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Report for Three UK and EE

Addendum to review of Ofcom's benchmarking of the value of the 1800MHz spectrum band to determine annual licence fees

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Contents

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1 Executive summary

Analysis Mason Ltd (Analysis Mason) and Aetha Consulting Ltd (Aetha) have been commissioned by Hutchison 3G UK Ltd (Three) and EE Ltd (EE) to provide this joint report for the use of each operator in its respective response to Ofcom's invitation for comments regarding European auctions since Ofcom's consultation on annual licence fees for 900MHz and 1800MHz spectrum.

Since Ofcom's original consultation on the annual licence fees for 900MHz and 1800MHz spectrum, ten spectrum auctions have been conducted in Europe. In this report, we consider if and how these auction results impact how the lump-sum value for 1800MHz spectrum should be set.

In our first report, we set out our view that Ofcom's approach to calculating lump-sum values is flawed and we proposed a simpler, more robust approach: the 'distance method'. The new evidence provided by the ten auctions since Ofcom's original consultation (some of which were already discussed in our first report) does not change our conclusion. In other words, the distance method continues to be the most appropriate approach for setting lump-sum values in the UK.

The ten auctions that have taken place since Ofcom's original consultation fall into three broad categories:

- auctions already covered within Analysis Mason and Aetha's first report (Austria, Czech Republic and Norway)
- auctions in countries for which no usable[1] 1800MHz spectrum price exists (Belgium, Estonia, Finland, Latvia and Lithuania)
- auctions that potentially offer additional data points for calculation of the 1800MHz lump-sum value (Slovakia and Slovenia).

We have analysed the results from each auction and the evidence they provide for setting 1800MHz lump-sum values in the UK. We conclude, subject to concerns regarding the appropriateness and implications of including non-public data from some package auctions (i.e. Austria and Ireland) but not others, that:

- As 1800MHz spectrum has not been auction in Belgium, Estonia, Finland, Latvia or Lithuania, they provide no useful evidence for setting the 1800MHz lump-sum value.

- It is not possible to glean any reliable band-specific prices from the results of the combinatorial clock auction (CCA) in Slovenia.

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[1]   As defined in Section 5.2 of our first report

- Our analysis and conclusions from the auctions in the Czech Republic (included as less important evidence) and Norway (excluded), which are provided in our first report, remain appropriate.

- A distance method estimate from Austria should continue to be included as less important evidence, but with the value revised to reflect the new linear reference price information provided by Ofcom.

- A distance method estimate can be derived from Slovakia but should be included as less important evidence since, as a CCA, band-specific prices cannot be directly inferred.

The distance method estimate of the 1800MHz lump-sum value for the UK provided in our first report should therefore be adjusted to include an evidence point from Slovakia and to adjust the value of the evidence point used for Austria. The combined impact of these two changes is to reduce the 1800MHz lump-sum value from GBP9.4 million/MHz (in our first report) to **GBP9.0 million/MHz**. We carried out a series of sensitivity tests on this value, details of which are in Section 5 of this report.

2 Introduction

Analysys Mason Ltd (Analysys Mason) and Aetha Consulting Ltd (Aetha) have been commissioned by Hutchison 3G UK Ltd (Three) and EE Ltd (EE) to provide this joint report for the use of each operator, in its respective response to Ofcom's invitation for comments regarding European auctions since Ofcom's consultation on annual licence fees for 900MHz and 1800MHz spectrum (referred to as Ofcom's 'Update on European auctions' in the remainder of this document).

Since Ofcom's original consultation on the annual licence fees for 900MHz and 1800MHz spectrum, ten spectrum auctions have been conducted in Europe. These have been in Austria, Belgium, Czech Republic, Estonia, Finland, Latvia, Lithuania, Norway, Slovakia and Slovenia. In this report, we consider if, and how, these auction results impact the setting of the lump-sum value for 1800MHz spectrum.

This report should be read as an addendum to Analysys Mason's and Aetha's first report, entitled 'Review of Ofcom's benchmarking of the value of the 1800MHz spectrum band to determine annual licence fees' (dated 9 January 2014),[2] which was submitted by Three and EE as part of their responses to Ofcom's consultation on this topic.

The remainder of this document is laid out as follows:

- **Section** 3 considers whether the 'distance method' (as defined in our first report) is still the most appropriate method of deriving lump-sum values for 1800MHz spectrum.

- **Section** 4 analyses the ten new auctions that have taken place since Ofcom's original consultation.

- **Section** 5 discusses the implications of including these ten new auctions for the calculation of the 1800MHz lump-sum values.

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[2]   Reference number 38441-23

3 Ofcom's overall approach to calculating the 1800MHz lump-sum value

In this section, we recap on the approach that we believe is most appropriate for calculating UK equivalent lump-sum values for 1800MHz spectrum.

In our first report we set out our view that Ofcom's approach to calculating lump-sum values is likely to lead to unreliable results and we proposed a simpler, more robust approach: the distance method. The new evidence provided by the ten auctions since Ofcom's original consultation (some of which were already discussed in our first report) does not change our conclusion. In other words, the distance method continues to be the most appropriate approach to setting lump-sum values in the UK.

In particular, we believe that the approach to calculating lump-sum values that Ofcom consulted on in 2013 contained three categories of estimation bias:

1. The use of unreliable and inconsistent approaches to deriving benchmarks.

2. The lack of a clear framework for selecting appropriate benchmarks for use in calculations of UK-equivalent, lump-sum values and determining which should be given greater and lesser weight (i.e. the categorisation of evidence points as 'more important' or 'less important').

3. The non-mechanistic approach to the conversion of a set of benchmarks to estimates of UK-equivalent, lump-sum values.

We briefly recap on each of these in the three sub-sections below. We then go on to provide our recommendation of the most appropriate approach for estimating 1800MHz lump-sum values (i.e. the distance method).

