aetha

Modelling of network capacity in the area covered by the proposed Telstra-TPG MOCN

Supplementary report for Gilbert + Tobin

Public Version

10 November 2022

Contents

1. Executive summary

This report is provided as a supplementary report to our earlier report, 'Modelling of network capacity in the area covered by the proposed Telstra-TPG MOCN', 27 July 2022.

Aetha Consulting Limited ('Aetha') has been further instructed by Telstra's solicitors, Gilbert + Tobin, as an independent expert in relation to a proposed application to the Australian Competition and Consumer Commission (ACCC) for merger authorisation under section 88(5) of the Competition and Consumer Act 2010 (CCA).

In this supplementary report we consider data and arguments presented in the witness statement of Mr Steve Turner, Director of Spectrum Strategy and Management at Singtel Optus Pty Ltd. and provide our response to the points raised in relation to our report. Our further letter of instruction is provided at Annex C.

This report has been prepared by Andrew Wright (Partner) and Lee Sanders (Managing Partner) with the support of consultants and business analysts at Aetha.

We have read, complied with and agree to be bound by the requirements for expert reports set out in the Federal Court's Expert Evidence Practice Note (GPN-EXPT) (Practice Note) and the Harmonised Expert Witness Code of Conduct. We have attached a declaration of compliance with the Code at Annex B.

We understand that we are not an advocate, and this report is an objective and impartial assessment from Aetha's specialised knowledge in the telecommunications industry.

1.1 Aetha's network dimensioning model

It is clear from Mr Turner's discussion of the Aetha modelling results from para. 141 to para. 169 of his witness statement that he has misunderstood an important aspect of the Aetha model methodology.

Mr Turner suggests in several places in his witness statement (summarised in Table 22) that the Aetha approach involves multiplying the spectral efficiency for a band by the frequency zone % coverage of the band and using the resultant product as the spectral efficiency in the calculation. This is a mischaracterisation of the Aetha model.

The Aetha model, in fact, tests whether the traffic on a site can be carried by the spectrum bands at the site in combination, recognising the different coverage of each band (or group of bands) but not discounting their spectral efficiency as Mr Turner suggests.

Mr Turner compares some internal Optus models to what he believes to be the Aetha model in Figure 36. Although the values in Figure 36 have been redacted in the public version of his witness statement, it seems clear that he has not applied Aetha's method in producing the results indicated in Figure 36 and the comparison is invalid.

1.2 Spectrum available to the MOCN and Optus in the RCZ

Our report presented a series of comparisons of spectrum available in the RCZ to the mobile operators and the proposed MOCN. Optus' submission[1] similarly made comparisons of spectrum, and Mr Turner has provided further information on those comparisons in his witness statement. Optus presented total

[1] Optus, 'Submission in response to ACCC market inquiry – Telstra and TPG application for merger authorisation for proposed spectrum sharing in regional Australia', June 2022

spectrum (i.e. the sum of uplink and downlink for FDD spectrum and the whole bandwidth for TDD spectrum) whereas our report focussed on effective downlink spectrum, although for comparison with Optus we also presented total spectrum.

The RCZ spans multiple spectrum licensing areas. We use a site-weighted average to create a single number for the average MHz in each band, based on different holdings in the different licence areas spanned by the RCZ. We regard this average as a suitable input to use in a 'sites x spectrum/SIO' indicator - a measure which both our report and the Optus submission use (albeit with different spectrum measures as discussed above).

Mr Turner does not construct an average but discusses ranges of values across the RCZ for each band, although in Figure 5 of his witness statement he compares low-band and mid-band spectrum between operators on the basis of a single value of total MHz rather than a range. The values used in Figure 5 are the same as those used in the Optus submission to construct a 'sites x spectrum/SIO' figure.

We calculate a site-weighted average across the RCZ of 271.3MHz[2] of mid-band spectrum for the MOCN, in contrast to Mr Turner's 350MHz. The differences are:

- Mr Turner's 350MHz is based on the *maximum* of the range of spectrum quantities across the RCZ that he presents. The maximum is a poor choice of value to represent the range because it only applies to part of the RCZ.
- Mr Turner has different values for the range of spectrum quantities in each band across the RCZ to the equivalent ranges that we have determined. This may be a result of using a different definition of the RCZ.
- Mr Turner has included the 2100MHz apparatus licences of Telstra and TPG whereas we excluded them[3] because the operators have no certainty over the apparatus licences and, in the case of Telstra, the apparatus licence spectrum is not contiguous with Telstra's licensed 2100MHz spectrum, making it practically unusable in combination with that spectrum. Furthermore, TPG's 2100MHz apparatus licence spectrum is not part of the MOCN agreement.

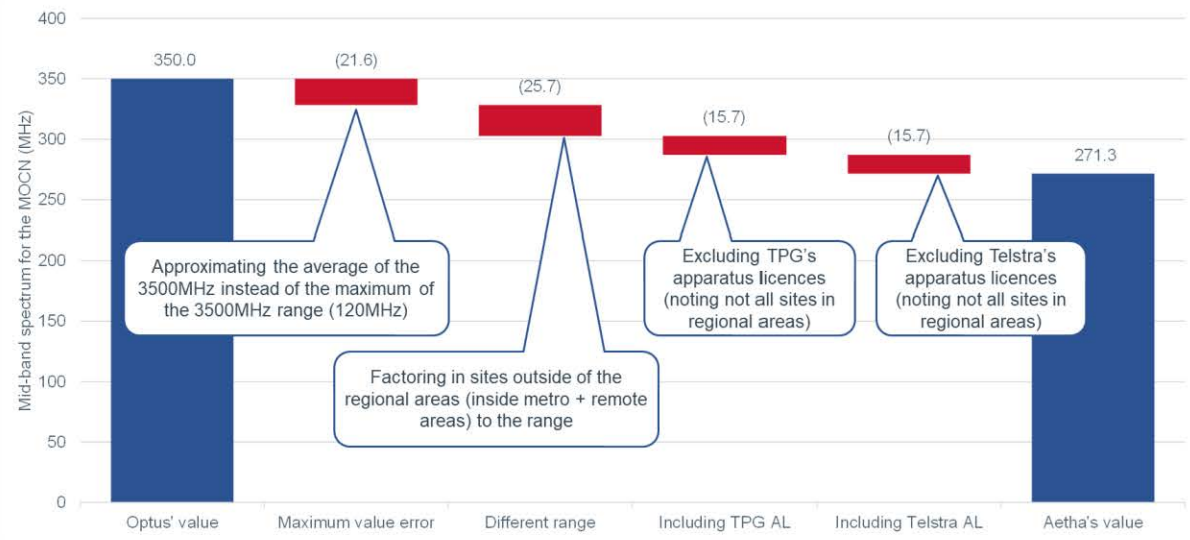
Figure 1, below, shows a breakdown of the differences between Mr Turner's/Optus' stated 350MHz of mid-band spectrum for the MOCN, which we believe to be an overstatement, and our weighted average of 271.3MHz.

[2] In our report we stated a rounded up value of 272MHz.

[3] Mr Turner also includes the Optus 2100MHz apparatus licence spectrum in the total for Optus and we exclude it.

[redacted]

Figure 1: Breakdown of differences between total mid-band spectrum for the MOCN in the RCZ presented by Mr Turner/Optus and Aetha



We also calculate a lower value than Mr Turner for mid-band spectrum for Optus at 134MHz compared to Mr Turner's 150MHz, the main difference being that we omit the apparatus spectrum and Mr Turner includes it.

We arrive at the same figures as Mr Turner for the low-band (sub-1GHz) spectrum – although we note that there are two possible values for the Optus low-band, depending on whether the lower 2 × 5MHz of the 900MHz spectrum is included. We understand that the use of the lower 2 × 5MHz is restricted until after the downshift of the adjacent 850MHz band.

The MOCN has available a total of 120MHz of low-band (sub-1GHz) spectrum and Optus has available 60MHz of low-band spectrum if the lower 2 × 5MHz of the 900MHz band is excluded, or 70MHz if the lower 2 × 5MHz of the 900MHz band is included.

The spectrum totals are summarised in Figure 2, below.

Figure 2: Total spectrum in the RCZ as calculated by Aetha and Optus [Source: Aetha, Optus submission, Witness Statement of Steve Turner]

Source	Operator	Low-band (Total MHz)	Mid-band (Total MHz)	Overall (Total MHz)
Optus submission / Mr Turner	Telstra (plus MOCN pooling)	120	350	470
Aetha	MOCN	120	271.3	391.3
Optus submission / Mr Turner	Optus	70	150	220
Aetha	Optus	60	134.0	194.0
Aetha, including lower 2 × 5MHz of 900MHz	Optus	70	134.0	204.0

1.3 Site counts in the RCZ

As explained in our report, Telstra provided us with a list of [**Confidential to Telstra**] [redacted] sites included in the MOCN. We have used the [**Confidential to Telstra**] [redacted] macro-cell sites on that list in our analysis and have excluded the [**Confidential to Telstra**] [redacted] micro-cells. We exclude the micro-cells because they are sites at which most of the spectrum cannot be exploited.

