Annex 8

Recent European awards

Introduction

A8.1 In this annex we discuss the results of mobile spectrum awards in Europe since the beginning of 2010. We have focused on countries in which at least one of the ALF bands has been auctioned in this period.[1]

A8.2 Our October 2013 consultation included a country-by-country assessment of auction results and benchmarks based on these results. Stakeholders commented in detail on this assessment.[2] The following analysis takes account of these comments, and of new evidence.

A8.3 Since the publication of our October 2013 consultation, the following six European countries have auctioned mobile spectrum including one or both ALF band(s):

- Austria (October 2013);
- the Czech Republic (November 2013);
- Norway (December 2013);
- the Slovak Republic (December 2013);
- Slovenia (April 2014); and
- Hungary (June 2014).

A8.4 Stakeholders provided comments on these auctions in their June 2014 responses to our May 2014 update note on European auctions. In view of these comments, and the available evidence, we have taken account of these new awards as follows:

a) We have included the auction results from Austria, the Czech Republic and the Slovak Republic in our benchmarking exercise, and provide an assessment of their results in this annex.

b) For the auctions in Norway and Slovenia (as well as for the Netherlands and Switzerland, where auctions were held before the publication of our October 2013 consultation), we consider that we do not have sufficient information to reliably determine band-specific prices. For each of these auctions, we set out our specific reasons for this view. We therefore do not produce benchmark estimates for the value of 900 MHz or 1800 MHz based on absolute or relative values from these auctions.

[1] In our October 2013 consultation we included France and Belgium as part of the benchmarking exercise. However, as these auctions did not include either or both of the ALF bands they did not contribute to the calculation of our proposed ALFs.

[2] Unless otherwise stated, stakeholder responses in this annex relate to the October 2013 consultation. June 2014 responses to our May 2014 update note are flagged as such.

c) In Hungary, applications to bid in their spectrum auction were submitted by four operators on 16 June 2014.[3] The auction design was not conventional in the sense that bidders who offered the highest price for spectrum would not necessarily win.[4] Due to the nature of the award, we do not consider that the results of this award will be informative about the value of 900 MHz and 1800 MHz spectrum in the UK. Therefore we do not include Hungary in our benchmarking exercise for this consultation.

A8.5 This annex has separate sections for each of the countries considered, organised in alphabetical order. For each country, we set out:

i) The circumstances and outcome of the auction. This includes a table summarising the amount of spectrum won by each winning bidder, and the prices paid. It also includes a table detailing the major rules and features of the auction design.

ii) Where relevant, a summary of our estimation of prices in CCA awards.

iii) Our position in the October 2013 consultation.

iv) A summary of responses to our October 2013 consultation and comments on our May 2014 update. Comments are split into those relating to whether auction prices are likely to reflect market value in the country concerned, and those which discuss whether market value in the country concerned is likely to reflect UK market value.

v) Our assessment of whether the absolute and relative values derived from each auction are likely to reflect market value in the country concerned, and also whether market value in the country concerned is likely to reflect UK market value, taking into account stakeholder comments.

vi) A summary of the benchmarks and our assessment. This includes a table and chart capturing all absolute and relative benchmarks from the award,[5] along with the tier of evidence to which the most important relative values (i.e. the 900 MHz / 800 MHz paired ratios and the distance method values) belong.[6] It also includes our interpretation of each benchmark in terms of the likelihood, scale and direction of any overstatement or understatement of UK market value. The likelihood and scale of overstatement or understatement are categorised as smaller, larger, or, if we consider that we cannot sensibly judge whether it is smaller or larger as "unknown". The direction of effect is categorised as "overstatement", "understatement", or, if we consider that we cannot sensibly judge the direction, as "unknown", for example where different factors may

[3] http://english.nmhh.hu/cikk/163243/NMHH_frequency_tender_for_broadband_services_published
[4] For 800 MHz, 900 MHz and 2.6 GHz spectrum, bidders offered a price along with proposed commitments and a timeline for achieving them. For 1800 MHz packages, bidders offered a price along with a commitment regarding the date of payment. The Hungarian regulator (NMHH) evaluated bids and awarded lots according to a 'points score' based on the various components of each bid.
[5] For completeness, in the tables and charts we include paired ratios of 1800 MHz to 800 MHz and 1800 MHz to 2.6 GHz. However, as explained in paragraph 3.27, we consider the distance method to be a more appropriate benchmark for 1800 MHz than either of these paired ratios. The charts also show our preferred estimates of the UK value of 800 MHz and 2.6 GHz (using relevant comparators for 800 MHz as outlined in Table 3.3 and Table 3.4).
[6] We do not discuss our assessment of the quality of evidence – i.e. the tier to which each country belongs – in this annex. This is covered in Section 3.

influence the benchmark but operate in different directions with the net effect being unclear.[7]

A8.6 The tables on the following three pages set out the principal relative benchmarks for the countries where these have been derived. Table A8.1 shows the 900 MHz / 800 MHz paired ratio[8] benchmarks for 900 MHz, and Table A8.2 shows the distance method benchmarks for 1800 MHz, which are the focus of our assessment in Section 3.

A8.7 For each of the benchmarks shown, the tables summarise our assessment of the quality of evidence represented by the benchmark (on the basis of which we have grouped these benchmarks into tiers, as explained in Section 3) and our interpretation of the benchmarks (i.e. our assessment of the risk that they overstate or understate market value, in terms of the likelihood, scale, and direction of overstatement or understatement). The tables also include brief summaries, in the last column, of the key considerations that are relevant to our interpretation of each benchmark. [9]

[7] In a small number of cases we have not identified any basis for expecting benchmarks to be overstated or understated, and we have labelled the risk as "none".
[8] We use the term "paired ratio" to refer to benchmarks based on the relative values in two bands (whereas the distance method incorporates values in three bands). The calculation of the 900 MHz / 800 MHz paired ratio is described in paragraph 3.23.
[9] We use the terms "likelihood" and "extent of risk" interchangeably in this annex.

Figure A8.1 Summary of 900 MHz / 800 MHz paired ratio benchmarks

Country	*900 MHz / 800 MHz ratio*	*Implied 900 MHz value £m/MHz*	*Quality of evidence*	*Interpretation of benchmark: risk of under/overstatement*			*Key considerations, indicating tendency to overstate (+) or understate (-) the benchmark*
				Likelihood (extent of risk)	*Scale*	*Direction*	
Austria	110%	39.2	1st tier	Unknown	Unknown	Unknown	Alleged strategic bidding for 900 MHz (+) Alleged strategic bidding for 800 MHz (-)
Ireland	62%	20.3	1st tier	Unknown	Unknown	Overstate	Alleged strategic bidding for 900 MHz (+) Alleged budget constraint for 800 MHz due to strategic bidding for other bands (+)
Portugal	67%	21.8	2nd tier	Unknown	Unknown	Unknown	Some unsold 900 MHz spectrum; all 800 MHz spectrum sold at reserve price (+) Non-contiguous 900 MHz lots (-)
Spain	65%	23.2	2nd tier	Larger	Unknown	Overstate	900 MHz spectrum sold at reserve price; 800 MHz sold above reserve price (+)
Denmark	18%	6.1	3rd tier	Larger	Larger	Understate	The three incumbents prevented from bidding for 900 MHz (-) Joint bidding reduced the number of bidders for 800 MHz (+)
Romania	108%	33.5	3rd tier	Unknown	Unknown	Unknown	Some unsold 800 MHz spectrum, all 900 MHz spectrum sold at reserve price (-) Greater importance of 2G (+)

Figure A8.2 Summary of 1800 MHz distance method benchmarks

Country	Implied 1800 MHz value £m/MHz	Quality of evidence	Interpretation of benchmark: risk of under/overstatement			Key considerations, indicating tendency to overstate (+) or understate (-) the benchmark
			Likelihood (extent of risk)	Scale	Direction	
Austria	25.5	1st tier	Unknown	Unknown	Unknown	Alleged strategic bidding for 1800 MHz (+) Alleged strategic bidding for 800 MHz (-)
Ireland	14.3	1st tier	Larger	Unknown	Overstate	Alleged strategic bidding for 1800 MHz (+) Alleged budget constraint for 800 MHz due to strategic bidding for other bands (+) 2.6 GHz unavailable for mobile services in Ireland (+)
Italy	13.5	1st tier	Unknown	Unknown	Unknown	[✂] (+) Alleged strategic demand reduction in 1800 MHz (-) Alleged strategic demand reduction in 2.6 GHz (+) 1800 MHz may not have been perceived as a core LTE band at the time of the award (-)
Germany	5.6	2nd tier	Larger	Larger	Understate	Likely that 1800 MHz was not perceived as a core LTE band at the time of the award (-) Possible lack of competition for frequency-specific 1800 MHz lots (-) Possible signalling through bids for 1800 MHz (+/-)
Sweden	17.5	2nd tier	Unknown	Unknown	Unknown	Possible that the joint venture reduced competition for 1800 MHz (-) Possible that the joint venture reduced competition for 800 MHz (+) More bidders for 800 MHz than 1800 MHz (-) 1800 MHz may not have been perceived as a core LTE band at the time of the award (-)

Czech Republic	7.5	3rd tier	Larger	Unknown	Understate	2x1 MHz lot sizes may have raised aggregation risks in the 1800 MHz band (-) Incumbent operators were excluded from bidding for the only large 1800 MHz block (-) Unsold 2.6 GHz spectrum with binding caps (+)
Portugal	6.1	3rd tier	Unknown	Unknown	Unknown	Likely that 1800 MHz was not perceived as a core LTE band at the time of the award (-) Unsold 1800 MHz spectrum with binding caps(-) Unsold 2.6 GHz spectrum with binding caps (+)
Romania	12.0	3rd tier	Unknown	Unknown	Unknown	1800 MHz sold at reserve price; no caps were binding (+) Unsold 800 MHz (-) Unsold 2.6 GHz (-)
Slovak Republic	7.5	3rd tier	Unknown	Unknown	Understate	Incumbents excluded from bidding for large block of contiguous 1800 MHz; other 1800 MHz lots were frequency-specific, small, and non-contiguous (-) Reserve price understates price of 2.6 GHz (+) Possible lack of competition in the 800 MHz band (+)

Austria

October 2010 2.6 GHz award

Description: Award of 2x70 MHz of paired 2.6 GHz and 50 MHz of unpaired 2.6 GHz spectrum using a CCA format.[10]

Context: Prior to this auction, Austria had four MNOs: Telekom Austria, T-Mobile, Orange and 3G Austria.[11]

Table A8.1.1: October 2010 auction results

	2.6 GHz	Unpaired 2.6 GHz	Price Paid[12]
Total Available	2x70	50	-
Telekom Austria	2x20	25	€13.2m
T-Mobile	2x20	-	€11.2m
Orange	2x10	-	€4m
Hi3G	2x20	25	€11m
Unsold	-	-	-

Table A8.1.2: October 2010 auction design

	Description	Implications
Number of bidders; number of lots; lot sizes	4 bidders. Spectrum was available in lots of 2x5 MHz paired and 5 MHz unpaired.[13]	It was possible for all bidders to win some spectrum in the auction.
Spectrum caps / Restrictions	A cap of 2x30 MHz applied to MNOs who already held 900 MHz or 1800 MHz spectrum (Telekom Austria, T-Mobile and Orange).	The cap was not binding for any MNO.
Reserve prices	All spectrum was sold above reserve prices.	
Obligations	An obligation on all winners of spectrum to provide at least 25% population coverage by December 31 2013. In the areas covered, a bearer service must be offered with a data transmission rate of at least 1 Mbit/s on the downlink and at least 256 Kbit/s on the uplink.[14]	

[10] See: http://www.dotecon.com/assets/images/dp1001.pdf
[11] In January 2013 a merger was completed between Hi3G and Orange, leaving only three national MNOs in the Austrian market.
[12] See: https://www.rtr.at/en/tk/FRQ_2600MHz_2010_AE
[13] See page 30: http://www.dotecon.com/assets/images/dp1001.pdf
[14] https://www.rtr.at/en/tk/FRQ_2600MHz_2010_AU/F4_08_TenderDocumentation_2_6_GHz.pdf

October 2013 multiband auction

Description: Award of spectrum in the 800 MHz, 900 MHz and 1800 MHz spectrum bands using a CCA format.

Context: Prior to this auction, Austria had three MNOs: Telekom Austria, T-Mobile Austria and H3G Austria.[15] In December 2013, T-Mobile Austria and H3G Austria appealed against the results of the auction.[16]

Table A8.1.3: October 2013 multiband auction results

Operator	800 MHz	900 MHz	1800 MHz	Price paid
Total available	2 x 30	2 x 35	2 x 75	€2,014.5m
Telekom Austria	2 x 20	2 x 15	2 x 35	€1,029.9m
T-Mobile Austria	2 x 10	2 x 15	2 x 20	€654.5m
H3G Austria	-	2 x 5	2 x 20	€330.1m
Unsold	-	-	-	-

Source: RTR, https://www.rtr.at/en/tk/multibandauktion_ergebnis

Table A8.1.4: October 2013 multiband auction design

	Description	Implications
Number of bidders; number of lots; lot sizes	The three incumbent operators were the only bidders. Spectrum was awarded in each band in 2x5 MHz lots.	The overall number of lots exceeded the number of potential bidders.
Spectrum caps[17] / Restrictions	Total package: A 2x70 MHz cap. Sub-1GHz: A 2x35 MHz cap. 800 MHz: A 2x20 MHz cap. 900 MHz: A 2x30 MHz cap. 2 x10 MHz of 800 MHz was reserved in a "pre-auction" for new entrants, but there was no take-up.[18]	The total package, sub-1 GHz and 800 MHz caps were binding on Telekom Austria
Reserve prices	Spectrum sold above reserve prices. Total revenue was approximately four times the sum of reserve prices.	
Obligations	Coverage obligations applied to all lots (but differentiated by band), with increased requirements for the A3 lot (2x5 MHz at 800 MHz).[19]	

[15] In January 2013 a merger was completed between 3G Austria and Orange, leaving only three national MNOs in the Austrian market.
[16] Total Telecom, 'Austrian operators appeal against 'exorbitant' LTE spectrum fees', November 2013.
[17] https://www.rtr.at/en/tk/multibandauktion_AU/2013-03-26_F1_11_Tender_Document_Multiband_Auction_2013.pdf section 4.4
[18] https://www.rtr.at/en/tk/multibandauktion_AU/2013-03-26_F1_11_Tender_Document_Multiband_Auction_2013.pdf section 2.1
[19] https://www.rtr.at/en/tk/multibandauktion_AU/2013-03-26_F1_11_Tender_Document_Multiband_Auction_2013.pdf, section 3.4

A8.9 The lot structure involved three sub-categories for each of the bands. As set out in the May 2014 update, the differences between these sub-categories are:

a) In the 800 MHz band, the A1 lot is subject to higher risk of interference or requirements to protect the adjacent DTT than A2 and A3 lots. The A3 lot is subject to more stringent rural coverage requirements (whereas the A1 lot and the four A2 lots are subject to lower targets of coverage).

b) In the 900 MHz band, different lot categories reflect the different timing of the spectrum becoming available: the B1 and B3 lots are only partially available (respectively 2x1.7 MHz and 2x4.1 MHz) from 2016 and fully available from 2018, while the five B2 lots are fully available from 2016. In addition, the B1 lot is also subject to possible usage restrictions or co-ordination requirements along railway lines to protect adjacent GSM-R.

c) In the 1800 MHz band, different lot categories reflect the different timing of the spectrum becoming available: the two C1 lots are fully available from 2016, the eight C2 blocks are partially available from 2016 and fully available from 2020, and the five C3 lots are fully available from 2018.

Our position in the October 2013 consultation and May 2014 update

A8.10 The multiband auction concluded after the publication of our October 2013 consultation document.

A8.11 In the May 2014 update on European auctions we set out prices by lot category estimated with the LRP methodology. We presented four scenarios: a base case (which used the original structure of lots categories and included the revenue constraint in the LRP optimisation problem), and three sensitivity scenarios which differed because of the exclusion of the revenue constraint and/or the use of a "condensed" lot structure (that is, the three lot categories for each frequency band were merged into a single category).

A8.12 We also suggested two approaches to identify the most relevant comparators to UK spectrum: the first uses LRP for categories A2, B2 and C1; and the second uses the LRPs calculated with the collapsed lot structure.

Stakeholder responses

Whether award outcomes are likely to reflect market value

Methodological issues

A8.13 AM&A (June 2014 report for H3G and EE, pages 12-13) said that the Austrian values adopted for the benchmarking analysis should be calculated with the revenue constraint in place, in order to be as consistent as possible with our approach to deriving values from the UK auction (albeit they consider that they have not examined the UK LRP calculation in detail).

A8.14 AM&A considered three approaches to the selection of relevant lot categories for each band. They dismissed the LRP calculated with condensed lot structure, on the grounds that this entails a higher sum of maximum excursions across bidders and there is no compelling reason for its use over data from bids for actual lots. They considered the use of A2, B2 and C1 lot categories as a possible option, but noted that none of these are exactly parallel to spectrum auctioned (or previously held) in

the UK, and that this is a level of detail that Ofcom has not applied to other benchmark countries. They preferred, on balance, an approach based on a weighted average, which they considered akin to the approach implicitly used by Ofcom in other benchmark countries.

A8.15 Telefónica (June 2014 response, page 6) said that the lack of access to Austrian bid data severely limits the ability to undertake detailed sensitivity analysis, meaning that confidence in results cannot be established. It (June 2014 response, page 7) further argued that it is unsatisfactory that Ofcom is seeking to use an approach that cannot be verified by operators.

A8.16 Frontier Economics, on behalf of Vodafone (June 2014 response, Annex 1)[20] argued that there are a number of reasons why LRP results may not be robust estimates of market clearing prices in Austria:

- LRP results do not purport to be market clearing prices for blocks of spectrum but are a linear decomposition of package prices, which by its nature averages out the incremental value of blocks of spectrum. Vodafone noted that there may be no decomposition of prices paid into linear prices which would clear the market;

- Winning prices and their decomposition into LRP are likely to be affected by losing bids with a high probability of strategic value (as discussed in more detail below); and

- Without access to the underlying bids data it is impossible to assess the robustness of the LRP calculations.

A8.17 For its own calculations Vodafone (June 2014 response, page 16) used the LRP for A2, B2 and C1 to calculate relative values. It considered that the A2 lots are comparable to the 800 MHz lots without coverage obligation in the UK, and that blocks in categories B2 and C1 are comparable to the equivalent 900 MHz and 1800 MHz blocks in the UK given that, unlike the other lot categories in the Austrian CCA, the entirety of these blocks are available for the whole licence period.

Cross-band comments

A8.18 AM&A (June 2014 report, page 15) considered that, if it is to be included in the benchmarking exercise, the distance method benchmark based on the Austrian results should be categorised as less important evidence because band-specific prices cannot be inferred directly from the Austrian auction (as it was a CCA). They considered that this continues to be the case with respect to band-specific LRPs.

A8.19 Telefónica (June 2014 response, pages 13 to 16) considered that the Austrian benchmark grossly overstates the market value for all spectrum bands in Austria and the UK, and that it should not be included in the benchmarking exercise, on the basis that:

a) Lax spectrum caps meant that it was possible for two bidders to block a third player from acquiring sub-1GHz spectrum and/or any spectrum at all. In light of this, it argued that “it does not make sense that Ofcom could use as a benchmark

[20] Vodafone’s responses to the October 2013 Consultation and the May 2014 update note included detailed submissions from Frontier Economics. For simplicity, in this annex we hereafter refer to any point in these reports as if it were made by Vodafone.

for UK prices bid values that may have been inflated by bidding behaviour explicitly ruled out as unacceptable in the UK auction."

b) The lack of aggregate demand data in most of the clock rounds appears to have created an environment in which operators bid aggressively, fearing they would be left paying proportionately a lot more than rivals for smaller quantities of spectrum. Telefónica said it was to be expected that bidders pushed down to smaller packages would retaliate with aggressive price setting bids in the supplementary round, including bids for packages of spectrum significantly in excess of their real demand that they knew would not win.

A8.20 Vodafone (June 2014 response, pages 16 to 17) argued that there is evidence of prices being influenced "by 'exclusionary' and / or 'price-setting' strategic bids…which may indicate that prices do not fully reflect the true market value of the spectrum". In particular, it considered:

a) The risk of strategic investment to foreclose rivals, given the small number of operators and loose spectrum caps. Vodafone said that this was particularly true for sub-1 GHz spectrum, where the caps allowed a single operator to obtain over half of the available spectrum.

b) The risk of strategic price-driving for 900 MHz and 1800 MHz spectrum, which was being re-auctioned and was likely to have a high incumbent private value.

A8.21 Vodafone linked these points by arguing (June 2014 report, page 37) that a combination of high values for initial "core" blocks of spectrum, and high strategic (foreclosure) valuations for marginal blocks in large packages could lead to large variations in the marginal cost of spectrum depending on the amount of spectrum acquired, and that "the LRP, by effectively averaging out this variation, could result in a significant loss of information". It comments that the risk of LRP over-estimating the prices at which all blocks would be sold is likely to be relatively high because of strategic considerations, the small number of bidders, and the large number of different lots available.

A8.22 Vodafone (June 2014 response, Annex 1) argued that its concerns around strategic bidding are supported by looking at the bidding activity in the Austrian auction:

a) In the clock round, spectrum demand was apparently reduced by multiple blocks in a round for some categories of spectrum. Vodafone said that such behaviour could be a sign of high combinatorial values or of strategic bidding, and that the former was not consistent with the final sale price. It also commented that such behaviour (by H3G) was observed in the UK 4G auction and that "analysis of the UK auction suggests that Hutchison's behaviour in that auction was consistent with strategic bidding."

b) Early in the auction, each of the three bidders bid for packages with 21 eligibility points (the maximum possible under spectrum caps); by the end of the primary round bidding was on packages with a total of 35 eligibility points (out of 41 available), indicating that "at least one bidder (most likely H3G) was bidding for far fewer than 21 points at the end of the primary rounds". Vodafone said that analysis from RTR showed a disproportionate number of supplementary bids for packages with 20 and 21 bid points (65% of the total bids made). It considered that this was evidence of price-setting bids which were not expected to be winning bids, commenting that "only plausible explanations for this behaviour are

bidders attempting to exclude a competitor or…influence the prices paid by others".

A8.23 Vodafone (June 2014 response, page 45) commented that "the limited analyses publicly available from the auction show evidence consistent with strategic bidding", and argued that without access to the bid data it is not possible to assess the robustness of LRPs and in particular the impact of combinatorial effects and strategic bidding on these prices.

900 MHz

A8.24 In addition to its cross-band comments, Telefónica (June 2014 response, page 13) suspected that the value of 900 MHz was likely grossly distorted by fall-out from competition for 800 MHz and, very likely, by price-driving in the 900 MHz band because Telekom Austria and T-Mobile, as 900 MHz operators, had predictable, irreducible demands to protect their legacy businesses.

A8.25 Vodafone (June 2014 response, page 22) said that H3G could strategically bid up the price of 900 MHz at little risk, with the high private values of 900 MHz spectrum meaning that the other two operators would continue to bid for this spectrum significantly above the market clearing price. It further argued that some of the reasons why some operators attached significant private value to the 900 MHz band (e.g. investments in GSM equipment) did not apply to the 800 MHz band, meaning that comparisons between the two bands could have been distorted.

1800 MHz

A8.26 AM&A (pages 43-44) said that one of the issues raised in the appeal against Austria's October 2013 auction is that the inclusion of frequency specific and time specific 1800 MHz lots in the primary-rounds and supplementary round led to strategic bidding, resulting in a high price for 1800 MHz.

A8.27 Telefónica (June 2014 response, page 13) considered that the price of 1800 MHz may have been affected by price-driving in a similar way to 900 MHz, as all three bidders had existing 1800 MHz operations that they needed to continue without interruption.

A8.28 Vodafone (June 2014 response, page 22-23) considered that a combination of strategic bidding and high private values for 1800 MHz likely led to prices bring bid up above market clearing level. It further argued that some of reasons why some operators attached significant private value to the 1800 MHz band (potentially creating opportunities for others to follow a price-driving strategy) did not apply to 800 MHz, meaning that comparisons between the two bands could have been distorted.

800 MHz

A8.29 Vodafone (Annex 4, pp. 86-87) argued the Austrian auction design implied its results were likely to provide limited information about the value of spectrum in the UK, and in particular that the less restrictive 2x20 MHz spectrum caps in the 800 MHz band meant it was likely that Telekom Austria bid aggressively for this spectrum in order to prevent competitors from obtaining it, thereby potentially limiting their ability to compete in the future.

Likelihood of reflecting UK market value

A8.30 Vodafone (Annex 4, page 86) commented that 900 MHz and 1800 MHz spectrum is likely to be more valuable in Austria than in the UK, due to higher AMPU ([✂] compared to [✂]) and higher demand for 2G services (2G penetration was [✂] in Austria compared to [✂] in the UK).

A8.31 Vodafone (June 2014 response, pages 18 to 20) argued that the available evidence suggests spectrum suitable for mobile data services is likely to be more valuable in Austria than in the UK. It said that Austria is the only EU country where the regulator concluded that there is substitutability between fixed and mobile broadband and where the European Commission accepted this finding.[21]

A8.32 Vodafone also referred to the European Commission's finding that in Austria (as well as Finland and Sweden) mobile broadband services are more widely used as a primary connection rather than as a complement to the existing fixed broadband subscriptions.[22] It reported that in Austria there is a higher proportion of users which rely on dedicated mobile access data (17% compared to 8% in the UK),[23] and also a higher level of data consumption per capita (slightly above 5GB per annum per capita, compared to around 4GB per annum per capita in the UK).[24]

Assessment

Whether award outcomes are likely to reflect market value

Methodological issues

A8.33 As we noted in Section 2 (paragraph 2.51), we do not agree with Vodafone's characterisation of LRP as involving averaging.

A8.34 As regards the selection of relevant comparators, AM&A's main reason for its preference for the LRP with revenue constraint is consistency with our proposals in the October 2013 consultation. However our current view is that the UK LRP with revenue constraint for 800 MHz is too low for the purposes of ALF (see Section 2, paragraph 2.43), while using the LRP without revenue constraint mitigates this concern and provides a better fit with the bids (as explained in Section 2, paragraph 2.50). We agree that the original lot structure is preferable for deriving LRP, due to the higher total excursions generated when using a condensed lot structure.

A8.35 In light of the above considerations, we use the Austrian LRP (calculated without revenue constraint) for the Austrian A2 lot category as the relevant comparator for 800 MHz spectrum without coverage obligation and gross of DTT co-existence costs.[25] As for the 900 MHz and 1800 MHz bands, we consider that the LRP without revenue constraint for lot categories B2 and C1 is the most appropriate comparator

[21] RTR *Definition for the market for broadband wholesale access* from December 2009 available at https://www.rtr.at/en/komp/KonsultationTKMVO2003/Marktabgrenzung%20Breitband_nat%20Konsultation.pdf
[22] *Scoreboard 2014 - Trends in European broadband markets 2014* Available at http://ec.europa.eu/digital-agenda/en/news/scoreboard-2014-trends-european-broadband-markets-2014
[23] See Figure 6 in Vodafone's June 2014 report.
[24] See Figure 7 in Vodafone's June 2014 report.
[25] See Section 3, paragraph 3.28 for the definition of value of 800 MHz "gross" and "net" of DTT co-existence costs.

for UK licences, as spectrum in these lot categories is available in its entirety from the start of the licence.[26] In this sense, using a weighted average of lot categories by band, as suggested by AM&A, would reduce the comparability of Austrian and UK spectrum.

A8.36 We consider below Vodafone's concern about the high probability of strategic value in losing bids.