Unreliable approach to deriving benchmarks

Ofcom uses three different methods for deriving benchmarks for each country: absolute values, and two different relative values. Absolute values are likely to have a significant margin of error, due to both underlying differences between the UK and other benchmark countries, and the inherent inaccuracies associated with converting European auction results into UK-equivalent values. While the relative value benchmarks largely eliminate the first of these errors, they cannot successfully adjust for all underlying differences between the UK and benchmark countries, which may affect the relative value of different spectrum bands in different ways. Moreover, the use of two different relative values (1800MHz/800MHz and 1800MHz/2.6GHz) may produce two very different results from the same benchmark country and does not provide a consistent view of

where the 1800MHz value should lie relative to the 800MHz and 2.6GHz linear reference prices (LRPs) in the UK.

Ofcom additionally considers a simple average of the UK 800MHz and 2.6GHz LRP values as a more important evidence point. This use of a simple average seems to be as arbitrary as any other value between these two points and a number of sources, suggesting that the value of the 1800MHz band is well below the straight-simple average of the 800MHz and 2.6GHz values. This is discussed in greater detail in Section 4 of our first report.

Lack of a clear framework for categorising benchmarks

Ofcom's categorisation of the benchmarks into more and less important evidence, as well as the manner in which it determines the benchmarks to be excluded, lacks transparency, objectivity and consistency; as a consequence, its approach injects inaccuracy into the resulting calculation of lump-sum values. This is discussed in more detail in Section 5.1 of our first report.

Non-mechanistic approach to deriving lump-sum values

Ofcom has used these benchmark values to 'derive' lump-sum values for 1800MHz and 900MHz spectrum. However, Ofcom did not seek to "*take a mechanistic approach*" and instead used its "*regulatory expertise and judgement*" in setting these proposed lump-sum values. In our opinion, this approach appears to bias the lump-sum values for 1800MHz upwards. This is discussed further in Section 6 of our first report.

The distance method provides a solution

As a result of these estimation biases, in our first report we proposed a simpler, more robust approach to calculating the lump-sum value. This dealt with the errors inherent in Ofcom's approach by:

1. applying a consistent method to derive a single, UK-equivalent benchmark from each country. This method measures the distance of the 1800MHz benchmark from the 2.6GHz benchmark as a fraction of the distance from the 800MHz benchmark to the 2.6GHz benchmark in each country;
2. applying a clear framework for deciding whether benchmarks from a given country should be excluded or weighted as more or less important evidence; and
3. applying a mechanistic weighted average calculation to derive lump-sum values from the included benchmarks.

We refer to the method described in step 1 above as the distance method and we continue to believe it is the most appropriate approach, in conjunction with the process set out in steps 2 and 3, to calculating the lump-sum values for the UK. The approach can be adapted to take account of any relevant[3] new benchmarks derived from auctions that have taken place since we wrote our first report.

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[3]   Defined in line with the criteria set out in Section 5.2 of our first report.

4 Assessment of the ten new auctions included within Ofcom's consultation

In this section we consider the ten new auctions discussed in Ofcom's update on European auctions. We analyse the general applicability of each, as a benchmark to help establish an 1800MHz lump-sum value and, more specifically, to the distance method.

The ten auctions fall into three broad categories:

- auctions already covered within Analysys Mason's and Aetha's first report
- auctions in countries for which no usable[4] 1800MHz spectrum price exists
- auctions that potentially offer additional data points for calculation of the 1800MHz lump-sum value.

We consider each of these categories in turn in the sub-sections below.

4.1.1 Auctions already covered within Analysys Mason's and Aetha's first report

Czech Republic and Norway

The Czech and Norwegian spectrum auctions concluded between Ofcom's original consultation and our first report. An analysis of these auctions was therefore included in our first report. The main conclusions were as follows:

- Czech 2013 Simultaneous multiple-round ascending (SMRA) auction (800MHz, 1800MHz, 2.6GHz FDD and TDD)
    - given it used an SMRA format, band specific-prices can be directly observed
    - as there were significant amounts of spectrum unsold in the 1800MHz and 2.6GHz bands, we recommended that the auction is considered as a less important evidence point for the UK lump-sum values.

- Norwegian 2013 first-price sealed bid package auction (800MHz, 900MHz, 1800MHz)
    - given the format used, band specific-prices cannot be directly observed, nor can they be inferred reliably from the results
    - therefore, we recommended that the Norwegian auction is excluded from the evidence base for the UK lump-sum values.

Given that no further information has been released about these auctions, our conclusions remain unchanged.

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[4]   As defined in Section 5.2 of our first report

Austria

In our first report, we set out the results of the Austrian auction. Given that the auction was a CCA, we concluded that no band-specific prices could be directly inferred. However, following the same approach as was used by Ofcom and DotEcon for the Irish auction, we used final clock round prices to calculate estimates of band-specific prices for the 800MHz, 900MHz and 1800MHz bands. Using the 800MHz, 1800MHz and 2.6GHz band price estimates we calculated an evidence point for the UK-equivalent, lump-sum value for 1800MHz spectrum using the distance method.

Since our first report, Ofcom has liaised with the Austrian regulator, the Rundfunk und Telekom Regulierungs-GmbH (RTR), to generate estimates of band-specific prices in Austria based on the LRP method.

Below we set out how these LRP estimates could be applied to generate estimates of UK-equivalent, lump-sum values, as well as raising some concerns with their use. In particular, we:

- raise the issue of whether using additional non-public information from the Austrian auction, but not from other CCAs, may produce a bias in Ofcom's estimate of 1800MHz lump-sum values
- assess which of the LRP options that Ofcom have provided is most appropriate to use
- comment on the implications of the Austrian benchmarks if Ofcom's absolute method is used
- calculate revised distance method estimates of 1800MHz lump-sum values using the LRPs in place of the final clock round prices for each band which we previously used.

► *Potential benchmarking bias*

In the price benchmarking used in both Ofcom's original consultation and Ofcom's update on European auctions, the majority of European spectrum auction price data was collected from publicly available information. However, in the case of two countries, the benchmark prices used in the calculation of the UK 1800MHz lump-sum value relied upon additional data not available in the public domain:

- In **Ireland**, information provided by Vodafone was used in combination with discussions with the regulator, ComReg, and publicly available data, to derive estimated band-specific prices.