For Optus we used the ACMA offline Register of Radiocommunications Licences (RRL) provided by Telstra in combination with the definition of the RCZ used in the MOCN agreement to determine a site count of 2743 for Optus in the RCZ. We also used the 2021 ACCC Mobile Infrastructure Report (MIR) data (based on record keeping rule (RKR) data) which provided a lower figure of 2118 Optus sites in the RCZ.

Given that site numbers typically increase over time we took the view that the ACMA RRL was probably the more up to date database. We have selected a sample of Optus sites in the ACMA RRL that appeared not to be present in the 2021 ACCC MIR data and have confirmed the presence of a mobile site by looking at satellite imagery in Google Maps.

We note that Optus has provided a lower site count, but as we observed in the comparison of spectrum quantities, above, it is possible that Optus is using a different definition of the RCZ to the one we are using.

1.4 Comparing spectrum x sites per SIO between the MOCN and Optus

In Figure 3 below we present a calculated 'spectrum x sites/SIO' comparison, including the calculation from Optus' submission and our report and in addition we include a version with the lower 2 × 5MHz of the 900MHz band included and a version with the Telstra and Optus apparatus licence spectrum included.

[redacted]

Figure 3: Spectrum x sites/SIO calculations [Source: Optus submission, Witness Statement of Steve Turner, Aetha] [Confidential to the Parties]

		Spectrum (MHz)	Sites	SIOs	Spectrum (kHz) x sites/SIO	Advantage
Optus calculation	MOCN	470	3921	4 031 209	457	36%
	Optus	220	2274	1 491 018	336	-
Aetha calculation	MOCN	391.3	[redacted]	[redacted]	293	-
	Optus	194.0	2743	1 403 754	379	29%
Aetha calculation (inc. lower 2 x 5MHz of 900MHz)	MOCN	391.3	[redacted]	[redacted]	293	-
	Optus	204.0	2743	1 403 754	399	36%
Aetha calculation, using Optus' sites and SIOs for Optus	MOCN	391.3	[redacted]	[redacted]	293	-
	Optus	194.0	2274	1 491 018	296	1%
Aetha calculation + Telstra/Optus apparatus spectrum	MOCN	407.0	[redacted]	[redacted]	305	-
	Optus	210.7	2743	1 403 754	412	35%

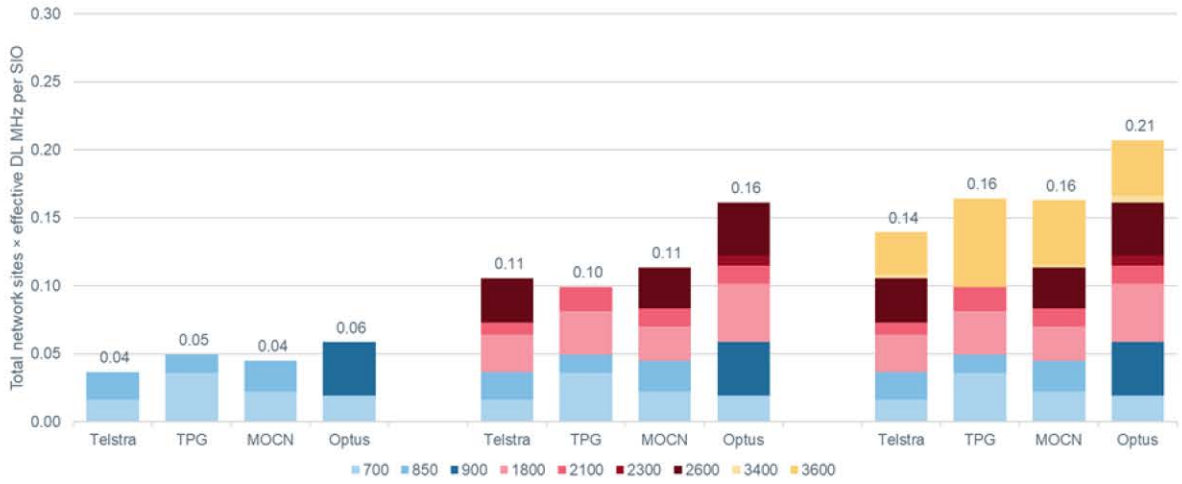
As indicated in Figure 4 below the Optus calculation (which we do not agree with for reasons discussed above) the MOCN has an advantage of 36% (i.e. a factor of 1.36) over Optus in 'sites x spectrum/SIO'. In our calculation, which is unchanged from our report, Optus enjoys a 29% advantage over the MOCN (i.e. a factor of 1.29). Optus' advantage extends further to 36% when the lower block of 900MHz spectrum is included.

As illustrated in our report, if we use Optus' figures for the Optus site count and Optus SIOs, Optus retains a slight (1%) advantage over the MOCN on this measure. If the Telstra and Optus apparatus licence spectrum is added to the analysis (but not the TPG apparatus licence spectrum, which is not part of the MOCN agreement) Optus' advantage increases from 29% to 35%.

In Figure 4, below, we present the equivalent (spectrum x sites/SIO) calculation using the site-weighted average effective downlink spectrum measure, in the format used in our report. Figure 4 leads to the same conclusion as Figure 3 above, and demonstrates that the conclusion holds not only for all sub-6GHz spectrum, but also for sub-3GHz and sub-1GHz spectrum. This conclusion is unchanged if we include both the Telstra and Optus 2100MHz apparatus licence spectrum.

[redacted]

Figure 4: Site effective DL MHz per SIO by operator within the 17% Regional Coverage Zone (without apparatus licences in 2100MHz)



Therefore, having reviewed Mr Turner's witness statement, our opinions have not changed from those expressed in our first report. We continue to be of the view that Telstra and TPG, through their use of the MOCN, will not hold an overwhelming network capacity advantage over Optus. On the contrary, our modelling shows that Optus will have a greater ability to accommodate usage growth, compared to the MOCN. The slight superiority of Optus' network in this regard is unsurprising, given its greater effective downlink capacity as measured by spectrum x sites/SIO.

2. Aetha's network dimensioning model

It is clear from Mr Turner's discussion of the Aetha modelling results from para. 141 to para. 169 that he has misunderstood an important aspect of the Aetha model methodology.

Mr Turner suggests in several places in his report (summarised in Table 22) that the Aetha approach involves multiplying the spectral efficiency for a band by the frequency zone % coverage of the band, and using the resultant product as the spectral efficiency in the calculation (for example, see para. 148 stating 'These percentages are then applied to Aetha's valuations of spectral efficiency to determine the capacity achievable by the entire regional network'). However, Mr Turner's statement is a mischaracterisation of how the Aetha model works. Mr Turner (para. 151) explains that Aetha applied the frequency zone ratios identified in Figure A-5 of Aetha's report to its spectral efficiency estimates. We should like to clarify that this is not how the frequency zone coverage is applied, and the conclusions that Mr Turner draws in Table 22 are incorrect.

We note that Mr Turner also provides some alternative Optus spectral efficiency estimates in Table 22 and in para. 15(b), but unfortunately these are redacted in the public version of Mr Turner's witness statement, and we are therefore unable to comment.

Mr Turner then provides a diagram in Figure 33 of how he believes the Aetha model works. This diagram and the discussion in para. 154 and para. 155 is also a mischaracterisation of the Aetha model.

Mr Turner then goes on to illustrate the implications of his misunderstanding in a series of results that purport to show how different Aetha's method is to Optus' method (see Figure 35 and Figure 36). Neither Figure 35 or Figure 36, nor the discussion that accompanies them, are valid because they are based on incorrect assumptions of how the Aetha model works.

Aetha's method does involve the two variables that are discussed by Mr Turner. Spectral efficiency is the factor that describes the average busy-hour (BH) throughput that can be achieved (in bps/Hz) and the traffic coverage by each frequency zone is a description of what proportion of the traffic in a sector can be addressed by a specific band or group of bands, as described in Section 4.2.4 of our report and the range of values used for the sites in the RCZ is discussed in Section 4.3.4 of our report.