A8.37 We recognise that the auction bids which are used in the derivation of LRPs are not publicly available. However, we do not consider this leads us to modify our view as to the usefulness of the Austrian LRPs for the following main reasons.

a) First, stakeholders are able to verify the software used by RTR for the calculation of LRPs. We published this software[27] along with a user manual.[28] The software is a variation of the version we use to compute LRPs for the UK 4G auction, adapted to the circumstances of the Austrian auction (in terms of lot structure etc.).

b) Second, RTR generate LRPs for four scenarios as explained above. For each scenario, we published not only the LRP results but also the log of the calculations including relevant diagnostic statistics such as the excursions in aggregate and by bidder.[29]

c) Third, there is some information on final clock prices in the public domain which was published by Telekom Austria (in Euros million): 89.7 for 800 MHz; 95.3 for 900 MHz; and 57.8 for 1800 MHz.[30] This information did not distinguish between the three lot categories in each band, but just referred to a single price for each band. We compare the ratios of these final clock prices to the ratios of the LRPs without revenue constraint (with lot categories A2, B2 and C1) in Table A8.1.5. As shown in that table, there is a significant degree of similarity between the ratios of the LRPs and final clock prices.

[26] However, we consider it appropriate to adjust the 900 MHz and 1800 MHz benchmarks to reflect the fact that spectrum only becomes available in 2016.

[27] http://www.ofcom.org.uk/static/consultations/8013%20Annual%20licence%20fees%20for%20900%20MHz%20and%201800%20MHz%20spectrum/AustrianLRP_v1-0.zip

[28] http://stakeholders.ofcom.org.uk/binaries/consultations/900-1800-mhz-fees/update/calculator.pdf

[29] http://www.ofcom.org.uk/static/consultations/8013%20Annual%20licence%20fees%20for%20900%20MHz%20and%201800%20MHz%20spectrum/lrp_base%20case.log; http://www.ofcom.org.uk/static/consultations/8013%20Annual%20licence%20fees%20for%20900%20MHz%20and%201800%20MHz%20spectrum/lrp_without%20rev%20constraints.log; http://www.ofcom.org.uk/static/consultations/8013%20Annual%20licence%20fees%20for%20900%20MHz%20and%201800%20MHz%20spectrum/lrp_condensed.log; and http://www.ofcom.org.uk/static/consultations/8013%20Annual%20licence%20fees%20for%20900%20MHz%20and%201800%20MHz%20spectrum/lrp_without_rev%20constraints_condensed.log

[30] http://cdn1.telekomaustria.com/final/de/media/pdf/TKA_acquires_austrian_spectrum_Presentation.pdf

Table A8.1.5: Comparison of ratios of LRPs and final clock prices

	900 MHz / 800 MHz	1800 MHz / 800 MHz	1800 MHz / 900 MHz
LRPs without revenue constraint	**1.11**	**0.66**	**0.59**
Final clock prices	**1.06**	**0.64**	**0.61**

A8.38 With reference to the information for Austria, even though LRP without revenue constraint is not our preferred method to derive estimates of market value of 800 MHz and 2.6 GHz for the UK 4G auction, we consider that these LRPs still provide useful reference points. Furthermore, the ratio of LRPs in the UK between 2.6 GHz and 800 MHz at 18% (5.7 / 31.2) is similar to the ratio with our preferred figures using the marginal bidder analysis at 17% (5.5 / 32.63).

Cross-band comments

A8.39 We explain in Section 3 (paragraphs 3.48 and 3.70) why we classify relative values from the Austrian auction in tier 1 and not as less important evidence.

A8.40 As set out above, various allegations of strategic bidding were made by stakeholders, in summary as follows:

a) Strategic investment to foreclose spectrum in the auction to competitors in general or specifically sub-1 GHz spectrum (alleged by both Telefónica and Vodafone).

b) Price driving in general in the auction (alleged by Telefónica), specifically in the 900 MHz and 1800 MHz bands (alleged by Vodafone), or by a bidder such as H3G (alleged by Vodafone). Vodafone also commented on why it considered that the available evidence of bidding activity supports the existence of price driving.

A8.41 As we note in paragraph A7.91 our approach to allegations of strategic bidding is to identify the direction of the potential understatement or overstatement, but to judge both the risk and the scale of any effect as being unknown, in the absence of clear evidence that it occurred. Furthermore, the evidence points from the Austrian auction that are most significant in our analysis are the relative values: for 900 MHz, the ratio of 900 MHz to 800 MHz; and for 1800 MHz, the distance of 1800 MHz between 800 MHz and 2.6 GHz.

A8.42 For the allegations of **strategic investment**, we recognise that the overall cap allowed as few as two operators to acquire all spectrum in the auction, and this could potentially raise the prospect of strategic investment for foreclosure. However, unless bidders were able to coordinate successfully, any firm pursuing such a strategy would have to rely on one of its other rivals pursuing the same strategy in order to exclude the third bidder. Otherwise, the first bidder would risk paying more than its intrinsic valuation for spectrum without achieving its strategic objective. We note that, in practice, the available spectrum, including the sub-1 GHz spectrum, was not won by two bidders, so such a foreclosure strategy either was not attempted, or did not succeed.

A8.43 Furthermore, to the extent that bids in the auction reflected strategic investment to foreclose rivals and materially affected band-specific prices, it is not clear that this

would have affected one band more than the others. This applies, for example, to the general allegation of strategic investment to foreclose the spectrum in the auction to competitors. For the allegation of strategic investment in sub-1 GHz spectrum, if this occurred and materially affected the band-specific prices, it could affect the relative values for the distance method for 1800 MHz. But even in this circumstance, there would be no clear implication for the relative value for 900 MHz.

A8.44 In relation to allegations by Telefónica and Vodafone of **price driving**, we recognise that there can be opportunities for price driving in auctions, including in CCAs. However, as discussed in paragraph A7.89 of Annex 7, price-driving can be a risky strategy for operators, as they are unlikely to have full knowledge of rival bidders' intrinsic value of spectrum and/or budget constraint in the auction. To drive prices above market value, bidders would need to make bids for spectrum above their own intrinsic value. If the bidder is not certain that such bids will fail to win, it would be taking a risk in making these bids, because, by definition, winning the spectrum would be unprofitable. The bidder therefore needs to judge whether the risk of losing money and failing to win its most preferred package of spectrum is worth the commercial gain it may perceive from pushing up the prices paid by competitors. In our view, therefore, it would be unreliable to conclude that price driving necessarily occurred just because of a theoretical opportunity to engage in such a bidding strategy.

A8.45 The allegations put forward by stakeholders include suggestions that there were some bids that bidders knew would not win. However, the evidential basis for bidders having such certainty is unclear to us.

A8.46 Furthermore, as for strategic investment, even if price driving occurred, it would only lead to a risk of understatement or overstatement in the relative values if it disproportionately affected some bands compared to others. It is unclear this would be the case for the allegation of price driving in general, or for the suggestion of price driving by H3G.

A8.47 An effect on the relative values is, however, being suggested in the allegation of price driving specifically in 900 MHz and 1800 MHz. In practice, as we discuss below, each of the three operators gained, and lost, some 900 MHz or 1800 MHz spectrum compared to their holdings before the auction (H3G and T-Mobile each lost some 1800 MHz spectrum, while Telekom Austria lost some 900 MHz). This means that an expectation, before the auction, that an operator would outbid rivals for all of the spectrum it previously held would not have been borne out by the results of the auction, and a bidder who followed a price driving strategy based on such an expectation would have risked winning spectrum at prices above its value of that spectrum.

A8.48 We also note that at the end of the clock rounds there was an excess supply of 2x10 MHz in each of the 900 MHz and 1800 MHz bands (i.e. compared to the demand in the final clock round).[31] This further suggests a possible reason why bidders may have considered price driving in the supplementary bids to be a risky strategy, as such excess supply in the final clock round can affect the probability of supplementary bids winning which are for larger packages including these bands.

[31] See slide 7 in the presentation by Telekom Austria, available here: http://cdn1.telekomaustria.com/final/de/media/pdf/TKA_acquires_austrian_spectrum_Presentation.pdf

A8.49 We have considered Vodafone's analysis of bidding activity. While this analysis may, as Vodafone said, be consistent with strategic bidding, we also consider that it could be consistent with other explanations:

a) We do not understand the basis for Vodafone's suggestion that the final sale price was not consistent with demand being reduced by multiple blocks in a clock round. Typically in CCAs the final auction prices are primarily determined by bids in the supplementary round and this is more likely to be the case if there is excess supply of spectrum in the final clock round, as in the Austrian auction. Furthermore, in our view, the parallel that Vodafone draws to H3G's behaviour in the UK 4G auction supports our interpretation, because H3G's clock round bids did not affect the final auction prices in the UK (contrary to Vodafone's apparent allegation).

b) We do not agree that the only plausible explanation for bids for large packages is strategic investment or price driving. Since most of the mobile spectrum in Austria was included in the auction, bidders could have placed bids at their intrinsic values for large packages of spectrum. Furthermore, especially given the excess supply of spectrum in the final clock round, it is unclear to us that there would necessarily have been minimal risk that bids for larger packages than final clock round packages would not be part of any winning combination, as Vodafone suggested. In any case, we do not know which of the bids were the highest losing bids that affected auction prices. Nor, even if there were strategic bidding, is it necessarily the case that relative values were materially affected.

A8.50 In our view, the available evidence does not provide clear evidence for or against the various allegations of strategic bidding that were put forward by stakeholders as materially affecting the relative values we use in our benchmarking analysis. Furthermore, we note that, even if all the bid data were available, it would not necessarily be straightforward to reach reliable conclusions on the allegations as they generally depend on knowledge of bidders' intrinsic values which are not usually publicly known. We therefore consider that the risks and scale of understatement or overstatement arising from the allegations of strategic bidding are unknown.

900 MHz

A8.51 For the Austrian CCA we have band-specific price information that is derived from the bids actually submitted in the auction. The LRP results indicate that all lots sold well above reserve price to the three incumbent bidders.

A8.52 Vodafone and Telefónica argued that the 900 MHz band was particularly susceptible to price-driving. We note that 900 MHz is currently used by some operators for core legacy services. However, Telekom Austria won 2x15 MHz of 900 MHz in the auction, down from pre-existing holdings of 2x20.2 MHz. This suggests that operators could not be sure that incumbent spectrum owners would be the highest-value bidders for this spectrum, making a price-driving strategy particularly risky.

A8.53 Overall, taking into account our cross-band assessments of the possibility of strategic investment and price driving, we consider that the 900 MHz auction price carries a risk of overstatement of Austrian market value, but the likelihood and scale of this risk is unknown.

1800 MHz

A8.54 The LRP results indicate that all 1800 MHz lots in the Austrian auction sold well above reserve price to the three incumbent bidders.

A8.55 We agree that the use of frequency-specific lots could potentially make it easier for operators to identify lots for which rival operators are likely to have significantly higher valuations due to existing holdings. This increases their ability to bid in excess of their intrinsic true value without incurring a high risk of winning such lots, as discussed at paragraph A7.89. However, it does not remove the risk that operators will acquire a certain spectrum allocation for more than they value it at.

A8.56 T-Mobile won 2x20 MHz of 1800 MHz, down from pre-existing holdings of 2 x 24.8 MHz. This suggests that operators could not be sure that incumbent spectrum owners would continue bidding for spectrum above the market clearing price, making such a strategy more risky.

A8.57 Overall, taking into account our cross-band assessments of the possibility of strategic investment and price-driving, we consider there is a risk that the 1800 MHz auction price carries a risk of overstatement of Austrian market value, but that the likelihood and scale of this risk is unknown.

800 MHz

A8.58 The LRP results show that all lots sold well above reserve price to the three incumbent bidders. The Austrian results are also around twice as high as the UK LRP for 800 MHz. We discuss the potential for strategic bidding across all bands above. In view of this, we consider that the 800 MHz price carries an unknown risk of overstating 800 MHz market value in Germany (of an unknown scale).

2.6 GHz

A8.59 We received no specific comments about the price of 2.6 GHz by respondents.[32] We have labelled the likelihood, scale and direction of risk as “none” in the table below.

Likelihood of reflecting UK market value

A8.60 As discussed in paragraphs A7.62 to A7.74, we do not consider that there are strong reasons, in principle, to expect a clear relationship between market profitability and spectrum values, or between demand for 2G services and spectrum value. In addition, the available evidence does not provide strong grounds for considering either such relationship to exist. We do not consider differences from the UK in either of these factors to be a basis for considering that the market value in Austria overstates the UK market value.

A8.61 To the extent that the higher take up of mobile broadband makes it more valuable in Austria (in particular, for the marginal bidder) than in the UK, it is unclear that such an effect is more prominent for one spectrum band over the others.

[32] We are aware that package prices in the Austrian CCA for paired and unpaired 2.6 GHz spectrum were non-linear across package size and non-uniform across bidders. Our 2.6 GHz benchmark is the simple average of the price per MHz of the two packages that only included paired 2.6 GHz spectrum (Orange’s 2x10 MHz package and T-Mobile’s 2x20 MHz package).

Relative benchmarks

A8.62 In summary, we have derived the benchmarks for the Austrian CCA as follows:

- We use the LRPs of lot categories A2, B2 and C1 as basis for deriving benchmarks of respectively 800 MHz, 900 MHz and 1800 MHz in the UK, on the basis that they have the closest licence characteristics to UK spectrum.
- We add the present value of annual fees of Euros 348.828 per 2x5 MHz block, due by spectrum holders over the lifetime of the auction; [33]
- We then derive UK equivalent absolute benchmarks using the benchmarking methodology set out in Annex 7; and
- To derive relative benchmarks, we use the paired ratios and Y/X ratio implied by Austrian absolute benchmarks in conjunction with the UK values of 800 MHz (without coverage obligation and gross of DTT co-existence costs) and 2.6 GHz spectrum.[34]

A8.63 As set out above, Telekom Austria published the final clock prices on its website. These final clock prices, which AM&A used in their analysis before LRPs were available, are broadly consistent with the relative values between bands indicated by the LRPs described above.

A8.64 In interpreting these evidence points we note the risk that prices for 900 MHz and 1800 MHz spectrum overstate market value in Austria. We also consider that there is a risk of overstatement in the 800 MHz price due to the possibility of strategic investment. In all cases, the likelihood and scale of these risks are unknown; in particular, we are not in a position to assess whether these risks affected one band more than another. As a result, we consider that there is a risk that the 900 MHz / 800 MHz paired ratio and distance method benchmarks understate or overstate UK market value, but that the likelihood, scale and direction is unknown.

A8.65 The following table summarises the available benchmarks (along with our interpretation of them) from the Austrian award:

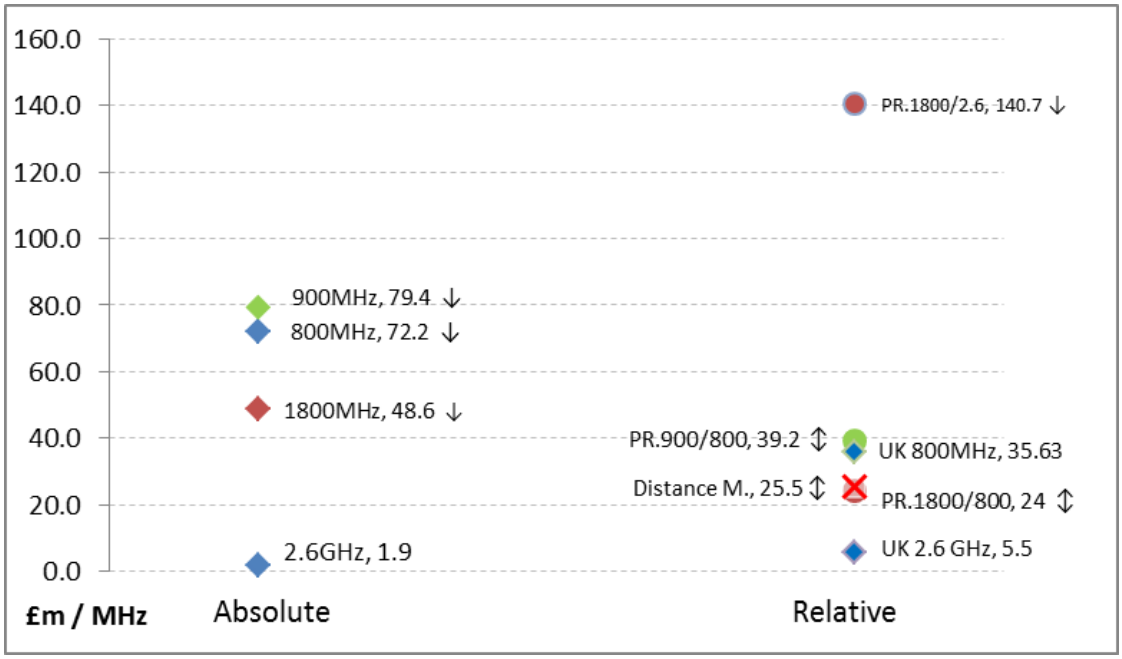
[33] The fee (581,38 Euro per month for 200 kHz) is set in the ordinance "Telekommunikationsgebührenverordnung - TKGV", available here: www.ris.bka.gv.at

[34] We acknowledge that there is a three year time gap between the multiband CCAs and the 2.6 CCAs, so expectations behind bids for 2.6 GHz in 2010 may not be entirely comparable with the expectations bidders had during the Austrian CCA in 2013. However, both auctions were within the time window of our sample with prices determined by bidding in the auction.

Table A8.1.6: Summary of evidence points from Austria

	800	900		1800				1800 /900	2.6
	Abs.	900 /800	Abs	Dist. Meth.	1800 /800	1800 /2.6	Abs.	%	Abs.
Values	72.2	**39.2**	79.4	**25.5**	24	140.7	48.6	61%	1.9
Tier		**First**		**First**					
Likelihood	Unkn	**Unkn.**	Unkn.	**Unkn.**	Unkn.	Unkn.	Unkn.	Unkn.	None
Scale of risk	Unkn.	**Unkn.**	Unkn.	**Unkn.**	Unkn.	Unkn.	Unkn.	Unkn.	None
Direction	Over	**Unkn.**	Over	**Unkn.**	Unkn.	Over	Over	Unkn.	None

Figure A8.1.1: Summary of evidence points from Austria



◆= Absolute values; ●= paired ratios; ✖= Distance Method benchmark
↑= risk of understatement; ↓= risk of overstatement; ↕= risk of understatement or overstatement
For all figures of this type in this annex, we take the relevant UK 800 MHz comparator as outlined in Section 3, Tables 3.2 and 3.3.

Czech Republic

November 2013 multiband award

Description: Award of spectrum in the 800 MHz, 1800 MHz and 2.6 GHz bands using a SMRA auction format.[35]

Context: There were five participants (the three winning bidders and two new applicants, Sazka Telecommunications and Revolution Mobile) in the auction. The Czech regulator, CTU, had previously broken off the auction on 8 March 2013 after bids became too inflated, reaching over CZK 20bn when CTU halted the process.[36]

Table A8.2.1: November 2013 multiband auction results[37]

Operator	800 MHz	1800 MHz	2.6 GHz paired	2.6 GHz unpaired	Price paid
Total available	2 x 30	2 x 24.8	2 x 70	45	CZK 8.5bn
T-Mobile	2 x 10	2 x 2	2 x 20	-	CZK 2.6bn
Telefónica	2 x 10	2 x 3	2 x 20	-	CZK 2.8bn
Vodafone	2 x 10	2 x 4	2 x 20	-	CZK 3.1bn
Unsold	-	2 x 15.8	2 x 10	45	-

Table A8.2.2: November 2013 multiband auction design

	Description	Implications
Number of bidders / number of lots?	There were five bidders – three incumbents and two new applicants 1800 MHz was available in one 2x15.8 MHz lot and nine 2x1 MHz lots	For each band, the overall number of lots exceeded the number of potential bidders.
Spectrum caps / Restrictions	800 MHz: A 2x10 MHz cap. Lot A3 (2x10 MHz) was initially reserved for new entrants but was eventually won by Vodafone. 1800 MHz: 2x23 MHz cap (including existing holdings). The 2x15.8 MHz block was reserved for new entrants. 2.6 GHz paired: A minimum 2x10 MHz bid and a 2 x 20 MHz cap 2.6 GHz unpaired: A minimum 15 MHz bid	The 800 MHz cap was binding for all three winners. The 2.6 GHz paired cap was also binding for all three winners.
Reserve prices	2.6 GHz paired spectrum sold at reserve price. 800 MHz and 1800 MHz lots sold slightly above reserve price.	

[35] http://www.ctu.eu/main.php?pageid=341&page_content_id=5597
[36] http://www.telecoms.com/122442/regulator-stops-czech-auction-over-pricing-worries/
[37] http://www.ctu.eu/164/download/Spectrum%20Auction/2013/invitation_to_tender_15_08_2013_summary_auction_results_20_11_2013.pdf

Obligations	800 MHz: Obligation to provide coverage[38] over seven years to an increasing number of specified residential districts, with priority for a group of districts where thinly populated areas prevail. Requirement for a minimum service speed (initially 2Mbps, increasing to 5Mbps after seven years).[39] 1800 MHz: Obligation on the winner of the 2x15.8 MHz lot to provide coverage to 50% of the population within eight years, with a minimum speed (download) of 2Mbps, increasing to 5Mbps after this period.[40] 2.6 GHz paired: Obligation to provide coverage to 10% of the population within seven years, with a minimum speed (download) of 2Mbps, increasing to 5Mbps after this period.[41] Obligation to provide wholesale access to MVNOs[42].

Our position in the October 2013 consultation

A8.66 This auction concluded after the publication of our October 2013 consultation.

Stakeholder responses

Whether award outcomes are likely to reflect market value

1800 MHz

A8.67 Telefónica (page 91) noted that the price for 1800 MHz in the Czech Republic was lower than any other country in Europe. It said that this might be explained by the fact that:

- Incumbents could only bid on incremental 2x1 MHz blocks positioned in between existing assignments, in contrast to the situation in most recent European auctions where 1800 MHz was sold in 2x5 MHz lots suitable for LTE. The implication of this is that smaller chunks of 1800 MHz spectrum may have much lower value than coherent 2x5 MHz LTE lots; and

- There were obvious market-sharing outcomes in the 1800 MHz band, given existing 1800 MHz assignments, so it is possible that competition was stalled owing to demand reduction incentives.

A8.68 Telefónica (page 91) considered that it was reasonable to exclude relative 1800 MHz values from the Czech Republic from the benchmarking exercise, on the basis that the price for 1800 MHz likely understates market value.

[38] Coverage is defined as 95% of the population, with 75% probability of indoor coverage without the use of an external antenna and with an 85% probability of indoor coverage with the use of an external antenna.
[39] http://www.ctu.cz/cs/download/vyberova_rizeni/invitation_to_tender_15_08_2013.pdf, section 5.3.1
[40] http://www.ctu.cz/cs/download/vyberova_rizeni/invitation_to_tender_15_08_2013.pdf, section 5.3.2
[41] http://www.ctu.cz/cs/download/vyberova_rizeni/invitation_to_tender_15_08_2013.pdf, section 5.3.3
[42] http://www.ctu.cz/cs/download/vyberova_rizeni/invitation_to_tender_15_08_2013.pdf, section 5.7.2

A8.69 Vodafone (June 2014 response, page 13) argued that the Czech auction would provide only limited information about the market value of 1800 MHz in the UK. It said that this is because the auction included significant measures to promote new entry and was undertaken twice, with the 2x15.8 MHz of 1800 MHz which was reserved for a new entrant going unsold.

800 MHz

A8.70 Telefónica (June 2014 response, page 18) noted that 2x10 MHz of spectrum was reserved for a new entrant, but no entrant bids were received for this lot, and so it was opened up to incumbent bidders. It said this implies that the reserve price may have exceeded the value of the spectrum to a marginal bidder.

2.6 GHz

A8.71 Telefónica (June 2014 response, page 18) said that the 2.6 GHz band did not attract any competition. It suggested that entrant bidders were deterred from pursuing this spectrum because the price of complementary 800 MHz spectrum was above their willingness to pay.

Assessment

Whether award outcomes are likely to reflect market value

1800 MHz

A8.72 The fact that the 2x15.8 MHz block of spectrum went unsold might suggest that the price was set above market value. However, the three incumbent bidders were excluded from bidding for this spectrum. It is possible that they valued it at more than reserve price and would have competed for it in the absence of the spectrum reservation.

A8.73 The 2x1 MHz lots that were purchased by the incumbents sold at just above reserve price. As Telefónica observed, though, these were located in between existing spectrum assignments and were therefore worth significantly more to particular operators, depending on their pre-auction holdings of 1800 MHz. This may have served to reduce competition among incumbent operators, and also new entrants, for individual 2x1 MHz lots. If so, it means that the average price for the 2x1 MHz lots of 1800 MHz is significantly lower than the market value in the Czech Republic of a 2x5 MHz block suitable for LTE.

A8.74 In view of this, we consider that there is a larger risk that the price of 1800 MHz understates market value in the Czech Republic, but of unknown scale.

800 MHz

A8.75 All 800 MHz spectrum sold to the three incumbents after the entrants had passed up the opportunity to bid for lot A3. Telefónica said that this suggests the reserve price for 800 MHz was above the marginal bidder's value. However, the fact that all but one lot sold slightly above reserve price indicates a degree of competition among incumbent operators for 800 MHz, and we cannot rule out the possibility that, in the absence of the 2x10 MHz cap, the incumbents would have competed for more spectrum in this band. Overall, we consider that the price for 800 MHz spectrum is likely to be reflective of market value in the Czech Republic.

2.6 GHz

A8.76 The fact that 2x10 MHz of 2.6 GHz spectrum went unsold might suggest that the price was set above market value. However, the three incumbent bidders all purchased up to their spectrum cap. In the absence of these caps, there would likely have been competition for 2.6 GHz lots, which would have raised auction prices above reserve. We therefore consider that there is a larger risk that the 2.6 GHz price understates market value in the Czech Republic, but that the scale of this understatement is unknown.

Likelihood of reflecting UK market value

A8.77 Respondents did not comment that market value in the Czech Republic may understate or overstate UK market value.

A8.78 We have not identified country-specific factors that may have such an effect.

Relative benchmarks

A8.79 We have sufficient information from the Czech auction from all relevant bands (i.e. 800 MHz, 1800 MHz and 2.6 GHz) to apply the distance method. We also use the absolute value of 1800 MHz as a cross-check against our proposed 1800 MHz LSV.

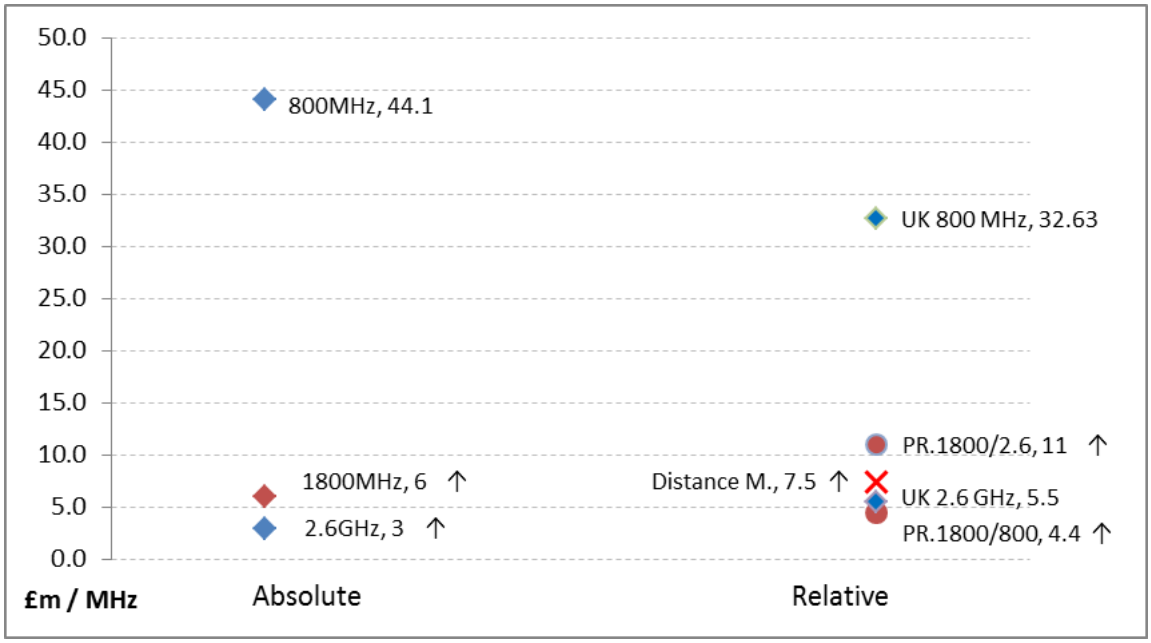
A8.80 In interpreting the evidence points, we consider that the price of 1800 MHz carries a larger risk of understating market value in the Czech Republic (with unknown scale) due to the lot structure in the auction and the tight spectrum caps / reservations. The 2.6 GHz price also understates market value with unknown likelihood and scale. For similar proportional understatements of the 1800 MHz and 2.6 GHz band, the net effect on the distance method is one of understatement. Hence, on balance, we consider that the distance method benchmark carries a larger risk of understatement of UK market value of unknown scale.