- In **Austria**, the RTR was provided by Ofcom with an LRP model produced by DotEcon to use in conjunction with confidential bid data from the October 2013 CCA to calculate estimated band-specific prices.

The inclusion of this additional, non-public data for two countries, but not for other countries that used CCAs[5] appears to be inconsistent and potentially leads to an inherent bias in the set of benchmarks. Examination of the benchmarks used from Ireland and Austria indicates that this is indeed likely to be the case. In particular, the absolute-value approach estimates for 1800MHz for

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[5]   The benchmark countries which held CCAs are Austria, Ireland, the Netherlands, Slovakia, Slovenia and Switzerland.

Austria and Ireland are significantly higher than for any other country in the benchmark set at GBP35.5[6] million/MHz and GBP23.1 million/MHz respectively. Furthermore, even the more reliable distance method estimates of the UK-equivalent values derived from these two countries are two of the three highest in the entire benchmark set,[7] at GBP18.2 million/MHz and GBP14.8 million/MHz respectively. These high benchmark values will have the effect of pushing up the overall estimate of a UK lump-sum value.

Our point here is not that Ofcom has been selective in its data-gathering process, nor that it has intended to introduce any kind of bias. In particular, we expect that Ofcom may have also approached other regulators to seek further data to allow estimates of LRPs from CCAs. However, given that only a small subset of regulators (i.e. Ireland and Austria) have provided this further information, for whatever reason, Ofcom has a duty to assess whether the partial response introduces an unintentional bias into the resulting lump-sum values. Given that both Ireland and Austria are at the high end of the evidence points – measured either using the distance method or in absolute terms – we believe that it does introduce such a bias.

We provide an illustration of this in Section 5, where we use the distance method to calculate the UK-equivalent, lump-sum value for 1800MHz spectrum excluding Ireland and Austria. Comparison to the corresponding value including these countries demonstrates that their inclusion results in an uplift of around 17% to the 1800MHz lump-sum value.[8]

In summary, given that additional regulatory data has not been provided for countries such as Switzerland[9], the inclusion of which in Ofcom's benchmark set would likely have reduced the 1800MHz lump-sum value estimate, we believe that, in the absence of additional information on CCAs from all regulators, the inputs to the UK 1800MHz lump-sum value should be restricted to data that is available in the public domain for all countries.[10]

Notwithstanding this concern, we have used this additional information for Austria and, as in our first report, Ireland, in our lump-sum value calculations in Section 5, although we do also test the sensitivity of the result to the inclusion of benchmarks from these countries. In the remainder of this section we analyse how the Austrian LRP values can be used as part of the distance method.

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[6] The exact level of the absolute value estimate for Austria depends upon which of Ofcom's LRP scenarios is used, as set out in Figure 4.3 and the surrounding discussion below. GBP35.5 million/MHz is the value that corresponds to the LRP calculations, which we consider to be most appropriate for use in deriving 1800MHz lump-sum values for the UK.

[7] The third is the value of GBP16.0 million/MHz implied by the Greek auction. While this value is also high, it is considered an upper bound due to the lack of availability of 800MHz and 2.6GHz price points. It is therefore calculated assuming that the 800MHz is equal to 900MHz in value and the 2.6GHz has a value of zero to generate the distance method value.

[8] See Section 5 for details.

[9] As set out in our first report, we believe that, even in the absence of non-public data from the regulator, it is possible to include evidence from Switzerland. We would therefore encourage Ofcom to include evidence from Switzerland, in the manner set out in our first report, independent of whether it chooses to include non-public auction data or not.

[10] If Ofcom wishes to carry out LRP calculations based on non-public data from countries which held CCAs, we suggest that Ofcom should seek to do an LRP calculation for all countries which held CCAs, though we recognise that in some instances the analysis may not reveal reliable LRPs.

► *Selection of the most appropriate LRP estimates*

The DotEcon LRP tool has been used by RTR to produce a number of different LRP estimates for the Austrian auction. In particular, Ofcom has provided values:

- with and without the use of a revenue constraint
- using the actual lots auctioned in Austria and using a condensed lot structure.[11]

In paragraph A8.43 of its original consultation document, Ofcom states that the fact that prices derived without the revenue constraint are higher in aggregate than the prices paid "*raises a question of whether substantial weight should be placed on them for the purpose of revising annual licence fees*". Ofcom concludes that it "*do[es] not consider there is a stronger case for this approach compared to the base case*".

We have not examined the UK LRP calculation in detail, but we have no reasons, *a priori*, to disagree with Ofcom's proposal to use LRP values calculated with the revenue constraint. Furthermore, in the absence of any clear reason to the contrary, we believe that the Austrian values adopted for the benchmarking analysis should also be calculated with the revenue constraint in place, in order to be as consistent as possible with the approach followed and the values derived from the UK auction. We therefore focus on the Austrian LRPs derived using the revenue constraint.

As mentioned above, LRPs have been produced both for the actual lot categories in the Austrian auction and for a condensed lot structure, in which it is assumed there is only one lot category in each of the 800MHz, 900MHz and 1800MHz bands. The LRPs calculated by RTR on behalf of Ofcom are shown in Figure 4.1 below, together with a weighted average across the three actual lot types that were auctioned in each band.

Figure 4.1: Austrian LRPs calculated from the bid data for the October 2013 auction with the revenue constraint (EUR million/Lot) [Source: Analysys Mason, Aetha, 2014]

	Condensed Lot	Lot type 1	Lot type 2	Lot type 3	Weighted average
800MHz (A)	82.40	84.80	95.70[12]	71.90	89.92
900MHz (B)	106.30	68.00	104.50[12]	99.00	98.50
1800MHz (C)	51.50	57.30[12]	49.70	54.10	52.18

From this data, a single band-specific price estimate needs to be identified for each band. We consider that there are three main options for the most appropriate LRP values to use as band-specific price estimates from Austria, the first two of which were suggested by Ofcom in Paragraph 20 of Ofcom's update on European auctions:

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[11] This approach attempts to calculate the LRPs that would have occurred had all of the lots auctioned in each band been equivalent.

[12] Lot selected by Ofcom as the relevant comparator to UK spectrum

- The condensed lot structure LRPs for each band.