The Aetha model, in fact, tests whether the traffic on a site can be carried by the spectrum bands at the site in combination, recognising the different coverage of each band (or group of bands) but not discounting their spectral efficiency as Mr Turner suggests. For example, consider a simplified situation of a sector that has two bands; 800MHz (2 × 10MHz) and 1800MHz (2 × 10MHz), the spectral efficiency of each band is 2.0 bps/Hz, the 800MHz coverage is 100% of the sector and the 1800MHz coverage is 50% of the sector (meaning it could serve the closest 50% of the traffic with a spectral efficiency of 2.0 bps/Hz but not the furthest 50% of traffic). This would amount to 20Mbps of downlink throughput from the 800MHz and 20Mbps of downlink throughput from the 1800MHz. If the traffic was 40Mbps, then in this example the full 40Mbps could be served; the 20Mbps closest to the cell site by the 1800MHz, and the remainder of the 40Mbps by the 800MHz. All of the traffic has been served by the spectrum operating at its spectral efficiency of 2.0 bps/Hz – the spectral efficiency is not discounted.

In para. 168, Mr Turner states that he has compared Optus' internal model, a second approach that he describes as the Optus SE method, and the methods employed by Aetha, to reach some conclusions illustrated in Figure 36. However, it seems clear that he has not applied Aetha's method, rather he has applied his misunderstanding of Aetha's method. The values that he achieves in Figure 36 have been redacted, but he seems to suggest that Aetha's method requires 7.2x as many sites as Optus' method. If that were the case, and given that Aetha's model concludes that Optus can deliver further growth in data usage in the RCZ without an excessive site build requirement, Optus' network would have to be running very low loading levels in the RCZ.

3. Comparing spectrum quantities

In this section, we will consider the different quantities of spectrum licensed to each operator within the RCZ and the methods of comparing those quantities.

3.1 The use of site-weighted average effective downlink spectrum

In our report (e.g. Figure 1) we provide a comparison of effective downlink spectrum between Telstra, TPG, the proposed MOCN and Optus. We consider this measure to be a relevant measure for comparison for the following reasons:

- The measure focuses on downlink spectrum, which is the main capacity constraint in mobile networks
- By using 'effective downlink spectrum' it allows TDD and FDD bands to be combined in the same metric
- By using a weighted average, it allows a single indicator to be used across the MOCN, which spans areas with different holdings for each of the operators
- By using the sites to weight the average, it explicitly recognises the non-uniform distribution of subscribers, their traffic and the sites that serve those subscribers across different spectrum licensing areas. Furthermore, by weighting the spectrum by sites we construct an average that when multiplied by the number of sites provides an indicator that is a proxy for the capacity that the network operator concerned could produce, using the spectrum and sites in question.

Furthermore, we calculate and comment on this measure in three distinct parts of the spectrum; the sub-6GHz spectrum, the sub-3GHz spectrum and the sub-1GHz spectrum because of the different range of those frequencies.

In para. 119(a) of his witness statement, Mr Turner objects to the use of an average across a large geographic area that spans licence boundaries. In our view it is a useful simplification to create an appropriately weighted average across the entire area. Optus, in its submission, did not create such an average, although it does use a single MHz figure, for each of the MOCN and Optus, representing the RCZ as a whole in its submission (at para. 5.47) – 470MHz for the Telstra-TPG MOCN and 220MHz for Optus – without offering any explanation of how the holdings in the various licence areas in the RCZ are reduced to a single value.

Mr Turner states (para. 119(b)) that we assume a uniform customer distribution, but we make no such assumption. Indeed, we use a site-weighted average for the spectrum because we know that the customers and the sites that serve them are not uniformly distributed across spectrum licence areas.

3.2 The spectrum available to the MOCN and Optus in the RCZ

Mr Turner has presented in his witness statement (para. 44 to para. 55) spectrum holdings, which we can compare to the values that we presented in Section 3.1 of our report.

Regardless of the differences of how the spectrum quantity is presented (as total MHz, which Optus used for the spectrum x sites/SIO calculation in its submission, or effective downlink MHz as Aetha used in its equivalent discussion of spectrum x sites/SIO), we can consider band by band, areas of agreement and difference between the values presented in our report (Figures 3-2 to 3-5) and those presented by Mr Turner in Table 1 to 4 of his witness statement:

- **700MHz**: We find agreement between our Figures 3-2 to 3-5 and Mr Turner's Table 1. Optus, Telstra and TPG have 2 × 10MHz, 2 × 20MHz and 2 × 15MHz respectively. 2 × 30MHz is included in the MOCN. In our Figures we present the downlink part, whereas Mr Turner presents it as uplink and downlink, based on our different approaches to comparing spectrum (total spectrum in the Optus submission and effective downlink spectrum in Aetha's report).
- **850MHz**: We agree that, post-June 2024, Telstra will have 2 × 25MHz, and that TPG has 2 × 5MHz. We further agree than the MOCN pooled spectrum is 2 × 20MHz, as presented by Mr Turner in his Table 2. The reason why we present the MOCN downlink figure as 30MHz, is that we regard Telstra's additional 2 × 10MHz as potentially usable for capacity at the MOCN sites, which are almost entirely Telstra sites, and we therefore consider it as potentially contributing to the same overall pool of capacity and include it with the MOCN spectrum in our analysis.
- **900MHz**: We agree that it is likely Optus will have 2 × 25MHz of spectrum after June 2024, of which 2 × 20MHz is immediately usable, subject to certain conditions. The remaining 2 × 5MHz has limitations on its use until after the downshift of the adjacent 850MHz band, which Mr Turner explains (para. 40(a)ii) is currently scheduled for 2028 (although we understand that it could potentially be used by Optus before this date). We have conservatively assumed 2 × 20MHz (rather than 2 × 25MHz) in all of our comparisons and in the modelling that we undertook, although we would note that in the medium- and long-term the full 900MHz will be usable and it would therefore be valid to include it in a long-term comparison of low-band spectrum.
- **1800MHz**: There are some differences between our figures and Mr Turner's figures for the 1800MHz band:
  - Firstly, we note that TPG's 1800MHz holdings are not being pooled under the proposed MOCN.
  - For Optus, Mr Turner states 2 × 20-25MHz (varying by region) whereas we believe it to be 2 × 15-25MHz, with an average of 2 × 22MHz. Although we do not know with certainty the reason for the difference between our figures and Optus' figures, one possible explanation is that Optus is using a different definition of the RCZ. For our calculation we use a list of SA1s and defined 'boundary' sites which are covered by the MOCN agreement.
  - For Telstra, Mr Turner states 2 × 40MHz. While we agree they have 2 × 40MHz in many parts of the RCZ (regional areas other than Regional Victoria), we understand the overall range to be from 2 × 15MHz to 2 × 40Mz (varying by region) with a site weighted average of 2 × 33.8MHz.
  - For TPG, Mr Turner states that the range is 2 × 10-15MHz, although we understand it to be 2 × 0-30MHz, with a site-weighted average of 2 × 13.3MHz.
  - In Table 4 of his witness statement, Mr Turner shows no pooled spectrum in the 1800MHz – however, in our Figure 3-2 we include the Telstra spectrum (2 × 15-40MHz, with a site weighted average of 2 × 33.8MHz) because Telstra's 1800MHz spectrum is included in the MOCN agreement, though TPG's 1800MHz spectrum is not. Note that whereas for 850MHz we included the Telstra spectrum that is not part of the MOCN agreement in our total for the MOCN because it can be used at the MOCN sites (i.e. Telstra sites) we have not done the same for TPG's 1800MHz because it will not be used at the Telstra sites and will not form part of the pool of spectrum and capacity at the sites where the MOCN operates. We therefore exclude it from the MOCN spectrum.
- **2100MHz:** As with 1800MHz there are some differences between our values and those of Mr Turner, the largest being that Mr Turner has included the apparatus licence spectrum that Telstra, Optus and TPG have access to, whereas we have not included the regional apparatus licences.
  - For Optus, Mr Turner quotes 2 × 15MHz, whereas we have 2 × 5-20MHz, varying by area, but an average of 2 × 6.9MHz. The largest part of the difference would appear to be the inclusion or not of apparatus licences. Again, it is possible that the remaining difference is explained by a different definition of the RCZ.
  - For Telstra, similarly, the difference would appear to be largely explained by the apparatus licences. Mr Turner quotes 2 × 20MHz, whereas we have 2 × 10-30MHz, and an average of 2 × 10.8MHz, without apparatus licences.