A8.81 The following table summarises the available benchmarks (along with our interpretation of them) from the Czech award:

Table A8.2.3: Summary of evidence points from the Czech Republic

	800	1800				2.6
	Abs.	Distance Method	1800/800	1800/2.6	Abs.	Abs.
Values	44.1	**7.5**	4.4	11	6	3
Tier		**Third**				
Likelihood	None	**Larger**	Larger	Larger	Larger	Larger
Scale of risk	None	**Unknown**	Unknown	Unknown	Unknown	Unknown
Direction	None	**Under**	Under	Under	Under	Under

Figure A8.2.1: Summary of evidence points from the Czech Republic



◆= Absolute values; ●= paired ratios; ✖= Distance Method benchmark
↑= risk of understatement; ↓= risk of overstatement; ↕= risk of understatement or overstatement;

Denmark

May 2010 2.6 GHz award

Description: Award of 2.6 GHz spectrum using a CCA format.[43]

Context: Denmark has four MNOs: TDC, Telenor, Telia and Hi3G.

Table A8.3.1: May 2010 2.6 GHz auction results

	2.6 GHz	Unpaired 2.6 GHz	Price Paid
Total Available	2x70	50	-
TDC	2x20	-	€44.8m
Telenor	2x20	10	€44.8m
Telia	2x20	15	€45.2m
Hi3G	2x10	25	€953k
Unsold	-	-	-

Table A8.3.2: May 2010 2.6 GHz auction design

	Description	Implications
Number of bidders; number of lots; lot sizes	4 bidders. Paired 2.6 GHz spectrum sold in 2x5 MHz lots, while unpaired 2.6 GHz spectrum sold in 5 MHz lots.[44]	It was possible for all bidders to win at least one licence in the auction.
Spectrum caps / Restrictions	A 2x20 MHz cap applicable to all bidders.	This was binding for the 3 largest incumbents – TDC, Telenor and Telia.
Reserve prices	TDC, Telia and Telenor acquired spectrum above reserve price. Hi3G acquired 2x10 MHz at reserve price because the three largest incumbents purchased up to their spectrum cap.	
Obligations	No coverage obligations.[45]	

[43] See page 14: http://www.dotecon.com/assets/images/dp1001.pdf
[44] See: http://www.dotecon.com/assets/images/dp1001.pdf
[45] See: http://m.policytracker.com/headlines/danish-2.6-ghz-auction-raises-50-times-more-than-dutch-auction

September 2010 900 MHz and 1800 MHz award

Description: 900 MHz and 1800 MHz spectrum was re-farmed and offered for sale by auction. The 3 largest incumbents were not allowed to participate. This was an attempt to improve competition in the downstream market by encouraging new entry.[46]

Table A8.3.3: September 2010 multiband auction results

	900 MHz	1800 MHz	Price Paid 900 MHz	Price Paid 1800 MHz
Total Available	2x5	2x10	-	-
Hi3G	2x5	2x10	DKK 4m	DKK 8m
Unsold	-	-	-	-

Table A8.3.4: September 2010 multiband auction design

	Description	Implications
Number of bidders; number of lots; lot sizes	One bidder entered the auction, 1 lot available in each band.	N/A
Spectrum caps / Restrictions	No caps.	N/A
Reserve prices	Licences were sold at the reserve price due to no excess demand.	
Obligations	No coverage obligations.	

[46] See: http://dba.erhvervsstyrelsen.dk/900-1800-mhz-auction

June 2012 800 MHz award

Description: Award of the 800 MHz spectrum using a CCA format.[47]

Table A8.3.5: June 2012 800 MHz auction results

	800 MHz	Price Paid[48]
Total Available	2x30	-
TDC	2x20	DKK627.8m
Telenor	2x10	DKK111.5m
Telia		
Hi3G	-	-
Unsold	-	-

Note: 2x10 MHz was won by TT-Netvaerket which is a joint venture between Telenor and Teliasonera.

Table A8.3.6: June 2012 800 MHz auction design

	Description	Implications
Number of bidders; number of lots; lot sizes	There were 3 bidders.[49] Telenor and Telia bid as a joint venture. The spectrum was available as one lot of 1 2x10 MHz (subject to usage restrictions to protect DTT users) and 4 2x5 MHz lots.[50]	Telenor and Telia participated in the auction in the form of the joint venture between them (TT), and won the 2x10 MHz lot of 800 MHz.
Spectrum caps / Restrictions	A 2x20 MHz cap applicable to all bidders.	The cap was binding for TDC.
Reserve prices	800 MHz spectrum was sold above reserve prices.	
Obligations	An obligation to ensure average download access speeds of at least 10 Mbit/s outdoors across 207 post code areas. Operators were not explicitly required to use the 800 MHz spectrum to meet this.[51] An innovative component allowed bidders to bid for regional exemptions from the coverage obligation imposed on the 800MHz licences.[52] Strict coexistence restrictions on 800 MHz band.	

[47] See: http://www.dotecon.com/news/danish-800mhz-auction-completed/
[48] See: http://dba.erhvervsstyrelsen.dk/800-mhz-auction
[49] See: http://dba.erhvervsstyrelsen.dk/800-mhz-auction
[50] See page 2: http://erhvervsstyrelsen.dk/file/251159/information-memorandum-800mhz-auction.pdf
[51] See pages 10-11: http://erhvervsstyrelsen.dk/file/251159/information-memorandum-800mhz-auction.pdf
[52] See: http://www.dotecon.com/news/danish-800mhz-auction-completed/

Our position in the October 2013 consultation

A8.82 In our October 2013 consultation, we noted that both 900 MHz and 1800 MHz spectrum sold at very low prices as a result of the three largest operators not being allowed to bid. On this basis we considered that the Danish auctions provide less important evidence when deriving ALFs for 900 MHz and 1800 MHz licences in the UK.

Stakeholder responses

Whether award outcomes are likely to reflect market value

Cross-band comments

A8.83 AM&A (page 48) said that the prices of 900 MHz and 1800 MHz in Denmark were significantly below market value because bidders were excluded from the September 2010 auction, and that these benchmarks should therefore be excluded from the evidence base.

A8.84 Vodafone (Annex 4, page 82) said that, with regard to the 900 MHz and 1800 MHz bands, "the extent to which price paid can be interpreted as market value is somewhat unclear" given that there was only one bidder who obtained spectrum at a nominally low reserve price.

900 MHz

A8.85 Telefónica (page 59) noted that the Danish regulator tried to attract a new entrant bidder, and said that "the fact that none was forthcoming means we cannot rule out the possibility that the 900 MHz reserve price was above market value, even if this seems less likely than the opposite conclusion."

A8.86 With regard to the 900 MHz / 800 MHz paired ratio, Telefónica (page 74) said that the Danish benchmark should be included but that there is a greater risk that this ratio understates rather than overstates the 900 MHz price, given that competitive pressures in the 800 MHz auction were stronger than in the 900 MHz auction.

1800 MHz

A8.87 Telefónica (page 83) argued that the absolute 1800 MHz value is likely to significantly understate rather than overstate the UK price, given uncertainty over the competitiveness of the 1800 MHz award, and (page 94) that the 1800/800 MHz paired ratio is more likely to understate as competitive pressures were stronger in the 800 MHz auction. It also said (page 102) that the 1800 MHz / 2.6 GHz paired ratio should be discarded as it implies a value of 2.6 GHz significantly above 1800 MHz and so is not plausible as a benchmark.

800 MHz

A8.88 AM&A (page 47) said that the comparatively low 800 MHz auction price was in large part due to two of the incumbent operators, Telenor and Telia, bidding jointly, which reduced the number of potential bidders in the auction from four to three.

2.6 GHz

A8.89 AM&A (page 47) said that the 2.6 GHz auction was significantly more competitive than the other Danish auctions and noted that it led to a price that was nearly ten times that of the 1800 MHz band.

Likelihood of reflecting UK market value

A8.90 Telefónica (page 83) said that the value of 1800 MHz in Denmark is more likely to understate the corresponding UK value because of the change in sentiment towards the 1800 MHz LTE ecosystem between 2010 and 2013.

A8.91 Vodafone (Annex 4, page 82) said that the market value of 900 MHz and 1800 MHz spectrum is likely to be higher in Denmark than the UK, due to higher AMPU [✂] compared to [✂]) and higher demand for 2G services (as 2G penetration and voice usage per user were both higher in Denmark compared to the UK).

Assessment

Whether award outcomes are likely to reflect market value

Cross-band comments

A8.92 As discussed in our assessment of the individual bands below, we agree with AM&A that the 900 MHz and 1800 MHz prices from Denmark risk understating market value in Denmark.

900 MHz

A8.93 Telefónica suggested that the lack of any new entrant bidders could possibly have been due to the reserve price being above market value. However such an interpretation would require us to expect that none of the incumbent operators who were excluded from bidding would have valued this spectrum above the reserve price. We do not consider that there is any basis for such an expectation. We consider that there is a larger risk that the 900 MHz price is a larger understatement of market value in Denmark.

1800 MHz

A8.94 In Denmark, 2x10 MHz of 1800 MHz was purchased by the only bidder (Hi3G) at reserve price, and the three largest incumbents were excluded from the auction. We consider there is a larger risk that this price is a larger understatement of market value in Denmark.

800 MHz

A8.95 In Denmark, 800 MHz spectrum was sold above reserve price. There is a risk that the joint venture may have reduced the intensity of competition in the auction.[53] On balance, we consider that the absolute 800 MHz price in Denmark carries an unknown risk of understatement of Danish market value of unknown scale.

[53] We note that the Danish Competition Council (DCC) raised a competition concern about the joint venture, but this related to a possible future imbalance in spectrum holdings and was addressed by an undertaking from the parties.

2.6 GHz

A8.96 Most 2.6 GHz spectrum sold above reserve price (Hi3G acquired 2x10 MHz at reserve price because the three largest incumbents purchased up to their spectrum cap). We consider that the price for 2.6 GHz, based on the winning bids by TDC, Telia and Telenor, is reflective of market value in Denmark.

Likelihood of reflecting UK market value

A8.97 As discussed in paragraphs A7.62 to A7.74, we do not consider that there are strong reasons, in principle, to expect a clear relationship between market profitability and spectrum values, or between demand for 2G services and spectrum value. In addition, the available evidence does not provide strong grounds for considering either such relationship to exist. In our assessment of the Danish benchmarks, we do not consider differences from the UK in either of these factors to be a basis for considering that the market value in Denmark overstates UK market value.

A8.98 We discussed above that the actual auction price for 1800 MHz is unlikely to be reflective of market value in Denmark. In paragraphs A7.83 to A7.84, we note that 1800 MHz was not widely seen as a core LTE band until between late 2011 and early 2012, and that there was much less certainty about the development of an LTE1800 MHz ecosystem in 2010. Given that 1800 MHz was auctioned in Denmark in September 2010, we consider that this creates a larger risk that the market value of 1800 MHz in Denmark at the time of the Danish auction is a larger understatement of the UK market value of 1800 MHz today.

Relative benchmarks

A8.99 We have not calculated a distance method benchmark because 2.6 GHz spectrum sold for more than 1800 MHz spectrum in Denmark, meaning that a distance method benchmark would be a negative number. We consider that, in any case, any benchmark for 1800 MHz based on the award of this band in Denmark would at best be third-tier evidence.

A8.100 In interpreting the evidence points for the 900 MHz / 800 MHz paired ratio, we consider that:

a. The price of 900 MHz carries a larger risk of larger understatement of Danish market value, given the absence of competition for the single lot of 2x5 MHz (which was acquired by Hi3G at reserve price).

b. Because there was competition for 800 MHz spectrum, the resulting price exceeded reserve price. However, the presence of the joint venture means that there is an unknown risk that it understates market value in Denmark (of unknown scale).

c. We therefore consider that, while there is a risk that the prices of both 900 MHz and 800 MHz understate market value in Denmark, the likelihood and scale of this risk is stronger for 900 MHz than 800 MHz. Hence we consider that the 900

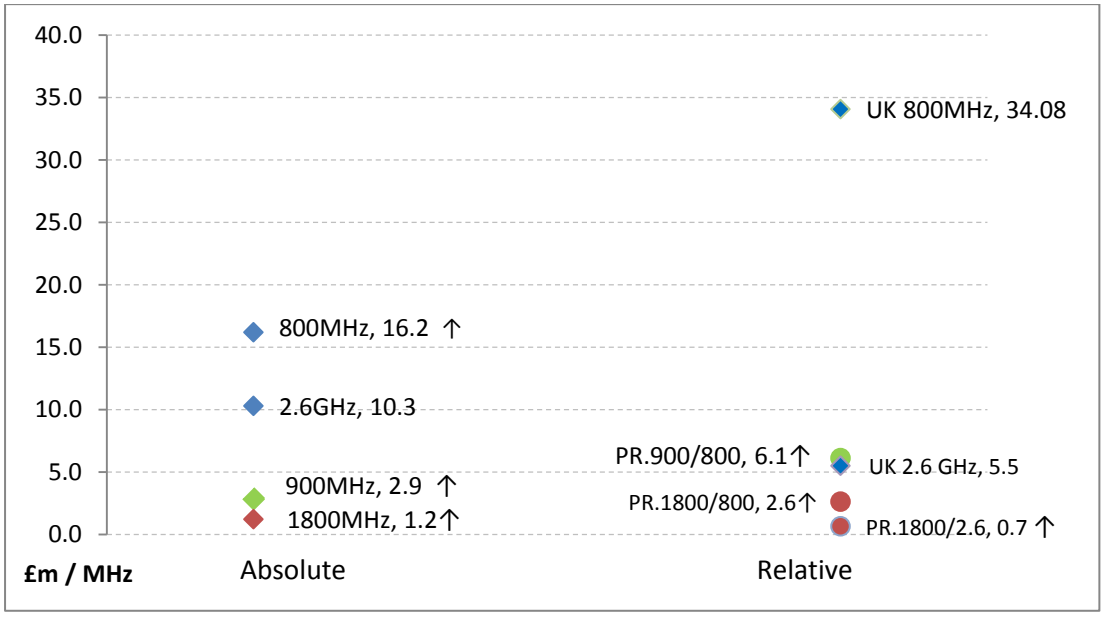
MHz / 800 MHz paired ratio also carries a larger risk of larger understatement of UK market value.

A8.101 The following table summarises the available benchmarks (along with our interpretation of them) from the Danish award:

Table A8.3.7: Summary of evidence points from Denmark

	800	900		1800				1800 /900	2.6
	Abs.	900 /800	Abs.	Dist. Meth.	1800 /800	1800 /2.6	Abs.	%	Abs.
Values	16.2	**6.1**	2.9	**N/A**	2.6	0.7	1.2	43%	10.3
Tier		**Third**							
Likelihood	Unknown	**Larger**	Larger	**N/A**	Larger	Larger	Larger	Unkn.	None
Scale of risk	Unknown	**Larger**	Larger	**N/A**	Larger	Larger	Larger	Unkn.	None
Direction	Under	**Under**	Under	**N/A**	Under	Under	Under	Unkn.	None

Figure A8.3.1: Summary of evidence points from Denmark



◆= Absolute values; ●= paired ratios; ✖= Distance Method benchmark
↑= risk of understatement; ↓= risk of overstatement; ↕= risk of understatement or overstatement;

Germany

May 2010 multiband auction

Description: Award of spectrum in the 800 MHz, 1800 MHz, 2.1 GHz and 2.6 GHz bands through an SMRA format.

Context: At the time of the award there were four MNOs in Germany: T-Mobile (Deutsche Telekom), Vodafone, Telefónica and E-Plus.[54] In contrast to other European countries, the fourth largest operator has similar spectrum holdings to the other incumbents. Telefónica has a slightly smaller subscriber share than E-Plus, but E-Plus only has access to a small amount of sub-1 GHz spectrum.

Table A8.4.1: May 2010 multiband auction results

	800 MHz	1800 MHz	2.1 GHz	2.1 GHz unpaired	2.6 GHz	2.6 GHz unpaired	Price Paid
Total Available	2x30	2x25	2x20	19.2	2x70	50	-
T-Mobile	2x10	2x15	-	-	2x20	5	€1.3bn
Vodafone	2x10	-	2x5	-	2x20	25	€1.4bn
Telefónica	2x10	-	2x5	19.2	2x20	10	€1.4bn
E-Plus	-	2x10	2x10	-	2x10	10	€284m
Unsold	-	-	-	-	-	-	-

Table A8.4.2: May 2010 multiband auction design

	Description	Implications
Number of bidders; number of lots; lot sizes	All spectrum in the auction was sold in 2x5 MHz lots with the exception of the unpaired 2.1 GHz which was sold as a single 1x5 MHz lot and a single 1x14.2 MHz lot.	There was potential for all operators to win spectrum from each band with the exception of the unpaired 2.1 GHz.
Spectrum caps / Restrictions	For 800 MHz, T-Mobile and Vodafone were subject to a cap of 2x10 MHz, E-Plus and Telefónica were subject to a cap of 2x15 MHz, and new entrants were limited to 2x20 MHz.	Both T-Mobile and Vodafone reached the cap imposed on them with respect to 800 MHz spectrum. Telefónica did not win the maximum allowed under its cap.
Reserve prices	Spectrum sold above reserve prices	
Obligations	An obligation on winners of licences in the 800 MHz band to roll-out mobile broadband to low density areas first.	

[54] We note that the EC has approved the acquisition of E-Plus by Telefónica subject to commitments.

Our position in the October 2013 consultation

A8.102 In our October 2013 consultation we considered that there were obvious contenders for the available spectrum in the 1800 MHz band among the incumbent operators.

A8.103 We considered that Germany provided less important evidence when deriving ALFs for 1800 MHz licences in the UK.

Stakeholder responses

Whether award outcomes are likely to reflect market value

1800 MHz

A8.104 AM&A (page 49) challenged the notion that there were obvious contenders for the lots available in the 1800 MHz band. It commented that:

a. One of the two lots which were sandwiched by existing holdings was won by E-Plus, which was not an adjacent spectrum holder, suggesting that the fragmented nature of the available spectrum did not materially impact demand. As further evidence for this point, they noted that the prices for these two lots were higher than the prices for the three contiguous lots;

b. The remaining three lots could be won as a contiguous 2x15 MHz block. This block is sufficiently large to be of value to all bidders, not just adjacent bidders.

A8.105 AM&A (page 50) proposed to treat the Germany 1800 MHz distance method benchmark as more important evidence.

A8.106 Telefónica (page 82) said it is inconsistent to treat Germany as less important evidence, given that spectrum sold above reserve, while classing benchmarks from other auctions in which 1800 MHz sold at reserve price as more important.

A8.107 Telefónica (page 82) also commented that demand reduction in the context of an SMRA format is possible, but said that "another explanation is that there was a significant quantity of high frequency spectrum in the auction, and at the prevailing prices, demand from the four incumbents was fully sated, revealing a true market price". It considered (p. 93) that our conclusion with regard to demand reduction in 1800 MHz is overstated.

A8.108 Vodafone (Annex 4, p. 84) commented that auction prices for 1800 MHz likely reflect market value in Germany, but also said that "there seems to be some indication that the competition for 1800 MHz might have been restricted by the specific distribution of the current spectrum holdings. This might have reduced the competition in 1800 MHz band leading to auction outcomes underestimating the market value in the UK".

800 MHz

A8.109 Telefónica (page 93) disagreed with the view that operators' demand for 800 MHz might have been restricted by spectrum caps, reducing the winning bids, but did not provide any arguments or evidence in support of this view.

2.6 GHz

A8.110 Telefónica (pages 101-102) noted DotEcon's comments that 2.6 GHz (paired and unpaired) prices were driven mostly by bidders trying to 'park' eligibility rather than genuine demand for incremental spectrum. Telefónica commented that the 1800 MHz / 2.6 GHz ratio has a greater risk of understating rather than overstating the market value of 1800 MHz, and that "it seems reasonable to treat this benchmark as suspect".

Likelihood of reflecting UK market value

A8.111 Telefónica (page 93) commented that "There has been a very substantial positive shift in market sentiment towards 1800 MHz as an LTE band in the years since the German auction, and it seems quite likely that German operators bidding for 1800 MHz in 2010 undervalued this spectrum". It argued that the 1800 MHz auction price in Germany, and all relative values, are more likely to understate than overstate the UK value of 1800 MHz.

A8.112 Vodafone (Annex 4, p. 84) commented that 1800 MHz spectrum is likely to be more valuable in Germany than the UK due to higher AMPU (by approximately [✂]). It also commented that 2G (only) penetration rates were more than double the UK, but voice usage per customer was [✂] lower than in the UK, leaving the overall effect of 2G spectrum demand on market value unclear.

Assessment

Whether award outcomes are likely to reflect market value

1800 MHz

A8.113 In the 1800 MHz band, there were five 2x5 MHz blocks available. Blocks A, B and C were offered as frequency-generic lots and were adjacent to a 2x5 MHz block held by T-Mobile. Two frequency-specific blocks (D and E) were located between spectrum holdings of T-Mobile and Telefónica, and Vodafone and E-Plus respectively.

Figure A8.4.1: 1800 MHz spectrum holdings in Germany (pre and post auction):

	Available in auction
	T-Mobile
	Telefónica
	E-Plus
	Vodafone

A8.114 Blocks A, B, C and E were each won by the only bidder, respectively T-Mobile and E-plus, who was in a position (given pre-auction adjacent holdings) to use them to create a 2x20 MHz block of contiguous bandwidth.[55]

A8.115 AM&A's first point relates to Block D, which was won by E-Plus despite being adjacent to spectrum held by T-Mobile and Telefónica. We recognise that this is an exception to the pattern described above of blocks being won by bidders who held adjacent spectrum. However, it is possible that this outcome was due to strategic bidding in the band in the form of signalling[56]:

a) Telefónica's bids raised the price of Block E significantly. Cramton and Ockenfels suggest that this strategy could be interpreted as an attempt at 'punishing' E-Plus for bidding aggressively in the 800 MHz band, and that E-Plus responded by bidding aggressively for the 1800 MHz block D adjacent to Telefónica's holdings (on which Telefónica was the highest bidder up to that point).[57]

b) These bids by Telefónica and E-Plus pushed the frequency-specific block prices well above the price for the three contiguous lots at the bottom of the frequency band. E-Plus and Telefónica then bid on the three lots held by T-Mobile until they reached comparable price levels. Cramton and Ockenfels argue that this bidding behaviour is consistent with an unwillingness among E-Plus and Telefónica to pay more than competitors for the same spectrum, which they refer to as a "price equalisation process".[58]

c) Telefónica eventually stopped bidding in the 1800 MHz band, leaving E-Plus as the high bidder on a non-adjacent lot. At this point, if E-Plus had not bid again on this lot, they would have had to pay their withdrawn bid for the block but not receive it. As a result, E-Plus paid to win the block even though this may have been in excess of their value for the spectrum.

[55] P. Cramton & A. Ockenfels, *The German 4G Spectrum Auction: Design and Behaviour* (June 2014), p. 4. Available at http://www.cramton.umd.edu/papers2010-2014/cramton-ockenfels-german-4g-auction.pdf
[56] Cramton and Ockenfels, p. 14
[57] Cramton & Ockenfels, p. p. 13
[58] Cramton & Ockenfels, p. 13

A8.116 In summary, we consider that the evidence of strategic bidding for the available 1800 MHz lots suggests a risk that the prices did not necessarily reflect the market value of the band.

A8.117 As regards AM&A's second point, we recognise that 2x15 MHz of 1800 MHz spectrum is large enough to be of value to all bidders. However, the fact that T-Mobile was the only bidder who could use this spectrum to create a 2x20 MHz block, which could potentially allow it to achieve higher data speeds than with 2x15 MHz, may have made it the most obvious bidder for this spectrum, which it in fact won.

A8.118 In summary there are possible reasons why the price of 1800 MHz spectrum might understate or overstate market value in Germany at the time of the auction in 2010.

800 MHz

A8.119 Cramton and Ockenfels comment that there was fierce price competition in the 800 MHz band as operators failed to coordinate a strategy of demand reduction between bands.[59] They noted that total auction revenues, of which around 80% came from the six 800 MHz lots, were close to the range that observers had expected in advance, assuming a competitive auction.

A8.120 We consider that the absolute 800 MHz benchmark is likely to reflect market value in Germany.

2.6 GHz

A8.121 Paired 2.6 GHz spectrum would normally be expected to sell for more than unpaired spectrum, whereas they sold at approximately the same average price in Germany. DotEcon said in its 2012 Spectrum Value Report that very similar prices might be evidence of 'parking strategies', where bids are placed on relatively cheap lots so as to maintain eligibility and hence flexibility to bid on high-value lots later during the auction. This is because parking strategies pick the cheapest lots to "park" eligibility regardless of whether it is paired or unpaired spectrum, and thus drive up prices uniformly. If so, it might mean that prices were not driven by genuine demand for incremental spectrum. DotEcon also commented that there was limited competition for the 2.6 GHz spectrum.

A8.122 On balance, we consider that the price of 2.6 GHz may understate market value in Germany. However we consider that the risk and potential scale of such an understatement are unknown.

Likelihood of reflecting UK market value

A8.123 As discussed in paragraphs A7.62 to A7.74, we do not consider that there are strong reasons, in principle, to expect a clear relationship between market profitability and spectrum values, nor, in general, between demand for 2G services and spectrum value. In addition, the available evidence does not provide strong grounds for considering either such relationship to exist. We do not consider differences from the UK in either of these factors to be a basis for considering that the market value in Germany overstates UK market value.

[59] Cramton & Ockenfels, p. 15

A8.124 The German award took place in 2010 at a time when 1800 MHz was not seen as a core LTE band. As discussed in paragraphs A7.83 to A7.84 we consider that this creates a larger risk that the market value of 1800 MHz in Germany at the time of the German auction is a larger understatement of the UK market value of 1800 MHz today.

Relative benchmarks

A8.125 We have sufficient information from the German auction from all relevant bands (i.e. 800 MHz, 1800 MHz and 2.6 GHz) to apply the distance method.

A8.126 In interpreting the evidence points we consider that:

a) There is a risk that the price of 1800 MHz might overstate or understate market value in Germany at the time of the auction, but a larger risk that the market value of 1800 MHz in Germany is a larger understatement of UK market value (due to the timing of the German auction).

b) There is a risk that the absolute value of 2.6 GHz understates market value in Germany (of unknown extent and scale).

