Annual licence fees for 900 MHz and 1800 MHz spectrum

Statement

Annex 8

Annex 8

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Introduction

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

A8.2 In our October 2013 consultation we included a country-by-country assessment of auction results and benchmarks based on these results. Stakeholders commented in detail on this assessment. Stakeholders also provided comments in response to our May 2014 update note focusing on new European auctions which had occurred between October 2013 and May 2014. We considered these comments as part of our assessment of each country in our August 2014 consultation.

[1] In our October 2013 consultation we included France and Belgium as part of the benchmarking exercise. These auctions did not contribute to the calculation of our proposed ALFs as they did not include either or both of the ALF bands. However, as discussed in Annex 7, we consider information from the Belgian auction in deriving our 2.6 GHz proxy.

A8.3 Stakeholders made further comments in relation to specific benchmarks as part of their responses to the August 2014 consultation. For some countries there was broad agreement with our assessment, while stakeholders disagreed with our view in relation to other countries.[2] We considered these new comments as part of our assessment of each country in our February 2015 consultation.

A8.4 This annex has been updated (from Annex 8 of the February 2015 consultation) in the following ways:

a) In their responses to the February 2015 consultation, stakeholder comments in relation to specific benchmarks were generally limited to **three countries**: **Austria**, **Ireland** and **Sweden**. Our final assessment of these three countries takes account of these new arguments.

b) In response to our February 2015 consultation, some stakeholders disagreed with the way in which we take account of the development of commercial opportunities for LTE900 in our assessment of 900 MHz benchmarks in **Denmark**, **Greece**, **Ireland, Portugal** and **Spain**. We have considered this issue in more detail in paragraphs A9.36 to A9.78 of Annex 9. We set out the implications of our analysis for each country in our final assessment of these countries.

c) As set out in paragraphs A7.171 to A7.181 of Annex 7, we have also considered whether evidence of changes in expectations of 700 MHz availability for mobile following the February 2012 World Radio Conference (WRC-12) provides a reason for reviewing our assessment of spectrum prices from auctions which took place prior to this date. This affects 900 MHz and 1800 MHz benchmarks in **Denmark, Germany, Greece, Italy, Portugal, Spain and Sweden.** We set out the implications of our analysis for each country in our final assessment of these countries.

d) Since the publication of the February 2015 consultation there has been a multiband auction in **Germany** involving 900 MHz and 1800 MHz spectrum. Following the conclusion of this auction, we derived relative benchmarks for 900 MHz and 1800 MHz (based on final auction prices) and published an update note in July 2015 setting out our provisional assessment of the benchmarks. A number of stakeholders commented on our views set out in this update note. We include the new German benchmarks in our final analysis, and in this annex we provide an assessment of these benchmarks (taking into account arguments put forward by stakeholders in response to our update note).

e) For all other benchmark countries (**Czech Republic, the Netherlands, Norway, Romania, Slovak Republic, Slovenia and Switzerland**) our analysis and conclusions remain as set out in Annex 8 of the February 2015 consultation.

A8.5 As with the February 2015 consultation, this annex contains separate sections for each of the countries considered, organised in alphabetical order. For each country, we include:

[2] In addition to our country-by-country assessments, we also said in paragraph A8.4 (c) of the August 2014 consultation that we did not consider the results of the Hungarian award to be informative of the value of 900 MHz and 1800 MHz spectrum in the UK, and we did not include Hungary in our benchmarking exercise. We received no comments disagreeing with this view, and we maintained our exclusion of Hungary.

a) The circumstances and outcome of the auction or auctions. This includes a table summarising the amount of spectrum won by each winning bidder, and the prices paid. Where relevant, we report the final price mark-up over reserve price. It also includes a table detailing the major rules and features of the auction design.

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

c) Our position in the October 2013 consultation.

d) A summary of responses to our October 2013 consultation and comments on our May 2014 update note. Comments are split into those relating to whether auction prices are likely to reflect market value in the country concerned at the time of the award, and those which discuss whether market value in the country concerned is likely to reflect forward-looking UK market value (including taking into account the date of the award).

e) Our provisional assessment and position in the August 2014 consultation.

f) A summary of responses to the August 2014 consultation.

g) Our provisional assessment and position in the February 2015 consultation.

h) Where relevant, a summary of responses to the February 2015 consultation (and, for Germany, to the July 2015 update note).

i) Our final 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 from all consultations and update notes.

j) A summary of the benchmarks and our assessment. This includes a table and chart capturing all absolute and relative benchmarks from the award,[3] along with the tier of evidence to which the most important relative values belong (i.e. the 900 MHz / 800 MHz paired ratios and the distance method values). 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 or larger if we consider that we can sensibly judge whether it is smaller or larger.[4] The direction of effect is categorised as "overstatement" or "understatement". We also indicate if we consider that we cannot be sure of the likelihood, scale and / or direction of understatement or overstatement (for

[3] 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 Annex 7 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 conclusions on the UK value of 800 MHz and 2.6 GHz (using relevant comparators for 800 MHz as outlined in Table A7.3 and A7.4).

[4] As illustrations we note that: (a) in Austria we conclude the 900 MHz value is at larger risk of larger overstatement, in part because it is 15% higher than 800 MHz, whereas technical and commercial evidence suggests 900 MHz is not higher value than 800 MHz (see paragraph A8.221); and (b) in Italy we conclude the 800 MHz value carries an unknown risk of smaller understatement, because bids may have been affected by a coverage obligation which we estimated might have reduced the observed value by around 5% (see paragraph A8.627).

example where different factors may influence the benchmark but operate in different directions with the net effect being unclear).[5]

A8.6 Tables A8.1 and A8.2 set out the principal relative value benchmarks for the countries where these have been derived – these are the focus of our assessment in Section 3. Table A8.1 shows the 900 MHz / 800 MHz paired ratio[6] benchmarks for 900 MHz, and Table A8.2 shows the distance method benchmarks for 1800 MHz.[7]

A8.7 For each benchmark, the tables summarise our assessment of the quality of evidence represented by the benchmark (on the basis of which we group these benchmarks into tiers, as explained in Section 3 and Annex 7). It also includes our assessment of the risk that benchmarks overstate or understate market value, in terms of the likelihood, scale, and direction of overstatement or understatement, along with brief summaries, in the last column, of the key considerations that are relevant to our assessment of each benchmark.[8]

A8.8 Where our conclusion from the assessment of the tiering or interpretation of a given benchmark is different from our position in the February 2015 consultation, we highlight the new position in the tables. We also highlight the assessment of risk and tier for the new benchmarks since February 2015 (i.e. Germany 2015 for both 900 MHz and 1800 MHz).

[5] In a small number of cases we have not identified any basis for expecting benchmarks to be overstated or understated, and we have labelled this as "no risk identified".
[6] 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).
[7] The paired ratios and Y/X ratios shown in percentages in Tables A8.1 and A8.2 are those used to generate the relative value benchmarks. Since we use different corresponding UK 800 MHz values in deriving the relative value benchmarks (with/without coverage obligation and gross/net of expected DTT co-existence costs, as discussed in Annex 7), these percentage figures are not all directly comparable to each other. Ratios on a directly comparable basis are shown in Tables 3.2 and 3.3 in Section 3.
[8] We use the terms "likelihood" and "extent of risk" interchangeably in this annex.

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

Country	*900 MHz relative value benchmark in £m per MHz (900:800 MHz ratio)*	*Assessment of risk*		*Tiering assessment*			
		Assessment	*Key considerations indicating risk of overstatement (+) or understatement (-) of the benchmark*	*Tier*	*Were prices determined by a market-driven process?*	*Intrinsic value bidding or strategic bidding? Or, if No in previous column, evidence of prices reflecting relative intrinsic values?*	*Relevant country-specific factors?*
Austria	£37.8m (115%)	Larger risk of larger over-statement	Suggested price driving in 900 MHz (+) Suggested limited strategic investment in sub-1 GHz (+/-) Technical / commercial evidence and ratio of 900 MHz to 800 MHz (+)	Tier 1	Yes	Evidence consistent with both intrinsic value bidding or strategic bidding with possible exception of technical / commercial evidence	No
Germany (2015)	£9.4m (29%)	Larger risk of larger under-statement	2x15 MHz spectrum cap in 900 MHz (-) Evidence of signalling and strategic demand reduction in 900 MHz (-) Evidence of change in expectations of 700 MHz availability between 2010 auction of 800 MHz and 2015 auction of 900 MHz(-)	Tier 1	Yes	Evidence of signalling and strategic demand reduction	Evidence of change in expectations about 700 MHz availability
Ireland	£18.2m (61%)	Risk of under- or over-statement	Suggested price driving in 900 MHz (+) Suggested weaker competition in 900 MHz band (-) LTE commercial developments may have increased value of 900 MHz since award (-) Suggested budget constraint in 800 MHz due to strategic bidding for other bands (+)	Tier 1	Yes	Intrinsic value bidding at least as likely as strategic bidding	No
Portugal	£21.2m (71%)	Risk of under- or over-statement	Some unsold 900 MHz spectrum; all 800 MHz spectrum sold at reserve price (+) Non-contiguous 900 MHz lots (-)	Tier 2	No	Some evidence that prices reflect relative intrinsic values	No

Country	900 MHz relative value benchmark in £m per MHz (900:800 MHz ratio)	Assessment of risk		Tiering assessment			
		Assessment	Key considerations indicating risk of overstatement (+) or understatement (-) of the benchmark	Tier	Were prices determined by a market-driven process?	Intrinsic value bidding or strategic bidding? Or, if No in previous column, evidence of prices reflecting relative intrinsic values?	Relevant country-specific factors?
Spain	£22.2m (67%)	Risk of under- or over-statement	900 MHz spectrum sold at reserve price; 800 MHz sold above reserve price (+) LTE commercial developments may have increased value of 900 MHz since award (-)	Tier 2	No	Some evidence that prices reflect relative intrinsic values	No
Denmark	£5.7m (18%)	Larger risk of larger under-statement	The three incumbents prevented from bidding for 900 MHz (-) Joint bidding reduced the number of bidders for 800 MHz (+)	Tier 3	No	No evidence that prices reflect relative intrinsic values	No
Greece	£28.8m (96%)	Larger risk of larger over-statement	900 MHz sold at reserve price (+) 900 MHz lots were very small (-) 900 MHz price set before developments in availability of 700 MHz band at WRC-12 (+)	Tier 3	No	No evidence that prices reflect relative intrinsic values	No
Romania	£30.6m (108%)	Risk of under-or over-statement	Some unsold 800 MHz spectrum, all 900 MHz spectrum sold at reserve price (-) Greater importance of 2G (+)	Tier 3	No	Some evidence that prices reflect relative intrinsic values	2G importance

Table A8.2: Summary of 1800 MHz distance method benchmarks

Country	*1800 MHz relative value benchmark in £m per MHz (Y/X ratio)*	*Assessment of risk*		*Tiering assessment*			
		Assessment	*Key considerations indicating risk of overstatement (+) or understatement (-) of the benchmark*	*Tier*	*Were prices determined by a market-driven process?*	*Intrinsic value bidding or strategic bidding? Or, if No in previous column, evidence of prices reflecting relative intrinsic values?*	*Relevant country-specific factors?*
Austria	£23.0m (64%)	Larger risk of over-statement	Suggested price driving in 1800 MHz (+) Suggested limited strategic investment in all bands (+/-)	Tier 1	Yes	Intrinsic value bidding at least as likely as strategic bidding	No
Germany (2015)	£15.1m (35%)	Larger risk of under-statement	Evidence of signalling and strategic demand reduction in 1800 MHz (-) Evidence of change in expectations of 700 MHz availability between 2010 auction of 800 MHz and 2015 auction of 1800 MHz (-)	Tier 1	Yes	Evidence of signalling and strategic demand reduction	Evidence of change in expectations about 700 MHz availability
Ireland	£13.3m (32%)	Larger risk of over-statement	Suggested price driving in 1800 MHz (+) Suggested budget constraint for 800 MHz due to strategic bidding for other bands (+) 2.6 GHz unavailable for mobile services in Ireland (+)	Tier 1	Yes	Intrinsic value bidding at least as likely as strategic bidding	No

Country	*1800 MHz relative value benchmark in £m per MHz (Y/X ratio)*	*Assessment of risk*		*Tiering assessment*			
		Assessment	*Key considerations indicating risk of overstatement (+) or understatement (-) of the benchmark*	*Tier*	*Were prices determined by a market-driven process?*	*Intrinsic value bidding or strategic bidding? Or, if No in previous column, evidence of prices reflecting relative intrinsic values?*	*Relevant country-specific factors?*
Italy	£12.8m (27%)	Risk of under- or over-statement	[✂] Suggested strategic demand reduction in 1800 MHz (-) Suggested 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 (-)	Tier 1	Yes	Intrinsic value bidding at least as likely as strategic bidding	No
Sweden	£16.0m (38%)	Risk of under-statement	Possible that the joint venture reduced competition for 1800 MHz (-) Possible that the joint venture reduced competition for 800 MHz (+) 800 MHz and 1800 MHz prices set before developments in availability of 700 MHz band at WRC-12 (-) 1800 MHz may not have been perceived as a core LTE band at the time of the award (-)	Tier 1	Yes	Intrinsic value bidding at least as likely as strategic bidding	No
Germany (2010)	£5.6m (0.4%)	Larger risk of larger under-statement	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 (-)	Tier 2	Not clear	Intrinsic value bidding less likely than strategic bidding Some evidence that prices reflect relative intrinsic values	Award pre-dates LTE developments

Country	1800 MHz relative value benchmark in £m per MHz (Y/X ratio)	Assessment of risk		Tiering assessment			
		Assessment	Key considerations indicating risk of overstatement (+) or understatement (-) of the benchmark	Tier	Were prices determined by a market-driven process?	Intrinsic value bidding or strategic bidding? Or, if No in previous column, evidence of prices reflecting relative intrinsic values?	Relevant country-specific factors?
Czech Republic	£7.2m (7%)	Larger risk of under-statement	2x1 MHz lot sizes may have raised aggregation risks in the 1800 MHz band (-) Incumbent operators excluded from bidding for the only large 1800 MHz block (-) Unsold 2.6 GHz with binding caps (+)	Tier 3	Yes	Intrinsic value bidding at least as likely as strategic bidding	Fragmented lots unsuitable for LTE, and tight caps
Greece	£14.4m (37%)	Larger risk of over-statement	1800 MHz sold at reserve price (+) Binding spectrum caps in 1800 MHz (-) 1800 MHz price set before developments in availability of 700 MHz band at WRC-12 (+)	Tier 3	No	No evidence that prices reflect relative intrinsic values	No
Portugal	£5.9m (2%)	Larger risk of under-statement	Likely that 1800 MHz was not perceived as a core LTE band at the time of the award (-) Unsold 1800 MHz with binding caps (-) 800 MHz and 1800 MHz prices set before developments in availability of 700 MHz band at WRC-12 (-) Unsold 2.6 GHz with binding caps (+)	Tier 3	No	No evidence that prices reflect relative intrinsic values	No
Romania	£11.3m (25%)	Risk of under- or over-statement	1800 MHz sold at reserve price; no caps were binding (+) Unsold 800 MHz (-); Unsold 2.6 GHz (-)	Tier 3	No	No evidence that prices reflect relative intrinsic values	No
Slovak Republic	£7.3m (7%)	Risk of under-statement	Incumbents excluded from bidding for large block of contiguous 1800 MHz (-) Reserve price used for 2.6 GHz (+) Possible lack of competition in the 800 MHz band due to cap (+)	Tier 3	No	No evidence that prices reflect relative intrinsic values	Fragmented lots unsuitable for LTE, and tight caps

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.[9]

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

Table A8.1.1: October 2010 auction results

	2.6 GHz	Unpaired 2.6 GHz	Price Paid[10]
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.[11]	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.[12]	

[9] See: http://www.dotecon.com/assets/images/dp1001.pdf
[10] See: https://www.rtr.at/en/tk/FRQ_2600MHz_2010_AE
[11] See page 30: http://www.dotecon.com/assets/images/dp1001.pdf
[12] 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.[13] In December 2013, T-Mobile Austria and H3G Austria appealed against the results of the auction.[14]

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[15] / 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.[16]	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).[17]	

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 as follows.

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

A8.10 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).

A8.11 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.

A8.12 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

A8.13 The multiband auction concluded after the publication of our October 2013 consultation document.

A8.14 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).

A8.15 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 to the October 2013 consultation and May 2014 update

Whether award outcomes are likely to reflect market value

Methodological issues

A8.16 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).

A8.17 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.

A8.18 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.

A8.19 Frontier Economics, on behalf of Vodafone (June 2014 response, Annex 1)[18] argued that there are a number of reasons why LRP results may not be robust estimates of market clearing prices in Austria:

a) 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;

b) 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

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

A8.20 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

A8.21 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.

A8.22 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

[18] 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.

A8.23 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.

A8.24 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.

A8.25 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".

A8.26 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

A8.27 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.

A8.28 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

A8.29 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.

A8.30 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.

A8.31 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

A8.32 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

A8.33 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).

A8.34 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.[19]

A8.35 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.[20] 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),[21] 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).[22]

Assessment in the August 2014 consultation

Whether award outcomes are likely to reflect market value

Methodological issues

A8.36 As we noted in Section 2 (paragraph 2.51 of the August 2014 consultation), we do not agree with Vodafone's characterisation of LRP as involving averaging.

A8.37 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 view was 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 agreed that the original lot structure is preferable for deriving LRP, due to the higher total excursions generated when using a condensed lot structure.

A8.38 In light of the above considerations, we used 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.[23] As for the 900 MHz and 1800 MHz bands, we considered that the LRP without revenue constraint for lot categories B2 and C1 is the most appropriate

[19] 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
[20] *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
[21] See Figure 6 in Vodafone's June 2014 report.
[22] See Figure 7 in Vodafone's June 2014 report.
[23] See Section 3, paragraph 3.28 of the August 2014 consultation for the definition of value of 800 MHz "gross" and "net" of DTT co-existence costs.

comparator for UK licences, as spectrum in these lot categories is available in its entirety from the start of the licence.[24] In this sense, using a weighted average of lot categories by band, as suggested by AM&A, would have reduced the comparability of Austrian and UK spectrum.

A8.39 We considered Vodafone's concern about the high probability of strategic value in losing bids.

A8.40 We recognised that the auction bids which are used in the derivation of LRPs are not publicly available. However, we did 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[25] along with a user manual.[26] 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 generated 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.[27]

c) Third, there was 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.[28] This information did not distinguish between the three lot categories in each band, but just referred to a single price for each band. We compared 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.

A8.41 With reference to the information for Austria, even though LRP without revenue constraint was not our preferred method to derive estimates of market value of 800 MHz and 2.6 GHz for the UK 4G auction, we considered that these LRPs still provided useful reference points. Furthermore, the ratio of LRPs in the UK between 2.6 GHz and 800 MHz at 18% (5.7 / 31.2) was similar to the ratio with our preferred figures using the marginal bidder analysis at 17% (5.5 / 32.63).

[24] 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.
[25] http://www.ofcom.org.uk/static/consultations/8013%20Annual%20licence%20fees%20for%20900%20MHz%20and%201800%20MHz%20spectrum/AustrianLRP_v1-0.zip
[26] http://stakeholders.ofcom.org.uk/binaries/consultations/900-1800-mhz-fees/update/calculator.pdf
[27] 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
[28] 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**

Cross-band comments

A8.42 We explained in Section 3 of the August 2014 consultation (paragraphs 3.48 and 3.70) why we classified relative values from the Austrian auction in tier 1 and not as less important evidence.

A8.43 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.

A8.44 As we noted in paragraph A7.91 of the August 2014 consultation our approach to allegations of strategic bidding was 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.

A8.45 For the allegations of **strategic investment**, we recognised 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 noted 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.

A8.46 Furthermore, to the extent that bids in the auction reflected strategic investment to foreclose rivals and materially affected band-specific prices, it was 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.

A8.47 In relation to allegations by Telefónica and Vodafone of **price driving**, we recognised that there can be opportunities for price driving in auctions, including in CCAs. However, as discussed in paragraph A7.89 of Annex 7 to the August 2014 consultation, 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 have been unreliable to conclude that price driving necessarily occurred just because of a theoretical opportunity to engage in such a bidding strategy.

A8.48 The allegations put forward by stakeholders included suggestions that there were some bids that bidders knew would not win. However, the evidential basis for bidders having such certainty was unclear to us.

A8.49 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 was unclear this would be the case for the allegation of price driving in general, or for the suggestion of price driving by H3G.

A8.50 An effect on the relative values was, however, being suggested in the allegation of price driving specifically in 900 MHz and 1800 MHz. In practice 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 meant 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.

A8.51 We also noted 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).[29] This further suggested 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.

A8.52 We considered Vodafone's analysis of bidding activity. While this analysis may, as Vodafone said, be consistent with strategic bidding, we also considered that it could be consistent with other explanations:

a) We did 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

[29] 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

excess supply of spectrum in the final clock round, as in the Austrian auction. Furthermore, in our view, the parallel that Vodafone drew to H3G's behaviour in the UK 4G auction supported 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 did not agree that the only plausible explanation for bids for large packages was 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 was 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 did not know which of the bids were the highest losing bids that affected auction prices. Nor, even if there were strategic bidding, was it necessarily the case that relative values were materially affected.

A8.53 In our view, the available evidence did 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 noted 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 considered that the risks and scale of understatement or overstatement arising from the allegations of strategic bidding are unknown.

900 MHz

A8.54 For the Austrian CCA we had band-specific price information that was derived from the bids actually submitted in the auction. The LRP results indicated that all lots sold well above reserve price to the three incumbent bidders.

A8.55 Vodafone and Telefónica argued that the 900 MHz band was particularly susceptible to price-driving. We noted 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 suggested 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.

A8.56 Overall, taking into account our cross-band assessments of the possibility of strategic investment and price driving, we considered that the 900 MHz auction price carried a risk of overstatement of Austrian market value, but the likelihood and scale of this risk was unknown.

1800 MHz

A8.57 The LRP results indicated that all 1800 MHz lots in the Austrian auction sold well above reserve price to the three incumbent bidders.

A8.58 We agreed 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 increased 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 of the August 2014 consultation. However, it did not remove the risk that operators will acquire a certain spectrum allocation for more than they value it at.

A8.59 T-Mobile won 2x20 MHz of 1800 MHz, down from pre-existing holdings of 2 x 24.8 MHz. This suggested 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.

A8.60 Overall, taking into account our cross-band assessments of the possibility of strategic investment and price-driving, we considered there was a risk that the 1800 MHz auction price carried a risk of overstatement of Austrian market value, but that the likelihood and scale of this risk is unknown.

800 MHz

A8.61 The LRP results showed that all lots sold well above reserve price to the three incumbent bidders. The Austrian results were also around twice as high as the UK LRP for 800 MHz. We discussed the potential for strategic bidding across all bands above. In view of this, we considered that the 800 MHz price carries an unknown risk of overstating 800 MHz market value in Austria (of an unknown scale).

2.6 GHz

A8.62 We received no specific comments about the price of 2.6 GHz by respondents.[30] We labelled the likelihood, scale and direction of risk as "none" in the table in Annex 8 of the August 2014 consultation.

Likelihood of reflecting UK market value

A8.63 As discussed in paragraphs A7.62 to A7.74 of the August 2014 consultation, we did 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 did not provide strong grounds for considering either such relationship to exist. We did 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.

A8.64 To the extent that the higher take up of mobile broadband made it more valuable in Austria (in particular, for the marginal bidder) than in the UK, it was unclear that such an effect was more prominent for one spectrum band over the others.

Relative benchmarks

A8.65 In summary, we derived the benchmarks for the Austrian CCA as follows:

a) We used the LRPs of lot categories A2, B2 and C1 (calculated without the revenue constraint) as basis for deriving benchmarks of respectively 800 MHz,

[30] 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).

900 MHz and 1800 MHz in the UK, on the basis that they have the closest licence characteristics to UK spectrum.

b) We added the present value of annual fees of Euros 348,828 per 2x5 MHz block, due by spectrum holders over the lifetime of the auction; [31]

c) We then derived UK-equivalent absolute values using the benchmarking methodology set out in Annex 7; and

d) To derive relative value benchmarks, we used the paired ratios and Y/X ratio implied by Austrian absolute values in conjunction with the UK values of 800 MHz (without coverage obligation and gross of DTT co-existence costs) and 2.6 GHz spectrum.[32]

A8.66 As set out above, Telekom Austria published the final clock prices on its website. These final clock prices, which AM&A used in its analysis before LRPs were available, were broadly consistent with the relative values between bands indicated by the LRPs described above.

A8.67 In interpreting these evidence points we noted the risk that prices for 900 MHz and 1800 MHz spectrum overstated market value in Austria. We also considered that there was 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 were unknown; in particular, we were not in a position to assess whether these risks affected one band more than another. As a result, we considered that there was a risk that the 900 MHz / 800 MHz paired ratio and distance method benchmarks understated or overstated UK market value, but that the likelihood, scale and direction was unknown.

A8.68 We placed both the 900 MHz / 800 MHz paired ratio and the distance method benchmark from Austria in the first tier of evidence on the basis that prices were above reserve, reflecting bidding in these auctions, and we did not identified country-specific differences which led us to modify our view that these benchmarks are more informative of the relative values of these spectrum bands in the UK.

Responses to the August 2014 consultation

Whether award outcomes are likely to reflect market value

Legal challenges

A8.69 Frontier (page 16 of its response to the August 2014 consultation) noted that the Austrian auction results are the subject of legal challenges by operators (as part of its discussion of why it is not clear that the LRP estimates from the Austrian auction reflect the true market value of spectrum in Austria). AM&A (page C-1) argued that the fact that some bidders are legally challenging the auction result due to alleged

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

[32] We acknowledged that there is a three year time gap between the multiband CCA and the 2.6 GHz CCA, 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.

irregularities with the auction procedure is a reason to question our decision to consider benchmarks from Austria as Tier 1.

Use of LRPs

A8.70 AM&A (page 15) considered that CCAs where band-specific prices are not available should be classified as Tier 2, and argued Ofcom is inconsistent in treating Austria and Ireland as Tier 1 while excluding other such as the Swiss CCA.

A8.71 Similarly, NERA (page 21) argued that using LRPs to infer band specific prices introduces a risk of error (with an ambiguous effect on the direction of bias in the ratios between frequencies).

A8.72 Frontier considered that the LRPs are not estimates of market clearing prices for individual blocks of spectrum and noted that we departed from using LRPs to estimate UK values of 4G bands (Frontier, page 16).

A8.73 Frontier (page 16) was concerned that it is not possible to assess the underlying drivers of value in the bids, including strategic value.

Claims of strategic behaviour

A8.74 Claims of strategic behaviour were put forward by Vodafone, by Frontier on behalf of Vodafone, and by NERA on behalf of Telefónica. These respondents argued that bidders in the auction bid above their intrinsic value for spectrum either with the aim of depriving rivals of spectrum in order to weaken them and foreclose downstream competition (strategic investment), or with the aim of forcing rivals to pay a higher price than they otherwise would for spectrum that they need (price driving).

A8.75 Vodafone/Frontier and NERA argued that such strategic behaviour was enabled by: the presence of only three bidders; lax spectrum caps, which allowed any bidder to acquire up to half the spectrum in the award; and the inclusion of spectrum in the award which operators needed to re-acquire in order to serve their legacy businesses. They argued that the following points were evidence that strategic behaviour had in fact taken place: the predominance of bids for large packages in the supplementary bids round, which could have had a foreclosure effect if they were winning bids, or a price-driving effect if they were not; and the fact that there was unsold spectrum in the final clock round, but that this did not lead to a drop in prices, suggesting that supplementary bids had been inflated by strategic behaviour.

A8.76 Vodafone (page 25) suggested that the following facts are evidence that strategic considerations provide the best overall explanation. First, a bidder would not have needed to completely exclude a third operator to achieve most of the strategic value, e.g. a first bidder taking half the spectrum while a second operator took a third (their “fair share”), leaving only a sixth for a third operator (a significantly diminished share). Second, supplementary bids were concentrated on packages for 20 and 21 eligibility points rather than along a range of different package sizes. Third, final auction prices were close to the final clock round prices, despite the existence of excess supply in the final clock round.

A8.77 Similarly Frontier, on behalf of Vodafone, argued (response to June 2014 update, page 16) that prices in Austria were influenced by supplementary bids which were either exclusionary or price driving, or both, and might hence reflect the potential value of converting a 3-operator market to a 2-operator market, or the value to a

third operator of trying to maintain its market presence and its competitive credibility.

A8.78 Frontier said (page 39 to 41) that the auction had three features which facilitated bids in the supplementary round intended to set prices for others but which were unlikely to be winning bids: only three bidders, loose spectrum caps, and bidders who had a high private value of retaining use of existing spectrum. Frontier said that with three bidders the price paid by any one bidder for its winning package reflects bids made by the other two bidders, and it was possible for the bids used to determine an auction price to be based on bids which bidders know with a high degree of certainty will not be part of any winning combination, for example because the package would be significantly larger than the final primary round package, and would involve a major – or total - loss of existing deployed spectrum by another bidder.

A8.79 Frontier noted (page 42 of June 2014 response) said that there were "a disproportionate number of supplementary bids for packages of 20 or 21 eligibility points" and argued that the plausible explanation is an attempt to exclude a competitor or, if this is not possible, to influence the price they pay.

A8.80 Frontier considered (page 44 of June 2014 response) that the pattern of demand reduction in multiple blocks during the clock phase could be a sign of either high combinatorial values or strategic bidding, but that the similarity of final clock prices and final prices is an indicator against strong complementarities, because in the presence of strong complementarities the spectrum could not all clear at the final round price, and most likely a significant discount to final round price would be needed to clear the partial package. It considered (page 17) that current holders' high private value for 900 MHz and 1800 MHz spectrum is therefore likely to inflate the private value of this spectrum compared to clear 800 MHz spectrum.

A8.81 NERA, on behalf of Telefónica (page 21) argued that unusually lax spectrum caps may have encouraged bidders to bid for larger packages than they needed, with a view to denying spectrum to a rival. NERA said that bids for large amounts of 900 MHz and 1800 MHz spectrum might have had high blocking value from creating disruption to a rival's legacy business, or could be particularly effective at price driving (given that the high value of the incumbent makes it unlikely to win). It considered that a relatively strong bidder such as Telekom Austria might have pursued the former strategy while weaker bidders may have pursued the latter.

A8.82 NERA (page 21) argued that strategic bidding may have had a different effect on the price of different ALF bands, because incumbent operators may have had predictable, irreducible demands to avoid disruption to legacy operations.

A8.83 NERA also argued that bidders may have engaged in deliberate price-setting strategic bids, whereby they are able to identify packages and related bid amounts that have little or no chance of winning but which will likely set an opportunity cost. It considered that a relatively weak bidder such as H3G Austria may have pursued this strategy.

A8.84 NERA argued that "lack of aggregate demand data in most of the clock rounds may have encouraged aggressive bidding, as each bidder likely feared paying proportionately more than rivals for smaller quantities of spectrum."

Likelihood of reflecting UK market value

A8.85 Vodafone and Frontier argued that relative prices in Austria are not relevant to the UK, for the following reasons:

a) Vodafone (page 26) considered that the ratio of 900/800 in Austria is inconsistent with our previously held view that the former is unlikely to be more valuable than the latter.

b) Frontier (page 14) argued that we had not provided additional evidence or explanations indicating that we changed this position in the August 2014 consultation. Hence it considered that the fact that the 900:800 MHz ratio was more than 100% means it cannot reflect relative market values in the UK, either because it is the result of either strategic bidding in Austria or because country-specific factors are driving 900 MHz above 800 MHz, making the outcome of the Austrian CCA less relevant to UK market values.

c) Frontier also considered (page 17) that there is evidence that spectrum suitable for delivery of mobile broadband services (including spectrum used to serve existing mobile broadband customers, in particular 900 MHz and 2.1 GHz) is likely to be more valuable in Austria due to higher take up of and heavier demand for such services.

Our assessment in the February 2015 consultation

Whether award outcomes are likely to reflect market value

Legal challenges

A8.86 We noted that the legal challenges have now been resolved and the Court upheld the outcome of the auction.[33]

Use of LRPs

A8.87 We explained in paragraphs A7.173-A7.184 of the February 2015 consultation the reasons why we consider that benchmarks from CCAs based on LRP can potentially be placed in Tier 1. We addressed specific stakeholder concerns about the LRPs in Austria in paragraphs A7.176-A7.180.

A8.88 We confirmed that we consider lot categories A2, B2 and C1 to be the most relevant comparators for the UK, for the reasons set out in paragraph A8.38 above.

A8.89 We used the revenue-constrained LRPs, for the reasons set out in paragraphs A7.178 and A7.180 of the February 2015 consultation. In Table A8.1.6 below we compared (for the lot categories A2, B2 and C1) the ratios of the final clock prices published by Telekom Austria to the ratios of both the revenue-constrained LRPs and the LRPs without revenue constraint. As the table illustrates, relative values based on the revenue-constrained LRPs were broadly consistent with, or generally lower than, those based on the LRPs without revenue constraint and the final clock prices. The 900 MHz / 800 MHz ratio for the revenue-constrained LRPs was 2% points below the ratio with the LRPs without revenue constraint, and 3% points

[33] https://www.vwgh.gv.at/aktuelles/pressemitteilungen/2014/12-1-frequenzauktion.html (English translation not available).

higher than the ratio with final clock prices. The Y/X ratio for the revenue-constrained LRPs was 6% points below the ratio with the LRPs without revenue constraint, and 4% points lower than the ratio with final clock prices.

Table A8.1.6: Comparison of ratios of LRPs and final clock prices

	900 MHz / 800 MHz	1800 MHz / 800 MHz	1800 MHz / 900 MHz	Y/X distance ratio
LRPs without revenue constraint	111%	66%	59%	65%
Revenue-constrained LRPs	**109%**	**60%**	**55%**	**59%**
Final clock prices	106%	64%	61%	63%

Source: Ofcom from May 2014 update and Figure A8.1.2 below

Note: The ratios in this table are different from those set out in Tables 3.3 and 3.4. This is because in this table we use unadjusted prices in Euro million per MHz, whereas in the other tables we rely on UK-equivalent absolute values in £m per MHz.

Claims of strategic behaviour

A8.90 In order to assess the claims that the prices in the Austrian CCA reflected strategic bidding:

a) We began with an account of the evidence available to us on:

i) some relevant circumstances of the auction;

ii) the pattern of bidding; and

iii) the outcome.

b) Then we summarised the reasons why stakeholders argued this evidence is consistent with strategic bidding.

c) Thereafter we discussed why it might be consistent with bidding based on intrinsic values.

d) Next we considered, in light of this information, whether the relative prices in the auction, which we use in our benchmarking analysis, are at least as likely to be based on operators' intrinsic values for spectrum as on strategic bidding.

e) Finally, we set out the implications for our interpretation of the 900 MHz and 1800 MHz relative value benchmarks in Austria.

Circumstances of the auction

A8.91 As described above, the auction included 2x140 MHz of spectrum, with 900 MHz and 1800 MHz (2x110 MHz in total) being re-auctioned.

A8.92 It was held shortly after the merger of H3G Austria and Orange.[34] Following the merger, but before the auction, H3G Austria sold almost all of its 900 MHz spectrum to A1 Telekom Austria, in a voluntary deal (that is, not as part of merger undertakings).[35]

A8.93 Market shares at the time of the auction were as follows:

a) A1 Telekom Austria: 44.2%;

b) T-Mobile Austria: 30.9%; and

c) H3G Austria: 24.9%.[36]

A8.94 The bidders entered the auction with spectrum holdings fairly evenly distributed, at around one third each. Because of the staggered expiry dates of existing licences, and because some mobile spectrum was not included in the auction, if any bidder had failed to acquire spectrum in the auction, it would still have held at least 17% of the total available mobile spectrum in the period 2014 to 2019, as shown in Table A8.1.7 below. For all bidders this included LTE spectrum in the 1800 MHz band (with some licences expiring at the end of 2015, others at the end of 2019) and in the 2.6 GHz band (licence expiration date at end of 2026). The percentages in Table A8.1.7 sum to less than 100% with the remainder of the spectrum being available in the auction.

Table A8.1.7: Share in the currently available paired mobile spectrum over time if the stated operator had not acquired any spectrum in the multiband auction

Betreiber/ Jahr	2014	2015	2016	2017	2018	2019
A1 Telekom	2x80,4 (30 %)	2x80,4 (30 %)	2x48,2 (18 %)	2x48,2 (18 %)	2x45 (17 %)	2x45 (17 %)
T-Mobile	2x73,2 (31 %)	2x73,2 (31 %)	2x51,8 (19 %)	2x51,8 (19 %)	2x51,8 (19 %)	2x51,8 (19 %)
Hutchison	2x79,8 (30 %)	2x79,8 (30 %)	2x79,8 (30 %)	2x79,8 (30 %)	2x50 (19 %)	2x50 (19 %)

Source: Table 2 in RTR's 2014 document

Note: Spectrum holdings are those held by each bidder at 1 January of years 2014 to 2019, assuming no spectrum was won in the auction.

A8.95 RTR also commented that during the period shown in the table "it can be expected also in any case that further mobile frequencies will be allocated".[37]

[34] Paragraph A8.92 of the February 2015 consultation incorrectly referred to T-Mobile instead of Orange.
[35] H3G Austria sold 2x3.2 MHz of 900 MHz spectrum; it retained 2x0.8 MHz. See https://www.rtr.at/en/tk/F1_12-59.
[36] Table 3 in RTR, Multiband Auction 2013, Comments on essential points of criticism addressed in the high-court proceedings, 18 December 2014 ("RTR's December 2014 document"), available at https://www.rtr.at/en/komp/Stellungnahme_Multiband_Auktion/Multiband_Auction_2013_Comments.pdf. Market shares are measured in terms of SIM cards (see page 5 of RTR's December 2014 document).
[37] RTR's December 2014 document, page 2.

A8.96 Aggregate supply of spectrum in the auction totalled 41 eligibility points (two eligibility points per lot of sub-1 GHz spectrum and one eligibility point per 1800 MHz lot), as follows:

a) Six 2x5 MHz lots in the 800 MHz band at two eligibility points per lot, i.e. 12 eligibility points; plus

b) Seven 2x5 MHz lots in the 900 MHz band at two eligibility points per lot, i.e. 14 eligibility points; plus

c) Fifteen 2x5 MHz lots in the 1800 MHz band at one eligibility point per lot, i.e. 15 eligibility points.

A8.97 Bidders could bid up to 21 eligibility points within the spectrum caps, as follows.

a) The sub-1 GHz cap permitted acquisition for each bidder up to 2x35 MHz, seven lots or 14 eligibility points; plus

b) The overall cap of 2x70 MHz permitted acquisition up to a further 2x35 MHz in the 1800 MHz band, seven lots or 7 eligibility points.

A8.98 The auction consisted of a clock stage, followed by a supplementary bids round:[38]

a) The clock stage consisted of a series of rounds with ascending prices until the demand in all lot categories no longer exceeded the available supply:

i) Bidders were able to submit a bid for one package of spectrum in each clock round at the prices for the lot categories specified by the auctioneer. As noted in paragraph A8.1.9 above, there were three lot categories for each band, i.e. nine lot categories in total.

ii) At the end of each round, bidders were told the price for each lot category in the next round.

iii) Information about the level of demand was not disclosed to bidders for the first 38 rounds of the clock stage. From round 39, bidders were given information about aggregate demand in each lot category in the previous round (i.e. demand aggregated across all bidders).

iv) The position in the final clock round was not the outcome of the auction, as that also depended on the bidding in the supplementary bids round. For example, as discussed below, in two bands in the final clock round the level of demand was below the available supply, which we refer to as “provisionally unsold” spectrum. This spectrum was in fact sold in the auction through bidding in the supplementary bids round.

b) In the supplementary bids round:

i) Each bidder was allowed to submit up to 3,000 mutually exclusive package bids (“supplementary bids“).

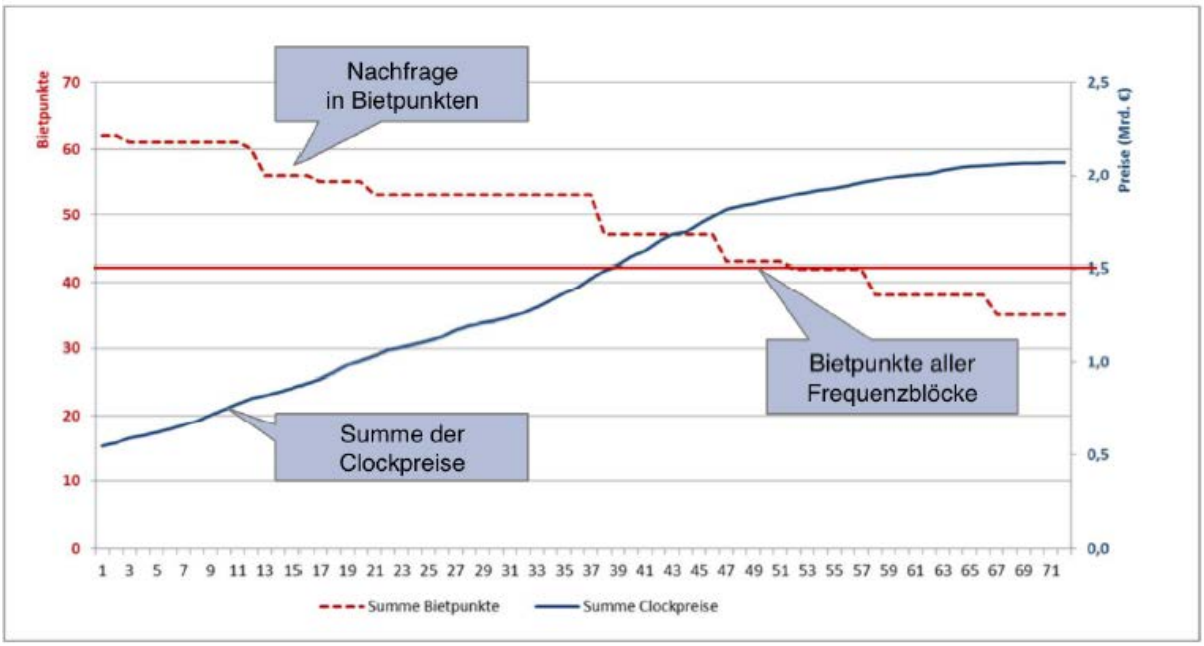
[38] In addition, there was a subsequent assignment stage which did not affect the amount of spectrum won by each winning bidder in each lot category, but determined the exact frequencies of that spectrum for each winner within each lot category. However, we focus on the bidding in the clock stage and supplementary bids round.

ii) There was a linkage between the way each bidder bid in the clock stage and the bids it was permitted to make in the supplementary bids round through the relative cap activity rule ("relative cap"). Under the relative cap, the bidder's supplementary bids were capped relative to its supplementary bid for the package of spectrum on which it was bidding in the final clock round ("final clock round package"), taking account of the pattern of bidding by that bidder in the clock rounds.[39]

Pattern of bidding

A8.99 After the auction RTR published information on overall aggregate demand and supply across all lot categories by clock round (see Figure A8.1.1 below).

Figure A8.1.1: Overall aggregate demand and supply (in terms of eligibility points) and sum of clock prices (Billion Euros)



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

A8.100 The dotted red line in Figure A8.1.1 represents overall aggregate demand measured in eligibility points ("Nachfrage in Bietpunkten"). The horizontal red line represents overall aggregate supply in eligibility points ("Bietpunkte aller Frequenzblocke"), i.e. 41 eligibility points as set out at paragraph A8.96 above. The blue line is the sum of clock prices ("Summe der Clockpreise").

A8.101 Figure A8.1.1 shows that bids in the first clock round added up to 62 eligibility points. This means that two bidders were bidding up to their maximum permitted

[39] The bids for the bidder's final clock round package were uncapped. Bids for a smaller package were capped relative to the supplementary bid on the bidder's final clock round package, with the permitted differential taking account of final clock round prices. Bids for a larger package ("L") were capped relative to the supplementary bid on the constraining package ("M"), which is the package the bidder bid for in the latest clock round when it had sufficient eligibility to bid on the larger package, L, but chose not to by bidding instead on the constraining package, M (and so dropped eligibility below the level of package L). The permitted differential in supplementary bids between the larger package and the constraining package reflected the clock prices in the round when eligibility was dropped.

levels under the spectrum caps in the first clock round (i.e. 21 eligibility points each), while the third bidder made a bid for a package of 20 eligibility points.[40]

A8.102 Figure A8.1.1 also shows that during the clock stage there were significant drops in demand in specific rounds. For example, RTR's December 2014 document states that one of the first two bidders reduced its bidding eligibility in round three and then the other did so in round 12. There were also significant drops in demand in later rounds.

A8.103 At the end of the clock stage (and before the supplementary bids round):

a) Two 900 MHz lots and two 1800 MHz lots were provisionally unsold (as reflected in the overall aggregate demand line in Figure A8.1.1 lying below the overall aggregate supply line in the final clock round). These lots amounted to six eligibility points. This information on provisionally unsold lots was known to bidders.

b) The sum of the three bidders' final clock round packages was 35 eligibility points, out of a possible 41, and this was known to bidders.

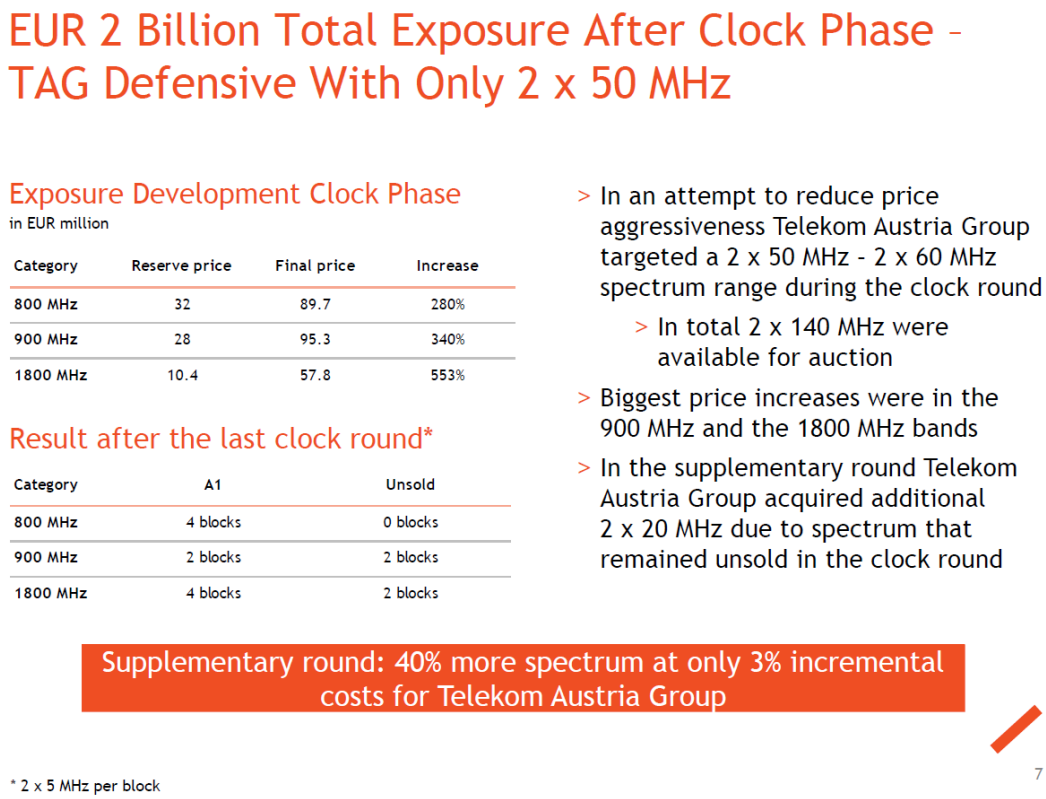
c) Any bidder who was active in the last clock round on a package of less than 14 eligibility points would know that two other bidders must have been active, given the overall spectrum cap of 21 eligibility points.

d) A bidder active on fewer than two 800 MHz blocks would know that two other bidders must still be active in the band, given the 800 MHz cap (of four lots per bidder) and the absence of provisionally unsold 800 MHz lots.

e) A1 Telekom Austria was bidding on a package of 16 eligibility points, having started bidding for a package of 21 (the maximum permitted under the spectrum caps). This is shown in the following slide from a presentation by A1 Telekom Austria which it published following the auction – see the second table in Figure A8.1.2, labelled "Result after the last clock round".

[40] RTR's December 2014 document states that one bidder reduced its bidding eligibility in the first clock round (see the first paragraph on page 3).

Figure A8.1.2: Details from A1 Telekom Austria on the final clock round



EUR 2 Billion Total Exposure After Clock Phase – TAG Defensive With Only 2 x 50 MHz

Exposure Development Clock Phase

in EUR million

Category	Reserve price	Final price	Increase
800 MHz	32	89.7	280%
900 MHz	28	95.3	340%
1800 MHz	10.4	57.8	553%

Result after the last clock round*

Category	A1	Unsold
800 MHz	4 blocks	0 blocks
900 MHz	2 blocks	2 blocks
1800 MHz	4 blocks	2 blocks

- In an attempt to reduce price aggressiveness Telekom Austria Group targeted a 2 x 50 MHz - 2 x 60 MHz spectrum range during the clock round
  - In total 2 x 140 MHz were available for auction
- Biggest price increases were in the 900 MHz and the 1800 MHz bands
- In the supplementary round Telekom Austria Group acquired additional 2 x 20 MHz due to spectrum that remained unsold in the clock round

Supplementary round: 40% more spectrum at only 3% incremental costs for Telekom Austria Group

* 2 x 5 MHz per block

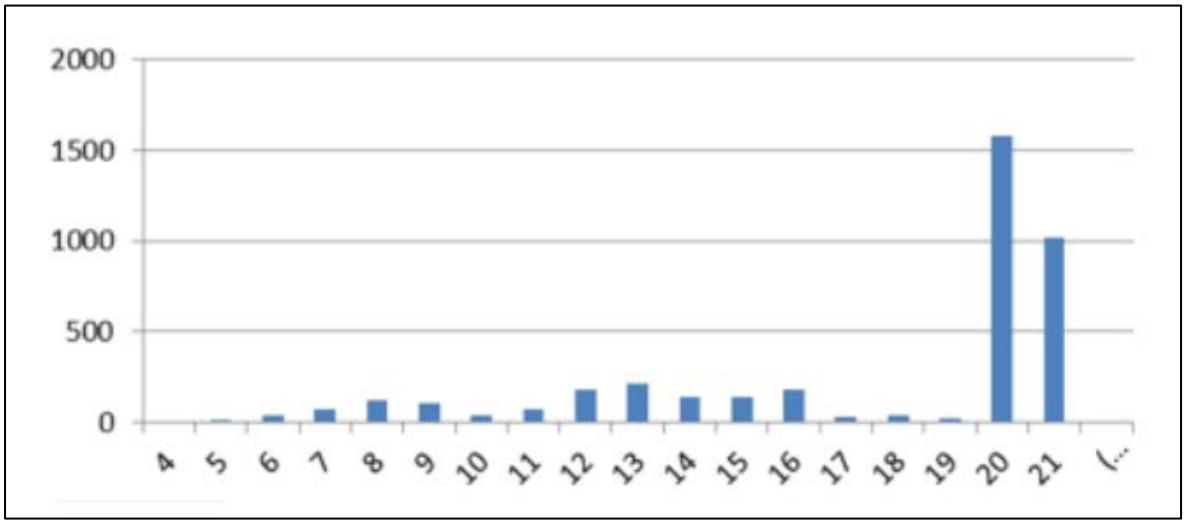
7

Source: A1 Telekom Austria, Slide 7 at:
http://cdn1.telekomaustria.com/final/de/media/pdf/TKA_acquires_austrian_spectrum_Presentation.pdf

A8.104 Following the clock stage, the three bidders submitted a total of 4,032 supplementary bids.[41] Information published by RTR[42] (see Figures A8.1.3 and A8.1.4 below) shows that most of the supplementary bids were placed on large packages of 20 or 21 eligibility points, and that more than 95% of these bids for large packages were placed at the maximum bid amount permitted under the relative cap.

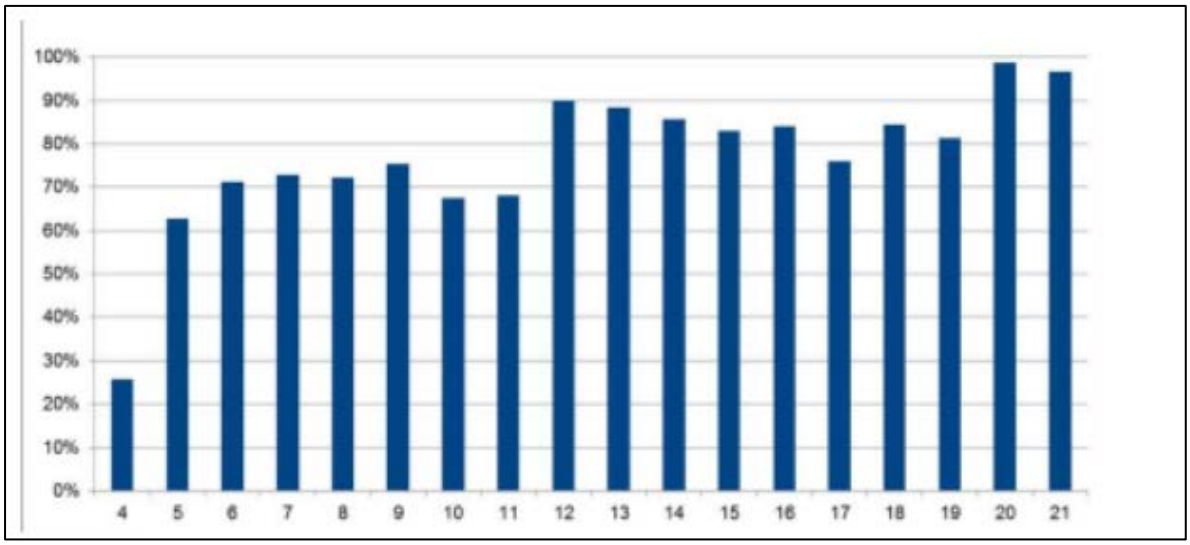
[41] See slide 7 at: https://www.rtr.at/de/pr/PI28102013TK/30167_PK28102013TK_Praesentation.pdf
[42] See slide 8 at: https://www.rtr.at/de/pr/PI28102013TK/30167_PK28102013TK_Praesentation.pdf

Figure A8.1.3 Number of supplementary bids by package size (in terms of eligibility points)



Source: RTR, slide 8: https://www.rtr.at/de/pr/PI28102013TK/30167_PK28102013TK_Praesentation.pdf

Figure A8.1.4: Proportion of bids at the relative cap by package size (in terms of eligibility points)



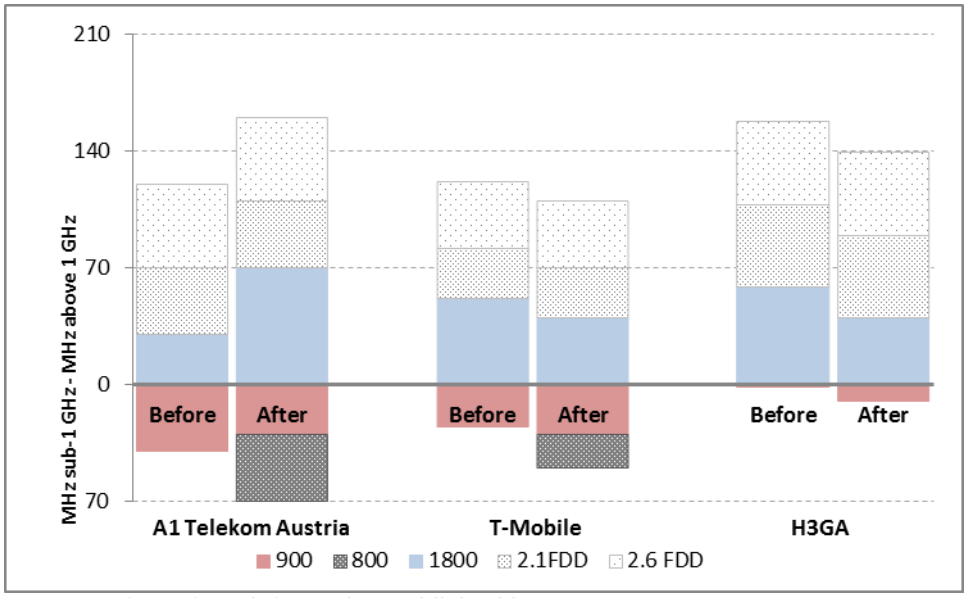
Source: RTR, slide 8: https://www.rtr.at/de/pr/PI28102013TK/30167_PK28102013TK_Praesentation.pdf

Outcome of the auction

A8.105 All three bidders won a significant package of spectrum, including some sub-1 GHz spectrum, as summarised in Table A8.1.3 above.

