
Application of the ‘distance method’ when estimating a lump-sum value for 900MHz spectrum

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1 Introduction

In January 2014, Analysys Mason Ltd (Analysys Mason) and Aetha Consulting Ltd (Aetha) jointly developed a report for Hutchison 3G UK Ltd (Three) and EE Ltd (EE) regarding Ofcom’s valuation of the 1800MHz band.¹ The report was subsequently submitted by each operator in its respective response to Ofcom’s consultation on the 900MHz and 1800MHz annual licence fees. In addition to the calculation of lump-sum values for 1800MHz spectrum, Ofcom must perform a similar analysis for 900MHz spectrum. This paper, developed for EE, extends the analysis undertaken in our first report to 900MHz spectrum. It is intended to show that the distance method can be applied to 900MHz spectrum in a consistent way to the approach demonstrated for 1800MHz spectrum.

In our first report, we proposed the ‘distance method’ as the most reliable and appropriate method for the calculation of lump-sum values for 1800MHz spectrum. This method places greater emphasis on the UK 800MHz and 2.6GHz linear reference prices (LRPs) (as required by the Government’s Direction) and measures how far between these two values the 1800MHz lump-sum value should lie, using benchmark countries for which the required information is available and reliable.

Clearly, there is a need for consistency between the approaches undertaken for the 900MHz and 1800MHz valuations. This paper, therefore, explains how the distance method could also be used to calculate a lump-sum value for 900MHz spectrum in the UK, including the criteria that should be used to determine whether individual evidence points from other countries should be included or excluded from the analysis.

For a more detailed background to this discussion, this paper should be read in conjunction with our first report.

2 The application of the distance method for the 900MHz band

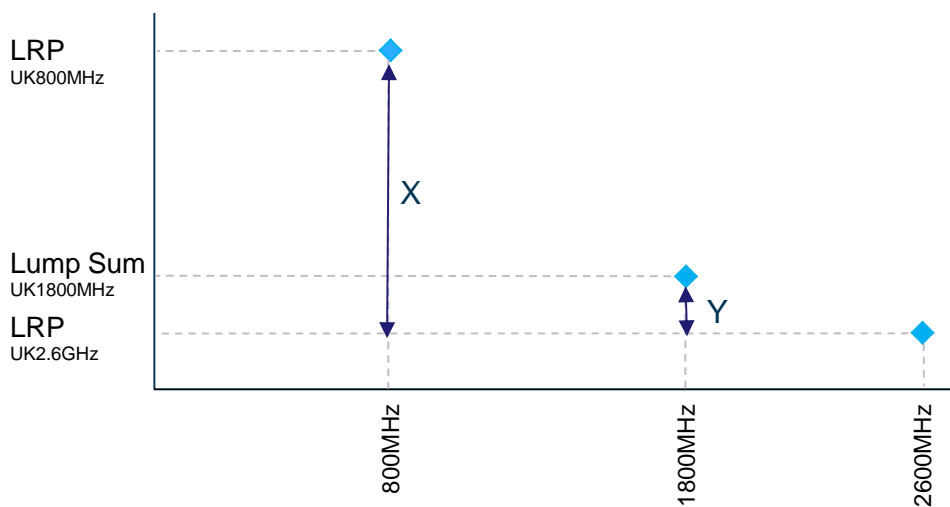
Before explaining how its application could be applied to the 900MHz band, we first recap on the distance method and how it is applied to the 1800MHz band.

¹ Review of Ofcom’s benchmarking of the value of the 1800MHz spectrum band to determine annual licence fees, Analysys Mason – Aetha Consulting, 9 January 2014

2.1 Use of the distance method for the 1800MHz band

The distance method is a simple and robust approach for interpreting the evidence available from auction benchmarks. It does not require the level of apparently subjective judgement that must be made when combining Ofcom's proposed evidence points. In addition, this approach uses the UK 800MHz and 2.6GHz LRPs as its starting point, in line with the Government's Direction and focuses the analysis on determining where in between them the 1800MHz lump-sum should fall; i.e. it answers the question, 'What is $\frac{Y}{X}$?' in Figure 1 below.