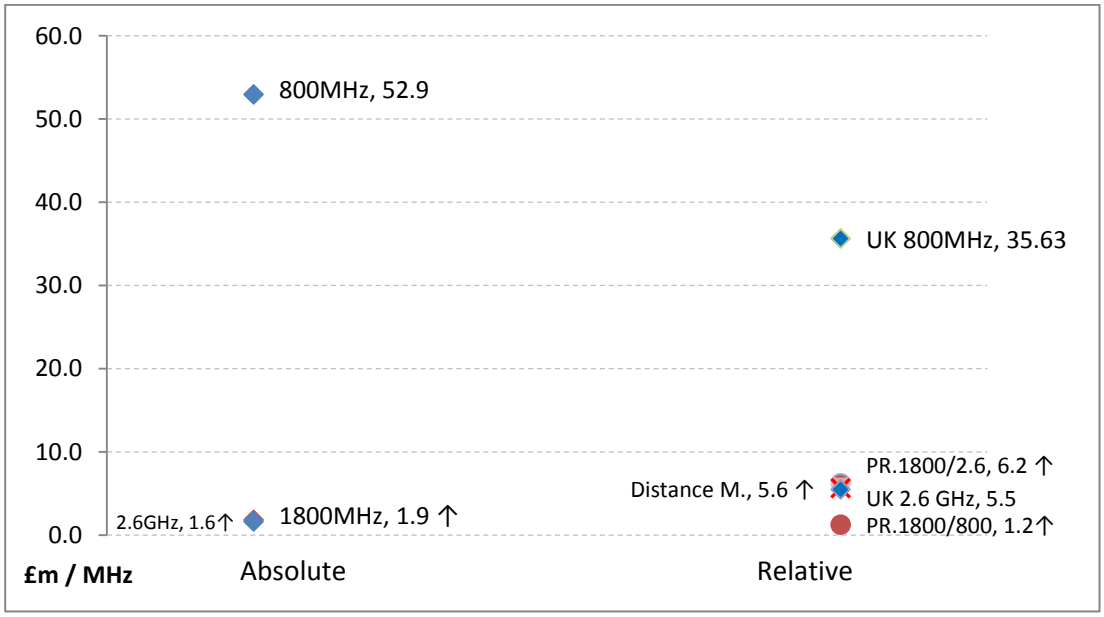
A8.127 Overall, we consider that there is a larger risk that the distance method benchmark for 1800 MHz is a larger understatement of UK market value.

A8.128 The following table summarises the available benchmarks (along with our interpretation of them) from the German award.

Table A8.4.3: Summary of evidence points from Germany

	800	1800				2.6
	Absolute	Distance Method	1800/800	1800/2.6	Absolute	Absolute
Values	52.9	**5.6**	1.2	6.2	1.9	1.6
Tier		**Second**				
Likelihood	None	**Larger**	Larger	Larger	Larger	Unknown
Scale of risk	None	**Larger**	Larger	Larger	Larger	Unknown
Direction	None	**Under**	Under	Under	Under	Under

Figure A8.4.2: Summary of evidence points from Germany



◆= Absolute values; ●= paired ratios; ✖= Distance Method benchmark
↑= risk of understatement; ↓= risk of overstatement; ↕= risk of understatement or overstatement

Greece

November 2011 multiband auction

Description: Greece's National Telecommunications & Post Commission (EETT) auctioned mobile operating frequencies in the 900 MHz and 1800 MHz bands.

Context: There are three MNOs in the Greek mobile market: Cosmote, Vodafone and Wind Hellas. EETT used a mixed system of granting of rights. In the first stage, a minimum spectrum was reserved for existing network providers in order to secure continuity and future enhancement of broadband services. In the second stage, the remaining spectrum was sold through a multiple rounds auction.[60]

Table A8.5.1: November 2011 multiband auction results

	900 MHz	1800 MHz	Price Paid[61]
Total Available	2x35	2x20	-
Cosmote	2x10	2x10	€118.8m
Vodafone	2x15	2x10	€168.5m
Wind Hellas	2x10	-	€93.2m
Unsold	-	-	-

A portion of 900MHz spectrum was pre-assigned to each operator and cost them a total EUR181.7 million – this is included in the allocations of 900 MHz spectrum above, but not in the total price paid.

Table A8.5.2 November 2011 multiband auction design

	Description	Implications
Number of bidders; number of lots; lot sizes	3 bidders and 3 winners.[62] 900 MHz: 14 blocks of 2x2.5 MHz 1800 MHz: 4 blocks of 2x5 MHz.	The number of lots exceeded the number of bidders, although lot sizes were small.
Spectrum caps / Restrictions	The spectrum cap on 900 MHz spectrum was dependent on the number of bidders; 2 × 12.5 MHz if there were four bidders, otherwise a 2 × 15 MHz cap. The 1800 MHz spectrum cap was 2 × 35 MHz. A spectrum floor of 2 × 5 MHz in the 900 MHz band would have been applied if there were four or more bidders.[63]	The 900 MHz cap was binding for Vodafone. The 1800 MHz cap was binding for Cosmote.
Unsold spectrum?	No	N/A
Reserve prices	Spectrum was sold at reserve prices. Reserve prices were effectively benchmarked to the Irish NRA, and then adjusted for population.	

[60] See: http://www.eett.gr/opencms/opencms/admin_EN/News/news_0126.html
[61] See: http://www.telegeography.com/products/commsupdate/articles/2011/11/15/three-cellcos-pay-eur380-5m-for-900mhz-1800mhz-frequencies/
[62] http://www.telegeography.com/products/commsupdate/articles/2011/10/24/no-outside-interest-in-greek-900mhz1800mhz-auction/
[63] See page 351: http://www.comreg.ie/_fileupload/publications/ComReg1225a.pdf

Our position in the October 2013 consultation

A8.129 In the October 2013 consultation, we considered that the absolute value of 900 MHz and 1800 MHz spectrum provided more important evidence in deriving ALFs for 900 MHz and 1800 MHz licences in the UK. However, because auction prices did not exceed reserve prices, we considered that there was a risk of these results understating the value of 900 MHz and 1800 MHz spectrum in Greece.

Stakeholder responses

Whether award outcomes are likely to reflect market value

900 MHz

A8.130 AM&A (page 50) considered that, since there were no auction rules likely to constrain spectrum demand, it is likely that the reserve price for 900 MHz value risks overstating market value. Vodafone (Annex 4, p. 57) also considered that the reserve price likely overstates market value in Greece.

A8.131 Telefónica (pages 64-65) considered it more plausible that the reserve price for 900 MHz spectrum was set above market value. It argued that:

a) The Greek NRA set reserve prices on the basis of benchmarking from the Irish NRA, and appears to have ignored the much lower purchasing power of Greek consumers relative to benchmark countries.

b) The absence of bids for 1800 MHz from Wind suggests that Wind were obliged to pay heavily for 900 MHz and thus had no budget left for 1800 MHz.

c) The government could set reserve prices above the market clearing level because incumbent operators had little choice but to acquire 900 MHz spectrum, as without it they would have had to prematurely close down their 2G networks.

1800 MHz

A8.132 AM&A (page 50) considered that, since there were no auction rules likely to constrain spectrum demand, it is likely that the reserve price for 1800 MHz value risks overstating market value. Vodafone (Annex 4, p. 57) also considered that the reserve price likely overstates market value in Greece.

A8.133 Telefónica (page 86) also said that the sale of 1800 MHz spectrum at reserve price overstated market value, for the same reasons that it gave in relation to 900 MHz.

Likelihood of reflecting UK market value

A8.134 Vodafone (Annex 4, page 58) said that prices paid in the Greek auction would likely overestimate the market value of 900 MHz spectrum in the UK because of higher AMPU ([✂] more than the UK), higher 2G penetration and voice usage per user (2G penetration was [✂] compared to[✂]), and lower levels of urbanisation (61% compared to 80%). It said the higher levels of AMPU and 2G penetration also suggest that the Greek 1800 MHz price overstates UK market value.

A8.135 Vodafone (Annex 4, page 58) also noted that 800 MHz spectrum has not yet been made available for use by the mobile sector, so the only sub-1GHz spectrum

available is 900 MHz spectrum. This could mean that the value of 900 MHz spectrum in Greece is higher relative to the UK. Vodafone said that the impact of the lack of availability of 800 MHz and 2.6 GHz spectrum on the level of demand for 1800 MHz spectrum is unclear.

Assessment

Whether award outcomes are likely to reflect market value

900 MHz

A8.136 All 900 MHz spectrum sold at reserve price. However, the 900 MHz spectrum cap was binding on Vodafone. In the absence of this cap it is possible that Vodafone would have competed for additional lots of spectrum, pushing prices above reserve.

A8.137 As regards Telefónica's comments we do not consider that we are in a position to reach a view on the regulator's motives or the reasons for Wind's decision not to bid for 1800 MHz. We recognise that operators may have needed 900 MHz spectrum for business continuity purposes.

A8.138 However, we also consider that operators faced aggregation risks associated with bidding for smaller 2x2.5 MHz lots, and this risk may have been reflected in lower bids than might otherwise have prevailed.

A8.139 On balance, we consider that the price of 900 MHz might either overstate or understate market value in Greece. The likelihood and scale of this risk is unknown.

1800 MHz

A8.140 All 1800 MHz spectrum sold at reserve price. On its own this suggests that the reserve price overstates market value. However, we also note that the 1800 MHz spectrum cap was binding on Cosmote. In the absence of this cap it is possible that Cosmote would have competed for additional lots of spectrum, pushing prices above reserve.

A8.141 Telefónica suggest possible reasons why it is more likely that the reserve price exceeded market value. As discussed in relation to the 900 MHz band, we do not consider that these reasons provide evidence for the reserve price overstating market value.

A8.142 On balance, we consider that the price of 1800 MHz might overstate or understate market value in Greece. The likelihood and scale of this risk is unknown.

Likelihood of reflecting UK market value

A8.143 As discussed in paragraphs A7.62 to A7.74, we do not consider that there are strong reasons, in principle, to expect a clear relationship between market profitability and spectrum values, or between demand for 2G services and spectrum value. In addition, the available evidence does not provide strong grounds for considering either such relationship to exist. In our assessment of the Greek benchmarks, we do not consider differences from the UK in either of these factors to be a basis for considering that the market value in Greece overstates UK market value.

A8.144 In paragraphs A7.75-A7.78, we also consider that the value of sub-1 GHz spectrum may be higher in countries which are less urbanised than the UK. Given that Greece

is significantly less urbanised than the UK (61% compared with 80%), this creates an unknown risk that the market value of 900 MHz spectrum in Greece overstates UK market value. The scale of this potential overstatement risk is also unknown.

A8.145 We have also considered the timing of the Greek award relative to the UK. In paragraphs A7.83-A7.84, we say that 1800 MHz was not fully acknowledged as a core LTE band until between late 2011 and early 2012, and that it is not clear whether or not operators would have anticipated the development of the LTE1800 ecosystem in 2011. Given that the Greek auction took place in November 2011, we consider that there is an unknown risk that the market value in Greece at the time of the auction is a smaller understatement of the UK market value of 1800 MHz spectrum today, because it may not fully reflect the potential for use as an LTE band.

A8.146 We note that 800 MHz and 2.6 GHz spectrum was not available in Greece for use as a mobile band. We consider that, to the extent that sub-1GHz bands are substitutable, the absence of 800 MHz spectrum may have made 900 MHz more valuable in Greece compared to the UK. However, it is not just immediate availability but also operators' expectations about the future availability of 800 MHz spectrum which would have been reflected in their auction bids for 900 MHz.

A8.147 It is unclear what expectations about the future availability of 800 MHz were like at the time of the Greek auction. As part of the digital dividend, Greece has committed to making this band available for mobile services and so operators would legitimately anticipate 800 MHz becoming available at some point in the future. Having said this, the digital switchover was not complete in Greece in 2011 and a date for the auction of the digital dividend was not set until 2012; this has since been postponed, and a consultation on the auction of 800 MHz and 2.6 GHz spectrum was published in May 2014.[64]

A8.148 Overall, given that 800 MHz spectrum was definitely unavailable at the time of the auction, and the future date of availability was uncertain, our view is that the market value of 900 MHz in Greece carries a larger risk of an unknown overstatement of the UK 900 MHz market value. We also consider that there is a possibility that the unavailability of 2.6 GHz spectrum means the market value of 1800 MHz is overstated relative to UK 1800 MHz market value.

Relative benchmarks

A8.149 We cannot derive a 900 MHz / 800 MHz paired ratio from the Greek auction, given the absence of an 800 MHz award. To calculate the distance method benchmark, it is necessary to use a proxy for 800 MHz (e.g. the price for 900 MHz spectrum) and 2.6 GHz (e.g. zero). We consider that the uncertainty created by the need to choose a proxy for both bands makes the distance method particularly uninformative for the purposes of estimating the market value of 1800 MHz spectrum. Compared with Ireland and Sweden, where only the 2.6 GHz band is absent, a very wide range of distance method benchmarks can be produced for Greece. We therefore do not include this benchmark as part of our derivation of an LSV for 1800 MHz. Instead, we use the absolute values of 900 MHz and 1800 MHz as part of our cross-checks on our LSVs. We also use the 900/1800 MHz ratio for Greece as an additional cross-check.

[64] http://www.eett.gr/opencms/opencms/admin_EN/News/news_0262.html

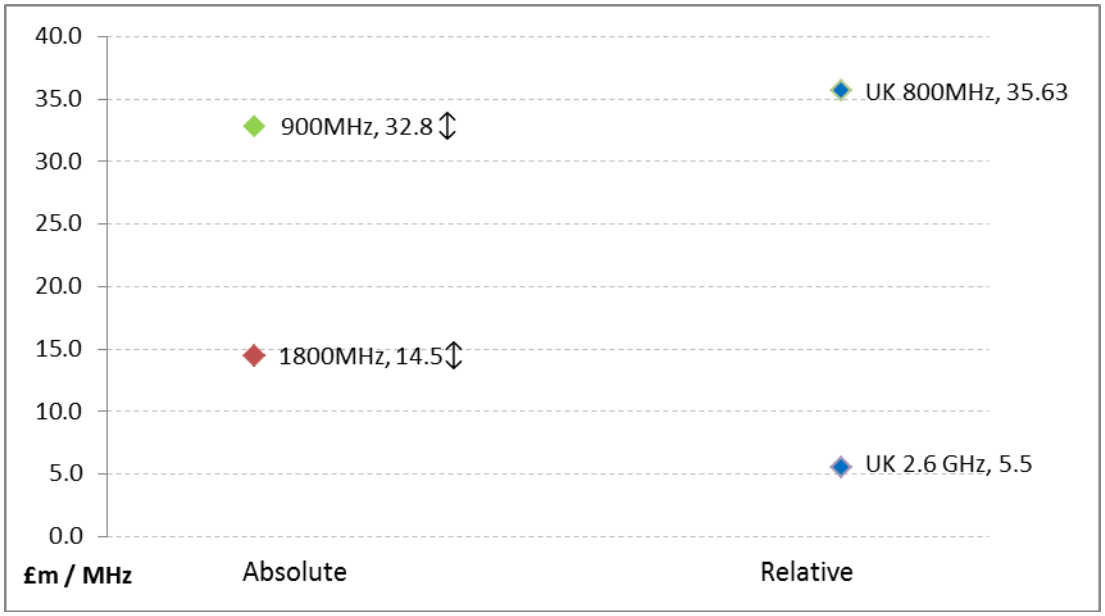
A8.150 In interpreting the available evidence points, we consider that the price of 900 MHz and 1800 MHz could understate or overstate market value in Greece. For 900 MHz, there is also a risk that the market value in Greece overstates the UK market value, while for 1800 MHz there is a risk that the market value could understate or overstate UK market value.

A8.151 The following table summarises the available benchmarks (along with our interpretation of them) from the Greek award:

Table A8.5.3: Summary of evidence points from Greece

	900	1800	1800/900
	Abs.	Abs.	%
Values	32.8	14.5	44%
Likelihood	Unknown	Unknown	Unknown
Scale of risk	Unknown	Unknown	Unknown
Direction	Unknown	Unknown	Unknown

Figure A8.5.1: Summary of evidence points from Greece



◆= Absolute values; ●= paired ratios; ✖= Distance Method benchmark
↑= risk of understatement; ↓= risk of overstatement; ↕= risk of understatement or overstatement

Ireland

November 2012 multiband auction

Description: Award of spectrum rights in the 800 MHz, 900 MHz and 1800 MHz bands using a CCA format.

Context: To accommodate the current expiry dates of GSM licence assignments, spectrum rights of use were auctioned across two time periods, applicable to each of the three bands being auctioned.[65] The results presented below, and corresponding prices, cover the second time period only (beyond 2015).[66] Ireland had 4 MNOs at the time of the auction: Meteor Mobile, Vodafone, Telefónica and H3G.[67]

Table A8.6.1 November 2012 multiband auction results

	800 MHz	900 MHz	1800 MHz	Price Paid[68]
Total Available	2x30	2x35	2x75	-
Meteor Mobile	2x10	2x10	2x15	€145m
Vodafone	2x10	2x10	2x25	€161m
Telefónica	2x10	2x10	2x15	€125m
H3G	-	2x5	2x20	€51m
Unsold	-	-	-	-

Table A8.6.2: November 2012 multiband auction design

	Description	Implications
Number of bidders; number of lots; lot sizes	At least 4 bidders All spectrum was available in lots of 2x5 MHz.[69]	The number of lots in each band exceeded the number of potential bidders.
Spectrum caps / Restrictions	There was a 2x20 MHz cap for sub-1 GHz spectrum. There was a total cap of 2x50 MHz for all bands.[70]	The sub 1 GHz cap was binding for 3 of the 4 winners. The overall spectrum cap was not binding for any winner.
Reserve prices	All spectrum sold above reserve prices. ComReg determined their	

[65] Spectrum in the Irish Auction was awarded on two different time periods: “Time Slice 1” between 2013 and 2015, and “Time Slice 2” between 2015 and 2030.
[66] http://www.dotecon.com/news/irelands-telecoms-regulator-publishes-its-decision-on-multi-band-spectrum-auction/
[67] We note that the European Commission has recently approved under the EU Merger Regulation the proposed acquisition of Telefónica Ireland by H3G.
[68] http://www.comreg.ie/_fileupload/publications/PR15112012.pdf
[69] See page 10: http://www.comreg.ie/_fileupload/publications/ComReg12123.pdf
[70] See page 10: http://www.comreg.ie/_fileupload/publications/ComReg12123.pdf

	reserve prices using an independent benchmarking study which estimated reserve prices on what it considered to be a lower bound of full market value for the spectrum.
Obligations	An obligation on all licence holders to attain and maintain a minimum coverage of 70% of the population and to attain this coverage obligation within 3 years. Licence holders may use spectrum rights in multiple bands to achieve the coverage targets, but at least 50% of the coverage requirement (i.e. 35% of the population) must be met using spectrum rights in the 800 MHz, 900 MHz and/or 1800 MHz bands.

Our estimate of spectrum values by frequency band

A8.152 Because of the combinatorial nature of the Multi-Band Spectrum Award and the confidentiality of bidding information, we cannot directly observe prices by band for this auction. However, we have obtained estimates of band prices on the basis of publicly available information and further evidence submitted by Vodafone which we have discussed with ComReg. This methodology is detailed in Annex 7 (pages 98-99) to the October 2013 consultation.

Our position in the October 2013 consultation

A8.153 In our October 2013 consultation, we considered that our estimated absolute and relative values of 900 MHz and 1800 MHz were more important evidence in deriving ALFs for 900 MHz and 1800 MHz licences in the UK, as all available spectrum sold above reserve price, despite binding spectrum caps.

Stakeholder responses

Whether award outcomes are likely to reflect market value

Cross-bands comments

A8.154 AM&A (page 36) considered that final clock round prices are not necessarily an accurate indicator of band specific prices, noting that the prices paid by each bidder can be heavily influenced by bids in the supplementary rounds. It also considered that the simplifying assumptions made in the derivation of band-specific prices risk introducing errors in the estimates based on final round prices. It argued that since band-specific prices cannot be directly inferred, the evidence from the Irish auction should be categorised as less important evidence.

A8.155 Telefónica (page 67 and pages 89-90) noted that there was no actual price for 900 MHz or 1800 MHz because of the combinatorial nature of the auction. It said our estimates “are credible as an indicator of the relative prices across bands, but it would be erroneous to look at individual values produced for any one band in isolation”.

A8.156 Telefónica also considered that the substantial amount of spectrum usage fees further complicates the process of determining a UK benchmark

A8.157 Telefónica (page 27) commented that the prices reported in page 97 of our October 2013 consultation were incorrect. Telefónica paid €125 million in total and Vodafone paid €161 million in total (i.e. these two numbers were transposed in the table).

900 MHz

A8.158 Telefónica (page 67) said that while "a cursory glance might suggest that the Irish auction is a better benchmark for UK 900 MHz prices" than other awards because there was actual bid competition, there are a number of issues to consider when analysing the Irish data. Some of these are noted in the cross-band comments section above.

A8.159 Additionally, Telefónica argued that "the use of CCA format and the structure of spectrum caps gave strong incentives for H3G to overstate its value for two lots of 900 MHz". It said that Meteor, Telefónica and Vodafone "needed exactly the cap of 2x10 MHz in the 900 MHz band to support their legacy 2G and 3G operations. With seven lots available, H3G was essentially guaranteed one lot. Furthermore, it was in an ideal position to drive up the 900 MHz price by bidding for a second lot, even if it had no business case for that lot at reserve. Such action would have made no difference to H3G's price (provided it dropped back to one lot before reaching a rival's high marginal value for a second lot) but would have driven up expected price for rivals, potentially reducing their funds for bidding for 800 MHz, where the auction outcome was much less certain." It adds that "Ofcom is not in a position to judge whether Irish prices were distorted by such strategic behaviour, but it should bear this in mind when assessing the evidence."

1800 MHz

A8.160 Telefónica (page 90) argued that the use of a CCA format and the structure of spectrum caps created potential incentives for Meteor, Telefónica and Vodafone to overstate their values for 1800 MHz. This was because 1800 MHz was the only band in which these three operators (unlike H3G) were not capped at their level of core demand. Telefónica believed that H3G has strong incentives to overbid for 900 MHz, with the implication that the only defence against this and the only way in which other operators could put some price pressure on H3G (or each other) was to overbid for 1800 MHz and drop demand late in the auction.

800 MHz

A8.161 Telefónica (pages 68 and 76) said that the auction outcome in the 800 MHz band was "much less certain" than for 900 MHz, and that there is no reason to suppose that 800 MHz prices were distorted by the price-driving behaviour that they allege in relation to 900 MHz. However it suggested that price-driving by H3G in other bands such as 900 MHz may have potentially reduced rivals' funds for bidding in 800 MHz.

Likelihood of reflecting UK market value

A8.162 Vodafone (Annex 4, page 72) argued that 900 MHz spectrum is likely to be more valuable in Ireland than in the UK due to higher AMPU, higher 2G penetration and lower urbanisation levels. It said that 1800 MHz spectrum is also likely to be more valuable due to the first and second of these factors.

A8.163 Telefónica (page 90) and H3G (pages 15 and 31) argued that operators placed a higher relative value on 1800 MHz in Ireland than in the UK because the 2.6 GHz band would not be available for mobile services for the foreseeable future.

Assessment

Whether award outcomes are likely to reflect market value

Cross-band comments

A8.164 Our estimates make a number of simplifying assumptions,[71] and we recognise that the presence of two "time slices" in the auction and substantial spectrum usage fees complicates the calculation. However ComReg examined our methodology and the assumptions made and considered these a reasonable indication of the relative values of the different frequency bands as revealed in the Irish auction, not just the final clock round prices. We do not consider that these estimates should be considered less important evidence on the basis that we have inferred band specific prices which could not be directly observed.

A8.165 We note Telefónica's comment about the inaccurate figures reported in the table on page 97 of the October 2013 consultation; Table A8.7.1 above now reports accurate prices paid by Vodafone and Telefónica. We can also confirm that the calculations in the October 2013 consultation used the correct prices paid by Telefónica and Vodafone.

900 MHz

A8.166 In relation to the argument that H3G had the ability to drive up the price of 900 MHz spectrum (because of spectrum caps), we recognise that the 900 MHz band could be more vulnerable to price-driving than newly available bands. However, such legacy issues may be more relevant to time slice 1 (up to 2015) rather than time slice 2, on which our ratios of final clock round prices were based.

A8.167 In the absence of clear supporting evidence, we are unable to reach a firm view as to whether the price-driving behaviour alleged by Telefónica occurred or did not occur.

A8.168 We consider that due to the possibility of price driving there is a risk that the estimated 900 MHz price overstates market value in Ireland, but the likelihood and scale of such risk is unknown.[72]

1800 MHz

A8.169 In relation to Telefónica's allegations of price driving in the 1800 MHz band, we note that H3G acquired 2x10 MHz for time slice 1 and 2x20 MHz in time slice 2, despite three unsold lots of 1800 MHz in time slice 1. It is not clear that H3G's level of

[71] For example, we assume that prices were linear, that the relevant discount factor in Ireland was the same as in the UK and that the relative values of spectrum bands were constant between time slice 1 and 2.

[72] We also note that there was an obligation associated with all licence holders stating that they must achieve 70% population coverage within 3 years. Licence holders could use multiple bands to meet this obligation, which did not require that a specific technology be used. We consider that the level of coverage specific by this obligation is not commercially unattractive, and that bids in the auction were unlikely to have been materially affected by it.

demand for spectrum in the two time slices could have been predicted with confidence by other bidders, and this could have raised the risk of a price-driving strategy. To the extent that price driving in 1800 MHz could potentially constrain H3G in other bands (to the benefit of all three other bidders) but at a risk to the price-driving bidder, there was a potential free-rider problem for the other bidders, who would prefer to let each other take the risk of pursuing a strategy from which they would all benefit.

A8.170 As with the alleged price driving in 900 MHz, in the absence of clear supporting evidence we are unable to reach a firm view as to whether the alleged price-driving behaviour did or did not occur. We consider that there is a risk that the Irish 1800 MHz overstates market value in Ireland, although the likelihood and scale of such risk is unknown.

800 MHz

A8.171 To the extent that price-driving by H3G in the 900 MHz band did occur, we agree with Telefónica that this may have reduced rival operators' available budget for 800 MHz (if they were budget-constrained bidders). This could in turn mean that bids – and therefore final prices – for 800 MHz were less than would otherwise have occurred.

A8.172 Overall, we consider that the 800 MHz price risks understating market value in Ireland, but the scale and extent of such a risk is unknown.

Likelihood of reflecting UK market value

A8.173 As discussed in paragraphs A7.62 to A7.74, we do not consider that there are strong reasons, in principle, to expect a clear relationship between market profitability and spectrum values, or between demand for 2G services and spectrum value. In addition, the available evidence does not provide strong grounds for considering either such relationship to exist. In our assessment of the Irish benchmarks, we do not consider differences from the UK in either of these factors to be a basis for considering that the market value in Ireland risks overstating UK market value.

A8.174 In paragraphs A7.75-A7.78, we consider that the value of sub-1 GHz spectrum may be higher in countries which are less urbanised than the UK. Ireland is less urbanised than the UK (63% compared with 80%), and this creates an unknown risk (of an unknown scale) that the market values of 800 MHz and 900 MHz spectrum in Ireland are overstated relative to UK market values.

A8.175 We have also considered the possibility that the unavailability of 2.6 GHz in Ireland may have increased willingness to pay for 1800 MHz.

- In February 2011, Aegis and Plum published a report for ComReg which favoured ending licences for the current use of 2.6 GHz spectrum in 2014, with an assumption this would be reallocated to mobile broadband. On 6 December 2012, the day after the conclusion of the Irish 4G auction, ComReg published a consultation proposing that the 2.6 GHz band should be subject to a technology-neutral award as early as possible. It is therefore possible that bidders in the Irish auction considered that there was at least some prospect of a change in use for the 2.6 GHz band towards mobile services, even if this was some years away.

- It is not clear how important a consideration the availability or otherwise of 2.6 GHz was in the auction, given the relatively low urbanisation and relatively sparse population in Ireland.

A8.176 Overall, we consider that the market value of 1800 MHz in Ireland carries a larger risk of overstating the UK 1800 MHz market value, though the scale of this risk is unknown.

Relative benchmarks

A8.177 We only have price information for two out of three bands used for the distance method (i.e. 800 MHz and 1800 MHz), but (as discussed below) we can use a proxy value for 2.6 GHz to calculate this benchmark.

A8.178 In interpreting these evidence points, we consider that:

a) There is a risk (of unknown extent and scale) that the absolute 900 MHz benchmark overstates the UK market value of 900 MHz due to price-driving by H3G and due to lower urbanisation in Ireland.

b) There is a larger risk (of unknown scale) that the absolute 1800 MHz benchmark overstates the UK market value of 1800 MHz due to price-driving and due to the unavailability of 2.6 GHz in Ireland.

c) There is a risk that the price 800 MHz understates market value in Ireland (of unknown extent and scale) due to price-driving by H3G, and a risk that the market value in Ireland is overstated relative to the UK market value due to lower urbanisation. Overall, therefore, the absolute 800 MHz benchmark might be an overstatement or an understatement (of unknown extent and scale) of the UK market value of 800 MHz.

d) There is no benchmark available for the 2.6 GHz band so we must use a proxy value for the distance method benchmark. As discussed in paragraph A7.49, we consider that an appropriate proxy for 2.6 GHz is derived by applying the geometric average of the 800 MHz / 2.6 GHz ratios from all relevant benchmark countries to the absolute value of 800 MHz in Ireland.