A8.106 Following the auction, spectrum holdings in 900 MHz and 1800 MHz differed from the pre-auction holdings for all three operators, as shown in Figure A8.1.5 below.

Figure A8.1.5: Spectrum holdings in Austria before and after the 2013 award



Source: Ofcom from information published by RTR

A8.107 Figure A8.1.2 above shows that A1 Telekom Austria's final clock round package was as follows:

a) 2x20 MHz of 800 MHz (4 lots, 8 eligibility points);

b) 2x10 MHz of 900 MHz (2 lots, 4 eligibility points); and

c) 2x20 MHz of 1800 MHz (4 lots, 4 eligibility points).

A8.108 A1 Telekom Austria did not win this final clock round package. It won a larger package including more spectrum in the 900 MHz and 1800 MHz bands (see Table A8.1.3):

a) 2x20 MHz of 800 MHz (4 lots, 8 eligibility points);

b) 2x15 MHz of 900 MHz (3 lots, 6 eligibility points); and

c) 2x35 MHz of 1800 MHz (7 lots, 7 eligibility points).

A8.109 This winning package included three of the four lots which had been provisionally unsold at the end of the clock stage (one 900 MHz lot and two 1800 MHz lots) and one 1800 MHz lot which received a bid at the end of the clock stage. Since all the available spectrum was sold in the auction, this means that either T-Mobile or H3G Austria acquired the other 900 MHz lot provisionally unsold at the end of the clock stage, and that one of these bidders did not win one of the 1800 MHz lots that was included in its final clock round package. Hence at least two bidders did not win their final clock package.

A8.110 T-Mobile stated on its (German) blog that "T-Mobile and another operator narrowly escaped a knockout in the auction, as became apparent afterwards".[43] T-Mobile's CEO stated that T-Mobile would have won nothing had it bid only €6m less.[44]

A8.111 The available information on prices in the final clock round and the final auction prices, in the form of LRPs, is set out in Table A8.1.8. Four sets of LRPs are shown: with or without the revenue constraint; and with the lot structure as in the auction (i.e. three lot categories for each band) or with a condensed lot structure (in which each band is condensed to a single category and a single LRP). We did not use the LRPs with condensed lot structure elsewhere in our analysis, but we showed them here for ease of comparison with the format of the available information on final clock prices.

Table A8.1.8: Comparison of final clock prices and LRPs (in EUR million)

	800 MHz			900 MHz			1800 MHz		
Final clock prices	89.7			95.3			57.8		
Revenue-constrained LRPs – condensed lot structure	82.4			106.3			51.5		
LRPs without revenue constraint – condensed lot structure	82.9			110.0			56.1		
Revenue-constrained LRPs	84.8	95.7	71.9	68.0	104.5	99.0	57.3	49.7	54.1
LRPs without revenue constraint	88.8	97.6	71.7	83.6	108.4	108.9	64.2	54.0	61.0

Source: Ofcom from Figure A8.1.2 and May 2014 update[45]

A8.112 We also compared final clock prices and final auction prices for the bidders' winning packages. This comparison is set out in Table A8.1.9. It showed that the final prices of the packages were similar to those packages if priced at the final clock prices. The final price is 6% lower for T-Mobile, 2% lower for A1 Telekom Austria and 1% higher for H3G.

[43] The relevant passage in German: "Tatsächlich sind T-Mobile und ein weiterer Bieter nur sehr knapp einem Knockout während der Auktion entgangen, wie sich danach zeigte." See T-Mobile, 2013, T-Mobile strebt neue Frequenzauktion an, available at: http://blog.t-mobile.at/2013/11/25/t-mobile-strebt-neue-freuquenzauktion-an/

[44] See E&W, 2013, T-Mobile will eine neue Frequenz-Auktion, available online at: http://www.elektro.at/25.11.2013-T-Mobile-will-eine-neue-Frequenz-Auktion.html

[45] http://stakeholders.ofcom.org.uk/consultations/900-1800-mhz-fees/update-note/

Table A8.1.9: Winning packages (in number of lots by band) at final clock prices and final auction prices

	800 MHz	900 MHz	1800 MHz	Package at final clock prices	Final package auction price	Difference
Final clock prices	€89.7m per lot	€95.3m per lot	€57.8m per lot			
A1 Telekom Austria	4	3	7	€1,049.3m	€1,029.9m	-2%
T-Mobile	2	3	4	€696.5m	€654.5m	-6%
H3G	0	1	4	€326.5m	€330.1m	+1%

Source: Ofcom from Figure A8.1.2 and Table A8.1.3

Explanation based on strategic bidding

A8.113 In this sub-section, drawing on the stakeholder responses set out above, we summarised how their arguments about strategic bidding could be consistent with the evidence of the circumstances, pattern of bidding and outcome set out above.

A8.114 The claims made by stakeholders suggested that a bidder might be bidding above its intrinsic value for spectrum:

a) to acquire that spectrum (at a price above its intrinsic value) and thereby deny it to a rival in order to weaken downstream competition (strategic investment); and/or

b) to avoid acquiring that spectrum but instead to raise the price paid for it by the rival that wins it (price driving).[46]

A8.115 First, stakeholders suggested that the **market conditions** at the time of the Austrian auction might have been consistent with strategic behaviour:

a) Vodafone/Frontier and NERA suggested that bidders might have anticipated that incumbent operators had predictable, irreducible demands in ALF bands to avoid disruption to legacy operations. Hence bids for large amounts of 900 MHz and 1800 MHz spectrum might either have strategic investment value (or blocking value) from creating disruption to a rival's legacy business, or could have been effective as price driving.

b) Several stakeholders suggested that reducing the number of effective competitors from three to two, through strategic investment in the auction to prevent a competitor acquiring any spectrum, could lead to a significant weakening of competition.

c) Vodafone suggested that a bidder might have considered that it would not need to completely exclude a third operator to achieve most of the strategic value, but just to confine it to winning a small package of spectrum. So an attempt to foreclose a rival did not necessarily require coordination with another bidder.

[46] For a discussion of different types of strategic bidding, see Annex 7, paragraph A7.183.

A8.116 Second, stakeholders suggested that the following **features of the auction** might have been consistent with strategic behaviour:

a) Vodafone/Frontier and NERA suggested that loose spectrum caps permitted bidders to bid for larger packages with a view to denying spectrum to a rival through strategic investment. Given that there were only three bidders in the auction, these spectrum caps did not prevent an outcome of one bidder failing to win any spectrum, or being restricted to winning a small package.

b) Stakeholders also noted that the bidders were given the opportunity to make a large number of supplementary bids. This might have given them scope to bid strategically as discussed below.

A8.117 Third, stakeholders suggested that **bidding in the clock phase** might have been consistent with strategic behaviour:

a) At several points during the clock phase, demand reduced by more than one lot in a single round, and there were provisionally unsold lots (excess supply) at the end of the clock phase. Frontier suggested this could have been due to a bidder driving the clock price above its intrinsic value to make rivals pay a higher price, and then dropping demand abruptly to reduce its likelihood of winning (at a price above its intrinsic value). NERA suggested that such a strategy might have been more attractive to H3G, as a weaker bidder (in NERA's view).

b) Frontier claimed that the similarity of final clock prices and final auction prices supported the explanation of strategic bidding, instead of the alternative explanation of the presence of strong complementarities.

A8.118 Fourth, stakeholders suggested that **the pattern of supplementary bids** might have been consistent with strategic behaviour:

a) Vodafone and Frontier suggested that the large number of bids for large packages of 20 and 21 eligibility points (the latter being the maximum permitted under the spectrum caps) was consistent with an attempt to foreclose a rival. Bids for large packages with a real chance of winning might have included an element of strategic investment to weaken or exclude a competitor.

b) In addition, Frontier and NERA suggested that, with three bidders, the price paid by each winner would reflect bids made by the other two. Frontier also suggested that the large proportion of supplementary bids for large packages of 20 and 21 eligibility points which were at the relative cap was consistent with price driving to push up prices to rivals.

c) Frontier suggested that supplementary bids for large packages by bidders who dropped eligibility the most during the clock rounds might have had minimal likelihood of being part of the winning combination but would form part of the price determination, so may be consistent with price driving.

A8.119 Finally, stakeholders suggested that the **outcome of the auction** might have been consistent with strategic behaviour:

a) Vodafone suggested that the evidence of final clock prices (and LRPs) that 900 MHz sold at a higher price than 800 MHz spectrum was consistent with price driving in a band where incumbents had high private value to avoid disruption to legacy operations.

Explanation based on intrinsic values

A8.120 In this sub-section, we discussed how straightforward bidding or bidding based on intrinsic valuations of the spectrum could be consistent with the evidence of the circumstances of the auction, pattern of bidding and outcome of the auction set out above.

A8.121 First, we considered the **market conditions** at the time of the Austrian auction which might have been consistent with bidding based on intrinsic valuations. We said:

a) As set out in Table A1.8.7, each of the three bidders entered the auction with the knowledge that, even if it failed to acquire any spectrum in the auction, it would still hold, for a period of time, at least 17% of the total available mobile spectrum (T-Mobile and H3G Austria would hold 19%).[47] This included LTE spectrum at 1800 MHz (in the medium term, until 2019) and in the 2.6 GHz band for the longer term (until 2026). There might, therefore, have been little prospect of eliminating a competitor from the downstream market through strategic investment in the auction.[48]

b) The market was already relatively concentrated, because the merger between H3G Austria and T-Mobile Austria took place before the auction (see paragraph A8.92 above). This could affect the potential gains from eliminating or weakening a competitor. In addition, it could increase the risk that such an outcome would lead to regulatory intervention, which could prevent strategic investment in the auction from having long-lasting effects and so reduce the pay-off from engaging in that strategic behaviour.

A8.122 Second, we considered the **features of the auction** which might have been consistent with bidding based on intrinsic valuations. We said:

a) The fundamental rationale for the CCA as an auction format is that it provides incentives for straightforward bidding by bidders. For example, providing such incentives is the reason for the pricing rule and the relative cap:

i) Pricing rule. The auction prices are set on the basis of the so-called "second price" reflecting the highest losing bids. These are prices based on opportunity cost (as discussed in detail for the UK 4G auction in Section 2 and Annex 6, which also used a CCA format). Under a simple second-price rule, the auction price for bidder X, if it wins, depends not on any bids made by bidder X but on the bids made by other bidders, i.e. the highest losing bids. Bidder X therefore has an incentive to bid its true value, because shading its bid does not reduce the price it pays if it wins, and instead bid shading just reduces its chances of winning.[49]

[47] For comparison, in the UK, H3G would have had 11% of paired spectrum if it had won no spectrum in the 4G auction.

[48] In its judgement, the Court noted that the "knock-out" that the appellant feared would not necessarily and inevitably have led to the immediate or total market exit by the appellant to the extent the appellant still had access to other (albeit less) spectrum.

[49] In the language used in Annex 6, this description relates to an auction with Vickrey prices (reflecting individual opportunity cost). The CCA uses a more complicated version of a second-price rule with core prices (reflecting collective opportunity cost), which can affect bidders' incentives in some

ii) Relative cap activity rule. This places restrictions on the supplementary bids that bidders can make based on their previous bidding behaviour in the clock stage, and the preferences which those bids have revealed. For packages that the bidder could have bid for during the clock stage, but chose not to, the supplementary bid amount is limited accordingly (relative to the supplementary bid on the final clock round package). By treating bids *as if* they are truthful, and applying restrictions on later bids accordingly, the relative cap seeks to encourage truthful bidding.

b) The auction had a restrictive information policy, with no disclosure of aggregate demand until after round 38 of the clock phase. This could have increased the risk for bidders of deviating from intrinsic valuations and so made strategic bidding less likely.[50]

c) The use of the relative cap meant that it was possible for any active bidder in the final clock round to calculate the minimum amount necessary to win its final clock round package (this is referred to as a "knock-out bid").[51] As such, under the auction design, bidders were able to ensure that they were not prevented, by strategic supplementary bids by others, from winning the spectrum in their final clock round package[52] (although we also note the comments by T-Mobile, reported in paragraph A8.110 above, suggesting that bidders almost failed to win any spectrum). This may have increased the difficulty to other bidders of pursuing a strategic investment (foreclosure) strategy.

A8.123 Third, we considered how **bidding in the clock phase** might have been consistent with bidding based on intrinsic valuations. We said:

a) It appears that at five points during the clock rounds, aggregate demand dropped by three or more eligibility points. There are a number of possible reasons for this, consistent with intrinsic value bidding:

i) It might have been due to a single bidder reducing its demand as prices rose, in significant increments of spectrum instead of a single lot at a time (as in round 12 – see paragraph A8.102 above). This might reflect complementarities in a bidder's package. One possible source of complementarities is in block sizes within a band (which we describe in terms

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circumstances. In the case of the winning outcome in the UK 4G auction, the Vickrey and core prices were the same.

[50] NERA suggested that lack of aggregate demand data in most of the clock rounds may have encouraged aggressive bidding, as each bidder likely feared paying proportionately more than rivals for smaller quantities of spectrum. However, the rationale for this suggestion is unclear to us. To the extent it relates to a bidder seeking to avoid an outcome of asymmetric prices, it is unclear to us how this would have been affected by greater transparency of aggregate demand before round 39 in the Austria auction.

[51] Given the relative cap activity rule in place in Austria, a bidder could determine the minimum amount necessary to win its final clock package for all possible allocations of aggregate demand in each of the clock rounds to other bidders and take the worst case amount (i.e. the highest possible estimate).

[52] We note that RTR's December 2014 document sets out the issue as follows (bottom of page 2): "For every single bidder the knockout risk in the auction was controllable. In particular, a bidder who is active until the end of the clock stage can make sure that it will at least win its final clock package by appropriately raising its final clock bid (and correspondingly structuring other supplementary bids). The amount by which the bidder must raise its final clock bid to have this guarantee results from the price constraints other bidders are subject to in submitting their supplementary bids. The bidder can determine the (amount of the) supplementary bid by means of which it can avoid a knockout."

of a contiguity premium in Section 2). Another possible source is a cross-band effect of complementarity value between bands.

ii) In addition, large drops in demand, as measured by eligibility points, might result from a single bidder who is willing to substitute lots across bands at a rate that differs from the eligibility ratio set by the regulator. For instance, at certain relative prices, a bidder might be willing to trade four lots in the 800 MHz for four lots in the 1800 MHz band. Because in the Austrian auction each lot in the 800 MHz (and 900 MHz) bands was assigned two eligibility points, and each lot in the 1800 MHz was assigned one eligibility point, by moving demand in the way described the bidder would in fact be dropping four eligibility points.

iii) Alternatively, the drop in aggregate demand might have been due to two or three bidders reducing demand at the same time and/or substituting lots in the way described above.

b) At the end of the clock rounds, any bidder active in the last clock round on a package of less than 13 eligibility points or a package with less than two 800 MHz lots would have known that two other bidders must still be active. As discussed above, this limited the scope for any bidder to be completely excluded from the auction.[53]

A8.124 Fourth, we considered how **the pattern of supplementary bids** might have been consistent with bidding based on intrinsic valuations. We said:

a) We only have aggregated information about the supplementary bids that took place, as set out above in Figures A8.1.3 and A8.1.4. The fact that there were three sub-categories for each spectrum band meant that there were a very large number of feasible combinations. A bidder could secure the package it was bidding on at the end of the clock phase with a single bid, as described above. But one of the features of a CCA is that it permits (and encourages) bidders to place many supplementary bids to describe their demand for spectrum in the auction, bidding at their intrinsic valuations for packages which they expect to be profitable. This could be a large number of bids, given the very large number of feasible combinations.

b) Each bidder was permitted to make up to 3,000 supplementary bids and in the event 4,032 supplementary bids were made in total, of which a little more than 2,500 were for packages with 20 or 21 eligibility points (see Figure A8.1.3). Given the lot structure, for each bidder there were more than 2,000 feasible bids for packages with 20 or 21 eligibility points.[54] It is possible, therefore, that a large proportion of the supplementary bids for 20 and 21 eligibility points were from a single bidder, for example from Telekom Austria, which in fact won a package of 21 eligibility points.

[53] We note that RTR's December 2014 document comments as follows (page 3): "As from this round [58], it was clear that each of the three bidders was able to successfully defend itself against a knockout by submitting a corresponding safe bid (so-called knockout bid). This bidding behaviour is irreconcilable with the hypothesis that the bidders had tried to eliminate each other."

[54] We have identified 2,316 packages with eligibility points of 20 or 21 that are consistent with the relevant spectrum caps (which, given the lot structure and the assignment rules, also implied that a feasible package would not include bids for spectrum in lot categories B1 and B3 at the same time).

c) In addition, in the final clock round there were provisionally unsold lots in both the 900 MHz and 1800 MHz bands, amounting to 6 eligibility points. Bidders following a straightforward approach of bidding their intrinsic valuations might be expected to make supplementary bids for larger packages than their final clock round package to seek to win this provisionally unsold spectrum. Telekom Austria's final clock round package was for 16 eligibility points, so a significant number of intrinsic value supplementary bids by it for packages of 20 or 21 eligibility points would be consistent with this explanation. If one of the other bidders had a final clock round package of 14 or 15 eligibility points, it could also have made supplementary bids at intrinsic value for packages of 20 or 21 eligibility points to seek to win the provisionally unsold spectrum.

d) Each bidder might also have wished to avoid an outcome of asymmetric auction prices (perhaps as a secondary objective to its primary objective of obtaining the spectrum it wished to acquire). Asymmetric auction prices could have involved bidder X paying a relatively high price for its spectrum package (due to the bids placed by the other two bidders), with the other two bidders paying a relatively low price (due to bidder X failing to make the right price-setting bids). For example, it is likely that bidders were aware of the asymmetric price outcome which occurred in the Swiss auction in February 2012. As shown in the information we set out on the Swiss auction later in this annex, the outcome involved Sunrise paying 34% more than Swisscom for a package which included significantly less spectrum. As stakeholders have pointed out, with only three bidders in the auction and given the overall spectrum cap, bidders could have expected that their bids which would set the prices of spectrum won by their rivals would be for large packages of 20 or 21 eligibility points. Faced with this situation, each bidder might have chosen to place a large number of bids for packages of 20 and 21 eligibility points, at its intrinsic value for each of these packages, in order to avoid an outcome in which rivals acquired spectrum for a lower price than it would have been willing to pay for it.[55]

e) On the one hand, the ability to make a knock-out bid for its final clock round package (see paragraph A8.122 c) above) implies that the bidder can also make some bids for other packages that have little or no chance of winning. Such bids would have to be structured in a particular way for them to remain riskless, and the relationship of the resulting bid structure to the bidder's intrinsic values would depend on a range of factors. On the other hand, if bidders were contemplating making price-driving bids for larger packages above intrinsic value that were not riskless, the existence of provisionally unsold lots in the final clock round might

[55] Under the CCA format in the Austrian auction with only three bidders, the price that bidder Z paid was determined by the highest value combination of bids for the available spectrum from the other two bidders, X and Y. The total spectrum available in the auction amounted to 41 eligibility points. If the highest value combination of bids from the other two bidders X and Y had a combined size of less than 41 points, then it might set a lower price for bidder Z because the combination would not include the value of bidders X and Y for all of the spectrum won by bidder Z.

Given that the maximum permitted package for any bidder was 21 eligibility points, a combination of package bids from X and Y amounting to 41 eligibility points would necessarily involve a bid from X at 21 eligibility points and a bid from Y at 20 eligibility points, or vice versa. In addition, to make up a feasible highest value combination of bids, the relevant package bids from each of X and Y would have to fit together, i.e. the sum of the lots in their package bids in each lot category could not exceed the available number of lots in that category.

Accordingly, if each bidder wished to ensure that its competitors did not win spectrum at a price below true opportunity cost, then it might have been expected to place a large number of supplementary bids for packages of 20 and 21 eligibility points.

have increased the level of risk of such strategic bidding. This is because it would tend to increase the chance that such bids might win. This is illustrated by the material difference between Telekom Austria's final clock round package and its winning package (see paragraphs A8.107-A8.109 above). It is also illustrated by the comment from T-Mobile's CEO that T-Mobile and another operator narrowly escaped a knockout in the auction, and that T-Mobile would have won nothing had it bid only €6m less (see paragraph A8.110 above). This comment suggests that there was indeed a chance of bidders winning large packages of 20 or 21 eligibility points.

f) The overall aggregate demand in the first clock round was 62 eligibility points and this fell to 35 in the final clock round (of which Telekom Austria's bid was for 16). In general, bidders who dropped most eligibility during the clock rounds were likely to be more constrained in their supplementary bids by the relative cap (although in any particular case this is affected by the specific pattern of relative prices when eligibility was dropped). If so, this would have reduced their ability to engage in price driving.

g) The pattern of supplementary bids involved a large proportion of supplementary bids for packages with 20 or 21 eligibility points and nearly all such bids placed at the limit of the relative cap. This might be consistent with bidders bidding their intrinsic values subject to the complications of managing the implications of budget constraints. As we set out in Section 2 (see paragraph 2.165 of the February 2015 consultation), a bidder facing a budget constraint in a CCA can respond in different ways. One challenge for a budget-constrained bidder is that it may need to deviate from bidding its true incremental values between different profitable packages. The observation of a large proportion of bids for packages with 20 or 21 eligibility points might be consistent with bidders managing such deviation in part by choosing not to make supplementary bids for smaller packages, therefore increasing the chances of winning a large package. The high proportion of bids at the limit of the relative cap for packages with 20 or 21 eligibility points might be consistent with bidders seeking to maintain their incremental bid values for these packages compared to smaller packages.

A8.125 Finally, we considered whether the **outcome of the auction** might have been consistent with bidding based on intrinsic valuations. We said:

a) All three operators won a significant package of spectrum in the award. Each bidder successfully acquired a 2x20 MHz (or larger) block in the 1800 MHz band, suitable for LTE. Each bidder also acquired some sub-1 GHz spectrum. The distribution of post-auction holdings is shown in Figure A8.1.5 above. This outcome is consistent with strategic investment either having failed or not having been attempted (either strategic investment to exclude a competitor entirely or to weaken it by confining it to winning a small package of spectrum).

b) As described above, at least two bidders won packages which were different from those they held at the end of the final clock round. This is consistent with the supplementary bids round enabling bidders to express complementarities which they were unable to express in the clock round (which is one of the purposes of such a supplementary round).

c) With the relative cap activity rule, the observation that the final prices were similar to, or in the case of H3G's winning package slightly higher than, final clock prices is, in general, consistent with intrinsic value bidding of complementarities. This is especially the case if relative prices changed during the clock phase (we do not

have evidence whether or not this occurred in the Austrian auction). For example, a bidder might reduce demand from a larger to a smaller package in an earlier clock round, but when relative prices change in a later clock round it might wish to bid back on the larger package. It would not be able to so in the clock phase, because it would not have sufficient eligibility. It can, however, make this bid in the supplementary bids round. If these circumstances applied in the Austrian auction, even with provisionally unsold lots in the final clock round, bidding based on intrinsic values can result in the observed relationship between final clock prices and final auction prices set out in Table A8.1.9.

d) As shown in Figure A8.1.5 there were differences between the holdings in the 900 MHz and 1800 MHz bands before and after the auction. Telekom Austria's holdings of 900 MHz spectrum reduced by 2x5.2 MHz and its holdings of 1800 MHz spectrum increased by 2x20 MHz. T-Mobile increased its holdings in the 900 MHz band by 2x2.2 MHz and reduced its 1800 MHz holdings by 2x4.8 MHz. This outcome is consistent with bidding based on intrinsic values. Although the previous incumbent holders might have wished to re-acquire spectrum in these bands, the outcome might be consistent with there being uncertainty about the amount of such spectrum that the incumbents needed to re-acquire. Such uncertainty would have made price driving a more risky strategy.

e) The pattern of auction prices across the nine lot categories is shown in Table A8.1.8 as measured by LRPs. The reason for three lot categories within each frequency band was the differences between the spectrum in terms of factors such as the date of spectrum availability, co-existence with users in neighbouring bands, and coverage obligations (as outlined in paragraphs A8.10 to A8.12 above). The differentials between the LRPs for the lot categories seem to be consistent with these differences:

    i) In the 800 MHz band, the highest LRP is for lot category A2, then A1, then A3. The A1 lot is subject to higher risk of interference or requirements to protect the adjacent DTT. The A3 lot is subject to more stringent rural coverage requirements.[56]

    ii) In the 900 MHz band, the highest LRP is for lot category B2, then B3, then B1. The spectrum in the B2 lots is fully available from 2016, whereas the B1 and B3 lots are only partially available in 2016 and fully available later in 2018. The B1 lot is also subject to possible usage restrictions or co-ordination requirements along railway lines to protect adjacent GSM-R.

    iii) In the 1800 MHz band, the highest LRP is for lot category C1, then C3, then C2. The spectrum in the C1 lots is fully available from 2016, whereas the C3 lots are fully available from 2018, and the C2 lots are only partially available from 2016 and fully available from 2020.[57]

[56] In addition, the A2 lots were the frequencies located in the middle of the 800 MHz band. Lot categories A1 and A3 each included only a single lot. Therefore, any bid for more than a single 2x5 MHz block in the 800 MHz band would have to include A2 lot(s). If there was a contiguity premium, this might be partially captured in the LRP of A2.

[57] We also note that the Court stated that there is no indication that the prices paid are above the market value of the spectrum.

Likelihood of strategic or intrinsic value bidding

A8.126 One of our criteria for inclusion of a relative value benchmark in Tier 1 was whether, based on the evidence available to us, the relative prices in the auction are at least as likely to be based on bidders' **intrinsic valuations** of spectrum as on strategic bidding.

A8.127 As noted in the August 2014 consultation (and repeated above at paragraph A8.53), we said it can be difficult to establish whether auction prices were materially affected by strategic bidding or reflected intrinsic values. We said this could remain the case even if all the bid data were available, in particular because bidders' intrinsic values are not usually publicly known.

A8.128 Taking into account the detailed discussion above of possible consistency with the circumstances of the auction, the pattern of bidding, and the outcome of the auction of each of strategic bidding and bidding based on intrinsic valuations, we considered that, based on the evidence available to us, the relative prices in the Austrian auction were at least as likely to reflect intrinsic valuation of spectrum in Austria as to reflect strategic bidding.

Likelihood of reflecting UK market value

A8.129 As discussed in paragraphs A7.155 to A7.161, we remained of the view that there are no 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, we said the available evidence does not provide strong grounds for considering either such relationship to exist. We did 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.

A8.130 To the extent that the higher take up of mobile broadband makes spectrum more valuable in Austria than in the UK, we said it is unclear that such an effect was more prominent for one spectrum band over the others. We said it is therefore unclear why such a feature in Austria would distort the relative values between bands.

A8.131 Vodafone argued that the fact that the price of 900 MHz in Austria (on a UK equivalent basis) was higher than the price of 800 MHz is not consistent with our stated position. We did not accept that argument for the reasons explained at paragraph A9.32.

A8.132 We remained of the view expressed at paragraphs A8.60 and A8.61 of the August 2014 consultation that there are no country-specific factors that suggest that values in Austria overstate UK market value. Respondents did not provide new evidence.

Relative benchmarks

A8.133 For Austria we had prices for 800 MHz, 900 MHz and 1800 MHz from the 2013 CCA and prices for 2.6 GHz spectrum from the 2010 auction. We had sufficient evidence points to calculate both the 900 MHz / 800 MHz paired ratio benchmark and the distance method benchmark for 1800 MHz spectrum.

Assessment of risks

A8.134 We said that when we take strategic behaviour into account in assessing the risk of under- or over-statement, we assess the direction of this risk by asking, *if* strategic

bidding took place, whether this is more likely to have led to an understatement or an overstatement of the benchmark. Our view was that there is an additional source of risk of strategic bidding relevant to the 900 MHz band and 1800 MHz bands, compared to the 800 MHz band. This was the risk of price driving due to previous incumbent holders of 900 MHz and 1800 MHz possibly wishing to re-acquire at least part of this spectrum to avoid disruption to legacy operations.

A8.135 On balance, we considered there is a risk that the 900 MHz / 800 MHz paired ratio benchmark and the 1800 MHz distance method benchmark overstate UK market value, but we said we cannot be sure of the scale of this possible overstatement or the likelihood (other than that intrinsic value bidding is at least as likely).

A8.136 We used the 2.6 GHz / 800 MHz ratio for the purpose of estimating a proxy value for 2.6 GHz in Ireland and Sweden. We considered that the 2.6 GHz / 800 MHz ratio in Austria carries a risk of understatement of relative market value in Austria, as we said we cannot rule out the possibility of strategic behaviour in the case of 800 MHz although we cannot be sure of the likelihood or scale of this risk.

A8.137 For the purpose of estimating a proxy value for 2.6 GHz, we considered that the Austrian 2.6 GHz / 800 MHz paired ratio provided more useful evidence of the ratio of 2.6 GHz prices to 800 MHz prices, given our (unchanged) view on the 2.6 GHz auction price in the August 2014 consultation (see paragraph A8.62) and our assessment of the tier for the Austrian benchmarks (as discussed below).

Tiering

A8.138 Considering each of the criteria for inclusion in Tier 1, we said:

a) The auction prices in the Austrian auction were significantly above reserve, and as such appear likely to have been primarily determined by a market-driven process of bidding.

b) For the reasons discussed in detail above, we considered that, based on the evidence available to us, the relative prices in the Austrian auction are at least as likely to reflect intrinsic valuation of spectrum in Austria as to reflect strategic bidding.

c) We did not have clear, evidence-based reasons to consider the auction outcome is less informative of forward-looking relative values in the UK (having regard to country-specific circumstances and auction dates).

A8.139 Therefore, we considered that the criteria are satisfied for both the 900 MHz / 800 MHz paired ratio benchmark and the 1800 MHz distance method benchmark from Austria. We include both relative value benchmarks in Tier 1.

Stakeholder responses to the February 2015 consultation

A8.140 EE, Telefónica and Frontier (on behalf of Vodafone) disagreed with our assessment of benchmarks from Austria and reiterated a number of their arguments made in response to the August 2014 consultation. EE and Telefónica commented in particular that Austria was an “outlier” compared to other benchmarks, and that the results of the auction were likely to have been due to strategic bidding. EE (p. 45) said that, as a result of strategic bidding, it is much more likely than not that the Austrian distance method benchmark is overstated. Telefónica (pp. 45-46) said that we have underestimated the likelihood of strategic deviations from straightforward

bidding in CCAs, and argued (p. 47) that the evidence that prices in Austria were distorted by strategic bidding is overwhelming. Telefónica presented reports by CEG (Professor Maarten Janssen) and NERA in support of its views.[58]

Use of LRPs

A8.141 CEG (p. 32, on behalf of Telefónica) noted that bidders in a CCA each pay individualised prices for spectrum packages, meaning that prices per unit may differ widely by bidder. CEG also said that the LRP methodology produces imputed, not realised, prices, and argued that "there is no guarantee that LRPs are equal to bidders' opportunity costs and are the appropriate measure of market value".

Claims of strategic behaviour

A8.142 The arguments presented for strategic bidding were that:

a) CCAs do not necessarily provide incentives for straightforward bidding;

b) Strategic investment and price-driving could have been mutually reinforcing;

c) Demand for spectrum in some bands was predictable, creating opportunities for price-driving and/or strategic investment;

d) Lack of aggregate demand information during the auction caused operators to bid defensively;

e) Strategic investment did not require coordination by bidders or total foreclosure of a competitor;

f) The clock round ended with excess supply;

g) Final auction prices for 900 MHz or 1800 MHz were higher than would be expected from intrinsic value bidding;

h) Public statements by the Austrian regulator and bidders supported a view of strategic bidding.

<u>CCAs do not necessarily provide incentives for straightforward bidding</u>

A8.143 In setting out auction features which might be consistent with intrinsic value bidding, we said in our February 2015 consultation (paragraph A8.122) that "[T]he fundamental rationale for the CCA as an auction format is that it provides incentives for straightforward bidding by bidders." EE (page 50) argued that the CCA format is vulnerable to bidding exceeding strategic value. It noted a paper which it said demonstrated this (Janssen and Karamychev, 2013)[59] and said that "[T]he authors cite the pattern of bidding in the Austrian 2013 auction (including relatively few bids on smaller packages) as fully in line with the predictions of their paper."

A8.144 Telefónica (paragraph 73) argued that "the CCA is just as vulnerable to distortion from strategic bidding as other multi-round formats". It commented (paragraphs 137

[58] Annex II and III of Telefónica response to the February 2015 consultation
[59] Janssen, M. and V. Karamychev, "Gaming in combinatorial clock auction", Tinbergen Institute Discussion Paper, 2013, p.4 http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2215812.

and 138) that "[W]henever Ofcom identifies prices it thinks are low in a SMRA setting, it typically attributes this to demand reduction", for example the German 2010 auction, but "[I]n sharp contrast, whenever Ofcom identifies high prices in a CCA setting, for example in relation to some of EE's marginal bids in the UK auction or with respect to the Austrian auction in general, Ofcom's default position is that these must reflect straightforward bidding."

Strategic investment and price-driving could have been mutually reinforcing

A8.145 NERA and CEG argued that incentives for strategic investment and price-driving might have reinforced each other:

a) NERA (p. 31) said that "if H3G feared being squeezed out by bids based on strategic investment, its only serious counter weapon is its ability to exploit its rival's predictable demand at 900 MHz....for Telekom [Austria] or T-Mobile, strategic investment could provide a valuation rationale to support price-driving strategies."

b) CEG presented a hypothetical example with three bidders, six available lots in a spectrum band, each bidder needing two lots to operate, and no bidder having an intrinsic value for one lot on its own so there is a "low likelihood that bidders make bids on one unit". In this scenario, CEG said that by bidding on three lots a bidder will either engineer a downstream duopoly (strategic investment) or raise other bidders' price for two lots (price-driving). In this way, bidders could "guard themselves against winning a larger package they do not want to acquire without restricting the market to a duopoly" (p.23).

Predictable demand in some bands

A8.146 CEG and NERA both argued that legacy bands (900 MHz and 1800 MHz) are susceptible to price-driving due to the fact that incumbents have predictable demand for lots, such that other bidders can submit bids above their intrinsic value for packages including these lots, which they are unlikely to win. CEG recognised that incumbents lost some legacy spectrum in the auction, suggesting uncertainty about incumbents' irreducible demand, but argued that:

a) In the 900 MHz band, it was predictable that Telekom Austria and T-Mobile Austria each would need to acquire at least two blocks in the 900 MHz band to service legacy customers, meaning that "H3G could reasonably infer that it would not acquire four 900 MHz blocks even if it bid high on packages including four such blocks" but that such high bids would determine prices paid by its competitors;[60]

b) In the 1800 MHz band, bidders could foresee that their competitors would secure at least 2x40 MHz together, meaning that any bidder could safely submit bids for packages including 2x40 MHz. In particular, Telekom Austria could bid high on more than 2x20 MHz in the 1800 MHz band to ensure other bidders did not win spectrum for less in comparative terms.

c) CEG (p. 14) agreed that bidders would not be willing to sacrifice their own intrinsic surplus if they only had a secondary preference for raising rivals' cost, but argued that the incentive to raise rivals' cost involves a trade-off between

[60] CEG response, p. 26

"raising rivals' cost and playing safe". The condition for price-driving is that "rival bidders are (reasonably) certain to have valuations for some units that are larger than the marginal valuations of the bidder under consideration".[61]

Lack of aggregate demand information during the auction

A8.147 CEG (pp. 24-25) and NERA (p. 31) said that the lack of aggregate demand data increased the incentive for bidders to engage in price-driving strategies. As individual bidders had no information about how other bidders were bidding in the early stages of the clock round, they could not know whether other bidders were creating scope to place large, price-setting bids in the supplementary round – which would potentially put them at the losing end of an asymmetric outcome. To protect against this possibility, all bidders assumed that it was the case and continued to bid up to the spectrum cap for many clock rounds.

Nature of strategic investment

A8.148 EE and NERA reiterated that lax spectrum caps created the possibility for strategic investment, and also argued the following:

a) EE (pp.49-50) said that the fact that there was little prospect of eliminating a competitor from the downstream market did not rule out strategic investment, as the auction outcome was consistent with bidding to weaken H3G by lowering the amount of sub-1 GHz spectrum won. EE said the fact that Austria was a concentrated market meant there was a greater risk of competitive harm if a competitor were eliminated.

b) NERA (p. 30) argued that two bidders would not need to win the entire spectrum available in order to constrain the third player from a capacity perspective, meaning that coordination and / or total foreclosure are not necessary features for there to have been such strategic bidding.

Excess supply in the clock round

A8.149 CEG (pp. 24-25) said that significantly reducing demand in the last clock round was the only way a bidder could combine high bids on packages it was very unlikely to acquire with a relatively safe bid on a package it could potentially acquire. This pattern of bidding could lead to excess supply at the end of the clock round, as demand was reduced by more than one unit. Thus CEG said that the observation of excess clock round supply was "perfectly in line with strategic bidding".

A8.150 CEG acknowledged that the existence of complementarities might be an alternative reason for this pattern of bidding, but said that it was less likely that complementarities played a major role in bids for large packages (which set final prices in the Austrian auction).

High final prices in the auction

A8.151 EE said that the Austrian 1800 MHz benchmark is at significant risk of being an outlier. Telefónica referred to a quantitative analysis by NERA which it said showed the absolute and relative values in Austria are high price outliers in the sample of European benchmarks.

[61] CEG response to the February 2015 consultation, p. 14

a) Regarding the 900 MHz benchmark, Telefónica (p. 47) said that the fact that 900 MHz spectrum sold for more than 800 MHz spectrum is inconsistent with technical / commercial evidence and industry wisdom on the relative value of the two bands, and also with Ofcom's proposed UK lump-sum values for 800 MHz and 900 MHz. Frontier (p. 2) also said that the Austrian 900 MHz / 800 MHz ratio is inconsistent with Ofcom's position (set out in our October 2013 consultation) that the value of 800 MHz spectrum should be expected to be higher.

b) Regarding the distance method benchmark, EE (p. 47) said that the very high Y/X ratio "suggests that Ofcom should be particularly cautious about factors that may have led to 1800 MHz prices in the 2013 multiband auction being inflated above intrinsic values".

A8.152 EE and Telefónica also cited an academic paper by Levin and Skrzypaczy[62] in which the authors noted that auction revenues were very similar to the sum of clock round prices, and said that "if bidding in both stages of the auction was truthful, average license prices under the Vickrey formula only would be as high as prices at the end of the clock phase if bidders were willing to pay for all their incremental spectrum at the same rate as for a marginal license."

Public statements

A8.153 EE and Telefónica both cited an October 2013 press release by RTR, the Austrian regulator, in which it said that: "More than 65% [of] supplementary bids were submitted for the largest permissible combinations of frequency blocks....These supplementary bids submitted on large frequency packages had a significant effect on the prices offered by the other bidders. At the same time, such bids generally only have a marginal likelihood of winning out in the end. If these bids for very large numbers of frequencies had been ignored when determining the winners and prices, the revenue from the auction would have settled at a level of about EUR 1 billion."

A8.154 EE (p. 47) said that in this statement RTR "has noted the likelihood and impact of price driving in doubling the prices in the auction". Telefónica (p. 48) said that this statement "effectively tells us that there was a billion dollars of opportunity cost created by bidders making very large bids for large packages that they could not expect to win". CEG (p. 21) commented "[T]hus, the press release states that there are clear indicators of strategic bidding". It also said that it contradicts our view in paragraph A8.48 of the February 2015 consultation that the evidence is unclear that bidders knew they would not win some bids.

A8.155 Telefónica (p. 48) and NERA (p. 32) also cited public statements made by bidders in the Austrian auction "arguing that the auction format encouraged them to make exceptionally large bids for strategic reasons":[63]

a) Telekom Austria said that in a CCA "each bidder has a high incentive to bid on much more spectrum than its real demand and thus to reduce its demand late to influence the price of rivals";

[62] J. Levin & A. Skrzypaczy, *Are Dynamic Vickrey Auctions Practical?: Properties of the Combinatorial Clock Auction* (September 2014)
[63] Telefónica response to the February 2015 consultation, p. 48

b) H3G said that "the auction process was illegal in form and in substance" and described the auction as a "disaster for the industry" because high prices are likely to see rural rollouts abandoned; and

c) T-Mobile said that prices in the Austrian auction are set at the market value of the entire company, rather than the market value of the spectrum.

Proposed adjustments

A8.156 EE noted our view that bidding according to intrinsic value is at least as likely as strategic bidding in Austria. It said that even a 50% chance of overstatement, due to the risk of strategic bidding, would imply that the Austrian benchmark is overstated on a probability-weighted basis, but Ofcom appears to have made no adjustment to the weight given to the results to account for this.

A8.157 EE argued that Austria should not be a Tier 1 benchmark without any adjustment to recognise the risk of strategic bidding. It proposed an adjusted distance method benchmark of £8.8m per MHz.[64] This is calculated by taking the ratio of total auction revenue in the absence of supplementary round bids (€765 million) to actual auction revenues (€2.01 billion), and applying it to our proposed benchmark (£23m per MHz). In the absence of such an adjustment, EE said Austria should be a Tier 3 country.

A8.158 Telefónica (p. 47) disagreed that Austria should be a Tier 1 benchmark for 900 MHz and 1800 MHz, based on the evidence that prices were distorted by strategic bidding.

Our assessment

Use of LRPs

A8.159 We explained our views on the use of LRPs from the Austrian auction in paragraphs A7.219 to A7.225. As explained in Annex 6, LRPs represent the linear prices that are closest to market-clearing. As such, they provide evidence on market value. We do not consider that benchmarks should be excluded from Tier 1 on the basis that band-specific prices have not been directly observed.

A8.160 As to CEG's suggestion that prices may differ widely by bidder because in a CCA bidders pay individualised package prices, we compare in Table A8.1.10 the prices of the winning packages at the revenue-constrained LRPs against the actual final prices of the winning packages. This comparison suggests some variation between bidders in the implied prices paid by lot category, but the overall variation is not especially wide.[65] We do not consider, therefore, that the variation between bidders undermines the use of the revenue-constrained LRPs. We also note that there is variation between lot prices for the same band in some of the SMRAs in other countries from which we derive average prices.

[64] EE response to the February 2015 consultation, p. 50

[65] The comparison can only be conducted at the level of winning packages (as this is the level at which final auction prices are determined). We also note that bidders won lots in different lot categories or in different proportions in the same lot category (e.g. A1 Telekom Austria was the only winner of lots in lot categories A1, A3, B3 and C1).

Table A8.1.10: Comparison of winning package final auction prices with prices at revenue-constrained LRPs

	Final package auction price	Prices at revenue-constrained LRPs	Difference
A1 Telekom Austria	€1,029.9m	€1,028.6m	-0.1%
T-Mobile	€654.5m	€667.5m	+2.0%
H3G	€330.1m	€316.8m	-4.0%

Source: Ofcom

Claims of strategic behaviour

A8.161 In the February 2015 consultation, we did not rule out the possibility that prices in the Austrian auction reflected strategic bidding. We noted that certain features of the auction were consistent with operators bidding strategically.

A8.162 We also set out in detail why we also considered that the evidence was consistent with intrinsic value bidding. We summarise below the main points of consistency between the evidence and intrinsic value bidding discussed in the February 2015 consultation:

a) All three operators would continue to have significant spectrum holdings for a period of time following the auction, even if one of them failed to win any new spectrum, and this limited the prospect of eliminating a competitor through strategic investment (paragraph A8.121 (a)).

b) The market was already concentrated, with only three players, so the incentive to reduce competition further might be limited, particularly given the risk that this would prompt regulatory intervention (paragraph A8.121 (b)).

c) The CCA format is intended to encourage straightforward bidding (paragraph A8.122 (a)).

d) Information restrictions during the Austrian auction could have increased the risk to bidders of deviating from intrinsic value bidding (paragraph A8.122 (b)).

e) Each bidder was able to calculate the minimum supplementary bid needed to win its final clock round package, limiting the scope for strategic investment (paragraph A8.122 (c)).

f) The drops in demand in some clock rounds by three or more eligibility points could have been due to complementarities within or across spectrum bands. Alternatively more than one bidder could have dropped demand at the same time (paragraph A8.123 (a)).

g) It is reasonable to expect that all three bidders knew the other two were active in the final clock round, and this limited the scope for any bidder to be completely excluded from the auction (paragraph A8.123 (b)).

h) Many supplementary bids were made, most of them for large packages (of 20 or 21 points). These bids could have been made by Telekom Austria (which won a package of 21 points), and/or by the other two bidders to win some of the lots

which were provisionally unsold in the final clock round. Since bidders could have expected that their bids for packages of 20 or 21 points would set the prices of spectrum won by their rivals, each bidder might have chosen to place a large number of bids for such packages at intrinsic values, in order to avoid an outcome of asymmetric auction prices (paragraphs A8.124 (a-d)).

i) The pattern of supplementary bids might be consistent with intrinsic value bidding subject to bidders managing the implications of budget constraints (paragraphs A8.124 (g)).

j) All three operators won a significant amount of spectrum in the auction, suggesting that strategic investment either failed or was not attempted (paragraph A8.125 (a)).

k) The final allocation was affected by supplementary bids, and final prices paid were similar to final clock prices, both of which we considered consistent with intrinsic value bidding of complementarities (paragraph A8.125 (b)).

l) The fact that some 900 MHz and 1800 MHz spectrum changed hands in the auction meant that a price driving strategy based on an assumption that rivals needed to reacquire their existing holdings might have been risky (paragraph A8.125 (d)).

m) The pattern of auction prices across lot categories within each band was consistent with the differences in the spectrum across these lot categories, such as date of availability, co-existence and coverage obligations paragraph A8.125 (e)).

A8.163 We note that for a number of the points summarised here, which addressed arguments that stakeholders had previously made, stakeholders did not submit any further comment in response to our February 2015 consultation (such as the points summarised at paragraphs A8.162 a), e), g), i) and m). The stakeholder responses to our February 2015 consultation outlined in paragraphs A8.140-A8.158 above include comments on some of the other points summarised here. We consider these responses, and new arguments presented by stakeholders, in the following.

A8.164 For each category of stakeholder argument discussed below, we address the following questions before drawing our conclusions:

a) Is the argument or evidence put forward by the stakeholder(s) consistent with strategic bidding?

b) Does it mean that the evidence is inconsistent with intrinsic value bidding?

c) Does it establish that the relative auction prices are more likely to reflect strategic bidding than intrinsic value bidding?

CCAs do not necessarily provide incentives for straightforward bidding

Is the argument or evidence put forward by the stakeholder(s) consistent with strategic bidding?

A8.165 In our earlier assessment, we commented that a rationale of CCAs was to encourage straightforward bidding. However, we did not assume that the CCA design entirely precludes the possibility of strategic bidding, or take this as a

"default" view. We agree with EE and Telefónica that bidders in CCAs may pursue strategic bidding strategies (as in SMRAs).

Does it mean that the evidence is inconsistent with intrinsic value bidding?

A8.166 Nevertheless, the fact that CCAs do not guarantee straightforward bidding does not mean that they are unable or unlikely to deliver this outcome. In other words, the relative price outcome in this auction format can be consistent with bidding based on intrinsic values.

Does it establish that the relative auction prices are more likely to reflect strategic bidding than intrinsic value bidding?

A8.167 Accordingly, we do not consider the fact that the Austrian auction was a CCA to mean that relative auction prices are more likely to reflect strategic bidding than intrinsic value bidding. It only means that we cannot rule out the possibility of strategic bidding in a CCA. Our view of the relative likelihood of strategic and intrinsic value bidding is based on a detailed assessment of the available evidence (including the "relatively few bids on smaller packages" to which EE referred[66]).[67]

Strategic investment and price-driving could have been mutually reinforcing

Is the argument or evidence put forward by the stakeholder(s) consistent with strategic bidding?

A8.168 We recognise that, in principle, operators could make bids above their intrinsic value on the basis that they will either win and have a strategic investment effect, or lose and have a price-driving effect. Furthermore, in the case where they are primarily pursuing a price-driving strategy, we recognise that it can lower the risk associated with such a strategy (because, in the event that they actually win the spectrum, they may find it profitable to have done so due to strategic investment value). As a result, we agree that the potential for mutually reinforcing strategies is consistent with strategic bidding.

Does it mean that the evidence is inconsistent with intrinsic value bidding?

A8.169 However, we also consider that the two strategies may not always be mutually reinforcing. For example, lots on which the target is vulnerable to price driving may be risky for strategic investment for a range of reasons. The spectrum in those specific lots could be of relatively low value to the strategic bidder to the extent that strategic investment is unprofitable. Or it might be difficult for a bidder to be sure that a winning strategic investment bid will have the desired effect of reducing competition (sufficiently to compensate the bidder for winning spectrum above its intrinsic value). Therefore, it is, in general, unlikely that the risk to a bidder from engaging in strategic bidding is eliminated.

A8.170 We do not consider that CEG's stylised example constitutes evidence that strategic bidding occurred in the Austrian auction. Firstly, CEG's example focuses on a single

[66] The Janssen and Karamychev paper which EE cited quotes a comment by RTR regarding the supplementary bids round, and comments that "[T]he behavior is fully in line what this paper predicts". Professor Janssen, one of the authors, made a similar point in his report for CEG on behalf of Telefónica, and we discuss this point below.

[67] The same is true of SMRAs: our assessment of strategic bidding in the Germany 2010 and 2015 SMRAs is also based on a detailed assessment of the available evidence for those specific auctions.

band of essential spectrum; in reality, the auction was multiband and operators still had spectrum holdings even if they won nothing in the whole auction (as we showed in paragraph A8.94). Secondly, the conclusion that, in winning half the spectrum, a bidder would guarantee a downstream duopoly relies on the fact that no-one would bid for one unit of spectrum. This does not appear to be a relevant assumption for the Austrian auction – indeed one outcome of the auction was that H3G won a single lot of 900 MHz.

A8.171 Given the risks that might remain for the operators even when they have both price-driving and strategic investment goals, we consider that the auction circumstances were consistent with intrinsic value bidding.

Does it establish that the relative auction prices are more likely to reflect strategic bidding than intrinsic value bidding?

A8.172 Overall, we do not consider the possibility that operators might have simultaneously held both price-driving and strategic investment objectives (in relation to some bids) provides evidence that relative prices are more likely to reflect strategic bidding than intrinsic value bidding.

Predictable demand in some bands

A8.173 We now consider CEG's arguments that operators' legacy holdings in the 900 MHz and 1800 MHz bands created an opportunity for price-driving.

Is the argument or evidence put forward by the stakeholder(s) consistent with strategic bidding?

A8.174 Price driving requires the bidder to be able to predict the spectrum needs of a rival with some confidence. In the 900 MHz band, the presence of legacy holdings is consistent with Telekom Austria and T-Mobile having relatively high valuations of 2x10 MHz. In turn, this is consistent with H3G submitting price-driving bids for packages including more than 2x15 MHz of 900 MHz spectrum in excess of its intrinsic value, based on H3G having a reasonable degree of certainty that the bids would not win. Similarly, it is possible that Telekom Austria was sufficiently certain about the other operators' demands for 1800 MHz to make corresponding price-driving bids in the 1800 MHz band.

Does it mean that the evidence is inconsistent with intrinsic value bidding?

A8.175 However, we also consider the following:

a) It is not necessarily the case that incumbent holders of spectrum needed to retain all their existing holdings. Indeed the outcome of the Austrian auction involved some changes in the holdings of 900 MHz and 1800 MHz spectrum (see Figure A8.1.5 above).

b) In Austria, the timing of availability of spectrum in the different lot categories gave incumbents a two-to-four year adjustment period before the licences changed hands, mitigating the potential cost of relinquishing legacy spectrum.

A8.176 As a result, we do not consider that stakeholders' arguments mean that the evidence is inconsistent with intrinsic value bidding. There may have been some risk for H3G to pursue a price driving strategy in 900 MHz, and the more aggressive the price driving, the greater the risk of exceeding a rival's intrinsic valuations. The

same applies to Telekom Austria in 1800 MHz. Such risks could have deterred operators from bidding above intrinsic values.

Does it establish that the relative auction prices are more likely to reflect strategic bidding than intrinsic value bidding?

A8.177 Overall, to reach a view that relative prices in the auction were more likely to be the result of price driving, we would need to consider that it was more likely than not that operators needed to retain the amounts of spectrum noted by CEG, that they were aware, with some certainty, of other bidders' spectrum needs (and valuations), and that, despite the risks, they pursued price driving strategies which drove auction prices significantly above intrinsic valuations. We do not consider that we are in a position to reach such a view based on the available evidence.

Lack of aggregate demand information during the auction

Is the argument or evidence put forward by the stakeholder(s) consistent with strategic bidding?

A8.178 Information about aggregate demand was not disclosed to bidders for the first 38 rounds of the clock stage. CEG argued that a lack of such information increased the incentive for bidders to engage in price driving strategies, in order to avoid being on the losing end of an asymmetric outcome. It suggested that all bidders bid up to the spectrum cap for many rounds.

A8.179 As set out at paragraph A8.101 to A8.102 above, in the first clock round two bidders bid up to the spectrum cap in terms of eligibility points, but one reduced its demand (in terms of eligibility points) in round three and the other in round 12 with some further reductions in eligibility by bidders before round 39 (see Figure A8.1.1). This evidence is not consistent with the suggestion that all bidders bid up to the spectrum cap for many rounds.

Does it mean that the evidence is inconsistent with intrinsic value bidding?

A8.180 The evidence of bids up to the spectrum cap from two bidders in the first clock round, with subsequent reductions in eligibility as clock prices increased, is consistent with intrinsic value bidding. The fact that information on aggregate demand was not disclosed to bidders before round 39 does not make the evidence inconsistent with intrinsic value bidding.

A8.181 In addition, we explained in the February 2015 consultation that the lack of information during the clock rounds could have increased the risk for bidders of deviating from intrinsic valuations (see paragraph A8.123b).

Does it establish that the relative auction prices are more likely to reflect strategic bidding than intrinsic value bidding?

A8.182 Before the end of the clock stage, there were more than 30 further clock rounds after the disclosure of aggregate demand data from round 39. The auction outcome is more likely to be determined by bidding in the later stages of the clock round when aggregate demand data was available to bidders (and in the supplementary bids round). In conjunction with the points set out above, we do not consider that CEG's argument establishes that the relative auction prices are more likely to reflect strategic bidding than intrinsic value bidding.

Nature of strategic investment

Is the argument or evidence put forward by the stakeholder(s) consistent with strategic bidding?

A8.183 EE and NERA argued that lax spectrum caps may have created an opportunity for strategic investment through limiting a competing bidder's spectrum acquisitions, for example by Telekom Austria and T-Mobile against H3G in sub-1 GHz spectrum.

A8.184 The outcome in the sub-1 GHz bands was as follows:

a) 800 MHz band: Telekom Austria won 2x20 MHz and T-Mobile won 2x10 MHz with H3G winning no spectrum.

b) 900 MHz band: Telekom Austria and T-Mobile each won 2x15 MHz with H3G winning 2x5 MHz.

A8.185 We recognise that the caps and the outcome could be consistent with strategic investment in sub-1 GHz spectrum.

A8.186 Spectrum caps (2x35 MHz for sub-1 GHz, 2x20 MHz for 800 MHz, and 2x30 MHz for 900 MHz) made it impossible for any operator acting unilaterally to prevent a rival from winning any sub-1 GHz spectrum. For example, even with Telekom Austria winning 2x20 MHz of 800 MHz spectrum and 2x15 MHz of 900 MHz spectrum, the other two were both able to acquire sub-1 GHz spectrum. Therefore if the outcome in sub-1 GHz spectrum did reflect strategic investment, it would have relied on tacit coordination.

A8.187 However, it is possible that such tacit co-ordination occurred. For example, the outcome could have reflected foreseeable focal points.

A8.188 EE suggested that there was a greater risk of competitive harm if a competitor were eliminated in a concentrated market such as Austria. However, the Austrian auction did not result in a competitor failing to win spectrum or being eliminated. We also explained in the February 2015 consultation the evidence against strategic investment involving elimination of a competitor (for a summary, see paragraphs A8.162a), b), e) and g).

Does it mean that the evidence is inconsistent with intrinsic value bidding?

A8.189 As well as 2x5 MHz of sub-1 GHz (900 MHz) spectrum, H3G won 2x20 MHz in the 1800 MHz band. In addition, H3G has significant holdings of higher frequency spectrum (from earlier auctions and due to the merger between H3G and Orange before the auction).