Figure 1: Illustration of the distance method as applied to the 1800MHz band [Source: Analysys Mason, Aetha, 2014]



This $\frac{Y}{X}$ ratio can be based on observations in benchmark countries for which 800MHz, 1800MHz and 2.6GHz values are available and, ideally, representative of market value. Once an estimate of this ratio is known based on the relevant countries, the lump-sum value for the 1800MHz band in the UK can be calculated from the two evidence points on which the Direction placed particular emphasis, namely the UK 800MHz and the 2.6GHz prices as established by the auction.

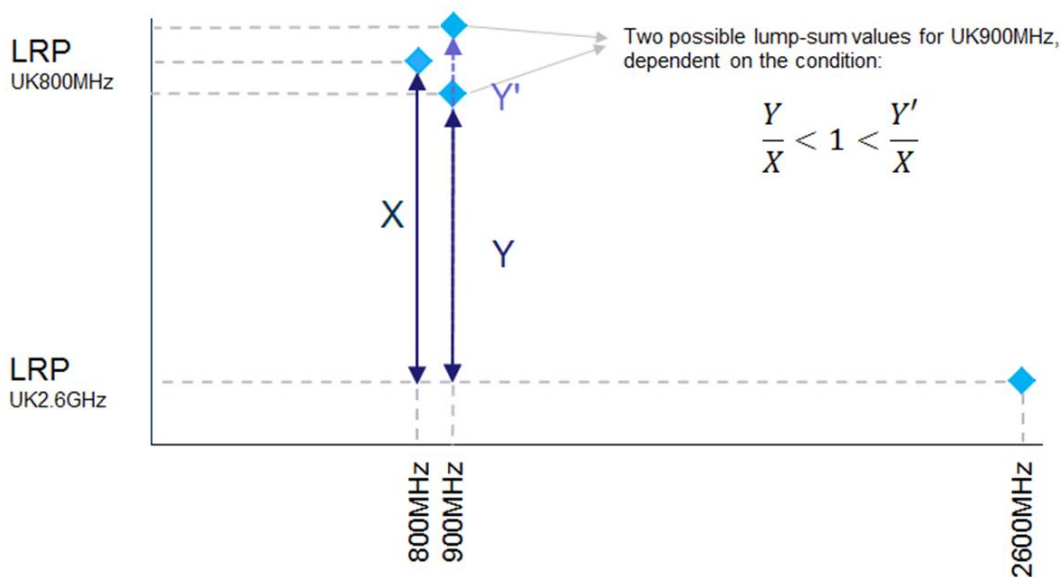
2.2 Application of the distance method calculation for the 900MHz band

Given the clear benefits of the distance method, as demonstrated for the valuation of 1800MHz spectrum, we note that there are no reasons, *a priori*, why the same methodology should not be applied to the calculation of lump-sum values for 900MHz spectrum. A similar set of issues to those with the methodology employed by Ofcom for the 1800MHz band also apply to the 900MHz band. Specifically, our concern is that neither Ofcom's absolute nor its relative approaches are likely to produce reliable estimates, instead producing a wide range of benchmarks that are unlikely to be useful in determining the 900MHz lump-sum value. Furthermore, we note that unlike for the 1800MHz band, Ofcom uses only 800MHz auction prices to determine relative

values. Therefore, an opportunity is missed to also use 2.6GHz price information from the UK auction to inform the 900MHz value.

The distance method can be applied to 900MHz spectrum using exactly the same formula as for 1800MHz spectrum. One additional point to note however is that the value of $\frac{Y}{X}$ may not necessarily be less than 1, since in some cases 900MHz spectrum has achieved higher auction values than 800MHz spectrum (e.g. in Romania and Switzerland²). This is analogous to the value of $\frac{Y}{X}$ not necessarily needing to be greater than zero for 1800MHz spectrum, in particular when the benchmark for 1800MHz is lower than the benchmark for 2.6GHz in a particular market.³

Figure 2: Illustration of the distance method as applied to the 900MHz band [Source: Analysys Mason, Aetha, 2014]



We are not of the opinion that the 800MHz value is necessarily an upper limit on the value of 900MHz. The 900MHz band is critical for the immediate, ongoing delivery of GSM services, and a substantial ecosystem for UMTS/HSPA+ at 900MHz is already in place. We understand that both Telefónica and Vodafone have deployed UMTS900 in the UK. Furthermore, although the 800MHz band is the leading low-frequency band for LTE, the device ecosystem for LTE900 is progressing rapidly (e.g. included in the specification for the iPhone 5s).