- The LRP for the lot type in each band considered to be most similar to the lots offered in the UK (Ofcom has argued that these are Lot Type 2 in the 800MHz and 900MHz bands, and Lot Type 1 in the 1800MHz band – these are highlighted in green in Figure 4.1).

- A weighted average (i.e. weighted by the number of equally sized lots sold) of LRPs across Lot Types 1 to 3 in each band (shown in the final column of Figure 4.1).

We analyse the impact of all three options at the end of this section. However, first we consider which option is likely to be most appropriate.

The condensed lot structure is a new approach that has not been followed in the UK and its impact on the calculated LRPs is unclear. We note that the total value of the maximum excursion across all bidders is significantly higher for the condensed lot structure LRPs than for those calculated in Ofcom's base case,[13] implying the results may be less reliable. More fundamentally, however, there is no compelling reason why this approach should now be relied upon over and above data arising from bids for the actual lots. We therefore suggest that results obtained using the condensed lot structure should be discarded to minimise any subjective interpretation in reaching the lot prices.

The LRPs for lots A2, B2 and C1 are a possible option. However, we consider that none of these lot types are exactly parallel to the lot types auctioned (or previously held) in the UK. For example, lot A2 in the 800MHz band is still subject to some level of coverage obligation, which is not true of the 800MHz lots without coverage obligation in the UK. Furthermore, this would appear to be a level of detail beyond which Ofcom has ventured in other benchmark countries. In particular, Ofcom's approach in other countries has been to average band-specific prices across all lots that are sold, rather than to single out specific lots as being most similar to those for which the UK LRPs are calculated.

The characteristics of the various lots in the various auctions will inevitably differ, both in Austria and across Europe.. Therefore, on balance, we prefer a simple weighted average approach, akin to the approach implicitly used by Ofcom in other benchmark countries, and would recommend using this approach to derive UK-equivalent, lump-sum values.

► *Impact of choice of LRP approach on the distance method calculation*

In Figure 4.2 below, we set out the LRPs for the 800MHz and 1800MHz bands for the three options set out above. In the final column we provide the band-specific prices implied by the final clock round prices, which we used in our first report.[14]

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[13]   See Table 5 of Ofcom's Update on European auctions.

[14]   Note that these band-specific prices are not exactly equal to the final clock round prices. Instead they are calculated by fixing the ratio between prices in each band, based on the final clock round prices, and scaling so that the band-specific prices are consistent with the total revenue raised by the auction.

Figure 4.2: Summary of 800MHz and 1800MHz lot values in Austria suggested by the different LRP options [Source: Analysys Mason, Aetha, 2014]

	Use of weighted average LRPs	Use of relevant comparator lot LRPs	Use of condensed lot LRPs	Lot values suggested by the final clock-round prices
800MHz LRP (EUR million/Lot)	89.92	95.70	97.60	87.59
1800MHz LRP (EUR million/Lot)	52.18	57.30	64.20	56.19

While the benchmark of band-specific prices in Austria will vary depending on the LRP approach selected by Ofcom, it is unlikely that this will have a significant impact on the UK-equivalent estimate produced by the distance method. The distance method makes use of the band-specific price estimates by calculating ratios between them. As in our first report, the 'Y/X' value is calculated as the amount by which the price estimate for the 1800MHz band exceeds the estimate for the 2.6GHz band, divided by the amount by which the estimate for the 800MHz band exceeds the estimate for the 2.6GHz band.

In Figure 4.3 below, we show the derivation of the Y/X ratios for the three[15] different LRP options calculated for Austria. These values range between 0.53 and 0.61,[16] which are close to the Y/X value for Austria of 0.59 derived from final clock round prices in our first report.

Figure 4.3: Calculation of Austrian Y/X values using updated LRPs inclusive of revenue constraint [Source: Analysys Mason, Aetha, 2014]

	Use of weighted average LRPs	Use of relevant comparator lot LRPs	Use of condensed lot LRPs
UK equivalent 800MHz price (GBP million/MHz)	65.0	69.0	70.3
UK equivalent 1800MHz price (GBP million/MHz)	35.5	38.9	43.4
UK equivalent 2.6GHz price (GBP million/MHz) [17]	1.8	1.8	1.8
Y/X	0.53	0.55	0.61

The use of any of these LRPs and their corresponding Y/X values therefore constitutes only a marginal change to one data point in the benchmark set, and as such will have little impact on the outcome of the results of the distance method calculation. Moreover, as discussed in our first

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[15] These are the three options described above and all exclude the LRPs calculated by RTR which do not include a revenue constraint.

[16] The Y/X ratios calculated without the revenue constraint fall between 0.58 and 0.62

[17] In 2010, there was also a 2.6GHz CCA in Austria. Given that this was a single-band CCA, gaining a band-specific price is not problematic. In its original consultation, Ofcom calculates the UK-equivalent price achieved in this auction to be GBP1.8 million per MHz. We used this value in our first report and continue to do so here.

report, the Austrian benchmark is considered less important because band-specific prices cannot be directly inferred. This continues to be the case and so this data point should continue to be considered less important.

We quantify the impact on our calculated UK 1800MHz lump-sum value in Section 5, using only the weighted average LRP approach.

► *Implication of the Austrian benchmark results on the absolute method*

As discussed in Section 3, we continue to believe that the distance method is the most appropriate approach to derive 1800MHz lump-sum benchmarks from each country. Austria provides another good example of why one of Ofcom's suggested approaches is inappropriate, which we note here.