A8.190 The auction outcome could have reflected the pattern of intrinsic values between H3G and the other bidders. For example, we noted in our February 2015 consultation that before the auction H3G had sold almost all of its 900 MHz spectrum (see paragraph A8.92 above). This could indicate limited interest in sub-1 GHz spectrum from H3G.

A8.191 In our view, operators can be credible competitors without large holdings of sub-1 GHz spectrum. For example, in the UK, two of the current four national operators (which we consider to be credible competitors) only hold 2x5 MHz of sub-1 GHz spectrum each (EE and H3G). Moreover, in our competition assessment for the UK

4G auction, we concluded that an operator could be credible even without any sub-1 GHz spectrum if it held at least 2x15 MHz in the 1800 MHz band and enough spectrum in higher frequency bands.

A8.192 Therefore, we consider that the existence of the spectrum caps and the outcome in sub-1 GHz spectrum is consistent with intrinsic value bidding.

Does it establish that the relative auction prices are more likely to reflect strategic bidding than intrinsic value bidding?

A8.193 Based on the available evidence, in our view strategic investment to eliminate a competitor is unlikely to have occurred in the Austrian auction. More limited strategic investment in the sub-1 GHz band may have been a more feasible objective, but in our view the evidence suggests that intrinsic value bidding is at least as likely for the reasons set out above and in the February 2015 consultation (summarised at paragraph A8.162).

Excess supply in the clock round

Is the argument or evidence put forward by the stakeholder(s) consistent with strategic bidding?

A8.194 CEG said that excess supply in the last clock round is evidence of a price-driving strategy by operators. This argument has previously been made by Frontier and NERA.[68] We recognised in the February 2015 consultation that excess supply in the clock round is consistent with price-driving.

Does it mean that the evidence is inconsistent with intrinsic value bidding?

A8.195 CEG's suggestion was that excess supply in the last clock round provided the potential for bidders to engage in price driving in the supplementary bids round. However, even if there was such potential, it does not mean that price driving necessarily occurred to distort relative auction prices.

A8.196 We outlined in the February 2015 consultation a number of explanations of excess supply in the last clock round which are consistent with intrinsic value bidding, including the presence of complementarities (see paragraph A8.123 (a) above).[69]

Does it establish that the relative auction prices are more likely to reflect strategic bidding than intrinsic value bidding?

A8.197 CEG argued that it is less likely that the presence of complementarities explains the pattern of bidding for large packages. However, CEG did not put forward any evidence for this.

A8.198 As a result, we remain of the view, based on the available evidence, that intrinsic value bidding is at least as likely as strategic bidding as an explanation for the observation of excess supply in the clock round.

[68] Paragraph A8.117 of the February 2015 consultation

[69] This paragraph discussed possible intrinsic value explanations of drops in aggregate demand of three or more eligibility points at five points during the clock rounds. The last of these drops led to excess supply at the end of the clock stage.

High final prices in the auction

Is the argument or evidence put forward by the stakeholder(s) consistent with strategic bidding?

A8.199 For 900 MHz, the ratio of 900 MHz / 800 MHz in Austria exceeds 100%. For 1800 MHz, the Y/X ratio in the distance method of 64% is significantly higher than in other countries.

A8.200 EE and Telefónica said that Austria's results were high price outliers. They referred to four types of evidence in support of their suggestion of strategic bidding: the high relative prices for 900 MHz and 1800 MHz in themselves; an academic paper by Levin and Skrzypacz; and, for 900 MHz, both technical / commercial evidence and Ofcom's position in the October 2013 consultation.

A8.201 We recognise that the relative prices in Austria are consistent with price-driving in the 900 MHz band and to a lesser extent in the 1800 MHz band.[70]

Does it mean that the evidence is inconsistent with intrinsic value bidding?

A8.202 We discuss in turn below the four types of evidence put forward by stakeholders.

A8.203 High relative prices for 900 MHz and 1800 MHz in themselves: Given the variation between country benchmarks and the potential for country specific factors, we are cautious about considering that price outcomes alone are a sufficient basis on which to conclude that bidding was inconsistent with intrinsic values. For example, we discuss NERA's quantitative analysis of benchmarks – and its suggestion of outliers – in more detail in paragraphs A7.232 to A7.249. Rather, our approach to assessing benchmarking evidence has been to consider whether there are auction or country-specific reasons to question the quality of evidence as a basis for estimating the lump-sum values of 900 MHz and 1800 MHz spectrum.

A8.204 Paper by Levin and Skrzypacz: The Levin and Skrzypacz paper noted that total revenues were close to the sum of final clock round prices and suggested this might not be consistent with truthful bidding. However, we said in the February 2015 consultation (see paragraph A8.125 c) above) that final prices being similar to, or even higher than, final clock prices could also be consistent with intrinsic value bidding of complementarities. We note that the model in the Levin and Skrzpaczy paper is based on an assumption of diminishing marginal value of spectrum, which does not take account of the possibility of complementarities. As a result, we do not consider the similarity of total revenues to final clock round prices or the Levin and Skrzypacz paper show that relative auction prices are inconsistent with intrinsic value bidding.

A8.205 Technical / commercial evidence: We recognise that, if an operator wished to use 900 MHz spectrum for LTE, the technical and commercial evidence does not seem to suggest a higher price for 900 MHz than 800 MHz spectrum. For 1800 MHz, the observed relative prices in the Austrian auction could be consistent with the technical and commercial evidence.

[70] It is less clear that the relative prices are consistent with having been determined by strategic investment, as that would require more strategic investment in 900 MHz and/or 1800 MHz than in 800 MHz, whereas stakeholders have generally put forward possibilities of strategic investment in all bands or in sub-1 GHz spectrum.

A8.206 Ofcom's position in the October 2013 consultation: We explained in paragraph A9.32 of our February 2015 consultation that our view in the October 2013 consultation about the relative value of 800 MHz and 900 MHz spectrum was based on the benchmark evidence available at that time, which did not include Austria.

Does it establish that the relative auction prices are more likely to reflect strategic bidding than intrinsic value bidding?

A8.207 Based on the discussion above, we recognise that based on available technical and commercial evidence the value of 900 MHz is likely to be lower than 800 MHz, and this tends to support the possibility that the high auction price of 900 MHz in Austria compared to 800 MHz is more likely to reflect strategic bidding than intrinsic value bidding. We consider the implications when drawing our conclusions below on the risk of overstatement and the choice of tier.

A8.208 We do not consider that the other points of evidence put forward by stakeholders, either individually or taken together, establish a greater likelihood of relative prices reflecting strategic bidding than intrinsic value bidding for either 900 MHz or 1800 MHz.

Public statements

Is the argument or evidence put forward by the stakeholder(s) consistent with strategic bidding?

A8.209 The public statements by RTR, Telekom Austria, H3G and T-Mobile referred to by stakeholders are consistent with strategic bidding.

Does it mean that the evidence is inconsistent with intrinsic value bidding?

A8.210 RTR stated that a majority of supplementary bids were for large packages and "such bids generally only have a marginal likelihood of winning". However, we do not agree with EE's and Telefónica's interpretation that RTR's press release stated that price driving or strategic bidding had occurred. RTR commented that bidding in the clock stage and in the supplementary bids round was consistently aggressive (or "offensive"). For example, it noted that the three bidders submitted more than 4,000 supplementary bids with 65% for the largest permissible packages. Without these bids, e.g. if bidders had adopted a "more defensive" strategy, RTR suggested that auction prices would have been much lower.

A8.211 However, in the February 2015 consultation we explained how the evidence to which RTR referred about the pattern of supplementary bids is consistent with intrinsic value bidding – see paragraph A8.124 above, which is also summarised in paragraph A8.162h) and i) above. This explanation took into account that bids for large packages might have had a relatively low likelihood of winning, but avoided an outcome of asymmetric auction prices. In our view, the evidence of RTR's press release does not invalidate this explanation.

A8.212 Telefónica said that public statements from the three bidders show that "prices exceeded market value owing to incentives for over-bidding".[71] Taking each statement in turn:

[71] NERA response to the February 2015 consultation, p. 31

a) The statement by Telekom Austria refers to the theoretical properties of a CCA, rather than the Austrian auction itself. As discussed in paragraph A8.165, we agree that CCAs do not guarantee truthful bidding by operators. However, we do not consider that this constitutes evidence that relative auction prices are inconsistent with intrinsic value bidding.

b) The statement made by H3G indicates that it considered the prices to be high and refers to the auction being, in its view, "illegal". But the statement does not refer to "over-bidding" or bidding for "strategic reasons". We do not consider that this opinion of H3G in itself shows that the evidence is inconsistent with intrinsic value bidding.

c) The statement by T-Mobile was made in the context of an appeal against the results of the auction, and presented the opinion of that bidder in relation to the auction outcome. It was not supported by an explanation of why T-Mobile considered that the auction prices reflected the value of the entire company. Given that all three operators would continue to have significant spectrum holdings for a period of time following the auction even if they had failed to win any new spectrum, we consider it is not clear that they would submit bids based on total enterprise value. Even if operators had done so, we note that auction prices are determined by incremental bid values for packages containing more spectrum than their winning packages. If both package bids being compared included the value of the entire company, the incremental bid value between them would not (because it would net out). Therefore, we do not consider that T-Mobile's view of the auction in itself establishes that the evidence is inconsistent with intrinsic value bidding.

Does it establish that the relative auction prices are more likely to reflect strategic bidding than intrinsic value bidding?

A8.213 In our view, for the reasons set out above, the public statements by RTR and the three bidders do not provide new evidence to cause us to change our view in the February 2015 consultation about the likelihood of relative auction prices reflecting strategic bidding or intrinsic value bidding.

Adjustments proposed by stakeholders

A8.214 We do not see any merit in EE's suggestion of an adjusted estimate which would effectively ignore all bidding in the supplementary round. Even if we did consider that strategic bidding was a more likely explanation of bidding in the Austrian auction, we would not adopt EE's proposed benchmark as we do not consider that adjusting our benchmark by the ratio of auction revenues (with and without supplementary round bids) is a sensible way of quantifying the alleged impact of strategic bidding:

a) First, if the supplementary bids were to be ignored, there would be an argument to look at the final clock prices to represent the auction prices. As shown in Table A8.1.6 above, the ratio of final clock prices is similar to the ratio of prices which we use from the auction (i.e. the revenue-constrained LRPs); and

b) Second, in any case, supplementary bids are an integral component of the CCA format and, in the case of the Austrian auction, they determined the final allocation of spectrum (as the excess supply in the last clock round was allocated to bidders based on supplementary bids). As such, ignoring all supplementary bids would be inconsistent with the outcome of the auction.

A8.215 Other stakeholder comments relate to the assessment of risks and the choice of tier, which we discuss below.

Conclusion on strategic bidding

A8.216 We have considered stakeholder arguments both individually and collectively. Based on the available evidence, our assessment in the February 2015 consultation and the further analysis in this document, in our view:

a) For some of the arguments advanced by stakeholders, the available evidence is unlikely to be consistent with an explanation based on strategic bidding, such as strategic investment to eliminate a competitor.

b) For the other arguments advanced by stakeholders, the available evidence is consistent with an explanation based on strategic bidding. However, that evidence is also consistent with an explanation of intrinsic value bidding, as explained in detail above.

c) Given the consistency of the evidence with both strategic and intrinsic value bidding, we do not consider that we have a sound basis on which to conclude that it is necessarily more likely that relative auction prices reflect strategic bidding than intrinsic value bidding (whether the claims of strategic bidding are considered individually or in combination).

d) The possible exception to our views in the two preceding sub-paragraphs relates to technical and commercial evidence for the value of 900 MHz relative to 800 MHz. We have not identified a specific reason for the 900 MHz price to exceed the 800 MHz price based on intrinsic value in Austria (or that such a reason would be equally applicable to intrinsic value in the UK). On the other hand, our view is that market-based evidence (which directly reflects valuations of spectrum expressed by market participants) is in principle more informative. We are therefore cautious before dismissing or downgrading it on the basis of an expectation derived from views about technical / commercial evidence.

e) We have not identified a similar exception for 1800 MHz. Therefore, our view remains that relative prices for the 1800 MHz band in the Austrian auction are at least as likely to reflect intrinsic valuation of spectrum in Austria as to reflect strategic bidding.

Relative benchmarks

A8.217 In our February 2015 consultation we included both the 900 MHz and 1800 MHz relative value benchmarks in Tier 1. We took account of the consistency of the evidence with strategic bidding through a risk of overstatement in both benchmarks, although we said that we could not be sure of the likelihood or scale of any overstatement. These risks were taken into account in our assessment of lump-sum values in Section 3 of the February 2015 consultation.

A8.218 EE argued that a 50% chance of overstatement implies the benchmarks are overstated on a probability-weighted basis and it suggested that we made no adjustment to the weight given to the results to account for this. Stakeholders generally argued that the Austrian benchmarks should not be in Tier 1.

A8.219 For the 1800 MHz benchmark, we continue to believe that it is more appropriate to reflect the possibility of strategic bidding through identifying a risk of overstatement

in the benchmark than through downgrading it from Tier 1 to Tier 2. In our view, the available evidence does not suggest a clear view whether the relative auction prices are more likely to reflect strategic bidding or intrinsic value bidding. Therefore, we consider that the second criterion for inclusion in Tier 1 is satisfied and that, based on the available evidence, the relative prices are at least as likely to be based on intrinsic valuations of spectrum as on strategic bidding.

A8.220 However, recognising the significant evidence that is consistent with strategic bidding, such as price driving in the 1800 MHz band, we now conclude that the 1800 MHz benchmark is at **larger** risk of overstatement. We remain of the view that we cannot be sure of the scale of any overstatement.

A8.221 For the 900 MHz benchmark, as well as the possibility of price driving, there is in addition the possibility that the relative prices are not consistent with technical and commercial evidence. Since such evidence suggests that 900 MHz is not higher value than 800 MHz, whereas the 900 MHz absolute value is 15% higher than the 800 MHz absolute value, it also informs the scale of any overstatement. Therefore, we now conclude that the 900 MHz benchmark is at **larger** risk of **larger** overstatement.

A8.222 As regards the choice of tier for the 900 MHz benchmark, compared to our assessment in the February 2015 consultation, we now place more weight on technical / commercial evidence. We have considered in Section 3 whether such evidence is sufficient for us to classify the 900 MHz Austrian benchmark in Tier 2 or whether it should remain in Tier 1. Our conclusion is to include the benchmark in Tier 1, for the reasons set out in paragraphs 3.63 to 3.67.

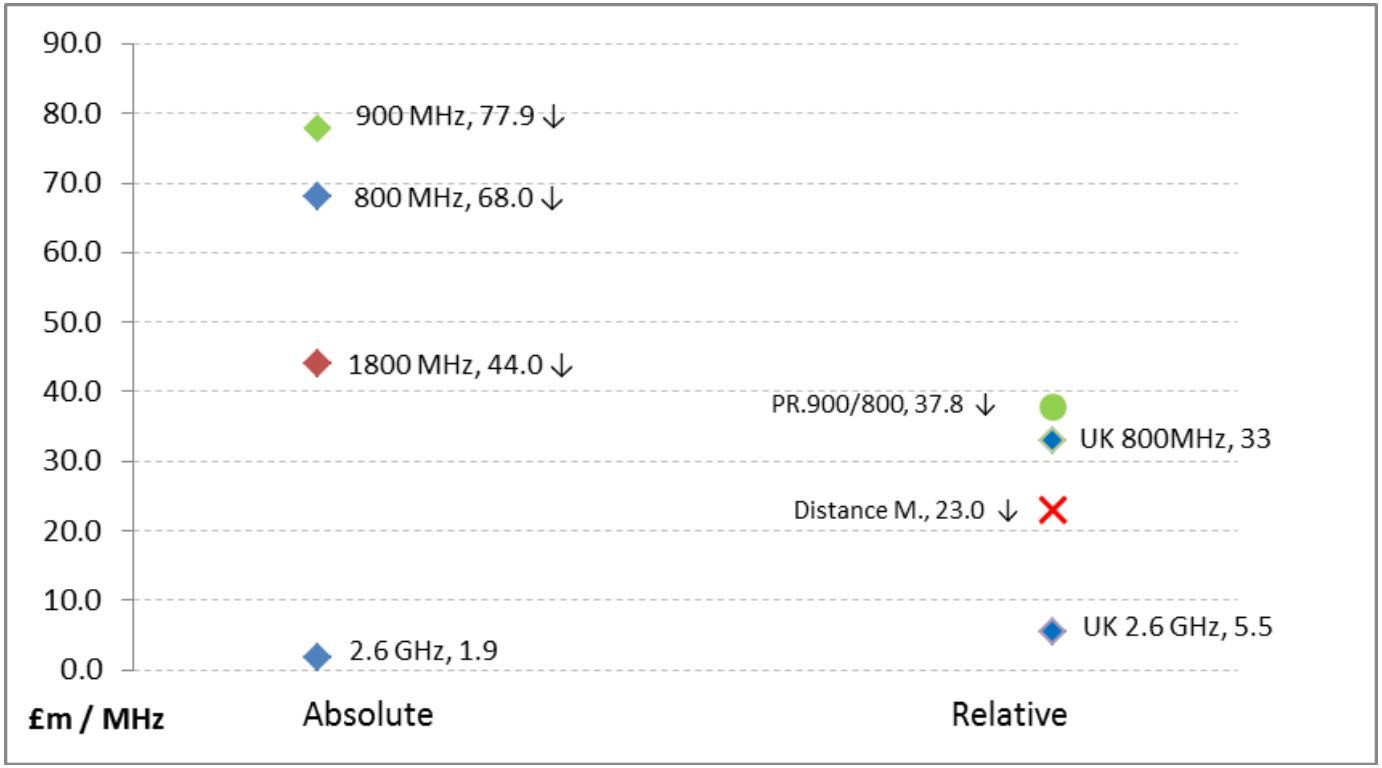
A8.223 The following table summarises the available benchmarks (along with our interpretation of them) from the Austrian award.

Table A8.1.10: Summary of evidence points from Austria

	Absolute values (£m / MHz)				Relative value benchmarks[1] (£m / MHz)		Ratios (%)			
	800 MHz	900 MHz	1800 MHz	2.6 GHz	900 MHz / 800 MHz	Distance method	1800 MHz / 800 MHz	1800 MHz / 2.6 GHz	1800 MHz / 900 MHz	2.6 GHz / 800 MHz
Final values	68.0	77.9	44.0	1.9	**37.8** **(115%)**	**23.0** **(64%)**	65%	2258%	56%	3%
Tier					**First**	**First**				
Assessment of risk	Risk of over-statement	Larger risk of larger over-statement	Larger risk of over-statement	No risk identified	Larger risk of larger over-statement	Larger risk of over-statement	Larger risk of over-statement	Larger risk of over-statement	Risk of under-statement	Risk of under-statement

1 Based on the UK 800 MHz value without coverage obligation and gross of expected DTT co-existence costs

Figure A8.1.6: 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.[72]

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.[73]

Table A8.2.1: November 2013 multiband auction results[74]

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	-
Reserve price for the band	CZK 6.56bn	CZK 270mn	CZK 960mn	-	-
Total auction revenue	CZK 7.28bn	CZK 288mn	CZK 960mn	-	-
% mark-up	11%	7%	0%	-	-

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.

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

Reserve prices	800 MHz and 1800 MHz spectrum sold marginally above reserve price 2.6 GHz paired spectrum sold at reserve price
Obligations	800 MHz: Obligation to provide coverage[75] 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).[76] 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.[77] 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.[78] Obligation to provide wholesale access to MVNOs[79].

Our position in the October 2013 consultation

A8.224 This auction concluded after the publication of our October 2013 consultation. In our May 2014 update[80] note we said that we were considering whether new information on further European spectrum auctions, including the Czech auction, provided relevant evidence for the purposes of estimating the market value of the 900 MHz and 1800 MHz licences in the UK. We invited stakeholders to comment on this new information.

Stakeholder responses to the October 2013 consultation and May 2014 update note

Whether award outcomes are likely to reflect market value

1800 MHz

A8.225 Telefónica (January 2014 response, 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:

a) 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

[75] 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.
[76] http://www.ctu.cz/cs/download/vyberova_rizeni/invitation_to_tender_15_08_2013.pdf, section 5.3.1
[77] http://www.ctu.cz/cs/download/vyberova_rizeni/invitation_to_tender_15_08_2013.pdf, section 5.3.2
[78] http://www.ctu.cz/cs/download/vyberova_rizeni/invitation_to_tender_15_08_2013.pdf, section 5.3.3
[79] http://www.ctu.cz/cs/download/vyberova_rizeni/invitation_to_tender_15_08_2013.pdf, section 5.7.2
[80] Update on European auctions since Ofcom's consultation on Annual licence fees for 900 MHz and 1800 MHz spectrum, May 2014; http://stakeholders.ofcom.org.uk/binaries/consultations/900-1800-mhz-fees/update/2014-05_ALF_Update_Note_on_Austria.pdf

b) 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.

A8.226 Telefónica (January 2014 response, 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.

A8.227 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

A8.228 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

A8.229 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 in the August 2014 consultation

Whether award outcomes are likely to reflect market value

1800 MHz

A8.230 We said 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. We said it was possible that they valued it at more than reserve price and would have competed for it in the absence of the spectrum reservation.

A8.231 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. We said this might have served to reduce competition among incumbent operators, and also new entrants, for individual 2x1 MHz lots. If so, it meant that the average price for the 2x1 MHz lots of 1800 MHz was significantly lower than the market value in the Czech Republic of a 2x5 MHz block suitable for LTE.

A8.232 In view of this, we considered that there was a larger risk that the price of 1800 MHz understated market value in the Czech Republic, but of unknown scale.

800 MHz

A8.233 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, we noted that the fact that all but one lot sold slightly above reserve price indicated a degree of competition among incumbent operators for 800 MHz, and we could not 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 considered that the price for 800 MHz spectrum was likely to be reflective of market value in the Czech Republic.

2.6 GHz

A8.234 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, we considered there would likely have been competition for 2.6 GHz lots, which would have raised auction prices above reserve. We therefore considered that there was a larger risk that the 2.6 GHz price understated market value in the Czech Republic, but that the scale of this understatement was unknown.

Likelihood of reflecting UK market value

A8.235 Respondents did not argue that market value in the Czech Republic might understate or overstate UK market value.

A8.236 We did not identify country-specific factors that might have such an effect.

Relative benchmarks

A8.237 We had 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 used the absolute value of 1800 MHz as a cross-check against our proposed 1800 MHz lump-sum value.

A8.238 In interpreting the evidence points, we considered that the price of 1800 MHz carried 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. We considered the 2.6 GHz price also understated 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 considered that the distance method benchmark carried a larger risk of understatement of UK market value of unknown scale.

A8.239 We considered that the Czech Republic distance method benchmark provided very little information about the value of 1800 MHz spectrum in the UK, and we placed it in the third tier of evidence. In particular, we noted that 1800 MHz spectrum was auctioned in very small (2x1 MHz) lots, and incumbents were unable to bid on the only block which was large enough to be suitable for LTE. Significant amounts of 1800 MHz and 2.6 GHz spectrum were unsold.

Stakeholder responses to the August 2014 and February 2015 consultations

A8.240 We summarise below stakeholders' responses to the August 2014 consultation. Stakeholders did not make any further comment on this benchmark country in response to the February 2015 consultation.

Whether award outcomes are likely to reflect market value

1800 MHz

A8.241 AM&A (Annex C2) said that "the unsold spectrum in the 1800 MHz band could mean that the reserve price was set too high and therefore exceeded market value, though the fact that incumbents were not allowed to bid for the unsold spectrum may also mean that full market value was not reached. Ultimately however, the spectrum that was sold was not influenced by the reserve price, as it sold for more". AM&A concluded that there are a number of reasons why the Czech Republic may overstate or understate market value.

800 MHz

A8.242 AM&A (page 24) argued that the Czech Republic 800 MHz price should be calculated using a weighted average of lots (rather than a straight average). It said that this lowers the absolute 800 MHz price by £1.1m / MHz to £44.1m / MHz.

Our assessment

Whether award outcomes are likely to reflect market value

1800 MHz

A8.243 We derive an auction price for 1800 MHz in the Czech Republic based on the 2x1 MHz lots that were sold in the auction. As we said in the August 2014 consultation, these lots 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. We said that 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.

A8.244 In light of this, our view remains that there is a larger risk that the price of 1800 MHz understates market value in the Czech Republic, but we cannot be sure of the scale of this possible understatement.

800 MHz

A8.245 As discussed in paragraph A7.26, we agree with a weighted average approach to calculating benchmarks, and we have recalculated the 800 MHz price (and distance method benchmark) accordingly.

A8.246 We have maintained our interpretation of the 800 MHz price and consider that it is likely to be reflective of market value.

2.6 GHz

A8.247 We received no comments on our assessment of the 2.6 GHz band and our view remains as set out in paragraphs A8.151 above.

Likelihood of reflecting UK market value

A8.248 Respondents provided no arguments that market value in the Czech Republic might understate or overstate UK market value. We have not identified country-specific factors that might have such an effect.

Relative benchmarks

A8.249 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.

Assessment of risk

A8.250 In interpreting the evidence points, our view remains that:

a) The price of 1800 MHz carries a larger risk of understating market value in the Czech Republic due to the lot structure in the auction and the tight spectrum caps and reservations, though we cannot be sure of the scale of this possible understatement.

b) The 2.6 GHz price also carries a larger risk of understating market value in the Czech Republic due to tight spectrum caps, though we cannot be sure of the scale of this possible understatement.

c) 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, though we cannot be sure of the scale of this possible understatement.

A8.251 We also consider that the 2.6 GHz / 800 MHz ratio carries a larger risk of understatement of relative market value in the Czech Republic (though we cannot be sure of the scale of understatement), as the 800 MHz price likely reflects market value while the 2.6 GHz price risks understating market value.

Tiering

A8.252 Considering the criteria for inclusion in Tier 1:

a) The auction prices for 1800 MHz and 800 MHz were above reserve, and we consider they appear likely to have been primarily determined by a market-driven process of bidding.

b) Based on the evidence available to us, the relative prices in the auction are at least as likely to be based on bidders' intrinsic valuations of spectrum as on strategic bidding; and

c) Due to the lot structure for 1800 MHz spectrum in the auction, the tight spectrum caps and reservations, and the fact that significant amounts of spectrum was

unsold, we consider that the 1800 MHz benchmark is less likely to be informative of forward-looking relative spectrum values in the UK.

A8.253 The benchmark does not meet the third of our criteria for Tier 1, We therefore consider the criteria for inclusion in Tier 2:

a) Given the fact that 800 MHz and 1800 MHz spectrum sold above reserve price, we consider there is some evidence that the relative auction prices reflect bidders' relative intrinsic valuations of these bands;

b) However, the 1800 MHz benchmark is obviously uninformative of forward-looking relative spectrum values in the UK.

A8.254 We therefore consider that the benchmark should be in Tier 3.

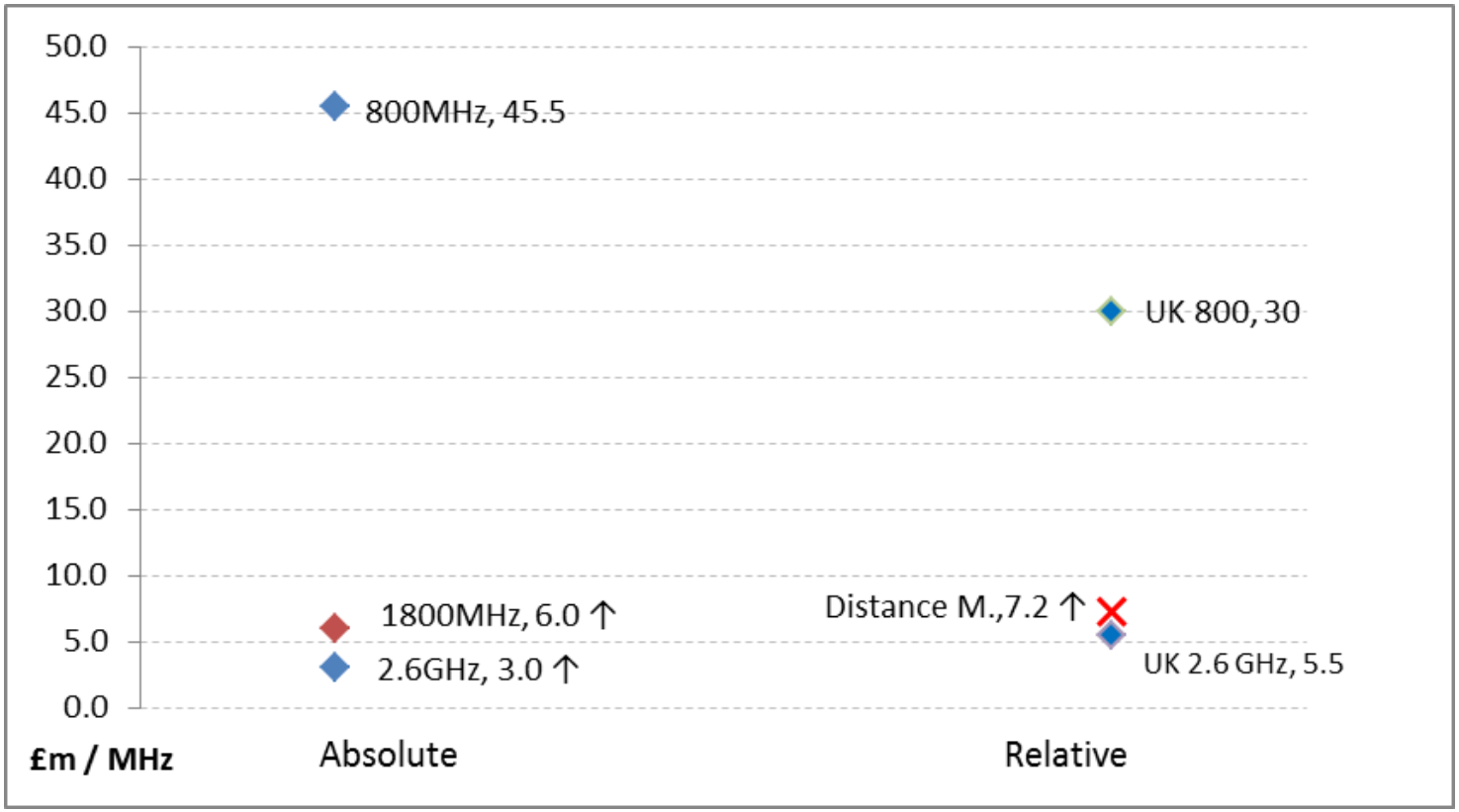
A8.255 The following table summarises the available benchmarks (along with our interpretation of them) from the Czech award:

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

	Absolute values (£m / MHz)			Relative value benchmarks[1] (£m / MHz)	Ratios (%)		
	800 MHz	1800 MHz	2.6 GHz	Distance method	1800 MHz / 800 MHz	1800 MHz / 2.6 GHz	2.6 GHz / 800 MHz
Final values	45.5	6.0	3.0	**7.2** **(7%)**	13%	200%	7%
Tier				**Third**			
Assessment of risk	No risk identified	Larger risk of under-statement	Larger risk of under-statement	Larger risk of under-statement	Larger risk of under-statement	Larger risk of under-statement	Larger risk of under-statement

1 Based on the UK 800 MHz value without coverage obligation and net of expected DTT co-existence costs

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.[81]

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	Package mark-up
Total Available	2x70	50	-	
TDC	2x20	-	€44.8m	8233%
Telenor	2x20	10	€44.8m	6567%
Telia	2x20	15	€45.2m	6015%
Hi3G	2x10	25	€953k	58%
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.[82]	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 materially 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.[83]	

[81] See page 14: http://www.dotecon.com/assets/images/dp1001.pdf
[82] See: http://www.dotecon.com/assets/images/dp1001.pdf
[83] 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.[84]

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	Spectrum was sold at reserve price	
Obligations	No coverage obligations.	

June 2012 800 MHz award

Description: Award of the 800 MHz spectrum using a CCA format.[85]

Table A8.3.5: June 2012 800 MHz auction results

	800 MHz	Price Paid[86]	Package mark-up
Total Available	2x30	-	
TDC	2x20	DKK627.8m	214%
Telenor	2x10	DKK111.5m	123%
Telia			
Hi3G	-	-	
Unsold	-	-	

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

[84] See: http://dba.erhvervsstyrelsen.dk/900-1800-mhz-auction
[85] See: http://www.dotecon.com/news/danish-800mhz-auction-completed/
[86] See: http://dba.erhvervsstyrelsen.dk/800-mhz-auction

Table A8.3.6: June 2012 800 MHz auction design

	Description	Implications
Number of bidders; number of lots; lot sizes	There were 3 bidders.[87] 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.[88]	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 sold materially 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.[89] An innovative component allowed bidders to bid for regional exemptions from the coverage obligation imposed on the 800MHz licences.[90] Strict coexistence restrictions on 800 MHz band.	

Our position in the October 2013 consultation

A8.256 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 provided less important evidence when deriving ALFs for 900 MHz and 1800 MHz licences in the UK.

Stakeholder responses to the October 2013 consultation

Whether award outcomes are likely to reflect market value

Cross-band comments

A8.257 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.

A8.258 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

[87] See: http://dba.erhvervsstyrelsen.dk/800-mhz-auction
[88] See page 2: http://erhvervsstyrelsen.dk/file/251159/information-memorandum-800mhz-auction.pdf
[89] See pages 10-11: http://erhvervsstyrelsen.dk/file/251159/information-memorandum-800mhz-auction.pdf
[90] See: http://www.dotecon.com/news/danish-800mhz-auction-completed/

A8.259 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."

A8.260 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

A8.261 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

A8.262 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

A8.263 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

A8.264 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.

A8.265 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 in the August 2014 consultation

Whether award outcomes are likely to reflect market value

Cross-band comments

A8.266 As discussed in our assessment of the individual bands below, we agreed with AM&A that the 900 MHz and 1800 MHz prices from Denmark risked understating market value in Denmark.

900 MHz

A8.267 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 have required us to expect that none of the incumbent operators who were excluded from bidding would have valued this spectrum above the reserve price. We did not consider that there was any basis for such an expectation. We considered that there was a larger risk that the 900 MHz price was a larger understatement of market value in Denmark.

1800 MHz

A8.268 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 considered there was a larger risk that this price was a larger understatement of market value in Denmark.

800 MHz

A8.269 In Denmark, 800 MHz spectrum was sold above reserve price. We said there was a risk that the joint venture may have reduced the intensity of competition in the auction.[91] On balance, we considered that the absolute 800 MHz price in Denmark carried an unknown risk of understatement of Danish market value of unknown scale.

2.6 GHz

A8.270 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 considered that the price for 2.6 GHz, based on the winning bids by TDC, Telia and Telenor, was reflective of market value in Denmark.

Likelihood of reflecting UK market value

A8.271 As discussed in paragraphs A7.62 to A7.74 of the August 2014 consultation, we did not consider that there were 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 did not provide strong grounds for considering either such relationship to exist. In our August 2014 assessment of the Danish benchmarks, we did not consider differences from the UK in either of these factors to be a basis for considering that the market value in Denmark overstated UK market value.

A8.272 We discussed above that the actual auction price for 1800 MHz was unlikely to be reflective of market value in Denmark. In paragraphs A7.83 to A7.84 of the August 2014 consultation, we noted 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 considered that this created a larger risk that the market value of 1800 MHz in Denmark at the time of the Danish auction was a larger understatement of the current UK market value of 1800 MHz.

[91] 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.

Relative benchmarks

A8.273 We did not calculate 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 considered 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.

A8.274 In interpreting the evidence points for the 900 MHz / 800 MHz paired ratio, we considered 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, we said the presence of the joint venture meant that there was an unknown risk that it understates market value in Denmark (of unknown scale).

c) We considered that, while there was a risk that the prices of both 900 MHz and 800 MHz understate market value in Denmark, the likelihood and scale of this risk was stronger for 900 MHz than 800 MHz. Hence we considered that the 900 MHz / 800 MHz paired ratio carried a larger risk of larger understatement of UK market value.

A8.275 We considered that the Danish 900 MHz / 800 MHz paired ratio provided very little information about the value of 900 MHz spectrum in the UK and said that it should be in the third tier of evidence, noting that the three incumbent operators were prevented from bidding for the single available lot of 900 MHz spectrum.

Stakeholder responses to the August 2014 consultation

Whether award outcomes are likely to reflect market value

Cross-band comments

A8.276 As explained in paragraph A7.27, Telefónica (p. 55) said that we should derive benchmarks for Denmark by either: (a) taking the least expensive licences in Denmark's 800 MHz and 2.6 GHz auctions, which were set by the 3rd/4th strongest bidder and reserve price (hypothetical 5th bidder) respectively, and thus are more directly comparable to the 900 and 1800 MHz auctions; or (b) taking the reserve prices for these auctions.

900 MHz

A8.277 H3G (p. 16) and AM&A (p. 9) said that the Danish 900 MHz / 800 MHz paired ratio is not at all informative given that the three main incumbents were not allowed to participate in the 900 MHz award, and should be excluded from the benchmarking set altogether.

Our assessment in the February 2015 consultation

Whether award outcomes are likely to reflect market value

Cross-band comments

A8.278 We explained in paragraphs A7.23 and A7.24 of the February 2015 consultation (A7.29 and A7.30 in this document) why we did not consider that Telefónica's alternative approaches to calculating benchmarks for Denmark should be used.

900 MHz

A8.279 We included a 900 MHz / 800 MHz benchmark from all European auctions within our time period in which there is sufficient price information to derive this benchmark. We considered that, rather than excluding certain countries entirely, it is preferable to include a benchmark wherever possible before assessing whether or not certain auction characteristics may have made relative auction prices less reflective of market value. As stated in our August 2014 consultation, we considered that the exclusion of incumbent operators from the 900 MHz auction creates a larger risk that the 900 MHz price is a larger understatement of market value in Denmark, and we took account of this risk in our interpretation of the Danish benchmark.

1800 MHz

A8.280 We received no comments on our assessment of the 1800 MHz band and our view remained as set out in paragraph A8.268 above.

800 MHz

A8.281 We received no comments on our assessment of the 800 MHz band and our view remained as set out in paragraphs A8.269 above.

2.6 GHz

A8.282 We received no comments on our assessment of the 2.6 GHz band and our view remained as set out in paragraphs A8.270 above.

Likelihood of reflecting market value

A8.283 As discussed in paragraphs A7.169, our view remained that the timing of the Danish award 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 forward-looking UK market value of 1800 MHz.

A8.284 We discussed above that the actual auction price for 900 MHz is unlikely to be reflective of market value in Denmark. As discussed in paragraphs A7.163, we also considered that the timing of the Danish award means that the 900 MHz value observed in Denmark risks understating the forward-looking market value of 900 MHz spectrum in the UK, although we said we cannot be sure of the scale or likelihood of this risk.

Relative benchmarks

A8.285 We did not include a distance method benchmark for Denmark because it is a negative number, which we did not consider to be in any way sensible as an indication of the UK market value of 1800 MHz. We considered 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.

Assessment of risk

A8.286 In interpreting the evidence points for the 900 MHz / 800 MHz paired ratio:

a) We still considered that 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). In addition, we also considered there is a risk that the 900 MHz market value understates forward-looking UK market value due to the timing of the award;

b) Because there was competition for 800 MHz spectrum, the resulting price exceeded reserve price. However, we said the presence of the joint venture meant that there is a risk that it understates market value in Denmark, though we said we cannot sure of the likelihood and scale of this understatement.

c) Our view remained 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. On balance, we considered that the 900 MHz / 800 MHz paired ratio also carries a larger risk of larger understatement of UK market value.

A8.287 We also considered that the 2.6 GHz / 800 MHz ratio carries a risk of overstatement of relative market value in Denmark, because there is a risk that the price of 800 MHz understates market value.

Tiering

A8.288 Considering the criteria for inclusion in Tier 1:

a) We said the auction price for 900 MHz was the reserve price, so it was not primarily determined by a market-driven process of bidding.

b) Based on the evidence available to us, we said the relative prices in the auction are at least as likely to be based on bidders' intrinsic valuations of spectrum as on strategic bidding; and

c) We did not have clear, evidence-based reasons to consider the auction outcome is less informative of forward-looking relative values in the UK, having regard to country-specific circumstances and auction dates.

A8.289 We said the benchmark does not meet the first of our criteria for Tier 1. We therefore considered the criteria for inclusion in Tier 2:

a) In the Danish auction for 900 MHz, the three incumbent operators were prevented from bidding for the single available lot of 900 MHz spectrum. As a result we did not consider there is evidence that relative auction prices reflect bidders' relative intrinsic valuations of the 900 MHz and 800 MHz band;

b) We considered that the auction outcome is not obviously uninformative of forward-looking relative spectrum values in the UK, having regard to country-specific circumstances and auction dates.

A8.290 As the 900 MHz benchmark for Denmark does not meet the first of our criteria for Tier 2, we therefore considered that the benchmark should be in Tier 3.

Stakeholder responses to the February 2015 consultation

Likelihood of reflecting market value

A8.291 Frontier (p. 13) disagreed with our view of the development of commercial opportunities for LTE900 over the period covering the auctions included in our benchmarking dataset. They said that it does not provide a justification as to why the price of 900 MHz in the Danish auction might understate the forward looking value of 900 MHz spectrum in the UK, relative to 800 MHz.

Our assessment

A8.292 We have assessed stakeholder responses to our view on LTE900 development in more detail in paragraphs A9.36-A9.78. Based on the assessment outlined in Annex 9, our view remains that LTE900 development creates a risk that the 900 MHz value observed in Denmark understates the forward-looking market value of 900 MHz spectrum, although we cannot be sure of the scale or likelihood of this risk.

A8.293 We also note that 900 MHz and 1800 MHz spectrum in Denmark was auctioned before WRC-12. As discussed in paragraphs A7.171 to A7.181, we consider that this creates a larger risk that the 900 MHz market value in Denmark at the time of the award is a larger overstatement of the forward-looking market value of 900 MHz. We also consider that this creates a larger risk that the 1800 MHz market value in Denmark at the time of the award overstates the forward-looking market value of 1800 MHz, though we cannot be sure of the scale of this overstatement.

A8.294 However, we discussed above that actual auction prices for 900 MHz and 1800 MHz are unlikely to be reflective of market value in Denmark at the time of the award. As a result, even though market value in Denmark at the time of the award of 900 MHz and 1800 MHz might overstate forward-looking market value, our view remains that the 900 MHz and 1800 MHz prices from Denmark carry a larger risk of larger understatement.

A8.295 Accordingly, our overall interpretation of the Danish 900 MHz / 800 MHz benchmark remains as set out in paragraphs A8.286 above.

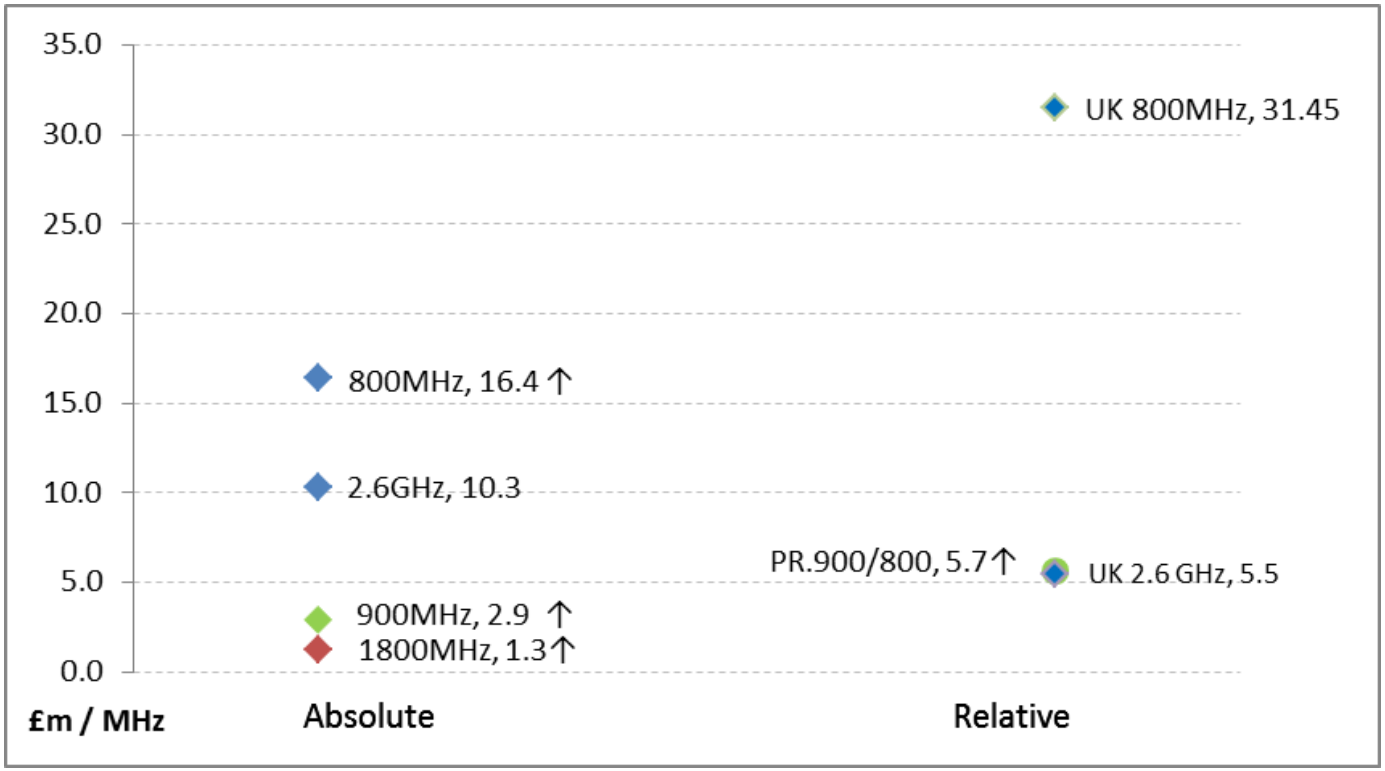
A8.296 The following table summarises the available benchmarks (along with our interpretation of them) from the Danish award:

Table A8.3.7: Summary of evidence points from Denmark

	Absolute values (£m / MHz)				Relative value benchmarks[1] (£m / MHz)		Ratios (%)			
	800 MHz	900 MHz	1800 MHz	2.6 GHz	900 MHz / 800 MHz	Distance method	1800 MHz / 800 MHz	1800 MHz / 2.6 GHz	1800 MHz / 900 MHz	2.6 GHz / 800 MHz
Final values	16.4	2.9	1.3	10.3	**5.7** **(18%)**	**N/A**	8%	12%	43%	64%
Tier					**Third**	**N/A**				
Assessment of risk	Risk of under-statement	Larger risk of larger under-statement	Larger risk of larger under-statement	No risk identified	Larger risk of larger under-statement	**N/A**	Larger risk of larger under-statement	Larger risk of larger under-statement	Risk of under or over-statement	Risk of over-statement

1 Based on the UK 800 MHz value with coverage obligation and gross of expected DTT co-existence costs

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 (2010)

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: Deutsche Telekom (T-Mobile)[92], Vodafone, Telefónica and E-Plus.[93] In contrast to other European countries, the fourth largest operator had similar spectrum holdings to the other incumbents. Telefónica had a slightly smaller subscriber share than E-Plus, but E-Plus only had 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	-
Deutsche Telekom	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	-	-	-	-	-	-	-
Reserve price for the band	€15m	€12.5m	€10m	€4.8m	€35m	€12.5m	-
Total auction revenue	€3.58bn	€104m	€348m	€11.4m	€258m	€86.5m	-
% mark-up	23743%	735%	3381%	138%	637%	592%	-

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, Deutsche Telekom 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 Deutsche Telekom 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	All spectrum sold materially 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.	

[92] In the February 2015 consultation we referred to Deutsche Telekom as T-Mobile. For consistency with our assessment of Germany (2015), we now use Deutsche Telekom.
[93] We note that the EC subsequently approved the acquisition of E-Plus by Telefónica subject to commitments.

Our position in the October 2013 consultation

A8.297 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.

A8.298 We considered that Germany provided less important evidence when deriving ALFs for 1800 MHz licences in the UK.

Stakeholder responses to the October 2013 consultation

Whether award outcomes are likely to reflect market value

1800 MHz

A8.299 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, it 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.

A8.300 AM&A (page 50) proposed to treat the Germany 1800 MHz distance method benchmark as more important evidence.

A8.301 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.

A8.302 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.

A8.303 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

A8.304 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

A8.305 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

A8.306 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.

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 in the August 2014 consultation

Whether award outcomes are likely to reflect market value

A8.307 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 Deutsche Telekom. Two frequency-specific blocks (D and E) were located between spectrum holdings of Deutsche Telekom 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
	Deutsche Telekom
	Telefónica
	E-Plus
	Vodafone

A8.308 Blocks A, B, C and E were each won by the only bidder, respectively Deutsche Telekom 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.[94]

A8.309 AM&A's first point related to Block D, which was won by E-Plus despite being adjacent to spectrum held by Deutsche Telekom and Telefónica. We recognised that this is an exception to the pattern described above of blocks being won by bidders who held adjacent spectrum. However, we said that it was possible that this outcome was due to strategic bidding in the band in the form of signalling[95]:

a) Telefónica's bids raised the price of Block E significantly. Cramton and Ockenfels suggested 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).[96]

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 Deutsche Telekom until they reached comparable price levels. Cramton and Ockenfels argued 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".[97]

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, it would have had to pay its 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 its value for the spectrum.

A8.310 In summary, we considered that the evidence of strategic bidding for the available 1800 MHz lots suggested a risk that the prices did not necessarily reflect the market value of the band.

A8.311 As regards AM&A's second point, we recognised that 2x15 MHz of 1800 MHz spectrum was large enough to be of value to all bidders. However, we said the fact that Deutsche Telekom 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.

A8.312 In summary we said 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.

[94] 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
[95] Cramton and Ockenfels, p. 14
[96] Cramton & Ockenfels, p. p. 13
[97] Cramton & Ockenfels, p. 13

800 MHz

A8.313 Cramton and Ockenfels commented that there was fierce price competition in the 800 MHz band as operators failed to coordinate a strategy of demand reduction between bands.[98] 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.

A8.314 We considered that the absolute 800 MHz benchmark is likely to reflect market value in Germany.

2.6 GHz

A8.315 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, we said 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.

A8.316 On balance, we considered that the price of 2.6 GHz may understate market value in Germany. However we considered that the risk and potential scale of such an understatement are unknown.

Likelihood of reflecting UK market value

A8.317 As discussed in paragraphs A7.62 to A7.74 of the August 2014 consultation, we did not consider that there were 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 did not provide strong grounds for considering either such relationship to exist. We did 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.

A8.318 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 of the August 2014 consultation we considered 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

A8.319 We had 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.

A8.320 In interpreting the evidence points we considered that:

[98] Cramton & Ockenfels, p. 15

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

A8.321 Overall, we considered that there was a larger risk that the distance method benchmark for 1800 MHz is a larger understatement of UK market value.

A8.322 As part of our tiering assessment, we considered whether the circumstances of the award might be so different from circumstances in the UK today, in terms of the drivers of spectrum value, that it was appropriate to recognise this in the choice of tier. The multiband auction in Germany, which included the 1800 MHz, 800 MHz and 2.6 GHz bands, took place in May 2010, well before important developments in the ecosystem for LTE1800. We said that this was likely to have had a substantial effect on the relative value of these bands in the German auction. We also said that, unlike the 800 MHz and 2.6 GHz bands, only a minority of the spectrum in the 1800 MHz band was available in the auction, and two of the five available 2x5 MHz lots of 1800 MHz spectrum were non-contiguous. For these reasons we considered Germany to be a second-tier benchmark for 1800 MHz.

Stakeholder responses to the August 2014 consultation

Whether award outcomes are likely to reflect market value

1800 MHz

A8.323 AM&A (Annex C4) said that our interpretations of the German auction are "merely one possible explanation of the bids that were made and do not constitute reliable evidence for a non-competitive auction outcome". In relation to specific lots in the 1800 MHz band:

a) AM&A noted our argument that E-Plus paid to win lot D even though this may have been in excess of its value for the spectrum. AM&A said that, in this case, the price of lot D may have been higher than E-Plus initially intended to bid for it. However, it considered that the increase in the price paid by E-Plus is likely to be just a single bid increment, which is unlikely to materially change the price raised for this lot, let alone the payment for the average lot;

b) AM&A agreed that having access to a 2x20 MHz carrier is important to mobile network operators as it allows them to offer the fastest data speeds. However, it said that:

i) All operators except E-Plus won 2x20MHz in the 2.6GHz band, allowing them to advertise the fastest peak speeds without 2x20 MHz of 1800 MHz (although at an arguably lower coverage level);

ii) A 2x15MHz block of 1800MHz delivers a comparable incremental capacity to operators with and without a further contiguous 2x5 MHz;

iii) Telefónica did not win lot D to form a 2x20 MHz block of spectrum; and

iv) Carrier aggregation was on the horizon at the time of the German auction.

c) The implication of these factors is that operators may not have placed so much importance on holding a 2x20 MHz block of contiguous spectrum. As a result, AM&A said that it did not consider we have clearly demonstrated that Deutsche Telekom was the obvious winner for lots A-C, and that other operators did not bid up prices to competitive levels.

A8.324 AM&A (p. 14) also did not consider the amount of spectrum sold in the auction to be an important factor in establishing whether market value was achieved. It noted that a lower proportion of the 1800MHz band was awarded in Italy (2x15 MHz) than in Germany, but we classify Italy as a Tier 1 benchmark.

A8.325 H3G (pages 24-25) argued that Germany's 1800 MHz price meets our main tier 1 criterion, as the price was determined by bidding and all lots sold above reserve, with no excluded bidders and no unsold lots. It noted that we cited an article by Cramton and Ockenfels and said that this article concluded that bidding was competitive and revenue was close to expectations.

A8.326 Frontier (p. 24) said that the German benchmark could be considered third tier, rather than second tier, because of strategic behaviour prevailing in the 1800 MHz auction.

Likelihood of reflecting UK market value

A8.327 AM&A (p. 13) disagreed with our view that the timing of the German award makes the relative values less reflective of market value today (as explained in paragraphs A9.35).

A8.328 Frontier (p. 19) noted that the 1800 MHz / 800 MHz paired ratio yields an estimate of the UK 1800 MHz value below the UK 2.6 GHz value, which is inconsistent with Ofcom's own view that the 1800 MHz value should be above the 2.6 GHz value.

Our assessment in the February 2015 consultation

Whether award outcomes are likely to reflect market value

1800 MHz

A8.329 We previously suggested that there were obvious contenders for the available spectrum in the 1800 MHz band among the incumbent operators. We said that the fact that operators bid against one another in this band, leading to prices which were above reserve price (as H3G noted), suggests that award outcomes might reflect market value. However, if strategic bidding took place it is possible that, absent strategic incentives, operators would have bid differently against each other, leading to a different outcome.

A8.330 In order to assess this issue, we began with an account of the bidding that took place in the auction. Next we considered whether this bidding activity is likely to reflect operators' intrinsic values for 1800 MHz spectrum, or whether it is more likely to be strategic in nature. We then set out the implications for our interpretation of the 1800 MHz price in Germany.

Bidding for 1800 MHz spectrum

A8.331 As shown in the August 2014 consultation, there were five 2x5 MHz lots available in the 1800 MHz band. Bidding in the auction lasted for 224 rounds. We noted that, during the auction:

a) In the case of the three contiguous lots A, B and C, Deutsche Telekom was the only operator to bid for all three (i.e. the whole 2x15 MHz block) in a single round. Vodafone made bids in three separate rounds, each for a single lot. Telefónica (which set Deutsche Telekom's price for lots A-C) made a number of bids on these lots, but only in two rounds did it bid for and hold two lots in the same round.

b) E-Plus and Telefónica were the only bidders for the non-contiguous lots D and E, and each of them bid on both lots.

