allocated bands (1800 MHz, 2.6 GHz) on a newly liberalised basis and introduction of entirely new bands (e.g. 2.3 GHz, 3.4 GHz) adding substantial additional bandwidth. Looking forward now, additional spectrum release for cellular networks above 1 GHz is primarily expected in the mmWave bands. These bands may be significantly less substitutable for spectrum below 3 GHz both because of limited propagation and heavy power demands on mobile terminals.”³⁰

This statement is untrue. The Draft 2025 FYSO Work Plan identifies several new allocations under consideration over the next five years, to 2029, in the 600 MHz, 1.5 GHz and 6 GHz bands. All of this spectrum is highly substitutable with the bands under consideration and will increase the supply of spectrum by 96%, which is likely to result in further price declines. This should have been reflected in the proposed spectrum prices.

²⁹ GSMA – Spectrum prices May 2025

³⁰ DotEcon - Review of the ACMA expiring spectrum licence pricing (2025)

To date, operators' 3.4 GHz business plans have not reflected the potential impact of 6 GHz spectrum, largely due to uncertainty regarding auction timing and the amount of spectrum to be released. Based on our experience developing 3.4 GHz valuations globally, 6 GHz has, at best, been treated only as a sensitivity. As 6 GHz becomes more firmly incorporated into operators' plans, it can be expected to exert downward pressure on 3.4 GHz prices.

Exhibit 49: Impact of possible new spectrum releases in Australia

	Current market spectrum	Likely new releases by 2029	Future total	% increase
Sub 1-GHz	200	80	280	40%
Lower 1-3 GHz	240	90	330	38%
Upper 1-3 GHz	238	0	238	0%
3.4 GHz	225	0	225	0%
4.4-4.8 GHz	0	200	200	n/a
6585-7100	0	500	500	n/a
Total	903	870	1773	96%

Source: Coleago

The uncertainty introduced by deferring price setting to account for future spectrum benchmarks undermine licensees' ability to ascertain which of their spectrum to renew.

11.11 The inclusion of future benchmarking creates uncertainty for licensees

The only mechanism proposed to reflect future spectrum prices is the inclusion of additional benchmarks as they become available. However, no detail is provided on how these future benchmarks would be incorporated, or how observed price declines would be treated for example, whether the 2018 cut-off would continue to apply.

This lack of transparency creates uncertainty around future pricing outcomes, which in turn complicates licensees' ability to assess the relative value of different spectrum holdings and to undertake robust planning for renewal decisions. This newly introduced uncertainty around future pricing undermines the ability of licensees to make rational decisions about which of their spectrum holdings are optimal to be renewed.

11.12 Public interest discount

To meet public policy objectives, a public interest discount should be applied to MNO ESLs. No affordability analysis has been provided to demonstrate that Optus and TPG can afford the updated preliminary prices, nor does the benchmark analysis incorporate a public interest discount.

12. Conclusion and recommendations

The ACMA should adopt risk based pricing in view of the complexities identified in the benchmarking

We recommend that the ACMA adopts a risk based pricing approach in view of the complexities we have highlighted in the benchmarking data set and assumptions.

- This dictates the need for a conservative approach in interpreting the benchmark data
- It is prudent given the asymmetrically higher risk if ESL fees are set too high (rather than too low).
- It will also ensure that ESL prices promote all the components of the long term public interest and reflect the public benefits that use of the spectrum will bring.

Exhibit 50 below compares the ACMA's updated preliminary prices to our risk based prices for each of the 4 band groups, both with and without adjusting the benchmark data by the CPI.