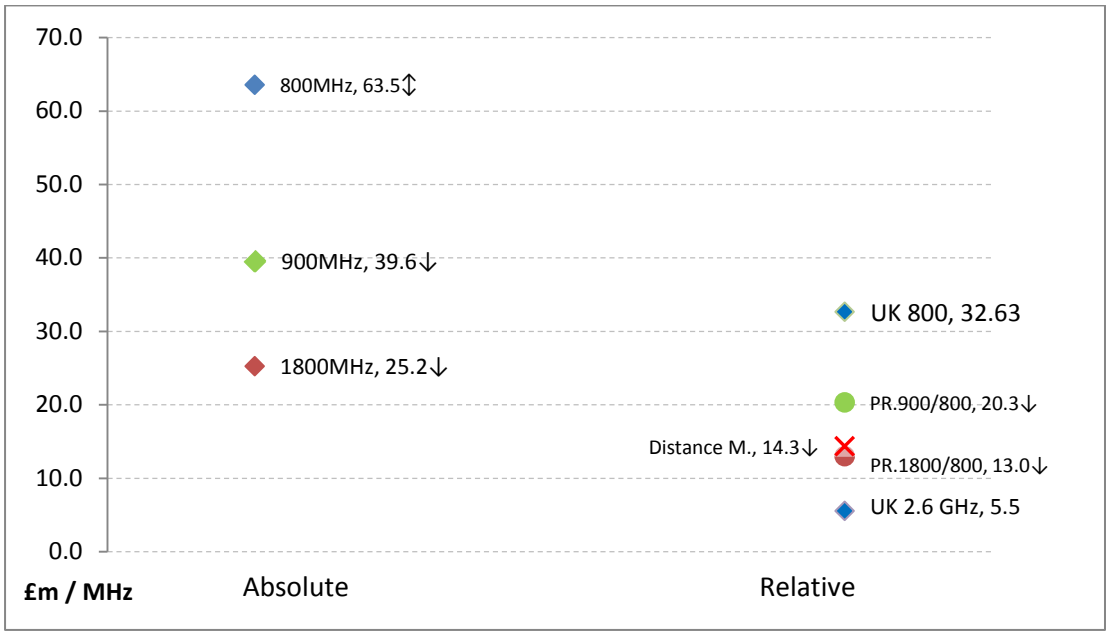
e) The 900 MHz / 800 MHz paired ratio carries a risk of overstatement of unknown likelihood and scale. This is because the price of 900 MHz risks overstating market value in Ireland, while the price of 800 MHz risks understating market value in Ireland. The market values of 900 MHz and 1800 MHz might both be overstated relative to UK market values (due to lower urbanisation in Ireland), but this is not relevant to the *ratio* of benchmarks.

f) The distance method benchmark on balance carries a larger risk of overstating market value in the UK (of unknown scale). This is because we have stronger reasons for 1800 MHz than 800 MHz to believe that the market value in Ireland overstates market value in the UK, and the price of 1800 MHz risks overstating market value in Ireland while the price of 800 MHz risks understating it. The following table summarises the available benchmarks (along with our interpretation of them) from the Irish award:

Table A8.6.3: Summary of evidence points from Ireland

	800	900		1800			1800 /900
	Abs.	900 /800	Abs.	Dist. Meth.	1800 /800	Abs.	%
Values	63.5	**20.3**	39.6	**14.3**	13	25.2	64%
Tier		**First**		**First**			
Likelihood	Unkn.	**Unkn.**	Unkn.	**Larger**	Larger	Larger	Unkn.
Scale of risk	Unkn.	**Unkn.**	Unkn.	**Unkn.**	Unkn.	Unkn.	Unkn.
Direction	Unkn.	**Over**	Over	**Over**	Over.	Over	Unkn.

Figure A8.6.1: Summary of evidence points from Ireland



◆= Absolute values; ●= paired ratios; ✖= Distance Method benchmark
↑= risk of understatement; ↓= risk of overstatement; ↕= risk of understatement or overstatement

Italy

September 2011 multiband auction

Description: Italy's multiband auction awarded licences in the 800 MHz, 1800 MHz, 2.1 GHz and 2.6 GHz bands.

Context: Italy has four MNOs: Telecom Italia, Vodafone, Wind and 3 Italia.

Table A8.7.1: September 2011 multiband auction results

	800 MHz	1800 MHz	2.1 GHz unpaired	2.6 GHz	2.6 GHz unpaired	Price Paid[73]
Total Available	2x30	2x15	15	2x60	30	-
Telecom Italia	2x10	-	-	2x15	-	€1.3bn
Vodafone	2x10	2x5	-	2x15	-	€1.3bn
Wind	2x10	2x5	-	2x20	-	€1.1bn
3 Italia	-	2x5	-	2x10	30	€305m
Unsold	-	-	15	-	-	-

Note: Prices for lots in individual bands are available here: http://frankrayal.com/2011/10/17/the-italian-4g-spectrum-auction-an-analysis/

Table A8.7.2: September 2011 multiband auction design

	Description	Implications
Number of bidders; number of lots; lot sizes	There were 4 bidders. All spectrum was available in lots of 2x5 MHz (apart from unpaired 2.1 GHz, which was available in 1x5 MHz lots).[74]	The number of lots exceeded the number of potential bidders for 800 MHz and 2.6 GHz, but not for 1800 MHz.
Spectrum caps / Restrictions	There was a 2x20 MHz cap on sub-1 GHz spectrum, and a 55 MHz cap on joint paired and unpaired 2.6 GHz spectrum, applicable to all bidders.	Neither of the caps was binding for any of the bidders, i.e. no bidder was restricted from bidding on additional spectrum over what it eventually won.
Reserve prices	Spectrum was sold above reserve prices.	
Obligations	800 MHz: 30% coverage in 36 months, 70% in 60 months. 2.6 GHz: 20% in 24 months, 40% in 48 months. Coverage refers to land and covers of a list of municipalities.[75]	

[73] http://frankrayal.com/2011/10/17/the-italian-4g-spectrum-auction-an-analysis/
[74] http://www.sviluppoeconomico.gov.it/images/stories/documenti/Disciplinarevesrionedefinitiva.pdf
[75] See page 69: http://www.agcom.it/Default.aspx?message=visualizzadocument&DocID=6447

Our position in the October 2013 consultation

A8.179 In our October 2013 consultation our view was that the absolute and relative values of 1800 MHz spectrum were more important evidence for 1800 MHz value in the UK, on the basis that all spectrum sold above reserve price and there were no binding spectrum caps.

Stakeholder responses

Whether award outcomes are likely to reflect market value

1800 MHz

A8.180 AM&A (page 51) said they "agree with Ofcom's assessment that there are no obvious reasons why market value might not have been achieved in this auction" and that it therefore provides more important evidence.

A8.181 Telefónica (pages 84-85) said it had identified "strong grounds for believing that the absolute benchmark may overstate the value of 1800 MHz". It commented that:

a) Owing to the structure of eligibility points and starting prices across categories, competition in the auction was initially on 800 MHz, then 1800 MHz, and then 2.6 GHz.

b) "Competition was particularly intense at 800 MHz. In the higher frequency bands, it appears operators eventually found a compromise outcome, in which Wind did not buy any additional 1800 MHz spectrum and Vodafone and Telecom Italia settled for just three lots of 2.6 GHz each, one less than Wind."

c) "At this point, prices in the 1800 MHz had already reached rather high levels, but the 2.6 GHz band was relatively cheap. Thus, while overall prices across the band may reflect market values, it is possible that both the 800 MHz and 1800 MHz prices were inflated relative to the 2.6 GHz price."

d) Telefónica (page 103) later commented that "As discussed previously, we believe that the 1800 MHz price in Italy may be overstated, owing to strategic factors, while at 2.6 GHz, there is evidence of demand reduction."

A8.182 Vodafone (Annex 4, p. 36) commented that the 1800 MHz reserve price was among the highest in Europe and added that "there is also some indication that the reserve prices were set to extract the private value of the auction participants", citing a "reference to this possibility" in a report by a US-based consultancy.[76] Vodafone argued on this basis that the reserve price in Italy is unlikely to reflect the market value of spectrum.

[76] "*The Impact of Bidding Eligibility Conditions on Spectrum Auction Revenues*", Martyn Roetter, Alan Pearce, February 2013, available at http://www.ccianet.org/wp-content/uploads/library/IAE%20Report%20-%20Final.pdf The reference in question appears to consist of a comment in this report that: "...In other cases, regulators appear to have focused on raising as much cash for the government as possible. The latter point is best illustrated by the high reserve prices set by some regulators, for example in France and Italy."

A8.183 Vodafone (Annex 4, pp. 68-69) also argued that although 1800 MHz spectrum sold slightly above the reserve price, there was no real competition for 1800 MHz in the auction and that this outcome was a result of the auction design. It commented that:

a) [✂];

b) [✂].

c) On this basis, Vodafone argued that 1800 MHz spectrum "was effectively sold at reserve price".

800 MHz

A8.184 Vodafone (Annex 4, p. 68) said that coverage obligations in the 800 MHz band "would likely push down the price paid for 800 MHz spectrum, further inflating 1800/800 ratio and the relative value of 1800 MHz spectrum".

Likelihood of reflecting UK market value

A8.185 Vodafone (Annex 4, p. 70) commented that there is "some comparability" between Italy and the UK, but argued that operators might be willing to pay more for 1800 MHz in Italy than in the UK because average margin per user (AMPU) was [✂] higher in Italy than in the UK, and 2G penetration was [✂] percentage points higher (although voice usage per customer was comparable). It commented that relative valuations of 1800 MHz to 800 MHz spectrum are likely to better control for these differences and "in the absence of price distortions described above, could be considered potentially a good indicator of the UK market value".

Assessment

Whether award outcomes are likely to reflect market value

1800 MHz

A8.186 Vodafone suggested that the 1800 MHz reserve price was intended to extract the private value of bidders and argues that this reserve price "is unlikely to reflect the market value of spectrum". The evidence it cites in support of this view is a report from a US-based consultancy. There is no suggestion in this report that its authors have information as to the intentions of the Italian authorities in setting reserve prices; rather it appears that their view of those intentions is an inference from their observation of "high reserve prices" in Italy. This comment in the report does not relate specifically to 1800 MHz spectrum. We do not consider that this evidence provides reliable guidance as to whether 1800 MHz reserve prices in Italy are likely to have been above market value.

A8.187 In any case, the 1800 MHz price was determined by an auction bid, not by the reserve price. [✂]

A8.188 [✂] Telefónica suggested that bidding for 1800 MHz spectrum occurred later in the auction. It is not clear why this, in itself, would lead to 1800 MHz prices being above market value. Indeed, to the extent that bidders were budget constrained, competition for 800 MHz could have restricted their subsequent ability to bid for 1800 MHz spectrum.

A8.189 [✂]

A8.190 Telefónica suggested that operators found a "compromise outcome" in the higher frequency bands. The implication appears to be that there was coordinated demand reduction in which WIND was allowed to win 2x20 MHz of 2.6 GHz spectrum while the other operators won only 2x15 MHz each. One reason why the other operators might accept this outcome would be an expectation that WIND would not continue to bid for 1800 MHz spectrum, whereas it might otherwise have an incentive to do so, raising prices for 1800 MHz above the levels that prevailed.

A8.191 This would suggest that, in the absence of the "compromise" referred to by Telefónica, competition could have been stronger in both the 1800 MHz and 2.6 GHz bands. Therefore, if Telefónica were correct about the "compromise", it could provide a reason for the 1800 MHz price to be below market value. We also note Vodafone's view that there was no real competition for 1800 MHz in the auction, which could also support a view that the 1800 MHz price was below market value.

A8.192 Overall, stakeholders' responses provided conflicting views on whether the 1800 MHz price reflects or overstates market value, and some of the comments potentially imply that the price understates market value. In the absence of supporting evidence, we are unable to assess whether any of these eventualities did or did not occur. We consider that, while we do not exclude the risk that the price for 1800 MHz understates or overstates market value in Italy, the likelihood and scale of such risk is unknown.

800 MHz

A8.193 It is not clear that bids were materially affected by the land coverage obligation on 800 MHz, as there is lack of evidence as to whether the requirements were onerous or not. To the extent that the obligation was indeed above commercially attractive levels, though, we can explore the potential impact of this risk by using the price of the UK A2 lot (800 MHz with coverage obligation) in the calculation of Italian relative benchmarks, which allows for a more like-for-like comparison. This yields an estimate of £13.1m per MHz for the distance method (i.e. £0.4m lower than the base case). The impact on relative benchmarks is relatively minor, although this depends on the cost of the coverage obligation in Italy being similar to the UK as a proportion of the value of 800 MHz.[77] On balance we consider that the price of 800 MHz Italy carries an unknown risk of smaller understatement of market value in Italy.

2.6 GHz

A8.194 Telefónica suggested that operators found a "compromise outcome" in the higher frequency bands. As discussed in relation to 1800 MHz, this would suggest that, in the absence of the "compromise" referred to by Telefónica, competition could have been stronger in both the 1800 MHz and 2.6 GHz bands. Therefore, if Telefónica were correct about the "compromise", it could provide a reason for the 2.6 GHz price to be below market value.

[77] We note that in the UK 4G auction the discount for the coverage obligation (of £1.55m/MHz) is just under 5% of the value of 800 MHz (£32.63m/MHz). If the coverage obligation in Italy were significantly onerous, it is likely to be more costly.

A8.195 As with our assessment of 1800 MHz, we consider that, while we do not exclude the risk that the Italian 2.6 GHz price understates market value in Italy, the likelihood and scale of such risk is unknown.

Likelihood of reflecting UK market value

A8.196 As discussed in paragraphs A7.62 to A7.74, we do not consider that there are strong reasons, in principle, to expect a clear relationship between market profitability and spectrum values, or between demand for 2G services and spectrum value. In addition, the available evidence does not provide strong grounds for considering either such relationship to exist. In our assessment of the Italian benchmarks, we do not consider differences from the UK in either of these factors to be a basis for considering that the market value in Italy overstates UK market value.

A8.197 We have also considered the timing of the Italian award relative to the UK. In paragraphs A7.83 to A7.84, we say that 1800 MHz was not fully acknowledged as a core LTE band until between late 2011 and early 2012, and that it is not clear whether or not operators would have anticipated the development of the LTE1800 ecosystem in 2011. Given that the Italian auction took place in September 2011, we consider there to be an unknown risk that the market value of 1800 MHz in Italy at the time of the auction is a smaller understatement of UK market value today, because it may not fully reflect the potential for use as an LTE band.

Relative benchmarks

A8.198 We have sufficient information from the Italian auction from all relevant bands (i.e. 800 MHz, 1800 MHz and 2.6 GHz) to apply the distance method. We also use the Italian absolute value as a cross-check for our 1800 MHz LSV.

A8.199 In interpreting these evidence points we consider that the price paid for 1800 MHz spectrum may understate or overstate market value in Italy, though the likelihood and scale of this risk is unclear. The early auction date also creates an unknown risk that market value in Italy might be a smaller understatement relative to the UK market value. However, the fact that the auction price might also overstate market value (to an unknown extent) means that the overall direction of understatement or overstatement with regards to the absolute 1800 MHz benchmark is unclear.

A8.200 We also consider that the 800 MHz and 2.6 GHz prices may understate market value in Italy in those bands. On its own, this might suggest that the relative values would overstate the value of 1800 MHz. However, because the absolute 1800 MHz benchmark may understate or overstate UK market value (with an unclear risk and magnitude), we consider that the distance method benchmark should be interpreted in the same way.

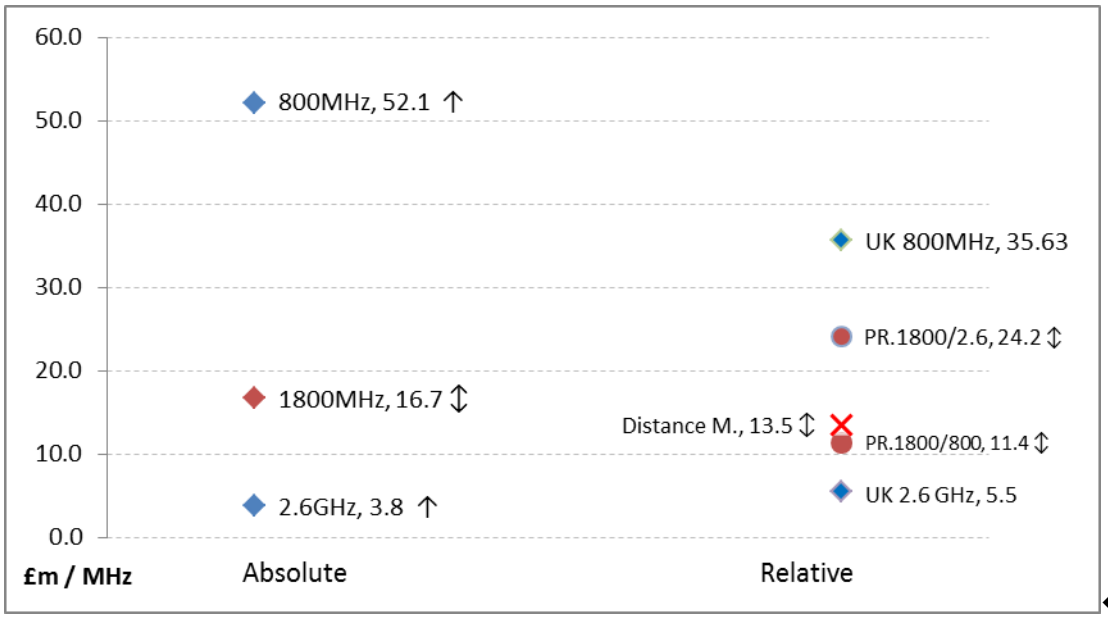
A8.201 The following table summarises the available benchmarks (along with our interpretation of them) from the Italian award:

Table A8.7.3: Summary of evidence points from Italy

	800	1800				2.6
	Abs.	Dist. Meth.	1800 /800	1800 /2.6	Abs.	Abs.
Values	52.1	**13.5**	11.4	24.2	16.7	3.8

Tier		First				
Likelihood	Unknown	**Unknown**	Unknown	Unknown	Unknown	Unknown
Scale of risk	Smaller	**Unknown**	Unknown	Unknown	Unknown	Unknown
Direction	Under	**Unknown**	Unknown	Unknown	Unknown	Under

Figure A8.7.1: Summary of evidence points from Italy



◆= Absolute values; ●= paired ratios; ✖= Distance Method benchmark
↑= risk of understatement; ↓= risk of overstatement; ↕= risk of understatement or overstatement;

The Netherlands

April 2010 2.6 GHz award

Description: Award of the 2.6 GHz spectrum using CCA auction format.

Context: Prior to the award of 2.6 GHz spectrum there were three MNOs; KPN, Vodafone and T-Mobile. The Dutch Parliament decided that the auction should limit the amount of spectrum that the three existing mobile operators could win, in order to ensure that new entrants could participate in the auction.

Table A8.8.1: April 2010 2.6 GHz auction results

	2.6 GHz	Unpaired 2.6 GHz	Price Paid[78]
Total Available	2x65	55	-
KPN	2x10	-	€909k
Vodafone	2x10	-	€200k
T-Mobile	2x5	-	€109k
Tele2	2x20	-	€400k
Ziggo	2x20	-	€1m
Unsold	-	55	-

Table A8.8.2: April 2010 2.6 GHz auction design

	Description	Implications
Number of bidders; number of lots; lot sizes	5 bidders. Spectrum was available in 2x5 MHz lots.	
Spectrum caps / Restrictions	For 2.6 GHz paired, there were caps of 2x10 MHz for KPN, 2x5 MHz for T-Mobile and 2x10 MHz for Vodafone.	The caps on the three incumbents were binding. The result of these caps was that 2x40 MHz of spectrum was reserved for new entrants (Tele2 and Ziggo).
Unsold spectrum?	All 2.6 GHz unpaired.	
Reserve prices	Spectrum sold above reserve prices	
Coverage obligations	Network coverage of 80 square kilometres by May 2012.	

[78] http://www.analysysmason.com/About-Us/News/Newsletter/Dutch-26GHz-auction-raises-just-EUR26m/

December 2012 multiband auction[79]

Description: Award of multiple bands using CCA auction format.

Context: Following the April 2010 2.6 GHz award, the Dutch mobile market had 5 operators.

Table A8.8.3: December 2012 multiband auction results

	800 MHz	900 MHz	1800 MHz	Unpaired 1900 MHz	2.1 GHz	Unpaired 2.6 GHz	Price Paid[80]
Total Available	2x30	2x35	2x70	4.9+9.7	2x10	55	-
KPN	2x10	2x10	2x20	-	2x5	30	€1.35bn
Vodafone	2x10	2x10	2x20	-	2x5	-	€1.38bn
T-Mobile	-	2x15	2x30	4.9+9.7	-	25	€911m
Tele2	2x10	-	-	-	-	-	€161m
Ziggo	-	-	-	-	-	-	-
Unsold	-	-	-	-	-	-	-

Table A8.8.4: December 2012 multiband auction design

	Description	Implications
Number of bidders; number of lots; lot sizes	5 bidders. All paired spectrum was available in 2x5 MHz lots.[81]	
Spectrum caps / Restrictions	2x10 MHz of 800 MHz and 2x5 MHz of 900 MHz were reserved for new entrants (including those who were new entrants in the April 2010 award).[82]	The 800 MHz spectrum reservation meant that only 2 of the incumbent operators were able to win 2x10 MHz of 800 MHz.
Unsold spectrum?	No	N/A
Reserve prices	Spectrum sold above reserve prices.	
Coverage obligations	800 MHz: An obligation to cover 308 square km after two years, increasing to 3080 square km after five years. 900 MHz: An obligation to cover 256.7 square km within two years, increasing to 2567 square kilometres after five years.	

[79] Results source: http://www.telecompaper.com/news/dutch-multiband-spectrum-auction-ends-with-four-winners--914279
[80] http://www.accessmylibrary.com/article-1G1-312372403/netherlands-dutch-multiband-spectrum.html
[81] See slide 8: http://tst.acgea.com/86/text/169/files/Dutch%20Multi-Band%20Spectrum%20Auction%20040612%20AGA%20[Compatibility%20Mode].pdf
[82] See: http://www.telegeography.com/products/commsupdate/articles/2010/12/10/netherlands-to-auction-spectrum-in-late-2011early-2012-paper-says/

Our position in the October 2013 consultation

A8.202 In our October 2013 consultation we considered that the Dutch CCA was potentially relevant but we were not able to determine reliable band-specific prices for this CCA.[83]

Stakeholder responses

A8.203 AM&A (page 42) said that it is very difficult to reliably infer 800 MHz, 900 MHz, 1800 MHz or 2.6 GHz prices from the Dutch auctions, and suggested that these auctions should be excluded from the benchmarking exercise.

A8.204 Telefónica (pages 70-71) also said that the use of a multi-band CCA format, and lack of disaggregated prices and bid data, means that the Dutch award can reasonably be ignored in the benchmarking exercise.

A8.205 Vodafone (Annex 4, page 88) noted that it is not possible to observe band-specific prices for CCA auctions such as the Netherlands, but it nevertheless provided indicative estimates for the prices paid for 900 MHz and 1800 MHz in the Dutch auction using the decomposition methodology which we outline in paragraph A7.13.

Assessment

A8.206 We agree with stakeholders that the nature of the Dutch CCA makes it difficult to determine band-specific prices from publicly available auction results. In particular, we consider that the package price for reserved 800 MHz won by Tele2 price is not indicative of market value. We did not place any significant weight on the estimates provided by New Street Research in our October 2013 consultation. In line with stakeholders' views, we now consider that they should not be included in the benchmarking exercise. As discussed in paragraphs A7.14 to A7.16, we also do not consider that the indicative prices proposed by Vodafone are reliable estimates of band-specific prices.

A8.207 Likewise, we did not place any significant weight on the Dutch reserve prices in our October 2013 consultation, only referring to them as a sense check on our LSV estimates. Given that reserve prices were significantly exceeded in the auction, we now consider that these estimates should also be excluded entirely.

A8.208 Finally, we have not been able to obtain estimates of band-specific prices for the Netherlands using the LRP methodology that was employed in relation to Austria.

A8.209 We do not therefore propose to derive benchmarks for the Dutch auction.

[83] We did consider estimates of band-specific prices from New Street Research, categorising them as less important evidence. We noted NSR's comment that "our breakdown is only one of many mathematically plausible solutions", and said that we do not have evidence to suggest that NSR's band-specific prices are sufficiently reliable or representative for us to place significant weight on them for the purpose of revising ALF in the UK.

Norway

December 2013 combinatorial multiband award

Description: A sealed bid, first price combinatorial auction awarding licences for the use of 800 MHz, 900 MHz and 1800 MHz spectrum.

Context: The auction awarded the whole 2 x 30 MHz in the 800 MHz band and the parts of the other two bands which are either near the expiry date (2 x 15.1 MHz at 900 MHz expiring on 31 December 2013) or currently unallocated (2 x 55 MHz at 1800 MHz).[84] One of the three incumbent MNOs, Tele2, did not win any spectrum in the auction, while new entrant Telco Data acquired the largest package.

Table A8.9.1: December 2013 multiband auction results

Operator	800 MHz	900 MHz	1800 MHz	Price paid
Total available	2 x 30	2 x 15	2 x 55	NOK 1784.7
TeliaSonera	2 x 10	2 x 5	2 x 10	NOK 626.7m
Telco Data	2 x 10	2 x 5.1	2 x 20	NOK 705m
TeleNor	2 x 10	2 x 5	2 x 10	NOK 453m
Tele2	-	-	-	-
Unsold	-	-	2 x 15	-

Source: Norwegian Post and Telecommunications Authority: http://eng.npt.no/topical-issues/news/final-result-of-the-auction

Table A8.9.2: December 2013 multiband auction design

	Description	Implications
Number of bidders / number of lots?	There were four bidders, but the number and identity of bidders was kept confidential prior to the auction: the three incumbents (TeliaSonera, Telenor and Tele2) and one entrant (Telco Data) Spectrum was awarded in each band in 2x5MHz lots.	The overall number of lots exceeded the number of potential bidders.
Spectrum caps[85] / Restrictions	800 MHz: 2x10 MHz 900 MHz: 2x15.2 MHz 1800 MHz: 2x20 MHz	The 800 MHz spectrum cap was binding for all three winning bidders. The 1800 MHz spectrum cap (including existing incumbent holdings) was binding for all three winners.

[84] TeliaSonera and TeleNor each have a 2 x 10 MHz existing licence expiring on 31 December 2017. At 1800 MHz, the same operators have each a 2 x 10 MHz existing licence, renewed with an administrative procedure in 2009 (after lack of interest from potential applicants following a public announcement). See sections 2.2 and 2.3 of the Auction Rules, available here: http://www.npt.no/aktuelt/h%C3%B8ringer/_attachment/9106?_download=true&_ts=1407b7941b3

[85] See sections 2.1, 2.2 and 2.3 of the Auction Rules, available here: http://www.npt.no/aktuelt/h%C3%B8ringer/_attachment/9106?_download=true&_ts=1407b7941b3

Unsold spectrum?	2 x 15 MHz at 1800 MHz	
Reserve prices	Spectrum sold above reserve prices, with total revenues almost four times the level implied by reserve prices.	
Obligations	All 800 MHz lots: Obligation to coverage 40% of population within four years, with an enhanced obligation for the A2 lot won by TeliaSonera to cover 98% of the population with a minimum average speed of 2Mbps (downlink) within five years.[86] There was also an obligation on all 800 MHz licensees to participate in a joint organisation with broadcasters to mitigate the risk of interference with DTT. Each 2 x 5 MHz lot in all bands is subject to an annual administration charge (NOK 240,000 for 800 MHz and 900 MHz, and NOK 210,000 for 1800 MHz) and an ALF (NOK 6,625,000 for all bands) from 2014.[87]	

Our position in the October 2013 consultation

A8.210 This auction concluded after the publication of our October 2013 consultation.

