

Update on Annual licence fees for 900 MHz and 1800 MHz spectrum: German 2015 auction

About this document

This document provides an update for comment on the German multiband spectrum auction which concluded in June 2015, following our February 2015 consultation on mobile annual licence fees for 900 MHz and 1800 MHz spectrum. We consider that the results of this auction provide relevant evidence for the purposes of estimating the market value of licences for those bands in the UK. While the German auction prices are in the public domain, this document sets out our provisional calculation of benchmarks derived from those prices for the purpose of estimating market values of spectrum in the UK, and our initial thinking on how we should interpret those benchmarks.

Role of European auctions in derivation of ALF

1. Ofcom was directed by the Government to revise the annual licence fees ('ALF') to be paid by the holders of licences to use the radio spectrum in the 900 MHz and 1800 MHz bands (the 'ALF bands') to reflect full market value, after completion of the UK 4G auction. We have been consulting on revising ALFs under the Government direction¹, including, in particular, our consultations in October 2013², August 2014³ and February 2015⁴.
2. As part of our analytical framework for revising ALFs, we have conducted an international benchmark analysis, considering the results of mobile spectrum awards since the beginning of 2010 in European countries in which at least one of the ALF bands has been auctioned.
3. Our February 2015 consultation set out the position that we had reached on the revised levels of ALF towards the end of 2014, before considering the impact of the geographic coverage obligation agreed between Government and mobile network operators in December 2014, as well as our initial views on whether, and if so how, the geographic coverage obligation affects the market value of the ALF spectrum.

¹ The Wireless Telegraphy Act 2006 (Directions to OFCOM) Order (S.I. 2010/3024).

² <http://stakeholders.ofcom.org.uk/consultations/900-1800-mhz-fees/>

³ <http://stakeholders.ofcom.org.uk/consultations/annual-licence-fees-900-MHz-1800-MHz/>

⁴ <http://stakeholders.ofcom.org.uk/consultations/annual-licence-fees-further-consultation/>

4. We have published responses to the February 2015 consultation on our website. We are carefully considering all stakeholders' comments received in response to that consultation and we have not yet taken a final decision on the appropriate level of the fees.
5. Since we published the February 2015 consultation, the German Federal Network Agency (or 'BNetzA') has conducted an auction of spectrum licences in the 700 MHz, 900 MHz, 1800 MHz and 1500 MHz bands. We consider that this auction provides relevant additional evidence for the purposes of estimating the market value of the 900 MHz and 1800 MHz licences in the UK. We have therefore decided to take it into account in our international benchmark analysis, which is part of our analytical framework for revising ALFs.
6. **We set out in this document our proposed approach to taking account of the German 2015 auction within our international benchmark analysis and we are seeking stakeholders' comments on this specific issue. If stakeholders wish to submit comments, we request they do so by 7 August 2015.**
7. The remainder of this document is set out as follows. First, we summarise some facts about the German 2015 auction design and outcome. Next we explain how we have calculated absolute and relative-value benchmarks for 900 MHz and 1800 MHz spectrum from this auction. Then we discuss how we propose to interpret these benchmarks. Finally we consider the implications for the lump-sum value of 900 MHz and 1800 MHz spectrum in the UK.

The German 2015 multiband spectrum auction

Auction design and outcome

8. BNetzA conducted a simultaneous multiple round ascending auction (SMRA) for the award of licences for the 700 MHz, 900 MHz, 1800 MHz and 1500 MHz bands in May and June 2015. In total 2x115 MHz of paired spectrum and 40 MHz of unpaired spectrum was auctioned. This included all of the 2x35 MHz spectrum in the 900 MHz band and 2x50 MHz (out of the total of 2x75 MHz) in the 1800 MHz band.⁵ The only qualified bidders in the auction were the three incumbent mobile network operators: Telekom Deutschland (T-Mobile), Vodafone, and Telefónica.
9. There were no restrictions on the amount of spectrum that bidders could win in the auction with the exception of the 900 MHz band. In a January 2015 decision,⁶ BNetzA set a 900 MHz spectrum cap of 2x15 MHz for all bidders in the auction. One objective of this cap was to maintain the existing GSM infrastructure (paragraph 421). BNetzA said the cap would allow each of the three existing mobile network operators to win at least 2x5 MHz of 900 MHz,⁷ which it considered would be sufficient to maintain

⁵ Of the 1800 MHz spectrum not included in the auction, 2x15 MHz had been won by Telekom Deutschland (T-Mobile), and 2x10 MHz by E-Plus (a company subsequently acquired by Telefónica) in the 2010 auction.

⁶ The non-official English translation of this decision is available on the BNetzA website: http://www.bundesnetzagentur.de/SharedDocs/Downloads/EN/BNetzA/Areas/Telecommunications/TelecomRegulation/FrequencyManagement/ElectronicCommunicationsServices/DecisionP2016_pdf.pdf?__blob=publicationFile&v=3

⁷ Albeit not guaranteeing this outcome (paragraph 528).

existing infrastructure, given their existing spectrum holdings and the foreseeable switch to new technologies (paragraph 520).

10. BNetzA's January 2015 decision also set out the following coverage obligation, to be achieved within three years of the auction (page 3):

“Each assignee –with the exception of new entrants –must ensure nationwide broadband coverage of the population with a minimum transmission rate of 50Mbit/s per sector, with coverage of a minimum of 98% of households nationwide, whereby a minimum of 97% must be achieved in each federal state. [...] Full coverage must be ensured for the main transport routes (national motorways and high speed railway lines), as far as is legally and practically possible. Assignees may use their entire spectrum package to meet this target”.⁸
11. The lowest frequency block in the 900 MHz band was awarded at a specific spectral position, because the need to protect GSM-R applications in the spectrum directly below means that limited use can be made of this block (paragraph 749).
12. The highest frequency block in the 1800 MHz band was awarded at a specific spectral position on account of the spectrum directly adjacent being used for DECT (paragraph 745).
13. Spectrum in the 900 MHz and 1800 MHz bands will be available from 1 January 2017.
14. At the start of each round, the results of the previous round (price and standing high bidder for each lot) were made available to bidders. The auction concluded on 19 June 2015 after 16 days and 181 rounds. Table 1 below shows the results.⁹
15. The prices by lot in the 900 MHz and 1800 MHz bands in the final round of the auction are shown in Table 2. All lots were sold above reserve price. Prices for 900 MHz exceeded reserve price (€75m per lot) by a factor of around 2.5, and the specific lot (A) was not priced at a discount to most of the generic lots. Prices for generic lots (A-I) of 1800 MHz exceeded reserve price (€37.5m per lot) by a factor of around 6.5, and the specific lot (J) was priced at a 25%-30% discount to the generic lots.