  - For TPG, Mr Turner states 2 × 15MHz, whereas we have 2 × 5-25MHz with an average of 2 × 7.4MHz. We believe that Mr Turner arrives at his figure by including the 2 × 10MHz of apparatus licence spectrum, in addition to TPG's 2 × 5MHz of licensed spectrum. Again, the remaining difference may be based on different definitions of the RCZ.
  - For the MOCN Mr Turner states a value of 2 × 35MHz pooled in Table 4, whereas our value, which does not include the apparatus licence, is a total is 2 × 15-40, with an average of 2 × 17.7MHz. The difference appears to be the inclusion of the apparatus licence spectrum that is available to both Telstra and TPG, with the remaining difference potentially being accounted for by different definitions of the RCZ.
- **2300MHz:** Mr Turner does not include this band in his analysis, but in fact the RCZ, as defined in the MOCN agreement, does overlap with areas in which Optus has 2300MHz spectrum. We have determined a range from 0-98MHz, with an average of 4.9MHz.
- **2600MHz:** We agree with Mr Turner's Table 3, that Optus has 2 × 20MHz, Telstra has 2 × 40MHz and TPG has no 2600MHz spectrum in the RCZ. We also agree with Mr Turner's Table 4, that the MOCN will have access to 2 × 40MHz of 2600MHz.
- **3500MHz:** In this frequency band Mr Turner presents the entire 3400-3700MHz as a single band, whereas we presented our ranges and average values in Figure 3-2 to Figure 3-4 by considering 3400MHz and 3700MHz separately. As it is not possible to sum our ranges to get ranges comparable to those presented by Mr Turner (because the highest value of each range is not in the same licence area), we have recalculated and determined the range for 3500MHz, taking the whole 3400-3700MHz to align to Mr Turner's approach.
  - For Optus, Mr Turner states 30-35MHz, whereas we have a range of 0MHz to 102.5MHz[4] and an average of 31.4MHz.
  - For Telstra, Mr Turner has 50-80MHz whereas we have a range of 0MHz to 103MHz[4] and an average of 54.9MHz.
  - For TPG, Mr Turner has 20-40MHz whereas we have a range of 0MHz to 95MHz and an average of 35.8MHz.
  - For the MOCN, Mr Turner has a value of 90-120MHz whereas we have a range of 0MHz to 157.5MHz and an average of 88.4MHz – just below the lower end of Mr Turner's range.

To summarise, the main differences in the values used by Mr Turner and Aetha are in the mid-band spectrum appear to be:

- Mr Turner has included the 2100MHz apparatus licence spectrum for Telstra, Optus and TPG, including both Telstra and TPG in the MOCN whereas we excluded them.
- Mr Turner does not appear to list the 1800MHz spectrum as being pooled in his Table 4– although we understand that the Telstra 1800MHz spectrum is included in the MOCN agreement whereas the TPG spectrum is not, so we include the Telstra spectrum but not the TPG spectrum.
- We have different ranges of values to Mr Turner for 1800MHz, 2100MHz and 3500MHz in some cases, which might be explained in part or in full by following different definitions of the RCZ. In some instances, our weighted average figure is in the middle of the range presented by Mr Turner, suggesting that the difference may be small or unimportant, but in other cases there is a material difference, for example, in the quantity of 3500MHz available to the MOCN (where our calculated average is below the lower end of the range that Mr Turner states).

We do not agree with the inclusion of the apparatus licence spectrum. Firstly, we understand that the apparatus licence spectrum is issued for a limited term with no certainty of renewal. We understand the spectrum is not exclusively reserved for Telstra and can be taken up by other users, such as industrial

[4] We note that the 3600MHz licensing areas do not perfectly overlap with the 3400MHz licensing areas, therefore it is possible that a site will have a different total amount of 3500MHz spectrum depending on its location – for example, it is possible that a site located in Adelaide for 3400MHz (28MHz) is classified as Regional South Australia for the 3600MHz band (75MHz), totalling 103MHz.

users or wireless broadband providers. Furthermore, the apparatus spectrum available to Telstra is not contiguous with Telstra's 2100MHz spectrum licence and is therefore essentially unusable in practice in locations where Telstra uses its licensed 2100MHz spectrum. Furthermore, Mr Turner has also included the TPG apparatus licence spectrum in the MOCN pooled spectrum, which is incorrect – even if TPG makes use of that spectrum, it is not part of the MOCN agreement and cannot therefore be used as part of the capacity at the Telstra sites that constitute the MOCN.

3.2.1 Spectrum available to the MOCN

In our report (page 23) we explained that we were unable to replicate the figures in the Optus submission (para. 5.47), where Optus presents its spectrum x sites/SIO comparison, either using our own figures or using values derived from Figure 9 and Figure 10 of Optus' submission. One key value that we could not reconcile with either Optus' values in Figure 9 and Figure 10, or our own value, was the total mid-band spectrum of the MOCN, which Optus stated as 350MHz and we had calculated, based on a site-weighted average, as 271.3MHz.

We have now attempted to re-construct the 350MHz of mid-band spectrum for the MOCN that Optus relies upon in its calculation (para. 5.47) based on the figures presented by Mr Turner in his witness statement.

Mr Turner quotes in Table 4, a figure of 240-270MHz for pooled spectrum available to the MOCN, expressing the figure as a range rather than a single figure. However, by the time we arrive at Figure 5 of Mr Turner's witness statement, the mid-band figure for Telstra (plus MOCN spectrum pooling) is 350MHz, matching the value at para. 5.47 of Optus' original submission.

We do not know how Mr Turner arrives at this single figure, but it appears to be consistent with taking the highest number in his range of 240-270MHz for pooled spectrum and adding the 80MHz (2 × 40MHz) of 1800MHz spectrum, which is his figure for Telstra 1800MHz spectrum.

We still do not agree with Mr Turner's 350MHz figure:

- Firstly, it includes the apparatus licence spectrum of both Telstra and TPG in 2100MHz. We believe it is incorrect to include Telstra's apparatus licence spectrum at locations where Telstra has other licensed, but non-contiguous, 2100MHz spectrum for the reasons discussed above (Telstra cannot practically use it in conjunction with its licensed spectrum, and it cannot be relied upon). We believe it is incorrect to include TPG's 2100MHz apparatus licence spectrum because it is not part of the MOCN agreement and therefore cannot be used.
- Secondly, Mr Turner's 350MHz is based on the *maximum* of the range of spectrum quantities across the RCZ, as understood by Optus. Although Mr Turner has explained that he does not like weighted averages, we do not believe it is correct in this type of analysis to base one's conclusion on the maximum of the range of values across different licence areas.
- Thirdly, it is incorrect to assume that the RCZ as defined in the MOCN agreement by a list of SA1s lies entirely within regional spectrum licensing areas. Although it is true that a majority of the SA1s are within the regional spectrum licensing areas – which can be seen from the averages above, there are areas of the MOCN region which are within other spectrum licensing areas (for example, Sydney Metro), and have different spectrum assignments, which should not be ignored. In Annex A we provide some maps of the RCZ as defined by the SA1s in the MOCN agreement, overlaid with spectrum licence areas.

We have re-examined our own calculation and we still find that the MOCN has available 271.3MHz[5] of mid-band spectrum (total spectrum rather than effective downlink spectrum, for comparison with Optus)

[5] The 271.3MHz was rounded up to 272MHz in our report.

and 120MHz of low-band spectrum, making 391.3MHz in total. This includes all Telstra licensed spectrum and spectrum that is part of the MOCN agreement but excludes both the Telstra apparatus licence spectrum and the TPG apparatus licence spectrum.

3.2.2 Spectrum available to Optus

We have also re-visited the mid-band spectrum that Optus has available in the RCZ, based on comparing Mr Turner's analysis to our own to again see if the two can be reconciled. Based on our previous exercise to compare the two, we found less difference in the Optus figures than in the MOCN figures. Optus stated 150MHz in para. 5.47 of its submission, whereas we calculated an average of 134MHz.

Mr Turner presents a range for Optus of 140-155MHz – the 150MHz used in Optus' submission is in that range, although Optus does not appear to have used the maximum value from the range for Optus, as it did for the Telstra and the Telstra-TPG MOCN. Our calculation of the average remains 134MHz.

The differences between our value for Optus (134MHz) and Optus' (150MHz) are:

- Optus includes the apparatus licence spectrum for 2100MHz and Aetha does not
- Optus is again using a number towards the top of its range (though not at the maximum of the range as it appears to do for the Telstra-TPG MOCN value)
- There are again other differences between our figures and Optus', which may relate to different definitions of the RCZ
- We include the 2300MHz band, which Optus has available in some areas of the RCZ according to our definition of the RCZ.

In Figure 5 below, we summarise both Mr Turner's calculation and our own calculation, in line with the values discussed above.

Although we do not include the apparatus licence spectrum for reasons discussed above, we present a version of the Aetha calculation with the apparatus licence spectrum of Telstra (though not TPG) and Optus included, should that be preferred. In Figure 6 we present a summary that is the same as Figure 5, except that the Aetha calculation in Figure 6 includes the Telstra and Optus apparatus licence spectrum. The Telstra apparatus licence spectrum is included in the Telstra values and the Telstra (+MOCN pooling) values. The Optus apparatus licence spectrum is included in the Optus values. The TPG apparatus licence is not included in the MOCN because it does not form part of the MOCN agreement.