Stakeholder responses

Whether award outcomes are likely to reflect market value

Cross-bands comments

A8.211 AM&A (pages 44-45) considered that the first-price nature of the auction incentivised bidders to shade their bids. They said that the effect on auction prices could be to overstate market value (if bidders are risk-averse with regard to the prospect of losing out) or understate market value (if all bidders shade their bids heavily). AM&A argued that Norway should be excluded from the benchmarking exercise.

A8.212 Telefónica (June 2014 response, page 21) also said that Norway should not be used for benchmarking. This was on the basis that there were no band-specific prices, the sealed bid format leaves bidders vulnerable to the winner's curse, and that bidders have an incentive to shade their bids below value, meaning that winning bids may or may not be representative of the market price.

A8.213 Vodafone (Annex 4, page 92) said that as the auction was a sealed-bid first-price auction it is unclear to what extent the prices paid reflect true market value in Norway.

[86] See section 2.1 of the Auction Rules, available here: http://www.npt.no/aktuelt/h%C3%B8ringer/_attachment/9106?_download=true&_ts=1407b7941b3

[87] See section 3 of the Auction Rules, available here: http://www.npt.no/aktuelt/h%C3%B8ringer/_attachment/9106?_download=true&_ts=1407b7941b3

Assessment

Whether award outcomes are likely to reflect market value

A8.214 Spectrum sold well above reserve prices. However, we agree with respondents that the sealed bid, first-price nature of the auction gave bidders a strong incentive for bid shading.

A8.215 We consider that Tele2's failure to win any spectrum is consistent with bid shading; we understand from NPT that Tele2 stated in the media that it did not anticipate strong competition by a new entrant and has, since the auction, publicly expressed interest in the unsold 2x15 MHz. Similarly, the substantially different prices for the same package paid by Telenor and TeliaSonera may partially depend on different degrees of bid shading by each bidder and not only on different intrinsic valuations of the spectrum.

Relative benchmarks

A8.216 NPT was unable to provide us with LRP or other band-specific price information.

A8.217 Since total receipts from the auction were well above reserve prices, it is not possible to use reserve prices as an approximation of the market value of spectrum by band.

A8.218 Vodafone proposed an alternative method to derive absolute benchmarks by band but, as discussed in paragraphs A7.14 to A7.17, we do not believe this is informative and it is not suitable for deriving relative benchmarks.

A8.219 For these reasons, we do not propose to derive benchmarks for the Norwegian auction.

Portugal

November 2011 multiband award

Description: Award for spectrum in the 800 MHz, 900 MHz, 1800 MHz and 2.6 GHz bands using a SMRA auction format.

Context: The Portuguese market has 3 MNOs: Vodafone, TMN and Optimus.[88]

Table A8.10.1: November 2011 multiband auction results

	450 MHz	800 MHz	900 MHz	1800 MHz	Unpaired 2.1 GHz	2.6 GHz	Unpaired 2.6 GHz	Price Paid[89]
Total Available	2x1.25	2x30	2x10	2x57	10	2x70	50	-
Vodafone	-	2x10	2x5	2x14	-	2x20	25	€146m
TMN	-	2x10	-	2x14	-	2x20	-	€113m
Optimus	-	2x10	-	2x14	-	2x20	-	€113m
Unsold	2x1.25	-	2x5	2x15	10	2x10	25	-

Table A8.10.2: November 2011 multiband auction design

	Description	Implications
Number of bidders; number of lots; lot sizes	There were four qualified bidders, but one of them – Zon III –submitted a zero bid in the first round and therefore lost all eligibility and could not participate in subsequent rounds. The 800 MHz, 900 MHz and paired 2.6 GHz bands were available in 2x5 MHz lots. The 1800 MHz band was packaged as 9 lots of 2x5 MHz and 3 lots of 2x4 MHz. The unpaired 2.6 GHz spectrum was packaged in 2 lots of 25 MHz.	The number of lots exceeded the number of bidders, allowing each of the 3 incumbents to win spectrum in the core bands available (800 MHz / 1800 MHz / 2.6 GHz).
Spectrum caps / Restrictions[90]	**800 MHz**: 2x10 MHz **900 MHz**: 2x5 MHz, or 2x10 MHz for new entrants **Cumulative 800/900 MHz:** A “deferred” cap of 2x20 MHz on existing holdings	The 800 MHz cap was binding for all 3 winners. The 900 MHz cap was binding for Vodafone, who also exceeded the deferred sub-1 GHz cap.

[88] We note that two bidders have changed name since the auction: TMN is now called MEO and Optimus after merging with ZON, is called NOS.
[89] See: http://www.anacom.pt/render.jsp?categoryId=344704
[90] http://www.anacom.pt/streaming/english_version_Auction_Regulation.pdf?contentId=1101807&field=ATTACHED_FILE

	and holdings won in the auction, which means that any spectrum in excess of 2x20 MHz must be either traded or handed back by December 2015. **1800 MHz**: Cap of 2x20 MHz, including existing holdings. All 3 incumbents already held 2x6 MHz. **2.6 GHz**: 2x20 MHz	The 1800 MHz cap was binding for all winners due to existing holdings.
Reserve prices	All spectrum sold was at reserve price. Anacom stated that reserve prices aimed at striking a balance between promoting competition in the market and ensuring a proper valuation of a scarce resource. The degree of competition expected for the award and the several multiband auctions that took place in Europe have been taken into consideration.[91]	No clear indication that reserve prices were set so as to reflect market value.

Our position in the October 2013 consultation

A8.220 In our October 2013 consultation, we considered that country-specific or auction-specific factors may have led to some 900 MHz spectrum being unsold, noting that non-contiguity of the unsold lot to operators' existing lots may have been a factor in this outcome. In 1800 MHz, we considered that unsold spectrum may have been due to tight spectrum caps.

A8.221 We considered that Portugal provided less important evidence in deriving ALFs for both 900 MHz and 1800 MHz licences in the UK, as some spectrum was unsold in both bands.

Stakeholder responses

Whether award outcomes are likely to reflect market value

Cross-band comments

A8.222 AM&A (page 51) considered that Portugal provides less important evidence because significant amounts of spectrum in the 900 MHz, 1800 MHz and 2.6 GHz (amongst other bands) were left unsold.

900 MHz

[91] Anacom, Report to the second public consultation on the draft Auction Regulations, October 2011, page 87-88. Available at: http://www.anacom.pt/streaming/Relatorio_CP_Regulamento_Leilao_Multifaixa_2011.pdf?contentId=1101158&field=ATTACHED_FILE (English translation unavailable)

A8.223 Telefónica (pages 62-63) considered it plausible that absolute and relative values of 900 MHz overstate the market value for this band, on the grounds that:

a) Unsold spectrum was the result of reserve prices set above market value, rather than tight spectrum caps.

b) Contiguity was unlikely to be a critical factor in operators' bids for 900 MHz, as:

i. In the short to medium term, operators at 900 MHz in Portugal are likely to be running both 2G and 3G spectrum in the bands, so having spectrum in two blocks should not be a serious constraint.

ii. In the medium-long term, an operator acquiring disaggregated spectrum may have strong grounds to appeal to the regulator for the band to be re-planned.

A8.224 Vodafone (Annex 4, pages 65-67) also argued that absolute and relative values overstate market value, on the grounds that TMN and Optimus responded to the cumulative spectrum cap by acquiring 2x10 MHz of 800 MHz spectrum over 900 MHz spectrum, even though they could have got 900 MHz spectrum for 67% of the price. However it also noted that spectrum caps meant no operator, provided that it obtained 2x10 MHz of 800 MHz spectrum, could obtain 900 MHz spectrum for their whole licence term. Vodafone said this likely implies that the valuation of spectrum might be higher in the UK (assuming no similar restrictions on spectrum use).

1800 MHz

A8.225 Telefónica (page 87-88) commented that unsold spectrum in the 1800 MHz might have been the result of substantial reserve prices rather than tight spectrum caps.

A8.226 Vodafone (Annex 4, page 66) said that the fact that 1800 MHz spectrum sold at reserve price, and that there was unsold spectrum, suggests that the price for 1800 MHz overstates market value.

800 MHz

A8.227 Telefónica (page 97) commented that the low level of competition in the Portuguese auction could reflect the fact that reserve prices were set above the market level, and that this seems rather more likely at 800 MHz, where the price is in the mid-range of available benchmarks, than 1800 MHz, where the price is towards the low end. Telefónica said that this suggests the 1800 MHz / 800 MHz paired ratio is more likely to understate than overstate the value of 1800 MHz.

Likelihood of reflecting UK market value

A8.228 Vodafone (Annex 4, page 70) commented that 900 MHz spectrum is likely to be more valuable in Portugal than in the UK due to higher AMPU, higher 2G penetration rates and lower urbanisation levels. It said that 1800 MHz spectrum is also likely to be more valuable due to the first and second of these factors.

Assessment

Whether award outcomes are likely to reflect market value

900 MHz

A8.229 The fact that some 900 MHz spectrum went unsold at reserve price may have been due to the deferred sub-1 GHz spectrum cap. Faced with this cap, operators may have chosen to forego bidding for a block of 900 MHz spectrum in order to acquire 2x10 MHz of 800 MHz at a higher reserve price. This indicates either that relative reserve prices were set at the correct level, in which case operators would be indifferent between blocks of 800 MHz and 900 MHz spectrum at prevailing prices, or that the 900 MHz reserve price was too high compared with 800 MHz, in which case the ratio of reserve prices would overstate 900 MHz market value in Portugal.

A8.230 However, operators' choice may be due in part to non-contiguity of 900 MHz lots. Only Vodafone could have acquired spectrum that was contiguous with its existing frequencies, and did indeed acquire 2x5 MHz of 900 MHz, which was as much as the spectrum cap would allow incumbents. It is possible that TMN and Optimus would have preferred the remaining 2x5 MHz lot of 900 MHz to an additional 800 MHz lot had they been able to achieve contiguity with existing holdings. We note Telefónica's arguments that non-contiguity would not be so important in Portugal. However, operators acquiring long-term licences are likely to value contiguity for their future operations, and may be concerned about relying on the uncertain prospect of regulatory re-planning to achieve this. As a result, we consider there is a risk that values for 900 MHz in Portugal understate market value, both in absolute terms and relative to 800 MHz.

A8.231 Overall, we consider that the price of 900 MHz carries a risk of understating or overstating market value in Portugal. The likelihood and scale of this risk are unknown.

1800 MHz

A8.232 In setting a 2x20 MHz spectrum cap on 1800 MHz holdings, the Portuguese NRA effectively reserved at least 2x15 MHz of 1800 MHz for a fourth operator because the three incumbents already held 2x6 MHz each. However, Zon III registered no non-zero bids in the auction, so the supply of spectrum exceeded demand, with the three incumbent operators winning up to their caps without competing. In the absence of these caps, there might have been competition for 1800 MHz lots, which would have raised auction prices. We consider there to be a larger risk that the 1800 MHz price understates market value in Portugal, but that the scale of this understatement is unknown.

800 MHz

A8.233 We do not consider that a comparison of Portugal's reserve prices with benchmarks which were available in 2011 provides a strong basis for considering that auction prices may have been overstated, particularly as incumbent operators acquired as much spectrum as they were allowed under the sub-1 GHz and 1800 MHz caps.

A8.234 Overall, we consider there is a larger risk that the price of 800 MHz might understate market value in Portugal because the presence of spectrum caps prevented competition for this spectrum between incumbents, which might have driven prices

above reserve price. However, we consider that the scale of this understatement is unknown.

2.6 GHz

A8.235 On its own, the fact that 2x10 MHz of 2.6 GHz spectrum (paired) went unsold in the Portuguese auction might suggest that the reserve price for this band was set above market value. However, all three operators purchased up to their spectrum cap in this band. In the absence of these caps, there would likely have been competition for 2.6 GHz lots, which would have raised auction prices. We therefore consider that there is a larger risk that the 2.6 GHz price understates market value in Portugal, but that the scale of this overstatement is unknown.

Likelihood of reflecting UK market value

A8.236 As discussed in paragraphs A7.62 to A7.74, we do not consider that there are strong reasons, in principle, to expect a clear relationship between market profitability and spectrum values, or between demand for 2G services and spectrum values. In addition, the available evidence does not provide strong grounds for considering either such relationship to exist. In our assessment of the Portuguese benchmarks, we do not consider differences from the UK in either of these factors to be a basis for considering that the market value in Portugal overstates UK market value.

A8.237 In paragraphs A7.75 to A7.78, we consider that the value of sub-1 GHz spectrum may be higher in countries which are less urbanised than the UK. This creates an unknown risk that, other things equal, the market values of 800 MHz and 900 MHz spectrum in Portugal overstate the UK market values of these bands (of an unknown scale).

A8.238 We have also considered the timing of the Portuguese award relative to the UK. In paragraphs A7.83 to A7.84, we note that 1800 MHz was not widely seen as a core LTE band until between late 2011 and early 2012, and that it is not clear whether or not operators would have anticipated the development of the LTE1800 ecosystem in 2011. Given that the Portuguese auction took place in November 2011, we consider that there is an unknown risk that the market value of 1800 MHz in Portugal at the time of the auction is a smaller understatement of the UK 1800 MHz market value today, because it may not fully reflect the potential for use as an LTE band.

Relative benchmarks

A8.239 There is sufficient price information from the Portuguese auction to calculate a 900 MHz / 800 MHz paired ratio and a distance method benchmark.

A8.240 In interpreting the absolute 900 MHz benchmark we note that, as set out above, it may understate or overstate UK market value, but that the risk and scale of either of these possibilities is unknown. This means that the 900 MHz / 800 MHz paired ratio may also understate or overstate UK market value (of unknown risk and scale).

A8.241 Turning to the 1800 MHz distance method benchmark, we consider that binding spectrum caps in the 1800 MHz band create a larger risk that the auction price understates market value in Portugal, but of unknown scale. However, because the 800 MHz and 2.6 GHz prices may also be understatements of market value (of unknown scale), we cannot establish whether the distance method benchmark understates or overstates UK market value.

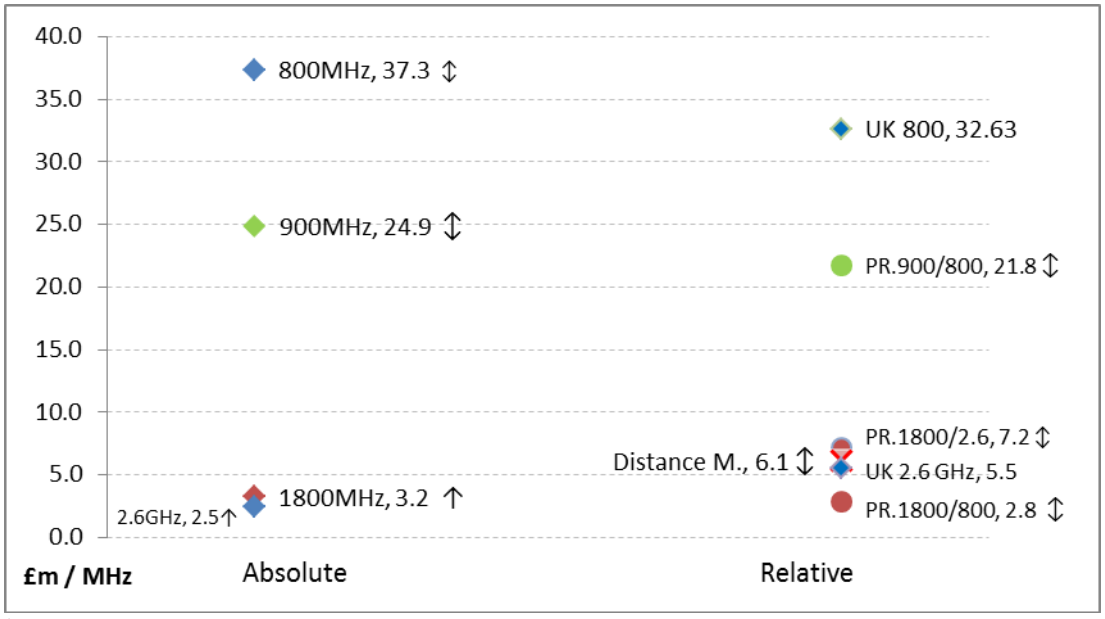
A8.242 We use absolute values for the two ALF bands as cross-checks, and the 1800/900 MHz ratio as an additional cross-check.

A8.243 The following table summarises the available benchmarks (along with our interpretation of them) from the Portuguese award:

Table A8.10.3: Summary of evidence points from Portugal

	800	900		1800				1800 /900	2.6
	Abs.	900 /800	Abs.	Dist. Meth.	1800 /800	1800 /2.6	Abs.	%	Abs.
Values	37.3	**21.8**	24.9	**6.1**	2.8	7.2	3.2	13%	2.5
Tier		**Second**		**Third**					
Likelihood	Unkn.	**Unkn.**	Unkn.	**Unkn.**	Unkn	Larger	Larger	Unkn.	Larger
Scale of risk	Unkn.	**Unkn.**	Unkn.	**Unkn.**	Unkn	Unkn.	Unkn.	Unkn.	Unkn.
Direction	Unkn.	**Unkn.**	Unkn.	**Unkn.**	Unkn.	Unkn.	Under	Unkn.	Under

Figure A8.10.1: Summary of evidence points from Portugal



◆= Absolute values; ●= paired ratios; ✖= Distance Method benchmark
↑= risk of understatement; ↓= risk of overstatement; ↕= risk of understatement or overstatement

Romania

September 2012 multiband award

Description: Award of spectrum in the 800 MHz, 900 MHz, 1800 MHz and 2.6 GHz bands using a CCA format.

Context: Prior to the auction there were four MNOs, with 2K Telecom being a new entrant into the market as a result of winning spectrum in the auction. ANCOM said the amount of spectrum available for mobile communications increased by 77% as a result of the award.

Table A8.11.1: September 2012 multiband auction results

	800 MHz	900 MHz	1800 MHz	2.6 GHz	Unpaired 2.6 GHz	Total Paid[92]
Total Available	2x30	2x35	2x75	2x70	45	-
Cosmote RMT	2x5	2x10	2x25	2x10	-	€179.9m
Orange	2x10	2x10	2x20	2x20	-	€227.1m
RCS & RDS	-	2x5	-	-	-	€40m
Vodafone	2x10	2x10	2x30	-	15	€228.5m
2K Telecom	-	-	-	-	30	€6.6m
Unsold	2x5	-	-	2x40	-	-

Table A8.11.2: September 2012 multiband auction design

	Description	Implications
Number of bidders; number of lots; lot sizes	There were five bidders. Spectrum was available in 2x5 MHz lots apart from unpaired 2.6 GHz for which there were three 1x15 MHz lots).	There was substantial spectrum available for bidders.
Spectrum caps / Restrictions	800 MHz: A 2x15 MHz cap 900 MHz: A 2x15 MHz cap Cumulative 800 & 900 MHz: A 2x20 MHz cap.[93]	Only the combined 800 MHz & 900 MHz cap was binding, and only for Orange and Vodafone.
Obligations	An obligation on holders of sub-1 GHz spectrum to ensure priority coverage of 90% of the population from certain areas by 5th April 2015, and coverage of certain areas inhabited by 60% of the population, by April 2019. An obligation on holders of spectrum over 1 GHz (1800 MHz and/or 2600 MHz FDD) to ensure coverage of certain areas inhabited by 30% of the population, until April 2019.[94]	

[92] http://www.ancom.org.ro/en/uploads/links_files/Rezultate_licitatie_-_final_EN.pdf
[93] See page 60: http://www.ancom.org.ro/en/uploads/forms_files/terms_of_reference1331893175.pdf

Our position in the October 2013 consultation

A8.244 In our October 2013 consultation, we noted that spectrum in all bands sold at or close to reserve price.

A8.245 We treated the absolute values of 900 MHz and 1800 MHz spectrum as more important evidence in deriving ALFs, but considered that they risked understating market value because auction prices did not exceed reserve prices. We also treated the relative values of these bands (to 800 MHz) as more important evidence but considered that they risked understating the value of each band, because reserve prices may understate the value of the 900 MHz and 1800 MHz bands, while the fact that some 800 MHz spectrum went unsold at reserve price suggested that this price overstates the value of the 800 MHz band.

Stakeholder responses

Whether award outcomes are likely to reflect market value

Cross-band comments

A8.246 AM&A (page 37) and Vodafone (page 62) agreed that reserve prices can be taken as a reasonable proxy of the price paid for specific bands.

900 MHz

A8.247 Telefónica (pages 65-66) disagreed with our view that Romanian benchmark prices may understate market value, and argued that the reserve price for 900 MHz was set above market value. It argued that:

a) The Romanian regulator appeared to have used Western European benchmarks to price spectrum without adequately adjusting for lower purchasing power in Romania. Telefónica suggested that the regulator may have been more concerned about revenue than efficiency when setting reserve prices.

b) Incumbent operators had little choice but to buy back the 2G and 3G spectrum they need for business continuity. Specifically, there was a need for the three larger incumbents to protect their core 2G business, and a need for the fourth operator (RCS&RDS) to improve the economics of its 3G network.

A8.248 Vodafone (Annex 4, page 63) also argued that the fact that 900 MHz spectrum sold at reserve price indicates that auction prices likely overstate the value of spectrum in Romania.

1800 MHz

A8.249 Telefónica (pages 88-89) commented that, as the 1800 MHz band was made available in its entirety, it is quite plausible that demand for 1800 MHz was sated. Telefónica said it was also possible that operators exhausted their budget in lower frequency bands or engaged in a degree of demand reduction. Telefónica considered that the 1800 MHz auction price may overstate or understate market value.

[94] Pages 26-27: http://www.ancom.org.ro/en/uploads/forms_files/terms_of_reference1331893175.pdf

A8.250 Vodafone (Annex 4, page 63) argued that, as 1800 MHz spectrum sold at reserve price, auction prices likely overstate the value of spectrum in Romania.

800 MHz

A8.251 AM&A (page 37) said that the presence of unsold spectrum in the 800 MHz band may suggest that reserve prices were set above market value. This creates a risk that the paired ratio would understate the value of 1800 MHz, and there is a potential error margins in the use of the distance method.

A8.252 Telefónica (page 75) also argued that the reserve price for 800 MHz overstates market value and that demand from the two smaller incumbents was choked off by the high reserve price and possibly also by budget constraints.

A8.253 Vodafone (Annex 4, page 64) argued that the 2x5 MHz unsold in this band indicate that the prices paid likely overestimate market value.

2.6 GHz

A8.254 AM&A (page 37) said that unsold 2.6 GHz spectrum may suggest that reserve prices were set above market value. This creates a risk that the paired ratio would understate the value of 1800 MHz, and there is a potential error margins in the use of the distance method.

A8.255 Telefónica (page 104) argued that unsold spectrum in 2.6 GHz is more likely explained by the fact that high prices for the other bands exhausted the resources of the bidders. It also commented that, since prices paid were apparently at the reserve price for all bands, it is unclear why the relative values would be affected by the presence of unsold spectrum.

Likelihood of reflecting UK market value

A8.256 Telefónica (page 66) commented that 2G and 3G spectrum was particularly important to Romanian operators given that 2G subscribers are still a very large part of the market, and that this was true even if the long term value of this spectrum is less than new 4G bands, as operators fear the brand damage that may flow from premature re-farming.

A8.257 Telefónica (pages 66-67) said that the lack of Romania's similarity to the UK market raised more general concerns about its suitability as a benchmark, noting that Romania's GDP per capita was $9,036 compared to $39,093 in the UK.

A8.258 Telefónica (page 89) argued that Romania is a very different market from the UK, being smaller, much less affluent and at an earlier stage in terms of penetration of high speed data services.

A8.259 Vodafone (Annex 4, page 62) noted that the 900 MHz reserve price was set above the 800 MHz reserve price, suggesting that the Romanian NRA considered 800 MHz spectrum to be less valuable than 900 MHz spectrum in Romania. It said that this is inconsistent with Ofcom's position that it is reasonable to expect the market value of 800 MHz spectrum to be the upper bound for the value of 900 MHz spectrum in the UK.

A8.260 Vodafone (Annex 4, page 64) argued that "auction outcomes in Romania are of very limited use in informing the market value in the UK".

A8.261 Vodafone (Annex 4, page 64) also commented that 900 MHz spectrum is likely to be more valuable in Romania than in the UK due to higher 2G penetration rates ([✂] compared to [✂]) and lower urbanisation levels (Romania was only 53% urbanised at the time of the auction compared with 80% in the UK). It said that 1800 MHz spectrum is also likely to be more valuable due to the first of these factors.

Assessment

Whether award outcomes are likely to reflect market value

Cross-band comments

A8.262 We have continued to use reserve prices as suitable proxies for band-specific prices in Romania, recognising that there may be a slight difference between actual band-specific prices and reserve prices for one or more bands (in the following discussion, we refer to bands as having sold at reserve price).

900 MHz

A8.263 The fact that 900 MHz spectrum sold at reserve price suggests that the reserve price might overstate market value. However, we also note that the sub-1 GHz cap (on 800 MHz & 900 MHz together) was binding on Vodafone and Orange. In the absence of this cap it is possible that both operators would have competed for additional lots of 900 MHz spectrum, pushing prices above reserve.

A8.264 On balance, we consider there to be a risk that the 900 MHz auction price overstates market value in Romania (of an unknown extent and scale).

1800 MHz

A8.265 The fact that all 1800 MHz spectrum sold at reserve prices in the absence of any spectrum caps suggests that reserve prices were set above market value.

A8.266 Overall, therefore, we consider that the price of 1800 MHz carries a larger risk of overstatement of Romanian market value, but the scale of this overstatement is unknown.

800 MHz

A8.267 The fact that there was 2x5 MHz of unsold 800 MHz spectrum at reserve price suggests that the reserve price might overstate market value. The extent and scale of this risk is unknown.

2.6 GHz

A8.268 In the 2.6 GHz band there was significant unsold spectrum at reserve prices, and no bidder won up to their spectrum cap. Given that all bidders could have purchased more 2.6 GHz lots at reserve price but chose not to, we consider that there is a larger risk that the price of 2.6 GHz overstates market value in Romania, but the scale of this overstatement is unknown.

Likelihood of reflecting UK market value

A8.269 In paragraphs A7.62 to A7.74, we note that we will only take account of differences in demand for 2G services between the UK and specific countries if there is clear

evidence that 2G is particularly important to that country. In Romania, 2G traffic levels are particularly high, not just compared to the UK, but also compared to other benchmark countries. This implies that the 900 MHz band, which is suitable for GSM services, is likely to be valued particularly highly in Romania relative to the UK and that market value in Romania may therefore overstate corresponding UK market value. This may be reflected in the fact that, in contrast to other NRAs, the Romanian regulator set a higher reserve price for 900 MHz than for 800 MHz.

A8.270 In paragraphs A7.75-A7.78, we also considered that the value of sub-1 GHz spectrum may be higher in countries which are less urbanised than the UK. This creates an unknown risk (of an unknown scale) that the market values of 800 MHz and 900 MHz spectrum in Romania overstate UK market values.

A8.271 Regarding Telefónica's wider concerns with Romania's suitability as a benchmark, we consider that differences in GDP / capita specifically will be captured in the PPP adjustments we make to auction prices in order to calculate a UK-equivalent benchmark. To the extent that such a difference is indicative more generally of the dissimilar state of the market in Romania compared with the UK, we have been mindful of this when assessing the tier in which to categorise the Romanian evidence points, as discussed in section 3, and we interpret the evidence accordingly.