⁸ Any new entrant would have been subject to a much lighter obligation.

⁹ This result is as published on the BNetzA website, which also provides results of each round: http://www.bundesnetzagentur.de/cln_1422/SharedDocs/Pressemitteilungen/EN/2015/1500617_Freq_unezversteigerung.html;jsessionid=D195220AD92E81D729CF11DFC6A75FA2

Table 1 – German 2015 auction results

Undertaking	Amount of spectrum		Award price
Telefónica Deutschland GmbH & Co. OHG	700 MHz: 900 MHz: 1800 MHz:	2 x 10 MHz 2 x 10 MHz 2 x 10 MHz	€ 1,198,238,000
Telekom Deutschland GmbH	700 MHz: 900 MHz: 1800 MHz: 1500 MHz:	2 x 10 MHz 2 x 15 MHz 2 x 15 MHz 20 MHz	€ 1,792,156,000
Vodafone GmbH	700 MHz: 900 MHz: 1800 MHz: 1500 MHz:	2 x 10 MHz 2 x 10 MHz 2 x 25 MHz 20 MHz	€ 2,090,842,000
Total	270 MHz		€ 5,081,236,000

Source: BNetzA

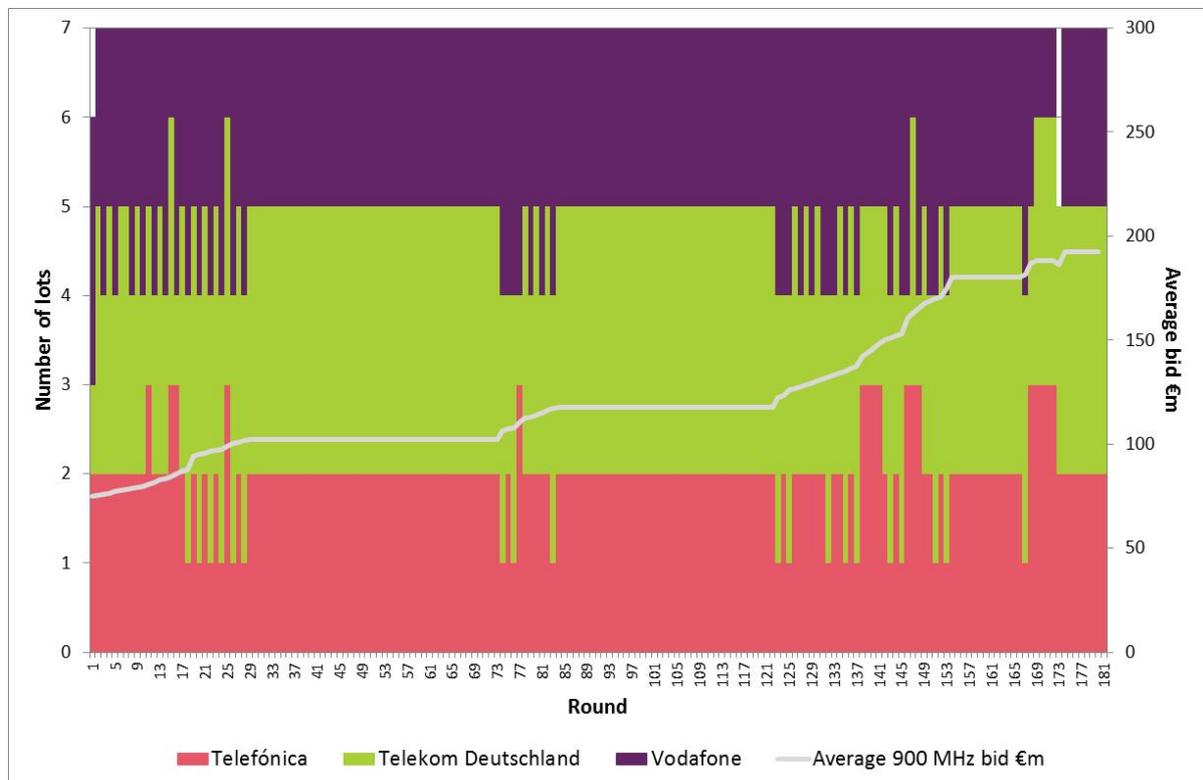
Table 2 – Prices by lot for 900 MHz and 1800 MHz in the final round (181)

Band	Lot	Standing High Bidder	Price (€m)
900 MHz	A	Telefónica	195.520
	B	Vodafone	211.807
	C	Vodafone	203.298
	D	Telekom Deutschland	183.671
	E	Telekom Deutschland	180.968
	F	Telekom Deutschland	180.465
	G	Telefónica	189.958
1800 MHz	A	Vodafone	237.494
	B	Telekom Deutschland	248.054
	C	Vodafone	258.247
	D	Vodafone	249.133
	E	Telekom Deutschland	248.101
	F	Vodafone	255.967
	G	Telefónica	239.228
	H	Telekom Deutschland	248.784
	I	Telefónica	240.288
	J	Vodafone	180.153