The inclusion of the Austrian LRPs calculated using the DotEcon LRP model in the benchmark set is particularly problematic when considering Ofcom's absolute value method. The Austrian LRPs for the 1800MHz band imply UK-equivalent values that all lie in the range of GBP35.5–43.4 million per MHz (EUR52.2–64.2 million per lot in Austria). This entire range is significantly above the UK LRP value calculated by Ofcom for 800MHz spectrum of GBP29.85 million per MHz, which we note should already be considered an upper bound if DTT interference mitigation costs turn out to be lower than originally anticipated by Ofcom. An 1800MHz absolute value above that of the 800MHz spectrum in the UK, makes the Austrian valuations completely inconsistent with the UK LRPs. This clearly demonstrates a major failing of the absolute value approach; however, if Ofcom were to persist with this approach we would certainly recommend that the Austrian 1800MHz benchmarks should be excluded since they lie above any rational estimate of the UK 1800MHz lump-sum value.[18]

4.1.2 Auctions in countries for which no usable 1800MHz spectrum price exists

Five of the ten countries that have conducted auctions since Ofcom's original consultation do not provide benchmarks for the value of 1800MHz spectrum. These were in Belgium, Estonia, Finland, Latvia and Lithuania. All of these auctions included only 800MHz spectrum.

To our knowledge neither 1800MHz nor 900MHz spectrum has been auctioned in any of these countries. Therefore, they cannot be used as evidence points for the value of 1800MHz or 900MHz spectrum in the UK.

4.1.3 Auctions that potentially offer additional data points for calculation of the 1800MHz lump-sum value

Since our first report, there have been two auctions that have included 1800MHz spectrum – in Slovakia and Slovenia – both of which were multi-band CCAs. It is not possible to directly

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[18] Furthermore, including an absolute benchmark for Austria in the UK lump-sum value determination, but not similar benchmarks from other countries such as Switzerland where no further LRP data from the relevant NRA has been made available, may lead to an unintended upward bias in the results, as we described earlier in this section.

observe band-specific prices from auctions using this format. However, as discussed in our first report, we recommend that where reliable information can be gleaned regarding the value of 1800MHz spectrum from an auction result, it should be included in the analysis to help set the lump-sum value of 1800MHz spectrum in the UK.

In this sub-section, we consider the Slovakian and Slovenian auctions in turn and discuss what can and cannot be reliably inferred from them, before then concluding with our recommendations for Ofcom's treatment of these auctions when determining the lump-sum values.

Slovakian 2013 CCA (800MHz,1800MHz, 2.6GHz FDD and TDD)

The Slovakian multiband CCA concluded in December 2013. The result of the auction was as follows:

Figure 4.4: Results of the Slovakian auction in MHz [Source: Analysys Mason, Aetha, 2014]

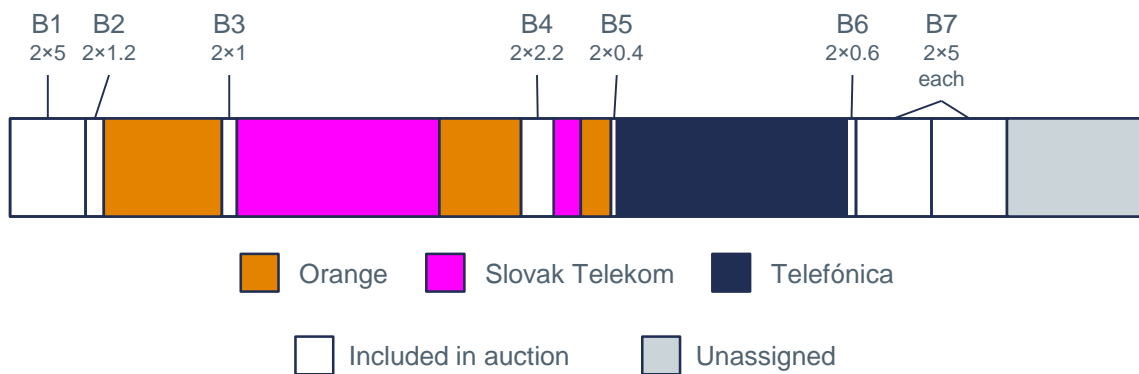| Operator	800MHz	1800MHz	2.6GHz FDD	2.6GHz TDD	Price from primary rounds (EUR millions)	Price from assignment rounds (EUR millions)	Total price (EUR millions)	Reserve price (EUR millions)
Orange	2×10	2×4.8	2×30		46.7	9.4	56.1	46.7
Slovak Telekom (T-Mobile)	2×10		2×40	50	60.8	-	60.8	50.8
Telefónica	2×10	2×0.6			38.3	2.0	40.3	38.3
SWAN		2×15			6.6	-	6.6	6.6

In addition to the above auction fees, the licensees are required to pay annual fees of EUR14 000 per MHz for spectrum below 1GHz and EUR10 800 per MHz for spectrum above 1GHz.

Orange, Slovak Telekom and Telefónica were existing operators in the Slovakian mobile market, while SWAN is a new entrant.

In order to interpret the Slovakian results appropriately, it is necessary to understand the packaging of the lots available in the 1800MHz band, the spectrum caps and the reserve prices.

The lots available in the 1800MHz band were very fragmented. The 2×20.4MHz available was split into eight lots varying from just 2×0.4MHz through to 2×5MHz. Furthermore, as illustrated below in Figure 4.5, these lots were distributed between the already fragmented holdings of the existing three operators.

Figure 4.5: 1800MHz band plan prior to the auction [Source: Analysys Mason, Aetha, 2014]
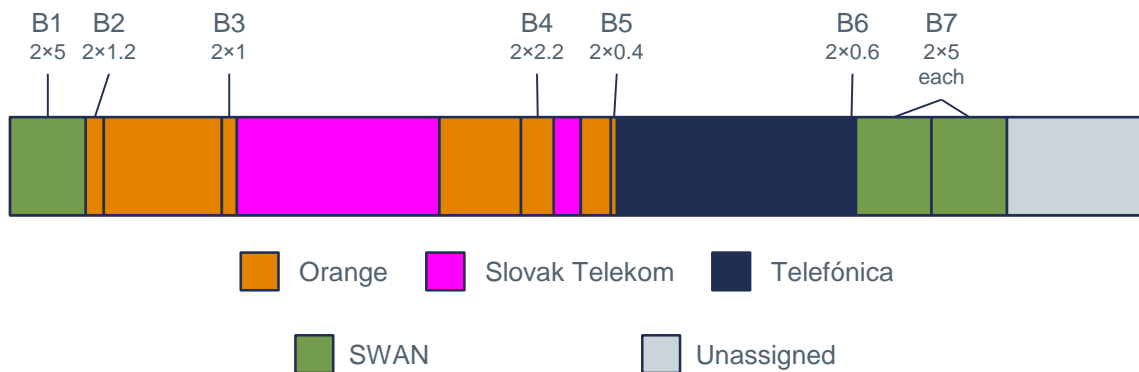

The spectrum caps were as follows:

- 800MHz band – 2×10MHz
- 1800MHz band – 2×20MHz (including existing holdings)
- 2.6GHz band – no cap.