Figure 5: Summary of Mr Turner's calculation and Aetha's calculation [Source: Optus submission, Witness Statement of Steve Turner, Aetha]

Optus/Mr Turner

		Telstra	Telstra (+MOCN pooling)	Optus
Low band				
	700MHz	2 x 20	2 x 30	2 x 10
	850MHz	2 x 25	2 x 30	
	900MHz			2 x 25 (2 x 20 upto 2028)
	Total	2 x 45	2 x 60	2 x 35 (2 x 30 upto 2028)
	Optus submission (para. 5.47)		**120**	**70**
	Turner, Figure 5	**90**	**120**	**70**
Mid band				
	1800MHz	2 x 40	2 x 40	2 x 20-25
	2100MHz	2 x 20	2 x 35	2 x 15
	2300MHz			
	2600MHz	2 x 40	2 x 40	2 x 20
	3500MHz	50-80	90-120	30-35
	Total	2 x 100 FDD 50-80 TDD	2 x 105 FDD 90-120 TDD	2 x 55-60 FDD 30-35 TDD
	Total (overall MHz)	250-280	320-350 Top of range	140-155 Within range
	Optus submission (para. 5.47)		**350**	**150**
	Turner, Figure 5		**350**	**150**
Total (Sub 6 GHz)				
	Total (overall MHz)		440-470	210-225
	Optus submission (para. 5.47)		**470**	**220**
	Turner, Figure 5		**470**	**220**

Aetha (using ranges and site-weighted averages)

		Telstra		Telstra (+MOCN pooling)		Optus	
		Range	Average	Range	Average	Range	Average
	700MHz	2 x 20	2 x 20	2 x 30	2 x 30	2 x 10	2 x 10
	850MHz	2 x 25	2 x 25	2 x 30	2 x 30		
	900MHz					2 x 25 (2 x 20 upto 2028)	2 x 25 (2 x 20 upto 2028)
	Total		2 x 45		2 x 60		2 x 35 (2 x 30 upto 2028)
	Aetha report Figure 3-10				**120**		**60**
	Aetha alternative:						**70 (full 900MHz)**
	1800MHz	2 x 15-40	2 x 33.8	2 x 15-40	2 x 33.8	2 x 15-25	2 x 22
	2100MHz	2 x 10-30	2 x 10.8	2 x 15-40	2 x 17.7	2 x 5-20	2 x 6.9
	2300MHz					0 - 98	4.9
	2600MHz	2 x 40	2 x 40	2 x 40	2 x 40	2 x 20	2 x 20
	3500MHz	0 -103	54.9	0 -157.5	88.4	0 - 102.5	31.4
	Total		2 x 84.6 FDD 54.9 TDD		2 x 91.5 FDD 88.4 TDD		2 x 48.9 FDD 36.3 TDD
	Total (overall MHz)				271.3		134.0
	Aetha report Figure 3-10				**272**		**134**
	Total (overall MHz)				391.3		194.0
	Aetha report Figure 3-10				**392**		**194**
	Aetha alternative:						**204 (full 900MHz)**

Figure 6: Summary of Mr Turner's calculation and Aetha's calculation amended to include Telstra and Optus 2100MHz apparatus licence spectrum (but not TPG apparatus licence spectrum) [Source: Optus submission, Witness Statement of Steve Turner, Aetha]

Optus/Mr Turner

		Telstra	Telstra (+MOCN pooling)	Optus
Low band				
	700MHz	2 x 20	2 x 30	2 x 10
	850MHz	2 x 25	2 x 30	
	900MHz			2 x 25 (2 x 20 upto 2028)
	Total	2 x 45	2 x 60	2 x 35 (2 x 30 upto 2028)
	Optus submission (para. 5.47)		**120**	**70**
	Turner, Figure 5	**90**	**120**	**70**
Mid band				
	1800MHz	2 x 40	2 x 40	2 x 20-25
	2100MHz	2 x 20	2 x 35	2 x 15
	2300MHz			
	2600MHz	2 x 40	2 x 40	2 x 20
	3500MHz	50-80	90-120	30-35
	Total	2 x 100 FDD 50-80 TDD	2 x 105 FDD 90-120 TDD	2 x 55-60 FDD 30-35 TDD
	Total (overall MHz)	250-280	320-350 Top of range	140-155 Within range
	Optus submission (para. 5.47)		**350**	**150**
	Turner, Figure 5		**350**	**150**
Total (Sub 6 GHz)				
	Total (overall MHz)		440-470	210-225
	Optus submission (para. 5.47)		**470**	**220**
	Turner, Figure 5		**470**	**220**

Aetha (using ranges and site-weighted averages) inc. Telstra and Optus 2100MHz AL spectrum

		Telstra		Telstra (+MOCN pooling)		Optus	
		Range	Average	Range	Average	Range	Average
Low band							
	700MHz	2 x 20	2 x 20	2 x 30	2 x 30	2 x 10	2 x 10
	850MHz	2 x 25	2 x 25	2 x 30	2 x 30		
	900MHz					2 x 25 (2 x 20 upto 2028)	2 x 25 (2 x 20 upto 2028)
	Total		2 x 45		2 x 60		2 x 35 (2 x 30 upto 2028)
	Aetha report Figure 3-10				**120**		**60**
	Aetha alternative:						**70 (full 900MHz)**
Mid band							
	1800MHz	2 x 15-40	2 x 33.8	2 x 15-40	2 x 33.8	2 x 15-25	2 x 22
	2100MHz	2 x 10-30	2 x 18.6	2 x 20-40	2 x 25.5	2 x 10-20	2 x 15.2
	2300MHz					0 - 98	4.9
	2600MHz	2 x 40	2 x 40	2 x 40	2 x 40	2 x 20	2 x 20
	3500MHz	0 -103	54.9	0 -157.5	88.4	0 - 102.5	31.4
	Total		2 x 92.4 FDD 54.9 TDD		2 x 99.3 FDD 88.4 TDD		2 x 57.2 FDD 36.3 TDD
	Total (overall MHz)				287.0		150.7
	Aetha value (inc. T/O AL)				**287.0**		**150.7**
	Aetha alternative:						
Total (Sub 6 GHz)							
	Total (overall MHz)				407.0		210.7
	Aetha value (inc. T/O AL)				**407.0**		**210.7**
	Aetha alternative:						**220.7 (full 900MHz)**

As we demonstrated in our report, Figure 3-10, using the correctly calculated average spectrum across the RCZ for the MOCN (or Telstra (plus MOCN spectrum pooling) in Mr Turner's terminology at his Figure 5) of 391.3MHz, rather than Mr Turner's value of 470MHz, results in a lower spectrum x sites/SIO for the MOCN than for Optus, when using the 194MHz total spectrum figure for Optus.

As we demonstrated in Figure 3-10 of our report this conclusion remains, even if the Optus spectrum x sites/SIO is calculated using the number of Optus sites (2274) and SIOs (1 491 018) provided by Optus in its submission.

In Figure 7 below we present again those calculated spectrum x sites/SIO comparisons from Figure 3-10 of our report and in addition we include a post-2028 calculation (where the lower 2 × 5MHz of the 900MHz band is included) and a version with the Telstra and Optus apparatus licence spectrum included.

Figure 7: Spectrum x sites/SIO calculations [Source: Optus submission, Witness Statement of Steve Turner, Aetha] [Confidential to the Parties]

		Spectrum (MHz)	Sites	SIOs	Spectrum (kHz) x sites/SIO	Advantage
Optus calculation	MOCN	470	3921	4 031 209	457	36%
	Optus	220	2274	1 491 018	336	-
Aetha calculation	MOCN	391.3	[redacted]	[redacted]	293	-
	Optus	194.0	2743	1 403 754	379	29%
Aetha calculation (inc. lower 2 x 5MHz of 900MHz)	MOCN	391.3	[redacted]	[redacted]	293	-
	Optus	204.0	2743	1 403 754	399	36%
Aetha calculation, using Optus' sites and SIOs for Optus	MOCN	391.3	[redacted]	[redacted]	293	-
	Optus	194.0	2274	1 491 018	296	1%
Aetha calculation + Telstra/Optus apparatus spectrum	MOCN	407.0	[redacted]	[redacted]	305	-
	Optus	210.7	2743	1 403 754	412	35%

As indicated in Figure 7, in the Optus calculation (which we do not agree with for reasons discussed above) the MOCN has an advantage of 36% (i.e. a factor of 1.36) over Optus in sites x spectrum/SIO. In our calculation, Optus enjoys a 29% advantage over the MOCN (i.e. a factor of 1.29). Optus' advantage extends further after 2028 when the lower block of 900MHz spectrum becomes usable.