Source: Ofcom from information published by BNetzA

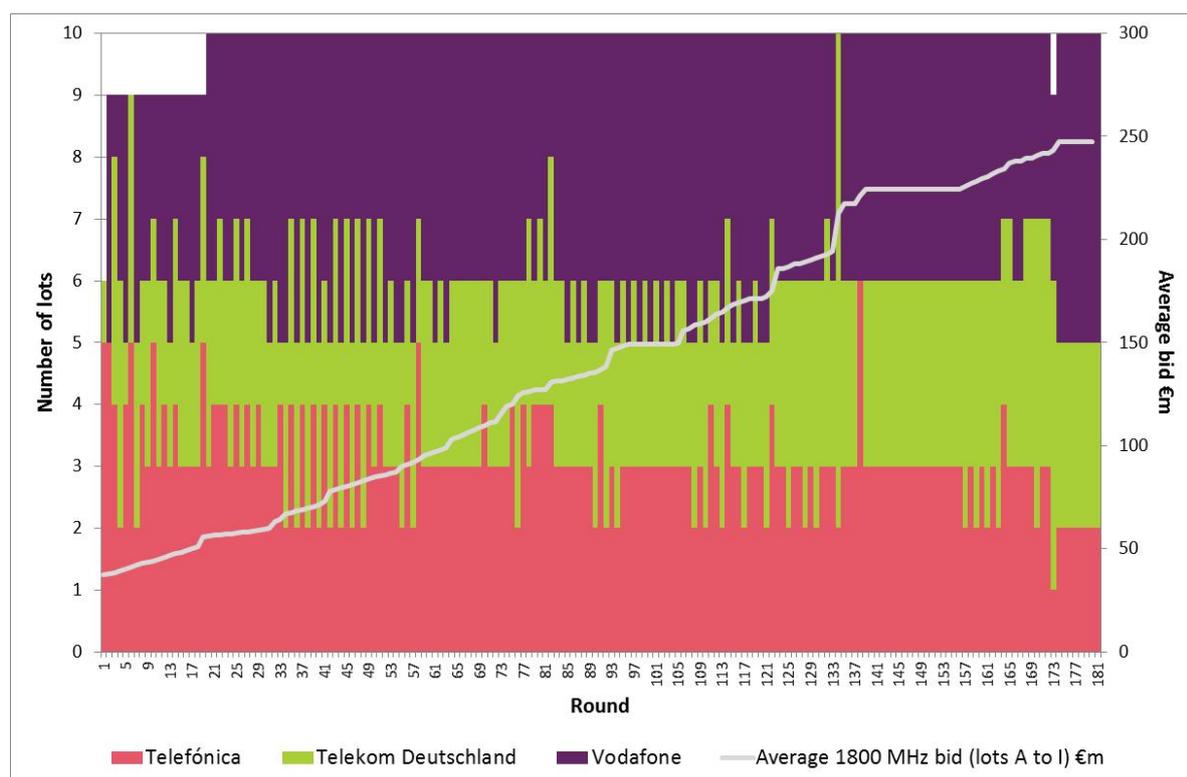
16. Bidding activity for 900 MHz and 1800 MHz is summarised in Figures 1 and 2 below.
17. Figure 1 shows that all seven lots of 900 MHz had a standing high bidder (SHB) by the end of Round 2. Bidding activity paused after Round 29, at which point Telekom Deutschland was SHB on three lots and the other two bidders were SHBs on two lots each. Further bidding took place intermittently in later rounds, but tended to return to an allocation in which Telekom Deutschland was SHB on three lots and the other bidders on two lots each.
18. Figure 2 shows that only 9 lots of 1800 MHz had a SHB until Round 20, when Vodafone bid reserve price for the frequency-specific lot. Bidding activity was more or less continual up to Round 138, at which point Telefónica pushed Telekom Deutschland off three lots, in addition to three lots Telefónica already held. Telekom Deutschland took three lots back from Telefónica in the following round, after which bidding paused. In Round 157 Telekom Deutschland outbid Telefónica on a fourth lot, after which bidding activity continued up to Round 173.
19. At this point, Telefónica withdrew its standing high bids on two of three 900 MHz lots and one 1800 MHz lots on which it had been SHB, risking a financial penalty for the withdrawn bids. In the same round it outbid Vodafone on Lot A of 900 MHz, so that Vodafone was not SHB on any 900 MHz lots (and Telefónica was still SHB on two). In the following round, Vodafone became SHB on all three of the lots from which Telefónica had withdrawn, and one lot of 1800 MHz on which Telekom Deutschland had been SHB (while Telefónica became SHB on another lot held by Telekom Deutschland). From this point on, bidding in the auction was confined to the lower-value 1500 MHz band.

Figure 1 – Number of 900 MHz lots for which each operator was standing high bidder



Source: Ofcom from information published by BNetzA

Figure 2 – Number of 1800 MHz lots for which each operator was standing high bidder



Source: Ofcom from information published by BNetzA

Calculation of benchmarks

20. Our calculation of UK-equivalent prices for the 900 MHz and 1800 MHz spectrum in the 2015 auction is summarised in Table 3. Column 1 shows the average lot prices, taking all lots for 900 MHz and all generic lots for 1800 MHz (i.e. excluding the frequency-specific lot J). These are then adjusted (column 2) to reflect the shorter licence duration of 17 years relative to the initial term of UK auction licences of 20 years, using the method set out in our February 2015 consultation (paragraphs A7.31 to A7.35). Then (column 3) we adjust for the delayed availability of 900 MHz and 1800 MHz spectrum (see paragraph 13 above), as set out in our February 2015 consultation (paragraphs A7.36 to A7.37). For both of these adjustments we have used a country-specific real, post-tax WACC of 4.15%.¹⁰
21. Next (columns 4 and 5) they are converted from Euro to Sterling values based on PPPs, and then adjusted for the difference in population between the UK and

¹⁰ This is based on a pre-tax real WACC of 6.38% (after exponential smoothing) and an inflation rate of 1.15%, as set out on page 60 of BNetzA's September 2014 consultation document, available at http://www.bundesnetzagentur.de/DE/Service-Funktionen/Beschlusskammern/1BK-Geschaeftszeichen-Datenbank/BK3-GZ/2014/2014_001bis099/BK3-14-012/Konsultationsentwurf.pdf?__blob=publicationFile&v=3. Only pre-tax values were determined by BNetzA so the corporate tax rate of 29.65% has been used to calculate post-tax figures (source: <http://www.kpmg.com/global/en/services/tax/tax-tools-and-resources/pages/corporate-tax-rates-table.aspx>).