Critically, none of the existing operators were eligible to acquire any of the 2×5MHz lots available in the 1800MHz band (B1 and B7), as this would mean that their total 1800MHz holdings would exceed the 2×20MHz cap. This spectrum could therefore only be won by entrants.

The 1800MHz band plan following the auction was as follows:

Figure 4.6: 1800MHz band plan following the auction [Source: Analysys Mason, Aetha, 2014]

The reserve prices were as follows:

- 800MHz band – EUR19 million per 2×5MHz lot
- 1800MHz band – EUR2.2 million per 2×5MHz lot (scaled for smaller lot sizes and rounded to the nearest EUR100 000)
- 2.6GHz FDD band – EUR1.1 million per 2×5MHz lot
- 2.6GHz TDD band – EUR0.4 million per 5MHz lot.

The auction included all three bands that are required to calculate an 1800MHz lump-sum value for the UK using the distance method – the 800MHz, 1800MHz and 2.6GHz FDD bands.

However, given the CCA format, some deciphering is required to gain meaningful information regarding band-specific prices.

Firstly considering the 1800MHz band, all of the available spectrum must have sold for reserve price (approximately EUR0.04 per MHz per population). SWAN clearly paid reserve price for the lots that it won. Given the 1800MHz lot structure and the result in this band, which meant that there would not have been an assignment round, both Telefónica and Orange must have also acquired their 1800MHz holdings at reserve price. Slovak Telekom did not acquire any 1800MHz spectrum.

Given that SWAN did not face competition from the existing three operators, it is unsurprising that it won its 1800MHz spectrum at reserve price. However, it is perhaps more surprising that the other operators also paid reserve price – given that there potentially could have been competition between them. The highly fragmented nature of the 1800MHz lots won by the existing operators, with the largest lot being just 2×2.2MHz, is likely to have negatively impacted the value of the spectrum. Although the existing operators could acquire lots to supplement their existing holdings, it was not possible to acquire large contiguous blocks suitable for LTE (at least prior to the commercial availability of intra-band carrier aggregation).

In conclusion, it is difficult to say with any certainty whether the price raised for 1800MHz spectrum represents a lower- or upper-estimate for the true market value. On the one hand, the fragmented lot structure will have dampened operators' valuations; but on the other hand, the fact that the spectrum sold at reserve may suggest that the true market value was lower.

Considering the 800MHz band, Telefónica acquired its 2×10MHz 800MHz lot for the reserve price of EUR38.0 million plus the EUR2.0 million it must have spent in the assignment round for this band. In the primary rounds, Orange also acquired its 2×10MHz 800MHz lot for the reserve price of EUR38.0 million. However, we suspect that the vast majority of the EUR9.4 million it spent in the assignment rounds was in the 800MHz band. This is for two reasons – first, 800MHz spectrum is much more valuable than 2.6GHz spectrum; and second, the value differences between lots are typically larger in the 800MHz band than the 2.6GHz band (e.g. due to potential interference issues with Digital Terrestrial Television). Given that both Telefónica and Orange paid reserve price following the primary rounds, and given the cap of 2×10MHz, it is likely (although not certain) that Slovak Telekom paid reserve price for this spectrum (given that it did not spend any money in the assignment rounds).

Therefore, assuming that both Telefónica and Orange spent all of their assignment round fees in the 800MHz band, the total amount spent on 800MHz spectrum was EUR125.4 million. This equates to an average of EUR20.9 million per 2×5MHz lot or EUR0.39 per MHz per population.

Assuming that Orange spent all of its assignment round fees in the 800MHz band, it then follows that it acquired its 2.6GHz FDD spectrum also at reserve price (EUR0.02 per MHz per population). In reality, it is likely to have spent a small amount of its assignment round fees in this band.

Assuming that Slovak Telekom acquired its 800MHz spectrum at reserve price, it then acquired 2×40MHz in the 2.6GHz FDD band plus 50MHz in the 2.6GHz TDD band for EUR22.8 million. It is not possible to split with certainty this amount between the two bands, therefore in order to provide an upper bound data point for the 1800MHz lump-sum value using the distance method, we suggest assuming that the 2.6GHz spectrum was sold at the reserve price of EUR1.1 million per 2×5MHz lot.

In summary, although it is not possible to directly observe band-specific prices from the Slovakian auction, we believe that the above analysis provide reasonable estimates:

- 800MHz band – EUR20.9 million per 2×5MHz lot
- 1800MHz band – EUR2.2 million per 2×5MHz lot
- 2.6GHz FDD band – EUR1.1 million per 2×5MHz lot
- 2.6GHz TDD band – EUR1.4 million per 5MHz lot.

It is possible that the price of the 2.6GHz TDD spectrum was lower with higher values in either or both of the 800MHz and 2.6GHz FDD bands. However, we do not believe that such a change would have any significant effect on our conclusions and note that higher prices in either the 800MHz or 2.6GHz FDD bands would lead to a lower distance method value. Our estimate for Slovakia can therefore be considered an upper bound.

Translating the above figures into UK equivalents and including the annual licence fees, results in the following evidence points:

Figure 4.7: Inferred prices per 2×5MHz lot and UK equivalents per MHz [Source: Analysys Mason, Aetha, 2013][19]

Band	Duration	Band-specific estimated prices including annual fees per 2×5MHz (EUR millions)	Band-specific prices translated to UK equivalent (GBP millions per MHz)
800MHz	15 years	22.5	40.6
1800MHz	12.75 years	3.3	6.7
2.6GHz FDD	15 years	2.3	4.2

Given the Slovakian auction provides us with benchmarks for the 800MHz, 1800MHz and 2.6GHz bands, it is possible to calculate a UK benchmark for the 1800MHz band using the distance approach. This produces a value of GBP6.7 million. However, given that band-specific prices cannot be inferred directly from the Slovakian auction, we categorise this evidence as less important.