A8.332 Table A8.4.3 below summarised bidding activity for 1800 MHz.[99]

Table A8.4.3: Selected bidding activity for 1800 MHz in the German multiband auction

	Lots A, B and C	Lot D	Lot E
Operators who could build a 2x20 MHz block with these lots[100]	Deutsche Telekom	Telefónica Deutsche Telekom (with lots B and C)	E-Plus
Rounds 1 to 37	Deutsche Telekom is standing high bidder	Telefónica is standing high bidder	E-Plus is standing high bidder
Round 37	***In the 800 MHz band, E-Plus increases its bid to the maximum three lots***		
Round 38			"Jump bid" from Telefónica of €12.9m on E-Plus's original bid of €2.5m
Rounds 39 to 56	From round 47, E-Plus and Deutsche Telekom outbid each other on lot A, with Deutsche Telekom eventually standing high bidder in round 56	Standing high bidder: - E-Plus (round 39) - Telefónica (round 40) - E-Plus (round 41) - Telefónica (round 46)	Lot price reaches €19.6m in round 46
Rounds 57 to 74	E-Plus becomes standing high bidder on B (in round 57 until 118) and C (in round 62 until 120)	E-plus becomes standing high bidder (round 74)	
Round 76			Telefónica withdraws its standing high bid

[99] Based data from BNetzA's website, http://www.bundesnetzagentur.de/SharedDocs/Downloads/DE/Sachgebiete/Telekommunikation/Unternehmen_Institutionen/Frequenzen/OffentlicheNetze/Mobilfunk/AuktionRundenergebnisse_zip.zip

[100] We focus on a 2x10 MHz block of 1800 MHz spectrum as carrier aggregation was not available at the time of the German auction.

Germany (2010)

	Lots A, B and C	Lot D	Lot E
Rounds 119 to 151	Up to this point prices for lots B and C are only €3.2m and €2.9m, compared to €10.2m for A (and €9m for D and €19.6m for E) Vodafone bids for the first time on either lot B or C in rounds 119, 121 and 123 E-Plus bids on lots B and/or C in rounds 120-122 and 131 Telefónica bids for the first time on lots A-C from round 123, generally for a single lot (apart from B-C in round 135, and A-B in round 148) Bidding by Telefónica equalises prices by about round 151 to circa €20m. Deutsche Telekom responds in the next round each time, to restore standing high bidder position Deutsche Telekom is standing high bidder of lots A-C from round 151 to the end of the auction	Telefónica becomes standing high bidder (round 123) E-Plus and Telefónica outbid each other between rounds 140 and 147, with E-Plus eventually standing high bidder	Bid from E-Plus in round 148
Round 156		E-Plus withdraws bid	
Round 188		E-Plus bids again (it would otherwise have been liable to pay its withdrawn bid without winning lot D)	
Winning bidder	Deutsche Telekom	E-Plus	E-Plus
Price per lot (€m)	20.7 (lot A) 20.7 (lot B) 19.869 (lot C)	21.550	21.536

Source: Ofcom from publicly available information

Our assessment of relative likelihood of strategic and intrinsic value bidding

A8.333 Table A8.4.3 showed that initial standing high bidders in the 1800 MHz band were those which could use these lots to build a 2x20 MHz contiguous block of spectrum. This allocation persisted for 37 rounds, until Telefónica bid for lot E (which we discuss below). We said this is consistent with a view that existing spectrum holdings created obvious contenders for 1800 MHz spectrum.

A8.334 We said it is also consistent with bidders engaging in co-ordinated strategic demand reduction. In many other auctions such a strategy is made more difficult by a lack of transparency in the information available to bidders during the auction. However, we noted that the information policy in the German auction allowed bidders to see the identity of standing high bidders.

A8.335 We noted Cramton and Ockenfels' comment that[101]:

> "Everything seemed to be settled efficiently: bidders held those blocks that were adjacent to their already held block. But then, in round 38, O2 [Telefónica] increased the price of the E-block at 1.8 GHz by €10 million. This block naturally complements E-Plus' already held frequency and is of no or only negligible value to O2. One possible interpretation of this behavior is that O2 got increasingly frustrated by E-Plus' aggressive strategy and signaling, including bidding on three blocks in 800 MHz. O2 possibly wanted to send a powerful counter message that they were not going to concede at 800 MHz. E-Plus immediately responded by bidding on blocks that naturally complement O2's portfolio: block D at 1.8 GHz and block D at 2.0 GHz."

A8.336 We said the fact that Telefónica made a number of bids for lot E could indicate that there was genuine competition for this lot and that prices reflected market value. However, its first bid for lot E occurred in round 38, immediately after E-Plus had increased its demand for 800 MHz spectrum, and was over five times the value of the standing high bid. Cramton and Ockenfels' interpretation is that Telefónica's activity in lot E was a way of signalling to E-Plus about its aggressive bidding in the 800 MHz band. Telefónica later withdrew its bid on lot E. We said that, while it is possible that Telefónica's valuation of this lot changed as the auction progressed, the withdrawal of the bid is also consistent with the earlier bid being intended to provide a signal to E-Plus.

A8.337 E-Plus's initial bid on lot D occurred in the round after Telefónica's jump bid (round 39). Again, Cramton and Ockenfels suggest that this was in retaliation against Telefónica for bidding on lot E, rather than an expression of genuine demand. The fact that E-Plus withdrew its standing high bid might indicate that it did not intend to win lot D and was expecting Telefónica to bid back on this lot (which was contiguous with Telefónica's per-auction holdings). E-Plus subsequently bid on lot D again, but this is not clear counter-evidence, as E-Plus would otherwise have had to pay its withdrawn bid for the block but not receive it (given that Telefónica did not in fact bid back on lot D). We said that if the interpretation of events suggested by Cramton and Ockenfels is correct, the final price paid for lot D may have been in excess of E-Plus's value for the spectrum. However, for E-Plus lot D was an isolated 2x5 MHz lot, not contiguous with its pre-auction holdings, so E-Plus' value for that lot may understate market value for 1800 MHz spectrum more generally. We said it is also possible that the general level of bid values was below market value, given the potential for strategic demand reduction.

A8.338 As regards subsequent bidding in lots A to C, Cramton and Ockenfels' account is as follows: [102]

> "A final example for a potential concern for relative payoffs is a "price equalization process" in the 1.8 GHz band. At some point, partly because of

[101] Cramton & Ockenfels, p. 13
[102] Cramton & Ockenfels, p. 14

> the punishment strategies described above, prices for the blocks A-E significantly differed, with the blocks next to what Deutsche Telekom already held being the least expensive. For instance, in round 124, prices for 1.8 GHz blocks ranged from €4.24 million for block B and C to €19.58 million for block E. But then, both E-Plus and O2 started bidding prices up until all blocks approximately reached the €20 million level of the highest-priced block in that band in round 153. After that, both bidders withdrew their interest in the blocks adjacent to Deutsche Telekom's blocks, and no high bidder was outbid anymore in that band. There is no simple explanation for this specific bid pattern in standard auction theory, but it is consistent with an aversion to paying more than competitors."

A8.339 We said a possible alternative explanation is, rather than pursuing such a price equalisation strategy, Telefónica and E-Plus were seeking to acquire 2x10 MHz of 1800 MHz in lots A to C. However, we said the withdrawal of interest in these lots when their prices reached the level of the highest-price lot in the 1800 MHz band is, as Cramton and Ockenfels note, consistent with a price equalisation strategy.

A8.340 In addition, final prices for lots A-E varied by less than €2m. Lots D and E cost slightly more than lots A-C. In the presence of intrinsic value bidding, we might expect that lots A-C would be significantly more expensive than D or E to reflect the fact that more than one bidder might attach a contiguity premium to these lots.[103]

A8.341 In relation to the arguments made by AM&A, we agreed with AM&A that a 2x15 MHz contiguous block of spectrum could in principle be potentially valuable to all operators wishing to deploy LTE, as the spectrum's value is driven by the incremental capacity benefit of 2x15 MHz. However, Deutsche Telekom was the only operator to bid for all three lots, A to C. Furthermore, Deutsche Telekom's bid for lots A to C could have reflected its value to build a 2x20 MHz block (rather than its value for a 2x15 MHz block on its own) given that its pre-auction holdings included the adjacent 2x5 MHz block.

A8.342 On balance, given the timing and nature of bids in the auction and the final prices for each lot, we considered that the bidding behaviour in lots A-C is more consistent with a price equalisation strategy than with a possible alternative explanation based on intrinsic value bidding. However, in reaching this view, we recognised that we cannot rule out the possibility that the bidding activity on the three contiguous lots of 1800 MHz could reflect bidders' relative intrinsic valuations for 2x10 MHz of 1800 MHz.

A8.343 We did not consider that this assessment of bidding is inconsistent with Cramton and Ockenfels' view that bidding in the auction was competitive, as the focus of this article was the 800 MHz band, not 1800 MHz, and the article identifies a number of instances of possible strategic bidding for 1800 MHz (discussed above).

A8.344 Overall, our view remained that there were obvious contenders for lots in the 1800 MHz band. As discussed above we considered that the bidding activity that did occur in this band is more likely to be strategic in nature, rather than reflective of genuine competition based on operators' intrinsic values. If so, this may have led to

[103] In particular, one would expect a contiguity premium to apply if the bidders competing with Deutsche Telekom for a 2x10MHz block in lots A-C (and so setting the price for these lots) had developed their intrinsic valuations on the basis of future LTE use.

an outcome in which final prices did not reflect market value of 1800 MHz in Germany at the time of the auction, even though they were above reserve prices.

A8.345 In the August 2014 consultation we suggested that there were 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. Our revised view was that, whilst it is possible that some bids could have exceeded bidders' own value for the spectrum (such as E-Plus for lot D), we considered it more likely that the price of 1800 MHz spectrum understated market value in Germany at the time of the auction in 2010.

800 MHz

A8.346 Stakeholders made no further comments in relation to the 800 MHz band. Our view remained that the price of 800 MHz is likely to reflect market value in Germany.

2.6 GHz

A8.347 Stakeholders made no further comments in relation to the 2.6 GHz band. Our view remained that the price of 2.6 GHz may understate market value in Germany, though we said we cannot be sure of the likelihood and scale of this understatement.

Likelihood of reflecting UK market value

A8.348 In relation to the points made by AM&A, reported in paragraph A8.327, we explained in paragraphs A9.36 and A9.37 of the February 2015 consultation why we continue to take account of the date of award in our interpretation of the relevant 1800 MHz benchmarks. We noted that Deutsche Telekom deployed an LTE1800 network in Germany in 2011, the second such deployment in Europe. However, while Deutsche Telekom's valuation of lots A to C of 1800 MHz may have been based on its use for LTE, as the winning bidder for these lots the price it paid was determined by the valuation of other bidders. In light of this, our view remained that the timing of the German award creates a larger risk that the market value of 1800 MHz at the time of the award is a larger understatement of the UK market value of 1800 MHz today.

Relative benchmarks

A8.349 We had 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.

Assessment of risk

A8.350 In interpreting the evidence points we considered that:

a) There is a risk that the price of 1800 MHz might understate market value in Germany at the time of the auction. In addition, there is 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, though we cannot be sure of the likelihood and scale of this risk.

A8.351 Overall, our view remained that there is a larger risk that the distance method benchmark for 1800 MHz is a larger understatement of UK market value.

A8.352 We also considered that the 2.6 GHz / 800 MHz ratio carries a risk of understatement of relative market value in Germany, though we said we cannot be sure of the likelihood and scale of this risk, as the 800 MHz price likely reflects market value while the 2.6 GHz price risks understating market value. For the purpose of estimating a proxy value for 2.6 GHz, we considered that the German 2.6 GHz / 800 MHz paired ratio provides more useful evidence of the ratio of 2.6 GHz prices to 800 MHz prices as both bands were auctioned in the same multiband award and prices were above reserve (i.e. determined by a market-driven process).

Tiering

A8.353 Considering each of the criteria for inclusion in Tier 1, we said:

a) The auction prices in the German auction were significantly above reserve. However, for the 1800 MHz band, we said it is not clear to us that this was necessarily primarily determined by a market-driven process of bidding.

b) For the reasons discussed in detail above, we considered that the 1800 MHz price, and therefore relative values, are more likely to reflect strategic bidding than to reflect intrinsic valuations of spectrum in Germany.

c) We considered that the fact that the German auction took place in May 2010, well before important developments in LTE1800, is likely to have had a substantial effect on the relative value of the bands in the German auction. In our view this provided a clear, evidence-based reason for relative auction prices in Germany to be less informative of forward-looking values in the UK.

A8.354 We considered that the distance method benchmark from Germany should not be placed in Tier 1.

A8.355 Considering, in turn, our criteria for including a benchmark in Tier 2:

a) While we considered that the 1800 MHz benchmark value is more likely to reflect strategic bidding than intrinsic valuations, some stakeholders argued that it reflects intrinsic valuations and we recognised there is some evidence consistent with this view.

b) We noted above a clear, evidence-based reason for considering that the outcome is less informative of forward-looking relative spectrum values in the UK, but we said it is possible that the outcome is not obviously uninformative of such forward-looking relative values.

A8.356 We said it is not clear whether the benchmark meets either of our criteria for Tier 2, and there is a case for it to be in Tier 3. However, on balance, we considered Germany to be a Tier 2 benchmark for 1800 MHz.

Stakeholder responses to the February 2015 consultation and July 2015 update note

A8.357 EE and Telefónica (page 15 and page 9) said that we should continue to include this distance method benchmark in our analysis (along with the distance method benchmark based on the May 2015 auction price, as discussed in the following section) as this increases the overall robustness of the analysis and resulting ALFs.

A8.358 Vodafone (Annex 3 of its response to the July 2015 update note) presented revised lump-sum value proposals for 1800 MHz which did not include the German 2010 benchmark, but it did not give a reason as to the exclusion of this benchmark.

Our assessment

A8.359 We have continued to include the German distance method benchmark in our final benchmarking analysis.

A8.360 We also note that the German award took place before WRC-12. As discussed in paragraphs A7.171 to A7.181, we consider that this creates a larger risk that the market value of 800 MHz in Germany at the time of the auction is a larger overstatement of the forward-looking market value of 800 MHz. We also consider that this creates a larger risk that the market value of 1800 MHz in Germany at the time of the auction overstates the forward-looking market value of 1800 MHz, though we cannot be sure of the scale of this overstatement.

A8.361 Taking this into account, along with other sources of risk identified in previous consultations we consider that overall:

a) There is a larger risk that the market value of 800 MHz in Germany at the time of the auction is a larger overstatement of the forward-looking market value of 800 MHz.

b) There is a risk that the price of 1800 MHz might understate market value in Germany at the time of the auction. In addition, there is a larger risk that the market value of 1800 MHz at the time of the award is a larger understatement of forward-looking market value (due to LTE1800 developments), and also a larger risk of unknown scale of overstating forward-looking market value (due to 700 MHz availability developments). On balance, we consider that the 1800 MHz price carries a larger risk of understatement, but we cannot be sure of the scale of this understatement.

c) There is a risk that the absolute value of 2.6 GHz understates market value in Germany, though we cannot be sure of the likelihood and scale of this risk.

A8.362 Overall, our view remains that there is a larger risk that the distance method benchmark for 1800 MHz is a larger understatement of UK market value.

A8.363 Our tiering assessment of the benchmark remains as set out in our February 2015 consultation.

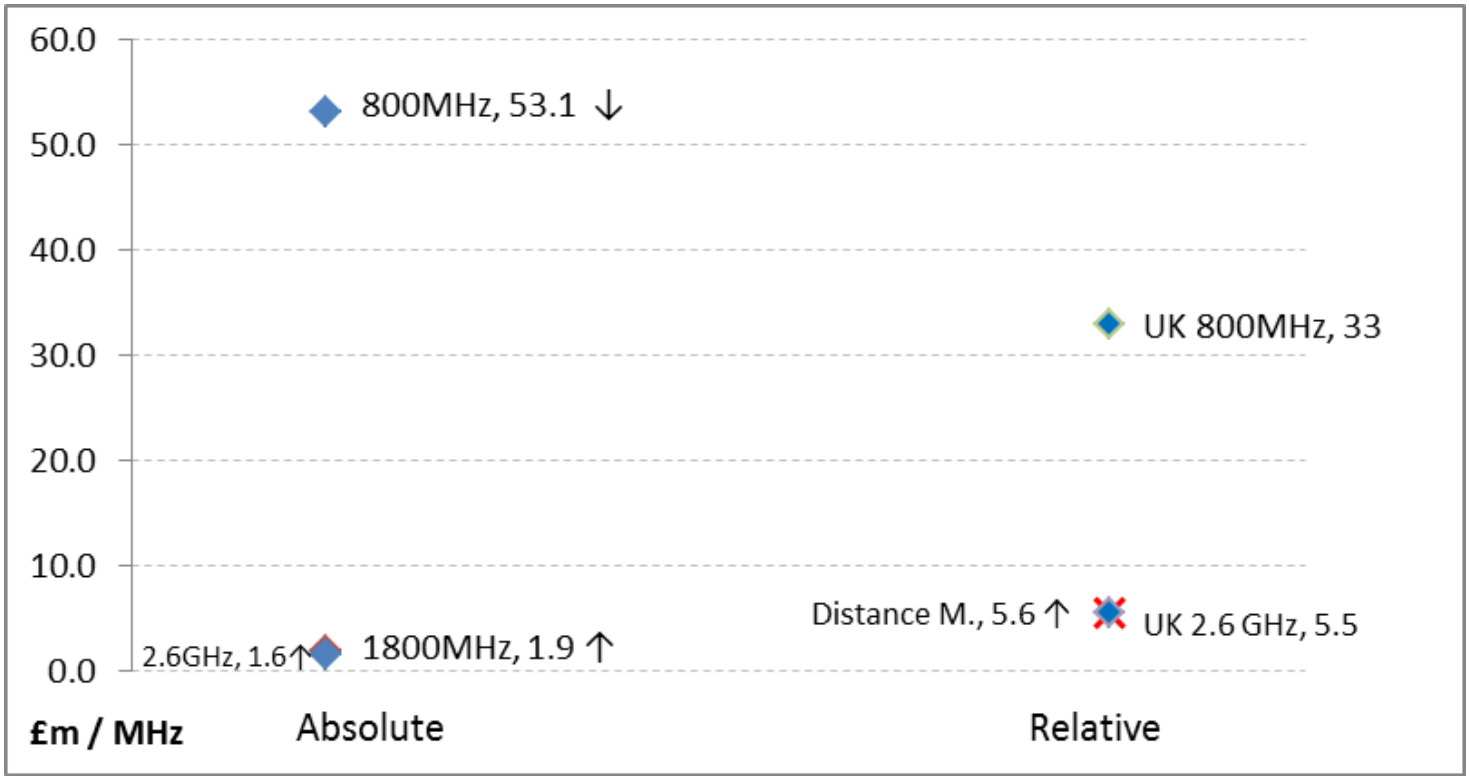
A8.364 The following table summarises the available benchmarks (along with our interpretation of them) from the German 2010 award:

Table A8.4.4: Summary of evidence points from Germany (2010)

	Absolute values (£m / MHz)			Relative value benchmarks[1] (£m / MHz)	Ratios (%)		
	800 MHz	1800 MHz	2.6 GHz	Distance method	1800 MHz / 800 MHz	1800 MHz / 2.6 GHz	2.6 GHz / 800 MHz
Final values	53.1	1.9	1.6	**5.6** **(0.4%)**	4%	113%	3%
Tier				**Second**			
Assessment of risk	Larger risk of larger over-statement	Larger risk of under-statement	Risk of under-statement	Larger risk of larger under-statement	Larger risk of larger under-statement	Risk of under-statement	Larger risk of larger under-statement

1 Based on the UK 800 MHz value without coverage obligation and gross of expected DTT co-existence costs

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

Germany (2015)

June 2015 multiband auction

Description: Award of spectrum in the 700 MHz, 900 MHz, 1800 MHz, and 1.5 GHz bands through an SMRA format.

Context: The three incumbent mobile network operators - Deutsche Telekom (T-Mobile), Vodafone, and Telefónica - were the only qualified bidders. Germany previously had a fourth national MNO, E-Plus, which won spectrum in the May 2010 auction, but E-Plus was subsequently acquired by Telefónica in October 2014. The 700 MHz and 1.5 GHz bands were new mobile bands, while 900 MHz and some 1800 MHz licences were being re-auctioned.

Table A8.5.1: June 2015 multiband auction results

	700 MHz	900 MHz	1800 MHz	1.5 GHz unpaired	Price Paid
Total Available	2x30	2x35	2x50	40	€5.1bn
Deutsche Telekom	2x10	2x15	2x15	20	€1.8bn
Vodafone	2x10	2x10	2x25	20	€2.1bn
Telefónica	2x10	2x10	2x10	-	€1.2bn
Unsold	-	-	-	-	-
Reserve price for the band	€450m	€525m	€375m	€150m	-
Total auction revenue	€1bn	€1.35bn	€2.41bn	€329.7m	-
% mark-up	122%	156%	541%	120%	-

Table A8.5.2: June 2015 multiband auction design

	Description	Implications
Number of bidders; number of lots; lot sizes	3 bidders. There were six lots of 700 MHz, seven lots of 900 MHz, 10 lots of 1800 MHz (all 2x5 MHz) and eight 5 MHz lots of 1.5 GHz. Bids were placed separately on specified lots but most were frequency-generic, allowing winning bidders to acquire contiguous blocks where possible. The bottom 900 MHz lot and the top 1800 MHz lot were the only frequency-specific lots and were subject to more stringent coexistence restrictions than other lots.[104]	Potential for all operators to win spectrum from each band
Spectrum caps / Restrictions	A 2x15 MHz cap in 900 MHz	Deutsche Telekom won up to the 900 MHz cap
Reserve prices	All spectrum sold significantly above reserve price.	
Obligations	Every successful bidder (except new entrants, if there had been any) was subject to an obligation to ensure, within three years, broadband coverage with a minimum transmission rate of 50Mbit/s per sector, to 98% of households, with a minimum of 97% in each federal state, and full coverage	

[104] http://www.bundesnetzagentur.de/SharedDocs/Downloads/EN/BNetzA/Areas/Telecommunications/TelecomRegulation/FrequencyManagement/ElectronicCommunicationsServices/DecisionP2016_pdf.pdf?__blob=publicationFile&v=3. Annex 2, page 1.

	for the main transport routes “as far as is legally and practically possible”. Bidders could use any spectrum to meet this target.

Our position in the July 2015 update note

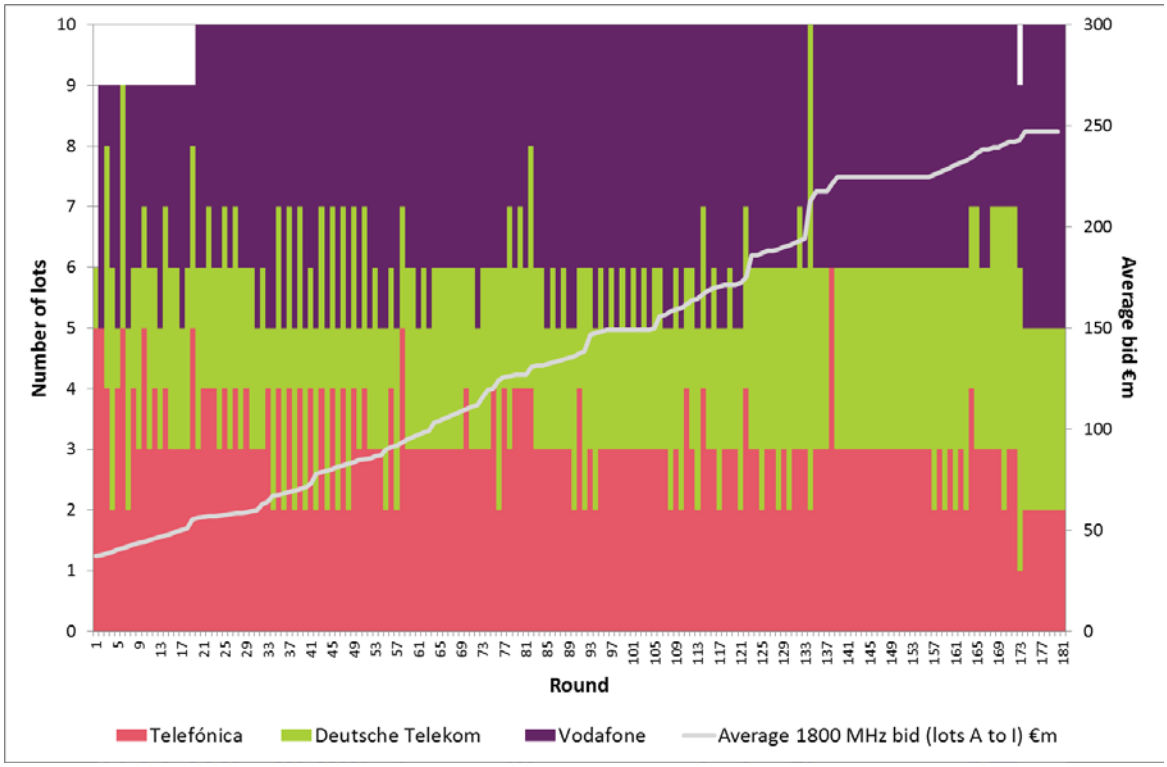
Bidding activity

A8.365 Our update note described bidding activity in the 900 MHz and 1800 MHz bands, as set out in Figures A8.5.1 and A8.5.2 below. At the start of each round, all bids submitted by all bidders in the previous round were made available to bidders. The auction concluded after 181 rounds.

Figure A8.5.1: Number of 900 MHz lots for which each operator was standing high bidder

Source: Ofcom from information published by BNetzA

Figure A8.5.2: Number of 1800 MHz lots for which each operator was standing high bidder



Source: Ofcom from information published by BNetzA

Whether award outcomes are likely to reflect market value

900 MHz

A8.366 In our assessment, we considered the following points:

a) First we considered the possible effect of the 900 MHz spectrum cap. We said it was possible that individual bidders in the German auction, particularly those with a need for 900 MHz spectrum for GSM in the medium term, were prevented by the spectrum cap from expressing their full range of valuations of 900 MHz spectrum for other uses such as LTE. Our initial view was that the spectrum cap introduced a risk that auction prices understate the forward-looking value of 900 MHz spectrum for a 2x10 MHz increment.

b) We then considered whether the 900 MHz band may have been subject to a degree of co-ordinated strategic demand reduction. We said that the evidence of active bidding in the 900 MHz band, and of final prices being well above the reserve price, suggested limitations on the extent of any strategic demand reduction that might have taken place. However we considered there was less evidence of competitive bidding in the 900 MHz band than in the 1800 MHz band and that, in the absence of an alternative explanation, this could be consistent with a degree of strategic demand reduction.

c) Next we considered the possibility that bidding involved signalling, rather than competition based on operators' intrinsic values. We noted that some aspects of the auction might not necessarily be consistent with straightforward bidding, for

example bidders raising bids for lots on which they were already standing high bidder, and possible interdependence in bidding across bands such as Telefónica withdrawing its standing high bids on two lots of 900 MHz spectrum and one lot of 1800 MHz spectrum in the same round (Round 173). We said one possible explanation of these bids was that they reflected some element of signalling. However, we said that if signalling did take place in the auction, we had not identified clear evidence that it influenced the final outcome.

d) Finally, we considered the possibility of other strategic behaviour, such as strategic investment and price driving, but we did not identify clear evidence of such strategic behaviour in the auction.

A8.367 We then considered, in light of this analysis, whether the 900 MHz price is at risk of understating or overstating the market value of 900 MHz in the UK.

A8.368 We considered that:

a) It was possible that the combination of the 900 MHz spectrum cap and the need of some operators to use 900 MHz spectrum for GSM may have prevented bidders from expressing their full range of valuations for additional 900 MHz spectrum for use in providing LTE services.

b) It was possible that a degree of strategic demand reduction may have occurred in the 900 MHz band, and that the final allocation of 900 MHz spectrum may have been a focal point during the auction. We considered there was more evidence for this possibility in the 900 MHz band than in the 1800 MHz band.

c) We did not identify clear evidence to support the possibilities that signalling had a significant effect on the auction or that strategic investment or price driving took place.

A8.369 We considered there is a risk that the auction price for 900 MHz spectrum is an understatement of the market value in Germany. However, we said we could not be sure of the likelihood or scale of this risk.

A8.370 We noted that 900 MHz sold at a significantly lower price than 1800 MHz in the German 2015 auction and we said we do not observe this outcome in any other auction in our dataset.[105] One interpretation of this outcome could be to treat the benchmark as having a larger risk of understatement (and/or that the scale of understatement is larger). However, we did not adopt this approach, especially given the limited number of evidence points in our dataset.

1800 MHz

A8.371 We noted that bidding activity in this band continued throughout most of the auction, and final prices were more than six times the reserve price for nine of the ten lots. As we discussed above, we said it is possible that some bidding activity in the auction may have been intended as signalling, possibly in relation to other bands.

A8.372 However, as Figure A8.5.2 above illustrates, bidding was more or less continual in the 1800 MHz band for the first two-thirds of the auction, with Vodafone making many bids for five lots (which it eventually won), Telefónica making many bids for

[105] We also note that BNtezA set a reserve price for 1800 MHz which was half that of 900 MHz.

three or four lots, some bids for five lots, and one for six lots before finally winning only two, and Deutsche Telekom making a number of bids throughout the auction for four or more lots before winning three. We had no reason to consider that the 1800 MHz outcome was affected by signalling, either in other bands or in the 1800 MHz band. We also considered that price driving was unlikely in this band, as each operator risked winning any bid it made and, in fact, all three bidders won at least two lots. We also considered that strategic investment was unlikely, particularly as all three operators had 2x10 MHz of 800 MHz spectrum, and all three had holdings of 2.6 GHz spectrum.

A8.373 Overall, we did not identify a reason for the auction price of 1800 MHz spectrum to be an understatement or overstatement of the market value of 1800 MHz spectrum in Germany.

800 MHz

A8.374 To derive relative 900 MHz and 1800 MHz benchmarks using the prices from the 2015 award, we also needed to use the 800 MHz price from the May 2010 award. As set out in paragraph A8.258 of the February 2015 consultation, we considered that the price of 800 MHz is likely to reflect market value in Germany in 2010.

2.6 GHz

A8.375 To derive a relative 1800 MHz benchmark using the prices from the 2015 award, we also needed to use the 2.6 GHz price from the 2010 award. As set out in paragraph A8.259 of the February 2015 consultation, we considered that the price of 2.6 GHz may understate market value in Germany, though we said we cannot be sure of the likelihood and scale of this understatement.

Likelihood of reflecting UK market value

A8.376 We said that we were not aware of any country-specific factors that would cause the value of 900 MHz or 1800 MHz spectrum in Germany to be an understatement or overstatement of the value in the UK.

Relative benchmarks

A8.377 We had sufficient information from the 2010 and 2015 German auctions to calculate relative benchmarks for both 900 MHz and 1800 MHz.

Assessment of risk

A8.378 As regards the 900 MHz / 800 MHz relative value benchmark, we noted that the 800 MHz band was auctioned five years earlier than the 900 MHz band[106] and, because of this, we considered that there is a risk that the value of this band has changed since 2010. We considered that this creates a risk of understatement or overstatement in the benchmark, although we said we cannot be sure of the likelihood or scale of this risk. Taking all the above factors into account, including the points discussed at paragraphs A8.366 to A8.370 above, our initial view was that this benchmark is at risk of understatement of the value of 900 MHz spectrum

[106] As we noted in our February 2015 consultation (paragraph A8.258) our view is that the price of 800 MHz observed in the 2010 German auction is likely to reflect market value in Germany at that time.

in the UK, although we said we could not be sure of the likelihood or scale of this risk.

A8.379 We said that the 1800 MHz distance method benchmark also depends on the Germany 2010 auction prices for 800 MHz and 2.6 GHz. As noted above, we said there is a risk that the value of 800 MHz spectrum may have increased or decreased in value since that date, whilst the 2.6 GHz price may understate market value in Germany. An understatement of the 2.6 GHz value would imply an overstatement of market value in the 1800 MHz distance method benchmark (other things being equal). However, we noted that the benchmark value is not highly sensitive to the 2.6 GHz price – for example doubling the 2.6 GHz estimate would reduce the benchmark from £15.2m to £14.6m per MHz, whereas halving the 800 MHz estimate would increase the benchmark to over £25m per MHz. We considered that there is a risk that the benchmark is an understatement or overstatement of the market value of 1800 MHz spectrum in the UK, but we said we could not be sure of the likelihood or scale of this risk.

Tiering

A8.380 We considered the appropriate tier for the 900 MHz / 800 MHz benchmark from the German auctions, according to our tiering criteria set out in paragraph A7.122 of our February 2015 consultation:

a) We considered that the benchmark met the first of our criteria for inclusion in Tier 1, namely that the auction prices (both 900 MHz and 800 MHz) appear likely to have been primarily determined by a market-driven process of bidding in the auctions, in the sense that they were not set by reserve prices.

b) The second of our criteria is that, based on the evidence available to us, the relative prices between these bands are at least as likely to be based on bidders' intrinsic valuations of spectrum as on strategic bidding. As discussed above, we considered there is some evidence of strategic bidding for 900 MHz spectrum. However, we said there is also evidence of competition for spectrum in the band, consistent with bidding based on intrinsic valuations. Therefore, our initial view was that this criterion is met. We reflected the possibility of strategic demand reduction in particular in our assessment of the risk of understatement of the benchmark.

c) The last of our three criteria is that the outcome appears likely to be informative of forward-looking relative spectrum values in the UK, having regard to country-specific circumstances and auction dates. Our initial view was that this criterion is met.

A8.381 Our provisional view was that the 900 MHz relative benchmark meets our criteria for Tier 1.

A8.382 We provisionally considered that the 1800 MHz distance method benchmark meets all three of our criteria for inclusion in Tier 1:

a) The auction prices (1800 MHz, 800 MHz, and 2.6 GHz) appear likely to have been primarily determined by a market-driven process of bidding in the auctions, in the sense that they were not set by reserve prices.

b) Based on the evidence available to us, the relative prices between these bands are at least as likely to be based on bidders' intrinsic valuations of spectrum as on strategic bidding.

c) The outcome appears likely to be informative of forward-looking relative spectrum values in the UK, having regard to country-specific circumstances and auction dates.

Stakeholder responses to the July 2015 update note

Whether award outcomes are likely to reflect market value

900 MHz

The 900 MHz cap and need for GSM provision

A8.383 EE and AM&A agreed with our view that the 900 MHz cap, coupled with bidders' need to gain sufficient spectrum to support GSM, was likely to have led bidding in the auction to understate the market value of 900 MHz spectrum.[107] EE said that at least two of the bidders were understood to require 900 MHz for GSM, potentially preventing them from expressing their valuations for services such as LTE. It also noted that the spectrum cap meant that all three bidders were guaranteed to win at least 2x5 MHz, and argued that this weakened competition in the band. Deutsche Telekom agreed that the spectrum cap reduced bidders' ability to compete for 900 MHz spectrum, and prevented bidders from acquiring enough spectrum to provide LTE services.[108]

A8.384 Telefónica said that "it is not unreasonable to assume that bidders were unable to express a value for 2x10 MHz of 900 MHz for LTE use".[109] However, Telefónica also said it does not follow from this that operators would have bid more for 900 MHz spectrum in the absence of the cap. According to Telefónica, the price of 900 MHz was set by Vodafone's demand for a third lot of spectrum, which would have reflected the value of a combination of GSM provision in the near term and LTE capacity in the long term. Telefónica argued that this value "presumably exceeded Vodafone's standalone value for 2x5 MHz incremental LTE capacity, and may or may not have exceeded 50% of its value for 2x10 MHz for LTE". Telefónica argued that the value of LTE900 in Europe is depressed due to a lack of "residual capacity" for LTE, and while the handset ecosystem was improving its prospects were less certain than for other bands.[110]

A8.385 Vodafone and Frontier disagreed that the spectrum cap might have led the 900 MHz price to understate market value:[111]

a) Frontier said that marginal values related to short or medium term GSM use are likely to have been much more significant for auction bidders and to have set the auction prices for 900 MHz spectrum. It noted that BNetzA expects the provision

[107] EE response to the July 2015 update, page 14
[108] Deutsche Telekom letter to Sharon White (Ofcom), 13 August 2015. EE is a 50:50 joint venture of Deutsche Telekom and Orange S.A.
[109] Telefónica response to the July 2015 update note, page 14
[110] Telefónica response to the Deutsche Telekom letter, 4 September 2015.
[111] Vodafone response to the July 2015 update note, p. 6

of 2G services to continue until 2025, while the LTE 900 ecosystem is still in the early stages of development.[112] [✂] ; and

b) Frontier said that all bidders would (in the medium to long term) be able to reduce their GSM 900 usage down to at most 2x5 MHz. This means that, even if operators were bidding on the basis of LTE use, bidders could still express preferences for 2x10 MHz of 900 MHz for LTE.[113]

Possibility of signalling and strategic demand reduction

A8.386 BT argued that we had "materially underestimated" the degree of strategic demand reduction that occurred in the German auction.[114] It said that:

a) The small number of bidders and transparency of bidding meant that the auction was more like a negotiation between bidders than a competitive market, with bidders aiming for an "acceptable" outcome, in which "everyone pays roughly the same price for the same type of spectrum", and to reach this outcome as quickly and cheaply as possible; and

b) In the 900 MHz band bidders "identified the outcome" in Round 29 and that subsequent bids were strategic bids related to other bands.

A8.387 In light of this BT believed that the German 2015 auction benchmarks for both 900 MHz and 1800 MHz bands should be Tier 2. It noted our position that the 2010 German benchmark should be Tier 2 "in part at least because…prices did not necessarily reflect the market value of the band as a result of strategic bidding".

A8.388 EE presented a report by AM&A which argued that signalling took place in the auction, giving three examples:[115]

a) In Round 134, Telekom bid on eight lots in the 1800 MHz band (having previously bid for three or four), increasing average lot prices by almost 10%. This included bids on all of Vodafone's standing high bids in the band (which were not the cheapest lots) and lots on which Telekom was already standing high bidder. AM&A argued that Telekom aimed to signal to Vodafone to reduce demand in the 1800 MHz band, and potentially the 900 MHz band.

b) In Round 138, Telefónica bid on six 1800 MHz lots, having previously been standing high bidder on five or fewer, and bid only on Telekom's lots which were among the most expensive in the band. Telefónica also became standing high bidder on three 900 MHz lots, substantially increasing the bids. AM&A said this appeared to have sent a signal to Telekom and Vodafone to reduce their demand in the 900 MHz band.

c) In Round 172, Vodafone became standing high bidder on all six 700 MHz lots. AM&A said this was clearly a signal to encourage competitors to drop demand in the 900 MHz and/or 1800 MHz bands. In the next round Telefónica withdrew on two lots of 900 MHz, while bidding on a cheaper lot, and withdrew on one lot in the 1800 MHz band. AM&A said that Vodafone's 700 MHz bids sent a signal to

[112] Vodafone response to the July 2015 update note, Annex 3, pp. 8-9
[113] Vodafone response to the July 2015 update note, Annex 3, p. 9
[114] BT response to the July 2015 update note, page 2
[115] AM&A report for EE response to the July 2015 update note, pp 6-7.

competitors to cease bidding in the 900 MHz and 1800 MHz bands, to which they responded.

A8.389 AM&A noted that it is difficult to prove beyond doubt that strategic bidding occurred in the auction, or whether its effect was so great that relative prices do not reflect intrinsic valuations, but commented that "Ofcom is sufficiently satisfied that this was the case in the 2010 German auction", and that the bidding activity described above is similar in nature to the strategic bidding we identified in the 2010 German auction. It said that in both cases bidders placed bids that were not valuation based with the aim of signalling to rivals that they should reduce demand in other bands. EE said that as a matter of consistency we should reach the same conclusion for the 2015 auction.

A8.390 Deutsche Telekom said there was evidence that final prices for 900 MHz and 1800 MHz were affected by strategic bids that were placed by all three bidders). It said that in particular some later bids by Vodafone did not appear to have any value-based rationale.[116]

A8.391 Telefónica argued that the evidence for strategic demand reduction at 900 MHz was weak. It noted that:[117]

a) There was significant competition and final prices were well above reserve;

b) In many rounds, excess demand was just 1 lot, implying that any bidder could have ended the competition at any time with a unilateral drop of 1 lot; and

c) Only Vodafone and Telefónica could have engaged in strategic demand reduction, given that Deutsche Telekom won the maximum permitted lots.

A8.392 In relation to point (c), Telefónica said that Vodafone's "greater focus on 900 MHz and the fact that it started the auction with smaller spectrum holdings overall" means it is reasonable to suppose that Vodafone had a higher value than Telefónica for a third lot, so "whether or not Telefónica's failure to bid consistently on a 3rd lot at 900 MHz was demand reduction or not is irrelevant to the price outcome" and one must conclude that the suggestion is of demand reduction by Vodafone. Telefónica argued that Vodafone's behaviour is "consistent with it seeing a 3rd lot at 900 MHz and 5th lot at 1800 MHz as substitutes…switching between bands only after driving the price of one band up significantly." Telefónica commented that:

> "This leaves open the possibility that at the relative prices at which the auction closed [Vodafone] might have preferred 900 MHz but chose 1800 MHz instead in order to close the auction. However, if Vodafone had actually valued the incremental 900 MHz lot higher than [the] 1800 MHz one, it would presumably have approached the auction differently. Therefore, even if Ofcom's speculation regarding strategic demand reduction has some truth, it seems likely that the impact of such behaviour on the 900 MHz price was modest".

[116] Deutsche Telekom letter to Sharon White, 13 August 2015

[117] Telefónica response to July 2015 update, pages 15-16. Vodafone and Frontier also noted that there was competitive bidding across bands and final prices were well above reserve price.

A8.393 Telefónica recognised that signalling may have occurred in the auction, but said there was "no clear evidence that bidders actually responded to these signals by changing their own demand".[118]

A8.394 In commenting on Deutsche Telekom's letter to Ofcom, Telefónica said that it was apparent that some bids in the auction had been strategic, and such bids were especially common in long SMRAs, but there was "no compelling evidence that strategic bids had a significant impact on final prices". It commented, based on discussions with Telefónica Deutschland, that:

a) "At the time Vodafone submitted the jump bids on 700 MHz, prices of 900 MHz and 1800 MHz had already reached high levels, so it is highly speculative to suppose that prices would have increased much further if Vodafone had not behaved in this manner."

b) Vodafone's bidding was consistent with its seeing a third block of 900 MHz and a fifth block of 1800 MHz as substitutes. "It is possible that if Telefónica Deutschland had not dropped demand at 1800 MHz, that the 900 MHz price would have increased further but, based on past bidding patterns, Vodafone would likely have switched back from 900 MHz to 1800 MHz".

A8.395 [✂] In relation to the circumstances of the auction, Vodafone said that:

a) [✂] ;[119]]

b) [✂] ;[120] and]

c) Frontier said that the lot structure and unequal spectrum position pre-auction blocked any realistic possibility of reciprocal demand reduction, as it was impossible for all bidders to simply renew their existing spectrum holdings, and therefore impossible to tell which "focal" outcome (i.e. 3-3-1 split or 3-2-2 split) was more likely.[121]

A8.396 [✂]

a) [✂] .[122]

b) [✂] .[123]

c) [✂].[124]

d) [✂]"[125]

A8.397 [✂] .[126]]

[118] Telefónica response to the July 2015 update note, page 16
[119] [✂]
[120] [✂]
[121] Vodafone response to the July 2015 update note, Annex 3, p.10
[122] [✂]
[123] [✂]
[124] [✂]
[125] [✂]
[126] [✂]

Possibility of price driving

A8.398 [✂] .[127]

.[128]

1800 MHz

A8.399 BT, Telefónica and Deutsche Telekom argued that the 1800 MHz price risked overstating market value in Germany.

a) BT[129] said that competitive intensity in the auction may have been increased by the fact that only 2x50 MHz (out of 2x75 MHz) of 1800 MHz spectrum was included in the auction.

b) BT said that "the amount of spectrum bid for would be likely to affect the position within the band", and for example that Vodafone's securing one frequency-specific lot and four generic lots could lead it to "achieve a contiguous assignment that could encompass parts of the band that span expiring as well as an existing licence", the latter currently held by E-Plus (Telefónica).

c) [✂] considered it possible that Vodafone was willing to bid beyond its intrinsic value for a fifth 1800 MHz lot, based on the broader strategic value of not falling further behind in terms of its long-term capacity holdings. It noted that Telefónica (Germany)'s network is built around 1800 MHz and said that "one would have expected Telefónica's incremental value for a 5th lot (or even a 6th lot) based on servicing GSM traffic to have exceeded Vodafone's value for a 5th lot".[130]

d) Deutsche Telekom said that the price of 1800 MHz was driven up by the uncertainty created by BNetzA's investigation into Telefónica's 2.1 GHz holdings (following the merger with E-Plus).[131] Deutsche Telekom argued that it created the threat that Telefónica would be forced by BNetzA to relinquish some 2.1 GHz spectrum, and that Telefónica responded by bidding for more 1800 MHz than it otherwise would have needed.

e) In its comments on Deutsche Telekom's letter, Telefónica said that this view was not recognised by Telefónica Deutschland itself, although it (Telefónica) agreed that the price of 1800 MHz may have been overstated relative to market value [✂]. It said that Telefónica Deutschland's bids for 1800 MHz in the auction were based solely on intrinsic value.

800 MHz and 2.6 GHz

A8.400 AM&A said that, even if we considered that there was no evidence of strategic bidding in the 2015 auction, our new relative 900 MHz and 1800 MHz benchmarks are based on 800 MHz and 2.6 GHz values from the May 2010 auction, for which we considered there to be evidence of strategic bidding in our February

[127] [✂]
[128] [✂]
[129] BT response to the July 2015 update note, pages 4 and 5
[130] [✂]
[131] Deutsche Telekom letter to Sharon White, 13 August 2015

consultation.[132] AM&A said this suggests on its own that benchmarks do not accurately reflect intrinsic relative market values.

Likelihood of reflecting UK market value

Timing of award

A8.401 BT and AM&A argued that we should place less weight on the German benchmarks as a result of the time gap between the 2010 and 2015 auctions:

a) BT said that "Ofcom must place a lower weight on ratios of prices derived from auctions held at materially different times, and particularly so if there have been material changes in the market between the two auctions concerned".[133] It noted two such changes as being: an increase in market concentration (from four to three operators), which may have led to less strong competition in the auction; and an increase in mobile data traffic.

b) AM&A said that "in order to be consistent with previous categorisations of benchmarks into tiers, we believe that an 1800MHz distance method benchmark and a 900MHz relative value method benchmark that rely so heavily on 800MHz and 2.6GHz benchmarks from five years ago should be at best categorised as Tier 2".[134]

A8.402 Frontier argued, in contrast, that all of the benchmark evidence suffers from "timing" errors in relation to the ideal benchmark, which would provide an 800 MHz price from 2013 (i.e. the time of the UK 4G auction) and a 900 MHz and 1800 MHz price at the latest available date. It said that the length of time between the 2010 German auction and the 2013 UK auction (which will influence the magnitude of the timing error from Germany) is similar to the length of time between the UK auction and the present day (which will influence the magnitude of the timing error for other benchmark jurisdictions). Vodafone argued that there is therefore no reason to reduce the weight given to Germany for this reason alone.[135]

Availability of 700 MHz

A8.403 BT argued that the availability of 700 MHz in Germany meant that around 50% more low frequency spectrum was available than in the UK, which it expected would reduce the market value of 900 MHz relative to the UK.[136]

1800 MHz / 900 MHz ratio

A8.404 BT, EE and AM&A all commented that Germany (2015) was the only country in our dataset where the 1800 MHz price is higher than the 900 MHz price. BT considered that this provided clear evidence of strategic bidding.[137] AM&A said it "must indicate that bidding in one or both of the bands departed considerably from bidding based on intrinsic value".[138] EE argued that 900 MHz selling at a significantly lower price

[132] AM&A report for EE response to the July 2015 update note, page 8
[133] BT response to the July 2015 update note, page 5
[134] AM&A report for EE response to the July 2015 update note, page 10
[135] Vodafone response to the July 2015 update note, Annex 3, page 12.
[136] BT response to the July 2015 consultation, page 2
[137] BT response to the July 2015 update note, page 4
[138] AM&A report for EE response to the July 2015 update note, page 8

than 1800 MHz was contrary to prior expectations in that, in the UK, 900 MHz spectrum is recognised as providing better propagation for indoor coverage than 1800 MHz.[139] Deutsche Telekom noted that the relative prices for 900 MHz and 1800 MHz were "highly unusual", which it believed more likely to reflect features of the auction such as strategic bidding rather than relative market values.[140]

A8.405 EE and AM&A also said that in our October 2013 consultation we noted that that the Danish 1800 MHz price was, in UK-equivalent terms, lower than the UK market value for 2.6 GHz, and we concluded on this basis that the result provided less important evidence for UK market values.[141] EE said this demonstrates that "Ofcom has clearly acknowledged that it should not place significant weight on benchmarks that provide such unexpected relative prices".[142]

A8.406 Telefónica recognised that the 1800 MHz / 900 MHz ratio from the German auction is surprising but said a possible explanation might be that "Vodafone did not place any significant incremental value on propagation benefits from securing more sub-1GHz spectrum, given the spectrum it already had or was about to win across 700 MHz, 800 MHz and 900 MHz. Instead, it may have seen the potential to acquire a contiguous 2x25 MHz block at 1800 MHz as a more valuable option for future proofing its networks".[143]

A8.407 Telefónica, in response to Deutsche Telekom's letter to Ofcom, argued that the value of the 900 MHz and 1800 MHz bands had converged in recent years, as 1800 MHz was the leading capacity band for LTE while there was "little supply or demand for spectrum for LTE at 900 MHz". It also argued that the relatively low price of 700 MHz in the auction indicated that the premium for sub-1 GHz spectrum has been eroded. Telefónica said that in Germany "Local factors may have affected the exact benchmark" but "the appropriate approach is to maintain Germany as a Tier 1 benchmark but acknowledge the possibility of understatement at 900 MHz and overstatement at 1800 MHz with respect to UK values."

A8.408 Vodafone considered that "the pair of values revealed by the auction is, in the circumstances of a post 4G launch value not particularly unexpected".[144] It put forward a number of reasons why it considered that low frequency spectrum may not be very much more valuable than high frequency spectrum for LTE. It also considered that 1800 MHz is "4G-ready" while the 900 MHz band is not. On this basis, Vodafone argued that relative 900 MHz and 1800 MHz prices in the German auction were entirely logical, and said that Ofcom needs to attach considerable weight to the outcome of the German auction in its benchmarking assessment. [✂]

A8.409 Frontier said that "the fact that 1800 sold relatively higher above its reserve price than 900 is readily explained by a higher than expected intrinsic demand for 1800 MHz spectrum, rather than the lack of competition for 900 MHz spectrum, as Ofcom appears to be suggesting".[145]

[139] EE response to the July 2015 update note, page 15
[140] Deutsche Telekom, letter to Sharon White, 13 August 2015.
[141] EE response to the July 2015 update note, page 15
[142] EE response to the July 2015 update note, page 16
[143] Telefónica response to the July 2015 update note, page 16
[144] Vodafone response to the July 2015 update note, pp. 9-10
[145] Vodafone response to the July 2015 update note, Annex 3, p. 10

Our assessment

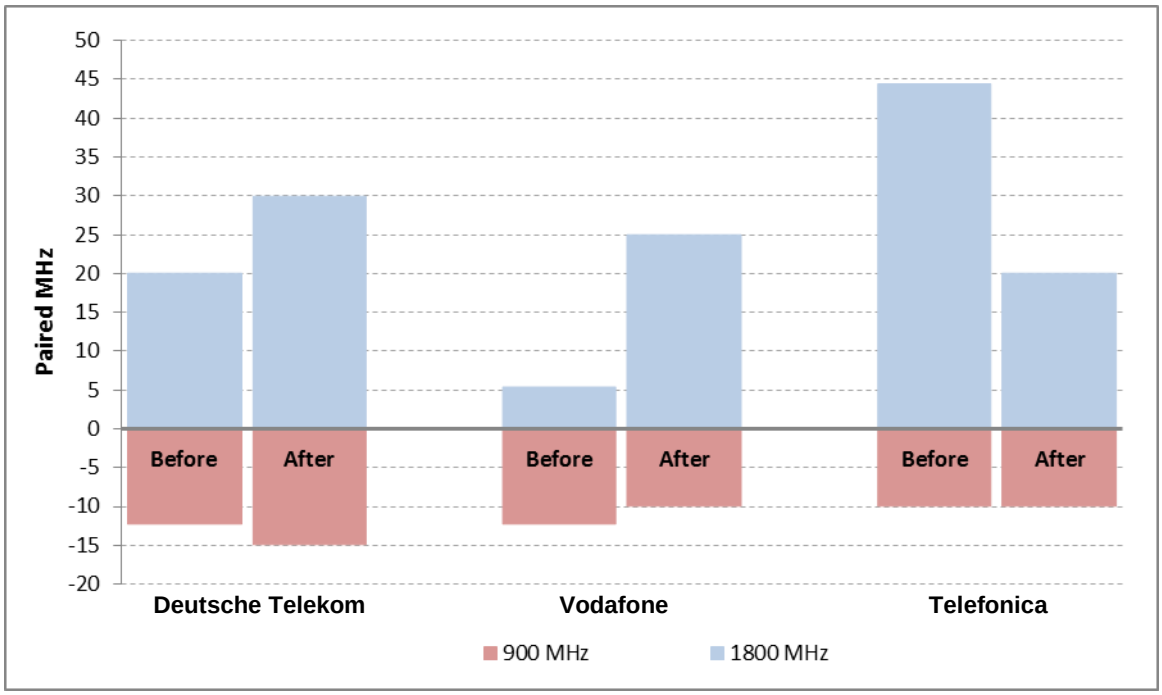
Whether award outcomes are likely to reflect market value

900 MHz

The 900 MHz cap and need for GSM provision

A8.410 Figure A8.5.3 shows the comparison between the bidders' holdings of 900 MHz and 1800 MHz spectrum before and after the auction. In the 900 MHz band, Telefónica won the same amount of spectrum (2x10 MHz) as its pre-auction holdings; Deutsche Telekom won 2x15 MHz in the auction which is 2x2.5 MHz larger than its pre-auction holdings; whereas Vodafone won correspondingly less 900 MHz spectrum in the auction than its previous holding.

Figure A8.5.3: 900 MHz and 1800 MHz holdings before and after the 2015 auction



A8.411 As set out above, EE and AM&A agreed with our view that the 900 MHz cap created a risk that 900 MHz prices understate market value. Telefónica agreed there was a possibility that bidders were unable to express a value for 2x10 MHz of 900 MHz for LTE use, and considered that the price of 900 MHz was set by Vodafone's value for a third spectrum lot which "may or may not have exceeded 50% of its value for 2x10 MHz for LTE".

A8.412 We said in paragraph 32 of our July 2015 update note that we are not in a position to reach a firm view on how much 900 MHz spectrum Vodafone or Deutsche Telekom needed for GSM provision. We agree that, in the medium to long-term, operators could potentially reduce their GSM 900 MHz usage down to 2x5 MHz. However, in our view we cannot rule out the possibility that one or both operators required more than 2x5 MHz for GSM in the shorter term, which would (combined with the spectrum cap) have prevented operators from expressing their full range of valuations of 900 MHz spectrum for other uses such as LTE.

A8.413 As regards the other points put forward by Telefónica and Vodafone (set out in paragraphs A8.384 to A8.385 above), firstly we note that: demand for GSM is already declining; Vodafone only lost 2x2.5 MHz of 900 MHz spectrum relative to its pre-auction holdings (with the other operators having at least as much after as before the auction); and Vodafone said that it expected to be able to reduce its GSM usage to at most 2x5 MHz in the medium to long term. These points are consistent with the valuation of GSM provision not having a substantial effect on the 900 MHz price at the margin.[✂]

A8.414 We remain of the view that the 900 MHz cap creates a risk that 900 MHz prices understate market value in Germany, but we cannot sure of the scale of any understatement.

Possibility of signalling and strategic demand reduction

A8.415 In the following section, we first assess arguments in relation to signalling and strategic demand reduction from BT and AM&A. We then consider whether arguments from Vodafone and Telefónica provide a basis for considering either that signalling and strategic demand reduction did not take place to a material degree or did not materially distort relative prices. In each case, we have regard to the following questions (which we also consider in our assessment of strategic bidding in Austria):

a) Is the argument or evidence put forward by the stakeholder(s) consistent with signalling and / or strategic demand reduction?

b) Does it mean that the evidence is inconsistent with intrinsic value bidding?

c) Does it establish that the relative auction prices are more likely to reflect strategic demand reduction than intrinsic value bidding?

A8.416 In considering arguments about demand reduction, it is useful to distinguish between bidders:

a) Reducing demand (i.e. reducing the number of lots in a band or overall eligibility points on which they are bidding) as prices rise above their valuation of an incremental lot. Such “demand reduction” is not inconsistent with intrinsic value bidding, and indeed is a desired outcome of the auction.

b) Bidding, from the outset of the auction, on less spectrum (fewer lots in a band, or fewer overall eligibility points), than the bidder has intrinsic demand for at reserve prices. This can be a strategy for avoiding competition in a band or bands, leading to prices below intrinsic values, and it can be facilitated if there is a “focal point” or obvious allocation of lots between bidders. It is not associated with any drop in demand observed during the auction.

c) Reducing demand, in the course of the auction, to fewer lots than the bidder has intrinsic demand for at current prices. This can be a strategy for avoiding *further* competition in a band or bands, leading to prices below intrinsic values. It can be facilitated if there is a focal point, which may have emerged in the course of bidding. The purpose of signalling is typically to elicit a demand-reducing response by a rival bidder that avoids such further competition.