Germany (see paragraphs A7.50 to A7.55 of our February 2015 consultation). The CPI adjustment is downward for 900 MHz and 1800 MHz, as we are adjusting from a 2015 value to a March 2013 value. In UK equivalent terms, our initial view is that the German 2015 auction implies values of **£15.5m per MHz** for 900 MHz spectrum, and **£20m per MHz** for 1800 MHz spectrum. We refer to these as the “absolute” benchmarks.

Table 3 – Calculation of UK-equivalent prices by band (absolute values)

Column:	1	2	3	4	5	6	7	8
	Average price	Duration	Delayed availability	PPP	CPI	Population	UK absolute value	Value without PPP adjustment
Adjustment factor (relevant prices in the previous column are multiplied by this factor)								
- for 900 MHz and 1800 MHz (2015 auction)		1.115	1.067	0.885	0.980	0.783	0.10 ¹¹	1.130
- for 800 MHz and 2.6 GHz (2010 auction)		1.195	1.000	0.868	1.098	0.773 ¹²	0.10	1.152
Prices after adjustment								
Metric:	€m per lot	€m per lot	€m per lot	£m per lot	£m per lot	£m per lot	£m per MHz	€m per MHz
900 MHz (2015)	192.2	214.4	229	202.5	198.4	155.4	15.5	17.56
1800 MHz (2015)	247.3	275.8	294	260.4	255.1	199.9	20.0	22.59
800 MHz (2010)	596.1	712.4	712.4	618.3	678.8	524.5	52.4	60.43
2.6 GHz (2010)	18.4	22.0	22.0	19.1	21.0	16.2	1.6	1.87

Source: Ofcom

22. We also derive “relative” benchmarks which reflect the values of the 900 MHz and 1800 MHz bands relative to the 800 MHz and 2.6 GHz bands in Germany (with these relativities then being combined with the equivalent UK market values for 800 MHz and 2.6 GHz in order to derive a lump sum value for 900 MHz and 1800 MHz in the UK). The values for 800 MHz and 2.6 GHz spectrum in Germany are also shown in Table 3 above; they are derived from the German 2010 auction as presented in our February 2015 consultation.¹³ In order to calculate relative benchmarks consistent with those presented in our February 2015 consultation, we convert the per MHz values back into Euros (column 8). This addresses the fact that the PPP adjustment factors in 2015 (for 900 MHz and 1800 MHz) are different from those in 2010 (for 800 MHz and 2.6 GHz).

¹¹ i.e. in this step we divide by ten to convert from £m per 2x5 MHz lot to £m per MHz.

¹² The World Bank reports a decline in the population of Germany from 81.8m in 2010 to 80.7m in 2013, the latest year for which figures are reported. See: <http://data.worldbank.org/country/germany>.

¹³ The value of 800 MHz spectrum of £52.4m per MHz is slightly lower than than the figure presented in our February 2015 consultation because we are now using a country-specific WACC for Germany.

23. Stakeholders have commented on the estimates of the UK market of 800 MHz and 2.6 GHz presented in our February 2015 consultation, and we are considering those comments. However, for illustration, using the figures from column 8, and the values reported in our February 2015 consultation of £33m per MHz for 800 MHz (gross of expected DTT co-existence costs and without coverage obligation) and of £5.5m per MHz for 2.6 GHz, we can calculate a 900 MHz / 800 MHz relative value benchmark of **£9.6m per MHz**, and an 1800 MHz distance method benchmark of **£15.2m per MHz**.¹⁴
- a. For 900 MHz, $(17.56 / 60.43) * 33 = 9.6$.
 - b. For 1800 MHz, $((22.59 - 1.87) / (60.43 - 1.87)) * (33 - 5.5) + 5.5 = 15.2$.
24. In paragraphs 3.94 to 3.97 and Table 3.7¹⁵ of our February 2015 consultation we considered within-country ratios of the value of 1800 MHz to the value of 900 MHz. The 1800 MHz / 900 MHz ratio for Germany, based on the results of the 2015 auction, would be 129%, well above the range of ratios we have observed to date (27% to 65%) and the ratio of our proposed lump-sum values in the February 2015 consultation of around 57%.

Interpretation of benchmarks

25. In the following, we set out our initial view of appropriate benchmarks from this auction, and how we consider we should interpret those benchmarks. Figures 1 and 2 above show evidence of active bidding in the auction for both 900 MHz and 1800 MHz, and we noted above that the prices for both bands were well above reserve prices. In this section we consider evidence and arguments that may be relevant to assessing the risk of the benchmarks understating or overstating market value or to the choice of tier for the benchmarks.¹⁶

900 MHz

Bidding for 900 MHz spectrum

26. In order to inform our assessment of this benchmark, we begin by considering the following points:
- a. First we consider whether the 900 MHz spectrum cap may have meant that bidders' intrinsic valuations for spectrum they could acquire in the auction

¹⁴ We noted in our August 2014 consultation (paragraphs A7.54 – A7.55 and Table A7.3) that the distance method generally produced higher benchmarks than an 1800 MHz / 800 MHz paired ratio relative value benchmark, and this is also the case in Germany (using 1800 MHz prices from the 2015 auction and 800 MHz and 2.6 GHz prices from the 2010 auction). This is due both to the high value of 800 MHz and the low value of 2.6 GHz in the 2010 German auction relative to the UK 4G auction. One implication of this is that while, in the German 2015 auction, the price of 1800 MHz is 28% higher than the price of 900 MHz, our relative (distance method) benchmark for 1800 MHz from Germany is 59% higher than our relative (paired ratio) benchmark for 900 MHz.

¹⁵ In Table 3.7 in our February 2015 consultation the heading for the first column is stated as "900 MHz / 800 MHz ratio". However, it should instead have been "1800 MHz / 900 MHz ratio", consistent with the title of the Table.