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[19] UK equivalent figures include annual fees. The duration of 1800MHz licences varied by block. A value of 17.3 years used in calculations is the average duration of licences sold.

Slovenian 2014 CCA (800MHz, 900MHz, 1800MHz, 2.1GHz FDD and TDD, 2.6GHz FDD and TDD)

The Slovenian multiband CCA concluded in April 2014. The result of the auction was as follows:

Figure 4.8: Results of the Slovenian auction in 2×5MHz blocks (with exception of 2.1/2.6GHz TDD lots ,which is in 5MHz blocks) [Source: Analysys Mason, Aetha, 2014]

Operator	800MHz	900MHz	1800MHz	2.1GHz TDD	2.1GHz TDD	2.6GHz FDD	2.6GHz TDD	Price (EUR millions)	Reserve price (EUR millions)
Si.mobil	2	3	6	4		7	5	63.9	35.2
Telekom Slovenije	2	3	5			7	5	64.2	42.6
Tušmobil	2	1	2					20.7	20.3
Unsold			2		1				

To our knowledge, no additional annual fees apply to the spectrum won in this auction.

There were two aspects of the result in the 800MHz band that are worth highlighting:

- The 800MHz spectrum acquired by Si.mobil was subject to a special coverage obligation, which requires the licensee to provide mobile broadband services at a bitrate of at least 10Mbit/s downlink outdoors to at least 95% of the population within three years.

- The 800MHz lots won by Tušmobil were reserved for operators with less than 15% market share, which effectively meant that Telekom Slovenije and Si.mobil were not permitted to bid on these lots.

The reserve prices and spectrum caps for the auction were as shown in Figure 4.9 below:

Figure 4.9: Reserve prices and spectrum caps applied in the Slovenian CCA [Source: Analysys Mason, Aetha, 2014]

Lot	Lot size	Reserve price (EUR millions)	Band-specific spectrum cap	Low frequency spectrum cap	Total spectrum cap
800MHz – coverage obligation lot	2x10MHz	1	-	2x30MHz across the 800MHz and 900MHz bands	2x105MHz, including existing holdings across all FDD bands
800MHz – other lots	2x5MHz	5.4	-		
900MHz	2x5MHz	4.7	2x15MHz		
1800MHz	2x5MHz	2.4	2x30MHz	-	
2.1GHz FDD	2x5MHz	1.8	-	-	

Lot	Lot size	Reserve price (EUR millions)	Band-specific spectrum cap	Low frequency spectrum cap	Total spectrum cap
2.1GHz TDD	5MHz	0.01	-	-	
2.6GHz FDD	2x5MHz	0.8	-	-	
2.6GHz TDD	5MHz	0.01	-	-	

Again, given the auction format – a CCA – it is not possible to directly observe band-specific prices. Furthermore, even if the bidding information was available in the public domain, given the small number of data points available from the auction and the large number of variables, it is unlikely that it would be possible to calculate reliable, band-specific prices using a linear model. Therefore, the amount of reliable information that can be gleaned from this auction is limited.

One may note that the price paid by Tušmobil for its spectrum (2×10MHz in the 800MHz band, 2×5MHz in the 900MHz band, and 2×10MHz in the 1800MHz band) was very close to reserve price. However, there are two reasons why this might not reflect the true market value of this spectrum:

- First, the price paid for the 800MHz spectrum may be an underestimate of market value, as Tušmobil did not face competition for this spectrum from the two clear market leaders – Telekom Slovenije and Si.mobil (which combined have over 80% market share).

- Second, 2×10MHz of spectrum in the 1800MHz band was left unsold, suggesting that the price raised exceeded true market value.

It is also likely that the prices paid by Telekom Slovenije and Si.mobil for 800MHz spectrum overstate the market value, due to the artificial scarcity resulting from the reservation. However, in any case, it is very difficult to infer any reliable information about the band-specific prices paid by either of these two operators. Both operators paid significantly above reserve price for their spectrum, but it is difficult to apportion the prices paid between the numerous bands in which they won spectrum.

Assuming that the price paid for 2.1GHz TDD was minimal (given that the licence duration was just seven years), the difference in the packages between the two operators was as follows:

- Si.mobil acquired one more 2×5MHz 1800MHz lot than Telekom Slovenije.

- Si.mobil acquired the 800MHz lot with the special coverage obligation.

As a result of these differences Telekom Slovenije paid just over EUR0.3 million more than Si.mobil. This provides an indication that the cost of meeting the coverage obligation is more than the value of an additional 1800MHz lot, but gives us little indication about the absolute value of the 1800MHz lots.

In conclusion:

- It is difficult to infer a price for the 800MHz band due to the inclusion of the reservation.

- Given that some 1800MHz spectrum was left unsold, the reserve price of EUR2.4 million per 2×5MHz lot (EUR0.12 per MHz per population) could provide an evidence point. However, this is likely to overstate market value.

- It is very difficult to infer anything reliable about prices in the 900MHz and 2.6GHz FDD bands.

Therefore, we suggest that this auction should not be used to calculate benchmarks for either 900MHz or 1800MHz spectrum, even using our proposed distance approach.

5   Implications for the calculation of the 1800MHz lump-sum values

In this section we use the distance method described in our first report to determine a single 1800MHz benchmark from each country for which the required information is available. We use the UK-equivalent benchmarks provided by Ofcom in Figure 4.2 of the original consultation document, as well as information for Austria provided in the Update on European auctions. Additionally, we include data for the Czech Republic and Slovakia (where auctions have taken place after the publication of Ofcom's original consultation and where band-specific prices can be derived) and Switzerland (for which Ofcom did not provide UK-equivalent value estimates) in our benchmark set.

The distance method values used are therefore the same as in our first report with the following exceptions:[20]

- An evidence point for Slovakia has been included.