Relative benchmarks

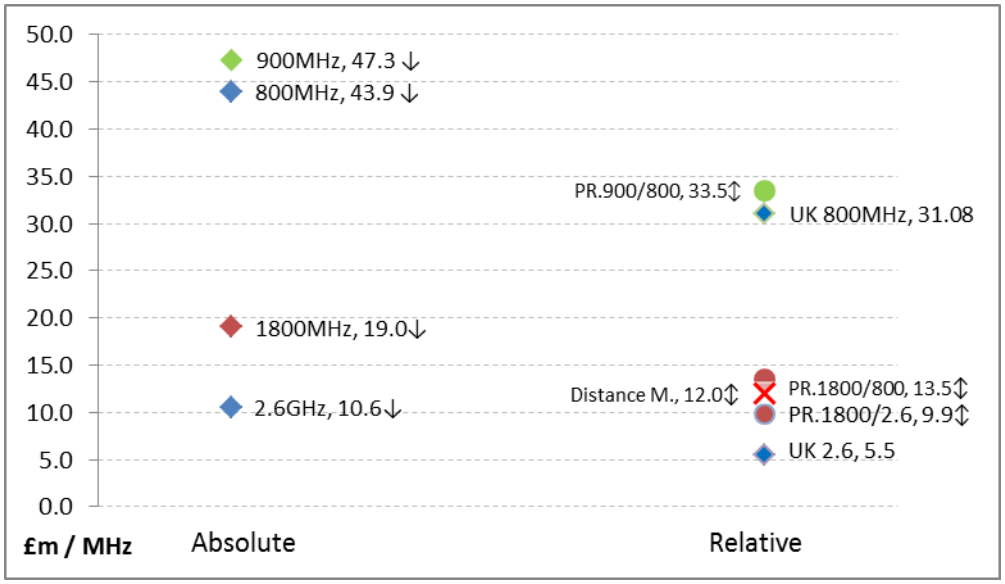
A8.272 There is sufficient price information from the Romanian auction to calculate a 900 MHz / 800 MHz paired ratio and a distance method benchmark. In interpreting these evidence points, we note that the absolute 800 MHz, 900 MHz, 1800 MHz and 2.6 GHz benchmarks carry risks of overstating market value in Romania. This means that both the 900 MHz / 800 MHz paired ratio and the distance method benchmark – as well as the other relative values – risk understating or overstating the UK market value of 900 MHz and 1800 MHz, with unknown likelihood and scale.

A8.273 The following table summarises the available benchmarks (along with our interpretation of them) from the Romanian award:

Table A8.11.3: Summary of evidence points from Romania

	800	900		1800				1800 /900	2.6
	Abs.	**900 /800**	**Abs.**	**Dist. Meth.**	**1800 /800**	**1800 /2.6**	**Abs.**	**%**	**Abs.**
Values	43.9	**33.5**	47.3	**12**	13.5	9.9	19	40%	10.6
Tier		**Third**		**Third**					
Likelihood	Unkn.	**Unkn.**	Unkn.	**Unkn.**	Unkn.	Larger	Larger	Unkn.	Larger
Scale of risk	Unkn.	**Unkn.**	Unkn.	**Unkn.**	Unkn.	Unkn.	Unkn.	Unkn.	Unkn.
Direction	Over	**Unkn.**	Over	**Unkn.**	Unkn.	Unkn.	Over	Unkn.	Over

Figure A8.11.1: Summary of evidence points from Romania



◆= Absolute values; ●= paired ratios; ✖= Distance Method benchmark
↑= risk of understatement; ↓= risk of overstatement; ↕= risk of understatement or overstatement

Slovak Republic

December 2013 multiband award

Description: Award for spectrum in the 800 MHz, 1800 MHz and 2.6 GHz bands using a CCA auction format.

Context: Prior to the auction the Slovak Republic had three incumbent operators; Orange, Slovak Telekom and Telefónica. The auction also reserved some 1800 MHz spectrum for a new entrant to the mobile industry and this was purchased by SWAN.

Table A8.12.1: December 2013 multiband auction results

	800 MHz	1800 MHz	2.6 GHz	Unpaired 2.6 GHz	Total Paid
Total Available	2x30	2x20.4	2x70	50	-
Orange	2x10	2x4.8	2x30	-	€56.1m
Slovak Telekom	2x10	-	2x40	50	€60.8m
Telefónica	2x10	2x0.6	-	-	€40.3m
SWAN	-	2x15	-	-	€6.6m
Unsold	-	-	-	-	-

Source: Operators' licences (which include prices) here (English translation unavailable)

Table A8.12.2: December 2013 multiband auction design

	Description	Implications
Number of bidders; number of lots; lot sizes	Four bidders. For 800 MHz and 2.6 GHz, 2x5 MHz lots were available. For 1800 MHz, there were eight lots, ranging in size from 2x0.4 MHz to 2x5 MHz.	Five of the eight 1800 MHz lots were very small (2x2.2 MHz or less)
Spectrum caps / Restrictions	800 MHz: 2x10 MHz 1800 MHz: 2x20 MHz	The 1800 MHz cap meant that, due to existing holdings, none of the three incumbents could win a 2x5 MHz lot of 1800 MHz spectrum
Unsold spectrum?	None	N/A
Obligations	Winners of 800 MHz: 25% population coverage by end of 2015; 50% population coverage by end of 2017; 70% population coverage by end of 2018. Access speeds of 2 Mbit/s Winners of 1800 MHz: 25% population coverage by end of 2015; 50% population coverage by end of 2018. Access speeds of 12.2 Kbit/s for GSM services and 2 Mbit/z for other technologies Winners of 800 MHz: 10% population coverage by end of 2015; 25% population coverage by end of 2018. Access speeds of 2 Mbit/s	

Our position in the October 2013 consultation

A8.274 This auction concluded after the publication of our October 2013 consultation document.

Stakeholder responses

Whether the outcome reflects market value

Cross-band comments

A8.275 Telefónica (June 2013 response, page 23) argued that because of lack of public band-specific information this auction cannot be used in the quantitative benchmarking but may have some value for qualitative analysis. To this end, it proposed a method for decomposing package prices to infer band-specific prices.

1800 MHz

A8.276 AM&A (June 2014 report, page 18) said that SWAN won spectrum at reserve price as they faced no competition from other operators. Based on the lot structure and auction result, they infer from this that the other operators also paid reserve price, despite the potential for competition for the non-reserved lots. AM&A considered that the highly fragmented nature of available lots is likely to have negatively impacted the value of spectrum, as it was not possible to acquire large contiguous blocks suitable for LTE. They said that it is difficult to say with certainty whether the 1800 MHz price is an overstatement or understatement of true market value.

A8.277 Telefónica (June 2014 response, page 23) argued that bidding for 1800 MHz was competitive, and that all lots sold at prices above reserve. However, it also said that the price of non-reserved lots may not be a good proxy for the value of a 2x5 MHz lot, as they were packaged in small non-contiguous lots.

A8.278 Vodafone (June 2014 response, page 27) considered that the price of 1800 MHz in the Slovak Republic may have been driven by the high reserve price for 800 MHz, which was set well above the UK's reserve prices for A1 and A2 lots (which it had previously argued was set above market value).

800 MHz

A8.279 AM&A (June 2014 report, page 18) noted that Orange and Telefónica both secured 2x10 MHz of 800 MHz at reserve price in the primary round, but assumed that the majority of the supplementary round bid value relates to this band. They also considered it likely (but not certain) that Slovak Telecom won its reserve lots at reserve, given that it did not pay anything in the supplementary round.

A8.280 Telefónica (June 2014 response, pages 22-23) said that bidding in the 800 MHz band was not competitive, due to the spectrum cap and the lack of entrant participation (possibly deterred by the high reserve price). It said that it is ambiguous whether the reserve price overstates or understates market value.

2.6 GHz

A8.281 AM&A (June 2014 report, page 18) said that, assuming all of Orange's assignment round fees relate to 800 MHz, it acquired paired 2.6 GHz spectrum at reserve price

(but considered that, in reality, it is likely to have spent a small amount of its assignment round fees in this band). AM&A also considered (June 2014 update, page 19) that Slovak Telekom acquired its 2.6 GHz spectrum above reserve price, based on the assumption that it paid the reserve price for 800 MHz. They said that, while it is not possible to split this revenue between paired and unpaired 2.6 GHz spectrum, taking a lower bound for paired 2.6 GHz (i.e. reserve price) would give an upper bound for the distance method benchmark.

A8.282 Telefónica (June 2014 response, page 23) argued that bidding in this band was competitive, as all lots sold for prices above reserve.

Likelihood of reflecting UK market value

A8.283 Telefónica (June 2014 response, page 23) argued that this award should in principle provide a reasonable benchmark for the UK, despite the Slovak Republic differing in both size and affluence, as it was competitive for 1800 MHz and 2.6 GHz.

A8.284 Vodafone (June 2014 response, page 27) considered that levels of AMPU were comparable between the Slovak Republic and the UK, while 2G penetration was higher in the Slovak Republic but voice usage was lower. It said that it is not clear if the price paid for 1800 MHz in the Slovak Republic is reflective of UK market value, and if anything there is some indication that it may overstate it.

Assessment

Whether award outcomes are likely to reflect market value

A8.285 We do not have bid data or band-specific price information for this auction. .

A8.286 We consider that reserve prices can be a reasonable proxy for the relative prices of different bands in the Slovak auction, since:

- Total auction revenue was only about 15% above reserve prices.
- Auction data published by the Slovak NRA show that total revenue excluding revenue from the assignment stage (i.e. from the base prices) was only 7% above reserve prices.[95] We consider that this is the most relevant comparator when looking at different bands, as it does not consider the value attributed to specific frequencies within the band for circumstances that may not apply in other settings.[96] For example, LRPs in the UK and Austrian auctions are calculated without reference to the outcome of the assignment stage.
- We also note that the base prices paid by three of the four winners were the reserve price of their winning packages.
- The operator that paid a base price in excess of the reserve price was Slovak Telecom. We do not consider that we have a reliable basis to attribute this amount above the reserve price between bands (although the 800 MHz caps

[95] See: http://www.teleoff.gov.sk/index.php?ID=8241 (English translation unavailable)
[96] For example, Analysys Mason suggested that in the Slovak Republic bids for 800 MHz in the assignment stage may be due to avoiding lots most affected by DTT co-existence costs. For this reason we consider the Slovak Republic on a "net" DTT costs basis.

provide a reason for this amount to be related to 2.6 GHz, it is unclear to us how to attribute the amount reliably between the paired and unpaired 2.6 GHz bands).

1800 MHz

A8.287 The results indicate that the package price for all winners of 1800 MHz was at reserve. This included the winner of the reserved spectrum (SWAN) and the winners of non-reserved spectrum (Orange and Telefónica). Some stakeholders argued that the reserve price was above market value.

A8.288 The fragmentation of available lots may have depressed valuations and their specific location within the band may have created obvious winners (that is, existing holders of adjacent spectrum).

A8.289 We consider that the reserve price could understate or overstate market value. The extent and scale of the risk is unknown.

800 MHz

A8.290 We consider that it is unlikely that bidding was competitive in this band. The three incumbents won a package at the level of the allowed cap of 2x10 MHz. The fact that the base price for Orange's and Telefónica's package was at reserve suggests that the entrant SWAN did not express demand for this band, or this would likely have shown in the base prices of all the incumbents. However, stakeholders argued that the reserve price was above market value.

A8.291 The reserve price may understate or overstate market value. The extent and scale of any understatement or overstatement is unknown.

2.6 GHz

A8.292 Some of the excess above reserve price in Slovak Telecom's base price may be attributable to the paired 2.6 GHz band. We do not consider we have a reliable basis to quantify the attribution and therefore we propose to use the reserve price for this band, as explained above. However, this suggests there may be a larger risk of understatement, but we consider the scale of this understatement is unknown.

Likelihood of reflecting UK market value

A8.293 As discussed in paragraphs A7.62 to A7.74, we do not consider that there are strong reasons, in principle, to expect a clear relationship between demand for 2G services and spectrum value. In addition, the available evidence does not provide strong grounds for considering such a relationship to exist. In our assessment of the Slovakian benchmarks, we do not consider differences from the UK in this factor to be a basis for considering that the market value in Slovakia overstates UK market value.

A8.294 In paragraphs A7.75-A7.78, we also considered that the value of sub-1 GHz spectrum may be higher in countries which are less urbanised than the UK. This creates an unknown risk (of an unknown scale) that the market value of 800 MHz spectrum in the Slovak Republic overstates UK market value.

A8.295 We consider that the fragmentation of the 1800 MHz bands into a range of non-contiguous lots of different (and in some cases very small) sizes creates a larger risk

of unknown scale that the market value in the Slovak Republic understates UK market value.

Relative benchmarks

A8.296 In summary, we derived benchmarks for the Slovak Republic as follows:

- We used the reserve prices as basis for deriving benchmarks of respectively 800 MHz, 900 MHz and 1800 MHz in the UK.
- We added the present value of annual fees set by the Slovak NRA:[97]
- Euros 14,000 per MHz for sub-1 GHz spectrum; and
- Euros 10,800 per MHz for spectrum above 1 GHz.
- We then derived UK equivalent absolute benchmarks using the benchmarking methodology set out in paragraphs A7.25 to A7.32.

A8.297 To derive relative benchmarks, we use the paired ratios and Y/X ratio implied by Slovak absolute benchmarks in conjunction with the UK values of 800 MHz (without coverage obligation and net of DTT co-existence costs) and 2.6 GHz spectrum.

A8.298 In interpreting these evidence points, we consider that:

- Overall, the 1800 MHz benchmark carries a larger risk of understating UK market value (of unknown scale);
- the absolute 800 MHz benchmark risks overstating or understating market value (with unknown likelihood and scale); and
- the 2.6 GHz benchmark carries a larger risk of understating UK market value (of unknown scale).

A8.299 On balance, we consider that the distance method benchmark risks understating the UK market value of 1800 MHz, but the extent and scale of this risk are unknown.

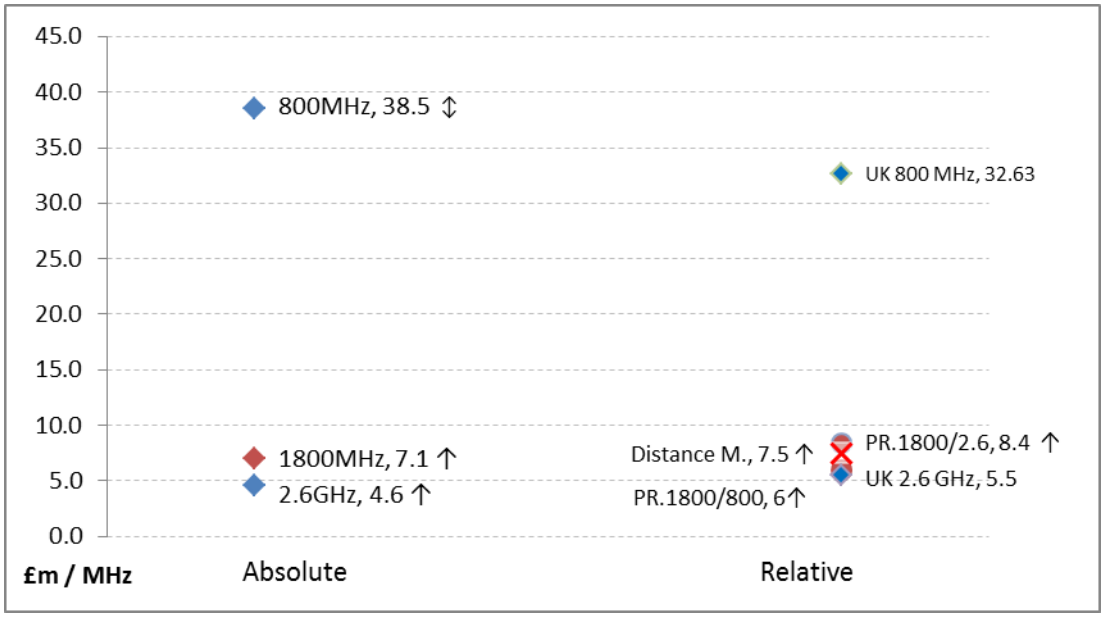
A8.300 The following table summarises the available benchmarks (along with our interpretation of them) from the Slovak award:

[97] See: http://www.teleoff.gov.sk/data/files/26551.pdf (English translation unavailable)

Table A8.12.3: Summary of evidence points from the Slovak Republic

	800		1800			2.6
	Abs.	**Dist. Meth.**	**1800 /800**	**1800 /2.6**	**Abs.**	**Abs.**
Values	38.5	**7.5**	6.0	8.4	7.1	4.6
Tier		**Third**				
Likelihood	Unknown	**Unknown**	Unknown	Larger	Larger	Larger
Scale of risk	Unknown	**Unknown**	Unknown	Unknown	Unknown	Unknown
Direction	Unknown	**Under**	Under	under	Under	Under

Figure A8.12.1: Summary of evidence points from the Slovak Republic



◆= Absolute values; ●= paired ratios; ✖= Distance Method benchmark
↑= risk of understatement; ↓= risk of overstatement; ↕= risk of understatement or overstatement

Slovenia

April 2014 multiband award

Description: Award of 800 MHz, 900 MHz, 1800 MHz, 2.1 GHz and 2.6 GHz spectrum using a CCA format.

Context: Prior to the auction, Slovenia had four MNOs. Three of these operators (Si.Mobil, Telekom Slovenije and Tusmobil) all won spectrum in multiple bands, while the fourth operator (T-2) did not enter the contest.

Table A8.13.1: April 2014 multiband auction results

	800 MHz	900 MHz	1800 MHz	2.1 GHz	Unpaired 2.1 GHz	2.6 GHz	Unpaired 2.6 GHz	Price Paid[98]
Total Available	2x30	2x35	2x75	2x5	20	2x70	50	-
Si.Mobil	2x10	2x15	2x30	-	20	2x35	25	€63.9m
Telekom Slovenije	2x10	2x15	2x25	-		2x35	25	€64.2m
Tusmobil	2x10	2x5	2x10	-	-	-	-	€20.7m
Unsold	-	-	2x10	2x5	-	-	-	-

Table A8.13.2: April 2014 multiband auction design

	Description	Implications
Number of bidders; number of lots; lot sizes	There were 3 bidders. Paired spectrum was available in 2x5 MHz lots.	
Spectrum caps / Restrictions	900 MHz: A 2x15 MHz cap 1800 MHz: A 2x30 MHz cap Sub-1 GHz cap: A 2x30 MHz cap Total spectrum: A 2x105 MHz cap The 800 MHz lots won by Tušmobil were reserved for operators with less than 15% market share	The restriction on two 800 MHz lots effectively ruled out Si.Mobil and Telekom Slovenije from bidding for these lots. Si.Mobil and Telekom Slovenije won up to the 900 MHz cap. Si.Mobil also won up to the 1800 MHz cap.
Obligations	Obligation on winners of sub-1 GHz spectrum to cover 25% of the population after one year, 50% after two years and 75% after 3 years	

[98] http://www.akos-rs.si/public-tender-with-a-public-auction-for-assigning-radio-frequencies-for-the-provision-of-public-communication-services-successfully-concluded

	Obligation on winners of above 1 GHz spectrum to cover 25% of the population after 3 years and 40% after five years (using an licenced frequency band above 1 GHz) Si.Mobil's 800 MHz lots carry an enhanced coverage obligation to provide mobile broadband services with 10Mbit/s access speeds to at least 95% of the population within three years
Other	800 MHz and 2.6 GHz spectrum is available immediately after the auction, while 900 MHz and 1800 MHz spectrum is available from January 2016.

Our position in the October 2013 consultation

A8.301 This auction concluded after the publication of our October 2013 consultation document.

Stakeholder responses

A8.302 AM&A (June 2014 report, page 21) commented that the amount of reliable information that can be gleaned from the Slovenian auction is limited. They argued (page 22) that it should be excluded from the benchmarking exercise.

A8.303 Telefónica (June 2014 report, page 25) said that the Slovenian auction cannot be used in the quantitative benchmarking exercise because band-specific prices are not available and bid data was not published. Telefónica proposed indicative prices for each band and suggested that these may be relevant as a sanity check on conclusions.

Assessment

A8.304 It is generally not possible to observe band-specific price information for CCAs without access to the underlying bids data and we agree with AM&A and Telefónica that this makes it difficult to construct reliable benchmarks for the Slovenian auction. In particular, we cannot infer any accurate final price information from reserve prices in Slovenia. As discussed in paragraphs A7.13 to A7.19, we also do not consider that the indicative prices proposed by Telefónica and Vodafone are reliable estimates of band-specific prices.

A8.305 We have attempted to obtain estimates of band-specific prices for Slovenia using the LRP methodology that was employed in relation to Austria but we have not been able to do so. As a result, we do not propose to derive benchmarks for the Slovenian auction.

Spain

May 2011 900 MHz and 1800 MHz Award

Description: Beauty contest under which applicants set out their cases for being awarded licences on the basis of the criteria set out in the invitation to bid. The spectrum is then awarded to the applicant who is best able to satisfy that criteria.

Context: Spain has 4 MNOs: Movistar, Vodafone, Orange and Yoigo, as well as several regional operators which serve only particular parts of the country.

Table A8.14.1: May 2011 900 MHz and 1800 MHz award results

	900 MHz	1800 MHz	Total Paid[99]
Total Available	2x5	2x15	-
Orange	2x5	-	€126m
Yoigo	-	2x15	€42m
Unsold	-	-	-

Note: As part of the bids Orange committed to €433m of investment over the next 3 years, and Yoigo made a €300m capex commitment. See: http://www.ihs.com/products/global-insight/industry-economic-report.aspx?id=1065929783

Table A8.14.2: May 2011 900 MHz and 1800 MHz award design

	Description	Implications
Number of bidders; number of lots; lot sizes	In the 900 MHz award only one lot was available, with two potential bidders. In the 1800 MHz award, three lots of 2x5 MHz were available, but only one potential bidder.	There was some scope for competition in the award of 900 MHz, but still somewhat limited due to the restrictions (see below). Competition in the award of 1800 MHz was extremely limited.
Spectrum caps / Restrictions	Movistar and Vodafone were prevented from participating in the 900 MHz award. Orange, Movistar and Vodafone were prevented from participating in the 1800 MHz award.	Only Orange, Yoigo or a new entrant could bid for the 900 MHz licence. Only Yoigo or a new entrant could bid for the 1800 MHz licences.

[99] http://www.ihs.com/products/global-insight/industry-economic-report.aspx?id=1065929783

July 2011 multiband auction

Description: Award of 800 MHz, 900 MHz and 2.6 GHz using an SMRA auction format.

Table A8.14.3: July 2011 multiband auction results

	800 MHz	900 MHz	2.6 GHz	2.6 GHz unpaired	Total Paid[100]
Total Available	2x30	2x10	2x70	50	-
Movistar	2x10	2x5	2x20		€668.3m
Vodafone	2x10	-	2x20		€517.6m
Orange	2x10	-	2x20		€437m
Regional Wholesalers	-	-	2x10		-
Unsold	-	2x5	*See table*	50	-

Table A8.14.4: July 2011 multiband auction design

	Description	Implications
Number of bidders; number of lots; lot sizes	4 incumbent bidders in the auction with 2 other bidders also allowed to bid. 800 MHz and 900 MHz spectrum was available in 2x5 MHz lots. National licences for 2.6 GHz spectrum were available in a mix of 2x5 MHz and 2x10 MHz lots. The unpaired 2.6 GHz spectrum was sold in 10 MHz blocks.	
Spectrum caps / Restrictions	There was a 2x20 MHz cap on sub-1 GHz spectrum. There was a limit of 115 MHz on joint 1800 MHz, 2.1 GHz and 2.6 GHz spectrum.	Spain's ministry of communications indicated that the top three operators reached their sub-1 GHz caps.
Unsold spectrum?	1 regional licence for a 2x10 MHz block of 2.6 GHz went unsold, along with 2x5 MHz of 900 MHz and the entire 50 MHz of unpaired 2.6 GHz.	The unsold lots were re-auctioned in November 2011 with the caps raised (see below).
Obligations	A joint obligation on the 800MHz licensees who win 2x10MHz to provide broadband access with access speeds of "at least 30 Mbit/s" to towns with less than 5000 inhabitants.[101]	

[100] http://www.minetur.gob.es/telecomunicaciones/es-ES/ResultadosSubasta/Informe_Web_29072011_fin_de_subasta.pdf

[101] Footnote 17 of DotEcon report for ComReg: http://www.comreg.ie/_fileupload/publications/comreg1223.pdf

November 2011 re-auction of unsold spectrum

Description: Re-auction of the spectrum licences which went unsold in the July 2011 multiband auction, using an SMRA format.[102]

Table A8.14.5: November 2011 re-auction results

	900 MHz	2.6 GHz unpaired	Price Paid[103]
Total Available	2x5	50	-
Movistar	2x5	-	€169m
Vodafone	-	20	€10.4m
Orange	-	10	€5.2m
Regional Wholesalers	-	10	€0.8m
Unsold	-	10	-

Table A8.14.6: November 2011 re-auction design

	Description	Implications
Number of bidders; number of lots; lot sizes	All 4 operators could bid for the spectrum available in this auction. There was one 2x5 MHz lot of 900 MHz available, and 5 lots of unpaired 2.6 GHz.	There was potential for competition for 900 MHz with only 1 lot available.
Spectrum caps / Restrictions	The sub-1 GHz spectrum cap was raised to 2x25 MHz for this auction, while the higher frequency cap was raised to 135 MHz.	Looser spectrum caps meant that all operators (including Movistar, Vodafone and Orange) to participate in the auction.
Unsold spectrum?	Some regional licences for 10 MHz of the unpaired spectrum went unsold, as did a regional licence for 2x10 MHz of 2.6GHz.[104]	
Reserve prices	The 900 MHz lot was sold at reserve price.	

[102] http://www.dotecon.com/news/spanish-auction-for-the-award-of-licences-in-the-900mhz-and-2-6ghz-bands-ended/
[103] http://www.minetur.gob.es/telecomunicaciones/es-ES/ResultadosSubasta2/Resultados_segunda_subasta_10112011.pdf
[104] http://www.dotecon.com/news/spanish-auction-for-the-award-of-licences-in-the-900mhz-and-2-6ghz-bands-ended/

Our position in the October 2013 consultation

A8.306 In our October 2013 consultation we noted that operators bidding for 900 MHz in the July 2011 auction were bound by spectrum caps. These caps were raised for the November 2011 auction, potentially allowing competition for the re-sold 2x5 MHz lot of 900 MHz spectrum.

A8.307 We considered that the absolute value of 900 MHz from the November 2011 auction provided more important evidence in deriving ALFs for 900 MHz licences in the UK, but because it was sold at the reserve price there was a risk of understating the value of 900 MHz. We also considered that the 900 MHz / 800 MHz paired ratio (based on the November 2011 900 MHz result) represented more important evidence.

A8.308 Finally, we included the May 2011 auction results as part of our less important evidence base, as this auction was run as a 'beauty contest'.

Stakeholder responses

Whether award outcomes are likely to reflect market value

900 MHz

A8.309 Telefónica (page 60) said that the outcome of the May 2011 award is unlikely to reflect the market value of 900 MHz in Spain and that it likely understates market value, given the inclusion of the investment commitment in the licence. However, Telefónica did consider that the value of 900 MHz as awarded in May 2011 may have some value as a lower bound, noting that there was a credible bidder who had the opportunity to bid for 900 MHz spectrum but declined to do so at reserve price.

A8.310 Telefónica (page 27) commented that the reported spectrum allocations for the Spanish July 2011 multi band auction are incorrect: the table reports that a 2x5 MHz block of 900 MHz was won by Orange when this spectrum was in fact won by Movistar.

A8.311 Telefónica (page 61) and Vodafone (Annex 4, page 60) disagreed with our view that the November auction price risks understating the market value of 900 MHz. Telefónica said that there is evidence that marginal bidders were not willing to buy 900 MHz at the reserve price, and this implied that the 900 MHz band was priced above the market level. Vodafone (Annex 4, pages 60-61) similarly argued that the 900 MHz / 800 MHz paired ratio overstates the market value in the UK because 900 MHz sold at the reserve price, whereas 800 MHz spectrum sold above the reserve price.

1800 MHz

A8.312 AM&A (page 52) argued that the May 2011 Spanish award should not be considered as part of the evidence base for 1800 MHz, given that the three largest operators were not allowed to bid for 1800 MHz spectrum.