¹⁶ Our framework for using benchmarks to assess UK market value is set out in paragraphs 3.46 to 3.51 of our February 2015 consultation.

were an understatement of the forward-looking market value of 900 MHz spectrum, given the need for ongoing GSM provision on this band.

- b. We then consider whether the 900 MHz band may have been subject to a degree of co-ordinated strategic demand reduction.
 - c. Next we consider the possibility that bidding involved signalling, rather than competition based on operators' intrinsic values.
 - d. Finally, we consider the possibility of other strategic behaviour, such as strategic investment and price driving.
27. We then consider, in light of this analysis, whether the benchmark is at risk of understating or overstating the market value of 900 MHz in the UK, and the appropriate tier for the benchmark.

The 900 MHz cap and need for GSM provision

28. We have considered the risk that, if Vodafone or Telekom Deutschland required 2x10 MHz or 2x15 MHz of 900 MHz spectrum in order to continue providing GSM services in the medium term, then this requirement, in combination with the spectrum cap, may have limited their scope to express their valuation of acquiring additional 900 MHz spectrum for other uses.
29. In our view, the value of 900 MHz spectrum for use in LTE is likely to be relevant to assessing the forward-looking value of the band in the UK (based on the value to the marginal excluded user). When analysing the UK market value of 800 MHz spectrum in the February 2015 consultation, we considered marginal increments of both 2x5 MHz and 2x10 MHz, and recognised that a 2x10 MHz block may include a contiguity premium, giving it a higher per-MHz value than a 2x5 MHz block. In light of this, we consider below whether bidders in the German auction were able to express their valuations for 2x5 MHz or 2x10 MHz of 900 MHz spectrum for LTE.
30. In assessing this, we need to consider how much 900 MHz spectrum bidders needed to continue providing GSM services. As we noted in paragraph 9 above, BNetzA considered that 2x5 MHz of 900 MHz would be sufficient to maintain existing infrastructure. However, the BNetzA decision document also reported a consultation respondent's view that "GSM was not likely to be phased out before 2020/2025, given the heavy demand in the market." (paragraph 71, see also paragraph 534), and that "[Some] respondents said it was absolutely necessary to divide the 900MHz spectrum into blocks of 2.5MHz because the same amount of spectrum [as now] would be required for GSM into the medium term." (paragraph 94).
31. Prior to the auction, Vodafone and Telekom Deutschland each had 2x12.4 MHz of 900 MHz spectrum which they were using to provide GSM services. Given the lot size of 2x5 MHz in the auction, to obtain at least the same amount of 900 MHz they would have needed to acquire 2x15 MHz. Telefónica had 2x10 MHz prior to the auction, having acquired 2x5 MHz from its acquisition of E-Plus, and we understand that Telefónica was using spectrum in the 1800 MHz band to provide GSM services.
32. We are not in a position to reach a firm view on how much 900 MHz spectrum Vodafone or Telekom Deutschland needed for GSM provision, or for how long, or their demand for additional 900 MHz spectrum above the cap. We are also not in a position

to assess how the need for 900 MHz spectrum for ongoing GSM provision in Germany compares with the UK, in terms of the amount of spectrum needed or the time period.

33. However it is 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. For example, if Vodafone needed more than 2x5 MHz of 900 MHz spectrum for GSM in the medium term, it could not have acquired 2x10 MHz for LTE. This is also true of Telekom Deutschland. Moreover, in the case that either Telekom Deutschland or Vodafone needed more than 2x10 MHz for GSM in the medium term they could not have expressed any valuation of 900 MHz spectrum for LTE at all.
34. Our current view is that the spectrum cap introduces a risk that auction prices understate the forward-looking value of 900 MHz spectrum for a 2x10 MHz increment.

Possibility of strategic demand reduction in the 900 MHz band

35. Next we consider the possibility that there was a degree of strategic demand reduction in the band, whilst recognising that the 900 MHz band saw active bidding in the auction and final prices were well above the reserve price.
36. The spectrum cap meant that each of the bidders was guaranteed to win 2x5 MHz, and could win no more than 2x15 MHz. This limited the range of possible outcomes from the band. The identity of SHBs by lot was published after every round, so bidders were able to monitor the respective positions of their rivals.
37. As noted, prior to the auction Telefónica held 2x10 MHz of 900 MHz spectrum while the other two bidders held 2x12.4 MHz each. One possible focal point might have been for the other two bidders to win at least as much as their prior holdings, i.e. 2x15 MHz each, and Telefónica to win 2x5 MHz. Other focal points might have been for Telefónica to win 2x10 MHz, with one of the other two bidders winning only 2x10 MHz.
38. In practice, bidding appeared to be centred around the allocation of Telefónica winning 2x10 MHz, Telekom Deutschland 2x15 MHz and Vodafone 2x10 MHz, which we will refer to as the “final allocation”.¹⁷ This allocation was first reached in Round 2, and again at Round 29, at which point bidding paused for 45 rounds. In Round 74, Vodafone recommenced bidding in 900 MHz, displacing Telefónica on one lot, and increasing its bids on the two lots for which it was already SHB. Bidding continued in 900 MHz up to round 84, when bidding again paused on what was to be the final allocation for 39 rounds. Bidding in 900 MHz recommenced two more times, again with Vodafone displacing Telefónica from a lot. In all, 128 of the 181 rounds involved this allocation, and no other allocation was sustained for longer than four rounds. Table 4 shows the number of rounds for which each bidder was SHB for 0, 1, 2, and 3 lots, with the final allocation highlighted. In addition, while both Vodafone and Telefónica made a number of bids for a third lot, both Telefónica and Telekom Deutschland appeared to react quickly to any change which put them at less than their share in the final allocation. In particular, Telefónica was never SHB on fewer than two lots for

¹⁷ In the sense that Telekom Deutschland was standing high bidder on three lots of 900 MHz, and Vodafone and Telefónica were standing high bidder on two each – not in the sense that they were bidding on the particular lots which they eventually won.

longer than a single round, and there were only two occasions when Telekom Deutschland was SHB on fewer than three lots for longer than a single round.