- The calculation for Austria has been adjusted to use a weighted average of the LRPs (with revenue constraint) provided by Ofcom to estimate band-specific prices in the 800MHz, 900MHz and 1800MHz bands.

The distance-method benchmarks that result from each country are shown in Figure 5.1 below.

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[20]   We note that the results of 800MHz auctions which have taken place in Belgium, Estonia, Finland, Latvia and Lithuania are not included. This is because, as explained in Section 4.1.2, there are no 1800MHz values available from these countries and therefore no applicable benchmarks can be calculated. We have therefore not calculated UK equivalent values for 800MHz auctions in these countries.

*Figure 5.1: Ofcom's UK-equivalent benchmarks and the resulting 1800MHz benchmark using the distance method [Source: Ofcom, Analysys Mason, Aetha: *UK equivalent benchmarks calculated by Analysys Mason and Aetha using Ofcom's methodology, 2013 ** Reserve prices]*

Country	Ofcom's UK equivalent benchmarks (GBP millions/MHz)				Distance method (GBP millions/MHz)
	800MHz	900MHz	1800MHz	2.6GHz	1800MHz
Austria[21]	65.0*	61.8*	35.5*	1.8	**18.2**
Belgium				4.5	**not applicable**
Czech Republic	42.7*		5.6*	2.8*	**6.7**
Denmark	10.1	2.4	1.0	9.5	**not applicable**
France	34.3			5.2	**not applicable**
Germany	50.1		1.8	1.5	**5.1**
Greece		31.4	13.9		**16.0[22]**
Ireland	58.6	35.7	23.1		**14.8**
Italy	48.3		15.5	3.5	**11.6**
Netherlands	n/a	n/a	n/a	n/a	**not applicable**
Norway	n/a	n/a	n/a	n/a	**not applicable**
Portugal	36.1	24.1	3.1	2.4	**5.5**
Romania	21.8	24.9	6.	2.5	**9.7**
Slovakia	40.6*		6.7*	4.2*	**6.7**
Slovenia	n/a	n/a	n/a	n/a	**not applicable**
Spain	31.4	25.4	2.9	3.1	**not applicable**
Sweden	14.3		9.1	9.7	**1.7[23]**
Switzerland	9.5**	Unknown	3.4**	3.4**	**5.0**

Carrying out calculations for the lump-sum value of 1800MHz spectrum in the UK using the distance method gives a value of **GBP9.0 million per MHz.** This result is calculated using the preferred approach in our original report of applying a 2:1 relative weighting between more important and less important evidence, and using the Analysys Mason/Aetha classification to determine which evidence should be considered as more or less important. The corresponding value in our first report, prior to the adjustment to Austria and the inclusion of Slovakia, was GBP9.4 million per MHz.

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[21] For Austria, we have used the Weighted Average LRP values, calculated inclusive of revenue constraint

[22] No 800MHz and 2.6GHz values available, so we assume that the 800MHz is equal to 900MHz in value and the 2.6GHz has a value of zero to generate the distance method value. This value should be considered as an upper bound.

[23] The 2.6GHz price in Sweden was a UK equivalent of GBP9.7 million whilst the 1800MHz price was a UK equivalent value of GBP9.1 million. This combination results in a distance method value for Sweden which is below the UK 2.6GHz LRP.

Sensitivity testing

Below, as we did in our first report, we test the sensitivity of this result to two different classifications of evidence points (as more or less important) and a number of different weightings between the more and less important evidence points.

Regarding the classification, we consider both:

- the classifications of evidence points derived from our analysis of each European auction in Section 5 of our first report, and our further analysis of Austria and Slovakia in this report
- the classifications implied by Ofcom's analysis in its original consultation

As in our first report, we note that in some cases judgement has been required because Ofcom has classified different relative evidence points from the same country as both more and less important. We have also assumed that Ofcom would classify countries not included in its original consultation in the same way as Analysys Mason and Aetha have done (i.e. Austria, Czech Republic and Slovakia are all classified as less important evidence).

Regarding the weightings, we consider our base case of a 2:1 ratio between the weighting of more and less important evidence, but also test and equal weighting and ratios of 3:1 and 10:1. The results of our distance method calculations are shown in Figure 5.2 below. The results show that there is only limited sensitivity to these assumptions and results are not significantly different to those set out in our first report.

Figure 5.2: Updated lump-sum values calculated using the distance method [Source: Analysys Mason, Aetha, 2014]

Classification of evidence points	Weighting applied between more and less important evidence			
	Equal weighting	2:1	3:1	10:1
Weighted average under Ofcom classification[24]	9.2	10.0	10.2	10.7
Weighted average under Analysys Mason/Aetha classification	9.2	**9.0**	9.0	8.7

Finally, as discussed in Section 4.1.1 we have some concerns over a potential bias which is introduced by Ofcom using non-public data from two countries but not from others. The countries concerned are Ireland and Austria which, as we mentioned in Section 4.1.1, produce band-specific benchmarks that are towards the high-end of the available benchmarks, whether considering the absolute value of 1800MHz benchmarks or using the distance method. To illustrate this point we

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[24] These differ from the classifications used in the first report as both the Austrian and Czech Republic benchmarks are given a less important classification, whereas in our first report they were excluded entirely under the "Ofcom classifications" scenario. Additionally, the benchmarks from the new Slovakian auction is included as less important.

set out in Figure 5.3 the UK equivalent lump-sum values for 1800MHz change excluding evidence points from Ireland and Austria.

Figure 5.3: Updated lump-sum values calculated using the distance method [Source: Analysis Mason, Aetha, 2014]

Classification of evidence points	Weighting applied between more and less important evidence			
	Equal weighting	2:1	3:1	10:1
Weighted average under Ofcom classification[25]	7.5	8.4	8.7	9.3
Weighted average under Analysys Mason/Aetha classification	7.5	**7.7**	7.8	8.1

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[25] These differ from the classifications used in the first report as both the Austrian and Czech Republic benchmarks are given a less important classification, whereas in our first report they were excluded entirely under the "Ofcom classifications" scenario. Additionally, the benchmarks from the new Slovakian auction is included as less important.