2.3 What objective criteria should be applied to the selection of benchmarks?

As detailed in our report for the 1800MHz band, we believe the benchmark analysis would greatly benefit from a set of objective criteria, which could then be transparently and consistently applied

² In our first report we concluded that it was not possible to determine accurately a band-specific price for the 900MHz band in Switzerland. However, it is clear that the price was higher than that of the 800MHz band.

³ There was one such example, Sweden, in our distance method calculation for 1800MHz set out in our first report.

to decide which countries should be included in the sample, and the weight that should be attached to each data point.

In line with our criteria for determining a relevant sample for 1800MHz benchmark analysis proposed in our first report, we recommend that countries are excluded from the 900MHz lump-sum determination if:

- The 900MHz band has not been auctioned within the relevant time period (as specified by Ofcom).
- For package bid auctions, no reliable information regarding the 900MHz prices can be inferred from publicly available information.
- Certain bidders were excluded from the auction (particularly incumbent operators) as this would significantly constrain demand in the auction.
- There is no reliable 800MHz benchmark – a requirement for the distance method calculation for 900MHz spectrum. In the absence of a 2.6GHz benchmark, a zero proxy can be used for the 2.6GHz price, noting that the calculated data point will then provide an upper bound estimate for the value of 900MHz spectrum in that country (since the zero approximation increases the distance between the 900MHz and 2.6GHz values).

We first note that the following countries are candidates for a 900MHz distance method evidence point, given that they have auctioned 800MHz, 900MHz and potentially 2.6GHz spectrum within the relevant time period (note that a 2.6GHz auction is not a prerequisite as zero can be used as a proxy).

Figure 3: Countries which have auctioned 800MHz, 900MHz and/or 2.6GHz spectrum within the relevant time period [Source: Analysys Mason, Aetha, 2014]

Country	Year	Award format	Spectrum included
Austria	2013	CCA	800MHz, 900MHz, 1800MHz
	2010	CCA	2.6GHz
Denmark	2012	CCA	800MHz
	2010	Sequential open auction	900MHz, 1800MHz
	2010	CCA	2.6GHz
Ireland	2012	CCA	800MHz, 900MHz, 1800MHz
Netherlands	2012	CCA	800MHz, 900MHz, 1800MHz, 2.1GHz, 2.6GHz TDD
Norway	2013	First-price sealed bid auction	800MHz, 900MHz, 1800MHz
	2007	SMRA	2.1GHz, 2.6GHz
Portugal	2011	SMRA	450MHz, 800MHz, 900MHz, 1800MHz, 2.1GHz TDD, 2.6GHz
Romania	2012	Package clock auction	800MHz, 900MHz, 1800MHz and 2.6GHz

Country	Year	Award format	Spectrum included
Slovenia	2014	CCA	800MHz, 900MHz, 1800MHz, 2.1GHz TDD, 2.6GHz FDD, 2.6GHz TDD
Spain	2011	SMRA	800MHz, 900MHz, 2.6GHz
	2011	Beauty contest	900MHz, 1800MHz
	2011	Re-auction	900MHz, 2.6GHz TDD
Switzerland	2012	CCA	800MHz, 900MHz, 1800MHz, 2.1GHz and 2.6GHz

Based on our criteria, we suggest that the following countries are included/excluded from the analysis,⁴ as summarised in the table below.

Figure 4: Result of categorisation to include/exclude countries [Source: Analysys Mason, Aetha, 2014]

Country	No 800MHz or 900MHz benchmark	No valuable 900MHz band-specific price available	Bidders excluded from auction	Conclusion
Austria				Include
Belgium	Yes			Exclude
Czech Republic	Yes			Exclude
Denmark			Yes	Exclude
France	Yes			Exclude
Germany	Yes			Exclude
Greece	Yes			Exclude
Ireland				Include
Italy	Yes			Exclude
Netherlands		Yes		Exclude
Norway		Yes		Exclude
Portugal				Include
Romania				Include
Slovakia	Yes			Exclude
Slovenia		Yes		Exclude
Spain ⁵				Include
Sweden	Yes			Exclude
Switzerland		Yes		Exclude

⁴ For a more detailed assessment of these individual auctions, please refer to Section 5.3 of the referenced document [1].