Table 4 – Number of rounds in which each bidder was SHB

Number of rounds in which standing high bidder for:	Vodafone	Telefónica	Telekom Deutschland
0 lots of 900 MHz	1	-	-
1 lot of 900 MHz	7	19	5
2 lots of 900 MHz	134	145	21
3 lots of 900 MHz	39	17	155

39. The evidence of active bidding in the 900 MHz band, and of final prices being well above the reserve price, suggest limitations on the extent of any strategic demand reduction that might have taken place. However we consider there is 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.

Possibility of signalling in the 900 MHz band

40. Next we consider the possibility that bidding involved signalling, rather than competition based on operators' intrinsic values.
41. We note that some aspects of the auction might not necessarily be consistent with straightforward bidding. For example:
- a. Bidders raising bids for lots on which they were already SHB: For example, in Round 6, Telefónica was SHB for Lot A (the frequency-specific lot) and Lot B. In the following round it raised its bid for Lot B. In Round 19 Telekom Deutschland raised its bids on three lots for which it was already SHB. When Vodafone recommenced bidding in the band in Round 74, and again in Round 123, it raised its bids on the two lots for which it was already SHB, as well as for one lot on which it displaced Telefónica.
 - b. Possible interdependence in bidding across bands: For example, in Round 123 Vodafone displaced Telefónica on one lot of 1800 MHz, and increased its bids on the two lots for which it was already SHB, while doing exactly the same in the 900 MHz band. In Round 173 Telefónica withdrew its standing high bids on two lots of 900 MHz spectrum and one lot of 1800 MHz spectrum. (In principle, by doing so it was liable to pay the value of those bids, a combined sum of almost €640m.) Bidding stopped in both bands until the end of the auction in the same round (Round 174).
42. One possible explanation of these bids is that they reflect some element of signalling. However, if signalling did take place in the auction, we have not identified clear evidence that it influenced the final outcome.

Possibility of other strategic behaviour

43. The expectation that one or two bidders may have needed some 900 MHz spectrum for GSM provision could in principle have led their rivals to place bids above their intrinsic value for 900 MHz spectrum, with the aim of ensuring that bidders who needed 900 MHz spectrum either did not get it (strategic investment) or paid a high price for it (price driving).
44. We consider there are reasons why the risk of such strategic behaviour may have been limited. One is that the 900 MHz spectrum cap ensured that all operators would be able to acquire at least 2x5 MHz of 900 MHz spectrum, so a bidder would only be vulnerable to strategic investment or price driving if it needed more than 2x5 MHz of 900 MHz spectrum. Another is that, also due to the cap, an individual bidder could only pursue such a strategy by bidding aggressively for up to 2x15 MHz, which would leave 2x20 MHz available for the other two bidders.
45. We note that on a number of occasions Telefónica, which was unlikely to require 900 MHz spectrum for GSM provision, bid for a third lot of 900 MHz. One possible interpretation could be that these bids had an element of strategic investment or price driving. However, we consider that bidding in the band was primarily driven by Vodafone seeking to outbid Telefónica for a third lot, and we note that, except in the early rounds of the auction (up to Round 16) Telefónica's bids for a third lot all took place immediately after it had been driven down to one lot in the previous round.
46. In light of this assessment, we do not consider there is clear evidence of strategic investment or price driving in this band.

Our provisional view

Assessment of risk

47. When we take into account the possible effects of spectrum caps or strategic bidding on the risk of understating or overstating market value, we assess the direction of this risk by asking, *if it took place*, whether this is more likely to have led to an understatement or an overstatement of the benchmark. Whether the outcome is more likely to reflect strategic bidding or intrinsic value bidding is one of the criteria in the choice of tier for the benchmark, which we discuss in the next sub-section below.
48. In view of the above analysis, 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.
 - b. It is 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 consider there is more evidence for this possibility in the 900 MHz band than in the 1800 MHz band.
 - c. We have not identified clear evidence to support the possibilities that signalling had a significant effect on the auction or that strategic investment or price driving took place.

49. We consider there is a risk that the auction price for 900 MHz spectrum is an understatement of the market value in Germany. However, we cannot be sure of the likelihood or scale of this risk.
50. We note that 900 MHz sold at a significantly lower price than 1800 MHz in the German 2015 auction and we do not observe this outcome in any other auction in our dataset.¹⁸ 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 do not adopt this approach, especially given the limited number of evidence points in our dataset.
51. We are not aware of any country-specific factors that would cause the value of 900 MHz spectrum in Germany to be an understatement or overstatement of the value in the UK.
52. As regards the 900 MHz / 800 MHz relative value benchmark, we note that the 800 MHz band was auctioned five years earlier than the 900 MHz band¹⁹ and, because of this, we consider that there is a risk that the value of this band has changed since 2010. We consider that this creates a risk of understatement or overstatement in the benchmark, although we cannot be sure of the likelihood or scale of this risk.
53. Taking all the above factors into account, our initial view is that this benchmark is at risk of understatement of the value of 900 MHz spectrum in the UK, although we cannot be sure of the likelihood or scale of this risk.

Tiering

54. Next, we consider 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 consider that the benchmark meets 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 consider there is some evidence of strategic bidding for 900 MHz spectrum. However, there is also evidence of competition for spectrum in the band, consistent with bidding based on intrinsic valuations. Therefore, our initial view is that this criterion is met. We reflect the possibility of strategic demand reduction in particular in our assessment of the risk of understatement or overstatement of the benchmark.

¹⁸ We also note that BNtezA set a reserve price for 1800 MHz which was half that of 900 MHz.