A8.313 Telefónica (page 84) considered it likely that the May 2011 auction price for 1800 MHz was understated due to the inclusion of the investment commitment. However,

Telefónica said that the benchmark may have some value as a lower bound for the value of 1800 MHz spectrum in the auction.

800 MHz

A8.314 Telefónica (page 61) said that the absence of a fourth bidder for 800 MHz is evidence that the price was set above the market level , but also considered the possibility that smaller bidders simply declined to bid for this band because there was a strong expectation that the three biggest companies would together win all 2x30 MHz .

A8.315 Vodafone (Annex 4, pages 60-61) said that the July 2011 auction for 800 MHz was competitive because the sub-1GHz spectrum cap was not binding for Orange, and also because one of the 800 MHz blocks is subject to interference, which meant that the three bidders were competing for the other five blocks of spectrum, pushing prices above reserve. It said that prices paid for 800 MHz spectrum can be seen as reflective of market value.

Likelihood of reflecting UK market value

A8.316 Vodafone (Annex 4, page 61) commented that the absolute valuation of 900 MHz spectrum is likely to be higher in Spain than in the UK due to higher AMPU ([✂]). It also commented that 2G penetration is higher in Spain ([✂]) than in the UK ([✂]), whereas voice usage per user is lower ([✂]), leaving the overall effect of 2G spectrum demand on absolute and relative market values of spectrum unclear. Vodafone considered that the relative value would be a potentially good indicator for the UK market value, absent the distortion of auction outcomes by high reserve prices.

Assessment

Whether award outcomes are likely to reflect market value

900 MHz

A8.317 We note Telefónica's comment about the inaccurate spectrum allocations reported in the table on page 111 of the October 2013 consultation; Table A8.15.3 above now reports accurate lots won by Movistar and Orange.

A8.318 We consider that the May 2011 award is unlikely to be informative of market value, as the award was a beauty contest format with Movistar and Vodafone excluded from participating. We consider that, for Spain, the July 2011 and November 2011 auctions are likely to provide more information about market value and so we consider these auctions when deriving benchmark estimates for the LSV of 900 MHz from Spain.

A8.319 In the July 2011 auction, one lot of 900 MHz went unsold at reserve price. The unsold 2x5 MHz lot of 900 MHz was re-auctioned in November 2011 at the same reserve price. Spectrum caps were raised for this auction to allow all operators to bid. This lot was purchased by Movistar at reserve price, suggesting that the marginal bidders' valuation for 900 MHz was below reserve price. We therefore consider that the auction price of 900 MHz price carries a larger risk of overstating market value in Spain of an unknown scale (as we do not know the extent to which the reserve price exceeded the marginal bidder for 900 MHz).

1800 MHz

A8.320 We consider that the May 2011 award is unlikely to be informative of market value, as the award was a beauty contest format with Movistar and Vodafone excluded from participating. As a result we do not consider this benchmark when deriving our estimate of the LSV of 1800 MHz.

800 MHz[105]

A8.321 All the five 800 MHz spectrum lots unaffected by DTT co-existence costs sold above reserve price in the July 2011 auction.

A8.322 The combination of sub-1 GHz caps and existing sub-1 GHz holdings may have limited competition for 800 MHz spectrum to some degree, in that two of the three bidders could only win 2x10 MHz. However, Vodafone has argued that interference costs associated with one lot meant that the operators had to compete if they wanted to win two out of the five other lots. This view is supported by the price differential between lots A1 (with interference) and lots A2.

A8.323 Overall, we consider that the absolute 800 MHz benchmark is likely to reflect market value in Spain.

Likelihood of reflecting UK market value

A8.324 As discussed in paragraphs A7.62 to A7.74, we do not consider that there are strong reasons, in principle, to expect a clear relationship between market profitability and spectrum values, or between demand for 2G services and spectrum value. In addition, the available evidence does not provide strong grounds for considering either such relationship to exist. In our assessment of the Spanish benchmarks, we do not consider differences from the UK in either of these factors to be a basis for considering that the market value in Spain overstates UK market value.

Relative benchmarks

A8.325 We derive a 900 MHz / 800 MHz paired ratio for Spain using the November 2011 900 MHz award and the July 2011 800 MHz award. We also use the absolute 900 MHz benchmark from the November 2011 auction as a cross-check.

A8.326 In interpreting these evidence points, we consider that the 900 MHz reserve price in Spain carries a larger risk of overstating market value in Spain, while the 800 MHz is likely to reflect market value. On balance, we consider that the 900 MHz / 800 MHz paired ratio carries a larger risk of overstating UK market value, but of an unknown scale.

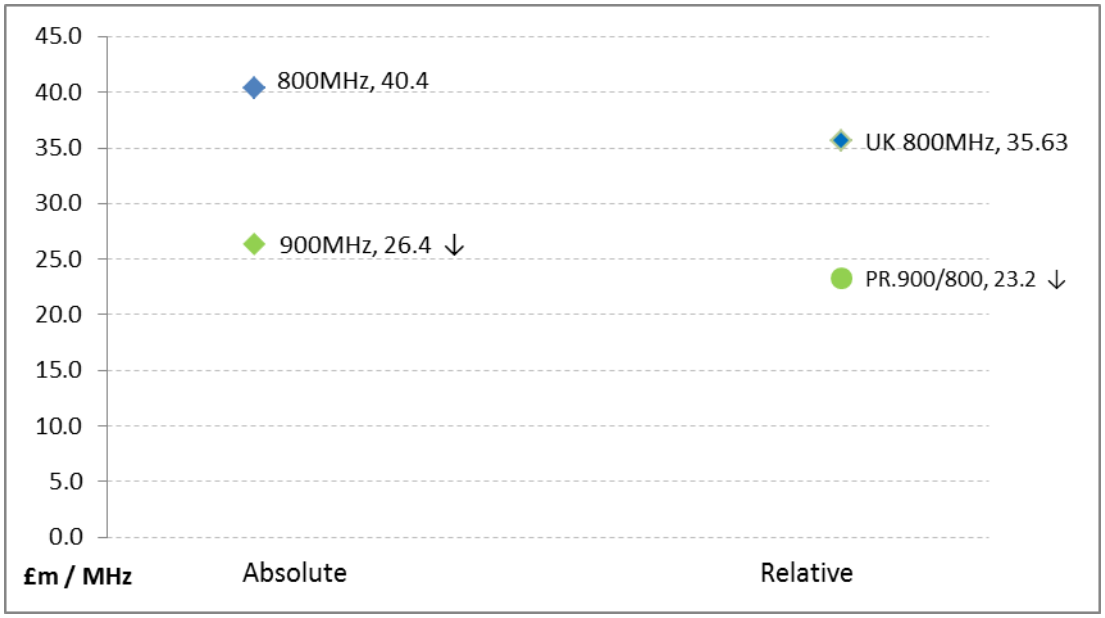
A8.327 The following table summarises the available benchmarks (along with our interpretation of them) from the Spanish award:

[105] Winners of 800 MHz spectrum are unable to deploy it until 1 January 2015, following the completion of the Spanish digital switchover. As with Austria, we have accounted for this delayed start date when calculating relative prices.

Table A8.14.7: Summary of evidence points from Spain

	800	900	
	Abs.	900/800	Abs.
Values	40.4	**23.2**	26.4
Tier		**Second**	
Likelihood	None	**Larger**	Larger
Scale of risk	None	**Unknown**	Unknown
Direction	None	**Over**	Over

Figure A8.14.1: Summary of evidence points from Spain



◆= Absolute values; ●= paired ratios; ✖= Distance Method benchmark
↑= risk of understatement; ↓= risk of overstatement; ↕= risk of understatement or overstatement

Sweden

March 2011 800 MHz auction

Description: Award of 800 MHz spectrum through an SMRA.

Context: Sweden's mobile market has 4 MNOs: Teliasonera, Tele2, Telenor and Hi3G.

Table A8.15.1: March 2011 800 MHz auction results

	800 MHz	Price Paid[106]
Total Available	2x30	-
Teliasonera	2x10	SEK 854m
Tele2	2x10	SEK 469m
Telenor		
Hi3G	2x10	SEK 431m
Unsold	-	-

Note: Net4Mobility, a joint venture between Tele2 and Telenor, won 2x10 MHz of 800 MHz in the auction.

Table A8.15.2: March 2011 800 MHz auction design

	Description	Implications
Number of bidders; number of lots; lot sizes	There were five bidders for 800 MHz - Com Hem AB and Netett Sverige AB also participated in the auction but did not win any licences.[107] Lots were available in 2x5 MHz.	There were five bidders for 800 MHz spectrum and six 2x5 MHz licences available.
Spectrum caps / Restrictions	2x10 MHz of 800 MHz applicable to all bidders.[108]	All winners won up to their spectrum cap.
Obligations	Coverage and rollout obligations only apply to FDD6 which was won by Hi3G and included a commitment of up to SEK 300m to meet the obligation.[109] The two bottom blocks of 800 MHz were subject to usage restrictions related to DTT coexistence.	The lowest frequency block, which was subject to usage restrictions, sold for almost two thirds of the value for the rest of the band.[110]

[106] See: http://www.pts.se/en-GB/News/Press-releases/2011/Press-release/
[107] See: http://www.pts.se/en-GB/News/Press-releases/2011/Press-release/
[108] See: http://www.pts.se/en-GB/News/Press-releases/2010/PTSs-invitation-to-auction-of-the-800-MHz-band/
[109] Full details at paragraphs 18-21: http://www.pts.se/upload/Beslut/Radio/2011/10-10534-appendix-a-to-decision-800mhz.pdf
[110] See paragraph 72, DotEcon 2012 Reserve price benchmarking report.

October 2011 1800 MHz auction

Description: Award of 1800 MHz spectrum through an SMRA.

Table A8.15.3: October 2011 1800 MHz auction results

	1800 MHz	Price Paid[111]
Total Available	2x35	-
Teliasonera	2x25	SEK 920m
Tele2	2x10	SEK 430m
Telenor		
Hi3G	-	-
Unsold	-	-

Note: Net4Mobility, a joint venture between Tele2 and Telenor, won 2x10 MHz 1800 MHz in the auction.

Table A8.15.4: October 2011 1800 MHz auction design

	Description	Implications
Number of bidders; number of lots; lot sizes	Three bidders for 1800 MHz. Hi3G did not win any spectrum. Lots were available in 2x5 MHz.	There were three bidders for 1800 MHz spectrum, with seven 2x5 MHz licences available.
Spectrum caps / Restrictions	No spectrum cap on 1800 MHz spectrum.[112]	N/A
Obligations	None[113]	N/A

Our position in the October 2013 consultation

A8.328 In our October 2013 consultation we considered that the absolute value of 1800 MHz provided more important evidence in deriving ALFs for 1800 MHz licences in the UK, but with a risk of understating this value because two operators bid jointly in the auctions.

A8.329 We also considered that the 1800 MHz / 800 MHz paired ratio provided more important evidence in deriving ALFs for 1800 MHz licences in the UK, but with a risk of understating or overstating the UK market value, because the 800 MHz absolute value also risked understating market value. In our overall assessment in Figure 4.5 of the October 2013 consultation, our view was that the paired ratio was more likely to overstate market value.

[111] See: http://www.pts.se/en-GB/News/Press-releases/2011/Auction-concluded/
[112] See: http://www.pts.se/en-GB/News/Press-releases/2011/PTS-invites-interested-parties-to-the-spectrum-auction-for-the-1800-MHz-band/
[113] See page 17: http://www.gsma.com/spectrum/wp-content/uploads/2012/07/refarmingcasestudysweden1800mhz20111129.pdf

Stakeholder responses

Whether award outcomes are likely to reflect market value

1800 MHz

A8.330 Telefónica (page. 85) noted our view that the 1800 MHz auction price is likely to understate market value because of the joint venture. It said that this was not compelling, given that the joint venture approach was cleared by the regulator as not being anti-competitive. It also said that we did not consider the possibility that the joint venture may have strengthened Tele2-Telenor as a competitor, and may even have enhanced competition.

A8.331 Vodafone (Annex 4, page 76) considered that, although the joint venture reduced the number of participants from four to three, it can still be seen as a competitive auction due to Teliasonera wanting and being able to obtain a large amount of 1800 MHz spectrum.

800 MHz

A8.332 Telefónica (page 95) said that "Ofcom appears to have been confused about who won which lots in Sweden and to have omitted the SEK 300m coverage spend obligation on uneconomic rural areas associated with one of the lots". It argued that the coverage spend obligation should be included as if it were auction revenue as, although the operator may be refunded up to SEK 300m for roll-out costs, these are real costs that the operator would not otherwise have spent without the obligation.

A8.333 Telefónica (pages 95-96) also said that "we share Ofcom's concern that the Swedish benchmark for 800 MHz risks understating UK value, owing to potential distortions created by lot-specific coordination requirements and coverage obligations. This view is supported by the huge variations in prices for individual 2x5 MHz lots in Sweden". It said that the 1800 MHz / 800 MHz paired ratio likely overstates the UK market value for 1800 MHz.

A8.334 Vodafone (Annex 4, page 76) argued that the appropriate comparator when deriving the 1800 MHz / 800 MHz paired ratio should be based on the average value across the five blocks without the highest frequency block, which carried an extensive rollout / coverage obligation. Vodafone said it would not be appropriate to exclude the lots affected by DTT coexistence costs as the estimated value of UK 800 MHz includes co-existence costs.

2.6 GHz

A8.335 AM&A (page 54) noted that 2.6 GHz had not been auctioned in the relevant time period but considered that the 2008 award for this band was likely to give the best indication of 2.6 GHz market value in Sweden, and in particular is likely to be more accurate than using a proxy of zero in the calculation of a distance method benchmark.[114]

[114] AM&A suggested that the lower value of 1800 MHz compared to 2.6 GHz is due to the falling value of spectrum in Sweden in the three year period between the two auctions. In this respect, H3G (page

Likelihood of reflecting UK market value

A8.336 Telefónica (page 102) noted the values for 1800 MHz and 2.6 GHz reported in the October 2013 consultation but said that "as the auctions were conducted in, respectively 2011 and 2008, during which time there was marked change in LTE band development, we doubt the value of any comparison".

A8.337 Vodafone (Annex 4, page 77) said that AMPU was [✂] higher in Sweden than in the UK whilst 2G penetration was significantly lower in Sweden at [✂], compared to [✂] in the UK. It said that it is unclear to what extent the absolute auction outcomes in Sweden are likely to be reflective of market value in the UK, but that the 1800 MHz / 800 MHz paired ratio is likely to be a good benchmark for the market value in the UK.

Assessment

Whether award outcomes are likely to reflect market value

1800 MHz

A8.338 In Sweden, 1800 MHz spectrum was sold above reserve price. Although the joint venture was cleared by the Swedish regulator as not being anticompetitive, this does not rule out the possibility that the price of 1800 MHz would have been higher had Tele2 and Telenor been also competing against one another.

A8.339 Telefónica argued that the joint venture may have enhanced competition by strengthening Tele2-Telenor as a competitor. However we consider it more likely that Tele2 and Telenor would have competed in the absence of a joint venture.

A8.340 We consider that the 1800 MHz price may understate market value in Sweden, but, given the uncertainty about the precise impact of the joint venture, the likelihood and scale of this risk is unknown.

800 MHz

A8.341 We have revised our calculation of the 800 MHz price in light of stakeholder comments about our methodology used in the October 2013 consultation. We now consider that the best estimate of the value of 1800 MHz is the average of the prices of the three blocks that are free from DTT co-existence costs and enhanced coverage obligations. This provides the closest possible comparison of spectrum value to UK circumstances (based on the price of lot A1 in the 4G auction). Using this methodology, there is no need to include the SEK 300m coverage spend obligation attached to the highest frequency 800 MHz spectrum block.

A8.342 In the 800 MHz band spectrum sold above reserve price and two bidders did not win any of the six available licences, indicating that there was competition among the five bidders. Having said this, the joint venture allowed each of the three winning bidders to acquire up to the 2x10 MHz spectrum cap just by outbidding the two losers, who were not established MNOs, rather than each other. In the absence of the joint venture, there would have been six bidders in total and four established MNO bidders all able to acquire 2x10 MHz with only 2x30 MHz available in total. This means that the joint venture may have led to lower final auction prices by reducing the intensity

13) considers that the 1800 MHz price being below the 2.6 GHz price is explained by the recession which occurred between 2008 and 2011.

of competition among the winning bidders, who are the established MNOs. We therefore consider that the 800 MHz price risks understating market value in Sweden, but the likelihood and scale of this risk is unknown.

2.6 GHz

A8.343 As mentioned, 2.6 GHz spectrum has not been auctioned for mobile use in Sweden since 2008. We agree with that using a value for 2.6 GHz from 2008, combined with 800 MHz and 1800 MHz auctions from 2011, introduces uncertainty into the relative values for 1800 MHz which use the 2.6 GHz band. We discuss below how we address the absence of a 2.6 GHz band price from within our time period (i.e. 2010 and later).

Likelihood of reflecting UK market value

A8.344 As discussed in paragraphs A7.62 to A7.74, we do not consider that there are strong reasons, in principle, to expect a clear relationship between market profitability and spectrum values. In addition, the available evidence does not provide strong grounds for considering such a relationship to exist. In our assessment of the Swedish benchmarks, we do not consider differences from the UK in this factor to be a basis for considering that the market value in Sweden overstates UK market value.

A8.345 We have considered the timing of the Swedish award relative to the UK. In paragraphs A7.83 to A7.84, we say that 1800 MHz was not fully acknowledged as a core LTE band until between late 2011 and early 2012, and that it is not clear whether or not operators would have anticipated the development of the LTE1800 ecosystem in 2011. Given that the Swedish auction took place in October 2011, we consider there to be an unknown risk that the market value of 1800 MHz in Sweden at the time of the Swedish auction is a smaller understatement of the UK market value today, because it may not fully reflect the potential for use as an LTE band.

Relative benchmarks

A8.346 We have price information from the Swedish auction for two out of three relevant bands (i.e. 800 MHz and 1800 MHz) used in the distance method. For the 2.6 GHz band, there are no awards in the time period that we have considered in our sample. As discussed in paragraph A7.49, we consider that an appropriate proxy for 2.6 GHz is derived by applying the geometric average of the 800 MHz / 2.6 GHz ratios from all relevant benchmark countries to the absolute value of 800 MHz in Sweden.

A8.347 We also use the absolute value of 1800 MHz as a cross-check.

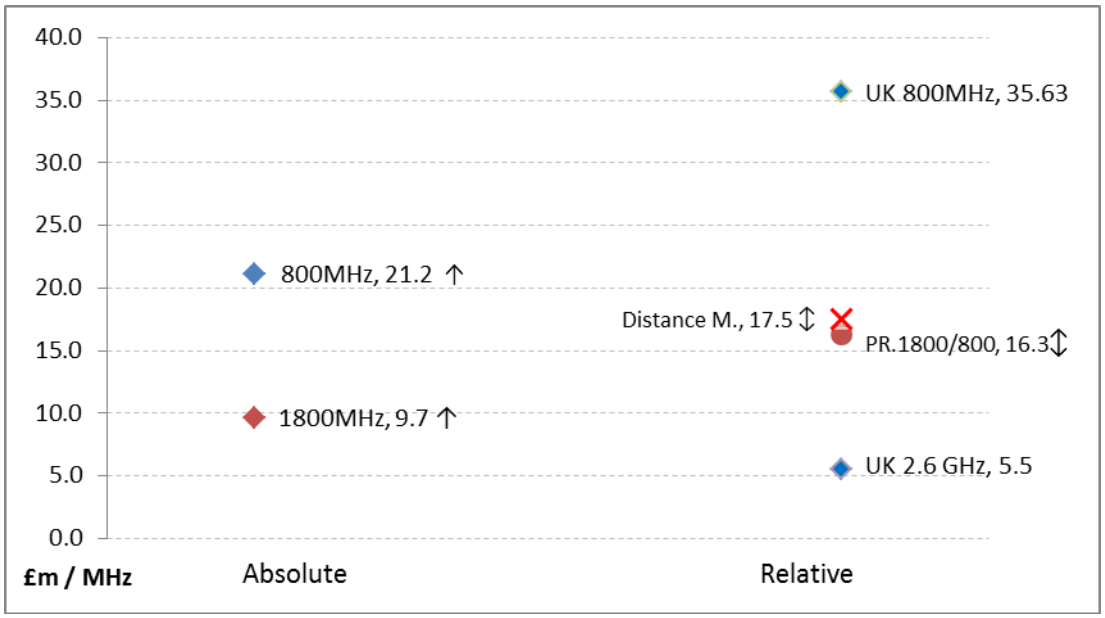
A8.348 In interpreting the benchmarks, we consider that the absolute 1800 MHz benchmark may understate market value in Sweden as a result of the joint venture in the auction, while the market value of 1800 MHz in Sweden in 2011 may be understated relative to current UK market value. However, as the 800 MHz price also risks understating Swedish market value of unknown likelihood and scale, the distance method benchmark could potentially be an understatement or overstatement of UK market value.

A8.349 The following table summarises the available benchmarks (along with our interpretation of them) from the Swedish award:

Table A8.15.5: Summary of evidence points from Sweden

	800	1800		
	Abs.	Dist. Meth	1800 /800	Abs.
Values	21.2	**17.5**	16.3	9.7
Tier		**Second**		
Likelihood	Unknown	**Unknown**	Unknown	Unknown
Scale of risk	Unknown	**Unknown**	Unknown	Unknown
Direction	Under	**Unknown**	Unknown	Under

Figure A8.15.1: Summary of evidence points from Sweden



◆= Absolute values; ●= paired ratios; ✖= Distance Method benchmark
↑= risk of understatement; ↓= risk of overstatement; ↕= risk of understatement or overstatement;

Switzerland

February 2012 multiband award[115]

Description: Award of spectrum in the 800MHz, 900MHz, 1800MHz, 2.1GHz and 2.6GHz bands using a CCA format. All spectrum suitable for mobile telecommunications services was offered in one combined award.

Context: The Swiss mobile market had four operators, one of which, In&Phone, failed to meet the entry criteria for the auction and subsequently ceased operating in the market. [116]

Table A8.16.1: February 2012 multiband auction results

	800 MHz	900 MHz	1800 MHz	2.1 GHz	Unpaired 2.1 GHz	2.6 GHz	Unpaired 2.6 GHz	Price Paid
Total Available	2x30	2x35	2x75	2x60	2x10	2x70	45	-
Orange	2x10	2x5	2x25	2x20	-	2x20	-	€154.7m
Sunrise	2x10	2x15	2x20	2x10	-	2x25	-	€481.7m
Swisscom	2x10	2x15	2x30	2x30	-	2x20	45	€359.8m
Unsold	-	-	-	-	2x10	2x5	-	-

Table A8.16.2: February 2012 multiband auction design

	Description	Implications
Number of bidders; number of lots; lot sizes	3 bidders.	There was a substantial amount of spectrum available in this auction.
Spectrum caps / Restrictions	Spectrum caps of: 2 × 135 MHz of the total available FDD spectrum. 2 × 25 MHz between 800 MHz and 900 MHz bands; 2 × 20 MHz for the 900 MHz band; 2 × 35 MHz for the 1800 MHz band; and 2 × 30 MHz for the 2.1 GHz band.[117]	The sub 1 GHz cap was binding for 2 of the operators, and the cap on 2.1GHz for 1 operator.
Unsold spectrum?	2x10 MHz of unpaired 2.1 GHz; 2x5 MHz of paired 2.6 GHz.	N/A

[115] Results source: http://www.news.admin.ch/NSBSubscriber/message/attachments/26004.pdf
[116] See page 369: http://www.comreg.ie/_fileupload/publications/ComReg1225a.pdf
[117] See page 368: http://www.comreg.ie/_fileupload/publications/ComReg1225a.pdf

Obligations	Licensees who have the right to use frequencies below 1 GHz are obliged to ensure coverage of 50% of the population of Switzerland via their own infrastructure by 31 December 2018 (800 MHz) and 31 December 2020 (900 MHz); licensees for 1800 MHz have until 31 December 2020 to achieve 25% coverage; licensees of 2.1 GHz spectrum have to achieve 25% coverage by 31 December 2021.[118]

Our position in the October 2013 consultation

A8.350 In the October 2013 consultation, we considered that the prices obtained in this auction could potentially have offered relevant evidence for deriving ALFs. However, given the CCA auction format we said that we were unable to determine band-specific prices. As a result we did not include results from Switzerland as part of our benchmarking exercise.

Stakeholder responses

Whether award outcomes are likely to reflect market value

Cross-band comments

A8.351 AM&A (pages 38-40) considered that some valuable evidence can be gleaned from the Swiss auction. They make the following observations about the auction results in Switzerland:

- Overall (unadjusted) prices were low compared to other multiband auctions of similar scale (substantially lower than Austria, Ireland and the Netherlands, lower than Italy and slightly higher than Germany).
- It is highly likely that the price for 900 MHz spectrum was high. AM&A compared the winning packages of Orange and Sunrise, and considered that Sunrise likely paid less for their additional 2.6 GHz lot than Orange's additional 1800 MHz and 2.1 GHz lots. They inferred from this that the price difference in operators' winning packages is an underestimate of the price Sunrise paid for two additional 900 MHz lots, which suggests a high minimum price for 900 MHz.
- The price for 800 MHz, 1800 MHz and 2.6 GHz was at or close to reserve prices. In support of this point AM&A noted that:
  - one lot of 2.6 GHz was unsold.
  - Orange paid reserve price for its winning package that included two lots of 800 MHz and four lots of 1800 MHz, and AM&A considered that the price differences between Orange and Sunrise/Swisscom were unlikely to be explained by different amounts of 1800 MHz spectrum.

[118] See page 369: http://www.comreg.ie/_fileupload/publications/ComReg1225a.pdf

A8.352 AM&A said that it is reasonable to use the 800 MHz, 1800 MHz and 2.6 GHz reserve prices to calculate a relative benchmark for the 1800 MHz value in the UK.

A8.353 Vodafone (Annex 4, page 89) agreed that the nature of the CCA auction in Switzerland means it is not possible to directly observe band-specific prices.

Assessment

A8.354 Total revenues in the Swiss auction are substantially above the level implied by reserve prices (even though Orange paid the reserve price for its winning package). In our view, reserve prices hence do not provide a reasonable proxy for market value in Switzerland. We note that, in any event, reserve prices would be unlikely to be very informative about the relative value of different bands, in that the regulator set the same reserve price for 800 MHz and 900 MHz, and the same reserve price for 1800 MHz and 2.6 GHz.

A8.355 We also consider that it is difficult to make reliable inferences about band-specific prices from the outcome of the Swiss auction.

A8.356 More specifically, we disagree with AM&A that one could infer that 800 MHz sold at reserve and 900 MHz sold at a high price. The implicit assumption in their analysis is that prices for the smallest common package won (i.e. Orange's) were uniform, i.e. the same price per MHz to different bidders for spectrum in the same band (they compare Orange and Sunrise, and Orange and Swisscom). They then consider that the differences between Orange's package price and the price paid by other bidders are mainly explained by differences in the amount of additional 900 MHz won.

A8.357 An assumption of uniform prices does not seem valid for the Swiss auction. Instead, there is evidence of prices that are materially non-uniform between bidders. For example, Swisscom paid 25% less than Sunrise for a package which included significantly more 1800 MHz and 2.1 GHz spectrum (2x10 MHz and 2x20 MHz respectively), and only 2x5 MHz less 2.6 GHz spectrum

Relative benchmarks

A8.358 The Swiss Regulator (OFCOM) did not provide us with LRP or bid data on the auction, and we consider that it is difficult to make reliable inferences about band-specific prices from the publicly available package information.

A8.359 Since total receipts from the auction were well above reserve prices, we do not consider these provide reasonable proxies for the market value of spectrum by band.

A8.360 Vodafone proposed an alternative method to derive absolute benchmarks by band but, as discussed in paragraphs A7.14 to A7.16, we do not believe this is informative and it is not suitable for deriving relative benchmarks. For these reasons, we do not propose to derive benchmarks for the Swiss auction.