Circumstances of the auction

Is this evidence consistent with signalling or strategic demand reduction?

A8.417 As to the scope for strategic behaviour in the auction, we agree with BT and Telefónica that the small number of bidders and transparency of bidding is consistent with, and indeed potentially conducive to, signalling or strategic demand reduction. Stakeholders generally agreed that signalling occurred in the auction (even if they differed in their views of the effects of signalling on the outcome).

Does it mean that the evidence is inconsistent with intrinsic value bidding?

A8.418 However, we do not consider that these circumstances preclude bidding based on operators' intrinsic values.[✂], there are examples of other SMRAs involving a small number of bidders and transparent bidding information, which have yielded prices that we consider to reflect intrinsic value bidding (e.g. 800 MHz in the Germany 2010 auction).

Does it establish that the relative auction prices are more likely to reflect strategic demand reduction than intrinsic value bidding?

A8.419 In light of this, we do not consider that the initial circumstances of the auction on their own are sufficient for us to conclude that strategic bidding is a more likely explanation of bidding in the auction than intrinsic value bidding.

Specific allegations of signalling

A8.420 In BT's characterisation of the auction, bidders were trying to reach an acceptable outcome quickly and cheaply and did so by **Round 29**. In practice, as Vodafone and Telefónica have emphasised, the auction ended after many rounds of bidding with prices well above reserve in all bands. This indicates that, even if strategic demand reduction was attempted, a strategic demand reduction outcome was not reached as early on in the auction as BT suggested.

A8.421 We agree with AM&A that Deutsche Telekom's bids in **Round 134** and Telefónica's bids in **Round 138** could be interpreted as signals to other bidders, as it described. However, similar to above, a significant degree of bidding activity occurred in both bands after Round 138, and final prices for 900 MHz were significantly higher than prices around the time of the alleged signalling. Again, this indicates that a strategic demand reduction outcome was not reached as early on as Round 134 or Round 138.

A8.422 Turning to AM&A's third example, in **Round 172**, we note the following sequence of events in the 700 MHz and 900 MHz bands:

a) Each bidder became standing high bidder for two lots of 700 MHz in Round 1. No further bidding took place until Round 155, when Vodafone displaced Telefónica on two lots. This could have been a response to Telefónica becoming standing high bidder on a second lot of 900 MHz in the previous round, displacing Vodafone from a third lot;

b) Vodafone first became standing high bidder on all six lots of 700 MHz in Round 169, increasing average prices in the band by almost 25%. Again, Telefónica had displaced Vodafone from a 900 MHz lot in the previous round;

c) In Round 172, as AM&A noted, Vodafone again became standing high bidder on all six 700 MHz lots, increasing average prices by 20%;

d) In Round 173, Telefónica withdrew bids for two 900 MHz lots (while displacing Vodafone as a standing high bidder on another lot) and withdrew its bid for one 1800 MHz lot; and

e) In Round 174, Vodafone bid on the three lots in the 900 MHz and 1800 MHz bands from which Telefónica had withdrawn, and no further bidding took place in the auction except in the 1.5 GHz band.

Is this evidence consistent with signalling or strategic demand reduction?

A8.423 We agree with AM&A that this sequence of events is consistent with an interpretation of the auction in which bidders were using the 700 MHz band to signal a strategic demand reduction outcome in 900 MHz and 1800 MHz. In this interpretation:

a) Bidders initially reached a strategic demand reduction outcome in the 700 MHz band, according to the obvious focal point of 2x10 MHz each. Vodafone's bid for additional 700 MHz lots in Rounds 155, 169 and 172 - amounting to bids for the entire band in the latter two cases - were signals, particularly to Telefónica, to drop demand in other bands.

b) Telefónica responded to Vodafone's signal in Round 172 by accommodating Vodafone in the other bands – i.e. withdrawing bids in the following round, with the expectation that Vodafone would bid on the lots from which Telefónica had withdrawn.[146] Telefónica's motivation for this was that it preferred to forego a third lot of 900 MHz than engage in further competition in 900 MHz or 1800 MHz, or fail to win 2x10 MHz of 700 MHz. By withdrawing from two 900 MHz lots while displacing Vodafone from a third lot, Telefónica sent a signal to Vodafone that it would settle for two lots in the band if Vodafone would also settle for two lots.

c) Vodafone's bid, in the following round, for the two lots from which Telefónica had withdrawn, was an acceptance of this potential strategy of demand reduction.

A8.424 [✂]

A8.425 [✂]

A8.426 [✂] We note that:

a) Telefónica's standing high bid on Lot C in the 900 MHz band was €193.6m, but when it withdrew this bid, it also placed a new bid on Lot A for a higher price of €195.5m.[147]

b) The other standing high bid for 900 MHz which Telefónica's withdrew in Round 173 was on Lot B for €201.7m. Telefónica placed this bid in Round 154, giving it two lots (Vodafone having displaced it from one lot in the previous round). It maintained this standing high bid from Round 155 to Round 172, only

[146] In Round 173, besides withdrawing bids from two 900 MHz lots, Telefónica also displaced Vodafone from Lot A.
[147] Lot A is the frequency-specific lot, which is adjacent to GSM-R.

withdrawing it after Vodafone had placed a second jump bid on all lots of 700 MHz. Telefónica's bidding pattern throughout the auction indicates an intention to win at least two lots of 900 MHz – e.g. it never allowed itself to be standing high bidder on fewer than two lots for more than a single round.

A8.427 In light of this, our view is that Telefónica's jump bid on Lot B in Round 154 can more readily be interpreted as suggesting an intention to win two lots of 900 MHz (i.e. the number it eventually won, albeit at a lower price on average) which would imply that the bid was within Telefónica's intrinsic valuation for the lot rather than as a price-driving bid which exceeded Telefónica's intrinsic valuation.

A8.428 We also note that, in its response to Deutsche Telekom's letter to Ofcom, Telefónica commented that "It is possible that if Telefónica Deutschland had not dropped demand at 1800 MHz, that the 900 MHz price would have increased further but, based on past bidding patterns, Vodafone would likely have switched back from 900 MHz to 1800 MHz". While this comment relates to Telefónica's withdrawn bid in 1800 MHz, rather than its two withdrawn bids in 900 MHz, it suggests that Telefónica (Deutschland) saw a risk of further increases in the price of 900 MHz if it had not withdrawn bids in Round 173.

A8.429 We consider that AM&A's explanation of bidding activity in Rounds 172 and 173, based on signalling and strategic demand reduction, is more consistent with the available evidence [✂].

Does it mean that the evidence is inconsistent with intrinsic value bidding?

A8.430 We next consider whether this sequence of events can be explained by intrinsic value bidding.[✂] We note that:

a) Vodafone's bids for 700 MHz all took place when Vodafone had either been displaced on a 900 MHz lot in the preceding round, or was standing high bidder on only one 900 MHz lot. Vodafone's bids on 700 MHz in Rounds 169 and 172 in particular substantially increased the 700 MHz band price. It is unclear why Vodafone would, under intrinsic value bidding, exceed the minimum bid increment by so much; and

b) In relation to Telefónica's bids for 900 MHz: Telefónica withdrawing two of its bids on 900 MHz has no obvious rationale had it been bidding according to intrinsic value.

A8.431 We consider that, for the reasons given above, bidding activity on 700 MHz and 900 MHz from rounds 169 to 173 is unlikely to be consistent with intrinsic value bidding.

Does it establish that the relative auction prices are more likely to reflect strategic demand reduction than intrinsic value bidding?

A8.432 Based on the assessments above, we consider that signalling and strategic demand reduction is a more likely explanation of bidding in these rounds of the auction than intrinsic value bidding. We note Telefónica's comment that, even if signalling occurred in the auction, there is "no clear evidence that bidders actually responded to these signals by changing their own demand". However, our view, based on the available evidence, is that Telefónica's withdrawal of two 900 MHz bids (and one 1800 MHz bid) in Round 173 is more likely to have been strategic demand reduction in response to a signal by Vodafone than to have been based on intrinsic values.

A8.433 Furthermore, as bidding in the 900 MHz band ended immediately after Vodafone bid on Telefónica's withdrawn lots in Round 174, we consider it to be more likely that, in the absence of this signalling by Vodafone and Telefónica, operators would have continued to compete directly for a third lot of 900 MHz. Had such competition occurred, it is possible that it would have led to a higher 900 MHz price, although the scale of any such effect is unclear.

A8.434 We now consider whether stakeholders' other arguments in relation to signalling and strategic demand reduction give us a reason to revise this view.

Pre-auction spectrum holdings

A8.435 We agree with Frontier that operators' pre-auction spectrum holdings gave rise to a number of possible focal points in 900 MHz (and/or 1800 MHz), and that this made it more difficult to engineer a strategic demand reduction outcome at the outset of the auction than if, for example, retention of existing holdings or another obvious focal point was a possible outcome. However, this does not rule out the possibility of strategic demand reduction occurring over the course of the auction. As a result, we do not consider that the nature of existing spectrum holdings gives us a reason to revise our view in paragraphs A8.432-A8.434 above.

Competition for lots and excess demand

A8.436 Telefónica noted that there was significant competition for lots, pushing prices well above reserve price. We agree that this is consistent with bidding based on intrinsic values for spectrum, and we noted in paragraphs A8.420-A8.421 that it implies that, even if strategic demand reduction was attempted in the early rounds of the auction, a strategic demand reduction outcome was not reached in these rounds. However, in relation to AM&A's suggestion of the possibility of signalling and strategic demand reduction in Round 172, bidding for 900 MHz and 1800 MHz ended in the rounds immediately afterwards. We consider it possible that, in the absence of any signalling and strategic demand reduction, further bidding may have led to a higher 900 MHz price.

A8.437 Telefónica commented that in many rounds any bidder could have ended competition in 900 MHz by dropping its demand by 1 lot. The fact that no bidder did so prior to Round 172 means that the extent of the impact of strategic demand reduction on final prices is less than if one of the bidders had dropped demand earlier in the auction. However, this does not rule out the possibility that, had Telefónica not reduced its demand in Round 173, further bidding would have occurred in the band leading to a higher price (as Telefónica recognised in paragraph A8.428 above). While Vodafone could have switched from 900 MHz to 1800 MHz as Telefónica suggested, we do not know how high a price of 900 MHz, relative to 1800 MHz, would have caused it to make such a switch.

A8.438 We are not in a position to judge which of Vodafone or Telefónica had a higher value for a third lot of 900 MHz, e.g. we note that both expressed demand for a third lot up to Round 172. As a result, we do not agree with Telefónica's view that "whether or not Telefónica's failure to bid consistently on a 3rd lot at 900 MHz was demand reduction or not is irrelevant to the price outcome".

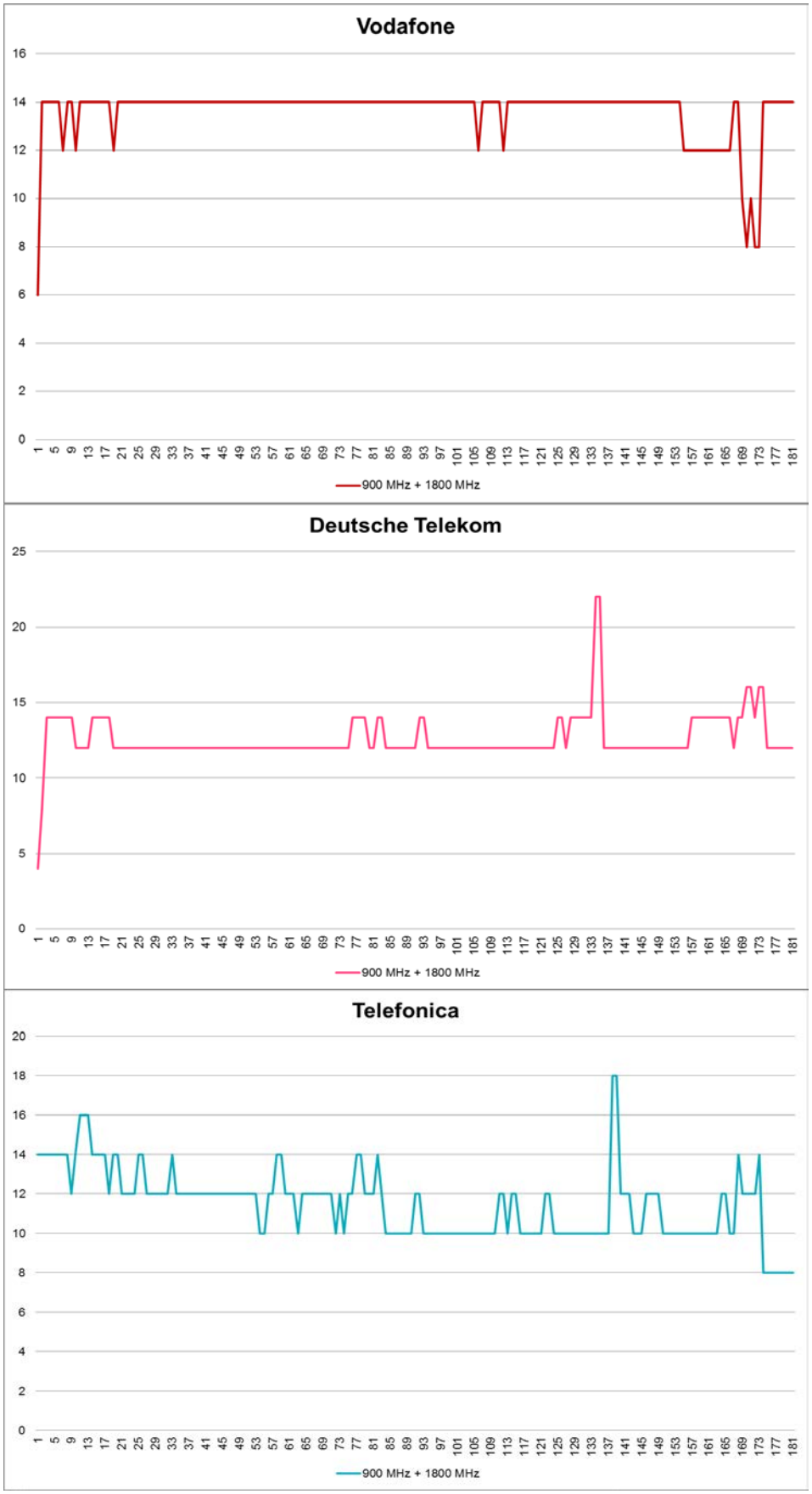
Bidding activity

A8.439 [✂]

A8.440 Figure A8.5.4 shows bidding activity (in terms of eligibility points) by bidder in the 900 MHz and 1800 MHz bands combined derived from public data. For each round, it shows standing high bids added to standing high bids in the previous round that have been outbid in the current round. It therefore represents total activity except that it excludes “collisions” (such as when Vodafone made a bid on a lot at the same time as another operator which became standing high bidder). In such cases, Figure A8.5.4 will understate the operator’s bidding activity in that round. For example, Vodafone’s apparent drops in demand to 12 points before Round 155 may be due to these “collisions”.

A8.441 Vodafone dropped its activity on 900 MHz and 1800 MHz in Round 155 when it began bidding on more than 2x10 MHz of 700 MHz. It then reverted to its previous level of activity across the two bands after Telefónica withdrew demand from both bands.

Figure A8.5.4: Bidding activity by bidder in eligibility points (excluding “collisions”) for the 900 MHz and 1800 MHz bands combined



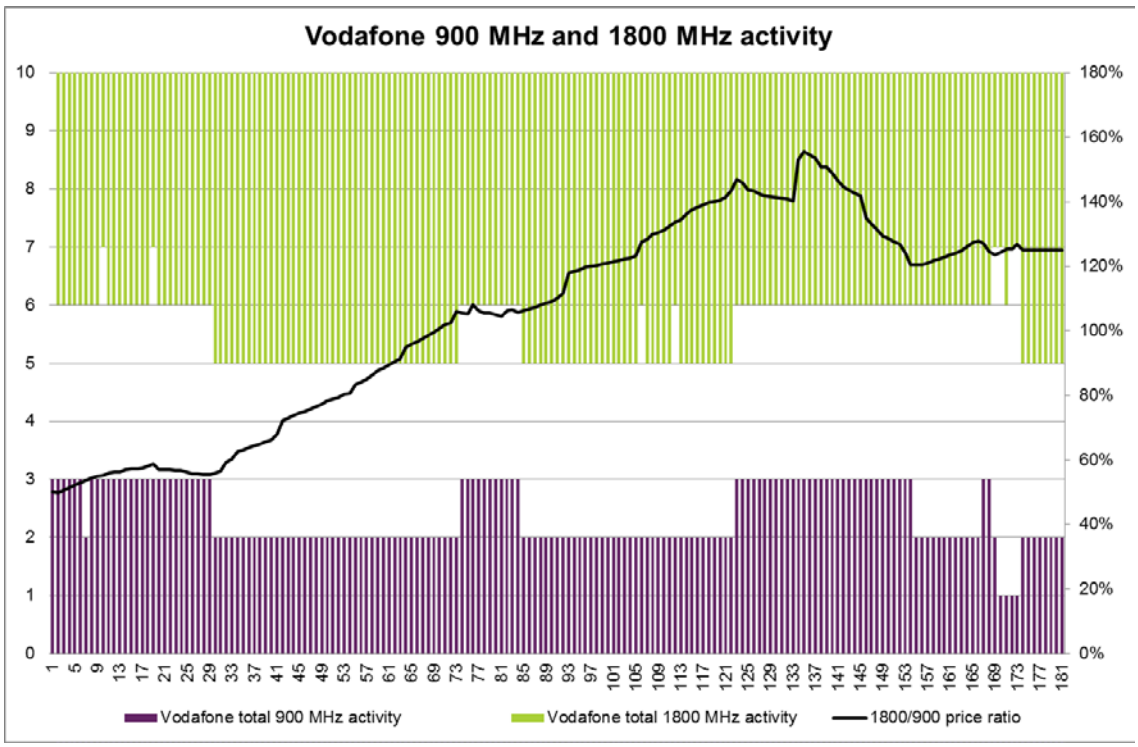
A8.442 Telefónica [✂] commented that Vodafone switched demand between 900 MHz and 1800 MHz throughout the auction. This is illustrated in Figure A8.5.5, which shows Vodafone's bidding activity for 900 MHz and 1800 MHz and the ratio of the average lot prices of 1800 MHz to 900 MHz.

A8.443 While the relative price of 1800 MHz to 900 MHz is likely to have been a factor in Vodafone's switching between bands, it is not clear that it was simply switching based on the relative price. For example, it switched to 900 MHz shortly after 1800 rose to above 100% of the 900 MHz price, but then switched back to 1800 MHz without any significant change in the relative price, and continued to bid on 1800 MHz as the ratio rose above 140%. Ultimately Vodafone won a fifth lot of 1800 MHz rather than a third lot of 900 MHz.

A8.444 Much of Vodafone's activity on 900 MHz and 1800 MHz, in which it responded to relative price signals, may be consistent with bidding based on intrinsic values. However, as Telefónica noted, it is possible that at the relative prices at which the auction closed Vodafone "might have preferred 900 MHz but chose 1800 MHz instead in order to close the auction".

A8.445 We do not consider that the evidence of Vodafone and Deutsche Telekom's bidding activity gives us a reason to revise our view in paragraphs A8.432-A8.434 above. We comment on Telefónica's bidding activity in paragraph A8.446 below.

Figure A8.5.5: Vodafone's bidding activity and relative prices in the 900 MHz and 1800 MHz bands



Summary for 900 MHz

A8.446 In our view, the available evidence is consistent with the following strategic bidding interpretation:

a) Vodafone's two jump bids in all lots of 700 MHz raised the cost of lots in this band to Telefónica first by around 25% and then a further 20% relative to its standing

high bids in this band prior to the jump bids. This may be seen as a strong signal, raising a risk of further jump bids in this band, which could potentially have induced Telefónica to relinquish incremental 900 MHz and 1800 MHz spectrum at prices significantly below its intrinsic value. The fact that Telefónica did not immediately respond to the first of these two bids in Round 169 does not rule out such a response in Round 172, and coming close together they could have had a cumulative impact.

b) If signalling and strategic demand reduction took place as described, then absent such behaviour, we cannot rule out that either Telefónica or Vodafone, or both, would have reverted to competing for a third lot of 900 MHz, with Telekom continuing to defend three lots until prices were materially higher. While Vodafone's bidding indicates it would likely have been willing to forego a third lot of 900 MHz if it could win a fifth 1800 MHz lot, Telefónica's bidding (up to Round 173) suggests that it might not have been willing to allow Vodafone to win a fifth 1800 MHz lot – indeed its bidding up to that point showed a strong commitment to at least two lots of 900 MHz and at least three lots of 1800 MHz.

c) This scenario could be characterised as one of excess demand of just one lot. However, as Telefónica noted (paragraph A8.391 above), excess demand was just one lot for many rounds of the auction, but this was enough for prices to rise substantially in the 1800 MHz and 900 MHz bands.

d) While the alleged signalling and strategic demand reduction took place after many rounds, it is possible that prices could have risen substantially in subsequent rounds. For example in the German 2010 auction of 800 MHz, prices were unchanged from rounds 116 to 200, but then rose by over 50% before the auction closed in round 224.

A8.447 We also consider that:

a) It is more likely than not that signalling took place in the auction, and in particular that Vodafone's jump bids for all lots in the 700 MHz band (particularly in Round 172) were intended as signals in relation to the 900 MHz band; and

b) It is more likely than not that bidders responded to some signals by changing their own demand, and in particular that Telefónica, in withdrawing from lots in Round 173, was responding to Vodafone's jump bids in the 700 MHz band and sending a signal relating to demand reduction strategy, which Vodafone accepted.

A8.448 On this basis, we consider there to be a risk that the price of 900 MHz in the 2015 auction understates market value in Germany.

A8.449 As regards the scale of any understatement in market value, whilst it could be significant (see, for example, paragraph A8.446 (d) above), we also note some possible reasons why it could be smaller:

a) Telefónica bid for at least 12 eligibility points of 900 MHz and 1800 MHz up to Round 54, when it dropped to 10 points for these two bands. It then bid between 10 and 14 points in these bands up to Round 78, and then between 10 and 12 points, with three exceptions of bidding for larger amounts, up to Round 174 when it bid for 8 points (see Figure A8.5.4 above).

b) In particular, it is not clear how strongly committed Telefónica was to winning three lots of 900 MHz. It bid for three lots of 900 MHz in only 25 of the first 173 rounds, becoming standing high bidder on seven separate occasions (in comparison, Vodafone was standing high bidder on three 900 MHz lots on 30 separate occasions).

c) In view of these points, if Telefónica was willing to respond to a signal in Round 172, this could indicate that prevailing prices had reached, or were close to, its intrinsic incremental valuation of a third lot of 900 MHz and a third lot of 1800 MHz. In contrast some earlier potential signals in the auction, as identified by AM&A above, may not have been effective because prices were too far below bidders' intrinsic valuations.

1800 MHz

Possibility of signalling and strategic demand reduction

A8.450 The discussion above regarding strategic demand reduction in the 900 MHz band also referred to the 1800 MHz band. For example, in relation to AM&A's arguments about signalling in Round 172, Telefónica not only withdrew bids for 900 MHz in Round 173 but also withdrew a bid for one lot of 1800 MHz, which (in AM&A's interpretation) indicated that it would settle for two lots in this band. AM&A suggested that Vodafone's bid, in the following round, for the lot from which Telefónica had withdrawn, was an acceptance of this signalling strategy. There was no further bidding for 1800 MHz after Round 174.

A8.451 There is a distinction between the 900 MHz and 1800 MHz bands in Round 174, the final round of activity. In 900 MHz, Vodafone bid on the two lots from which Telefónica had withdrawn, and no other activity took place. In 1800 MHz, while Vodafone bid on the lot from which Telefónica had withdrawn, both bidders also outbid Deutsche Telekom on one lot each, leaving it with three lots. This could have led to further competition if Deutsche Telekom had responded. However, the fact that Deutsche Telekom had been standing high bidder on three or fewer lots for most of the auction (158 rounds) may have indicated to the other two bidders that they could both (a) win these lots and (b) end bidding for 1800 MHz in the same round, which was what happened.

A8.452 As with 900 MHz, we consider that an explanation of bidding activity in Rounds 172 and 173, based on signalling and strategic demand reduction, is more consistent with the available evidence [✂]. Accordingly, we consider that, based on the evidence, there is a risk that the price of 1800 MHz understates market value in Germany. However, as discussed in paragraph A8.449 while the scale of any understatement in market value could be significant), we also note some possible reasons why it could be smaller.

Comparison of the 2010 and 2015 auctions

A8.453 We note BT and AM&A's comments that the signalling activity they described is similar in nature to the strategic bidding we identified in the 1800 MHz band in the 2010 German auction, implying that as a matter of consistency we should reach the same conclusion for the 2015 auction.

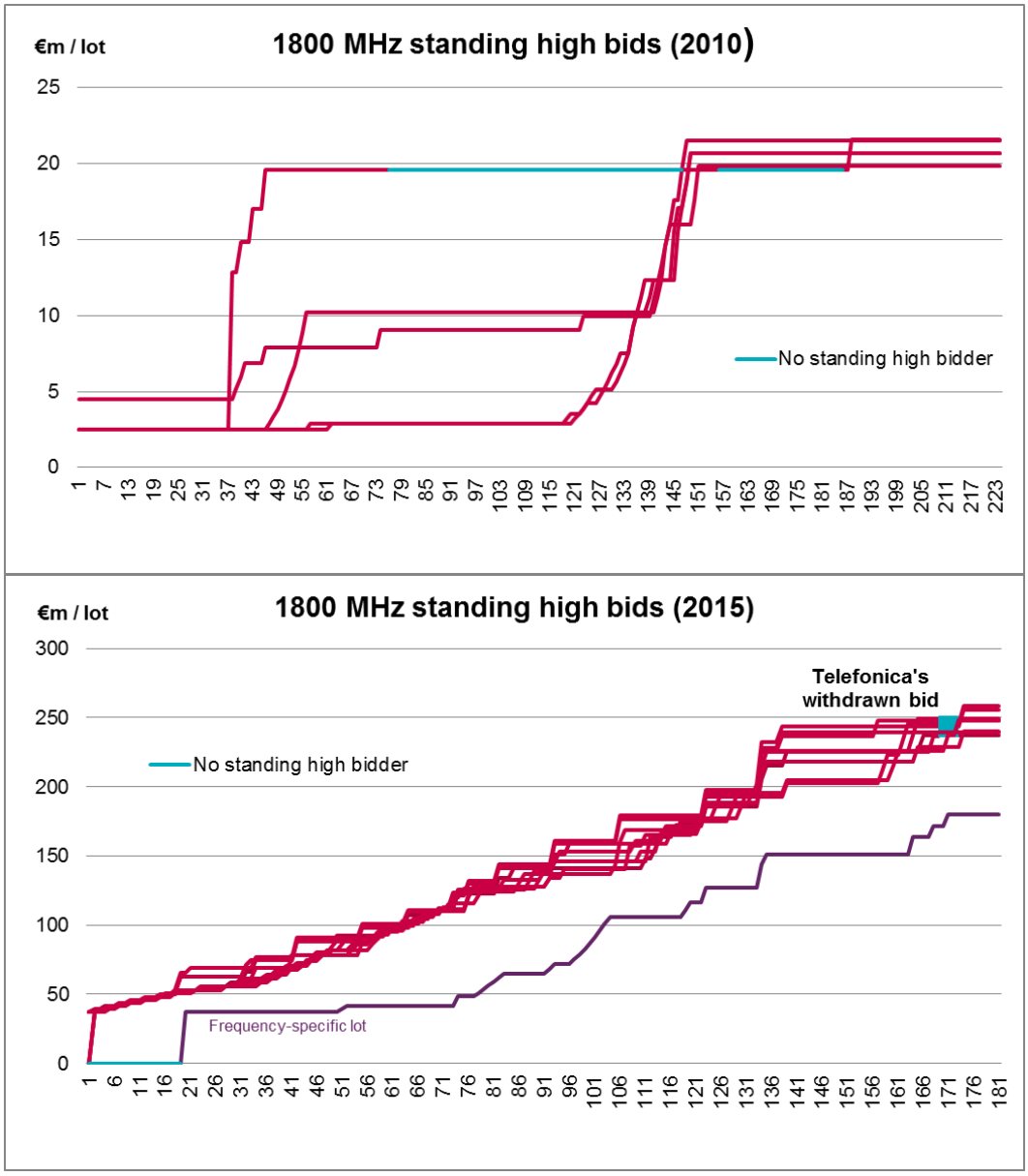
A8.454 We consider that there are important differences between bidding activity in 1800 MHz in 2010 compared to the 2015 auction. Figure A8.5.6 below compares the progression of bidding for each auction:

a) The 2010 auction: As discussed in our February 2015 consultation (and repeated in this Annex for in the section on Germany 2010), existing spectrum holdings created obvious winners for each lot. The initial allocation (that was consistent with these obvious winners) persisted for the first 37 rounds. Subsequently, there were long periods in the auction when no operators bid for 1800 MHz. Moreover, for lots D and E there was a long period with no standing high bidder following the withdrawal of bids by E-Plus and Telefónica.

b) The 2015 auction: There was sustained bidding for all the generic lots from the second round of the auction. There was only one round where no 1800 MHz lots attracted bids (Round 84) until Round 124 of the auction. Bidding continued until Round 172 of the auction. Lot prices were much more closely clustered than in 2010; the difference between the minimum and maximum standing high bids in each round was, on average, 14.7% of the average standing high bid for each round, compared with an average of 100% for the 2010 auction. Telefónica's withdrawal of a bid on lot F in Round 173 was the first such withdrawal.

A8.455 In our February 2015 consultation we said that the 2010 1800 MHz price, and therefore relative values, are more likely to reflect strategic bidding than to reflect intrinsic valuations of spectrum in Germany. This was based on a consideration of all the bidding features summarised above. Many of these features are absent in the 2015 auction. Given these differences, we do not consider that it would be inconsistent if we were to reach different conclusions as to the likelihood that prices reflect strategic or intrinsic value bidding.

Figure A8.5.6: Bidding activity in 1800 MHz in the auctions in 2010 and 2015



Risks of overstatement

A8.456 BT noted that only 2x50 MHz of 1800 MHz spectrum was auctioned in 2015. However, the other 2x25 MHz was acquired by the mobile operators in 2010, and we expect that operators' bids for 1800 MHz in 2015 would have reflected their existing holdings acquired in 2010. We also consider that 2x50 MHz is a substantial quantity of mobile spectrum. As a result, we do not consider that the amount of spectrum available in the 2015 auction provides a reason why prices overstate market value.

A8.457 Regarding stakeholders' views that operators' bids for 1800 MHz incorporated strategic values (reported at paragraph A8.399 b-c):

a) BT's comments could be interpreted as suggesting that some operators (such as Vodafone) acquired additional spectrum above and beyond their intrinsic demand, in order to disrupt frequency-specific equipment investments. In our view, for operators to have such an incentive, there would need to have been a

sufficient payoff in the form of weaker post-auction competition. We consider this would have been uncertain and it is unlikely that such investments would have raised rivals' costs to such an extent that it would have a material effect on competition in the post-auction mobile market; and

b) As regards [✂] argument, it is not obvious that the intrinsic value to Vodafone of the fifth 1800 MHz lot it acquired would have been less than its value to Telefónica, or that Vodafone could have expected to gain a significant strategic advantage from preventing Telefonica from acquiring this lot. For example, we note that, by acquiring a fifth 1800 MHz lot, Vodafone expanded its share of total paired spectrum holdings in the 1800 MHz, 2.1 GHz and 2.6 GHz bands[148] to 29% (from 27%).[149] Again, we consider that, to have an incentive to bid in excess of its intrinsic value, Vodafone would have needed to derive sufficient "broader strategic value" from this additional share of capacity spectrum. It is not clear to us that such strategic value would arise from this relatively small difference in spectrum holdings.

A8.458 Deutsche Telekom noted BNetzA's intention to investigate the need for possible action in respect of post-merger spectrum holdings, following the 2015 auction, and suggested that this uncertainty led Telefónica to bid for more 1800 MHz than it otherwise would have needed. BNetzA set out this intention in its July 2014 decision regarding frequency regulation aspects of the merger between Telefónica and E-Plus.[150] In relation to paired 2.1 GHz spectrum, it said that:

a) The merger would leave the merged company with more than half of the paired 2.1 GHz spectrum. However, for reasons outlined in its decision, BNetzA did not currently see any discrimination problem as a result of the merged company's larger spectrum holding at 2.1 GHz and said there is "no sufficient factual basis for a decision about the ordering of measures in this frequency band".[151]

b) It will investigate the need for action in particular at 2.1 GHz in light of operators' post-auction spectrum holdings. BNetzA said that, as the 2.1 GHz band is comparable to the 1800 MHz band in respect of its propagation characteristics and the services offered, the two bands should be looked at together as regards the provision of broadband services.

A8.459 Given BNetzA's focus on total 1800 MHz and 2.1 GHz holdings as the relevant consideration, it is unclear to us how Telefónica could expect to manage the risk of forgoing 2.1 GHz spectrum by acquiring more 1800 MHz spectrum, as this would increase its total post-auction holdings of both bands and presumably increase the likelihood of regulatory intervention.

A8.460 We also note Telefónica's comment that Deutsche Telekom's view of Telefónica Deutschland's business case for bidding on 1800 MHz spectrum was not shared by

[148] [✂]
[149] The equivalent expansion in share of total holdings (in MHz terms) would be to 30%, rather than 28%, if unpaired 2.1 GHz and 2.6 GHz spectrum is included in the total.
[150] Paragraphs 290-303, BNetzA, Decision on frequency regulation aspects of the proposed merger between Telefónica Deutschland Holding AG and E-Plus Mobilfunk GmbH & Co. KG, July 2014, http://www.bundesnetzagentur.de/SharedDocs/Downloads/EN/BNetzA/Areas/Telecommunications/TelecomRegulation/FrequencyManagement/ElectronicCommunicationsServices/Merger_Decision.pdf?__blob=publicationFile&v=3
[151] Paragraph 291, BNetzA decision

Telefónica Deutschland. It said that Telefónica Deutschland's bids for 1800 MHz were based solely on intrinsic value.[152]

A8.461 In our view, the evidence discussed above does not support Deutsche Telekom's suggestion of overbidding in the 1800 MHz band by Telefónica.

Summary for 1800 MHz

A8.462 On balance, we consider that there is stronger evidence for the possibility of strategic demand reduction than there is for the possibility that operators bid in excess of intrinsic values. As a result, we consider that the 1800 MHz price is more likely to understate than overstate market value in Germany.

800 MHz and 2.6 GHz in the 2010 auction

A8.463 AM&A suggested that we had considered in the February 2015 consultation that there was evidence of strategic bidding in the Germany 2010 auction for 800 MHz and 2.6 GHz (with which the 2015 auction prices are combined to derive relative value benchmarks for Germany 2015). In the February 2015 consultation, we considered that the *1800 MHz* price from the 2010 auction was more likely to reflect strategic bidding than intrinsic valuations of spectrum and this affected our choice of tier for the 1800 MHz relative value benchmark for Germany 2010. However, we did not say that all 2010 German auction prices were influenced by strategic bidding. In fact, we considered that the 800 MHz price was likely to reflect market value (noting Cramton and Ockenfels' view that "there was fierce price competition as operators failed to coordinate a strategy of demand reduction") – see paragraphs A8.313-A8.314.

A8.464 For the 2.6 GHz band, we said that similar prices for paired and unpaired spectrum might be evidence of 'parking strategies' and that, if so, it might mean that prices were not driven by genuine demand for incremental spectrum. We recognise that this means prices might not reflect intrinsic values for 2.6 GHz spectrum. However, we note that the Germany 2015 benchmark for 1800 MHz is not highly sensitive to changes in the 2010 2.6 GHz price. The benchmark using the 2.6 GHz price in 2010 is £15.1m. To illustrate the sensitivity to changes in the 2.6 GHz price, we can compare this benchmark to the value we would obtain with alternative figures for 2.6 GHz. For example, for Ireland and Sweden we use a proxy 2.6 GHz price - using our 2.6 GHz proxy methodology for Germany, the benchmark value would be £1.3m / MHz lower at £13.7m / MHz (see Figure A7.3 and Table A7.9). We do not consider that a lower benchmark for Germany 2015 at such a level would lead us to reach a different conclusion on lump-sum value for 1800 MHz in Section 5 (e.g. it would only have a marginal effect on the Tier 1 average or midpoint between average and lowest benchmark).

Likelihood of reflecting UK market value

Timing of award

A8.465 We have not previously downgraded benchmarks automatically on the basis of a time gap between auctions. Rather, we assess whether a time gap between auction dates provides a clear, evidence-based reason for considering that the outcome is less informative of forward-looking relative spectrum values in the UK, having

[152] Telefónica response to the Deutsche Telekom letter, p. 1.

regard to expectations or developments which might have changed during that period.

A8.466 BT proposed two areas in which it claimed there had been "material changes" between 2010 and 2015: market concentration and data traffic. We consider that:

a) As explained in paragraph 2.22 (and accompanying footnote), we do not have reliable evidence on how operators' spectrum valuations would be affected by changes in market structure. To the extent that the change in market structure has lowered competition for spectrum in the auction, we have considered this as part of our assessment of the possibility of signalling and strategic demand reduction; and

b) As BT noted, mobile data traffic has also grown significantly in the UK as well as in Germany. We recognise that there is a longer time period between the 2010 and 2015 German auctions than there is between the UK 4G auction and the present day. But it is not clear how expectations of growth in mobile data traffic changed in the period between the German and UK auctions of 800 MHz and 2.6 GHz in 2010 and 2013 respectively. On balance, we do not consider that the potential for changes in expectations about mobile data traffic growth provides a clear, evidence-based reason for the Germany 2015 benchmarks to be less informative of forward-looking relative spectrum values in the UK.

A8.467 In response to Vodafone's comments about "timing errors", as discussed above, we disagree that the magnitude or importance of any such "timing errors" can be assessed purely by considering the number of months or years between auction dates. We base our assessment on a consideration of possible expectations or developments which might have changed during that period (such as the availability of 700 MHz, discussed below). We note that, in some cases, these developments might potentially improve the quality of the benchmark if they reflect changes which have similarly occurred in the UK, and, as a result, we assess each relevant development on a case-by-case basis.

Availability of 700 MHz

A8.468 BT suggested that the availability of the 700 MHz band in the 2015 auction might reduce the market value of 900 MHz, relative to the UK. In assessing this possibility, we consider the following issues:

a) The extent to which expectations about the availability of 700 MHz spectrum for mobile differed between the 2010 and 2015 auctions in Germany;

b) The extent to which expectations about the availability of 700 MHz spectrum for mobile differ between the 2013 4G auction and the present day in the UK; and

c) The impact on ALF spectrum values of changing expectations about the availability of 700 MHz spectrum.

A8.469 In relation to **expectations** about the availability of 700 MHz spectrum in **Germany**:

a) There is clearly no doubt that operators' bids for 900 MHz in the 2015 auction reflected certainty over the availability of 700 MHz spectrum, as it was available in the same auction. BNetzA intends to make 700 MHz acquired in this auction

available for mobile communications from 2017 and, where possible, for nationwide mobile broadband from mid-2018.[153]

b) As regards the extent to which 700 MHz release for mobile was anticipated at the time of the May 2010 auction, we set out in paragraphs A7.173-A7.174 of Annex 7 that the February 2012 World Radio Conference might have caused a substantial change in expectations about the availability of the 700 MHz band. We note that:

i) There is no mention of the potential for the 700 MHz band to be released for mobile in BNetzA's 2010 auction statement.

ii) In 2011 (i.e. a year after the May 2010 auction), the German Monopolies Commission (the Monopolkommission) published a Special Report (61) on strengthening investment incentives and securing competition in telecoms, in which it recommended a second Digital Dividend. The Commission said that "*in the long term it would seem necessary, given the anticipated growth in the volume of mobile data, to provide further spectrum for mobile communications below 1 GHz by 2018 / 2020 at the latest….by making further spectrum below 790MHz, previously used for terrestrial broadcasting, available for mobile communications".* [154] However, it did not identify a specific frequency band for possible release for mobile.

iii) In June 2013, BNetzA proposed awarding 700 MHz spectrum early to coincide with the same award of re-licensed 900 MHz and 1800 MHz frequencies. BNetzA also indicated that the merger between Telefónica and E-Plus (which was not announced until 2013) sped up the timeline of this award, as it wanted to give competitors the opportunity to respond to the change in market structure.[155]

iv) A national consensus between the German government and federal states on using 700 MHz for mobile broadband was reached in December 2014. [156]

A8.470 Overall, considering the apparent change in expectations and timeframes brought about in particular by WRC-2012, but also by BNetzA in response to domestic considerations, we consider that there is evidence of a substantial change in expectations about the availability of the 700 MHz band in Germany, between the 2010 auction of 800 MHz and the 2015 auction of 900 MHz.

A8.471 We assess **expectations** about the availability of 700 MHz spectrum in the **UK** in detail in Annex 9. We consider that when the price of 800 MHz was set in the 2013 4G auction, the 700 MHz band was recognised as likely to become available for mobile use. As explained in paragraph A9.27, we also note that work on the release of the 700 MHz band has continued to progress since the 4G auction and these developments will tend to reduce uncertainty about its future availability. Therefore, in our view, any change in expectations between the 4G auction and today is much less substantial than in Germany between the 2010 and 2015 auctions.

[153] Page 2, BNetzA auction statement, January 2015, http://www.bundesnetzagentur.de/SharedDocs/Downloads/EN/BNetzA/Areas/Telecommunications/TelecomRegulation/FrequencyManagement/ElectronicCommunicationsServices/DecisionP2016_pdf.pdf?__blob=publicationFile&v=3
[154] Page 24, BNetzA auction statement.
[155] Page 2, BNetzA auction statement.
[156] Page 2, BNetzA auction statement.

A8.472 In relation to the **impact** on spectrum values of a substantial change in expectations about 700 MHz availability between the 2010 and 2015 auctions in Germany, we note that:

a) This constitutes a 46% increase in the supply of sub-1 GHz spectrum. [157]

b) The (per MHz) price for 700 MHz in the 2015 German auction was 87% of 900 MHz and 67% of 1800 MHz. While the price of 900 MHz and 1800 MHz could understate market value, we also consider that there was a possibility of strategic demand reduction in the 700 MHz band, as explained in paragraph A8.423 (a). This suggests that 700 MHz prices could also understate market value.

A8.473 Taking into account the material increase in overall quantity of sub-1 GHz spectrum, and the similarity in the price paid by operators for 700 MHz (as for 900 MHz), we consider that the change in expectations in Germany about the availability of 700 MHz spectrum is likely to have affected the forward looking value of other sub-1 GHz (800 MHz and 900 MHz) spectrum in Germany, e.g. through providing spectrum that is to a significant degree a substitute. The potential impact on the market value of 800 MHz and 900 MHz spectrum might therefore be substantial.

A8.474 This impact in Germany might be larger than in the UK because (a) 800 MHz spectrum was auctioned in Germany before WRC-12, whereas in the UK it was auctioned after WRC-12, and (b) the prospect of earlier availability of the 700 MHz band in Germany than the UK could have implications for the value of 900 MHz. On the latter point, in Germany the 700 MHz band is intended to be available from 2017 and nationwide from mid-2018, compared to our view in the 700 MHz statement of availability in the UK by the start of 2022 and sooner if possible (see paragraph A9.8 (a)).

A8.475 We consider that the potential impact on the market value of 1800 MHz might be less pronounced than for 900 MHz, because 700 MHz might be a less close substitute for higher frequency spectrum than for other sub-1 GHz spectrum.

Implications

A8.476 Based on our assessment of both expectations about 700 MHz availability, and the impact on other spectrum values, we consider that:

a) Other things equal, the value of 900 MHz in the 2015 award (and to a lesser extent 1800 MHz) may be understated relative to the UK, where 700 MHz may not be available until a later date.

b) The value of 800 MHz in the 2010 auction is likely to be overstated relative to the UK value of 800 MHz in 2013, because of the lesser expectation in 2010 of 700 MHz availability for mobile.

A8.477 We consider that the evidence of changing expectations of 700 MHz availability for mobile provides a reason why the Germany 2015 benchmark for 900 MHz (which combines the 2015 price of 900 MHz with the 2010 price of 800 MHz) might substantially understate the forward-looking UK market value of 900 MHz.

[157] An additional 2x30 MHz on an existing 2x65 MHz across the 800 MHz and 900 MHz bands

A8.478 We consider that this is also a possibility for the 1800 MHz benchmark (which combines the 2015 price of 1800 MHz with the 2010 prices of 800 MHz and 2.6 GHz), although this is likely to be to a lesser extent because the impact on the 1800 MHz price is smaller (as discussed in paragraph A8.475 above).

1800 MHz / 900 MHz ratio

A8.479 We note that the German 1800 MHz / 900 MHz ratio is the only such ratio in our dataset which exceeds 100%. BT, EE and AM&A suggested that this in itself provided evidence of strategic bidding, although Telefónica and Vodafone argued it was consistent with 900 MHz not being a core band for LTE.

A8.480 As indicated in our assessment above, we have identified stronger reasons to believe that the price of 900 MHz understates market value than we have for 1800 MHz:

a) The impact of the 900 MHz cap is confined to the 900 MHz band; and

b) The impact of changes in expectation about 700 MHz availability might be greater for 900 MHz than for 1800 MHz.

A8.481 The 1800 MHz / 900 MHz ratio is consistent with our interpretation of the two bands, having regard to relative risks of understatement or overstatement (although we do not rule out other possible explanations of the ratio).

A8.482 We have reflected these risks in our interpretation of the 900 MHz and 1800 MHz benchmarks, and take account of these risks in our assessment of lump-sum values for each band. We do not consider that we should downgrade either benchmark on the basis that the observed 1800 MHz / 900 MHz ratio is out of line with other countries.

A8.483 We note that the implication of our assessment of relative risks of overstatement and understatement (i.e. stronger reasons for 900 MHz than for 1800 MHz to believe that the auction price understates market value) is that the 1800 MHz / 900 MHz ratio carries a risk of overstatement, though we cannot be sure of the likelihood or scale of this overstatement.

A8.484 EE and AM&A suggested that in our October 2013 consultation we had downgraded the importance of the Denmark 1800 MHz price on the basis of an unexpected relativity to another band (2.6 GHz) and argued we should adopt a similar approach as regards the relativity of 900 MHz to 1800 MHz in Germany. In relation to 1800 MHz information from Denmark, we noted in our October 2013 consultation that 1800 MHz spectrum sold at a UK-equivalent price which was lower than 2.6 GHz. We also noted that 900 MHz spectrum sold at a very low price and said that “neither of these outcomes is surprising given that the three largest operators were not allowed to bid”.[158] On this basis, we concluded that both 900 MHz and 1800 MHz prices provided less important evidence. Our assessment was therefore based on the exclusion from the auction of the three largest operators, not relative band prices on their own. Similar circumstances of incumbents being excluded did not apply in the Germany 2015 auction.

[158] Page 90, Ofcom, First consultation on Annual Licence Fees for 900 MHz and 1800 MHz spectrum, October 2013, http://stakeholders.ofcom.org.uk/binaries/consultations/900-1800-mhz-fees/summary/900-1800-fees.pdf

A8.485 [✂]

Relative benchmarks

A8.486 By combining values of 900 MHz and 1800 MHz from the 2015 auction with values of 800 MHz and 2.6 GHz from the 2010 auction, we have sufficient information from the German auctions to calculate a 900 MHz / 800 MHz paired ratio and a distance method 1800 MHz benchmark.

Assessment of risk

A8.487 For the 900 MHz benchmark, we consider that:

a) It is possible that the combination of the 900 MHz spectrum cap and the need of some operators to use 900 MHz spectrum for GSM may have prevented bidders from expressing their full range of valuations for additional 900 MHz spectrum for use in providing LTE services. This could lead prices to understate market value, although we cannot be sure of the scale of this effect.

b) There is evidence that the price of 900 MHz spectrum in the 2015 auction might have been affected by strategic demand reduction. This could lead prices to understate market value, although we cannot be sure of the scale of the effect.

c) There is evidence of a substantial change in expectations about the availability of the 700 MHz band between the 2010 auction of 800 MHz and the 2015 auction of 900 MHz (which is quite different from the possible change in expectations relevant to the UK, between the 2013 4G auction and today). This provides a reason why market value in Germany might substantially understate forward-looking UK market value.

A8.488 Taking these points into account, we conclude that the 900 MHz benchmark is at **larger** risk of **larger** understatement of market value in the UK.

A8.489 For the 1800 MHz benchmark, there is no corresponding risk of understatement arising from a spectrum cap. However, as for 900 MHz, there is also evidence that the price of 1800 MHz spectrum in the 2015 auction might have been affected by strategic demand reduction, although we cannot be sure of the scale of the effect. We also consider that the evidence of a substantial change in expectations about the availability of the 700 MHz between the 2010 and 2015 auctions provides a reason why market value in Germany might understate forward-looking UK market value, although the scale of this effect is likely to be smaller for 1800 MHz than for 900 MHz. Taking these points into account, we conclude that the 1800 MHz benchmark is at **larger** risk of understatement, but we consider that we cannot be sure of the scale of any understatement.

Tiering

A8.490 Considering the criteria for inclusion in Tier 1:

a) The auction prices in all bands were significantly above reserve, and as such appear likely to have been primarily determined by a market-driven process of bidding.

b) As there is evidence that the price of 900 MHz and 1800 MHz spectrum in the 2015 auction might have been affected by strategic demand reduction, this could

indicate that the second criterion for inclusion in Tier 1 is not met. However, we note that we cannot be sure of the scale of any such effect on relative prices.

c) The evidence of a substantial change in expectations about the availability of 700 MHz for mobile between the 2010 auction of 800 MHz and the 2015 auction of 900 MHz might be a reason for considering that relative values in Germany are less informative of forward-looking relative spectrum values in the UK, particularly for 900 MHz.

A8.491 We recognise that there are possible reasons why the 900 MHz and 1800 MHz benchmarks might not meet both the second and third criteria for inclusion in Tier 1. We have considered in Section 3 whether such evidence is sufficient for us to classify these benchmarks in Tier 2, or whether they should be included in Tier 1. Our conclusion is to include the benchmark in Tier 1, for the reasons set out in paragraphs 3.63 to 3.67 and 3.75 to 3.76.

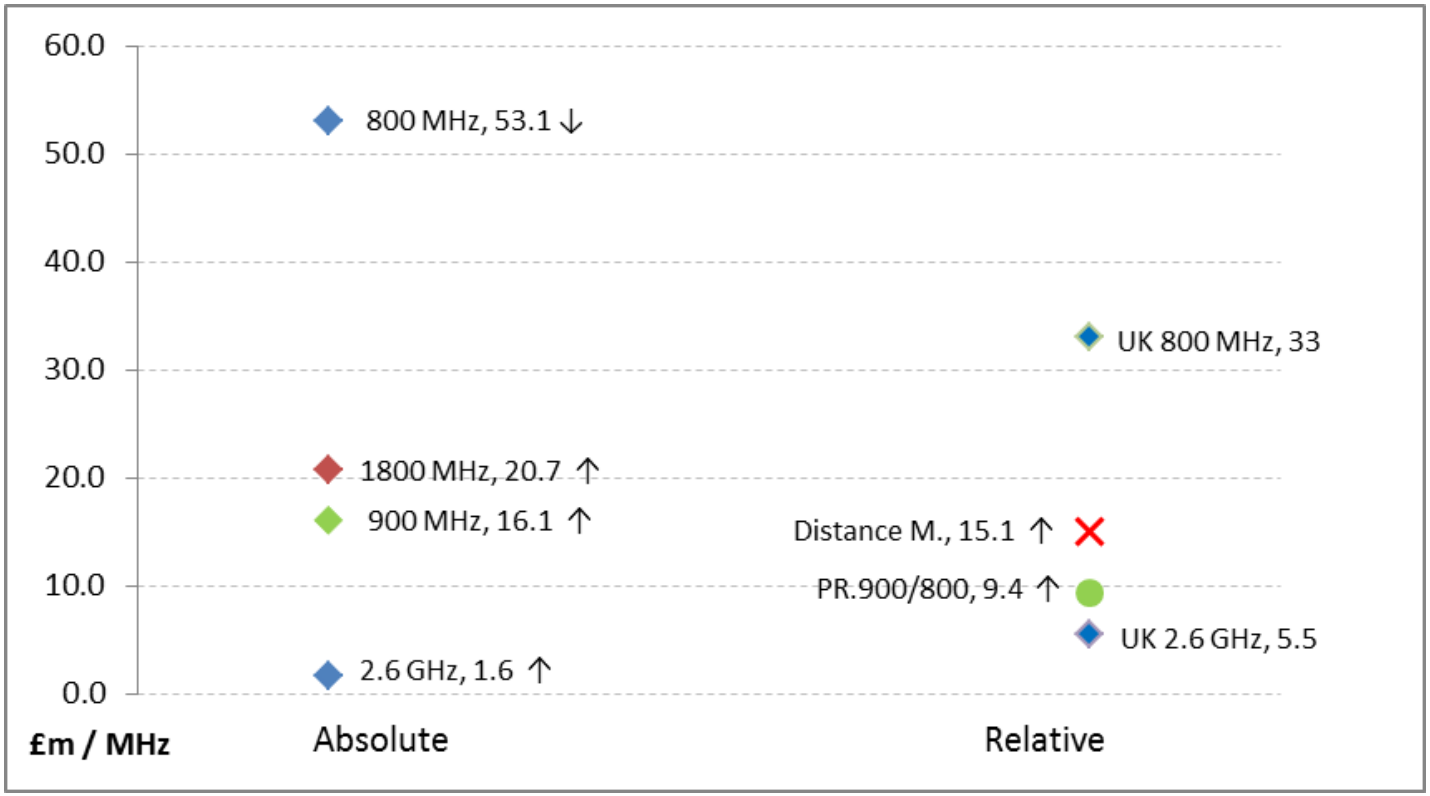
A8.492 The following table summarises the available benchmarks (along with our interpretation of them) from the German award. We note that the 1800 MHz / 2.6 GHz ratio is based on a value at larger risk of understatement, which is divided by a value at risk of understatement (and, because it is the denominator in the ratio, on its own implies a risk of overstatement in the ratio). In such cases we would typically expect the ratio to be at larger risk of understatement overall, given the *larger* risk of understatement in the 1800 MHz value. However, in paragraph A8.452 we noted that there are possible reasons why the scale of understatement of 1800 MHz could be smaller, and on balance we consider that this ratio has a risk of understatement or overstatement.

Table A8.5.4: Summary of evidence points from Germany (2015)

	Absolute values (£m / MHz)				Relative value benchmarks[1] (£m / MHz)		Ratios (%)			
	800 MHz	900 MHz	1800 MHz	2.6 GHz	900 MHz / 800 MHz	Distance method	1800 MHz / 800 MHz	1800 MHz / 2.6 GHz	1800 MHz / 900 MHz	2.6 GHz / 800 MHz
Values	53.1	16.1	20.7	1.6	**9.4** **(29%)**	**15.1** **(35%)**	37%	1581%	129%	3%
Tier					**First**	**First**				
Assessment of risk	Larger risk of larger over-statement	Larger risk of under-statement	Larger risk of under-statement	Risk of under-statement	**Larger risk of larger under-statement**	**Larger risk of under-statement**	Larger risk of larger under-statement	Risk of under or over-statement	Risk of over-statement	Larger risk of larger under-statement

1 Based on the UK 800 MHz value without coverage obligation and gross of expected DTT co-existence costs.

Figure A8.5.8: Summary of evidence points from Germany (2015)



◆= 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.[159]

Table A8.6.1: November 2011 multiband auction results

	900 MHz	1800 MHz	Price Paid[160]
Total Available	2x35	2x20	-
Cosmote	2x10	2x10	€118.8m
Vodafone	2x15	2x10	€168.5m
Wind Hellas	2x10	-	€93.2m
Unsold	-	-	-
Reserve price for the band	€298.2m	€82.0m	-
Total auction revenue	€298.3m	€82.3m	-
% mark-up	0.03%	0.3%	-

Note: The allocations and total prices paid include the 900 MHz lots that were pre-assigned to operators at reserve price.