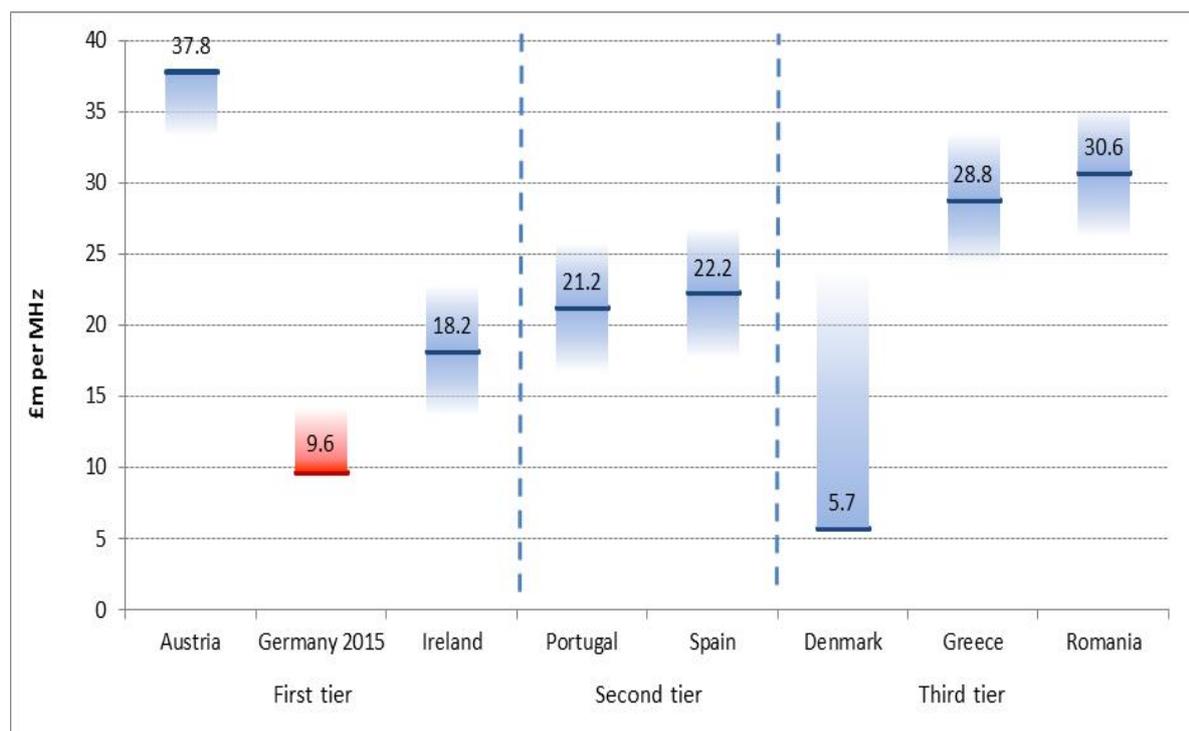
¹⁹ As we noted in our February 2015 consultation (paragraph A8.258) our view is that the price of 800 MHz observed in the 2010 German auction is likely to reflect market value in Germany at that time.

- 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 is that this criterion is met.

55. Our provisional view is that the benchmark meets our criteria for Tier 1.

56. For illustration, we present below our proposed Germany benchmark for 900 MHz, alongside the other 900 MHz benchmarks as we presented them in our February 2015 consultation.²⁰

Figure 3: 900 MHz paired ratio benchmarks in £m per MHz



1800 MHz

Bidding for 1800 MHz spectrum

- 57. 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, it is possible that some bidding activity in the auction may have been intended as signalling, possibly in relation to other bands.
- 58. However, as Figure 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 three or four lots, some bids for five lots, and one for six lots before finally winning only two, and Telekom Deutschland making a number of bids throughout the auction for four or more

²⁰ For the avoidance of doubt, we are simply repeating the other benchmarks included in this figure, without prejudice to our analysis of responses to the February 2015 consultation.

lots before winning three. We have 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 consider 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 consider 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.

Our provisional view

Assessment of risk

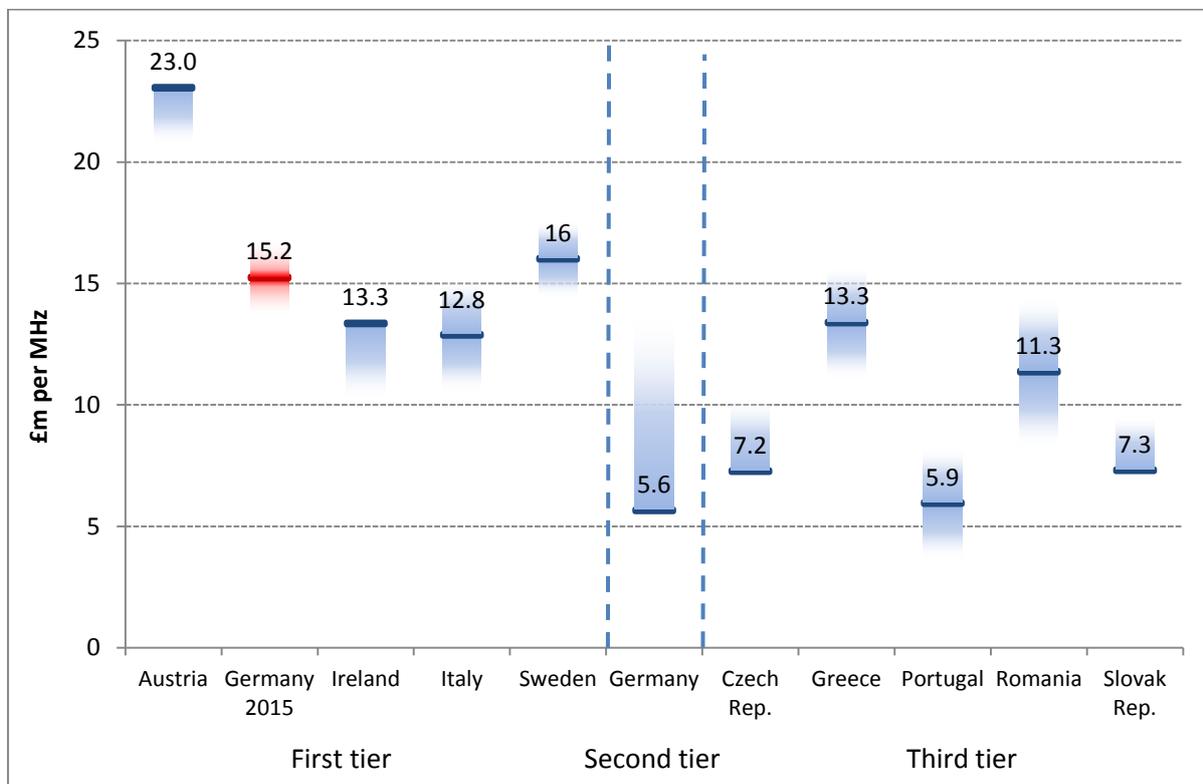
59. We have not identified a reason for the auction price of 1800 MHz spectrum to be an understatement or overstatement of the market value of 1800 MHz spectrum in Germany.
60. We are not aware of any country-specific factors that would cause the value of 1800 MHz spectrum in Germany to be an understatement or overstatement of the value in the UK.
61. The 1800 MHz distance method benchmark also depends on the Germany 2010 auction prices for 800 MHz and 2.6 GHz. As noted above our measure of 800 MHz and 2.6 GHz spectrum in Germany is based on an auction from 2010. There is a risk that the value of 800 MHz spectrum may have increased or decreased in value since that date. Our analysis of the 2.6 GHz price was that it may understate market value in Germany, though we cannot be sure of the likelihood and scale of this understatement (see, for example, paragraphs A8.227-A8.228 in our February 2015 consultation). Such 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, 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 consider 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 cannot be sure of the likelihood or scale of this risk.