⁵ Despite the exclusion of bidders for 900MHz (and 1800MHz) spectrum in the May 2011 beauty contest, and the effective exclusion of bidders for 900MHz spectrum in the July 2011 auction (the caps meant that Movistar and Vodafone could not bid for both 2x10MHz of 800MHz spectrum plus 900MHz spectrum), one lot of unsold 900MHz was re-auctioned in November 2011 with relaxed spectrum caps (such that no bidders were excluded). We therefore only use the 900MHz price from the November 2011 auction.

This leaves Austria, Ireland, Portugal, Romania and Spain as suitable evidence points for the application of the distance method to determine the lump-sum value of 900MHz spectrum in the UK.

However, some countries provide more valuable benchmarks than others. As per our first report regarding the 1800MHz band, we believe that this is most appropriately accounted for by giving them more weight in the final determination of the lump-sum values. To be consistent with our first report, we recommend that countries are considered as less important if either:

- band-specific prices cannot be *directly* inferred – this would mean that benchmarks from package bid auctions would at best be considered as less important
- a proxy is used for 2.6GHz price when using the distance method (i.e. we use zero as a proxy for the 2.6GHz value)
- there is unsold spectrum in any of the three bands relevant for the distance method (800MHz, 900MHz or 2.6GHz)
- there is a significant time gap between the auctioning of the three required bands (800MHz, 900MHz or 2.6GHz).

We therefore conclude that Spain should be considered as more important evidence, and weighted accordingly; whilst Austria, Ireland, Portugal and Romania should be considered as less important evidence.⁶

3 Results of the application of the distance method for the 900MHz band

Applying the distance method calculation for the suitable countries yields five estimates for the lump-sum value of the 900MHz band in the UK, as summarised in the table below.

⁶ Due to the combinatorial nature of the package auctions in Austria, Ireland and Romania, band-specific prices cannot be directly inferred. In Romania and Portugal there was also unsold spectrum in the 800MHz and 900MHz bands respectively. In Ireland, there is no 2.6GHz benchmark therefore we use a zero proxy in the distance method calculation. For these reasons we consider the results in Austria, Ireland, Portugal and Romania to be less important evidence points.

Figure 5: Results of the application of the distance method for the 900MHz band [Source: Analysys Mason, Aetha, 2014]

Country	800MHz	2.6GHz			
UK LRPs	29.9 ⁷	5.0			
Country	800MHz	900MHz	2.6GHz	Weighting 2:1	Distance method result for 900MHz UK lump-sum value
Austria	65.0	61.8	1.8	1	28.6
Ireland	58.6	35.7	0.0 ⁸	1	20.1
Portugal	36.1	24.1	2.4	1	21.0
Romania	21.8	24.9	2.5	1	33.8
Spain	31.4	25.4 ⁹	3.1	2	24.6
AVERAGE					25.4

With a weighting of 2 applied to Spain as more important evidence and 1 to the remaining evidence points, this produces the result of GBP25.4 million per MHz for the lump-sum value for 900MHz spectrum in the UK.¹⁰

⁷ This value includes a value of GBP3.0 million/MHz for DTT interference mitigation.

⁸ We use a zero approximation for the Irish 2.6GHz benchmark, as the band has not been awarded. This provides an upper bound estimate for the UK equivalent lump-sum value of the 900MHz band based on Irish benchmarks when using the distance method.

⁹ This is an updated value issued by Ofcom in its document '*Correction Slip*' and therefore differs from the value of GBP24.9m/MHz quoted in the original consultation.

¹⁰ As additional sensitivities to this result, we consider an alternative weighting of 3:1 for more important evidence points, which yields a weighted average of GBP25.3 million per MHz. A weighting of 10:1 yields a weighted average of GBP24.9 million per MHz.