As illustrated in our report, if we use Optus' figures for Optus' site count (which we discuss further below) and Optus' SIOs it retains a slight advantage over the MOCN on this measure. If the Telstra and Optus apparatus licence spectrum is added to the analysis (but not the TPG apparatus licence spectrum), Optus' advantage is greater.

[redacted]

4. The site counts in the RCZ

In addition to spectrum, which we have addressed above, the other key input to the comparison between the MOCN (or Telstra and the MOCN in combination) and Optus in the RCZ is the number of sites.

4.1 MOCN sites

As we discussed in our report, Telstra provided us with a list of **[Confidential to Telstra]** [redacted] sites that are included in the MOCN and we have used the **[Confidential to Telstra]** [redacted] macro sites from that list as our macro-site count, and to construct our site-weighted average spectrum quantities for the MOCN. The **[Confidential to Telstra]** [redacted] micro-cells are excluded from our analysis because they are not sites where the entire spectrum, or a substantial part of it, can be used. Micro-cells generally use only a small subset of the spectrum, contributing comparatively small amounts of capacity.

We noted in Figure 3-8 of our report that the ACMA offline RRL data that we were provided with contained 3855 sites in total for Telstra in the RCZ, compared to the **[Confidential to Telstra]** [redacted] in the MOCN site list provided by Telstra. We also note that Optus uses a figure of 3921 for Telstra sites in Figure 13 of its submission, which it sources to the RKR. In his re-construction of our sites x spectrum/SIO calculation (para. 131, Table 18) Mr Turner uses the ACMA offline RRL figure of 3855 from our table (the internal figure from Telstra being redacted in the public version of our report) but makes no adjustment for micro-cells.

The primary sources of difference between our figure and Optus' figure are:

- We have used the internal Telstra figures for sites included in the MOCN, whereas Optus use the RRL and/or RKR figures
- Optus includes micro-cells in the site count whereas we exclude them.

4.2 Optus sites

For Optus sites, we used the ACMA offline RRL database provided, which indicates 2674 Optus sites within the RCZ as defined by the list of SA1s within the RCZ, which forms part of the MOCN agreement. We understand the MOCN agreement to cover the entirety of the SA1s listed, plus some additional Telstra sites outside of the SA1s listed ('boundary' sites). We have identified from this list a further 69 sites which are located within 1km of a Telstra 'boundary' site – bringing the total Optus sites considered to 2743.

As we noted in Section 2.2 (page 24) of our report, the ACMA RRL database contains a greater number of Optus sites than the ACCC MIR database (based on the RKR) in the RCZ. We compare the figures that we obtain from each of the databases below with the figure that Optus uses in its submission.

Figure 8: Site number comparison by operator [Source: ACMA RRL, 2021 ACCC MIR]

	Telstra	Optus (excl. 'boundary' sites)
Telstra internal	**[Confidential to Telstra]** [redacted]	-
ACMA RRL	3853	2674
2021 ACCC MIR	3674	2118

Because site numbers generally increase over time rather than decrease, we took the view that the RRL was likely to be more up to date than the 2021 ACCC MIR, because it included more Optus sites. Unfortunately, we have no means of conclusively determining which of the two publicly available databases is correct.

In an attempt to partially validate the ACMA RRL data, we have examined a selection of the sites which were present in the RRL database but appeared to be absent from the 2021 ACCC MIR database using Google Maps. This enabled us to verify that there was a mobile cell tower present at the location at the date of the most recent satellite imagery (which in a majority of cases was 2022) which we took as a partial validation of the database. Based on this partial validation, we have no reason to doubt the accuracy of the ACMA RRL database.

Optus provided a figure of 2274 in its submission and uses that figure to calculate its sites x spectrum/SIO figure. The figure used by Optus is further confirmed in Table 9 of Mr Turner's witness statement, which clarifies it as being 2274 macro sites (of a total of 2375, the other 100 being small cells/IBC).

While we would certainly expect Optus to know the location of its own sites, we observed in our review of the spectrum values used by Optus that a possible explanation for part of the difference in spectrum quantities was that Optus is not using the same definition of the RCZ that we are using, which is based on the SA1s and 'boundary' sites included in the MOCN agreement. If that is the case, it may explain part of the difference between the number of Optus sites that Optus counts and the number that we extracted from the RRL.

[redacted]

5. Comparing spectrum between operators of different size

Aetha put forward comparisons of spectrum holdings, and spectrum x sites, between operators of different scale that were expressed on a 'per SIO' basis The reason for this is that spectrum is a key input to the production of network capacity and the subscribers (i.e. SIOs) are the source of demand for that capacity. The adequacy of a mobile network operator's capacity can only be considered in the correct context of the number of subscribers they serve, or the traffic that they must serve.

Aetha's report put forward comparisons between operators and the proposed MOCN in terms of:

- Site-weighted average downlink spectrum (without adjustment for sites or SIOs)
- Site-weighted average downlink spectrum per SIO (as a measure of the amount of spectrum relative to size), and
- Sites x site-weighted average effective downlink MHz per SIO – which can be used as comparator between network operators that relates to capacity that the operator can produce.

Aetha's instructions were to test whether Telstra would be able to outperform any competition on a capacity basis as a result of the MOCN and these indicators were constructed to assist in answering that question.

Of course, spectrum is not the only input to network capacity. The type and configuration of technology used and the number of sites in the network are also determinants of the network capacity.

However, for a given technology and site configuration, it is the number of cell sites and the amount of spectrum that together determine the capacity of a mobile network, and because the spectrum can be re-used at each site, the capacity of the network is related to the product of spectrum and sites (spectrum x sites).

As capacity is related to spectrum x sites, and as the demand for capacity is related to SIOs, the measure spectrum x sites/SIO is an indicator that can be used as a comparator between networks for assessing the relative adequacy of their spectrum holdings and sites in combination. Because networks are usually constrained by downlink capacity, we refine the measure by focusing on the effective downlink spectrum (effective downlink spectrum x sites per SIO). As we have already discussed in Section 3.1, we consider the site-weighted average spectrum to be the most appropriate measure, which when multiplied by sites is an indicator of the capacity that can be produced by the network, given the sites and spectrum available.

Thus, we create an overall figure of merit for the quantity of spectrum in relation to capacity needs, site-weighted average effective downlink spectrum x sites/SIO, as a comparator that indicates the relative capability of different networks to provide capacity relative to demand.

5.1 Site-weighted average downlink spectrum

Mr Turner puts forward (para. 117 to 125) his concerns regarding our use of site-weighted average spectrum per SIO. He notes (para. 119(a)) that the RCZ is 'a large geographic area across which MNOs have varied spectrum holdings'. We agree with this point, and it is exactly because of the large geographic area spanning regions with different holdings that we construct a weighted average. As we discussed in Section 3.2, Optus does not construct an average, but simply chooses the highest spectrum value that the MOCN has in any of the areas (i.e. the maximum of the range for MOCN spectrum that Mr Turner presents in Tables 2 and 4) when calculating its version of the sites x spectrum/SIO values.

In para. 119 (c) Mr Turner again complains that Aetha has not included the remote apparatus licenses available to TPG and Telstra. We have indeed omitted the apparatus licences for 2100MHz spectrum in locations where Telstra has available licensed 2100MHz spectrum, for the reason we discussed in Section 3.2, above (Telstra cannot practically use it in conjunction with its licensed spectrum, and it cannot be relied upon). Furthermore, we omit TPG apparatus licence spectrum for 2100MHz from the MOCN spectrum total for the simple reason that it is not included in the MOCN agreement and cannot therefore be used by Telstra at the MOCN sites.

We do include Telstra's 2100MHz apparatus licence in remote areas, where Telstra does not have any licensed 2100MHz spectrum.

We also note that we have treated Optus' apparatus licences in an identical manner to our treatment of Telstra's licences – that is we have omitted Optus' 2100MHz regional apparatus licences, although we understand that in Optus' case the apparatus licence spectrum is adjacent to Optus' licensed spectrum, so can be used in practice.

Mr Turner re-states our site-weighted average downlink spectrum with the 2100MHz apparatus licence. Although we do not agree with using this modified total including apparatus licences, we would point out in particular that adding the TPG apparatus spectrum to the MOCN figure is incorrect because the TPG apparatus spectrum is not included in the MOCN agreement and therefore is not part of the spectrum that will be used to create capacity at the Telstra sites. The Telstra 2100MHz spectrum is also not part of the MOCN agreement – though in principle (if not in practice) it could be used for capacity at the sites.

We therefore produce, below, a corrected version of Mr Turner's Table 16, which does not ascribe TPG's 2100MHz apparatus licence spectrum to the MOCN, but does include the Telstra apparatus spectrum and the Optus apparatus spectrum. Figure 9 shows that adding the apparatus licences increases Optus' site-weighted effective downlink spectrum by 7.9%, whereas the MOCN's value is increased by 3.6%.