Tiering

62. We provisionally consider that the benchmark meets all three of our criteria for inclusion in Tier 1, namely (i) that 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, (ii) 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, and (iii) 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.
63. For illustration, we present below our proposed Germany benchmark for 1800 MHz, alongside the other 1800 MHz benchmarks as we presented them in our February 2015 consultation.
64. In this illustration, we have not removed the benchmark derived from the German 2010 auction of £5.5m per MHz which we presented in our February 2015 consultation. However, our current view is that this benchmark is less informative than the more

recent evidence of the value of 1800 MHz in Germany from the 2015 auction. In any case, as we discussed in paragraph 3.70 of our February 2015 consultation, we considered the 2010 benchmark was at larger risk of being a larger understatement, and we did not consider there was a strong basis to modify our view of the 1800 MHz market value, based on first-tier benchmarks, in light of the 2010 benchmark.

Figure 4: 1800 MHz paired ratio benchmarks in £m per MHz



Cross checks

65. In our February 2015 consultation, paragraphs 3.82 to 3.93, we considered absolute values of 900 MHz and 1800 MHz as cross checks on our estimate of market value in the UK. We would expect to include the absolute value of £15.5m per MHz for 900 MHz and £20m per MHz set out in paragraph 21 above in this cross check. In paragraphs 3.94 to 3.97 of our February 2015 consultation we considered within-country ratios of the value of 1800 MHz to 900 MHz as a further cross-check of our estimates, and we would expect to include the within-country ratio of 129% set out in paragraph 24 above in this cross check.

Implications for estimated lump-sum value of 900 MHz and 1800 MHz in the UK

66. We consider that it would be appropriate to include a relative benchmark for both 900 MHz and 1800 MHz from the 2015 German auction in our dataset for deriving Lump Sum Values of the 900 MHz and 1800 MHz spectrum in the UK, following the methodology set out in the August 2014 and February 2015 consultations. These relative benchmarks are derived by combining the 900 MHz and 1800 MHz prices from the 2015 German with the 800 MHz and 2.6 GHz prices from the 2010 German auction.

67. As noted in paragraph 3.29 of our February 2015 consultation, we remain of the view that, in deriving lump-sum value estimates, we should consider the benchmarks in the round, rather than relying on summary statistics such as weighted averages.
68. In the case of 900 MHz, as Figure 3 above illustrates, if we include the Germany benchmark in Tier 1 it will be one of only three Tier 1 benchmarks, and will be considerably lower than the other two, albeit that we consider it to be at risk of understatement. It is also considerably lower than both Tier 2 benchmarks and considerably lower than our lump-sum value estimate in the February 2013 consultation of £23m per MHz.
69. We are currently considering responses to our February 2015 consultation, which may have implications for our estimate of the lump-sum value of either band. However, for the purpose of illustration we take as given our approach to the benchmarks in our February 2015 consultation. On this basis, our current view is that, other things being equal, if we were to consider the Germany 2015 benchmark as a Tier 1 benchmark with a risk of understatement as proposed, and included the results of the German auction in our cross-check analysis as indicated in paragraph 65 above, there could be a case for a material downward adjustment to our estimate in the February 2015 consultation of £23m per MHz for the lump-sum value of 900 MHz spectrum²¹.
70. Turning to 1800 MHz, if we included the Germany 2015 benchmark in Tier 1 it would be one of five Tier 1 benchmarks, and it would be within the range of these benchmarks. However, the benchmark would be somewhat above our lump-sum value estimate in the February 2015 consultation of £13m per MHz.
71. Our current view is that, other things being equal, if we were to consider the Germany 2015 benchmark as a Tier 1 benchmark with a risk of understatement or overstatement as proposed, and included the results of the German auction in our cross-check analysis as indicated in paragraph 65 above, there could be a case for a moderate upward adjustment to our estimate of the lump-sum value of 1800 MHz spectrum. Alternatively, we could take the view that it is not necessary to make an adjustment to this estimate.

Next steps

72. We are seeking stakeholders' comments on the specific issue of how we propose to take account of the German 2015 auction in our international benchmark analysis, which is part of our analytical framework for revising ALFs.
73. We will take stakeholders' comments into account in our overall process for reaching a final decision on the revised level of ALFs, including consideration of the responses to our February 2015 consultation.
74. We anticipate that we will make our final decision towards the end of September or beginning of October 2015.

²¹ If, however, we were to instead consider it as a Tier 2 benchmark, it is less clear that its inclusion would cause us to adjust our estimate, and any such adjustment would likely be smaller.