Table A8.6.2 November 2011 multiband auction design

	Description	Implications
Number of bidders; number of lots; lot sizes	3 bidders and 3 winners.[161] 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.[162]	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.	

October 2014 multiband auction

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

Description: Award of the 800 MHz and 2.6 GHz bands.

Context: EETT used a mixed system of granting of rights. In the first stage the participants have the right to apply for one 2x5 MHz lot of the 800 MHz band at the reserve price. The second stage is based on multiple rounds of ascending prices with simultaneous separate bids for spectrum rights.

Table A8.6.3 October 2014 multiband auction results

	800	2.6 FDD	2.6 TDD	Total price (Euro millions)
Total available	2x30	2x70	40	381.1
Cosmote	2x10	2x30	20	134.8
Vodafone	2x10	2x20	20	124.5
Wind	2x10	2x20		121.8
Unsold	-	-	-	-
Reserve price for the band	€309.0m	€65.8m	€5.2m	-
Total auction revenue	€309.1m	€65.8m	€6.2m	-
% mark-up	0.04%	0.04%	19%	-

Note: The allocations and total prices paid include the 800 MHz lot that was pre-assigned to each operator at reserve price.

Source: EETT press release of 13 October 2014, *Greek telecoms regulator raises 381.1 million euros in mobile spectrum auction*, available at: http://www.eett.gr/opencms/opencms/admin_EN/News/news_0315.html

Table A8.6.4 October 2014 multiband auction design

	Description	Implications
Number of bidders; number of lots; lot sizes	3 bidders and 3 winners. 800 MHz: 3 of the 6 lots of 2x5 MHz were available for bidding, since the three bidders had previously exercised the right to request one lot each at reserve price. 2.6 GHz: 14 blocks of 2x5 MHz (FDD) and four 10 MHz blocks (TDD).	The number of 800 MHz lots equalled the number of bidders.
Spectrum caps / Restrictions	2x15 MHz at 800 MHz, 70 MHz in total at 2.6 GHz. Coverage obligation on all holders of 800 MHz to cover at least 95% of the population of Greece within five years. Obligation on all holders of 800 MHz to protect DTT reception, either directly or via a third party set out jointly.	The 2.6 GHz cap was binding on Cosmnote[163]
Unsold spectrum?	No	N/A
Reserve prices	In the 800 MHz and 2.6 GHz paired spectrum bands, some lots sold at reserve prices and some lots marginally above reserve.	

Source: EETT, Executive summary of the tender process of the 800 and 2600 MHz spectrum bands in Greece, available at: http://www.eett.gr/opencms/export/sites/default/admin/downloads/Licencing/800_2600/DDTP_Exec_Summary.pdf

Our position in the October 2013 consultation

A8.493 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 to the October 2013 consultation

Whether award outcomes are likely to reflect market value

900 MHz

A8.494 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.

A8.495 Telefónica (pages 64-65) considered it more plausible that the reserve price for 900 MHz spectrum was set above market value. It argued that:

[163] We note the discrepancy between the press-release about the auction outcome (which stated that Cosmote won "eight (six 2x5 MHz and two 10 MHz) segments in the 2600 MHz band", for a total of 80 MHz) and the executive summary of the tender process (which states that "bidder cannot bid for more than […] more than 70 MHz in total in 2600 MHz band.")

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

A8.496 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.

A8.497 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

A8.498 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.

A8.499 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 in the August 2014 consultation

Whether award outcomes are likely to reflect market value

900 MHz

A8.500 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 was possible that Vodafone would have competed for additional lots of spectrum, pushing prices above reserve.

A8.501 As regards Telefónica's comments we did 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 recognised that operators may have needed 900 MHz spectrum for business continuity purposes.

A8.502 However, we also considered 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.

A8.503 On balance, we considered that the price of 900 MHz might either overstate or understate market value in Greece. The likelihood and scale of this risk was unknown.

1800 MHz

A8.504 All 1800 MHz spectrum sold at reserve price. On its own this could suggest that the reserve price overstates market value. However, we also noted that the 1800 MHz spectrum cap was binding on Cosmote. In the absence of this cap it was possible that Cosmote would have competed for additional lots of spectrum, pushing prices above reserve.

A8.505 Telefónica suggested 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.

A8.506 On balance, we considered that the price of 1800 MHz might overstate or understate market value in Greece. The likelihood and scale of this risk was unknown.

Likelihood of reflecting UK market value

A8.507 As discussed in paragraphs A7.62 to A7.74 of the August 2014 consultation, we did 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 did not provide strong grounds for considering either such relationship to exist. In our assessment of the Greek benchmarks, we did 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.

A8.508 In paragraphs A7.75-A7.78 of the August 2014 consultation, we also considered 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%), we said this created 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.

A8.509 We also considered the timing of the Greek award relative to the UK. In paragraphs A7.83-A7.84 of the August 2014 consultation, we said 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 considered that there was 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.

A8.510 We noted that 800 MHz and 2.6 GHz spectrum was not available in Greece for use as a mobile band. We considered 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.

A8.511 It was 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 had committed to making this band available for mobile services and so operators would have legitimately anticipated 800 MHz becoming available at some point in the future. Having said this, the digital switchover had not been completed 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.[164]

A8.512 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 was that the market value of 900 MHz in Greece carried a larger risk of an unknown overstatement of the UK 900 MHz market value. We also considered that there was a possibility that the unavailability of 2.6 GHz spectrum meant the market value of 1800 MHz was overstated relative to UK 1800 MHz market value.

Relative benchmarks

A8.513 We could not 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 was necessary to use a proxy for 800 MHz (e.g. the price for 900 MHz spectrum) and 2.6 GHz (e.g. zero). We considered that the uncertainty created by the need to choose a proxy for both bands made 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 could have been produced for Greece. We therefore did not include this benchmark as part of our derivation of a lump-sum value for 1800 MHz. Instead, we used the absolute values of 900 MHz and 1800 MHz as part of our cross-checks on our lump-sum values. We also use the 900/1800 MHz ratio for Greece as an additional cross-check.

A8.514 In interpreting the available evidence points, we considered that the price of 900 MHz and 1800 MHz could understate or overstate market value in Greece. For 900 MHz, there was also a risk that the market value in Greece overstated the UK market value, while for 1800 MHz there was a risk that the market value could understate or overstate UK market value

Stakeholder responses to the August 2014 consultation

A8.515 We received no comments from stakeholders relating to our assessment, or to our proposal not to derive benchmarks for the Greek auction.

Our assessment in the February 2015 consultation

Whether award outcomes are likely to reflect market value

900 MHz and 1800 MHz

A8.516 We said we had no reasons to change our assessment in the August 2014 consultation that the price of 900 MHz and 1800 MHz might either overstate or understate market value in Greece, but we cannot be sure of the scale and likelihood of such risk.

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

800 MHz

A8.517 800 MHz sold at, or very slightly above, reserve price. Operators were not prevented by caps from competing for more 800 MHz spectrum than they acquired. We said one possibility is that bids in the auction fully reflected demand, and that the reserve price was set above the incremental value to the marginal bidder. Another possibility was that operators engaged in co-ordinated strategic demand reduction with a focal point in which each won 2x10 MHz in total, rather than driving up prices by trying to acquire more spectrum.

A8.518 On balance, we considered there is a risk of 800 MHz prices understating or overstating market value in Greece, but we cannot be sure of the likelihood and scale of possible overstatement.

2.6 GHz

A8.519 Some lots in the 2.6 GHz band sold fractionally above reserve price while others sold at reserve price. As with 800 MHz it is possible that the reserve price was set above market value or there was co-ordinated strategic demand reduction.

A8.520 On balance, we considered there is a risk of 2.6 GHz prices understating or overstating market value in Greece, but we cannot be sure of the likelihood or scale.

Likelihood of reflecting UK market value

A8.521 As discussed above, in August 2014 we considered there were reasons why the Greece auction price might overstate the value of 900 MHz in the UK, namely the lower level of urbanisation in Greece than the UK, and the fact that 800 MHz was not available to mobile operators.

A8.522 We discussed above that the actual auction price for 900 MHz is unlikely to be reflective of market value in Greece. As discussed in paragraph A7.163, we also considered that the timing of the Greek award means that the 900 MHz value observed in Greece risks understating the forward-looking market value of 900 MHz spectrum in the UK, although we said we cannot be sure of the scale or likelihood of this risk.

A8.523 On balance, we considered that the market value of 900 MHz in Greece risks understating or overstating forward-looking UK market value, though we cannot be sure of the likelihood and scale of potential understatement or overstatement.

Relative benchmarks

A8.524 There was sufficient price information from the auctions in Greece to calculate a 900 MHz / 800 MHz paired ratio and an 1800 MHz distance method benchmark.

Assessment of risk

A8.525 In interpreting the absolute values of 900 MHz and 800 MHz we considered that both are at risk of being an understatement or overstatement of current UK market value, as described above. Our overall view was that the 900 MHz / 800 MHz paired ratio may understate or overstate UK market value and that we cannot be sure of the likelihood or scale of understatement or overstatement.

A8.526 Turning to the 1800 MHz distance method benchmark, we considered that the 1800 MHz, 800 MHz and 2.6 GHz auction values all carry a risk of understating or overstating market value in Greece as discussed above. We therefore considered that the 1800 MHz distance method benchmark risks understating or overstating UK market value, though we said we cannot be sure of the likelihood and scale of potential understatement or overstatement.

Tiering

A8.527 Considering the 900 MHz and 1800 MHz benchmarks against each of the criteria for inclusion in Tier 1, we said:

a) All spectrum sold at or close to reserve price, so the benchmarks largely reflect the relative value of reserve prices set by the regulator, rather than a market-driven process of bidding.

b) Based on the evidence available to us, the relative prices in the auction are at least as likely to be based on bidders' intrinsic valuations of spectrum as on strategic bidding; and

c) The outcome appears likely to be informative of forward-looking relative spectrum values in the UK, having regard to country-specific circumstances and auction dates.

A8.528 We considered that neither benchmark meets the first of our criteria for Tier 1. We therefore considered the criteria for inclusion in Tier 2.

a) The award does not provide evidence that operators had a stronger demand for some bands than for others at these relative prices, so we did not consider there is evidence that the relative auction prices reflect bidders' relative intrinsic valuations of the bands;

b) The outcome is not obviously uninformative of forward-looking relative spectrum values in the UK having regard to country-specific circumstances and auction dates.

A8.529 We considered that neither benchmark meets the first of our criteria for Tier 2. We therefore considered that both benchmarks should be in Tier 3.

Stakeholder responses to the February 2015 consultation

Likelihood of reflecting market value

A8.530 Frontier (p. 13) disagreed with our view of the development of commercial opportunities for LTE900 over the period covering the auctions included in our benchmarking dataset. They said that it does not provide a justification as to why the price of 900 MHz in the Greek auction might understate the forward looking value of 900 MHz spectrum in the UK, relative to 800 MHz.

Our assessment

A8.531 We have assessed stakeholder responses to our view on LTE900 development in more detail in paragraphs A9.36-A9.78. Based on the assessment outlined in Annex 9, our view remains that LTE900 development creates a risk that the 900

MHz value observed in Greece understates the forward-looking market value of 900 MHz spectrum, although we cannot be sure of the scale or likelihood of this risk.

A8.532 We also note that 900 MHz and 1800 MHz spectrum in Greece was auctioned before WRC-12. As discussed in paragraphs A7.171 to A7.181, we consider that this creates a larger risk that the market value of 900 MHz in Greece at the time of the auction is a larger overstatement of the forward-looking market value of 900 MHz. We also consider that this creates a larger risk that the market value of 1800 MHz in Greece at the time of the auction overstates the forward-looking market value of 1800 MHz, though we cannot be sure of the scale of this overstatement.

A8.533 In interpreting these evidence points, we consider that:

a) The price of 900 MHz could understate or overstate market value in Greece at the time of the auction. However, we now have three reasons why this market value might be overstated relative to forward-looking UK market value: lower levels of urbanisation in Greece, and the lack of availability of both 700 MHz and 800 MHz at the time of the award. There is also a risk (of unknown likelihood and scale) that market value is understated, due to LTE900 developments. However, on balance our view is that the 900 MHz price carries a larger risk of overstating forward-looking UK market value of larger scale.

b) The price of 1800 MHz could understate or overstate market value in Greece at the time of the auction. There is a risk (of smaller scale) that this market value understates forward-looking market value, due to LTE1800 developments, but also a larger risk that it overstates market value due to 700 MHz availability developments. On balance, our view is that the 1800 MHz price carries a larger risk of overstatement, but we cannot be sure of the scale of this overstatement.

c) Our assessments of the 800 MHz and 2.6 GHz bands remain as set out in our February 2015 consultation.

A8.534 Turning to our benchmarks, we now consider that the 900 MHz / 800 MHz carries a larger risk of larger overstatement. This is in line with our interpretation of the 900 MHz price above, and represents a change from our assessment in the February 2015 consultation.

A8.535 We also consider that the distance method benchmark carries a larger risk of overstatement (of unknown scale), as the 1800 MHz price carries a larger risk of overstatement, while the 800 MHz and 2.6 GHz prices are at risk of understatement or overstatement. This also represents a change from our assessment in the February 2015 consultation.

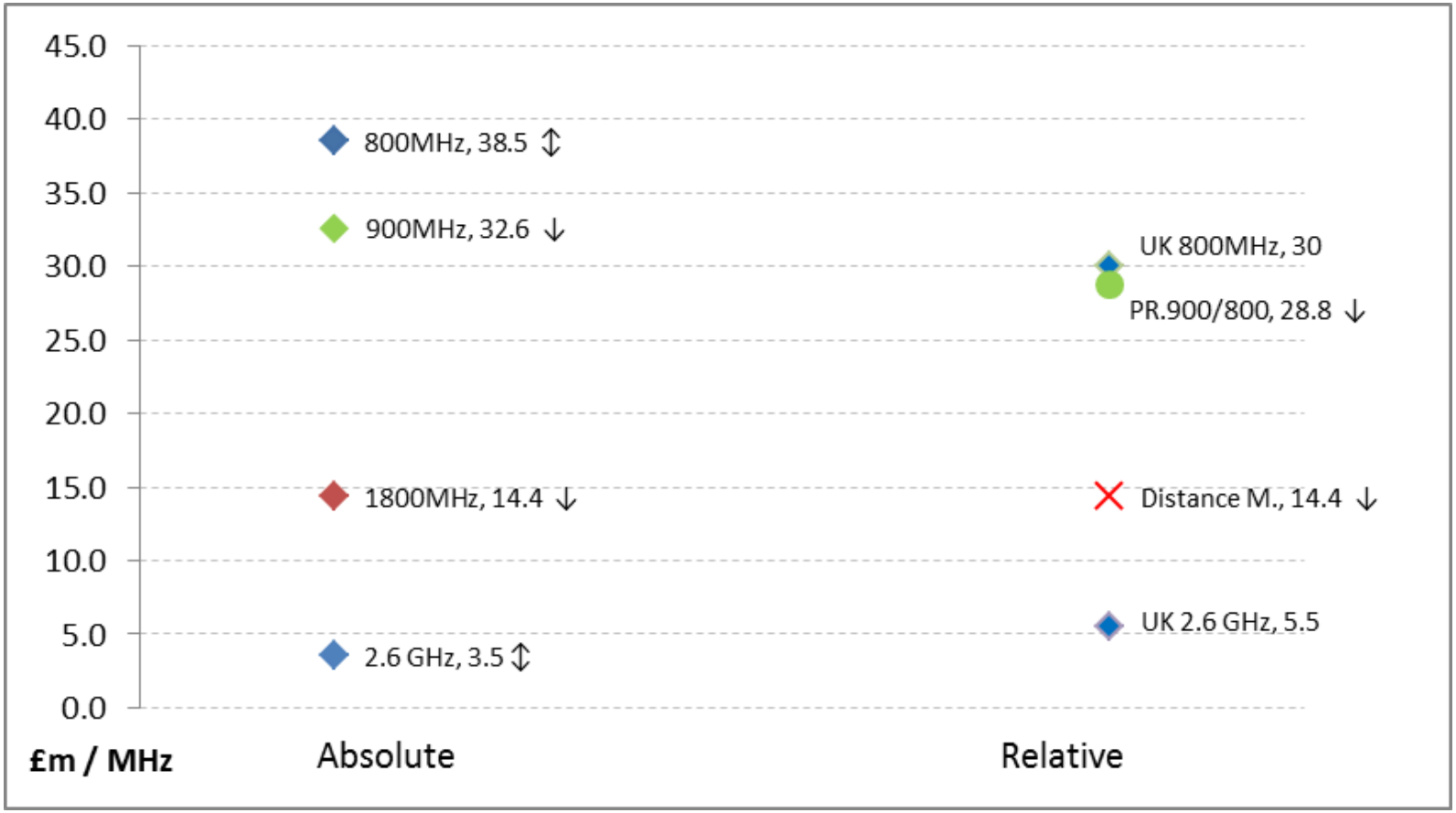
A8.536 The following table summarises the available benchmarks (along with our interpretation of them) from the Greek award.

Table A8.6.5: Summary of evidence points from Greece

	Absolute values (£m / MHz)				Relative value benchmarks[1] (£m / MHz)		Ratios (%)			
	800 MHz	900 MHz	1800 MHz	2.6 GHz	900 MHz / 800 MHz	Distance method	1800 MHz / 800 MHz	1800 MHz / 2.6 GHz	1800 MHz / 900 MHz	2.6 GHz / 800 MHz
Final values	38.5	32.6	14.4	3.5	**28.8** **(96%)**	**14.4** **(37%)**	42%	363%	44%	9%
Tier					**Third**	**Third**				
Assessment of risk	Risk of under or over-statement	Larger risk of larger over-statement	Larger risk of over-statement	Risk of under or over-statement	Larger risk of larger overstatement	Larger risk of over-statement	Larger risk of over-statement	Larger risk of over-statement	Risk of under-statement	Risk of under or over-statement

1 Based on the UK 800 MHz value without coverage obligation and net of expected DTT co-existence costs

Figure A8.6.1: 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.[165] The results presented below, and corresponding prices, cover the second time period only (beyond 2015).[166] Ireland had 4 MNOs at the time of the auction: Meteor Mobile, Vodafone, Telefónica and H3G.[167]

Table A8.7.1 November 2012 multiband auction results

	800 MHz	900 MHz	1800 MHz	Price Paid[168]	Package mark-up
Total Available	2x30	2x35	2x75	-	
Meteor Mobile	2x10	2x10	2x15	€145m	160%
Vodafone	2x10	2x10	2x25	€161m	138%
Telefónica	2x10	2x10	2x15	€125m	125%
H3G	-	2x5	2x20	€51m	71%
Unsold	-	-	-	-	

Table A8.7.2: 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.[169]	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 also a 2x10 MHz spectrum cap for 900 MHz in time slice 1 (up to 2015).[170] There was a total cap of 2x50 MHz for all bands.[171]	The sub 1 GHz cap was binding for 3 of the 4 winners. The overall spectrum cap was not binding for any winner.

[165] 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.
[166] http://www.dotecon.com/news/irelands-telecoms-regulator-publishes-its-decision-on-multi-band-spectrum-auction/
[167] We note that the European Commission has approved under the EU Merger Regulation the proposed acquisition of Telefónica Ireland by H3G.
[168] http://www.comreg.ie/_fileupload/publications/PR15112012.pdf
[169] See page 10: http://www.comreg.ie/_fileupload/publications/ComReg12123.pdf
[170] This information was provided by H3G in its response to the August 2014 consultation, and has since been verified.
[171] See page 10: http://www.comreg.ie/_fileupload/publications/ComReg12123.pdf

Reserve prices	All spectrum sold materially above reserve prices. ComReg determined 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

A8.537 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

A8.538 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 to the October 2013 consultation

Whether award outcomes are likely to reflect market value

Cross-band comments

A8.539 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.

A8.540 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”.

A8.541 Telefónica also considered that the substantial amount of spectrum usage fees further complicates the process of determining a UK benchmark

A8.542 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

A8.543 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.

A8.544 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

A8.545 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

A8.546 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

A8.547 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.

A8.548 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 in the August 2014 consultation

Whether award outcomes are likely to reflect market value

Cross-band comments

A8.549 We said that our estimates make a number of simplifying assumptions,[172] and we recognised 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 did 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.

A8.550 We noted Telefónica's comment about the inaccurate figures reported in the table on page 97 of the October 2013 consultation; and said that Table A8.7.1 above now reports accurate prices paid by Vodafone and Telefónica. We also confirmed that the calculations in the October 2013 consultation used the correct prices paid by Telefónica and Vodafone.

900 MHz

A8.551 In relation to the argument that H3G had the ability to drive up the price of 900 MHz spectrum (because of spectrum caps), we recognised that the 900 MHz band could be more vulnerable to price-driving than newly available bands. However, we said that 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.

A8.552 In the absence of clear supporting evidence, we were unable to reach a firm view as to whether the price-driving behaviour alleged by Telefónica occurred or did not occur.

A8.553 We considered that due to the possibility of price driving there was a risk that the estimated 900 MHz price overstates market value in Ireland, but the likelihood and scale of such risk is unknown.[173]

1800 MHz

A8.554 In relation to Telefónica's suggestion of price driving in the 1800 MHz band, we noted 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. We said it was not clear that H3G's level of 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, we said there was a potential free-rider problem for the

[172] 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.

[173] We also noted 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 considered that the level of coverage specific by this obligation was not commercially unattractive, and that bids in the auction were unlikely to have been materially affected by it.

other bidders, who would prefer to let each other take the risk of pursuing a strategy from which they would all benefit.

A8.555 As with the alleged price driving in 900 MHz, in the absence of clear supporting evidence we were unable to reach a firm view as to whether the alleged price-driving behaviour did or did not occur. We considered that there was a risk that the Irish 1800 MHz overstates market value in Ireland, although the likelihood and scale of such risk is unknown.

800 MHz

A8.556 To the extent that price-driving by H3G in the 900 MHz band did occur, we agreed 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.

A8.557 Overall, we considered 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

A8.558 As discussed in paragraphs A7.62 to A7.74 of the August 2014 consultation, we did not consider that there were 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 did not provide strong grounds for considering either such relationship to exist. In our assessment of the Irish benchmarks, we did 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.

A8.559 In paragraphs A7.75-A7.78 of the August 2014 consultation, we considered 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 we said this created 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.

A8.560 We also considered the possibility that the unavailability of 2.6 GHz in Ireland may have increased willingness to pay for 1800 MHz.

A8.561 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. We said it was 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.

A8.562 We said it was 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.

A8.563 Overall, we considered 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

A8.564 We only had 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 used a proxy value for 2.6 GHz to calculate this benchmark.

A8.565 In interpreting these evidence points, we considered 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 of 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, we said 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 said we must use a proxy value for the distance method benchmark. As discussed in paragraph A7.49 of the August 2014 consultation, we considered 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. We said 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. We said the market values of 900 MHz and 800 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). We said 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.

A8.566 We placed both the 900 MHz / 800 MHz paired ratio and the distance method benchmark from Ireland in the first tier of evidence on the basis that prices were above reserve, reflecting bidding in these auctions, and we did not identify country-specific differences which led us to modify our view that these benchmarks were more informative of the relative values of these spectrum bands in the UK.

Stakeholder responses to the August 2014 consultation

Whether award outcomes are likely to reflect market value

Cross-band comments

A8.567 AM&A (Annex C5) said that accepting a benchmark, which was selectively provided by a stakeholder to the process (Vodafone) who had an interest in providing a low 900 MHz benchmark, introduces a bias to the process, as Vodafone has not provided other similar benchmarks from other auctions that Vodafone Group was involved in. The effect of this is to lower the lump-sum value for 900 MHz relative to 1800 MHz, a band for which Vodafone had less regard.

A8.568 AM&A (page 15) considered that CCAs where band-specific prices are not available should be classified as Tier 2, and argued Ofcom is inconsistent in treating Austria and Ireland as Tier 1 while excluding other such as the Swiss CCA.

900 MHz

A8.569 H3G (p. 36) argued that the relative prices of 900 MHz and 800 MHz in Ireland were affected by the specific auction design:

a) There was 2x35 MHz of 900 MHz spectrum in the auction and 2x30 MHz of 800 MHz, leading to a "relative scarcity" of 800 MHz spectrum;

b) H3G said that the 2x10 MHz spectrum cap in 900 MHz (time slice 1), combined with the 2x20 MHz sub-1 GHz cap, created a focal point in the auction in which incumbent operators protected their 900 MHz spectrum holdings, but did not try to expand them, as it would have reduced their ability to bid for 800 MHz;

c) The implication of this was that the fourth bidder (H3G) was able to acquire 2x5 MHz of 900 MHz spectrum relatively easily, while the other three operators acquired 2x10 MHz each, but faced more intense competition for 800 MHz (where operators each wanted 2x10 MHz and only 2x30 MHz was available). This resulted in a relative price which understates the forward-looking value of 900 MHz.

Likelihood of reflecting UK market value

A8.570 AM&A (p. 27) argued that Ireland is far from a conservative benchmark, since the 1800 MHz price in Ireland is likely to have been skewed upwards due to the lack of 2.6 GHz spectrum available for mobile (which means that the 1800 MHz band price in Ireland risks overstating market value in the UK).

Our assessment in the February 2015 consultation

Whether award outcomes are likely to reflect market value

Cross-band comments

A8.571 We did not consider that the inclusion of an Irish benchmark introduces a bias into the process. We said that we have attempted to obtain band-specific price information from all relevant CCAs within our time period, and derived benchmarks from all package auctions in which Vodafone was involved apart from the Netherlands (where we were unable to obtain band-specific prices). We said that

our consultation process has given all stakeholders the opportunity to provide relevant information about auctions.

A8.572 AM&A's comment related to the inclusion of benchmarks for Ireland, rather than the level of those benchmarks, however we said it is worth reiterating that our benchmarks from the Ireland auction are not solely dependent on the information submitted by Vodafone, as they were examined and verified by Comreg, the national regulator – see paragraph A8.319 above.

A8.573 We explained in paragraphs A7.173-A7.184 of the February 2015 consultation the reasons why we consider that benchmarks from CCAs can potentially be placed in Tier 1. We addressed specific stakeholder concerns about the derivation of band-specific prices for Ireland in paragraphs A7.181-A7.183.

900 MHz

A8.574 We said H3G's argument suggests a possible situation in which all bidders recognised a focal point of incumbents retaining their spectrum holdings and the smaller incumbent (H3G) acquiring 2x5 MHz. In theory, we said this may have led operators to bid less aggressively for larger 900 MHz packages in the clock stage of the auction, with the result that prices may have understated the market value for 900 MHz.

A8.575 In considering whether there was a focal point of this nature, we noted that:

a) The 900 MHz spectrum cap only applied to time slice 1 (up until June 2015). This means that incumbent bidders were not prevented from bidding for more 900 MHz spectrum under time slice 2 (fifteen year licences), at least up to the 2x20 MHz sub-1 GHz cap.

b) If incumbents viewed 900 MHz as a close substitute for 800 MHz for LTE deployment, as H3G suggested, they might have had an underlying incentive to bid equally aggressively for additional 900 MHz spectrum over and above that which they needed to serve existing GSM customers.

c) Moreover, the value realised by the 900 MHz band was well above the sum of reserve prices, suggesting that a significant degree of competition occurred.

A8.576 Having said this, we said it remains possible that the intensity of competition was lowered to an extent by a desire by the incumbent holders to protect existing holdings and an acceptance that this might leave H3G with the new block of 2x5 MHz spectrum. If incumbents took the view that bidding aggressively for 900 MHz in the clock stage of the auction would trigger a response from other incumbents eager to protect their legacy 900 MHz holdings, they may have attempted to avoid this outcome by bidding for smaller 900 MHz packages, thus limiting the extent to which they could compete for larger (i.e. more than 2x10 MHz) packages in the supplementary round.

A8.577 Turning to the incentives of H3G, we considered that:

a) H3G's argument assumes that its sister company in Ireland (H3G Ireland), the non-incumbent holder in the 900 MHz band, was happy to be accommodated in the 900 MHz band with a 2x5 MHz spectrum acquisition. Although this is consistent with the outcome in some other European auctions, H3G did not present any evidence that it was the case in Ireland.

b) Even if it was the case, H3G could have driven up the price of 900 MHz spectrum for incumbents with a high private value for legacy spectrum, as argued by Telefonica in response to our October 2013 consultation. As in the August 2014 consultation, we recognised that the 900 MHz band could be more vulnerable to price-driving than newly available bands, in which case the 900 MHz price could overstate market value. However, we also considered that such legacy issues are 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.

A8.578 Overall, we were unable to reach a firm view as to whether 900 MHz spectrum was acquired in the way that H3G has suggested. However, we also did not have clear supporting evidence that H3G were engaging in price-driving in the 900 MHz band. We considered that auction prices are at least as likely to be based on bidders' intrinsic values as on strategic bidding. In light of this, we considered that there is a risk that the 900 MHz price could understate or overstate market value in Ireland, but we said we cannot be sure of the likelihood and scale of this risk. This represented a change in our view (in terms of the direction of risk) compared to the August 2014 consultation.

1800 MHz

A8.579 Stakeholders made no further comments in relation to the 1800 MHz band. As in the August 2014 consultation, in the absence of clear supporting evidence we said we were unable to reach a firm view as to whether the suggested price-driving behaviour in the 1800 MHz band did or did not occur. We considered that auction prices are at least as likely to be based on bidders' intrinsic values as on strategic bidding. Our view remained that there is a risk that the Irish 1800 MHz overstates market value in Ireland (for the reasons explained in paragraphs A8.554-A8.555), but we said we cannot be sure of the likelihood and scale of this risk.

800 MHz

A8.580 Stakeholders made no further comments in relation to the 800 MHz band. Our view remained that the 800 MHz price risks understating market value in Ireland, but we said we cannot be sure of the likelihood and scale of this risk.

Likelihood of reflecting UK market value

A8.581 We agreed with AM&A that the unavailability of the 2.6 GHz band may have inflated the price of 1800 MHz in Ireland. In our August 2014 consultation we explicitly considered this as part of our interpretation of the 1800 MHz band, for which we suggested a larger risk of overstatement.

A8.582 As discussed in paragraphs A7.163, we also considered that the timing of the Irish award means that the 900 MHz value observed in Ireland risks understating the forward-looking market value of 900 MHz spectrum in the UK, although we said we cannot be sure of the scale or likelihood of this risk.

A8.583 As discussed in paragraphs A7.158-A7.160, our view remained that the fact that Ireland is less urbanised than the UK creates a risk that the market values of 800 MHz and 900 MHz spectrum in Ireland are overstated relative to UK market values, though we said we cannot be sure of the likelihood and scale of this risk.

Relative benchmarks

A8.584 We only had price information for two out of three bands used for the distance method (i.e. 800 MHz and 1800 MHz), but (as discussed in Annex 7) we used a proxy value for 2.6 GHz to calculate this benchmark.

Assessment of risk

A8.585 In interpreting these evidence points:

a) We still considered there to be a risk 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. However, we considered there is also a risk that it understates market value, as operators may have accommodated the non-incumbent holder of 900 MHz spectrum (H3G) in the newly available portion of the band. We also considered there to be a risk that the timing of the auction means that market value understates forward-looking UK market value. Overall, we concluded that the 900 MHz benchmark could overstate or understate market value.

b) Our interpretation of the 1800 MHz and 800 MHz bands remained as set out in paragraphs A8.579-A8.580 above. Our calculation of a 2.6 GHz proxy is discussed in paragraphs A7.114 to A7.140.

c) We now considered that the 900 MHz / 800 MHz paired ratio carries a risk of overstating or understating UK market value, but we said we cannot be sure of the likelihood and scale of this risk. This is because the price of 900 MHz risks overstating or understating market value in Ireland, while the price of 800 MHz risks understating market value in Ireland. We said the market values of 900 MHz and 800 MHz might both be overstated relative to UK market values due to lower urbanisation in Ireland, but this does not seem relevant to the *ratio* of these values.

d) We still considered that the distance method benchmark on balance carries a larger risk of overstating market value in the UK, though we said we cannot be sure of the scale of this risk. We said this is because:

   i) In terms of whether award outcomes are likely to reflect market value in Ireland, the price of 1800 MHz risks overstating market value and the price of 800 MHz risks understating it.

   ii) In terms of the likelihood of reflecting UK market value, the effects are potentially in different directions, but we have stronger reasons to believe that the market value in Ireland overstates market value in the UK for 1800 MHz (the unavailability of the 2.6 GHz band) than for 800 MHz (a lower level of urbanisation).

Tiering

A8.586 Considering each of the criteria for inclusion in Tier 1:

a) We said the auction prices in the Irish auction were significantly above reserve, and as such appear likely to have been primarily determined by a market-driven process of bidding.

b) For the reasons discussed in detail above, we considered that, based on the evidence available to us, the relative prices in the Irish auction are at least as likely to reflect intrinsic valuation of spectrum in Ireland as to reflect strategic bidding.

c) We used a proxy measure for 2.6 GHz in Ireland, and we have assessed the reliability of this approach in paragraphs A7.114 to A7.140. Overall, we did not have clear, evidence-based reasons to consider the auction outcome is less informative of forward-looking relative values in the UK having regard to country-specific circumstances and auction dates).

A8.587 Therefore, we considered that the Tier 1 criteria are satisfied for both the 900 MHz / 800 MHz paired ratio benchmark and the 1800 MHz distance method benchmark from Ireland. We included both relative value benchmarks in Tier 1.

Stakeholder responses to the February 2015 consultation

Whether award outcomes are likely to reflect market value

A8.588 Telefónica and Vodafone disagreed with our view that the price of 900 MHz in the Irish auction carries a risk of understating the market value of 900 MHz:

a) Telefónica (p. 42) said that the CCA format is very robust to demand reduction;

b) NERA (on behalf of Telefónica, p.23) argued that an accommodation equilibrium in the Irish auction would require at least one of Vodafone, Telefónica or Meteor to drop demand for low band spectrum, but they each bid up to the sub-1 GHz cap at 800 MHz and 900 MHz throughout the auction;

c) Frontier (on behalf of Vodafone, p. 22) said that [✂]

A8.589 Telefónica (p. 42) argued it was much more likely that, if strategic bidding occurred, it caused the 900 MHz price relative to 800 MHz to be inflated. It said that the high degree of predictable demand in the Irish auction created strong incentives for H3G to overbid for 900 MHz spectrum, knowing that it could fall back to one lot at zero opportunity cost due to the spectrum caps.

A8.590 In support of this interpretation, NERA (pp. 21-22) said the following:

a) [✂] "[174],

b) [✂]

c) Vodafone, Telefónica and Meteor all won larger spectrum portfolios than H3G but paid between 220% and 175% of H3G's price. NERA said that this was "consistent with H3G imposing high opportunity cost in both the 800 MHz and 900 MHz bands".

[174] [✂]

A8.591 [✂] said that bidding up the price of 900 MHz spectrum past its own private value would be a low-risk strategy for H3G, and is "consistent with the Irish demand pattern and with H3G's bidding in the UK".

Likelihood of reflecting market value

A8.592 Frontier (p. 13) and Telefónica (p. 42) disagreed with our view of the development of commercial opportunities for LTE900 over the period covering the auctions included in our benchmarking dataset. They said that it does not provide a justification as to why the price of 900 MHz in the Irish auction might understate the forward looking value of 900 MHz spectrum in the UK, relative to 800 MHz.

Tiering assessment

A8.593 Frontier (pp. 7-8) agreed that the 900 MHz and 1800 MHz benchmarks from Ireland should be classified as Tier 1 evidence points.

A8.594 NERA (p. 21 and 23) said that its "view that H3G engaged in strategic bidding cannot seriously be disputed by anyone with knowledge of what happened in the clock rounds", but also said that, at 900 MHz, "it is ambiguous how much the price actually rose beyond market value". NERA said that our assessment of the Irish 900 MHz benchmark in the August 2014 consultation (Tier 1 with risk of overstatement) was "entirely consistent with the evidence regarding strategic bidding".

Our assessment

Whether award outcomes are likely to reflect market value

A8.595 Stakeholders' responses to the February 2015 consultation focused on the risks of understatement or overstatement in 900 MHz band. For each of these sources of risk, we first consider whether the available evidence from the auction is consistent with that view. Next, we consider whether the evidence is consistent with an alternative view of intrinsic value bidding. We then summarise our overall view on risks of understatement and / or overstatement of 900 MHz.

Bidding in the auction caused relative 900 MHz prices to be understated

A8.596 We recognise that CCAs can weaken incentives to pursue a strategy of demand reduction. We also noted in our February 2015 consultation that the value realised by the 900 MHz band was well above the sum of reserve prices, suggesting that a significant degree of competition occurred for 900 MHz as well as for 800 MHz.

A8.597 However, the risk of understatement of the 900 MHz price relative to 800 MHz arises from the suggestion of weaker competition for 900 MHz than for 800 MHz spectrum due to the trade-off made by bidders faced with the sub-1 GHz cap, and given the larger amount of spectrum available in the 900 MHz (2x35 MHz, compared to 2x30 MHz in the 800 MHz band). To remain within the sub-1 GHz spectrum cap of 2x20 MHz, bidders in Ireland wishing to compete for at least 2x15 MHz of 900 MHz spectrum would have had to reduce demand for 800 MHz to no more than 2x5 MHz. Dropping 800 MHz demand from, for example, 2x10 MHz to 2x5 MHz may have entailed loss of a contiguity premium in that band. Had the sub-1 GHz spectrum cap been looser (e.g. at the higher level of 2x27.5 MHz as in the UK 4G auction), it would have been possible for Vodafone, Meteor and Telefónica to acquire 2x10 MHz of 800 MHz while still competing to win more than 2x10 MHz

of 900 MHz spectrum.[175] With the other three bidders winning 2x10 MHz each out of the 2x35 MHz available, this means that the spectrum cap in Ireland may have allowed H3G to secure its 2x5 MHz of 900 MHz for a lower price than would otherwise have been the case.

A8.598 We do not agree with NERA's view that bidding patterns are inconsistent with the possible outcome described above on the basis that it would have required one of Vodafone, Telefónica or Meteor to drop demand below the 2x20 MHz cap for sub-1 GHz spectrum. For example:

a) At some point in the clock phase, all three could have been bidding for 2x10 MHz of 800 MHz and 2x10 MHz of 900 MHz, and at this point H3G could have dropped its demand for 900 MHz to 2x5 MHz but continued to bid on 800 MHz. [✂]

b) In response, each of Vodafone, Telefónica and Meteor could have decided to continue competing to ensure they won 2x10 MHz in each band, rather than bidding for packages with more 900 MHz and less 800 MHz. In that case, the clock price of 900 MHz would have stopped rising, while the clock price of 800 MHz would have continued to rise.

c) Vodafone, Telefónica and/or Meteor could have decided not to respond to this increasing price differential (i.e. by switching demand to 900 MHz), in order to avoid further increases in the 900 MHz price. They could also potentially have seen a strategic advantage in H3G winning 900 MHz spectrum rather than 800 MHz (given that the sub-1 GHz cap meant that H3G would win at least 2x5 MHz of either 900 MHz or 800 MHz). There was a clear focal point for such strategic bidding of each of the three larger incumbents winning 2x10 MHz of 800 MHz and 2x10 MHz of 900 MHz (which was indeed the outcome of the auction). We note that the activity rule in the Irish auction included a final price cap (which constrained the supplementary bids that bidders could place on all packages relative to the one they bid for in the final clock round).[176] This would have limited the scope for bidders to place supplementary bids substantially out of line with the relative valuations expressed in the final clock round (and in any case Comreg suggested to us that the relativities in the final auction prices were similar to those in the final clock prices – see paragraph A8.549 above).

A8.599 Without access to the bid data we are unable to assess whether bidding took place as described above. However, we consider that the factors set out in the above paragraph illustrate that the available bidding evidence is consistent with weaker competition for 900 MHz band. Accordingly, our view remains that there is a risk that the 900 MHz price could understate market value in Ireland.

A8.600 However, in our view, the evidence is also consistent with intrinsic value bidding in the Irish auction.

[175] We note that it is relatively unusual in other benchmark countries auctioning whole spectrum bands for bidders (even if not as restricted by spectrum caps as in Ireland) to win more than 2x10 of 800 MHz, but more typical for bidders to win up to 2x15 of 900 MHz (such as in Greece, the Netherlands, Slovenia and Switzerland).

[176] A further explanation of the final price cap is set out in paragraphs 6.65 to 6.72 in the November 2014 PSSR award consultation, http://stakeholders.ofcom.org.uk/binaries/consultations/2.3-3.4-ghz-auction-design/summary/2_3_and_3_4_GHz_award.pdf.

Bidding in the auction caused relative 900 MHz prices to be overstated

A8.601 Turning to price-driving arguments, we agreed in our February 2015 consultation that the evidence is consistent with a risk of H3G having engaged in price-driving in the 900 MHz band, though we considered that we did not have clear supporting evidence of this outcome. Telefónica argued that this was a much more likely explanation of bidding in the Irish auction than the alternative explanations, and referred to the evidence put forward by NERA that H3G had engaged in strategic overbidding.

A8.602 In relation to the evidence from **bid data**:

a) Firstly, NERA made inferences about H3G's clock round bids based on changes in aggregate demand. Without access to the full bid data, we are not in a position to know whether H3G was responsible for the clock round bidding activity in the way that NERA suggested.[177]

b) Secondly, [✂]. Again, without access to the full bid data we are unable to draw reliable conclusions from changes in demand in individual clock rounds, especially without also considering supplementary rounds bids (from which final auction prices are derived).

c) Thirdly, as we have previously noted, even with access to the full bid data it can be difficult to establish whether auction prices were materially affected by strategic bidding. Bidders' intrinsic values are not usually publicly known and can contain features such as contiguity premia, cross-band substitutability and cross-band complementarities. These possible features can mean that observed bidding patterns are consistent with more than one explanation.

A8.603 As a result, we do not consider that the limited bid data evidence provided by NERA is inconsistent with a view that relative prices in the auction were based on intrinsic value bidding.

A8.604 In relation to evidence from **final prices:**

a) NERA said that Vodafone / Meteor / Telefonica's package price premium is consistent with H3G "imposing high opportunity cost in both the 800 MHz and 900 MHz bands" on the other MNOs. As NERA's comment refers to both the 800 MHz and 900 MHz bands, it is unclear to us that (even if correct) it would necessarily provide evidence of the 900 MHz price being inflated relative to the 800 MHz price.

b) We also note the potential for alternative explanations for any differences in prices paid by H3G and the other bidders, such as the sub-1 GHz cap (given that the other three bidders all won spectrum up to the limit of the cap and auction prices were derived from highest losing bids for additional spectrum).

A8.605 Regarding [✂] argument, we agree (as noted above) that there is a risk that H3G engaged in price-driving in 900 MHz (though we also consider that the evidence is

[177] [✂]

consistent with intrinsic value bidding). We do not consider that H3G's bidding in the UK is relevant to our assessment of bidding in the Irish auction.[178]

A8.606 As in the February 2015 consultation, we consider there to be a risk that the 900 MHz price is overstated due to the possibility of price-driving by H3G. In this regard, we note that NERA considered that "it is ambiguous how much the [900 MHz] price actually rose beyond market value". In any case, we consider that the available evidence could also be consistent with an explanation of bidding in the auction based on intrinsic values (or with weaker competition for the 900 MHz band as discussed above).

Overall view on risks of understatement and / or overstatement of 900 MHz

A8.607 Overall, our view remains that there is a risk that the 900 MHz price could overstate market value in Ireland, relative to the 800 MHz price, due to price-driving by H3G (suggested by Vodafone and Telefónica) or understate it due to weaker competition from other bidders for 900 MHz than for 800 MHz spectrum (suggested by H3G). We also consider that it possible that both strategies could have taken place, as each relates to suggested bidding behaviour by different bidders. However, we do not have clear supporting evidence that either bidding strategy was present or, if they were, to decide which was more likely (or, if both were present, which was likely to have had more influence on the relative price outcome), especially given the limited evidence on bids in the Irish auction available to us. Therefore, we consider that there is a risk that the 900 MHz price could understate or overstate market value in Ireland, but we cannot be sure of the likelihood and scale of this risk.

Likelihood of reflecting UK market value

A8.608 We have assessed stakeholder responses to our view on LTE900 development in more detail in paragraphs A9.36-A9.78. Based on the assessment outlined in Annex 9, our view remains that LTE900 development creates a risk that the 900 MHz value observed in Ireland understates the forward-looking market value of 900 MHz spectrum, although we cannot be sure of the scale or likelihood of this risk.

Relative benchmarks

Assessment of risk

A8.609 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 in Annex 7) we used a proxy value for 2.6 GHz to calculate this benchmark.

A8.610 In interpreting these evidence points, our view remains as set out above in paragraph A8.585. We consider that the 900 MHz / 800 MHz paired ratio carries a risk of overstating or understating UK market value, but we cannot be sure of the likelihood and scale of this risk. We consider that the distance method benchmark on balance carries a larger risk of overstating market value in the UK, though we cannot be sure of the scale of this risk.

[178] In any case, we have previously set out our disagreement with some of Frontier's suggestions about H3G's bidding in the UK (see paragraphs A8.49-A8.51 in the October 2013 consultation).

Tiering assessment

A8.611 Although no stakeholder explicitly questioned our tiering assessment of the Ireland benchmarks, NERA argued that strategic bidding was a more likely explanation of bidding for 900 MHz spectrum. If we considered this to be the case, the Ireland 900 MHz relative benchmark would not satisfy the second criterion to be included in the first tier of evidence. However, our view remains that, based on the evidence available to us, auction prices are at least as likely to be based on intrinsic values as on strategic bidding. As a result, we have retained the 900 MHz and 1800 MHz relative benchmarks from Ireland in the first tier of evidence.

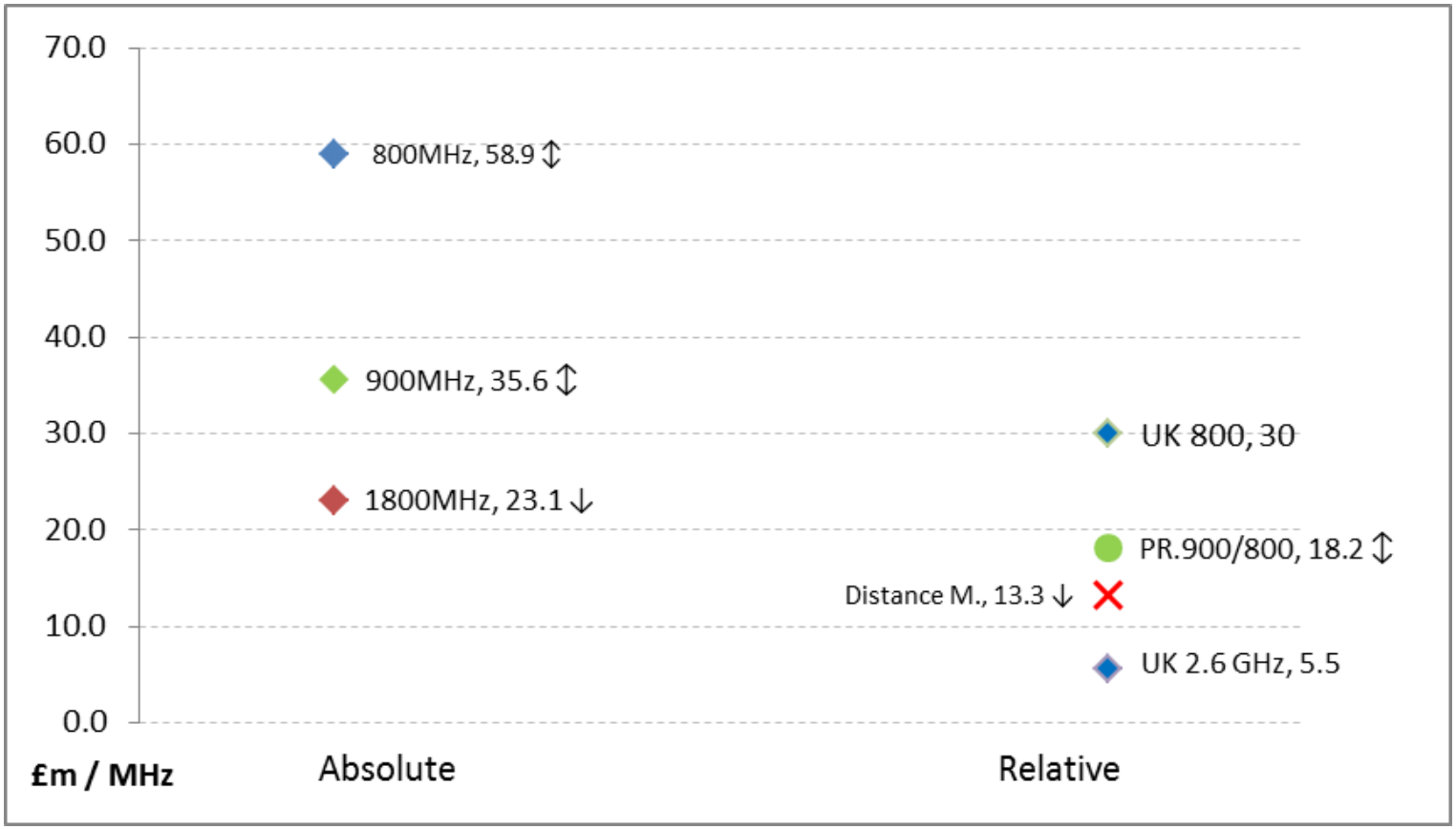
A8.612 The following table summarises the available benchmarks (along with our interpretation of them) from the Irish award.

Table A8.7.3: Summary of evidence points from Ireland

	Absolute values (£m / MHz)			Relative value benchmarks[1] (£m / MHz)		Ratios (%)	
	800 MHz	900 MHz	1800 MHz	900 MHz / 800 MHz	Distance method	1800 MHz / 800 MHz	1800 MHz / 900 MHz
Final values	58.9	35.6	23.1	**18.2** **(61%)**	**13.3** **(32%)**	39%	65%
Tier				**First**	**First**		
Assessment of risk	Risk of under or over-statement	Risk of under or over-statement	Larger risk of over-statement	**Risk of under or over-statement**	**Larger risk of over-statement**	Risk of over-statement	Risk of over-statement

1 Based on the UK 800 MHz value without coverage obligation and net of expected DTT co-existence costs

Figure A8.7.1: 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 A8.8.1: September 2011 multiband auction results

	800 MHz	1800 MHz	2.1 GHz unpaired	2.6 GHz	2.6 GHz unpaired	Price Paid[179]
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	-	-	-
Reserve price	€2.12bn	€468m	-	€368m	€73.6m	-
Total auction revenue	€2.96bn	€477m	-	€432m	€74m	-
% mark-up	40%	2%	-	17%	0.6%	-

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

Table A8.8.2: 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).[180]	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	The 800 MHz and 2.6 GHz paired spectrum bands sold materially above reserve price. The 1800 MHz band sold marginally above reserve price.	
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.[181]	

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

Our position in the October 2013 consultation

A8.613 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 to the October 2013 consultation

Whether award outcomes are likely to reflect market value

1800 MHz

A8.614 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.

A8.615 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."

A8.616 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.[182] Vodafone argued on this basis that the reserve price in Italy is unlikely to reflect the market value of spectrum.

A8.617 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:

[182] "*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."

a) [✂]

b) [✂]

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

800 MHz

A8.618 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

A8.619 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 in the August 2014 consultation

Whether award outcomes are likely to reflect market value

1800 MHz

A8.620 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 did 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.

A8.621 In any case, we said the 1800 MHz price was determined by an auction bid, not by the reserve price. [✂]

A8.622 [✂] Telefónica suggested that bidding for 1800 MHz spectrum occurred later in the auction. We said 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, we said competition for 800 MHz could have restricted their subsequent ability to bid for 1800 MHz spectrum.

A8.623 [✂]

A8.624 Telefónica suggested that operators found a "compromise outcome" in the higher frequency bands. We said that 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.

A8.625 We said this suggested 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 noted 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.

A8.626 Overall, we said 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 were unable to assess whether any of these eventualities did or did not occur. We considered 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

A8.627 We said it was 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 explored 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 yielded an estimate of £13.1m per MHz for the distance method (which was £0.4m lower than the base case in that consultation of £13.5m, and corresponded to an increase in the 800 MHz benchmark of around 5%). We said that the impact on relative benchmarks is relatively minor, although this depended on the cost of the coverage obligation in Italy being similar to the UK as a proportion of the value of 800 MHz.[183] On balance we considered that the price of 800 MHz carries an unknown risk of smaller understatement of market value in Italy.

2.6 GHz

A8.628 Telefónica suggested that operators found a "compromise outcome" in the higher frequency bands. As discussed in relation to 1800 MHz, we said this suggested 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.

A8.629 As with our assessment of 1800 MHz, we considered that, while we did 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.

[183] 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.

Likelihood of reflecting UK market value

A8.630 As discussed in paragraphs A7.62 to A7.74 of the August 2014 consultation, we did 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 did not provide strong grounds for considering either such relationship to exist. In our assessment of the Italian benchmarks, we did 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.

A8.631 We also considered the timing of the Italian award relative to the UK. In paragraphs A7.83 to A7.84, we said that 1800 MHz was not fully acknowledged as a core LTE band until between late 2011 and early 2012, and that it was 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 considered 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

A8.632 We had 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 used the Italian absolute value as a cross-check for our 1800 MHz lump-sum value.

A8.633 In interpreting these evidence points we considered 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 created an unknown risk that market value in Italy might be a smaller understatement relative to the UK market value. However, we said 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.

A8.634 We also considered 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 considered that the distance method benchmark should be interpreted in the same way.

A8.635 We placed the Italian distance method benchmark in the first tier of evidence. We noted that there was a single multiband award involving all bands and prices of the relevant spectrum bands were above reserve, reflecting bidding in these auctions. We also did not identify country-specific differences which led us to modify our view that the relevance of these benchmarks for the purposes of informing the relative values of these spectrum bands in the UK. However we also noted that only 2x15 MHz of 1800 MHz spectrum was auctioned, in 2x5 MHz lots (although these were generic lots) which were won by different operators, and considered that there was potentially a case for including Italy in our second tier.

Stakeholder responses to the August 2014 and February 2015 consultations

A8.636 In response to the August 2014 consultation:

a) AM&A (Annex C6) said that "there are no substantial arguments why this benchmark would not have provided market value in the relevant bands".

b) Telefónica and Vodafone provided no substantive comments in relation to our assessment of the Italian benchmarks.

A8.637 Stakeholders did not make any further comment on this benchmark country in response to the February 2015 consultation.

Our assessment

Relative benchmarks

A8.638 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.

Assessment of risk

A8.639 We received no comments disagreeing with our assessments of the Italian benchmarks.

A8.640 However, we note that the Italy award occurred before WRC-12. As discussed in paragraphs A7.181 to A7.181, we consider that this creates a larger risk that the market value of 800 MHz in Italy at the time of the auction is a larger overstatement of the forward-looking market value of 800 MHz. We also consider that this creates a larger risk that the market value of 1800 MHz in Italy at the time of the auction overstates the forward-looking market value of 1800 MHz, though we cannot be sure of the scale of this overstatement.

A8.641 In interpreting these evidence points, we now consider that:

a) The possible impact of the coverage obligation creates a risk (of smaller scale) that the price of 800 MHz understates market value in Italy, while the impact of developments in 700 MHz availability creates a larger risk that the market value of 800 MHz in Italy at the time of the auction is a larger overstatement of forward-looking market value. We consider on balance that the 800 MHz price carries a larger risk of a larger overstatement of forward-looking market value.

b) The price paid for 1800 MHz spectrum may understate or overstate market value in Italy at the time of the auction, though we cannot be sure of the likelihood and scale of this risk. There is a risk that the market value of 1800 MHz in Italy at the time of the auction is a smaller understatement of forward-looking market value (due to LTE1800 developments), and a larger risk that the market value is an overstatement of forward-looking market value (of unknown scale) due to 700 MHz availability developments. On balance, we consider that the 1800 MHz price carries a larger risk of overstatement of forward-looking market value, though we cannot be sure of the scale of this overstatement.

c) The 2.6 GHz price carries a risk of understatement (of unknown likelihood and scale) for the reasons discussed in paragraphs A8.628 to A8.629 above.

A8.642 In terms of our distance method benchmark, the larger risk of overstatement of 1800 MHz, combined with the risk of understatement of 2.6 GHz, create a risk that the distance method benchmark overstates forward-looking market value. However, the larger risk of larger overstatement of 800 MHz provides an offsetting risk (of

understatement) for the benchmark. On balance, therefore, our view remains that the distance method benchmark could understate or overstate forward-looking UK market value, of unknown likelihood and scale.