Figure 9: Correction to Mr Turner's Table 16

Operator	Optus						Telstra					
Analysis	Aetha			+ remote apparatus			Aetha			+ remote apparatus		
Band	Min	Max	SWAED	Min	Max	SWAED	Min	Max	SWAED	Min	Max	SWAED
700	10.0	10.0	10.0	10.0	10.0	10.0	20.0	20.0	20.0	20.0	20.0	20.0
850	-	-	-	-	-	-	20.0	25.0	24.7	20.0	25.0	24.7
900	20.0	20.0	20.0	20.0	20.0	20.0	-	-	-	-	-	-
1800	15.0	25.0	22.0	15.0	25.0	22.0	15.0	40.0	33.8	15.0	40.0	33.8
2100	5.0	20.0	6.9	10.0	20.0	15.2	10.0	30.0	10.8	10.0	30.0	18.6
2300	-	73.5	3.6	-	73.5	3.6	-	-	-	-	-	-
2600	20.0	20.0	20.0	20.0	20.0	20.0	40.0	40.0	40.0	40.0	40.0	40.0
3400	-	54.0	2.6	-	54.0	2.6	-	24.4	2.5	-	24.4	2.5
3600	-	26.3	20.9	-	26.3	20.9	-	60.0	38.6	-	60.0	38.6
Total SWAED			**106.1**			**114.4**			**170.4**			**178.2**
Increase with AA						7.87%						4.60%

Operator	TPG						MOCN					
Analysis	Aetha			+ remote apparatus			Aetha			+ remote apparatus		
Band	Min	Max	SWAED	Min	Max	SWAED	Min	Max	SWAED	Min	Max	SWAED
700	15.0	15.0	15.0	15.0	15.0	15.0	30.0	30.0	30.0	30.0	30.0	30.0
850	5.0	10.0	5.5	5.0	10.0	5.5	30.0	30.0	30.0	30.0	30.0	30.0
900	-	-	-	-	-	-	-	-	-	-	-	-
1800	-	30.0	13.3	-	30.0	13.3	15.0	40.0	33.8	15.0	40.0	33.8
2100	5.0	25.0	7.4	10.0	25.0	15.5	15.0	40.0	17.7	20.0	40.0	25.5
2300	-	-	-	-	-	-	-	-	-	-	-	-
2600	-	-	-	-	-	-	40.0	40.0	40.0	40.0	40.0	40.0
3400	-	-	-	-	-	-	-	24.4	2.5	-	24.4	2.5
3600	-	71.3	26.9	-	71.3	26.9	-	93.8	63.8	-	93.8	63.8
Total SWAED			**68.0**			**76.1**			**217.8**			**225.6**
Increase with AA						11.94%						3.60%

5.2 Site-weighted average downlink spectrum per SIO

Mr Turner objects to site-weighted average downlink spectrum per SIO, again repeating his concern that we are averaging across boundaries, but also suggesting (para. 123 (b)) that calculating bandwidth on a SIO basis is of little utility because it only indicates the ability of a network to meet current demand.

Mr Turner then goes on to explain that 'bandwidth per population' would be a better method as it acknowledges that MNOs have the ability to build (or lose) their customer base. While we understand Mr Turner's concern that an operator should be able to build or lose market share, this does not mean that its capacity needs to be related to the population.

It would be unusual for any consumer-facing business to dimension its productive capacity on the basis of the population, rather than its customer base. For example, a small airline with a low market share does not need the same number and size of aircraft, or the same number of take-off and landing slots, as a large airline with a higher market share, despite the fact that both airlines are available to the entire population.

Naturally, a mobile operator that wishes to expand its market share will require the means to increase its capacity to do so, but this does not mean the 'spectrum per pop' or 'spectrum x sites per pop' are appropriate comparators. In the short-term any of the operators can expand its capacity by building additional sites, and in the medium- to long-term, it can also buy additional spectrum so that it can build capacity using its chosen mix of technology, spectrum and sites.

Finally, Mr Turner quotes the ACCC on the subject of determining the spectrum requirements of an operator. We would simply note that we are not seeking to determine any operator's spectrum requirements, rather we are aiming to provide a method for comparing the capacity of different operators

to test whether Telstra – through the MOCN – would gain the ability to outperform any competitor on a capacity basis. In testing this, it is important that capacity is considered relative to scale.

5.3 Site effective downlink MHz per SIO

Our final metric, the site effective downlink MHz per SIO, is the site-weighted average effective downlink spectrum x sites/SIOs.

Although Mr Turner now suggests that he prefers 'per population' measures, it should be noted that the Optus submission appears to favour spectrum x sites/SIO. In objecting to a measure of Hz/SIO in the application document, Optus state that the analysis contains a fundamental error in that it did not consider sites, and then went on to describe 'spectrum per site per SIO' as the correct metric – although we suspect that it was intended to say 'spectrum x sites/SIO', which is what it goes on to calculate and present in Figure 14 at para. 5.47.

Our measure is related to Optus' spectrum x sites/SIO, the primary difference being that we construct a weighted average of effective downlink spectrum to get to our 'spectrum' quantity, whereas Optus appears to select a value for spectrum that is somewhere in the range of total MHz. The differences in input values have been discussed elsewhere in this report.

Mr Turner discusses in para. 133 and 134 that the MOCN site count that he assumes Aetha to have used. In fact, the site counts that we used, which include macro sites but not micro-cells, are fully explained in Figure 3-8 of our report – although unfortunately redaction of some of the figures in the public version of the report may have prevented Mr Turner from appreciating the reason for the deduction of sites.

Mr Turner goes on to explain (para. 135) that we have used a different site count for Optus to the value that he uses. That point is discussed above in Section 4.2.

Finally in Table 20 and Table 21 of his witness statement, Mr Turner produces two tables, one based on sites x spectrum/SIO and one based on sites x spectrum/population.

We have already provided our view on considering capacity per population in Section 5.2, but we note here that by suggesting a sites x spectrum/population metric Mr Turner is not only removing any notion of scale from the demand part of the comparison (i.e. the denominator) he is also effectively penalising Telstra, and the proposed MOCN, for having built the necessary sites to serve its larger customer base.

For the sites x spectrum/SIO produced at Table 20, we provide an updated series of calculations below.

Figure 10: Site effective DL MHz per SIO by operator within the 17% Regional Coverage Zone (without apparatus licences in 2100MHz)

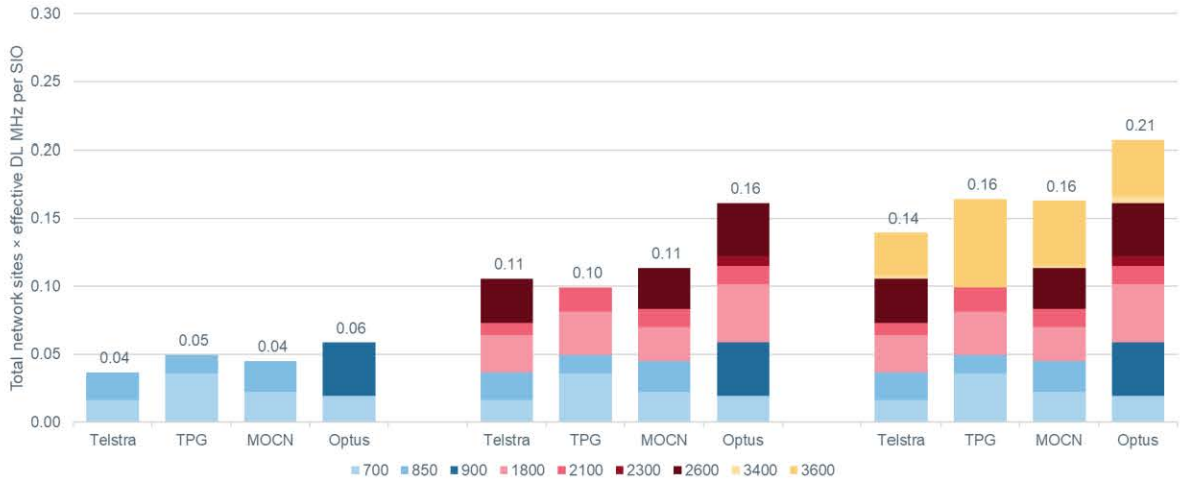
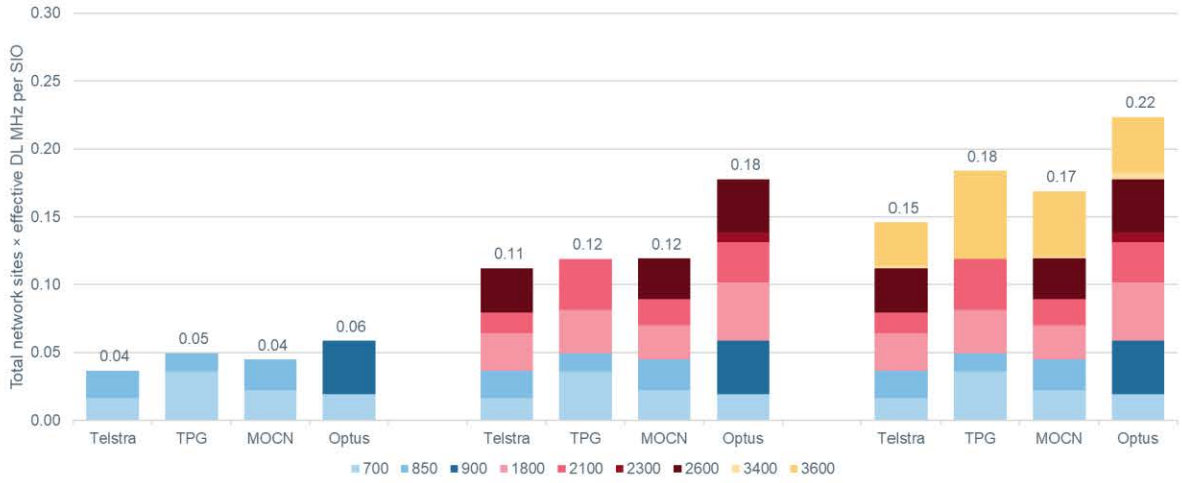