Exhibit 50: Recommended ESL prices based on risk

365-day price / MHz / pop AUD 2025	Sub 1 GHz	Lower 1-3 GHz	Upper 1-3 GHz	3.4 GHz
20% benchmark price limit (real values)	0.0455	0.0083	0.0070	0.0087
20% benchmark price limit (nominal values)	0.0381	0.0083	0.0055	0.0071
ACMA updated preliminary price	0.0755	0.0307	0.0167	0.0217
% reduction (real values)	40%	73%	58%	60%
% reduction (nominal values)	49%	73%	67%	67%

Risk based price - AUD / MHz/ pop full licence				Industry bill - AUD millions and % change vs. ACMA		
	ACMA	CPI excluded	CPI included	ACMA	CPI excluded	CPI included
700	0.7405	0.3743	0.4465	1,945.9	984 (-49%)	1,173 (-40%)
850	0.7558	0.3820	0.4558	858.9	434 (-49%)	518 (-40%)
1800	0.3030	0.0819	0.0820	1,295.5	350 (-73%)	350 (-73%)
2100	0.2757	0.0745	0.0746	801.5	217 (-73%)	217 (-73%)
2300	0.1596	0.0529	0.0668	322.9	107 (-67%)	135 (-58%)
2600	0.1621	0.0537	0.0679	661.6	219 (-67%)	277 (-58%)
3400	0.2052	0.0669	0.0823	1,502.5	490 (-67%)	603 (-60%)
Total				7,388.8	2,801 (-62%)	3,274 (-56%)

Source: Coleago and ACMA

If the ACMA maintains its proposed approach, benchmarking issues must be fixed and the resulting prices must address all public interest issues

However, if the ACMA decides to maintain its proposed approach of setting ESL prices according to the central estimates – geometric mean and median – it must:

- address the methodological issues we have identified; and
- still take a conservative approach and demonstrate that ESL prices promote all public interest objectives.

Our key recommendations if the ACMA takes this route are as follows:

- Exclude outliers that meet standard tests for identification and are backed up by clear a priori evidence – we estimate this would reduce the total value of spectrum by 11%.
- Adjust benchmarks by trends in mobile spectrum prices and remove the CPI adjustment. We estimate that removing the CPI adjustment would reduce the total value of spectrum by a further 16%. Adjusting the benchmarks for the falling trends in mobile spectrum prices would reduce ESL prices significantly further. We recommend the ACMA proposes a way to apply this factor and the MSR index used in Stage 3 could be a starting point.
- Adjusting for outliers and CPI reduces the total value of spectrum \$5.5bn.
- Finally, the ACMA should apply a public interest discount in view of the fact that mobile is an essential service and the public benefits it brings. As in Stage 3, we recommend that a similar discount to NBN and Rail is applied, i.e. 50%.

Exhibit 51 below shows the impact of adjusting for outliers and removing CPI compared to the ACMA's updated preliminary prices.

Exhibit 51: ESL prices based on benchmarking with Coleago amendments

365-day price / MHz / pop AUD 2025	Sub 1 GHz	Lower 1- 3 GHz	Upper 1- 3 GHz	3.4 GHz
Geometric mean excluding outliers	0.0725	0.0285	0.0149	0.0154
Geometric mean excl. outliers, no CPI adjustment	0.0619	0.0244	0.0116	0.0131
Geometric mean excl. outliers, no CPI & MSR adjustment	0.0557	0.0221	0.0073	0.0113
ACMA updated preliminary price	0.0755	0.0307	0.0167	0.0217
% reduction (exclude outliers)	4%	7%	11%	29%
% reduction (no outliers, no CPI adjustment)	18%	20%	31%	40%
% reduction (no outliers, no CPI & MSR adjustment)	26%	28%	56%	48%

	Prices adjusted for outliers, CPI and MSR (AUD, full licence)		Total Industry bill (AUD million)		
	ACMA	Adjusted	ACMA	Adjusted	Change
700	0.7405	0.5462	1,945.9	1,435.3	26%
850	0.7558	0.5575	858.9	633.6	26%
1800	0.3030	0.2182	1,295.5	933.1	28%
2100	0.2757	0.1986	801.5	577.3	28%
2300	0.1596	0.0697	322.9	141.0	56%
2600	0.1621	0.0708	661.6	289.0	56%
3400	0.2052	0.1073	1,502.5	785.4	48%
Total			7,388.8	4,794.7	35%

Source: Coleago and ACMA