A8.643 We also consider that the 2.6 GHz / 800 MHz carries a larger risk of understating the relative market value (of larger scale), as there is a risk that the 800 MHz price risks overstating forward-looking UK market value while the 2.6 GHz price risks understating market value. For the purpose of estimating a proxy value for 2.6 GHz, we consider that the Italian 2.6 GHz / 800 MHz paired ratio provides more useful evidence of the ratio of 2.6 GHz prices to 800 MHz prices, as both bands were auctioned in the same multiband award and sold above reserve price (i.e. prices were determined by a market-driven process).

Tiering

A8.644 There was a single multiband award including the relevant bands. Only 2x15 MHz of 1800 MHz spectrum was auctioned, in 2x5 MHz lots (although these were generic lots) which were won by different operators. Stakeholders provided conflicting views as to why the 1800 MHz price may have been above or below a market price. However, on balance we consider that this price appears at least as likely to have reflected intrinsic valuations. We have included Italy in our first tier.

A8.645 Considering each of the criteria for inclusion in Tier 1:

a) The auction prices in the Italian auction were above reserve price. Stakeholders provided conflicting views as to why the 1800 MHz price may have been above or below a market price. On balance we consider this price is likely to have been primarily determined by a market-driven process of bidding.

b) Again, stakeholders provided conflicting views about the nature of bidding in the auction. However, on balance we consider that, based on the evidence available to us, the relative prices in the Italian auction are at least as likely to reflect intrinsic valuation of spectrum in Italy as to reflect strategic bidding.

c) We do not have clear, evidence-based reasons to consider the auction outcome is less informative of forward-looking relative values in the UK having regard to country-specific circumstances and auction dates).

A8.646 Therefore, we consider that the Tier 1 criteria are satisfied for the 1800 MHz distance method benchmark from Italy. We include this benchmark in Tier 1.

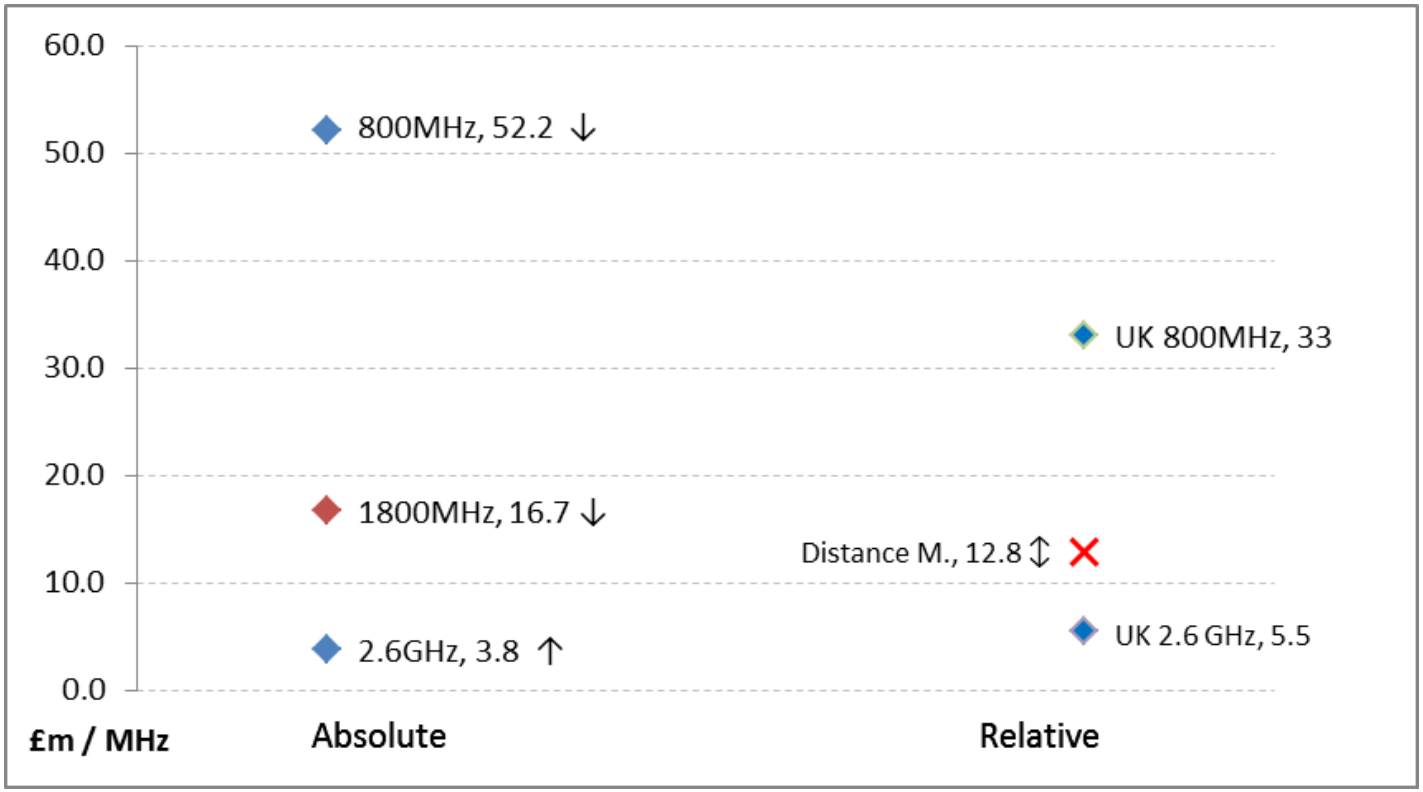
A8.647 The following table summarises the available benchmarks (along with our interpretation of them) from the Italian award.

Table A8.8.3: Summary of evidence points from Italy

	Absolute values (£m / MHz)			Relative value benchmarks[1] (£m / MHz)	Ratios (%)		
	800 MHz	1800 MHz	2.6 GHz	Distance method	1800 MHz / 800 MHz	1800 MHz / 2.6 GHz	2.6 GHz / 800 MHz
Final values	52.2	16.7	3.8	**12.8** **(27%)**	32%	439%	7%
Tier				**First**			
Assessment of risk	Larger risk of larger over-statement	Larger risk of overstatement	Risk of under-statement	**Risk of under or over-statement**	Risk of under-statement	Larger risk of larger overstatement	Larger risk of larger under-statement

1 Based on the UK 800 MHz value without coverage obligation and gross of expected DTT co-existence costs

Figure A8.8.1: 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 A8.9.1: April 2010 2.6 GHz auction results

	2.6 GHz	Unpaired 2.6 GHz	Price Paid[184]	Package mark-up
Total Available	2x65	55	-	
KPN	2x10	-	€909k	355%
Vodafone	2x10	-	€200k	0%
T-Mobile	2x5	-	€109k	9%
Tele2	2x20	-	€400k	0%
Ziggo	2x20	-	€1m	152%
Unsold	-	55	-	

Table A8.9.2: 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	Vodafone and Tele2 acquired spectrum at reserve price. T-Mobile acquired spectrum marginally above reserve price. KPN and Ziggo acquired spectrum significantly above reserve price.	
Coverage obligations	Network coverage of 80 square kilometres by May 2012.	

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

December 2012 multiband auction[185]

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 A8.9.3: December 2012 multiband auction results

	800 MHz	900 MHz	1800 MHz	Unpaired 1900 MHz	2.1 GHz	Unpaired 2.6 GHz	Price Paid[186]	Package mark-up
Total Available	2x30	2x35	2x70	4.9+9.7	2x10	55	-	-
KPN	2x10	2x10	2x20	-	2x5	30	€1.35bn	808%
Vodafone	2x10	2x10	2x20	-	2x5	-	€1.38bn	851%
T-Mobile	-	2x15	2x30	4.9+9.7	-	25	€911m	692%
Tele2	2x10	-	-	-	-	-	€161m	130%
Ziggo	-	-	-	-	-	-	-	-
Unsold	-	-	-	-	-	-	-	-

Table A8.9.4: 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.[187]	
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).[188]	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	All spectrum sold materially 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.	

[185] Results source: http://www.telecompaper.com/news/dutch-multiband-spectrum-auction-ends-with-four-winners--914279
[186] http://www.accessmylibrary.com/article-1G1-312372403/netherlands-dutch-multiband-spectrum.html
[187] See slide 8: http://tst.acgea.com/86/text/169/files/Dutch%20Multi-Band%20Spectrum%20Auction%20040612%20AGA%20[Compatibility%20Mode].pdf
[188] 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

A8.648 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.[189]

Stakeholder responses to the October 2013 consultation

A8.649 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.

A8.650 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.

A8.651 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 outlined in paragraph A7.13 of the August 2014 consultation).

Assessment in the August 2014 consultation

A8.652 We agreed 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 considered 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 considered that they should not be included in the benchmarking exercise. As discussed in paragraphs A7.14 to A7.16 of the August 2014 consultation, we also did not consider that the indicative prices proposed by Vodafone are reliable estimates of band-specific prices.

A8.653 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 lump-sum value estimates. Given that reserve prices were significantly exceeded in the auction, we considered that these estimates should also be excluded entirely.

A8.654 Finally, we were not able to obtain estimates of band-specific prices for the Netherlands using the LRP methodology that was employed in relation to Austria.

A8.655 We did not therefore propose to derive benchmarks for the Dutch auction.

Stakeholder responses to the August 2014 and February 2015 consultations

A8.656 In response to the August 2014 and February 2015 consultations, we received no comments from stakeholders regarding our proposal not to derive benchmarks for the Dutch auction.

[189] 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.

Our assessment

A8.657 We have maintained our position as set out in the August 2014 and February 2015 consultations. We do not derive benchmarks from the Dutch auction.

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).[190] 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 A8.10.1: December 2013 multiband auction results

Operator	800 MHz	900 MHz	1800 MHz	Price paid	Package mark-up
Total available	2 x 30	2 x 15	2 x 55	-	-
TeliaSonera	2 x 10	2 x 5	2 x 10	NOK 626.7m	527%
Telco Data	2 x 10	2 x 5.1	2 x 20	NOK 705m	315%
TeleNor	2 x 10	2 x 5	2 x 10	NOK 453m	183%
Tele2	-	-	-	-	-
Unsold	-	-	2 x 15	-	-

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

Table A8.10.2: 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[191] / 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.
Unsold spectrum?	2 x 15 MHz at 1800 MHz	
Reserve prices	Total revenue in the auction was 315% higher than the sum of reserve prices of all lots sold.	

[190] TeliaSonera and TeleNor each have a 2x10 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

[191] 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

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.[192] 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.[193]

Our position in the October 2013 consultation

A8.658 This auction concluded after the publication of our October 2013 consultation. In our May 2014 update note[194] we said that we were considering whether new information on further European spectrum auctions, including the Norwegian auction, provided relevant evidence for the purposes of estimating the market value of the 900 MHz and 1800 MHz licences in the UK. We invited stakeholders to comment on this new information.

Stakeholder responses to the October 2013 consultation and May 2014 update note

Whether award outcomes are likely to reflect market value

Cross-bands comments

A8.659 AM&A (January 2014 response, 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.

A8.660 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.

A8.661 Vodafone (January 2014 response, 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.

[192] See section 2.1 of the Auction Rules, available here: http://www.npt.no/aktuelt/h%C3%B8ringer/_attachment/9106?_download=true&_ts=1407b7941b3
[193] See section 3 of the Auction Rules, available here: http://www.npt.no/aktuelt/h%C3%B8ringer/_attachment/9106?_download=true&_ts=1407b7941b3
[194] Update on European auctions since Ofcom's consultation on Annual licence fees for 900 MHz and 1800 MHz spectrum, May 2014; http://stakeholders.ofcom.org.uk/binaries/consultations/900-1800-mhz-fees/update/2014-05_ALF_Update_Note_on_Austria.pdf

Assessment in the August 2014 consultation

Whether award outcomes are likely to reflect market value

A8.662 Spectrum sold well above reserve prices. However, we agreed with respondents that the sealed bid, first-price nature of the auction gave bidders a strong incentive for bid shading.

A8.663 We considered that Tele2's failure to win any spectrum was consistent with bid shading; we understood 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, we said 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

A8.664 NPT was unable to provide us with LRP or other band-specific price information.

A8.665 Since total receipts from the auction were well above reserve prices, we considered that it was not possible to use reserve prices as an approximation of the market value of spectrum by band.

A8.666 Vodafone proposed an alternative method to derive absolute values by band but, as discussed in paragraphs A7.14 to A7.17 of the August 2014 consultation, we did not believe this was informative and it was not suitable for deriving relative benchmarks.

A8.667 For these reasons, we did not propose to derive benchmarks for the Norwegian auction.

Stakeholder responses to the August 2014 and February 2015 consultations

A8.668 In response to the August 2014 and February 2015 consultations, we received no comments from stakeholders regarding our proposal not to derive benchmarks for the Norwegian auction.

Our assessment

A8.669 We have maintained our position as set out in the August 2014 and February 2015 consultations. We do not derive benchmarks from 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.[195]

Table A8.11.1: 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[196]
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	-
Reserve price	-	€270m	€30m	€33m	-	€36m	€3m	
Total auction revenue	-	€270m	€30m	€33m	-	€36m	€3m	
% mark-up	-	0%	0%	0%	-	0%	0%	

Table A8.11.2: 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[197]	**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 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.	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. The 1800 MHz cap was binding for all winners due to existing holdings.

[195] 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.
[196] See: http://www.anacom.pt/render.jsp?categoryId=344704
[197] http://www.anacom.pt/streaming/english_version_Auction_Regulation.pdf?contentId=1101807&field=ATTACHED_FILE

	1800 MHz: Cap of 2x20 MHz, including existing holdings. All 3 incumbents already held 2x6 MHz. **2.6 GHz**: 2x20 MHz	
Reserve prices	All spectrum sold at reserve prices. 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.[198]	No clear indication that reserve prices were set so as to reflect market value.

Our position in the October 2013 consultation

A8.670 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.

A8.671 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 to the October 2013 consultation

Whether award outcomes are likely to reflect market value

Cross-band comments

A8.672 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

A8.673 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:

[198] 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)

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.

A8.674 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

A8.675 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.

A8.676 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

A8.677 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

A8.678 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 in the August 2014 consultation

Whether award outcomes are likely to reflect market value

900 MHz

A8.679 We said 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.

A8.680 However, we said 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 noted Telefónica's arguments that non-contiguity would not be so important in Portugal. However, we said 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 considered there is a risk that values for 900 MHz in Portugal understate market value, both in absolute terms and relative to 800 MHz.

A8.681 Overall, we considered 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

A8.682 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, we said there might have been competition for 1800 MHz lots, which would have raised auction prices. We considered 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

A8.683 We did not consider that a comparison of Portugal's reserve prices with benchmarks which were available in 2011 provided 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.

A8.684 Overall, we considered 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 considered that the scale of this understatement is unknown.

2.6 GHz

A8.685 On its own, we said 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, we said there would likely have been competition for 2.6 GHz lots, which would have raised auction prices. We therefore considered that there is a larger risk that the 2.6 GHz price

understates market value in Portugal, but that the scale of this understatement is unknown.

Likelihood of reflecting UK market value

A8.686 As discussed in paragraphs A7.62 to A7.74 of the August 2014 consultation, we did 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, we said the available evidence did not provide strong grounds for considering either such relationship to exist. In our assessment of the Portuguese benchmarks, we did 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.

A8.687 In paragraphs A7.75 to A7.78 of the August 2014 consultation, we considered that the value of sub-1 GHz spectrum may be higher in countries which are less urbanised than the UK. We said 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).

A8.688 We also considered the timing of the Portuguese award relative to the UK. In paragraphs A7.83 to A7.84 of the August 2014 consultation, we noted 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 considered 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

A8.689 We considered that there is sufficient price information from the Portuguese auction to calculate a 900 MHz / 800 MHz paired ratio and a distance method benchmark.

A8.690 In interpreting the absolute 900 MHz benchmark we noted 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 meant that the 900 MHz / 800 MHz paired ratio may also understate or overstate UK market value (of unknown risk and scale).

A8.691 Turning to the 1800 MHz distance method benchmark, we considered 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 could not establish whether the distance method benchmark understates or overstates UK market value.

A8.692 We used absolute values for the two ALF bands as cross-checks, and the 1800/900 MHz ratio as an additional cross-check.

A8.693 We placed the 900 MHz / 800 MHz paired ratio in the second tier of evidence. We said that spectrum sold at reserve price and so the benchmarks reflected the relative value of reserve prices set by the regulator for 900 MHz and 800 MHz spectrum. In addition, only 2x10 MHz of the 900 MHz band was available in the auction in non-contiguous lots of which 2x5 MHz was unsold. Whilst there was a

case for the benchmark to be categorised in the third tier, on balance, we considered it was more informative than other benchmarks we have included in the third tier.

A8.694 We considered that the Portuguese distance method benchmark provided very little information about the value of 1800 MHz spectrum in the UK, and we placed it in the third tier of evidence. In particular, we noted that there was some unsold spectrum in 1800 MHz and 2.6 GHz due to binding spectrum caps, and no spectrum in any band sold significantly above reserve price.

Stakeholder responses to the August 2014 consultation

Whether award outcomes are likely to reflect market value

Cross-band comments

A8.695 AM&A (Annex C7) agreed that the combination of spectrum selling at reserve price while stringent caps were in place means we cannot be sure whether market value is understated or overstated for the Portuguese benchmarks.

1800 MHz

A8.696 AM&A (p. 24) argued that the Portuguese 1800 MHz price should be calculated using a weighted average of lots (rather than a straight average). It said that this raises the absolute 1800 MHz price by £0.1m / MHz to £3.3m / MHz.

Our assessment in the February 2015 consultation

Whether award outcomes are likely to reflect market value

1800 MHz

A8.697 As discussed in paragraph A7.26, we agreed with a weighted average approach to calculating benchmarks, and we recalculated the 1800 MHz price accordingly. We noted that, on its own, this does not change the actual distance method benchmark value.

A8.698 We maintained our interpretation of the 1800 MHz price and considered that it carries a larger risk of understatement, though we said we cannot be sure of the scale of this risk.

900 MHz

A8.699 We received no comments on our assessment of the 900 MHz band and our view remained as set out in paragraphs A8.679-A8.681 above.

800 MHz

A8.700 We received no comments on our assessment of the 800 MHz band and our view remained as set out in paragraphs A8.683-A8.684 above.

2.6 GHz

A8.701 We received no comments on our assessment of the 2.6 GHz band and our view remained as set out in paragraph A8.685 above.

Likelihood of reflecting market value

A8.702 As discussed in paragraphs A7.158 to A7.160, our view remained that the fact that Portugal is less urbanised than the UK creates a 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, though we said we cannot be sure of the likelihood and scale of this risk.

A8.703 As discussed in paragraphs A7.169, our view remained that the timing of the Portuguese award creates a risk that the market value of 1800 MHz in Portugal at the time of the auction is a smaller understatement of the forward-looking UK market value of 1800 MHz, though we said we cannot be sure of the likelihood of the risk.

A8.704 As discussed in paragraph A7.163, we also considered that the timing of the Portuguese award means that the 900 MHz value observed in Portugal risks understating the forward-looking market value of 900 MHz spectrum in the UK, although we said we cannot be sure of the scale or likelihood of this risk.

Relative benchmarks

A8.705 We said there is sufficient price information from the Portuguese auction to calculate a 900 MHz / 800 MHz paired ratio and a distance method benchmark.

Assessment of risk

A8.706 Faced with a deferred sub-1 GHz cap, we said operators may have foregone bidding for 900 MHz spectrum to acquire 800 MHz spectrum at a higher reserve price. In itself, we said this might suggest that the Portugal benchmark risks overstating the value of 900 MHz, because it reflects a relative reserve price of (900 MHz to 800 MHz) at which operators in fact preferred 800 MHz. However the non-contiguity of 900 MHz lots presents a countervailing risk that the value of 900 MHz was understated. Our overall view remained that the 900 MHz / 800 MHz paired ratio may understate or overstate UK market value, though we said we cannot be sure of the likelihood and scale of this risk.

A8.707 Turning to the 1800 MHz distance method benchmark, our view remained that binding spectrum caps in the 1800 MHz band create a larger risk that the auction price understates market value in Portugal, though we said we cannot be sure of the scale of this understatement. However, because the 800 MHz and 2.6 GHz prices may also be understatements of market value, we said we cannot establish whether the distance method benchmark understates or overstates UK market value.

A8.708 As the 800 MHz price carries a risk of understatement or overstatement, we considered that the 2.6 GHz / 800 MHz ratio also risks understating or overstating the relative market value in Portugal.

Tiering

A8.709 Considering the 900 MHz benchmark against each of the criteria for inclusion in Tier 1, we said:

a) This benchmark reflects the relative value of reserve prices set by the regulator for 900 MHz and 800 MHz spectrum, rather than a market-driven process of bidding.

b) Based on the evidence available to us, the relative prices in the auction are at least as likely to be based on bidders' intrinsic valuations of spectrum as on strategic bidding; and

c) The outcome appears likely to be informative of forward-looking relative spectrum values in the UK, having regard to country-specific circumstances and auction dates.

A8.710 The 900 benchmark does not meet the first of our criteria for Tier 1. We therefore considered the criteria for inclusion in Tier 2.

a) There is some evidence that the relative auction prices reflect bidders' relative intrinsic valuations of the 900 MHz and 800 MHz bands in that there was unsold 900 MHz spectrum at reserve price while all 800 MHz spectrum was sold at reserve price; and

b) The outcome is not obviously uninformative of forward-looking relative spectrum values in the UK having regard to country-specific circumstances and auction dates.

A8.711 We therefore considered that the benchmark should be in Tier 2.

A8.712 Considering the 1800 MHz distance method benchmark against each of the criteria for inclusion in Tier 1, we said:

a) There was some unsold spectrum in 1800 MHz and 2.6 GHz. The fourth bidder made a zero bid in the first round, leaving more 1800 MHz spectrum than the three active bidders could acquire under the spectrum caps, and a 2.6 GHz cap was also binding on the three active bidders. No spectrum in any band sold significantly above reserve price. As a result, we said this benchmark largely reflects the relative value of reserve prices set by the regulator, rather than a market-driven process of bidding.

b) Based on the evidence available to us, the relative prices in the auction are at least as likely to be based on bidders' intrinsic valuations of spectrum as on strategic bidding; and

c) The outcome appears likely to be informative of forward-looking relative spectrum values in the UK, having regard to country-specific circumstances and auction dates.

A8.713 We said the 1800 MHz benchmark does not meet the first of our criteria for Tier 1. We therefore considered the criteria for inclusion in Tier 2.

a) Given the auction constraints described above, we did not consider there is evidence that the relative auction prices reflect bidders' relative intrinsic valuations of the 900 MHz and 800 MHz bands;

b) The outcome is not obviously uninformative of forward-looking relative spectrum values in the UK having regard to country-specific circumstances and auction dates.

A8.714 The 1800 MHz benchmark does not meet the first of our criteria for Tier 2. We therefore considered that the benchmark should be in Tier 3.

Stakeholder responses to the February 2015 consultation

Likelihood of reflecting market value

A8.715 Frontier (p. 13) disagreed with our view of the development of commercial opportunities for LTE900 over the period covering our auctions. Frontier said that it does not provide a justification as to why the price of 900 MHz in the Portuguese auction might understate the forward looking value of 900 MHz spectrum in the UK, relative to 800 MHz.

Our assessment

A8.716 We have assessed stakeholder responses to our view on LTE900 development in more detail in paragraphs A9.36-A9.78. Based on the assessment outlined in Annex 9, our view remains that LTE900 development creates a risk that the 900 MHz value observed in Portugal understates the forward-looking market value of 900 MHz spectrum, although we cannot be sure of the scale or likelihood of this risk.

A8.717 We also note that Portuguese award occurred before WRC-12. As discussed in paragraphs A7.171 to A7.181, we consider that this creates a larger risk that the market values of 800 MHz and 900 MHz in Portugal at the time of the auction are larger overstatements of forward-looking market values. We also consider that this creates a larger risk that the market value of 1800 MHz in Portugal at the time of the auction overstates the forward-looking market value, though we cannot be sure of the scale of this overstatement.

A8.718 In interpreting these evidence points, we consider that overall:

a) There is a larger risk that the price of 800 MHz might understate market value in Portugal at the time of the award. However, there is a larger risk (of larger scale) that the market value at the time of the award overstates forward-looking market value, due to 700 MHz availability developments, as well as a risk that forward-looking market value overstates forward-looking UK market value (of unknown likelihood and scale), due to the fact that Portugal is less urbanised than the UK. On balance, we consider that the 800 MHz price carries a larger risk of larger overstatement of forward-looking UK market value.

b) There price of 900 MHz could understate or overstate market value in Portugal at the time of the award. There is a risk that market value in Portugal at the time of the award understates forward-looking market value, due to LTE900 developments, and a larger risk (of larger scale) that it overstates it, due to 700 MHz availability developments. In addition, there is a risk that forward-looking market value in Portugal overstates forward-looking UK market value, due to the fact that Portugal is less urbanised than the UK. On balance, we consider that the 900 MHz price carries a larger risk of overstatement of forward-looking UK market value of larger scale.

c) For 1800 MHz, we said that binding spectrum caps in the 1800 MHz band create a larger risk that the auction price understates market value in Portugal at the time of the award, though we said we cannot be sure of the scale of this understatement. There is also a risk that market value in Portugal at the time of the award is a smaller understatement of the forward-looking market value of 1800 MHz, due to LTE1800 developments, but a larger risk (of unknown scale) that forward-looking market value is overstated due to 700 MHz availability developments. On balance, we consider that the 1800 MHz price could

understate or overstate forward-looking market value, though we cannot be sure of the likelihood and scale of this risk.

d) The 2.6 GHz price carries a larger risk of understatement of forward-looking market value, for the reasons discussed above.

A8.719 In relation to the 900 MHz / 800 MHz benchmark, our assessments of the individual bands are different to our February 2015 consultation assessment, and reflect our view that the market values of 800 MHz and 900 MHz at the time of the Portuguese award might both be overstated relative to forward-looking market values, due to 700 MHz availability developments. However, as the benchmark measures the *ratio* of these values, our overall interpretation of the Portuguese 900 MHz / 800 MHz benchmark remains the same as in our February 2015 consultation.

A8.720 In relation to the distance method benchmark, our assessment of the 800 MHz band indicates that the distance method benchmark carries a larger risk of larger understatement of forward-looking UK market value. This is partially offset by the larger risk of understatement of the 2.6 GHz band, which implies an overstatement of the benchmark. However, on balance we consider that the distance method benchmark carries a larger risk of understatement of forward-looking UK market value, though we cannot be sure of the scale of this risk. This represents a change from our assessment in the February 2015 consultation. .

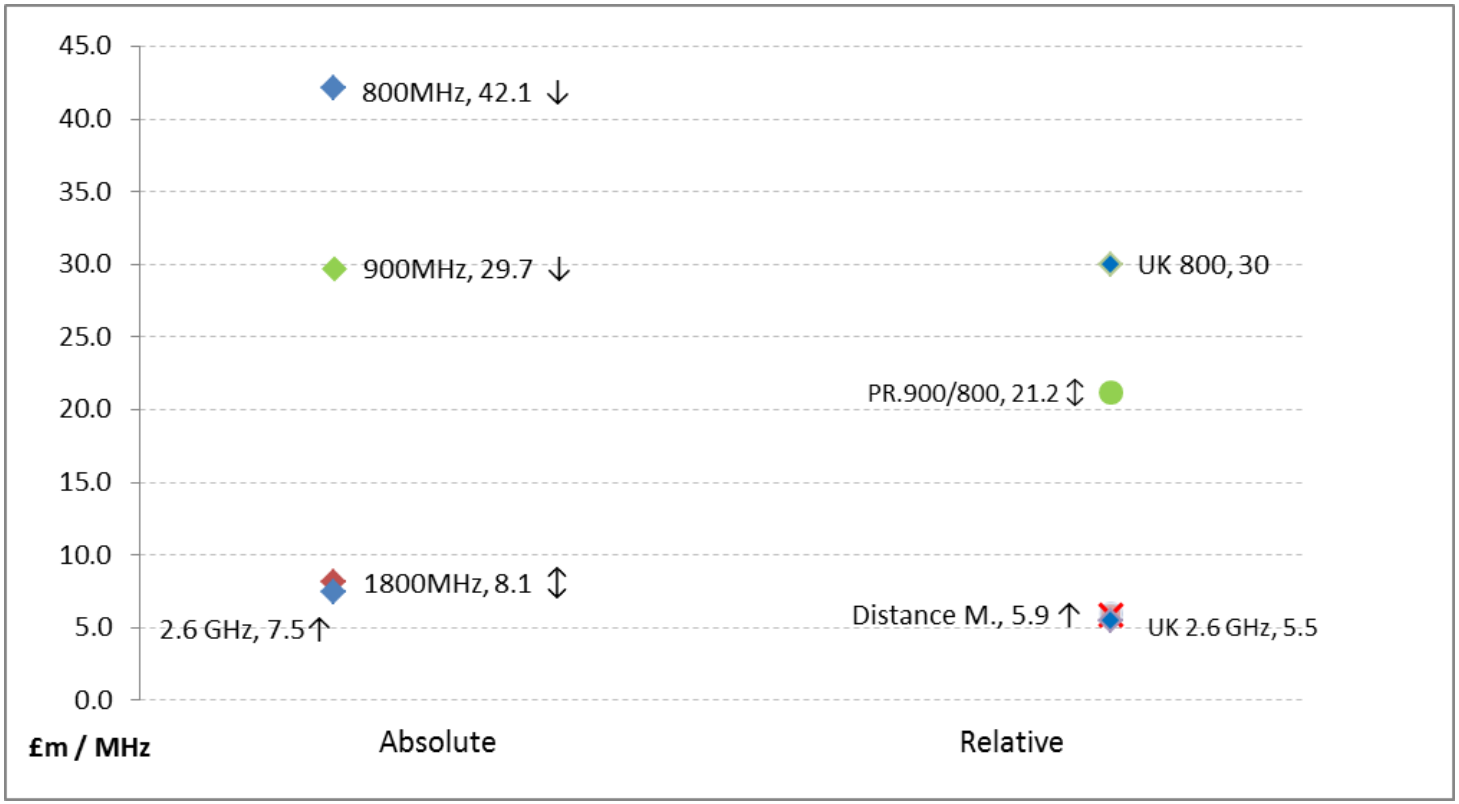
A8.721 The following table summarises the available benchmarks (along with our interpretation of them) from the Portuguese award.

Table A8.11.3: Summary of evidence points from Portugal

	Absolute values (£m / MHz)				Relative value benchmarks[1] (£m / MHz)		Ratios (%)			
	800 MHz	900 MHz	1800 MHz	2.6 GHz	900 MHz / 800 MHz	Distance method	1800 MHz / 800 MHz	1800 MHz / 2.6 GHz	1800 MHz / 900 MHz	2.6 GHz / 800 MHz
Final values	42.1	29.7	8.1	7.5	**21.2** **(71%)**	**5.9** **(2%)**	19%	108%	27%	18%
Tier					**Second**	**Third**				
Assessment of risk	Larger risk of larger over-statement	Larger risk of larger over-statement	Risk of under-statement or over-statement	Larger risk of under-statement	Risk of under or overstatement	Larger risk of under-statement	Larger risk of larger under-statement	Larger risk of over-statement	Larger risk of larger under-statement	Larger risk of larger under-statement

1 Based on the UK 800 MHz value without coverage obligation and net of expected DTT co-existence costs

Figure A8.11.1: 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 A8.12.1: September 2012 multiband auction results

	800 MHz	900 MHz	1800 MHz	2.6 GHz	Unpaired 2.6 GHz	Total Paid[199]	Package mark-up
Total Available	2x30	2x35	2x75	2x70	45	-	--
Cosmote RMT	2x5	2x10	2x25	2x10	-	€179.9m	4%
Orange	2x10	2x10	2x20	2x20	-	€227.1m	5%
RCS & RDS	-	2x5	-	-	-	€40m	0%
Vodafone	2x10	2x10	2x30	-	15	€228.5m	2%
2K Telecom	-	-	-	-	30	€6.6m	10%
Unsold	2x5	-	-	2x40	-	-	-

Table A8.12.2: 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.[200]	Only the combined 800 MHz & 900 MHz cap was binding, and only for Orange and Vodafone.
Reserve prices	Total revenue in the auction was 3% higher than the sum of reserve prices of all lots sold .	
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.[201]	

[199] http://www.ancom.org.ro/en/uploads/links_files/Rezultate_licitatie_-_final_EN.pdf
[200] See page 60: http://www.ancom.org.ro/en/uploads/forms_files/terms_of_reference1331893175.pdf
[201] Pages 26-27: http://www.ancom.org.ro/en/uploads/forms_files/terms_of_reference1331893175.pdf

Our position in the October 2013 consultation

A8.722 In our October 2013 consultation, we noted that spectrum in all bands sold at or close to reserve price.

A8.723 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 to the October 2013 consultation

Whether award outcomes are likely to reflect market value

Cross-band comments

A8.724 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

A8.725 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.

A8.726 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

A8.727 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.

A8.728 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

A8.729 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.

A8.730 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.

A8.731 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

A8.732 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.

A8.733 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

A8.734 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.

A8.735 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.

A8.736 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.

A8.737 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.

A8.738 Vodafone (Annex 4, page 64) argued that "auction outcomes in Romania are of very limited use in informing the market value in the UK".

A8.739 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 in the August 2014 consultation

Whether award outcomes are likely to reflect market value

Cross-band comments

A8.740 We 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

A8.741 The fact that 900 MHz spectrum sold at reserve price suggested that the reserve price might overstate market value. However, we also noted that the sub-1 GHz cap (on 800 MHz & 900 MHz together) was binding on Vodafone and Orange. In the absence of this cap we said it is possible that both operators would have competed for additional lots of 900 MHz spectrum, pushing prices above reserve.

A8.742 On balance, we considered there to be a risk that the 900 MHz auction price overstates market value in Romania (of an unknown extent and scale).

1800 MHz

A8.743 The fact that all 1800 MHz spectrum sold at reserve prices in the absence of any spectrum caps suggested that reserve prices were set above market value.

A8.744 Overall, therefore, we considered 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

A8.745 The fact that there was 2x5 MHz of unsold 800 MHz spectrum at reserve price suggested that the reserve price might overstate market value. The extent and scale of this risk is unknown.

2.6 GHz

A8.746 In the 2.6 GHz band there was significant unsold spectrum at reserve prices, and no bidder won up to its spectrum cap. Given that all bidders could have purchased more 2.6 GHz lots at reserve price but chose not to, we considered 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

A8.747 In paragraphs A7.62 to A7.74 of the August 2014 consultation, we noted 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 implied 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. We said 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.

A8.748 In paragraphs A7.75-A7.78 of the August 2014 consultation, we also considered that the value of sub-1 GHz spectrum may be higher in countries which are less urbanised than the UK. We said 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.

A8.749 Regarding Telefónica's wider concerns with Romania's suitability as a benchmark, we considered 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 were mindful of this when assessing the tier in which to categorise the Romanian evidence points, as explained in paragraph A8.487 below, and we interpreted the evidence accordingly.

Relative benchmarks

A8.750 There was 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 noted that the absolute 800 MHz, 900 MHz, 1800 MHz and 2.6 GHz benchmarks carry risks of overstating market value in Romania. We said 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.

A8.751 We placed the 900 MHz / 800 MHz paired ratio and the distance method benchmark in our third tier of evidence.

a) As part of our tiering assessment, we considered factors relating to the circumstances of awards which may represent a set of circumstances which were so different from circumstances in the UK today in terms of the drivers of spectrum value that it is appropriate to recognise this in the choice of tier. In Romania, the price of the 900 MHz band was higher than the price of the 800 MHz band. This reflected the relativity of the reserve prices that were set by the regulator. Moreover, despite having a lower reserve price, there was unsold 800 MHz spectrum in Romania, but no unsold 900 MHz spectrum. We said this indicates that the higher price of 900 MHz compared to 800 MHz was driven to a large extent by the much greater importance of 2G in Romania compared with the UK. We regarded this as so different to the key drivers of the relative value of these bands in the UK that we considered Romania to be a third-tier benchmark for 900 MHz.

b) We considered that the distance method benchmark provides very little information about the value of 1800 MHz spectrum in the UK. In particular, we noted that no spectrum in any band sold significantly above reserve price, and there was some unsold spectrum in 800 MHz and 2x40 MHz of unsold 2.6 GHz – i.e. the two other bands that are used to generate the distance method benchmark for 1800 MHz.

Stakeholder responses to the August 2014 and February 2015 consultations

A8.752 We summarise below stakeholders' responses to the August 2014 consultation. Stakeholders did not make any further comment on this benchmark country in response to the February 2015 consultation.

Whether award outcomes are likely to reflect market value

Cross-band comments

A8.753 Telefónica (p. 52) said that it was deeply sceptical about the merits of converting the prices of Romanian lots from Euros to Leu in order to derive benchmarks. It said that "we suspect these changes have the impact of grossly exaggerating the absolute value of bands in Romania and distorting relative values".

Likelihood of reflecting UK market value

A8.754 AM&A (p. 13) disagreed with our decision to downgrade Romania on the basis of the greater importance of 2G. AM&A said "we do not doubt that Romania has a larger proportion of 2G subscribers than the UK (although Ofcom does not present any evidence for this). However, no two European mobile markets are the same; indeed they differ across a whole range of dimensions…it appears odd that Ofcom includes this criterion – especially when it leads only to the downgrading of Romania – when there are numerous other factors that make the value of spectrum in other countries different from that in the UK".

A8.755 H3G (pp. 25-26) argued that the 900 MHz benchmark from Romania should be accorded the same status as Portugal and Spain and more weight than Denmark. It noted that:

a) 2G is also much more important in Portugal than in the UK;

b) There were "obvious contenders" for 900 MHz spectrum in Portugal and Spain;

c) The entire 900 MHz band was auctioned in Romania, whereas in Portugal and Spain just two and one blocks respectively were available; and

d) The 900 MHz and 800 MHz prices in Spain are taken from different auctions.

Our assessment

Whether award outcomes are likely to reflect market value

Cross-band comments

A8.756 NRA documents from Romania list reserve prices in Euros. However our PPP conversion factors are based on Leu, which necessitates conversion to Leu in order to derive UK-equivalent prices. We do not consider there to be any reason why this adjustment would necessarily exaggerate absolute auction prices in Romania. Relative value benchmarks, including for Romania, are not dependent on exchange rates and reflect relative prices in the currency used in the auction.

A8.757 We received no comments on our assessments of whether award outcomes are likely to reflect market value. As noted in paragraph A8.742 above, our view in August 2014 was that on balance there was a risk that the 900 MHz auction price

overstates market value in Romania. Our view now is that, in light of the considerations set out in paragraph A8.741 (sub-1 GHz cap and reserve price), there is a risk that this auction price understates or overstates market value in Romania, although we cannot be sure of the likelihood or scale of this risk. We remain of the view that the 900 MHz / 800 MHz benchmark risks understating or overstating UK market value, although we cannot be sure of the likelihood or scale of this risk. With the exception of this point, our view remains as set out in paragraphs A8.740 – A8.746 above.

Likelihood of reflecting UK market value

A8.758 In paragraph A8.747 above, we explained that the evidence suggests that 2G is the key driver of the value of 900 MHz spectrum in Romania.

A8.759 We do not have similar evidence suggesting that 2G is the key driver of 900 MHz values in other benchmark countries. In Portugal, the reserve price for 900 MHz was set below the 800 MHz reserve price (unlike in Romania). We also note that 3G penetration in Portugal in the year of the auction was significantly higher than in Romania, and indeed also higher than in the UK, suggesting that 2G services were much less important in Portugal than Romania.

A8.760 As regards the other differences between Romania and Spain / Portugal that H3G highlighted, we have considered these factors as part of our interpretation of the Spanish and Portuguese benchmarks.

A8.761 As discussed in paragraphs A7.158 – A7.160, our view remains that the fact that Romania is much less urbanised than the UK creates a risk that the market values of 800 MHz and 900 MHz spectrum in Romania are overstated relative to UK market values, though we cannot be sure of the likelihood and scale of this risk.

Relative benchmarks

A8.762 There is sufficient price information from the Romanian auction to calculate a 900 MHz / 800 MHz paired ratio and a distance method benchmark.

Assessment of risk

A8.763 In interpreting these evidence points, our view remains 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, though we cannot be sure of the likelihood and scale of this risk.

A8.764 We also consider that the 2.6 GHz / 800 MHz ratio carries a risk of understating or overstating the relative market value in Romania, though we cannot be sure of the likelihood and scale of this risk.

Tiering

A8.765 Considering the criteria for inclusion in Tier 1:

a) Both benchmarks largely reflect the relative value of reserve prices set by the regulator, rather than a market-driven process of bidding.

b) Based on the evidence available to us, the relative prices in the auction are at least as likely to be based on bidders' intrinsic valuations of spectrum as on strategic bidding; and

c) In the case of 900 MHz, we consider that evidence that 2G was the key driver of the value of this band in Romania means that this benchmark is less likely to be informative of forward-looking relative spectrum values in the UK.

A8.766 Neither benchmark meets the first of our criteria for Tier 1, while the 900 MHz benchmark also does not meet the third criterion.

A8.767 We next consider the 900 MHz benchmark against the criteria for inclusion in Tier 2:

a) There is some evidence that the relative auction prices reflect bidders' relative intrinsic valuations of the 900 MHz and 800 MHz bands in that there was unsold 800 MHz spectrum at reserve price while all 900 MHz spectrum was sold at reserve price; and

b) The 900 MHz benchmark is obviously uninformative of forward-looking relative spectrum values in the UK due to the evidence that 2G was the key driver of 900 MHz value in Romania.

A8.768 As the 900 MHz benchmark does not meet the second of our criteria for Tier 2, we therefore consider that the benchmark should be in Tier 3.

A8.769 Considering the 1800 MHz benchmark against the criteria for inclusion in Tier 2:

a) Given the fact that all spectrum sold close to reserve price, and there was unsold spectrum in the 800 MHz and 2.6 GHz bands, we do not consider that there is evidence that the relative auction prices reflect bidders' relative intrinsic valuations of the spectrum bands used in the 1800 MHz distance method benchmark;

b) The 1800 MHz benchmark is not obviously uninformative of forward-looking relative spectrum values in the UK having regard to country-specific circumstances and auction dates.

A8.770 As the 1800 MHz benchmark does not meet the first of our criteria for Tier 2, we therefore consider that the benchmark should be in Tier 3.

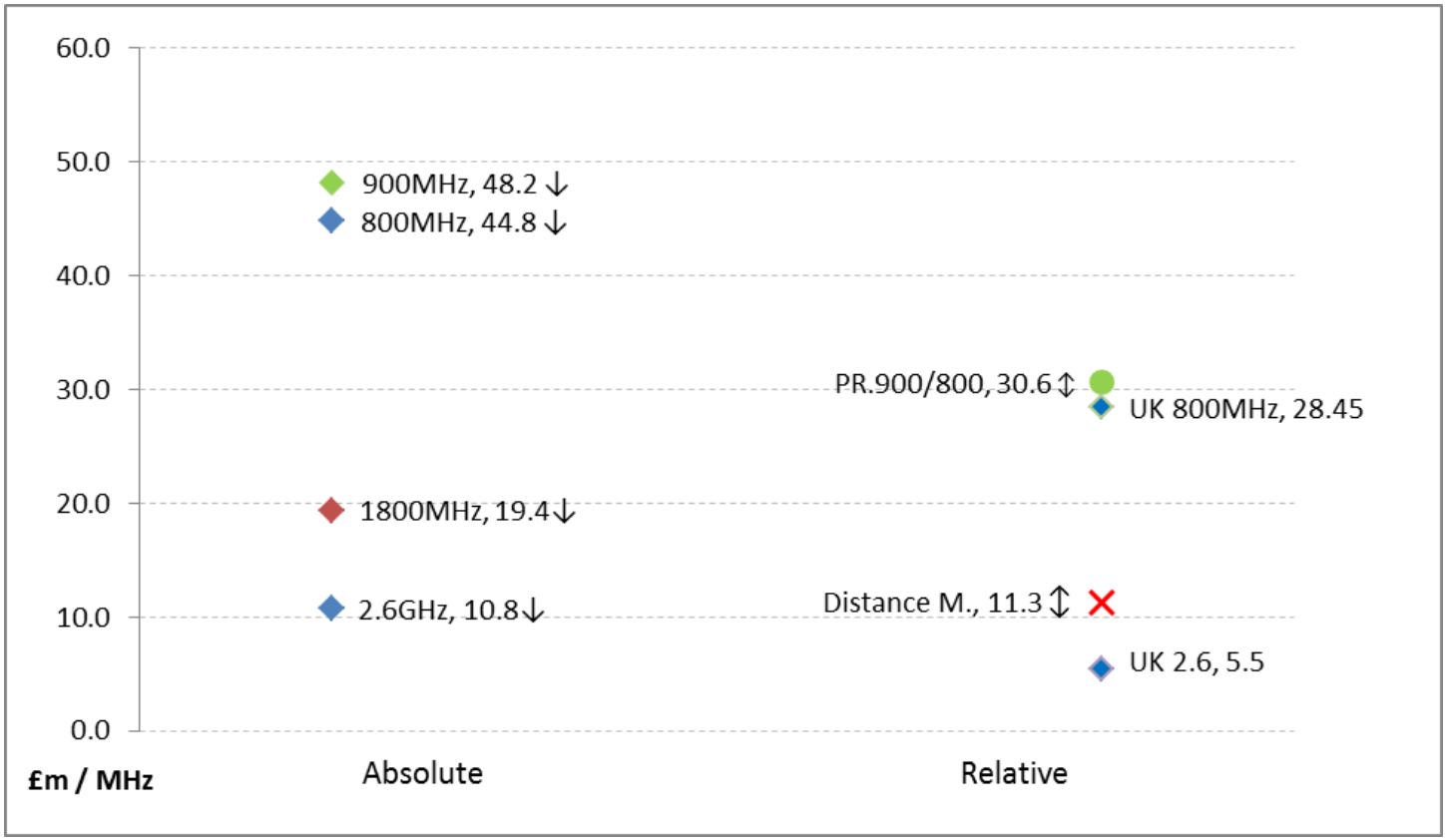
A8.771 The following table summarises the available benchmarks (along with our interpretation of them) from the Romanian award. We note that the first, third and fourth of the ratios presented are each based on a value at larger risk of overstatement, divided by a value at risk of overstatement. In such cases we would typically expect the ratio to be at larger risk of overstatement overall. However, on balance we consider that these ratios have a risk of understatement or overstatement, having regard to the potential sources of overstatement in the 800 MHz and 900 MHz prices in Romania set out above.

Table A8.12.3: Summary of evidence points from Romania

	Absolute values (£m / MHz)				Relative value benchmarks[1] (£m / MHz)		Ratios (%)			
	800 MHz	900 MHz	1800 MHz	2.6 GHz	900 MHz / 800 MHz	Distance method	1800 MHz / 800 MHz	1800 MHz / 2.6 GHz	1800 MHz / 900 MHz	2.6 GHz / 800 MHz
Final values	44.8	48.2	19.4	10.8	**30.6** **(108%)**	**11.3** **(25%)**	43%	180%	40%	24%
Tier					**Third**	**Third**				
Assessment of risk	Risk of over-statement	Risk of over-statement	Larger risk of over-statement	Larger risk of over-statement	**Risk of under or over-statement**	**Risk of under of over-statement**	Risk of under of over-statement	Risk of under or over-statement	Risk of under of over-statement	Risk of under or over-statement

1 Based on the UK 800 MHz value with coverage obligation and net of expected DTT co-existence costs

Figure A8.12.1: 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.

Table A8.13.1: 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 A8.13.2: December 2013 multiband auction price mark-ups

	Total paid	Total paid in primary stage	Total reserve price	% mark-up
Orange	€56.1m	€46.7m	€46.7m	0%
Slovak Telekom	€60.8m	€60.8m	€50.8m	20%
Telefónica	€40.3m	€38.3m	€38.3m	0%
SWAN	€6.6m	€6.6m	€6.6m	0%

Table A8.13.3: 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[202]	The three incumbents' existing 1800 MHz holdings of 2x15.2 MHz each prevented them from acquiring 2x5 MHz or more in the auction. The auction reserved 2x15 MHz of 1800 MHz spectrum for a new entrant to the mobile industry and this was purchased by SWAN.
Unsold spectrum?	None	N/A

[202] TUSR, invitation to submit bids, August 2013: http://www.teleoff.gov.sk/data/files/35571.pdf

Reserve price	Three out of four winners paid the reserve price for their packages. Total auction revenue from the primary stage was 7% above the sum of reserve prices.
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/s 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

A8.772 This auction concluded after the publication of our October 2013 consultation document.

Stakeholder responses to the May 2014 update note

Whether award outcomes are likely to reflect market value

Cross-band comments

A8.773 Telefónica (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

A8.774 AM&A (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.

A8.775 Telefónica (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.

A8.776 Vodafone (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

A8.777 AM&A (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 assignment 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.

A8.778 Telefónica (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

A8.779 AM&A (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. It 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.

A8.780 Telefónica (page 23) argued that bidding in this band was competitive, as all lots sold for prices above reserve.

Likelihood of reflecting UK market value

A8.781 Telefónica (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.

A8.782 Vodafone (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 in the August 2014 consultation

Whether award outcomes are likely to reflect market value

A8.783 We did not have bid data or band-specific price information for this auction.

A8.784 We considered that reserve prices can be a reasonable proxy for the relative prices of different bands in the Slovak auction, since:

a) Total auction revenue was only about 15% above reserve prices.

b) Auction data published by the Slovak NRA showed that total revenue excluding revenue from the assignment stage (i.e. from the base prices) was only 7%

above reserve prices.[203] We considered 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.[204] For example, LRPs in the UK and Austrian auctions are calculated without reference to the outcome of the assignment stage.

c) We also noted that the base prices paid by three of the four winners were the reserve price of their winning packages.

d) The operator that paid a base price in excess of the reserve price was Slovak Telecom. We did not consider that we have a reliable basis to attribute this amount above the reserve price between bands (although the 800 MHz caps provided a reason for this amount to be related to 2.6 GHz. It was unclear to us how to attribute the amount reliably between the paired and unpaired 2.6 GHz bands).

1800 MHz

A8.785 We said 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.

A8.786 We said 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).

A8.787 We considered that the reserve price could understate or overstate market value but that the extent and scale of the risk was unknown.

800 MHz

A8.788 We considered that it was 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 suggested 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.

A8.789 We considered that the reserve price might understate or overstate market value, but that the extent and scale of any understatement or overstatement was unknown.

2.6 GHz

A8.790 We said that some of the excess above reserve price in Slovak Telecom's base price may be attributable to the paired 2.6 GHz band. We did not consider we have a reliable basis to quantify the attribution and therefore we proposed to use the reserve price for this band, as explained above. However, this suggested there may

[203] See: http://www.teleoff.gov.sk/index.php?ID=8241 (English translation unavailable)
[204] 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 co-existence costs basis.

be a larger risk of understatement, but we considered the scale of this understatement is unknown.

Likelihood of reflecting UK market value

A8.791 As discussed in paragraphs A7.62 to A7.74 of the August 2014 consultation, we did not consider that there were strong reasons, in principle, to expect a clear relationship between demand for 2G services and spectrum value. In addition, the available evidence did not provide strong grounds for considering such a relationship to exist. In our assessment of the Slovakian benchmarks, we did 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.

A8.792 In paragraphs A7.75-A7.78 of the August 2014 consultation, we also considered that the value of sub-1 GHz spectrum may be higher in countries which are less urbanised than the UK. We said 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.

A8.793 We considered 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

A8.794 In summary, we derived benchmarks for the Slovak Republic as follows:

a) We used the reserve prices as a basis for deriving absolute values of respectively the 800 MHz, 900 MHz, 1800 MHz and 2.6 GHz bands.

b) We added the present value of annual fees set by the Slovak NRA:[205]

i) Euros 14,000 per MHz for sub-1 GHz spectrum; and

ii) Euros 10,800 per MHz for spectrum above 1 GHz.

c) We then derived UK equivalent absolute values using the benchmarking methodology set out in Annex 7.

A8.795 To derive relative benchmarks, we used the paired ratios and Y/X ratio implied by Slovak absolute values in conjunction with the UK values of 800 MHz (without coverage obligation and net of DTT co-existence costs) and 2.6 GHz spectrum.

A8.796 In interpreting these evidence points, we considered that:

a) Overall, the 1800 MHz value carries a larger risk of understating UK market value (of unknown scale);

b) The absolute 800 MHz value risks overstating or understating market value (with unknown likelihood and scale); and

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

c) The 2.6 GHz value carries a larger risk of understating UK market value (of unknown scale).

A8.797 On balance, we considered that the 1800 MHz distance method benchmark risks understating the UK market value of 1800 MHz, but the extent and scale of this risk are unknown.

A8.798 We considered that the Slovak Republic 1800 MHz distance method benchmark provided very little information about the value of 1800 MHz spectrum in the UK, and we placed it in the third tier of evidence. In particular, we noted that incumbents were unable to bid on the only block which was large enough to be suitable for LTE.

Stakeholder responses to the August 2014 and February 2015 consultations

A8.799 We summarise below stakeholders' responses to the August 2014 consultation. Stakeholders did not make any further comment on this benchmark country in response to the February 2015 consultation.

Whether award outcomes are likely to reflect market value

1800 MHz

A8.800 AM&A (Annex C9) noted that we considered a number of reasons why the 1800 MHz and 800 MHz prices in Slovakia may risk overstating or understating market value in each case. We also suggested the 2.6 GHz value could have a risk of understating market value, but by an unknown amount. They said that "given this inconclusive evidence we do not agree with Ofcom's assessment that the distance method result will necessarily understate market value".

Likelihood of reflecting market value

A8.801 AM&A (p. 14) disagreed with our view that the size of 1800 MHz lots in the auction (which we said were too small for LTE) should be used to support the Slovak Republic's third tier categorisation. AM&A noted that ALF spectrum is used for GSM, UMTS and LTE both in the UK and across Europe, and said that "given that Ofcom does not provide evidence that one technology is more profitable than others, it does not necessarily follow that offering spectrum in small lot sizes will significantly influence the market value".

Our assessment

Whether award outcomes are likely to reflect market value

1800 MHz

A8.802 As noted in paragraphs A8.785 to A8.787 above, our view in August 2014 was that there was a risk that the 1800 MHz reserve price understates or overstates market value in Slovakia. However, although it is possible that the reserve price for 1800 MHz was set above market value, we consider that the reservation of spectrum for an entrant, the fragmentation of the remaining spectrum, and the potential for there to be obvious winners for this spectrum are all consistent with the reserve price being an understatement of market value. Our view now is that, on balance, there is a risk that this 1800 MHz reserve price understates market value in Slovakia, although we cannot be sure of the likelihood or scale of this risk.

800 MHz

A8.803 As noted in paragraph A8.789 above, our view in August 2014 was that there was a risk that the 800 MHz auction price understates or overstates market value in Slovakia. However, although it is possible that the reserve price for 800 MHz was set above market value, all three incumbents won spectrum up to the allowed cap in this band. Our view now is that, on balance, there is a risk that this auction price understates market value in Slovakia, although we cannot be sure of the likelihood or scale of this risk.

2.6 GHz

A8.804 We received no comments on our assessment of the 2.6 GHz band and we remain of the view that the 2.6 GHz reserve price in Slovakia is at larger risk of understating market value, although we cannot be sure of the scale of potential understatement.

Likelihood of reflecting UK market value

A8.805 For the purposes of ALF we are estimating the value of incremental 1800 MHz spectrum. Because operators have much less need for additional GSM capacity, we remain of the view that 1800 MHz spectrum is more valuable if it can be deployed for LTE.[206] The fragmented nature of 1800 MHz spectrum that was available to incumbents in this award makes it unsuitable for LTE provision. As in August 2014, we consider that the 1800 MHz value in Slovakia is at larger risk of understating UK market value. Our view now is that this of sufficient importance to imply a larger risk of larger understatement.

A8.806 As discussed in paragraphs A7.158-A7.160, our view remains that the fact that the Slovak Republic is less urbanised than the UK creates a risk that the market value of 800 MHz spectrum in the Slovak Republic is overstated relative to UK market values, though we cannot be sure of the likelihood and scale of this risk. As discussed in paragraph A8.803 above, we consider that the 800 MHz auction price understates market value in Slovakia. Taking these two points together, we consider that the 800 MHz auction price in Slovakia risks understating or overstating the UK market value of 800 MHz, and we cannot be sure of the likelihood or scale of this risk.