Figure 11: Site effective DL MHz per SIO by operator within the 17% Regional Coverage Zone (updated version inclusive of apparatus licences in 2100MHz)



As can be seen from the Figures above, the conclusion we drew in our report that Optus has a higher value of MHz × sites/SIO than the MOCN still holds with the updated numbers from Mr Turner (once corrected). It also holds true when including the apparatus licence spectrum in the 2100MHz band – although we once again state that this spectrum should not be included as Telstra's apparatus licence spectrum is non-adjacent to its licenced spectrum, and the TPG apparatus licence is not included in the MOCN agreement.

Annex A Spectrum licence area and RCZ SA1 maps

In this annex we present a series of maps showing the RCZ (coloured in pale yellow) and the additional 'boundary' sites (light blue) overlaid with the respective spectrum band licence regions. We have coloured each region a different shade of red, with the darkest shade representing Telstra's largest spectrum holdings in that band and the lighter shades representing lower holdings.

Figure 12: RCZ overlaid with the 850MHz licence regions [Confidential to the Parties]

It can be seen in Figure 12 that there are five metro regions in which Telstra has 2 × 20MHz of 850MHz (Adelaide, Brisbane, Melbourne, Perth, and Sydney). In the remaining areas – 3 of which are metro (Hobart, Darwin, and Canberra), 9 of which are regional (Cairns, Mackay, Maryborough, Grafton, Dubbo, Albury, Regional VIC, Regional SA, and Regional WA) and one of which is the remote area – Telstra has 2 × 25MHz

Figure 13: RCZ overlaid with the 1800MHz licence regions [Confidential to the Parties]

It can be seen from Figure 13 that the RCZ spans a large number of different 1800MHz licensing areas. Some of the RCZ has no 1800MHz spectrum licences, and where there is spectrum licensed for Telstra, it ranges from 2 × 15MHz (Melbourne, Sydney) to 2 × 40MHz (all regional areas except Victoria).

Figure 14: RCZ overlaid with the 2100MHz licence regions [Confidential to the Parties]

It can be seen from Figure 14 that, similarly to the 1800MHz, the RCZ spans a large number of different 2100MHz licensing areas. Some of the RCZ has no 2100MHz spectrum licences, and where there is 2100MHz spectrum licensed for Telstra, it ranges from 2×10MHz (regional areas) to 2×30MHz (Canberra).

Figure 15: RCZ overlaid with the 3400MHz licence regions [Confidential to the Parties]

It can be seen from Figure 15 that the majority of the RCZ falls outside of the (mobile) licence regions for 3400MHz. Telstra's spectrum ranges from 28MHz in Adelaide to 32.5MHz in all other 3400MHz licence regions.

Figure 16: RCZ overlaid with the 3600MHz licence regions [Confidential to the Parties]

It can be seen from Figure 16 that a small part of the RCZ (along with the sites in remote areas) does not overlap with the 3600MHz licensing areas. However, where Telstra does have spectrum licensed in the RCZ ranges from 30MHz (Brisbane, Canberra, and Perth) up to 80MHz in Regional Western Australia.

We note that the 3600MHz licensing areas do not perfectly overlap with the 3400MHz licensing areas, therefore it is possible that a site will have a different total amount of combined 3400MHz and 3600MHz spectrum depending on its location – for example, it is possible that a site located in Adelaide for 3400MHz (28MHz) is classified as Regional South Australia for the 3600MHz band (75MHz), totalling 103MHz.

Annex B Declarations made in accordance with the Federal Court's Harmonised Expert Witness Code of Conduct

1.1 We have read the Federal Court's Harmonised Expert Witness Code of Conduct and agree to be bound by it.

1.2 We have made all the inquires that we believe are desirable and appropriate (save for any matters identified explicitly in the report), and no matters of significance which we regard as relevant have, to our knowledge, been withheld.

1.3 Signed: 

A.P. Wright

1.4 Date: 10 November 2022

1.5 Signed:

L.P. Sanders

1.6 Date: 10 November 2022

Annex C Letter of Instruction

Aetha's letter of instruction is provided on the following pages.

Special Counsel Geoff Petersen
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10 November 2022

By email: [redacted] and [redacted]

Lee Sanders
Managing Partner
Aetha Consulting Ltd

Andrew Wright
Partner
Aetha Consulting Ltd

[redacted]

Dear Mr Sanders and Mr Wright

Application to the Australian Competition and Consumer Commission for Merger Authorisation

1 We refer to our letter of engagement to you dated 29 April 2022 and letter of instructions dated 27 July 2022 (**July Letter**). Defined terms in both letters have the same meaning in this letter.

2 We also refer to the submission from Optus in response to the ACCC's Statement of Preliminary Views dated 26 October 2022 (**Optus submission**), and the Witness Statement of Steve Turner dated 20 October 2022 (the **Witness Statement**).

3 This letter sets out further instructions for the preparation of an expert report in response to Optus' submission and the Witness Statement.

Instructions

4 You are instructed to prepare a further written report which:

(a) addresses the matters raised in the Optus submission and the Witness Statement, insofar as they relate to the questions asked of you in our July Letter and the opinions expressed in your report dated 27 July 2022; and

(b) identifies any change to the opinions expressed in your report dated 27 July 2022, and the reasons for any such changes.

Documents provided

5 In preparing your report, please consider the documents listed in **Schedule 1** and the factual assumptions and documents referred to in your July Letter.

Contents of your report

6 We ask that you prepare your report in accordance with the requirements of the Federal Court's Expert Evidence Practice Note (GPN-EXPT) (**Practice Note**), which includes the Harmonised

Expert Witness Code of Conduct (**Code**). A copy of the Practice Note (including the Code) was enclosed with your letter of engagement.

7 Under the Code, your report must clearly state the following:

(i) your name and address;

(ii) an acknowledgement that you have read this code and agree to be bound by it;

(iii) your qualifications as an expert to prepare the report;

(iv) the assumptions and material facts on which each opinion expressed in the report is based (this letter of instructions may be annexed);

(v) the reasons for and any literature or other material utilised in support of each such opinion;

(vi) (if applicable) that a particular question, issue or matter falls outside your field of expertise;

(vii) any examinations, tests or other investigations on which you have relied, identifying the person who carried them out and that person's qualifications;

(viii) the extent to which any opinion which you have expressed involves the acceptance of another person's opinion, the identification of that other person and the opinion expressed by that other person;

(ix) a declaration that you have made all the inquiries which you believe are desirable and appropriate (save for any matter identified explicitly in the report), and that no matters of significance which you regard as relevant have, to your knowledge, been withheld from the court;

(x) any qualifications on an opinion expressed in the report without which the report is or may be incomplete or inaccurate;

(xi) whether any opinion expressed in the report is not a concluded opinion because of insufficient research or insufficient data or for any other reason; and

(xii) where the report is lengthy or complex, a brief summary of the report at the beginning of the report.

Next steps

8 We look forward to receipt of your report in due course.

Yours faithfully
Gilbert + Tobin

Geoff Petersen
Special Counsel

Simon Muys
Partner

Andrew Low
Partner

Schedule 1: Documents provided

No.	Document description
1.	Optus: Submission in response to ACCC Statement of Preliminary Views - Telstra and TPG application for merger authorisation for proposed spectrum sharing in regional Australia (26 October 2022)
2.	Witness Statement of Steve Turner dated 20 October 2022

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