Relative benchmarks

A8.807 As set out above, we now consider that the reasons for considering the 1800 MHz reserve price is at risk of understating UK market value are stronger than our proposed assessment in the August 2014 consultation. We consider that the 800 MHz reserve price should be seen as a risk in both directions. We recognise that, depending on the scale of potential understatement of 1800 MHz, compared to the scale of potential understatement of the 2.6 GHz price, it is possible in principle, as AM&A suggested, for the 1800 MHz distance method benchmark to be overstated. However, taking the evidence in the round, we remain of the view that the 1800

[206] We note that AM&A itself said in its response to our May 2014 update note (p. 18) that the fragmented nature of the 1800MHz lots won by existing operators is likely to have negatively impacted the value of the spectrum, commenting that "although the existing operators could acquire lots to supplement their existing holdings, it was not possible to acquire large contiguous blocks suitable for LTE (at least prior to the commercial availability of intra-band carrier aggregation)."

MHz distance method benchmark risks understating UK market value, although we cannot be sure of the likelihood or scale of this risk.

Assessment of risk

A8.808 In interpreting these evidence points, our view is that:

a) Overall, the 1800 MHz value carries a larger risk of larger understatement of UK market value;

b) The 800 MHz value risks understating or overstating market value, though we cannot be sure of the likelihood and scale of this risk; and

c) The 2.6 GHz value carries a larger risk of understating UK market value, though we cannot be sure of the scale of this understatement.

A8.809 On balance, we consider that the distance method benchmark risks understating the UK market value of 1800 MHz, although we cannot be sure of the likelihood and scale of this risk.

A8.810 We consider that the 2.6 GHz / 800 MHz ratio carries a larger risk of understating relative market value in Slovakia, though we cannot be sure of the scale of this risk.

Tiering

A8.811 Considering the criteria for inclusion in Tier 1:

a) Three of the four winning packages were sold at the reserve price, and we use the reserve prices for all bands in deriving absolute values, so the benchmarks reflect the relative value of reserve prices set by the regulator, rather than a market-driven process of bidding.

b) Based on the evidence available to us, the relative prices in the auction are at least as likely to be based on bidders' intrinsic valuations of spectrum as on strategic bidding; and

c) Due to the lot structure for 1800 MHz spectrum in the auction and the tight spectrum caps (preventing the incumbents from bidding for a block large enough to be suitable for LTE), we consider that the 1800 MHz benchmark is less likely to be informative of forward-looking relative spectrum values in the UK.

A8.812 The benchmark does not meet the first or third of our criteria for Tier 1. We therefore consider the criteria for inclusion in Tier 2:

a) The award does not provide evidence that operators had a stronger demand for some bands than for others at these relative prices, so we do not consider there is evidence that the relative auction prices reflect bidders' relative intrinsic valuations of the bands.

b) The 1800 MHz benchmark is obviously uninformative of forward-looking relative spectrum values in the UK (for the reasons noted above in relation to the third criterion for Tier 1).

A8.813 We therefore consider that the benchmark should be in Tier 3.

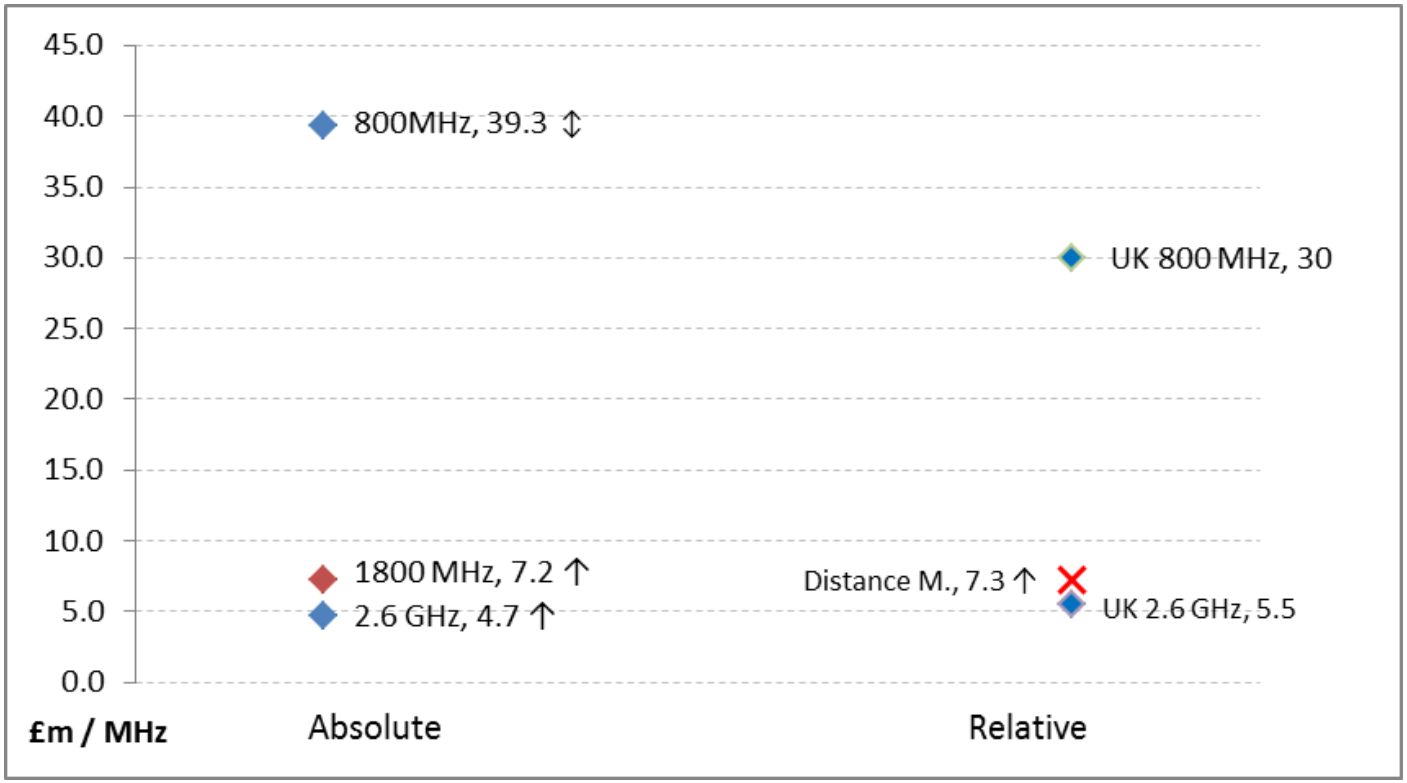
A8.814 The following table summarises the available benchmarks (along with our interpretation of them) from the Slovak award.

Table A8.13.4: Summary of evidence points from the Slovak Republic

	Absolute values (£m / MHz)			Relative value benchmarks[1] (£m / MHz)	Ratios (%)		
	800 MHz	1800 MHz	2.6 GHz	Distance method	1800 MHz / 800 MHz	1800 MHz / 2.6 GHz	2.6 GHz / 800 MHz
Final values	39.3	7.2	4.7	**7.3** **(7%)**	18%	153%	12%
Tier				**Third**			
Assessment of risk	Risk of under-statement or over-statement	Larger risk of larger under-statement	Larger risk of under-statement	**Risk of understatement**	Larger risk of larger under-statement	Risk of under-statement	Larger risk of under-statement

1 Based on the UK 800 MHz value without coverage obligation and net of expected DTT co-existence costs

Figure A8.13.1: 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 A8.14.1: 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[207]	Package mark-up
Total Available	2x30	2x35	2x75	2x5	20	2x70	50	-	-
Si.Mobil	2x10	2x15	2x30	-	20	2x35	25	€63.9m	82%
Telekom Slovenije	2x10	2x15	2x25	-		2x35	25	€64.2m	51%
Tusmobil	2x10	2x5	2x10	-	-	-	-	€20.7m	2%
Unsold	-	-	2x10	2x5	-	-	-	-	-

Table A8.14.2: 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.

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

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 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
Reserve prices	Si.Mobil and Telekom Slovenije acquired spectrum materially above reserve price. Tusmobil acquired spectrum marginally above reserve price.
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

A8.815 This auction concluded after the publication of our October 2013 consultation document. In our May 2014 update[208] we noted that we were considering whether new information on further European spectrum auctions, including the Slovenian auction, provided relevant evidence for the purposes of estimating the market value of the 900 MHz and 1800 MHz licences in the UK. We invited stakeholders to comment on this new information.

Stakeholder responses to the May 2014 update note

A8.816 AM&A (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.

A8.817 Telefónica (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 in the August 2014 consultation

A8.818 We said that it is generally not possible to observe band-specific price information for CCAs without access to the underlying bids data and we agreed with AM&A and Telefónica that this makes it difficult to construct reliable benchmarks for the Slovenian auction. In particular, we said we cannot infer any accurate final price information from reserve prices in Slovenia. As discussed in paragraphs A7.13 to A7.19 of the August 2014 consultation, we also did not consider that the indicative prices proposed by Telefónica and Vodafone were reliable estimates of band-specific prices.

[208] Update on European auctions since Ofcom's consultation on Annual licence fees for 900 MHz and 1800 MHz spectrum, May 2014; http://stakeholders.ofcom.org.uk/binaries/consultations/900-1800-mhz-fees/update/2014-05_ALF_Update_Note_on_Austria.pdf

A8.819 We attempted to obtain estimates of band-specific prices for Slovenia using the LRP methodology that was employed in relation to Austria but we were not able to do so. As a result, we did not propose to derive benchmarks for the Slovenian auction.

Stakeholder responses to the August 2014 and February 2015 consultations

A8.820 In response to our August 2014 and February 2015 consultations, we received no comments from stakeholders regarding our proposal not to derive benchmarks for the Slovenian auction.

Our assessment

A8.821 We re-contacted AKOS in May 2015 and, again, we were unable to obtain the bid data.

A8.822 We have maintained our position as set out in the August 2014 and February 2015 consultations. We do not derive benchmarks from 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 A8.15.1: May 2011 900 MHz and 1800 MHz award results

	900 MHz	1800 MHz	Total Paid[209]
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 A8.15.2: 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.

[209] 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 A8.15.3: July 2011 multiband auction results

	800 MHz	900 MHz	2.6 GHz	2.6 GHz unpaired	Total Paid[210]
Total Available	2x30	2x10	2x70	50	-
Movistar	2x10	2x5	2x20	-	€668.3m
Vodafone	2x10	-	2x20	-	€517.6m
Orange	2x10	-	2x20	-	€437m
Regional Wholesalers	-	-	2x10	-	€24.01m
Unsold	-	2x5	*See table*	50	-
Reserve price	€1.02bn	€169m	€69.8m	-	-
Total auction revenue	€1.3bn	€169m	€172.7m	-	-
% mark-up	28%	0%	148%	-	-

Table A8.15.4: 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.
Reserve prices	800 MHz and 2.6 GHz spectrum sold materially above reserve price.	
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.[211]	

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

[211] 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.[212]

Table A8.15.5: November 2011 re-auction results

	900 MHz	2.6 GHz unpaired	Price Paid[213]
Total Available	2x5	50	-
Movistar	2x5	-	€169m
Vodafone	-	20	€10.4m
Orange	-	10	€5.2m
Regional Wholesalers	-	10	€0.8m
Unsold	-	10	-
Reserve price	€169m	€15.8m	-
Total auction revenue	€169m	€16.4m	-
% mark-up	0%	3.8%	-

Table A8.15.6: 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 allowed 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.[214]	
Reserve prices	The 900 MHz lot sold at reserve price.	

Our position in the October 2013 consultation

A8.823 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.

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

A8.824 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.

A8.825 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 to the October 2013 consultation

Whether award outcomes are likely to reflect market value

900 MHz

A8.826 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.

A8.827 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.

A8.828 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

A8.829 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.

A8.830 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

A8.831 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 .

A8.832 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

A8.833 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 (by [✂]. 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 in the August 2014 consultation

Whether award outcomes are likely to reflect market value

900 MHz

A8.834 We noted Telefónica's comment about the inaccurate spectrum allocations reported in the table on page 111 of the October 2013 consultation; Table A8.14.3 in the August 2014 consultation (and above) reported accurate lots won by Movistar and Orange.

A8.835 We considered 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 considered that, for Spain, the July 2011 and November 2011 auctions are likely to provide more information about market value and so we considered these auctions when deriving benchmark estimates for the 900 MHz lump-sum value from Spain.

A8.836 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 considered 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

A8.837 We considered 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 did not consider this benchmark when deriving our estimate of the 1800 MHz lump-sum value.

800 MHz[215]

A8.838 All the five 800 MHz spectrum lots unaffected by DTT co-existence costs sold above reserve price in the July 2011 auction.

A8.839 We said 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 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.

A8.840 Overall, we considered that the absolute 800 MHz benchmark is likely to reflect market value in Spain.

Likelihood of reflecting UK market value

A8.841 As discussed in paragraphs A7.62 to A7.74 of the August 2014 consultation, we did 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 did not provide strong grounds for considering either such relationship to exist. In our assessment of the Spanish benchmarks, we did 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

A8.842 We derived 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 used the absolute 900 MHz benchmark from the November 2011 auction as a cross-check.

A8.843 In interpreting these evidence points, we considered 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 considered that the 900 MHz / 800 MHz paired ratio carries a larger risk of overstating UK market value, but of an unknown scale.

A8.844 We placed the 900 MHz / 800 MHz paired ratio in the second tier of evidence. We noted that the benchmark relates to the price of 800 MHz in the July 2011 auction, and the reserve price of 900 MHz spectrum in the November 2011 auction. We also noted that in each of the July 2011 and November 2011 auctions the reserve price of 900 MHz was the same and only 2x5 MHz of spectrum was sold at this price (2x5 MHz was unsold in the former). Whilst there is a case for the benchmark to be categorised in the third tier, on balance, we considered that it is more informative than other benchmarks we have included in the third tier.

[215] 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.

Stakeholder responses to the August 2014 consultation

Whether award outcomes are likely to reflect market value

900 MHz

A8.845 AM&A (Annex C10) noted that just one 2x5 MHz lot of 900 MHz spectrum was sold in the November 2011 auction. They said that, depending on the value that operators assigned to having contiguous spectrum lots of greater than 5 MHz, it is possible (although probably less likely) that the 900 MHz / 800 MHz paired ratio could understate market value.

2.6 GHz

A8.846 AM&A (p. 25) argued that the Spanish 2.6 GHz price should be calculated using an average of lots which is weighted by size and population (rather than a straight average). It said that this lowers the absolute 2.6 GHz price by £1.4m / MHz to £1.9m / MHz.

Likelihood of reflecting UK market value

A8.847 Frontier (p. 17) considered the 900 MHz / 800 MHz paired ratio from Spain to be a first tier evidence point, because this measure of relative value is likely to control for country-specific factors when comparing Spain to the UK.

Our assessment in the February 2015 consultation

Whether award outcomes are likely to reflect market value

900 MHz

A8.848 In the November 2011 auction there was one 2x5 MHz lot of 900 MHz available. As this lot was adjacent to Telefónica and Vodafone's existing holdings, we considered that both operators had the opportunity to extend their contiguous spectrum block by acquiring this lot. We said Vodafone's decision not to bid for this spectrum may therefore indicate that its value for contiguous 900 MHz spectrum was less than reserve price.

A8.849 In view of this, we maintained our assessment that the Spanish auction price for 900 MHz price carries a larger risk of overstating market value in Spain, though we said we cannot be sure of the scale of overstatement.

1800 MHz

A8.850 We received no comments on our assessment of the 1800 MHz band and our view remained as set out above in paragraph A8.837.

800 MHz

A8.851 We received no comments on our assessment of the 800 MHz band and our view remained as set out above in paragraphs A8.838-A8.840.

2.6 GHz

A8.852 As discussed in paragraph A7.26, we agreed with a weighted average approach to calculating benchmarks, and we recalculated the 2.6 GHz price accordingly. We noted that, as we did not include a distance method benchmark for Spain, this only affected our quantitative analysis to the extent that it changed the value of our 2.6 GHz proxy (which is calculated using information from the Spanish 2.6 GHz award). We said that the impact of this change on the 2.6 GHz proxy is itself very small.

A8.853 Lots in the 2.6 GHz band sold significantly above reserve price. We considered that there was competition among MNOs to create a 2x20 MHz block of spectrum using national licences, and that this pushed prices above reserve. In addition, the total auction cap was not binding for any MNO. Overall, our view was that the price of 2.6 GHz likely reflects market value in Spain.

Likelihood of reflecting UK market value

A8.854 We agreed with Frontier that Spain is a comparable country to the UK in terms of characteristics that might affect the relative value of 900 MHz and 800 MHz spectrum.

A8.855 However, as discussed in paragraph A7.163, we considered that the timing of the Spanish award means that the 900 MHz value in Spain at the time of the award risks understating the forward-looking market value of 900 MHz spectrum in the UK, although we said we cannot be sure of the scale or likelihood of this risk.

Relative benchmarks

A8.856 We derived a 900 MHz / 800 MHz paired ratio for Spain using the November 2011 900 MHz award and the July 2011 800 MHz award.

Assessment of risk

A8.857 In interpreting this benchmark, our view remained that the observed value of 900 MHz in Spain (which was the reserve price plus licence fees) carries a larger risk of overstating market value in Spain at the time of the award. However, we considered that the market value of 900 MHz in Spain at the time of the award risks understating forward-looking UK market value. On balance, we considered that the observed 900 MHz value could understate or overstate UK market value, though we said we cannot be sure of the likelihood and scale of this risk, while the 800 MHz is likely to reflect market value.

A8.858 On this basis, we considered that the 900 MHz / 800 MHz benchmark could understate or overstate UK market value, though we said we cannot be sure of the likelihood and scale of this risk.

A8.859 For the purpose of estimating a proxy value for 2.6 GHz, we considered that the Spanish 2.6 GHz / 800 MHz paired ratio provides more useful evidence of the ratio of 2.6 GHz prices to 800 MHz prices, as both bands were auctioned in the same multiband award and sold for more than reserve price (i.e. prices were determined by a market-driven process).

Tiering

A8.860 Considering each of the criteria for inclusion in Tier 1, we said:

a) The 900 MHz auction price was set by a reserve price, rather than a market-driven process of bidding.

b) Based on the evidence available to us, the relative prices in the auction are at least as likely to be based on bidders' intrinsic valuations of spectrum as on strategic bidding; and

c) The outcome appears likely to be informative of forward-looking relative spectrum values in the UK, having regard to country-specific circumstances and auction dates.

A8.861 We considered that the 900 benchmark for Spain does not meet the first of our criteria for Tier 1. We therefore considered the criteria for inclusion in Tier 2:

a) We said that there is some evidence that the relative auction prices reflect bidders' relative intrinsic valuations of different bands in that they indicate that in Spain the value of 900 MHz is not higher than the reserve price, whereas 800 MHz spectrum sold above the reserve price; and

b) We said that the outcome is not obviously uninformative of forward-looking relative spectrum values in the UK having regard to country-specific circumstances and auction dates.

A8.862 We therefore considered that the benchmark should be in Tier 2.

Stakeholder responses to the February 2015 consultation

Likelihood of reflecting market value

A8.863 Frontier (p. 13) and Telefónica (p. 43) disagreed with our view of the development of commercial opportunities for LTE900 over the period covering our auctions. They said that it does not provide a justification as to why the price of 900 MHz in the Spanish auction might understate the forward looking value of 900 MHz spectrum in the UK, relative to 800 MHz.

Our assessment

A8.864 We have assessed stakeholder responses to our view on LTE900 development in more detail in paragraphs A9.36-A9.78. Based on the assessment outlined in Annex 9, our view remains that LTE900 development creates a risk that the 900 MHz value observed in Spain understates the forward-looking market value of 900 MHz spectrum, although we cannot be sure of the scale or likelihood of this risk.

A8.865 We also note that the Spanish awards took place before WRC-12. As discussed in paragraphs A7.171 to A7.181, we consider that this creates a larger risk that the market value of 800 MHz and 900 MHz in Spain at the time of the auction is a larger overstatement of forward-looking market value.

A8.866 In light of this assessment, we consider that overall:

a) There is a larger risk that the 800 MHz price is a larger overstatement of forward-looking market value.

b) The 900 MHz in Spain (which was the reserve price plus licence fees) carries a larger risk of overstating market value in Spain at the time of the award. The market value of 900 MHz in Spain at the time of the award risks understating

forward-looking market value (due to LTE900 developments) but also carries a larger risk of a larger overstatement (due to 700 MHz availability developments). On balance, we consider there to be a larger risk that the 900 MHz price is a larger overstatement of forward-looking market value.

A8.867 These individual band assessments are different to our February 2015 consultation assessment, and reflect our view that the market values of 800 MHz and 900 MHz at the time of the Spanish award might both be overstated relative to forward-looking market values, due to 700 MHz availability developments. However, as the benchmark measures the *ratio* of these values, our overall interpretation of the Spanish 900 MHz / 800 MHz benchmark remains the same as in our February 2015 consultation.

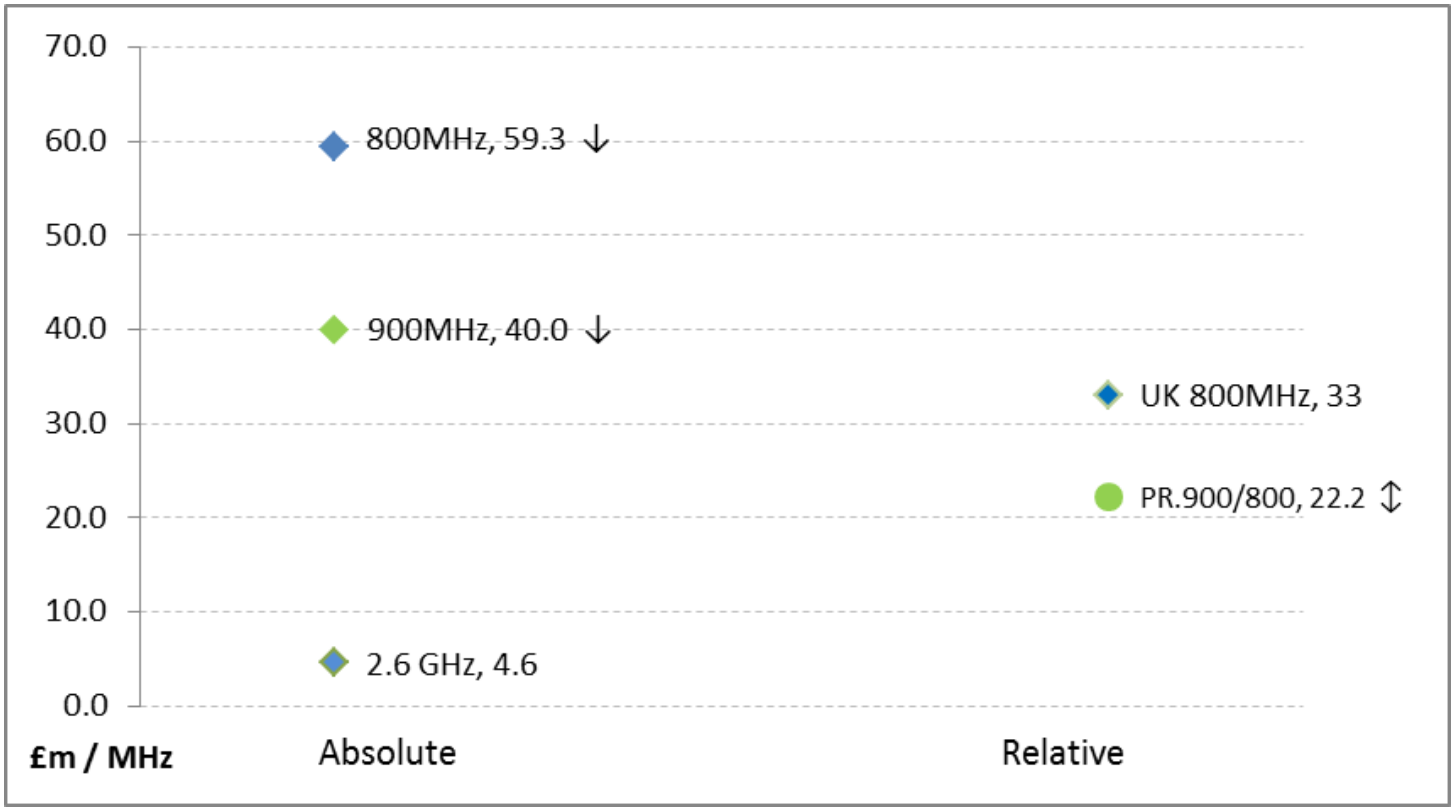
A8.868 The following table summarises the available benchmarks (along with our interpretation of them) from the Spanish award:

Table A8.15.7: Summary of evidence points from Spain

	Absolute values (£m / MHz)			Relative value benchmarks[1] (£m / MHz)	Ratios (%)
	800 MHz	900 MHz	2.6 GHz	900 MHz / 800 MHz	2.6 GHz / 800 MHz
Final values	59.3	40.0	4.6	**22.2** **(67%)**	8%
Tier				**Second**	
Assessment of risk	Larger risk of larger overstatement	Larger risk of larger overstatement	No risk identified	**Risk of under or over-statement**	Larger risk of larger understatement

1 Based on the UK 800 MHz value without coverage obligation and gross of expected DTT co-existence costs

Figure A8.15.1: 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 A8.16.1: March 2011 800 MHz auction results

	800 MHz	Price Paid[216]
Total Available	2x30	-
Teliasonera	2x10	SEK 854m
Tele2	2x10	SEK 469m
Telenor		
Hi3G	2x10	SEK 431m
Unsold	-	-
Reserve price	SEK900m	-
Total auction revenue	SEK1.75bn	-
% mark-up	95%	-

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

Table A8.16.2: 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.[217] 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.[218]	All winners won up to their spectrum cap.
Obligations	Coverage and rollout obligations only apply to the spectrum which was won by Hi3G and included a commitment of up to SEK 300m to meet the obligation.[219] 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.[220]

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

October 2011 1800 MHz auction

Description: Award of 1800 MHz spectrum through an SMRA.

Table A8.16.3: October 2011 1800 MHz auction results

	1800 MHz	Price Paid[221]
Total Available	2x35	-
Teliasonera	2x25	SEK 920m
Tele2	2x10	SEK 430m
Telenor		
Hi3G	-	-
Unsold	-	-
Reserve price	SEK70m	-
Total auction revenue	SEK1.35bn	-
% mark-up	1829%	-

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

Table A8.16.4: 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.[222]	N/A
Obligations	None[223]	N/A

Our position in the October 2013 consultation

A8.869 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.

A8.870 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.

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

Stakeholder responses to the October 2013 consultation

Whether award outcomes are likely to reflect market value

1800 MHz

A8.871 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.

A8.872 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

A8.873 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.

A8.874 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.

A8.875 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

A8.876 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.[224]

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

Likelihood of reflecting UK market value

A8.877 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".

A8.878 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 in the August 2014 consultation

Whether award outcomes are likely to reflect market value

1800 MHz

A8.879 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.

A8.880 Telefónica argued that the joint venture may have enhanced competition by strengthening Tele2-Telenor as a competitor. However we considered it more likely that Tele2 and Telenor would have competed in the absence of a joint venture.

A8.881 We considered that the 1800 MHz price might 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

A8.882 We revised our calculation of the 800 MHz price in light of stakeholder comments about our methodology used in the October 2013 consultation. We considered that the best estimate of the value of 800 MHz was 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 value of 800 MHz in the UK without coverage obligation and gross of expected DTT co-existence costs). Using this methodology, there is no need to include the SEK 300m coverage spend obligation attached to the highest frequency 800 MHz spectrum block.

A8.883 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. However, 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 of competition among the winning bidders, who are the established MNOs. We therefore considered that the 800 MHz price risks

understating market value in Sweden, but the likelihood and scale of this risk is unknown.

2.6 GHz

A8.884 As mentioned, 2.6 GHz spectrum has not been auctioned for mobile use in Sweden since 2008. We agreed with Telefónica 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

A8.885 As discussed in paragraphs A7.62 to A7.74 of the August 2014 consultation, we did 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 did not provide strong grounds for considering such a relationship to exist. In our assessment of the Swedish benchmarks, we did 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.

A8.886 We considered the timing of the Swedish award relative to the UK. In paragraphs A7.83 to A7.84 of the August 2014 consultation, we said that 1800 MHz was not fully acknowledged as a core LTE band until between late 2011 and early 2012, and that it was 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 considered 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

A8.887 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 of the August 2014 consultation, we considered 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.

A8.888 We also used the absolute value of 1800 MHz as a cross-check.

A8.889 In interpreting the benchmarks, we considered 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 due to the date of the award. 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.

A8.890 As regards tiering, we noted that 800 MHz and 1800 MHz were sold in separate awards in March 2011 and October 2011 respectively while 2.6 GHz had not been auctioned since 2008. We noted that two operators bid jointly in both awards; in

total there were five bidders in the 800 MHz award but only three bidders in the 1800 MHz award, which might have resulted in less competition for 1800 MHz than 800 MHz spectrum. We considered there was potentially a case for treating Sweden as a first-tier country. However, on balance due to the auction circumstances described above we included Sweden in the second tier, rather than the first tier.

Stakeholder responses to the August 2014 consultation

Whether award outcomes are likely to reflect market value

Cross-band

A8.891 AM&A (p.13-14) and Frontier (p.19) argued that we failed to demonstrate that market value was not achieved in the Swedish auction because of the joint venture. AM&A said that both auctions lasted many rounds with prices exceeding reserve level and at least one bidder did not win any spectrum.

1800 MHz

A8.892 AM&A (p. 24) argued that the Swedish 1800 MHz price should be calculated using a weighted average of lots (rather than a straight average). It said that this lowers the absolute 1800 MHz price by £0.4m per MHz to £9.3m per MHz.

2.6 GHz

A8.893 AM&A (page 26-27) criticised our method used to generate a 2.6 GHz proxy value in Sweden and said that "it would seem much more reasonable to use specific evidence points from each benchmark country, where these are available, even if this was from before Ofcom's (arbitrary) cut-off period". AM&A suggested using the May 2008 2.6 GHz auction price (which we calculate as £9.9m per MHz), or alternatively adjusting this down to the Swedish 1800 MHz price (£9.4m per MHz) as proxies for the value of 2.6 GHz. These alternative assumptions produce distance method benchmarks of £4.3m and £5.5m per MHz respectively. AM&A said that the adjusted figure "provides a much more representative figure for the market value of 2.6 GHz spectrum in Sweden than a simple average based on market value in other countries".

A8.894 AM&A (page 17) also argued Sweden's distance method benchmarks relying on proxies should be at most Tier 2.

Our assessment in the February 2015 consultation

Cross-band

A8.895 In line with AM&A's comment, we calculated the UK-equivalent prices as weighted averages, using lot size (MHz) and population applicable to the licences as weights.

A8.896 We said it was unclear whether the joint bidding for 800 MHz or 1800 MHz reduced competitive pressure in one or both the auctions. We noted that average prices were substantially above reserve prices for both 800 MHz (around 130% mark-up) and 1800 MHz (where the mark-up was in excess of 1800%). In the case of 800 MHz, we said the spectrum cap may have created a focal point for the three main bidders to win 2x10 MHz each, but the two other bidders may have imposed a competitive constraint on bidders. In the case of 1800 MHz, we said the absence of bidders other than the three established operators raises the possibility that there

was less competition than for 800 MHz. However, we said there was no obvious focal point and the outcome was that one bidder (Tele2/Telenor joint venture) won a large amount of spectrum while another bidder (Hi3G) won no 1800 MHz spectrum. We discussed the implication for our choice of tier for the Sweden relative value benchmark, as set out below. In our assessment of risks we considered that the absolute values of 800 MHz and 1800 MHz both carry a risk that they understate market value because the joint venture may or may not have reduced competitive pressures in the auction, although we said we cannot be sure about the scale and likelihood of this understatement.

2.6 GHz

A8.897 We agreed in principle that a market-based price, where available, will typically be more informative than a proxy value. However, in the relevant circumstances we did not agree that the Swedish 2.6 GHz auction which ended in May 2008 is preferable to a proxy for the value of this band.

A8.898 The date of this award was outside of the pool of evidence on which we are drawing for all other benchmark evidence, i.e. European auctions since 2010. We said the rationale for this cut-off date is that generally more recent evidence is likely to be more informative.

A8.899 At the time of the Swedish auction in May 2008, the 2.6 GHz band was the only band which was available for 4G deployment. It was also the only band that held out the clear prospect of being available for 4G deployment on a harmonised basis throughout the majority of Europe in the near term. This followed many years of work in international regulatory bodies to make this band available for 4G use (including LTE and WiMAX). In particular:

a) The 2.6 GHz band was identified for IMT at the WRC in 2000.

b) CEPT prioritised work on the 2.6 GHz band in response to the European Commission's WAPECS mandate in 2006 (to create least restrictive technical conditions for the exploitation of existing and prospective mobile bands in Europe). This culminated in the December 2007 CEPT report 19, which contains technical conditions and guidance for the application of least restrictive conditions to base stations and terminal stations operating in the 2.6 GHz band.

c) On 2 April 2008 the Radio Spectrum Committee of the European Commission (RSC) unanimously agreed the text of a decision on harmonised use of the 2.6GHz band which required Members States to designate the 2.6 GHz band for use (on the basis of technical conditions to enable LTE and WiMAX use) within 6 months of the decision's entry into force.[225]

A8.900 The corresponding regulatory work for other LTE bands took place later, with the RSC harmonisation decisions for the 800 MHz and 1800 MHz bands being made in May 2010 and April 2011 respectively. These decisions were therefore two years and three years, respectively, after the Swedish 2.6 GHz auction. The timing of harmonisation decisions, along with the development of the relevant standards in 3GPP, is significant for the prospects of the equipment ecosystems (which is a key driver of spectrum value).

[225] This decision then came into force in 13th June 2008 (http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:163:0037:0041:EN:PDF)

A8.901 Moreover, the 2.6 GHz band was largely free of existing use in a significant number of European countries. It was also a globally harmonised band with interest in early 4G deployments around the world. In contrast, the RSC Decision on 800 MHz in 2010 did not set a deadline for Member States to make the 800 MHz band available. Instead, a subsequent Decision of the European Parliament and Council of March 2012 set a deadline of January 2013 for making the 800 MHz band available, although 12 Member States were granted derogations from this deadline, reflecting that fact that the band was (and in some cases, still is) being used for Digital Terrestrial Television services. In other words, at the time of the Sweden auction of 2.6 GHz in 2008, not only was the European harmonisation decision for 800 MHz two years off, but there was no realistic prospect of the 800 MHz band being widely available for LTE use across Europe for several years at least.

A8.902 Turning to the 1800 MHz band, it was encumbered with GSM services (i.e. required re-farming for alternate use) and, as set out in Annex 9, we considered that increased interest in Europe in 1800 MHz for LTE can reasonably be dated between late 2011 and early 2012.

A8.903 The price paid for 2.6 GHz spectrum in the Swedish auction will have reflected its status as the only prospective means of providing 4G services in the near term after May 2008. Our view was that the 2008 auction price for the 2.6 GHz band is likely not to be representative of the value of 2.6 GHz spectrum relative to the value of the 800 MHz and 1800 MHz bands today when these latter two bands are now used to provide the main LTE network layers in Europe.[226]

A8.904 Therefore, we considered that the 2008 price of 2.6 GHz in Sweden is not an appropriate measure for the value of this spectrum, in calculating an 1800 MHz distance measure benchmark.

A8.905 We also noted that the price of 2.6 GHz from the 2008 auction of £9.9m per MHz is higher than the price of 1800 MHz from the 2011 auction of £9.4m per MHz. We said that we were not aware of a reason why the value of 2.6 GHz spectrum would exceed the value of 1800 MHz spectrum.

A8.906 We said AM&A's suggestion in response to this relativity seems to be to use the price of 1800 MHz in Sweden as an approximation of the price of 2.6 GHz. We considered this ad hoc assumption still generates an excessively high price. We said the available technical evidence and market-based information does not support a view that 2.6 GHz and 1800 MHz spectrum have the same value, and the former has sold at an often considerable discount compared to the latter, as shown in Table 3.1 in Section 3.

A8.907 In the circumstances, we considered that the more informative approach is to use a proxy for 2.6 GHz based on our preferred method. This yielded a value for 2.6 GHz spectrum of £2.1m per MHz, as set out in Annex 7.

[226] In addition, the 2.6 GHz award took place before the global financial crisis and the widespread recession that broke out at the end of that year. H3G suggested that this explains the 2.6 GHz price being above the 1800 MHz price in Sweden.

Relative benchmarks

A8.908 We used price information from Swedish auctions for two out of three relevant bands (i.e. 800 MHz and 1800 MHz) used in the distance method and a proxy for the 2.6 GHz band.

Assessment of risk

A8.909 We considered that the market value of 1800 MHz in Sweden in 2011 may be understated relative to current UK market value.

A8.910 We used our preferred method to derive a proxy value for 2.6 GHz. We said there is a risk that the average ratio of 2.6 GHz to 800 MHz that it relies upon may not reflect closely the relative value of the bands in Sweden, hence the distance method may overstate or understate market value in Sweden.

A8.911 Overall, we considered that the Swedish distance method benchmark may understate or overstate UK market value, but we said we cannot be sure of the scale and likelihood of this risk.

Tiering

A8.912 Considering each of the criteria for inclusion in Tier 1:

a) We said the auction prices in the Swedish auctions for 1800 MHz and 800 MHz were significantly above reserve, and as such appear likely to have been primarily determined by a market-driven process of bidding.

b) We considered that, based on the evidence available to us, the relative prices in the Swedish auction were at least as likely to reflect intrinsic valuation of spectrum in Sweden as to reflect strategic bidding.

c) We used a proxy measure for 2.6 GHz in Sweden, and we have assessed the reliability of this approach in paragraphs A7.114 to A7.140 of Annex 7. Overall, we did not have clear, evidence-based reasons to consider the auction outcome is less informative of forward-looking relative values in the UK (having regard to country-specific circumstances and auction dates).

A8.913 Therefore, we considered that the Tier 1 criteria are satisfied for the 1800 MHz distance method benchmark from Sweden and we included this benchmark in Tier 1.

Stakeholder responses to the February 2015 consultation

A8.914 Telefónica (p. 43) disagreed with our proposal to move the 1800 MHz benchmark to Tier 1 from Tier 2. It noted our view that "there is no uniquely correct methodology to derive a 2.6 GHz proxy", and said that this highlights the fact that the 2.6 GHz proxy estimate is "particularly noisy". It also said that there is particular uncertainty over the 2.6 GHz value in Sweden, given that the actual value in the 2008 auction was much higher than our proposed 2.6 GHz proxy.[227] Telefónica's view was that

[227] In fact, Telefónica referred to the "2007" auction, but we assume that it was intending to refer to the 2008 2.6 GHz auction in Sweden.

the uncertainty and risk of error which the use of a 2.6 GHz proxy introduces to the benchmark calculation means that it should not be raised to Tier 1 evidence.

Our assessment

Relative benchmarks

Assessment of risk

A8.915 We did not receive any comments relating to our interpretation of the Swedish distance method benchmark

A8.916 However, we note that the awards in Sweden occurred before WRC-12. As discussed in paragraphs A7.171 to A7.181, we consider that this creates a larger risk that the market value of 800 MHz in Sweden at the time of the auction is a larger overstatement of forward-looking market value. We also consider that this creates a larger risk that the market value of 1800 MHz in Sweden at the time of the auction overstates forward-looking market value, though we cannot be sure of the scale of this overstatement.

A8.917 In interpreting the Swedish distance method benchmark, we consider that overall:

a) There is a risk that the 800 MHz and 1800 MHz prices both understate market value in Sweden at the time of the award;

b) There is a larger risk that the market value of 800 MHz in Sweden at the time of the auction is a larger overstatement of the forward-looking market value of 800 MHz. Combined with (a), we consider that the 800 MHz price from Sweden carries a larger risk of overstatement of forward-looking 800 MHz market value, but we cannot be sure of the scale of overstatement; and

c) There is a risk that the market value of 1800 MHz in Sweden at the time of the auction is a small understatement of forward-looking market value due to LTE1800 developments, but there is a larger risk that the market value at the time of the award is an overstatement of forward-looking market value (of unknown scale) due to 700 MHz availability developments. Combined with (a), we consider that the 1800 MHz price from Sweden carries a risk of overstatement of forward-looking 1800 MHz market value, but we cannot be sure of the likelihood or scale of overstatement;

A8.918 As regards our distance method benchmark, given our view that there is a larger risk that 800 MHz overstates forward-looking market value than there is for 1800 MHz, we consider that the distance method benchmark risks understating forward-looking UK market value, though we cannot be sure of the likelihood or scale. This represents a change from our assessment in the February 2015 consultation.

Tiering assessment

A8.919 We analyse the choice of 2.6 GHz proxy in paragraphs A7.114-A7.140. While we note that there is no uniquely correct method to derive a 2.6 GHz proxy value in Sweden, we set out in Annex 7 our methodological and empirical reasons for favouring our preferred approach over alternative methods.

A8.920 Our preferred approach yields a distance method benchmark for 1800 MHz in Sweden of £16m per MHz (corresponding to a proxy 2.6 GHz value of £2.1m per

MHz). In Annex 7 we discuss alternative methods which would imply distance method benchmarks of £14.6m per MHz and £17.6m per MHz (see Table A7.9), which are respectively 9% below and 10% above the benchmark we use. As noted above, we have specific reasons to favour our preferred approach to these alternatives. In any case, we do not consider that the range between these figures is sufficiently large to warrant exclusion of this benchmark from the Tier 1 evidence group. In other words, we disagree with Telefónica and in our view the distance method benchmark is not a "particularly noisy" estimate.

A8.921 We recognise that a significantly different distance method benchmark would be generated if we used the 2.6 GHz price from the 2008 auction in Sweden. However, for reasons discussed in paragraphs A8.897 to A8.904 above, we do not consider that the 2008 price of 2.6 GHz in Sweden is an appropriate measure for the value of this spectrum, in calculating an 1800 MHz distance measure benchmark.

A8.922 As a result, we continue to include the Swedish distance method benchmark as a Tier 1 evidence point.

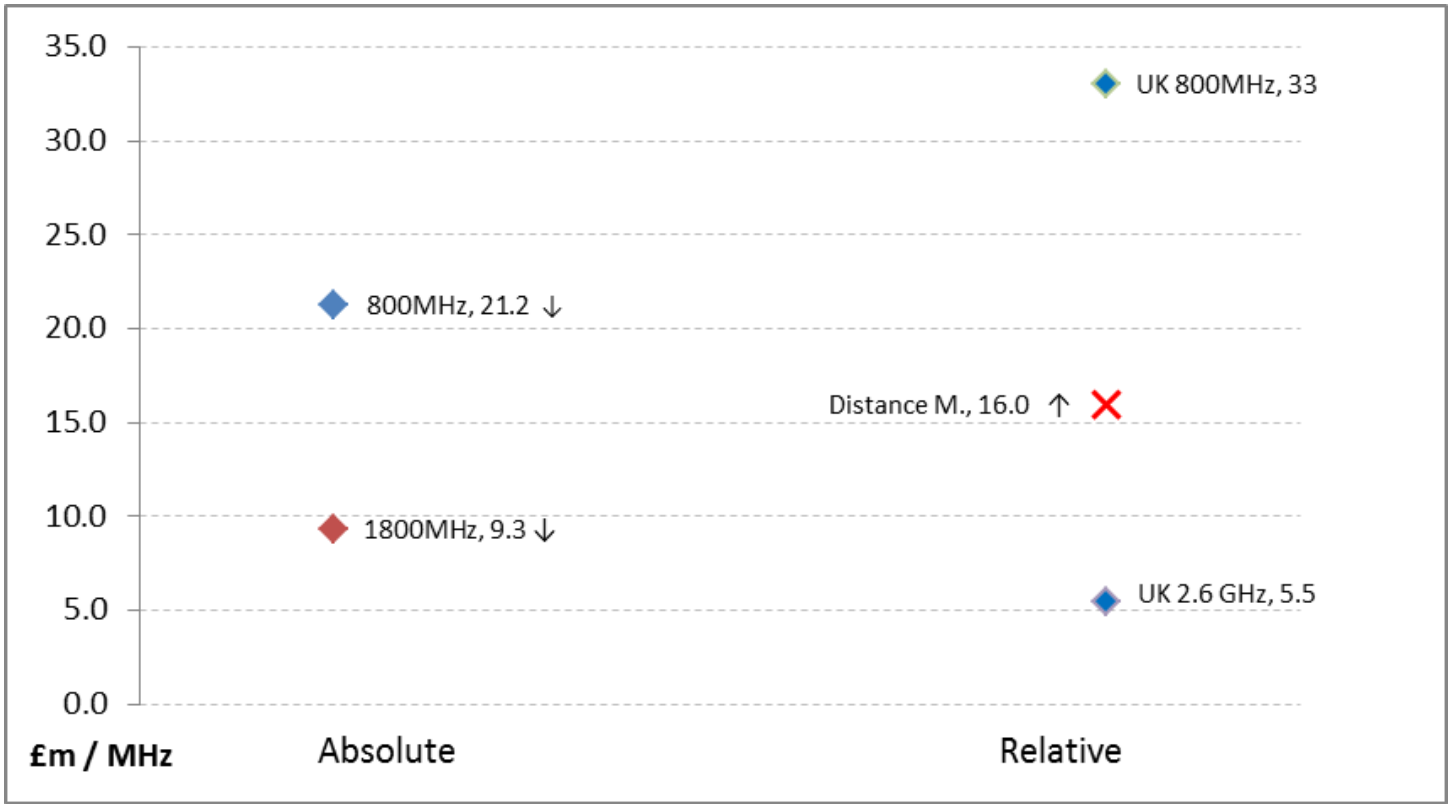
A8.923 The following table summarises the available benchmarks (along with our interpretation of them) from the Swedish awards.

Table A8.16.5: Summary of evidence points from Sweden

	Absolute values (£m / MHz)		Relative value benchmarks[1] (£m / MHz)	Ratios (%)
	800 MHz	1800 MHz	Distance method	1800 MHz / 800 MHz
Final values	21.2	9.3	**16.0** **(38%)**	44%
Tier			**First***	
Assessment of risk	Larger risk of over-statement	Risk of over statement	Risk of under statement	Risk of understatement

1 Based on the UK 800 MHz value without coverage obligation and gross of expected DTT co-existence costs.
* This is a change from the August 2014 consultation in which this benchmark was included in the second tier.

Figure A8.16.1: 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[228]

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. [229]

Table A8.17.1: 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	-	CHF 154.7m
Sunrise	2x10	2x15	2x20	2x10	-	2x25	-	CHF 481.7m
Swisscom	2x10	2x15	2x30	2x30	-	2x20	45	CHF 359.8m
Unsold	-	-	-	-	2x10	2x5	-	-

Table A8.17.2: 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.[230]	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
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.[231]	
Reserve prices	Total revenue in the auction was 65% higher than the sum of reserve prices of all lots sold.	

[228] Results source: http://www.news.admin.ch/NSBSubscriber/message/attachments/26004.pdf
[229] See page 369: http://www.comreg.ie/_fileupload/publications/ComReg1225a.pdf
[230] See page 368: http://www.comreg.ie/_fileupload/publications/ComReg1225a.pdf
[231] See page 369: http://www.comreg.ie/_fileupload/publications/ComReg1225a.pdf

Our position in the October 2013 consultation

A8.924 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 to the October 2013 consultation

Whether award outcomes are likely to reflect market value

Cross-band comments

A8.925 AM&A (pages 38-40) considered that some valuable evidence can be gleaned from the Swiss auction. They made the following observations about the auction results in Switzerland:

a) 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).

b) 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 its 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.

c) 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:

   i) one lot of 2.6 GHz was unsold.

   ii) 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.

A8.926 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.

A8.927 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 in the August 2014 consultation

A8.928 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, we said reserve prices hence do not provide a reasonable proxy for market value in Switzerland. We noted 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.

A8.929 We also considered that it is difficult to make reliable inferences about band-specific prices from the outcome of the Swiss auction.

A8.930 More specifically, we disagreed 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 its 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.

A8.931 We said that 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

A8.932 The Swiss Regulator (OFCOM) did not provide us with LRP or bid data on the auction, and we considered that it is difficult to make reliable inferences about band-specific prices from the publicly available package information.

A8.933 Since total receipts from the auction were well above reserve prices, we did not consider these provide reasonable proxies for the market value of spectrum by band.

A8.934 Vodafone proposed an alternative method to derive absolute values by band, but we did not believe this is informative and it is not suitable for deriving relative benchmarks. For these reasons, we did not propose to derive benchmarks for the Swiss auction.

Stakeholder responses to the August 2014 and February 2015 consultations

A8.935 We summarise below stakeholders' responses to the August 2014 consultation. Stakeholders did not make any further comment on this benchmark country in response to the February 2015 consultation.

A8.936 AM&A (p. 17) noted that we excluded Switzerland on the basis that no reliable information can be gleaned from the auction result. It said that it does not necessarily agree with this position, but did accept that the band-specific data that can be derived is less reliable than for some other CCAs.

A8.937 However, AM&A (Annex C1) also said that whilst there may be some differences between the results of the Swiss and Austrian auctions which mean that band-specific prices are harder to infer in Switzerland, there is still some evidence that can be gleaned from it – for example, that the price of 900MHz was clearly relatively high. AM&A's view was that it was inconsistent for Switzerland's band-specific prices to be excluded on the basis that they are unreliable evidence, while no consideration is given to the lack of reliability of band-specific prices in Austria (and also Ireland, another tier 1 country).

Our assessment

A8.938 In Annex 7 we explain our view that there are significant differences in the quality of evidence from the Swiss auction compared to the Austrian and Irish auctions, and that it remains appropriate to treat them in a different way. Unlike Austria and Ireland, we do not consider that we have sufficient information to derive reliable band-specific prices from the Swiss auction.

A8.939 In particular, we disagree with AM&A's view that the price of 900 MHz was clearly relatively high in Switzerland. We explained the reasons for this in paragraph A8.356 of the August 2014 consultation. AM&A has not presented any further evidence suggesting otherwise.

A8.940 As a result, we have maintained our position as set out in the August 2014 and February 2015 consultations. We do not derive benchmarks from the Swiss auction.

Turkey

August 2015 multiband award

Description: Award of spectrum in the 800 MHz, 900 MHz, 1800 MHz, 2.1 GHz and 2.6 GHz bands. In total 390 MHz of spectrum was available for auction.

Context: There were three participants (the three incumbent operators, Avea, Turkcell and Vodafone) in the auction. A prospective new entrant, NetGSM, ultimately did not bid in the auction.[232] Initially scheduled to start on 26 May the auction was postponed by three months and was held on 26 August 2015.

Table A8.18.1: August multiband auction results[233]

Operator	800 MHz	900 MHz	1800 MHz	2.1 GHz paired	2.1 GHz un-paired	2.6 GHz paired	2.6 GHz un-paired	Price paid
Total available	2 x 30	2 x 10.4	2 x 59.8	2 x 10	10	2 x 60	40	€3.36bn
Avea	2 x 10	2 x 7.6	2 x 20	-	-	2 x 10	15	€955m
Turkcell	2 x 10	2 x 1.4	2 x 29.8	2 x 10	10	2 x 25	10	€1.62bn
Vodafone	2 x 10	2 x 1.4	2 x 10	-	-	2 x 15	10	€778m
Unsold	-	-	-	-	-	2 x 10	5	-
Reserve price for the band	€1.12bn	€297m	€569m	€71m	€36m	€155m	€52m	-
Total auction revenue	€1.14bn	€297m	€835m	€348m	€36m	€650m	€48m	-
% mark-up	2%	0%	47%	388%	0%	319%	-7%	-

A8.941 BTK, the Turkish telecommunications regulator, conducted an award of 800 MHz, 900 MHz, 1800 MHz, 2.1 GHz and 2.6 GHz spectrum in August 2015. We understand that each band was awarded sequentially, beginning with 800 MHz and ending with 2.6 GHz, and within each band, each lot was awarded sequentially in descending order of lot size.[234] There were three incumbent bidders, bidding for three lots in each band. We also understand that the bidders were generally prevented from winning more than one lot in each band,[235] with the result that the third lot in each band was acquired for the reserve price.[236]

A8.942 800 MHz was sold in frequency-specific 2x10 MHz lots, with prices at or close to (within 5% of) reserve prices (which was €18.6m per MHz). A spectrum cap of 2x10

[232] http://www.totaltele.com/view.aspx?ID=490925
[233] http://eng.btk.gov.tr/tr-TR/Kurumdan-Haberler/45-G-Ihalesi-Ankarada-Yapildi
[234] [✂]
[235] [✂]
[236] Except in the 2.1 GHz paired band, where Turkcell won two lots of 2x5 MHz, and in the 2.6 GHz paired and unpaired bands, where the third lot in each band – which was smaller than the first and second – sold at reserve, but a fourth lot was reserved for a prospective entrant, NetGSM, but was unsold. NetGSM was prevented from bidding for other bands.

MHz guaranteed that each incumbent operator would be awarded a 2x10 MHz lot. Therefore competition for lots may relate to the different frequency location preferences of the operators within the band rather than being indicative of market value.

A8.943 900 MHz was sold in one lot of 2x7.6 MHz and two lots of 2x1.4 MHz. A spectrum cap of 2x12.5 MHz meant that only Avea could win the larger lot, and all lots sold at reserve price (€14.3m per MHz). We note that the band was not packaged in lot sizes suitable for LTE use. The 900 MHz reserve price was 76.5% of the 800 MHz reserve price in per MHz terms.

A8.944 The 1800 MHz band was sold in one lot of 2x29.8 MHz, one lot of 2x20 MHz and one lot of 2x10 MHz, while 2.6 GHz was sold in one lot of 2x25 MHz, one lot of 2x15 MHz and two lots of 2x10 MHz, with one of the smaller lots reserved for a new entrant. In both bands, the two larger lots sold for significantly above (around 50% in the case of 1800 MHz and over 300% in the case of 2.6 GHz) the reserve price (€4.8m per MHz for the 1800 MHz band and €1.3m per MHz for the 2.6 GHz band).[237]

A8.945 The average of lot prices in each band is unlikely to be a meaningful indicator of market value, because the auction design guaranteed each operator would be awarded at least one lot. This ensured there was no competition for the smallest lot which was awarded at the reserve price in both bands. In principle the incremental price between the smallest and larger lots may provide a more meaningful indicator of the value operators placed on spectrum. The average incremental price for larger amounts of 2.6 GHz spectrum (compared to winning the smallest lot at reserve price) was substantially (around 75%) higher than the corresponding average incremental price for 1800 MHz.[238]

A8.946 In our view:

a) If we were to include a 900 MHz benchmark from this auction, based on the ratio of reserve prices of 76.5%, this would at best be a Tier 3 benchmark which would not cause us to revise our estimate of the value of 900 MHz in the UK.

b) A distance method benchmark based on average prices would be a Tier 3 benchmark at best as the 800 MHz band sold at marginally above the reserve price and the 1800 MHz and 2.6 GHz average prices are unlikely to be meaningful indicators of market value. As to a benchmark based on average incremental prices, we said in the October 2013 consultation that we do not consider it credible that 1800 MHz spectrum has a lower value than 2.6 GHz spectrum in the UK[239] and this remains our view (see paragraph A9.125). This suggests that the higher average incremental price of 2.6 GHz than 1800 MHz in Turkey may be due to auction-specific or country-specific circumstances which are not relevant to the UK. This means that, in our view, a distance method benchmark would be Tier 3 at best.

[237] These reserve prices were low relative to the 800 MHz reserve price – 26% and 7% respectively.
[238] For each of the 1800 MHz band and the 2.6 GHz band, we calculate an incremental price per MHz for each of the largest and second largest lots compared to the price paid for the smallest lot (which was the reserve price). We then take the simple average of these two incremental prices. For 1800 MHz, the incremental prices per MHz of the largest and second largest lots are €10.745m and €8.457m respectively, with an average of €9.601m. For 2.6 GHz, the incremental prices per MHz are €21.414m and €11.938m, with an average of €16.676m.
[239] Paragraph 4.45 in our October 2013 consultation.

A8.947 [✂] suggested the 1800 / 900 ratio in the Turkish auction is supportive of the high 1800 / 900 ratio in the 2015 German auction. However, we consider that due to the lack of competition for 900 MHz spectrum, and the unsuitability of auctioned 900 MHz licences for LTE use described above, the ratio of 1800 MHz to 900 MHz auction prices does not provide reliable evidence of the relative prices of these bands.

A8.948 We conclude that we should not include relative benchmarks or absolute values from this auction in our dataset for 900 MHz or 1800 MHz. We note that no stakeholder has argued that we should do so. If we were to include benchmarks from the Turkey auction, we do not consider that it would materially affect our conclusions on lump-sum values of ALF spectrum, given the discussion of tiering above.